Document Type: BA-Administrative Record
Index Field: Consultation and Interagency Review
Project Name: Bat Programmatic Strategy Reinitiation

REINITIATION OF THE PROGRAMMATIC BIOLOGICAL ASSESSMENT FOR EVALUATION OF THE IMPACTS OF TENNESSEE VALLEY AUTHORITY'S ROUTINE ACTIONS ON FEDERALLY LISTED BATS

Prepared by:
TENNESSEE VALLEY AUTHORITY
Knoxville, Tennessee

April 2023

To request further information, contact:
Elizabeth Hamrick
Biological Compliance
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902
E-mail: ecburton@tva.gov

EXECUTIVE SUMMARY

The Tennessee Valley Authority (TVA) is a federal agency of the United States created by and existing pursuant to the TVA Act of 1933. Its broad mission is to foster social and economic welfare in the TVA region (Tennessee Valley Watershed and TVA's Greater Power Service Area combined) and promote proper use and conservation of the region's natural resources. TVA's 20-year Action Area (1,015,221 acres [ac]) in this programmatic biological assessment (BA) makes up 1.21 percent of the TVA region. Estimated affected acreage within the Action Area is 461,564 ac. The Action Area is characterized by variable land ownership and land allocation.

This BA addresses ten overarching actions and 96 routine activities that TVA authorizes, funds, or carries out, and how these activities may affect *Myotis sodalis (*Indiana bat), *M. septentrionalis (*northern long-eared bat), *M. grisescens (*gray bat), and *Corynorhinus townsendii virginianus* (Virginia big-eared bat). The ten actions are to: 1) manage for biodiversity and public use; 2) protect cultural resources; 3) manage land use and disposal; 4) manage 26a permitting; 5) operate, maintain, retire, construct, and expand power plants; 6) maintain existing transmission line assets; 7) convey electric transmission property; 8) expand or construct new transmission assets; 9) promote economic development; and 10) promote solar sites. Prior to this programmatic approach, actions and activities with potential to affect bats have been addressed on a project-specific basis, which is time-consuming, resource intensive, can result in schedule and cost uncertainties, and may not provide significant bat conservation benefits.

TVA's project-specific consultations, pursuant to Section 7 of the Endangered Species Act, for potential impacts to bat species increased in recent years. White-nose syndrome (WNS) has killed millions of bats since its arrival in New York in 2007. WNS has been detected on all cave-dwelling bats, including those addressed in this BA. WNS has measurably reduced the number of individual bats observed on the landscape over the last 16 years. This in turn has led to heightened concern for the health and vulnerability of local bat populations, especially federally listed bats, to impacts of any kind. This front-end programmatic assessment of TVA actions and effects analysis of TVA activities allows for consistency in the project review process, certainty of desired outcomes, and the reduction of project-specific consultations. Furthermore, working within a programmatic framework enables TVA to more effectively address conservation needs for bats at local and landscape levels.

Proactive conservation stewardship is an existing component of TVA's mission. Seventy-eight percent (228,540 ac) of TVA-managed land is allocated for natural and sensitive resource management. Over its history, TVA has contributed substantially to the management and protection of listed species of bats. Targeted efforts include annual WNS surveillance monitoring at up to 20 caves, annual gray bat emergence counts at up to 6 caves per year, cave gating, habitat improvement, artificial roost installation at 11 sites to date, radio tracking, public outreach and educational awareness, management of TVA Natural Areas, and maintaining database records of bat occurrences, natural communities, and other sensitive natural resources (e.g., caves).

TVA's 96 routine activities were analyzed for effects to four protected bat species. The results identified the potential for impacts to bats from: noise, vibration, human disturbance, smoke, heat, fire, tree removal, alteration or removal of unconventional roosts (i.e., barns, bridges, other man-made structures), sedimentation, and contaminants. With the exception of tree removal and smoke/heat/fire, potential impacts to bats are avoided or reduced by the implementation of conservation measures. Activities with the potential to expose bats to these impacts may affect, but are not likely to adversely affect protected species of bats. Implementation of conservation measures also are expected to prevent adverse impacts to bats while roosting in caves.

On an annual basis, TVA estimates approximately 100,000 ac across the Action Area would be affected by proposed activities and that tree removal would involve 2,010 - 3,759 ac of the affected acreage. Cumulative tree removal within the affected acreage is estimated at 47,204 ac, which accounts for 10 percent of affected acreage, 4.6 percent of the Action Area, and 0.06 percent of the TVA region. While a number of conservation measures are in place to avoid or minimize impacts to bats resulting from tree removal, there will be cases when surveys cannot be conducted, tree removal needs to occur outside of winter with no practicable alternative, and bats potentially are roosting in trees identified for removal. Tree removal, therefore, has potential to adversely affect Indiana bat and northern long-eared bat.

In order to address recent reclassification of the northern long-eared bat from Threatened to Endangered under the Endangered Species Act, TVA is reinitiating this consultation with the U.S. Fish and Wildlife Service. On March 31, 2023, the reclassification of the northern long-eared bat will nullify the 4(d) ruling for this species under which all previously evaluated actions in the programmatic fell. Therefore, in order to ensure continued compliance under Section 7 of the ESA, TVA has revised the Biological Assessment below to include updated information for Indiana bat, gray bat, Virginia big-eared bat, and northern long-eared bat. The overall project area and proposed actions have not changed since the original 2018 consultation was completed. Properties sold and acquired over the last 5 years are within the estimates expected and anticipated under the original 20-year Bat Programmatic Consultation (BPC).

Populations of gray bats appear stable if not increasing since the original BPC was signed in 2018. Populations of Virginia big-eared bat have not seen significant changes since 2018. In the TVA Region, populations of Indiana bat and northern long-eared bat dropped significantly after 2013, approximately 2-3 years after the arrival of WNS in the TVA region. The most dramatic declines in these species populations were observed in 2014 and 2015. By 2017, populations of Indiana bat had declined up to 90% in some caves in the TVA region. Since 2018, when the programmatic consultation was signed, these populations have continued to decrease but at a much slower rate. Therefore, the populations of Indiana bat and northern long-eared bat assessed at the time of the signing of the original 2018 programmatic consultation were already very low.

Over the last 5 years TVA has only used 3.4% of the Take issued for the 20-year duration of the PBC (Table 3-3). During this time TVA accounted for removal of habitat for northern long-eared bat the same way they did for Indiana bat. Thus, removal of northern long-eared bat habitat was deducted from the total Take allotted and the amounts of Take used over the last 5 years account for impacts to habitat for both species. TVA also implemented or required bat conservation measures on all projects that relied on the PBC to address potential impacts to federally listed bats. TVA also has continued to implement projects, monitoring, and support research intended to support the recovery of imperiled bats.

Based on population trends, lack of changes to scope of the BPC, conservation measures employed over the last 5 years, and use of Take thus far, TVA is not asking to revise issued Incidental Take amounts for Indiana bat or to revise previous determinations for Indiana bat, northern long-eared bat, gray bat, or Virginia big-eared bat. With this reinitation effort, TVA is requesting issuance of Incidental Take for northern long-eared bat.

Table of Contents

List of Appendices

List of Tables

List of Figures

Symbols, Acronyms, and Abbreviations

ARPA	Archaeological Resources Protection Agency
AST	Aboveground storage tank
ATV	All-terrain vehicle
BA	Biological Assessment
BMP	Best Management Practice
BPC	Bat Programmatic Consultation
BO	Biological Opinion
CFR	Code of Federal Regulations
CVLP	Comprehensive Valley-wide Land Plan
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FLMA	Federal Land Management Agency
FY	Fiscal year
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HPA	Habitat Protection Area
IRP	Integrated Resource Plan
kV	kilovolt
LAA	Likely to adversely affect
LPC	Local power company
LULC	Land Use/Land Cover
MW	megawatt
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NLAA	Not likely to adversely affect
NLEB	Northern long-eared bat
NRP	Natural Resource Plan
OSHA	Occupational Health and Safety Administration
PSA	Power Service Area
PTO	Power take-off
PV	Photovoltaic
PVC	Polyvinyl chloride
RGA	Ruth’s golden aster
RLA	Rapid lands assessment
RLMP	Reservoir Land Management Plan
ROW	Right-of-way
RV	Recreational vehicle
RU	Recovery unit
SMP	Shoreline Management Policy
SMZ	Streamside or Shoreline Management Zone
TL	Transmission line
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground storage tank
VBEB	Virginia big-eared bat
WNS	White-nose syndrome

CHAPTER 1 – INTRODUCTION AND BACKGROUND

1.1 Purpose of the Programmatic Bat Strategy

The Tennessee Valley Authority (TVA) is a federal agency of the United States created by and existing pursuant to the TVA Act of 1933. Its broad mission is to foster the social and economic welfare of the people of the TVA region (Tennessee Valley Watershed and TVA's Greater Power Service Area [PSA] combined) and to promote the proper use and conservation of the region's natural resources. One component of this mission is the generation, transmission, and sale of reliable and affordable electric energy. TVA operates the nation's largest public power system, producing approximately four percent of all of the electricity in the nation. TVA provides electricity to most of Tennessee and parts of Virginia, North Carolina, Georgia, Alabama, Mississippi, and Kentucky. Currently, it serves more than ten million people in this seven-state region of the mid-south.

TVA's mission is to provide safe, clean, reliable, and affordable electricity while supporting a robust economic development policy to help communities prosper and to be stewards of the regions' natural resources. These goals extend to steps TVA takes to ensure compliance with the Endangered Species Act (ESA), administered by the U. S. Fish and Wildlife Service (USFWS). This programmatic biological assessment (BA) addresses the potential for impacts of certain routine TVA actions on four federally listed bats: *Myotis sodalis (*Indiana bat), *M. septentrionalis (*northern long-eared bat), *M. grisescens (*gray bat), and *Corynorhinus townsendii virginianus* (Virginia big-eared bat). The TVA Action Area (a combination of sites within the TVA region in which actions are funded, authorized, or carried out by TVA) overlaps with the ranges of these federally listed bats. Three of these bats are wide-ranging species with the potential to occur throughout the TVA region (See Chapter 2 for further discussion of TVA region and Action Area). Prior to the 2018 BPC, TVA actions with the potential to affect federally listed bat species were addressed on a project-specific basis, which was time-consuming, resource intensive, resulted in uncertainties in schedule and cost, and may not have provided significant conservation benefits. The first 5 years of the BPC have increased efficiencies both internally to TVA and externally to USFWS with regard to the number of individual projects submitted for case-by-case Section 7 consultation. Appropriate conservation measures specific to bats have been implemented for each project that relied on the BPC to address potential bat impacts.

Factors influencing TVA's programmatic approach:

- TVA actions routinely involve the need for the removal of trees.
- White-nose syndrome (WNS) has been documented on all cave-dwelling bats, including those addressed in this BA. WNS has measurably reduced the number of bats observed on the landscape (e.g., during mist net or cave surveys) over the last 16 years and has led to heightened concern for cumulative impacts to bats, including potential impacts from tree removal.
- A programmatic strategy facilitates an approach to conservation that prioritizes needs at a population and regional level for bats, as well as lends to increased potential for conservation benefits that extend beyond bats (e.g., other cave fauna, terrestrial wildlife via habitat improvements).

- A programmatic framework will expedite the project-specific process for compliance with Section 7 of the ESA by eliminating the need for case-by-case consultations for routine and repetitive actions.

Consistency in the review process and certainty of desired outcomes are increased due to the front-end programmatic analyses of numerous actions and activities.

1.2 TVA Polices, Plans and Processes Relevant to TVA's Program-level Bat Strategy

1.2.1 TVA's Three-Pronged Mission

TVA's original purpose, set forth in the Tennessee Valley Act of 1933 (TVA Act), was to address the TVA region's most important issues in energy, environmental stewardship, and economic development (TVA 1933). That three-pronged mission continues today: 1) to provide reliable, low-cost energy for residents of the TVA region in a way that is both affordable and clean, 2) to serve as an environmental steward to the waters and lands that comprise the Tennessee River watershed, and 3) to advance the economic development of the TVA region. The TVA Act requires the TVA power system to be self-supporting and operated on a nonprofit basis and directs TVA to sell electricity at rates as low as feasible.

TVA receives no taxpayer funding, deriving 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 (approximately 293,000 acres [ac]) for the Tennessee River system and assists local power companies (LPCs) and state and local governments with economic development and job creation. TVA staff use an integrated model to manage public land and water, protect cultural resources, and meet environmental standards.

1.2.2 TVA Environmental Policy

TVA's 2020 Environmental Policy (TVA 2020a), approved by TVA's Board of Directors, has four key objectives that are relevant to TVA's bat strategy:

- Enhance land and water resources to provide multiple benefits in the TVA region, making it a better place to live, work, and play.
- Foster public health and safety by improving air and water quality and protecting the TVA region's natural resources.
- Reduce consumption of water resources and the generation of waste and by-products for a sustainable future.
- Align with TVA's threefold mission of providing low-cost and reliable power, promoting sustainable economic development, and operating as a steward of the TVA region's natural resources.

1.2.3 TVA Biodiversity Policy

TVA's Board of Directors approved TVA's new Biodiversity Policy in November 2021 recognizing the importance of biodiversity to the quality of life of the region's residents. The policy commits TVA to working proactively to protect biodiversity through stewardship of public lands, management of the Tennessee River system, local and regional partnerships, and integration of species and habitat conservation in project planning.

1.2.4 TVA Integrated Resource Plan

TVA's 2019 Integrated Resource Plan (IRP) guides TVA's generation planning to meet long-term energy needs of the TVA region (TVA 2019). It evaluates scenarios over a 20-year period and discusses ways that TVA can meet future energy demand while supporting TVA's mission. The IRP was developed in collaboration with TVA customers, TVA stakeholders, and the general public who depend on the energy TVA provides in partnership with LPCs. This collaboration ensured thorough consideration of the differing views, priorities and issues that co-exist in the TVA region.

Relevant components of the IRP:

- TVA manages its power system to provide low-cost, reliable, clean energy and minimize environmental impacts from its operations.
- TVA's goal is to identify an optimal, system-wide energy resource mix that performs well under a variety of future conditions, taking into account cost, risk, environmental stewardship, operational flexibility and Valley economics.
- The IRP considers a broad range of feasible supply-side and demand-side options and assesses them with respect to financial, economic, and environmental impacts.

1.2.5 TVA Natural Resource Plan

TVA's Natural Resource Plan (NRP) was developed in 2011in parallel with the IRP, mapping out a 20-year plan for natural resource management and ongoing stewardship activities (TVA 2011a). The NRP creates a framework for balancing land use, human activity, and conservation of resources to achieve the greatest public benefit while providing recreational opportunities, prompting economic growth, protecting sensitive resources, and promoting water quality. The NRP also creates avenues for greater public involvement such as volunteerism, and environmental education and outreach. As described in the NRP, 78 percent (228,540 ac) of TVA-managed land is allocated for natural and sensitive resource management. The remaining portion (22 percent) is allocated for project operations, and industrial, residential, and recreational development. TVA updated the NRP in 2020 to incorporate changes reflecting the BPC (TVA 2020b).

Relevant components of the NRP:

- Compliance with Section 7 of the ESA,
- WNS surveillance monitoring of hibernating bats,
- Census of summer gray bat populations,
- Cave gating and protection,
- Wildlife habitat improvement,
- Forest resource management,
- Multi-agency monitoring of Indiana bats,
- Public outreach and educational awareness,
- Management of TVA Natural Areas, and
- Database management of sensitive natural resource features.

1.2.6 TVA Land Policy

TVA originally acquired approximately 1.3 million ac of land in the TVA region. The TVA reservoir system ultimately inundated approximately 470,000 ac. TVA also transferred or sold approximately 508,000 ac of land to federal and state partners, providing large expanses of public land for state parks, wildlife refuges, national parks, and national forests. TVA retained approximately 293,000 ac, which it continues to manage pursuant to the TVA Act. TVA's Land Policy describes the agency's management of the reservoir system and surrounding reservoir lands to maximize public benefits such as flood control, navigation, power production and economic growth (TVA 2006).

1.2.7 TVA Shoreline Management Policy

TVA's Shoreline Management Policy (SMP) was adopted by the TVA Board of Directors in 1999 (TVA 1999). The SMP is based on TVA's Shoreline Management Initiative, which examines environmental consequences of managed shoreline development (docks, bank stabilization, vegetation management, and other shoreline development), including TVA's permitting process for docks and other shoreline water use facilities. The SMP establishes a policy for the TVA region to improve protection of shoreline and aquatic resources while allowing reasonable access to the water by adjacent property owners. This included establishing standards for construction of facilities and vegetation management along reservoirs, which were codified in 2003 in 18 Code of Federal Regulations [CFR] Part 1304.

Relevant components of the SMP:

- Incorporates Reservoir Land Management Planning (RLMP), a landscape-level review of reservoir properties.
- Limits residential development to 38 percent of reservoir shoreline (sum of flowage easement and TVA-owned residential access shoreland).
- Incorporates site inspections to document resources, including wetlands and rare species.
- Requires a vegetation management plan when adjacent landowners propose to remove vegetation on TVA-retained shoreline.
- Established vegetation management standards:
    - In subdivisions developed before November 1, 1999, woody vegetation less than 3 inches in diameter may be removed from TVA shoreline fronting private land.
    - In subdivisions developed after November 1, 1999, woody vegetation less than 3 inches in diameter may be removed, but is limited to an approved access corridor and other restrictions.
    - Removal of damaged and dead trees is discouraged (unless they are deemed a threat to life or property) based on their benefit to wildlife.
    - Hazard tree removal requires a prior review and approval to ensure oversight and minimize unnecessary removal.
- TVA considers potential for impacts to sensitive resources (e.g., plants, animals, archaeological resources), and may include special conditions in its approval to avoid or minimize impacts consistent with applicable laws, regulations and policies.

1.2.8 TVA Environmental Review Process

As a federal agency, actions proposed by TVA are subject to an environmental review process at multiple levels to ensure compliance with the National Environmental Policy Act (NEPA), ESA, and other environmental laws https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews).

Relevant Components of the Environmental Review Process:

- TVA Land Management reviewers screen actions proposed on TVA-managed lands (e.g., residential, commercial, and industrial shoreline facilities, habitat improvement, campground management, and public recreation activities).
- Subject matter experts (e.g., terrestrial zoologists, botanists, wetland scientists, aquatic biologists) review actions across TVA (e.g., power generation, transmission, economic development, natural resource management) to identify potential for impact to rare and protected species as well as sensitive resources (e.g., caves).
- NEPA staff determines the appropriate level of review and develops supporting documentation for all projects.
- Other TVA staff implement Land Disposal worksheets to ensure disposal requests (e.g., conveyance, sale, relinquishment of rights) align with the TVA Land Policy, the TVA NRP, and Environmental Policy, and that all related programmatic and environmental resource areas are considered.
- Reviews of major recreation actions can include a phased approach:
    - A needs analysis is performed on large proposals that would result in major expansions of existing facilities or raw land development.
    - The full development of existing recreational operations (e.g., existing commercial campgrounds) is encouraged prior to disposal (i.e., approval to develop) of undeveloped lands.
    - Consideration is made of local/regional carrying capacity (i.e., are there enough, or too many, recreational opportunities [e.g., camping pads] for the local population in the community or region).

Programmatic reviews such as the bat strategy assessed in this BA help achieve efficiencies in the environmental review process by dispensing with the need for case-by-case review for certain activities.

1.3 Regulatory Drivers

Section 7(a)(1) of the ESA states that federal agencies use their authorities to carry out programs to conserve endangered and threatened species, including conducting proactive conservation activities. TVA has worked extensively to address conservation needs of many species throughout the region, including designating TVA Natural Areas to protect rare species and their habitats, and developing and maintaining long-term monitoring programs for threatened and endangered species. TVA's bat strategy will incorporate existing conservation measures, partnerships, and initiatives to conserve threatened and endangered bats. Historic and/or current work includes cooperative research on foraging and roosting habitat, protection and monitoring of bat populations, and participating in studies to track migratory bats.

Pursuant to ESA Section 7(a)(2), TVA is consulting with the USFWS to assess, on a programmatic basis, the impact of certain activities on listed bat species and their habitat. The purpose for undertaking this programmatic consultation is to reduce the likelihood of conflicts between proposed actions and listed species or designated critical habitat, to produce positive environmental results, and to increase efficiency in TVA's ESA compliance. This will be accomplished by utilizing applicable plans and guidance to design projects to avoid or minimize adverse effects on listed bat species with the goal of undertaking a quick and efficient Section 7 review process for individual projects.

1.4 Involved Agencies

TVA consulted with Regional and State USFWS offices to develop this programmatic strategy to ensure that the benefits of undertaking a programmatic analysis of TVA actions are realized. This BA covers activities authorized, funded, or carried out by TVA. For projects that involve multiple actions of TVA and other federal land management agencies (FLMAs), TVA may rely on the consultation protocol established herein to comply with its Section 7 obligations; alternatively, TVA may initiate consultation on a case-by-case basis, or, if applicable, follow consultation mechanisms used by FLMAs (e.g., existing consultations established for USFWS National Wildlife Refuges, U. S. Forest Service lands, or National Park Service (NPS) lands).

1.5 Covered Species

This BA addresses four federally listed bat species. Bats included are the federally listed as endangered Indiana bat, gray bat, northern long-eared bat, and Virginia big-eared bat.

1.6 History of the Key Consultation Correspondence Milestones

In August 2014, TVA initiated discussions with USFWS's Southeast (SE) Region Section 7 Coordinator about the process for programmatic consultation. Coordination with the SE and Midwest Regional USFWS Offices, and Ecological Service (ES) Field Offices (FO) of TN, NC, KY, AL, MS, GA, and VA occurred through 2018. In March of 2018, USFWS issued a letter of concurrence regarding not likely to adversely affect determinations for all four species as well as for designated critical habitats for the Indiana bat (USFWS 2018a). In April 2018, the original Programmatic Consultation with USFWS for TVA's impacts of routine actions on federally listed bats was completed with the issuance of a Biological Opinion from USFWS (USFWS 2018b). Three of the evaluated actions were determined to "likely adversely affect" the Indiana bat and northern long-eared bat. An Incidental Take Statement was issued for Indiana bat but not for northern long-eared bat. It was determined that all proposed actions were exempted under the 4(d) ruling in place for the then Threatened northern long-eared bat. In October 2022, TVA initiated contact with these same Ecological Services offices regarding our intent to reinitiate consultation due to the pending uplisting of the northern long-eared bat from Threatened to Endangered. In January 2023, TVA sent a letter of intent to reinitiate the Programmatic Consultation to the Tennessee ES FO. In February 2023, the Tennessee ES FO responded that reinitiation was appropriate. See Table 1-1 for dates, participants, and meeting details.

1.7 Programmatic Consultation Process

This consultation between TVA and USFWS is for the purpose of assessing the impact of activities associated with routine and repetitive actions. TVA has gained considerable experience in the assessment of impacts of such routine and repetitive actions.

Accordingly, such actions are appropriate for coverage under a programmatic consultation. The intent of this consultation is to implement a TVA region-wide programmatic strategy encompassing TVA's PSA and watershed region to streamline the implementation of Section 7 responsibilities for such routine and repetitive actions with the potential to impact the four bat species. Staff from USFWS Field Offices (FOs) and Regions 4 and 5 have contributed to the development of this BA. Additional Section 7 consultation will be necessary for actions that are outside the scope of this assessment.

Consultation Process:

- TVA prepared a programmatic BA in coordination with the FOs to address impacts of routine and repetitive actions.
- USFWS prepared a programmatic biological opinion (BO) identifying measures to minimize harm to listed species and their designated critical habitat (DCH).
- TVA will use the programmatic BA and BO as guidance to avoid or minimize adverse effects of TVA actions.
- TVA will document site-specific activities covered by the programmatic consultation (e.g., via a project tracking database) and notify the USFWS via email or letter when the actions are near occurrence records.
- TVA will provide an annual report that includes activities addressed in the BA, conducted during the previous calendar year, and with Not Likely to Adversely Affect (NLAA) or Likely to Adversely Affect (LAA) determinations. An annual meeting will be conducted when further discussion is warranted.
- No further consultation with the USFWS will be necessary unless an action or activity is outside the scope of the BA/BO and warrants consultation or the listing status changes for one of the species evaluated.

Table 1-1. History of the Key Consultation Correspondence Milestones

Date	Location/Type of Correspondence	Participants	Discussion Topic
August 22, 2014	Telephone call	TVA staff; USFWS SE Region Section 7 Coordinator	TVA interest in learning about Programmatic Consultation
September 23, 2014	TVA Office, Knoxville, TN/Conference call	Staff from TVA, SE Regional Office, and TN Ecological Services (ES) Field Office (FO)	Discussion on development of a region-wide programmatic consultation (e.g., pros/cons, components, limitations, time frame).
January 23, 2015	TVA office, Knoxville, TN	Staff from TVA and TN ES FO	Initiation of programmatic consultation
February 10, 2015	Conference call	TVA staff; SE and Midwest Regional Offices and TN ES FO staff	Framework and aspects in development of modeling approach to determine potential presence of Indiana bat and northern long-eared bat within TVA's Action Area
April 22, 2015	Conference call	Staff from TVA and ES FOs in TN, NC, KY, AL, MS, GA, & VA	Introductions among consultation partners; TVA shared focus and framework, discussion on what to keep in mind moving forward.
July 22, 2015	USFWS office, Cookeville, TN/Conference call	Staff from TVA, SE Regional Office and ES FOs in TN, AL, KY, and MS	Status Meeting (routine actions, acreage estimates, data/modeling, AMMs, visits with ES offices)
August 20, 2015	TVA Towers, Knoxville, TN	TVA staff; GIS staff from ES FOs in TN and NC	Geographic information system (GIS) Modeling and Analysis
December 16, 2015	Athens, GA	TVA staff; Staff from GA ES FO	Overview, Status, and Q&A of Bat programmatic consultation with GA USFWS staff
January 6, 2015	Cookeville, TN	TVA staff; TN ES FO staff	Checkpoint
January 14, 2016	Atlanta, GA	TVA staff; Staff from SE Regional office and TN ES FO	Overview and Status
January 22, 2016	Email correspondence	TVA staff; TN ES FO staff	Provided BA Chapters 1-2 for USFWS review.
February 1, 2016	TVA Office, Chattanooga, TN	TVA staff; AL ES FO staff	Overview, Status, and Q&A of Bat Programmatic Consultation with AL USFWS staff
February 16, 2016	USFWS Office, Jackson, MS / Conference call	TVA staff; MS ES FO staff	Overview, Status, and Q&A of Bat Programmatic Consultation with MS USFWS staff
February 22, 2016	USFWS Office Frankfort, KY / Conference call	TVA staff; KY ES FO staff	Overview, Status, and Q&A of Bat Programmatic Consultation with KY USFWS staff

Date	Location/Type of Correspondence	Participants	Discussion Topic
March 7, 2016	USFWS Office, Abingdon, VA	TVA staff; staff from VA ES FOs	Overview, Status, and Q&A of Bat Programmatic Consultation with VA USFWS staff
March 8, 2016	USFWS Office, Asheville, NC	TVA staff; NC ES FO staff	Overview, Status, and Q&A of Bat Programmatic Consultation with NC USFWS staff
March 10, 2016	Email correspondence	TVA staff; TN ES FO staff	Next steps, prep for July effects analysis meeting.
May 5, 2016	Email correspondence	TVA staff; TN ES FO staff	Review request of effects analysis framework
May 23, 2016	Email correspondence	TVA staff; TN ES FO staff	Response from USFWS staff on approach to effects analysis
May 18, 2016	Email correspondence	TVA staff; NC ES FO GIS staff	Indiana bat data for GIS analysis
July 13, 2016	Email correspondence	TVA staff; TN ES FO staff	Documentation for USFWS review prior to July 20th meeting: Action Area; acreage estimates; available forest cover; environmental practices; effects analysis for activities.
July 20, 2016	Chattanooga, TN	TVA staff; Staff from SE Regional office, and ES FOs in KY, MS, TN, AL, NC	Meeting to discuss effects analysis of routine actions and conservation measures
August 10, 2016	Email correspondence	TVA staff; USFWS staff	Notes, comments, actions items from meeting on July 20, 2016, distributed for review
August 25, 2016	Email correspondence	TVA staff; USFWS staff	Distribution of (finalized) notes from July 20th.
July 21, 2016; September 1, 2016	Email correspondence	USFWS staff; TVA staff	Comments on effects analysis and conservation practices
Sept 13, 2016	Email correspondence	TVA staff; NC ES FO GIS staff	GIS data provided to TVA for Indiana bat habitat
September 15, 2016	Telephone call	Message left by TVA staff for TN ES FO staff	Confirmation of next steps (address comments, complete BA)
December, 2016 - January 2017	Email correspondence	TVA staff; SE Regional office staff, KY ES FO staff	Followed up regarding minimization measures.
February 9, 2017	Crossville, TN	TVA staff; TN ES FO staff	Status of BA, relevance to TVA's proposed programmatic Transmission System Vegetation Management Environmental Impact Statement

Date	Location/Type of Correspondence	Participants	Discussion Topic
June 16, 2017	Email, postal correspondence	TVA staff, staff in SE and NE Regional offices and ES FO	Submission of BA
March 8, 2018	Email correspondence	TVA staff, TN ES FO Staff	Letter of concurrence for NLAA determinations
April 4, 2018	Email, postal correspondence	TVA staff, TN ES FO Staff	Final, signed Biological Opinion
October 27, 2022	Email correspondence	TVA staff, AL, GA, KY, MS, NC, TN, VA ES FO staff	Request for designation of contact person for the reinitiation effort.
November 4, 2022	Conference call	TVA staff, TN ES FO staff, Regional Office staff	Summary of existing consultation, status of "Take" used to date, establishment of process and deliverables for reinitation of Programmatic Consultation
November 2022 – January 2023	Conference calls and phone calls	TVA staff, AL, GA, KY, MS, NC, TN, ES FO staff	Separate discussion with each FO regarding current bat population status and trends in population data since 2018.
January 9, 2022	Email Correspondence	TVA staff, AL, GA, KY, MS, NC, TN, VA ES FO staff, Region 4 Office Staff	TVA Letter of intent to reinitiate the Programmatic Consultation sent.
February 9, 2023	Conference call	TVA staff, TN & NC ES FO staff, Regional Office staff	Small group meeting to discuss approach and initial edits to Draft Programmatic Reinitation document.
February 9, 2023	Email Correspondence	TVA staff, TN ES FO Staff	Response to TVA letter of intent to reinitiate Programmatic Consultation. Service agreed that reinitation is appropriate.
February 27, 2023	Conference call	TVA Staff, TN, VA, MS, KY, GA ES FO Staff	Large group meeting to summarize BA updates, provide path for acquiring NLEB population estimates for TVA Region, establish timelines for reviews
March 6, 2023	Conference call	TVA Staff, TN, VA, MS, KY, GA, AL, NC ES FO Staff	Large group meeting discussing due dates of BA review by ES FO offices and updates on gathering occupancy rates for NELB and BO draft process

Date	Location/Type of Correspondence	Participants	Discussion Topic
March 13, 2023	Conference call	TVA Staff, TN, VA, MS, KY, GA, AL, NC ES FO Staff	Large group meeting discussing due dates and opportunity to voice concerns over the draft BA.
March 20, 2023	Conference call	TVA Staff, TN, VA, MS, KY, GA, AL, NC ES FO Staff	Large group meeting discussing due dates for final revised BA and BO, received occupancy rates, and take calculation estimates.

Objectives of Biological Assessment of Programmatic Strategy:

- Identify Action Area, routine actions and associated activities with reasonable and foreseeable likelihood to occur as well as estimates of associated acreage.
- Identify listed species and DCH within the Action Area.
- Compile available information (e.g., occurrence records in TVA's Regional Natural Heritage Database) to describe status of species within the Action Area.
- Identify direct, indirect, and cumulative effects, and interdependent and interrelated actions, to be added to the environmental baseline.
- Develop avoidance and minimization measures to remove or reduce risk of direct impacts to listed species and their DCH.
- Group TVA activities according to appropriate effect determinations: No effect (NE), NLAA, or LAA.
- Develop a process to track project actions and activities and determination of effects for project-specific documentation and notification and annual reporting.

CHAPTER 2 - DESCRIPTION OF THE ACTION AREA

2.1 Introduction

The 20-year Action Area (1,015,221 ac) addressed in this BA comprises 1.24 percent of the TVA region (i.e., approximately 82,818,834 ac). Acreage affected by proposed activities, however, will not include the entire 1,015,221 ac within the Action Area. The 20-year cumulative estimate for affected acreage within the Action Area is 461,564 ac (45.5 percent of acreage within the Action Area). It is necessary to differentiate between "Action Area" and "affected acreage" for the following reasons. While some activities will occur at specific sites (e.g., pond closures at a TVA fossil plant) or on a specific land type (e.g., prescribed burns on TVA-owned Reservoir Lands), the precise location of other activities (e.g., construction of new transmission line (TL) substations or solar farms) have not yet been determined. Even so, based on review of long-term historic data and quantitative analysis of future needs and activities, sufficient information exists to cumulatively estimate affected acreage within Action Area. The 20-year cumulative estimated tree removal within affected acreage is 47,204 ac, which is ten percent of affected acreage, 4.65 percent of the Action Area, and 0.06 percent of the TVA region. The action area addressed in the reinitation of the BPC has not changed, nor has the cumulative estimate for affected acreage over the 20-year duration of the PBC. Acreage removed over the last 5 years has fallen within the amounts estimated.

2.2 TVA Region

The TVA region (Figure 2-1) is comprised of two primary overlapping areas: the Tennessee River Watershed and TVA's PSA.

Section 26a of the TVA Act requires that TVA's approval be obtained prior to construction, operation, or maintenance of any dam, appurtenant works, or other obstruction affecting navigation, flood control, or public lands or reservations across, along, or in the Tennessee River or any of its tributaries. TVA implements Section 26a of the Act through its Section 26a regulations (18 C.F.R. part 1304) and TVA's SMP (see Section 1.2.6).

Within the PSA, TVA maintains one of the largest TL systems in North America, connecting power from TVA generating plants to 10 million people in the Tennessee Valley, across 80,000 square miles in seven states (Alabama, Georgia, Tennessee, Mississippi, Kentucky, North Carolina and Virginia). TVA provides power to 153 individual LPCs, 58 large industrial customers, and seven federal installations.

2.3 TVA-Retained Land

TVA-retained reservoir lands (planned reservoir lands [293,000 ac] plus additional operational lands [38,000 ac]) account for 0.41 percent (331,000 ac) of the TVA region (82,818,834 ac) and 33.1 percent of the Action Area (1,000,221 ac) (Table 2-1). A number of activities described in this BA occur on TVA-retained reservoir lands.

2.3.1 History

TVA manages public lands to meet a wide range of regional and local resource development needs and to improve quality of life throughout the Tennessee Valley. Public lands have been used for parks, industrial development, commercial recreation, residential development, tourism development, wildlife management areas, and to meet a variety of other needs associated with local communities and government agencies.

Shortly after its creation in 1933, TVA purchased approximately 1.3 million ac of land to develop 46 reservoirs within the TVA region. As of 2018, of these 1.3 million ac, approximately 508,000 ac have been sold or transferred to other federal agencies, state agencies, and others, mostly for public use. Approximately 470,000 ac were inundated by TVA's reservoir system. Approximately 293,000 ac of land (11,000 miles of shoreline) are managed for public use and 38,000 ac are used for power, transmission and commercial operations.

TVA-managed lands are subdivided into manageable parcels, and each parcel is designated for a single-use or allocation. Under this methodology, RLMPs focus on individual reservoirs or groups of reservoirs. Even though some RLMPs may include multiple reservoirs, planning is still performed on a reservoir-by-reservoir basis. Single-use parcel allocation RLMPs are planned in a public forum and approved by the TVA Board or its designee and adopted as agency policy (TVA 2011a).

2.3.2 Comprehensive Valley-wide Land Plan

TVA provides efficient resource stewardship that is responsive to stakeholder interests, incorporating integrated resource management principles to achieve an optimum level of multiple uses and benefits that protect and enhance natural, cultural, recreational and visual resources. Through this approach, TVA ensures that resource stewardship issues and stakeholder interests are considered while optimizing benefits and minimizing conflicts. As part of the 2011 NRP (TVA 2011a), TVA developed a Comprehensive Valley-wide Land Plan (CVLP) to guide resource management and administration. The CVLP identifies the most suitable uses for TVA-managed lands and categorizes them into seven zone designations.

The proportion of land allocations (i.e., CVLP target ranges (Table 2-1)) were developed using the single-use parcel allocations in existing Board-approved RLMPs. Ranges represent the total percentage of TVA lands that are or will be designated to each zone across TVA reservoirs as a whole. During subsequent planning efforts, lands that are no longer suitable for their current allocation typically would be reviewed and reallocated to another zone designation if the land is capable and suitable for another use and the change is within the allocation ranges of the CVLP.

The RLMP planning process is a systematic method of identifying and evaluating the most suitable use of public lands under TVA's stewardship. TVA uses public input, computer analysis, information, and expertise from other federal, state and local agencies to designate parcels of land by category, or zone. Further detail on the RLMP planning process may be found at https://www.tva.gov/Environment/Environmental-Stewardship/Land-Management/Reservoir-Land-Management-Planning-Zones).

The RLMP process includes the following seven zones (also see Table 2-1 for zones and acreage):

Zone 1: Non-TVA Shoreland

Shoreland located above summer pool elevation that TVA does not own in fee, or land that was never purchased by TVA. TVA does not allocate private or other non-TVA land. This category is provided to assist in any comprehensive evaluation of potential environmental impacts of TVA's allocation decisions. In many instances, TVA may have purchased the right to flood and/or limit construction of structures on this non-TVA land in the form of flowage easements.

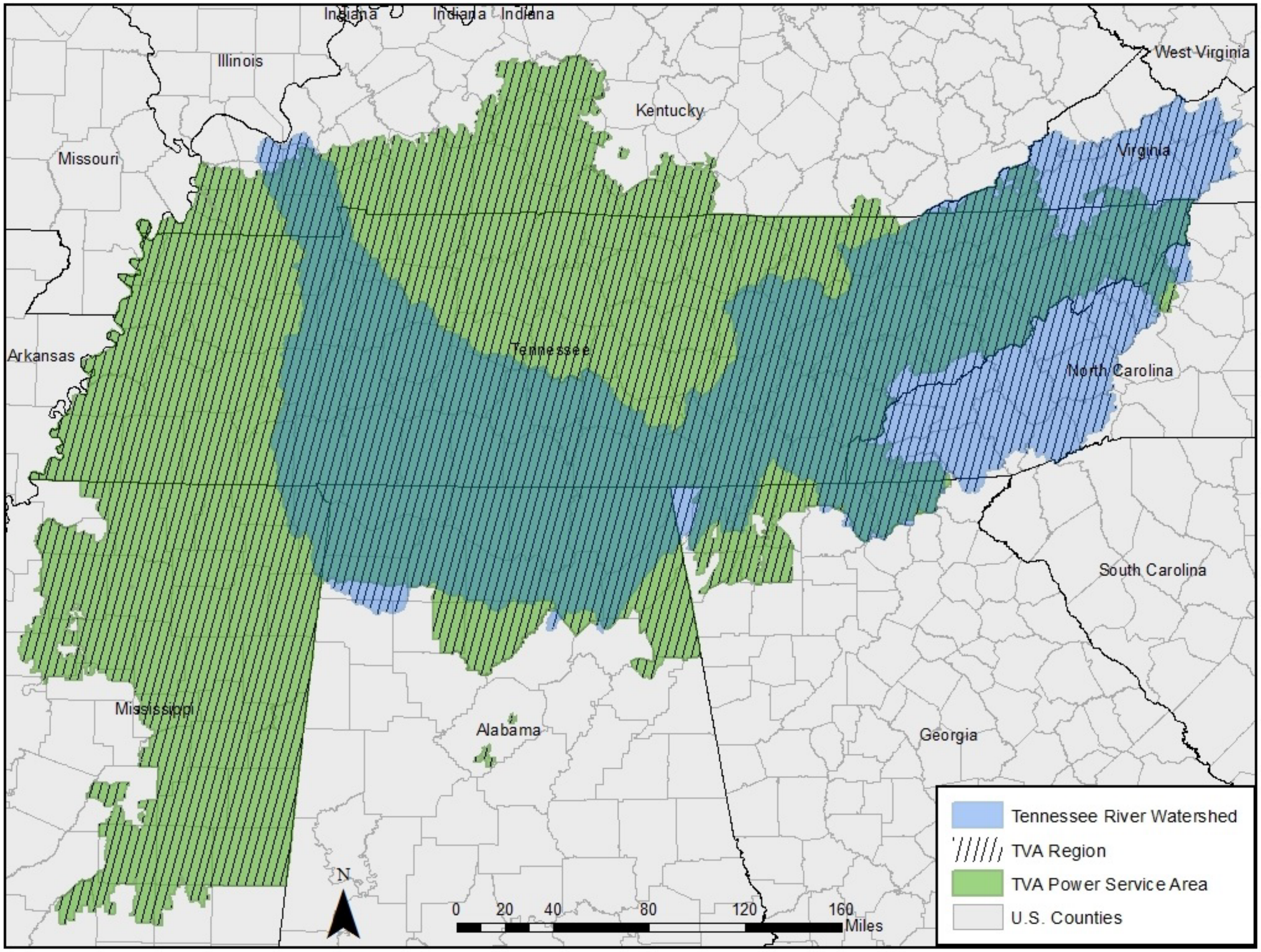


Figure 2-1. The Tennessee Valley Authority Region is Composed of the Tennessee River Watershed and Tennessee Valley Authority Power Service Area Combined

Table 2-2. Action Area: TVA's 20-Year Programmatic Strategy for Routine Actions and Bats

Area	Land Type/ Disposition	Land Allocation	Action Area Acreage	% of Land Type	CVLP[2] Range	% of TVA Region	% of Action Area
Total TVA Region [1] = 82,818,834							
TVA-Retained Land (Section 2.3)							
	Reservoir Land	Project Operations, Zone 2	20,510	7%	5 - 7%	0.02%	2.05%
		Sensitive Resource Management, Zone 3	49,810	17%	16 -18%	0.06%	5.00%
		Natural Resource Conservation, Zone 4	178,730	61%	58 - 65%	0.22%	17.90%
		Industrial, Zone 5	5,860	2%	1 - 2%	0.01%	0.59%
		Developed Recreation, Zone 6	23,440	8%	8 - 10%	0.03%	2.34%
		Shoreline Access, Zone 7	14,650	5%	5%	0.02%	1.46%
		Total Planned Reservoir Lands	293,000			0.36%	29.30%
	Power Properties (Transmission and Commercial)		38,000			0.05%	3.80%
	Land Under Water (Not Included in Action Area)		470,000			0.57%	
	Land Sold or Transferred (Not Included in Action Area)		508,000			0.61%	
	Total TVA-Retained Land potentially used for Actions[3]		**331,000**			**0.41%**	**32.60%**
TVA Transmission Easements (Section 2.4)							
	Existing Transmission Line (TL) Right-of-Way (ROW)		237,300			0.29%	23.72%
	100-ft Maintenance Buffer Adjacent to Existing TL ROW		307,901			0.37%	30.78%
	Estimate of New TL ROW		23,800			0.03%	2.38%
	Total Acreage Managed for TL ROW Actions		**569,001**			**0.69%**	**56.05%**
Public Land (non-TVA) associated with TVA's Economic Development Program (Section 2.5)							
	Sites identified for Economic Product Development		**75,220**			**0.09%**	**7.41%**
Private Land associated with TVA's Renewable Energy Program (Section 2.6)							
	Sites identified for Distributed (mid-scale) Solar Generation[4]		**40,000**			**0.05%**	**3.94%**
Proportion of TVA Region that is the 20-Year Action Area			**1,015,221[5]**			**1.24%**	**100%**

[1] Combination of TVA Power Service Area and Tennessee River Watershed.
[2] CVLP = Comprehensive Valley-wide Land Plan for TVA's Reservoir Lands as stated in TVA's 2011 Natural Resources Plan (TVA 2011a). Some zoning acreages shifted in TVA's 2020 Natural Resources Plan but the Total Planned Reservoir Lands remains the same.
[3] Does not include land under water or land sold/transferred (these were included in Table to reflect historically owned/acquired land).
[4] From TVA's Integrated Resource Plan Final EIS (TVA 2015) and Distributed Solar Solutions Program (TVA 2017a)
[5] Note that Action Area (1,000,221 ac) is different than affected acreage (446,564 ac). As anticipated in the original BPC, some properties have been acquired and sold since 2018 and new TL easements acquired and ROWs maintained. Actions that have occurred over the first 5 years of the BPC align with these original estimates. See Section 2.1.

Zone 2: Project Operations
All TVA reservoir land currently used for operations and public works projects. This includes:

- Land adjacent to established navigation operations: locks, lock operations and maintenance facilities and the navigation work boat dock and bases
- Land used for TVA power projects operations: generation facilities, switchyards and transmission facilities and right-of-way (ROW) that is owned by TVA
- Dam reservation land: areas used for developed and dispersed recreation, maintenance facilities, watershed team offices, research areas and visitor centers
- Navigation safety harbors/landings: areas used for tying off commercial barge tows and recreational boats during adverse weather conditions or equipment malfunctions
- Navigational dayboards (informational signboards) and beacons: areas with structures placed on the shoreline to facilitate navigation
- Public works projects: includes fire halls, public water intakes, public treatment plants, etc.
- Land planned for any of the above uses in the future

Zone 3: Sensitive Resource Management
Land managed for protection and enhancement of sensitive resources. Sensitive resources, as defined by TVA, include resources protected by state or federal law or executive order (EO) and other land features/natural resources TVA considers important to the area viewscape or natural environment. Recreational activities, such as hunting, wildlife observation and camping on undeveloped sites may occur in this zone, but the overriding focus is protecting and enhancing the sensitive resource the site supports. This includes:

- TVA-designated sites with potentially significant archaeological resources.
- TVA public land with sites/structures listed on or eligible for listing on the National Register of Historic Places.
- Wetlands: aquatic bed, emergent, forested and scrub-shrub wetlands. TVA is guided by EO 11990 (Protection of Wetlands, 1977), utilizes database resources and site visits to evaluate potential impacts to wetlands, and works with applicants (and the U.S. Army Corps of Engineers [USACE], if needed) to avoid impacts.
- TVA public land under easement, lease or license to other agencies/individuals for resource protection purposes.
- TVA public land fronting land owned by other agencies or individuals for resource protection purposes.
- Habitat Protection Areas (HPA): TVA Natural Areas managed to protect populations of species identified as threatened or endangered by the USFWS, state-listed species and any unusual or exemplary biological communities/geological features.
- Ecological Study Areas: TVA Natural Areas designated as suitable for ecological research and environmental education by a recognized authority or agency.

- Small Wild Areas: TVA Natural Areas managed by TVA alone or in cooperation with other public agencies or private conservation organizations to protect exceptional natural, scenic or aesthetic qualities that can also support dispersed, low-impact types of outdoor recreation.
- River corridor with sensitive resources: a river corridor is a linear green space along both stream banks of selected tributaries entering a reservoir managed for light boat access at specific sites, riverside trails, and interpretive activities.
- Significant scenic areas: these are areas designated for visual protection because of their unique vistas or particularly scenic qualities.
- Champion tree site: areas designated by TVA as sites that contain the largest known individual tree of its species in that state; the state forestry agency Champion Tree Program designates the tree, while TVA designates the area of the sites for those located on TVA public land.
- Other sensitive ecological areas: examples of these areas include heron rookeries, uncommon plant and animal communities and unique cave or karst formations.

Zone 4: Natural Resource Conservation

Land managed for the enhancement of natural resources with an emphasis on public use. Appropriate activities in this zone include hunting, timber management to promote forest health, wildlife observation and camping on undeveloped sites. Includes the following:

- TVA public land under easement, lease or license to other agencies for wildlife or forest management purposes.
- TVA public land fronting land owned by other agencies for wildlife or forest management purposes.
- TVA public land managed for wildlife or forest management projects.
- Informal recreation areas maintained for passive, dispersed recreation activities, such as hunting, hiking, bird-watching, photography, primitive camping, bank fishing and picnicking.
- Shoreline Conservation Areas: narrow riparian strips of vegetation between the water's edge and TVA's back-lying property that are managed for wildlife, water quality or visual qualities.
- Wildlife Observation Areas: TVA Natural Areas with unique concentrations of easily observed wildlife that are managed as public wildlife observation areas.
- River corridor without sensitive resources present: a river corridor is a linear green space along both stream banks of selected tributaries entering a reservoir managed for light boat access at specific sites, riverside trails and interpretive activities.
- Islands of 10 ac or less.

Zone 5: Industrial

Land managed for economic development, including businesses in distribution-processing-assembly and light manufacturing. Preference will be given to businesses requiring water access. Parcel descriptions should describe the primary type of use and discuss potential for infrastructure, access and development; access for water supply or structures associated with navigation such as barge terminal, mooring cell, etc.; and land-based development potential.

Areas included in Zone 5 are:

- TVA public land under easement, lease or license to other agencies/individuals for purposes described above.
- TVA public land fronting land owned by other agencies/individuals for industrial for purposes described above.
- Sites planned for future use supporting sustainable development.

Types of development that can occur on Zone 5 land include:

- Business parks (not including retail, service-based businesses like laundry, fast food, grocery stores, gas stations, day cares or any walk-in type businesses).
- Industrial access: access to the waterfront by back-lying property owners across TVA property for water intakes, wastewater discharge, or conveyance of commodities (i.e., pipelines, rail or road).
- Barge terminal sites: public or private facilities used for the transfer, loading and unloading of commodities between barges and trucks, trains, storage areas or industrial plants.
- Fleeting areas: sites used by the towing industry to switch barges between tows or barge terminals that have both offshore and onshore facilities.
- Minor commercial landing: a temporary or intermittent activity that takes place without permanent improvements to the property—these sites can be used for transferring pulpwood, sand, gravel and other natural resource commodities between barges and trucks.

Zone 6: Developed Recreation

Designations are based on levels of development and the facilities available to the public, graduating from informal use to more developed use. Parcel descriptions should describe the primary type of use and discuss potential for infrastructure, access, and development.

- Water access: small parcels of land, generally less than 10 ac, and typically shoreline areas conveyed to public agencies for access.
- Public: more recreational opportunities, some facilities, more than just launching a boat and typically generally greater than 10 ac including areas that have been conveyed for public recreation.
- Commercial: property suitable and capable to support commercial water-based operations including areas that have been conveyed for commercial recreation.

These lands include all reservoir land managed for concentrated, active recreational activities that require capital improvement and maintenance, including:

- TVA public land under easement, lease or license to other agencies/individuals for recreational purposes.
- TVA public land fronting land owned by other agencies/individuals for recreational purposes.
- TVA public land developed for recreational purposes, such as campgrounds, day use areas, etc.
- Land planned for any of the above uses in the future.

Types of development that can occur on Zone 6 land includes:

- Water access: e.g., typically informal areas and can include launching ramps, courtesy piers, canoe access, parking areas, picnic areas, trails, etc.
- Public recreation: recreation on publicly owned land with facilities developed by a public agency and providing amenities open to the general public. Facilities at "public recreation" (municipalities/communities) areas typically include playgrounds/play structures, picnic facilities, tennis courts, horseshoe areas, play courts, recreation center, athletic fields, trails, Natural Areas, amphitheaters, food concessions (vending, snack bar), access to water for fishing and boating, swimming areas and swimming pools, marina facilities owned by the public entity, parking and/or overnight (developed) camping.
- Commercial recreation: defined as recreation amenities that are provided for a fee to the public intending to produce a profit for the owner/operator. These primarily water-based facilities typically include marinas and affiliated support facilities like restaurants and lodges; campgrounds; cabins; military vessel attractions, excursion tour vessels (restaurant on the water), etc.
- Greenways: linear parks or developed trails located along natural features, such as lakes or ridges, or along man-made features, including abandoned railways or utility ROWs, which link people and resources together.

Zone 7: Shoreline Access
This is TVA-owned land where Section 26a applications and other land use approvals for shoreline alterations are considered. Requests for shoreline alterations are considered on parcels identified in this zone where such use was previously considered and where the proposed use would not conflict with the interests of the general public. Types of development/management that can occur on this land are:

- Residential water use facilities, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space and non-potable water intakes,
- Shoreline access corridors, e.g., pathways, wooden steps, walkways or mulched paths, which can include portable picnic tables and utility lines,
- Shoreline stabilization, e.g., bioengineering, riprap, gabions, and retaining walls,
- Shoreline vegetation management on TVA-owned access shoreland,
- Conservation easements for protection of the shoreline, and
- Other activities, e.g., fill, excavation, grading, etc.

2.4 TVA Transmission Easements

In 2018 TVA maintained 237,300 ac of existing TL ROW easements throughout its PSA. At that time TVA estimated that 23,800 ac of new ROW would be developed over the next 20 years. To meet reliability standards and requirements (e.g., North American Electric Reliability Corporation [NERC]), TVA also has to take actions to address hazard trees within 100 ft of either side of existing ROWs. Land adjacent (i.e., within 100 ft) to and within ROWs (totaling 569,001 ac) constitute 0.69 percent of the TVA region and 56.89 percent of the Action Area (Table 2-1). At present, TVA now maintains approximately 240,054 acres of existing TL ROW which is within the projected estimates of the original BPC. Projected estimates for total ROW developed over the 20-year duration of the BPC remain the same as originally estimated.

While TVA owns the underlying land for some of its TL ROW, the majority of TVA's transmission system is located on property that is not owned by TVA. Rather, TVA purchases easements from landowners for new ROW. These easements give TVA the right to construct, operate, and maintain the TL, as well as remove hazard trees adjacent to the ROW. The fee simple ownership of the land within the ROW remains with the landowner, and many activities and land uses can continue to occur on the property. Terms of the easement, however, prohibit activities within the ROW that could interfere with operation and maintenance of the TL.

2.5 Sites Located on Public (non-TVA) Land and Associated with TVA's Economic Development Program

As part of its mission of promoting economic development, TVA provides grants to municipalities for economic development projects. Based on historic data, TVA potentially could contribute funds or conduct activities for economic development in the Action Area that will involve approximately 75,220 ac of on-the-ground projects. Land ownership for the majority of such projects is publicly owned. This acreage accounts for 0.09 percent of the TVA region and 7.52 percent of the Action Area (Table 2-1).

2.6 Sites Located on Private Land and associated with TVA's small and mid-scale Renewable Programs for Solar Projects

TVA currently owns and operates 14 small photovoltaic (PV) installations. TVA also purchases energy generated from numerous PV facilities up to 20 megawatts (MW) in size that usually are located on private land. Over the next 20 years, TVA anticipates that small and mid-scale solar installations would involve an estimated 40,000 ac, which constitutes 3.94 percent of the Action Area and 0.05 percent of the TVA region (Table 2-1). Land requirements for small and mid-scale PV facilities vary greatly and depend on the type of installation. Building-mounted systems typically do not require land use. Ground-mounted systems may be on canopies that provide shelter. Land requirements for stand-alone ground-mounted systems vary with the type of mounting system. Small and mid-scale solar projects associated with TVA's Renewable Programs have the potential to occur across the TVA region and likely will range from generating 50-kV to 2 MW. However, it is anticipated that most of the future solar development within the TVA region will be utility-scale solar and outside of the scope of this consultation.

2.7 Vegetation in the TVA Region

2.7.1 Ecoregions

The nine ecoregions (Figure 2-2) spanned by the TVA region include the Blue Ridge, the Ridge and Valley, the Central Appalachians, the Southwestern Appalachians, the Interior Plateau, the Interior River Valley and Hills, the Southeastern Plains, Mississippi Valley Loess Plain, and the Mississippi Alluvial Plain (Omernik 1987). The diverse terrain across the TVA region ranges from the mountains of the Blue Ridge to the bottomland hardwoods and cypress swamps of the Mississippi Alluvial Plain. This area, rich in biodiversity, is composed of numerous habitats and plant communities and approximately 4,000 species of herbs, shrubs, and trees (A. Weakley and B. E. Wofford, personal communication, July 6, 2010). Much of the region is heavily forested. The Final EIS for TVA's NRP (TVA 2011b) provides a detailed overview of each of the nine ecoregions located in the TVA Region.

2.7.2 Forest Regions

There are three forest regions and two subregions in the TVA region (Dyer 2006). Much of the TVA region is dominated by the mesophytic forest region, which is the most diverse among the regions with 162 tree species. No species assumes canopy dominance across the region, but red maple and white oak have the highest average importance values. Within the mesophytic forest region, the Appalachian oak subregion is dominated by various species of oak: black oak, chestnut oak, northern red oak, scarlet oak, and white oak. The area of the Nashville Central Basin has close affinities with beech-maple-basswood forests that dominate the Midwestern U.S. Species associated with this forest region are American basswood, American beech, American elm, black cherry, northern red oak, sugar maple, white ash, and white oak (Dyer 2006). The oak-pine subregion of the Southern Mixed forest region is found in portions of Alabama, Georgia, and Mississippi where the dominate species are loblolly pine, sweetgum, red maple, and southern red oak (Dyer 2006). The black belt area of Alabama and Mississippi has close affinities to the Mississippi Alluvial Plain and is known for its rich, dark soils. Much of the area has been cleared for agricultural purposes. The Mississippi Alluvial Plain is the final forest region found within the TVA region and is restricted to the Mississippi River Valley. The bottomland forests in this region are dominated by American elm, bald cypress, green ash, loblolly pine, sugarberry, and sweetgum (TVA 2011b).

2.7.3 Invasive Plants

Most lands in the TVA region have been affected by invasive plants, which are the second-leading threat to imperiled native species NatureServe (2009). Certain nonnative species are considered invasive and pose threats to the natural environment. EO 13751 defines an invasive species as a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health (Obama 2016). This EO directs actions to continue coordinated federal prevention and control efforts related to invasive species. The EO incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into federal efforts to address invasive species and strengthens coordinated, cost-efficient federal action.

Invasive plants infest under and beside forest canopies and occupy small forest openings, increasingly eroding forest productivity, hindering forest use and management activities, and degrading diversity and wildlife habitat. They occur as trees, shrubs, vines, grasses, ferns, and forbs. Some have been introduced into this country accidentally, but most were brought here as ornamentals or for livestock forage. Because these robust plants arrived without their natural predators of insects and diseases they increase across the landscape with little opposition, beyond the control and reclamation measures applied by landowners and managers on individual land holdings (Miller 2003).

Invasive plants occur across southern Appalachian forests, accounting for 15 to 20 percent of documented flora (USFS 2009). Data show that 19 percent of Alabama, 5 percent of Georgia, 16 percent of Kentucky, 5 percent of North Carolina, 16 percent of Tennessee, and 10 percent of Virginia forests are estimated to be covered by one or more invasive plants listed in Table 2-2 (Miller et al. 2008).

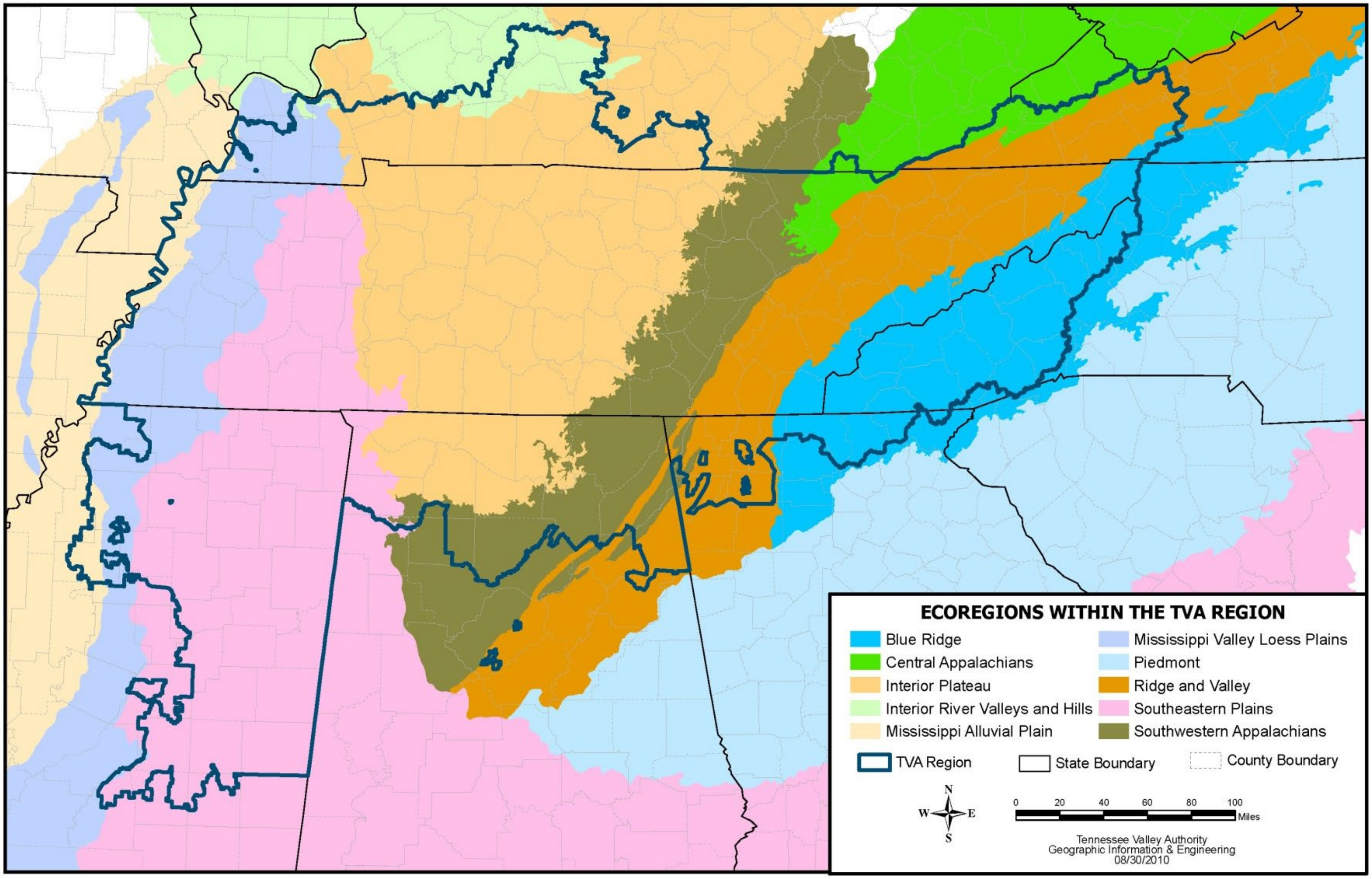


Figure 2-2. Ecoregions Within the TVA Region. Adapted from Omernik (1987)

Table 2-3. Invasive Plants in the TVA Region

Trees	Tree-of-heaven (*Ailanthus altissima*)
	Silktree or mimosa (*Albizia julbrissin*)
	Princesstree or paulownia (*Paulownia tomentosa*)
	Chinaberrytree (*Melia azedarach*)
	Tallowtree or popcorntree (*Triadica sebifera*)
	Russian olive (*Elaeagnus angustifolia*)
Shrubs	Silverthorn (*Elaeagnus pungens*)
	Autumn olive (*Elaeagnus umbellata*)
	Winged burning bush (*Euonymus alatus*)
	Chinese and European privets (*Ligustrum sinense* and *L. vulgare*)
	Japanese and glossy privets (*Ligustrum japonicum* and *L. lucidum*)
	Nonnative bush honeysuckles (*Lonicera maackii, L. morrowii, L., tartarica, L. fragrantissima,* and *L. xbella*)
	Nandina (*Nandina domestica*)
	Nonnative roses (*Rosa multifora, R. bracteata,* and *R. laevigata*)
Vines	Nonnative climbing yams (*Dioscorea oppositifolia* and *D. bulbifera*),
	Wintercreeper (*Euonymus fortunei*)
	English ivy (*Hedera helix*)
	Japanese honeysuckle (*Lonicera japonica*)
	Kudzu (*Pueraria montana*)
	Vincas or periwinkles (*Vinca minor* and *V. major*)
	Nonnative wisterias (*Wisteria sinensis* and *W. floribunda*)
	Oriental bittersweet (*Celastrus orbiculatus*)
Grasses and canes	Giant reed (*Arundo donax*)
	Tall fescue (*Lolium arundinaceum*)
	Cogongrass (*Imperata cylindrica*)
	Nepalese browntop or microstegium (*Microstegium vimineum*)
	Chinese silvergrass (*Miscanthus sinensis*)
	Nonnative bamboos (*Phyllostachys aurea,* other *Phyllostachys* spp., and *Bambusa* spp.)
Ferns and forbs	Japanese climbing fern (*Lygodium japonicum*)
	Garlic mustard (*Alliaria petiolata*)
	Shrubby lespedeza (*Lespedeza bicolor*)
	Chinese lespedeza (*Lespedeza cuneata*)
	Tropical soda apple (*Solanum viarium*)

2.7.4 Vegetation Types and Trends on TVA Lands

Based on an analysis of land use/land cover (LULC) data for typical Zone 3 and Zone 4 reservoir lands, the dominant vegetation types are upland deciduous hardwood, bottomland hardwood, mixed, and evergreen forests (predominantly pine and eastern red cedar) (Figure 2-3). These four vegetation types cover about 85 percent of the land area. Four other vegetation types cover the remainder of the land area. Forests on TVA lands are similar to forests found in Tennessee (Oswalt et al 2009), where deciduous hardwood forests dominated by oak-hickory is the most common forest type.

A large portion of evergreen or pine-dominated forests on TVA lands are mature loblolly pine plantations in the southern and western Valley. Compared to Tennessee as a whole, TVA land contains a higher percentage of bottomland forest. This is largely due to the location of most TVA lands along the Tennessee River and its tributaries, where bottomlands can be extensive.

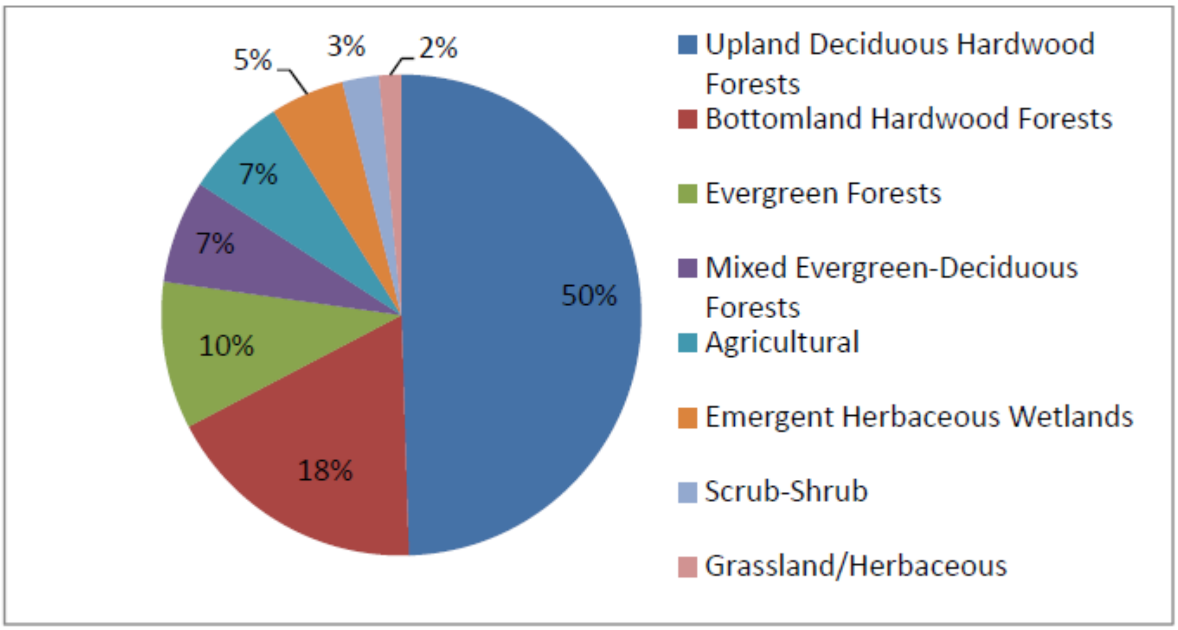


Figure 2-3. Vegetation Types on TVA Zone 3 and Zone 4 Reservoir Lands by Percent of Land Cover

TVA has not collected TVA region-wide forest inventory data since the 1990s and therefore the precise average age of its forests is not known. However, based on inventory data and the fact that TVA has only conducted very limited salvage timber harvests (primarily associated with storm or insect damage) in recent years, TVA's forested lands have likely increased in age class structure. In addition, similar trends reported in Tennessee forests (Oswalt et al. 2009) can be inferred to be occurring on TVA lands as well. These trends show the peak in age class distribution has shifted to the 56-60+ year old age class and acreage in most of the younger age classes has declined.

In general, early successional vegetation types are decreasing across the TVA region. One exception to this can be found in former agricultural license tracts in the southern and western areas of the TVA region that are reverting back to bottomland hardwood forests, particularly sweetgum, green ash and red maple. Also, loss of some loblolly pine plantations to southern pine bark beetle infestations has created pockets of early successional vegetation, particularly in the eastern portion of the TVA region. Much of the regenerating vegetation in these areas is impacted by increase in nonnative invasive species that reduce plant diversity and value to wildlife habitat.

Trends in forest types between 2000 and 2010 on federal lands in Tennessee other than U.S. Forest Service and NPS lands were analyzed using Forest Inventory and Analysis data (USFS 2011). TVA lands make up the majority of these federal lands. This data shows large decreases in pine-dominated, other softwood, and oak-pine forest types and corresponding increases in oak-hickory and maple-beech-birch forest types to 57 percent and 13 percent of the forest area, respectively. Factors in the reduction of pine and other softwood forest types include mortality from southern pine beetle outbreaks and hemlock wooly adelgid (TVA 2011b).

2.7.5 Habitat Suitable for Tree-dwelling Bats in the TVA Region

LULC data was analyzed to calculate forest cover and potentially suitable habitat for tree-roosting bats in terms of acreage for the TVA region. LULC classifications (NLCD 2011) are defined in Table 2-3. Classifications included in the analysis were those identified by the USFWS and NiSource's Habitat Conservation Plan (HCP) (NiSource 2013) as potentially containing suitable tree-roosting habitat for Indiana bat and northern long-eared bat. This included: developed, open space (21); developed, low-intensity (22); developed, medium intensity (23); developed, high intensity (24); deciduous forest (41); evergreen forest (42); mixed forest (43); and woody wetlands (90). These nine classifications were included by NiSource due to potential for them to have some type/amount of tree cover (Mike Armstrong, personal communication, July 20, 2016). TVA differentiated potentially suitable tree-roosting habitat (all nine classifications) from forest cover by defining forest cover as the sum of acreage across only the latter four classifications (41, 42, 43, and 90). Based on this geographic information system (GIS) analysis, the TVA region contains 36,236,078 ac (44 percent) of forest cover and 41,919,482 ac (51 percent) of potentially suitable tree-roosting bat roost habitat (Table 2-4). To be conservative in identifying potential landscape-level effects to available tree-roosting habitat for both Indiana bat and northern long-eared bat, TVA analyzed tree removal (discussed further in Chapter 3) in the context of proportion of forest cover (versus suitable tree-roosting bat habitat).

Figure 2-4 provides an area-specific snapshot of LULC characterization surrounding Bull Run Fossil Plant, one of TVA's power properties.

Table 2-4. National Land Cover Database 2011 Classification Descriptions

Class\ Value	Classification Description
Water	
11	**Open Water**- areas of open water, generally with less than 25% cover of vegetation or soil.
Developed	
21[S]	**Developed, Open Space**- Mixture of some constructed materials, but mostly vegetation in form of lawn grasses. Impervious surfaces account for less than 20% of total cover. Most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22[S]	**Developed, Low Intensity**- Mixture of constructed materials and vegetation. Impervious surfaces account for 20-49% of total cover. Most commonly include single-family housing.
23[S]	**Developed, Medium Intensity** -Mixture of constructed materials and vegetation. Impervious surfaces account for 50-79% of total cover. Most commonly include single-family housing.
24[S]	**Developed High Intensity**-highly developed areas where people reside or work in high numbers (e.g., apartment complexes, row houses, commercial/industrial). Impervious surfaces account for 80-100% of total cover.
Barren	
31	**Barren Land (Rock/Sand/Clay)** - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Forest	
41[S,F]	**Deciduous Forest**- areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of tree species shed foliage simultaneously in response to seasonal change.
42[S,F]	**Evergreen Forest**- Dominated by trees generally taller than 5 meters, and greater than 20% of total vegetation cover. More than 75% of tree species maintain their leaves all year. Canopy is never without green foliage.
43[S,F]	**Mixed Forest**- Dominated by trees generally taller than 5 meters and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrubland	
52	**Shrub/Scrub**- areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
Herbaceous	
71	**Grassland/Herbaceous**- Dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. Not subject to intensive management (e.g., tilling), but can be utilized for grazing.
Planted/ Cultivated	
81	**Pasture/Hay**-areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
82	**Cultivated Crops** -areas used for production of annual crops (e.g., corn, soybeans, vegetables, tobacco, cotton, and also perennial woody crops (e.g., orchards, vineyards). Crop vegetation accounts for greater than 20% of total vegetation. Includes all actively tilled land.
Wetlands	
90[S,F]	**Woody Wetlands**- areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and soil or substrate is periodically saturated/covered with water.
95	**Emergent Herbaceous Wetlands**- Perennial herbaceous vegetation accounts for greater than 80% of vegetative cover, soil or substrate is periodically saturated/covered with water.

[S] Classifications included in Land Use/Land Cover (LULC) analysis to calculate potentially suitable tree-roosting habitat for Indiana bat and northern long-eared bat (NiSource 2013) in the TVA region.
[F] Classifications in LULC analysis to calculate total forest cover in the TVA region.

Table 2-5. Available Forest Cover and Suitable Tree-roosting Bat Habitat[1] in the TVA Region

Value	Classification	Acreage in TVA Region	Proportion of TVA Region
	TVA Region	*82,818,834*	
21	Developed, open space	3,757,858.22	4.54%
22	Developed, low intensity	1,284,113.90	1.55%
23	Developed, medium intensity	465,252.01	0.56%
24	Developed, high intensity	176,180.31	0.21%
41	Deciduous forest	26,315,899.52	31.78%
42	Evergreen forest	4,530,484.26	5.47%
43	Mixed forest	2,773,305.69	3.35%
90	Woody wetlands	2,616,388.80	3.16%
	Total Forest Cover (41,42,43,90)	36,236,078.27	43.75%
	Total Suitable Bat Habitat (21,22,23,24,41,42,43,90)	41,919,482.72	50.62%

[1] As defined in NiSource (2013) for Indiana bat and northern long-eared bat.

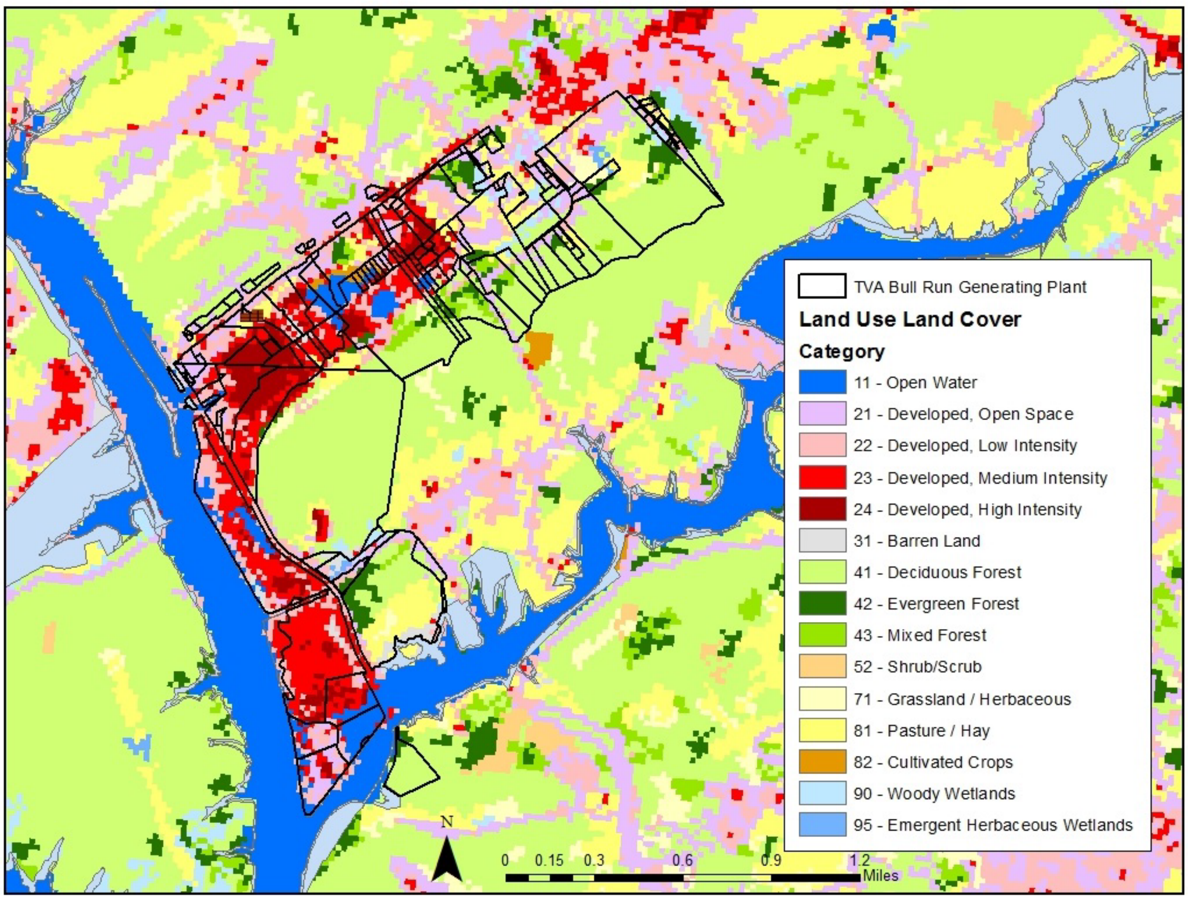


Figure 2-4. Example of a Land Use/Land Cover Characterization Surrounding a TVA Power Property

2.7.6 Karst Habitat in the TVA Region

Portions of the TVA region contain Karst topography supporting numerous caves and sinkholes (Luther 1977). Caves are abundant features throughout much of the TVA region, especially in north Alabama, northwest Georgia, and the eastern half of Tennessee. These sites provide a unique mixture of microhabitats used by a diverse array of cave-dependent species, some endemic to single cave systems. These areas in Alabama, Georgia, and Tennessee compose the southern end of a belt of limestone laid down hundreds of millions of years ago when the region was covered by an ancient sea. Where there is limestone there are likely to be caves, because limestone is susceptible to corrosion by slightly acidic water. Over millions of years this slow dissolution has riddled the bedrock with tunnels and chambers, creating a subterranean world in which the potential for exploration and discovery of undocumented sites is almost limitless. There are more than 14,000 known caves in these areas - 9,200 in Tennessee, 4,800 in Alabama, and 600 in Georgia (Jenkins 2009). Where conditions within a cave are suitable (e.g., humidity, air flow, temperature) there is potential for cave-dwelling bats to occur. All four species of bat addressed in this BA have been documented in caves located within the TVA region.

2.8 Water Resources in the TVA Region

2.8.1 Wetlands

Wetlands are highly productive and biologically diverse ecosystems that provide multiple benefits, one of which is serving as habitat for fish and wildlife resources, including potential water and foraging habitat for bats. Wetlands are defined by TVA Environmental Review Procedures (TVA 1983) as "those areas inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, mud flats, and natural ponds." The abundance of wetlands varies across the nine ecoregions encompassing the TVA region (Table 2-5). In eastern portions of the TVA region, wetlands occupy a relatively small percent of the landscape relative to uplands within the Blue Ridge, Ridge and Valley, and Central Appalachians ecoregions. These ecoregions are typically marked by relatively steep topography and deeply incised stream channels; wetlands are typically small and isolated or linear in feature and associated with the floodplain areas of streams, rivers, and creeks (Hefner et al. 1994). Farther west, the topography levels out and wetlands become more common. Broad, flat floodplain areas are common features, and various types of wetland habitats, especially bottomland hardwood forested wetlands, are widespread.

Table 2-6. Regional Variation of Wetland Abundance by Ecoregion[1]

Ecoregion	Proportion (Percent) of Ecoregion Covered by Wetlands (all types of wetlands)
Blue Ridge	>0.1
Ridge and Valley	>0.1
Central Appalachians	0.3
Southwestern Appalachians	0.2
Interior Plateau	>0.7
Interior River Valley and Hills	4.6
Southeastern Plains	10.3
Mississippi Valley Loess Plain	4.6
Mississippi Alluvial Plain	19.0

[1]Source: U.S. Department of the Interior 2008

Approximately 90 percent of wetlands on TVA lands are located on the mainstem Tennessee River reservoirs. Tributary reservoirs have few wetlands because of the steeper slope of the shorelines and the larger drawdown for flood control. The topography around mainstem reservoirs is flatter, lending itself to the establishment of wetlands. Within mainstem reservoirs, wetlands occur on flats between summer and winter pool elevations, on islands, along reservoir shorelines, in dewatering areas, in floodplains, on river terraces, along connecting rivers and streams, around springs and seeps, in natural depressions, in areas dammed by beaver, in and around constructed reservoirs and ponds (diked and/or excavated), and in additional areas that are isolated from other surface waters. On tributary reservoirs, wetlands are typically located at the backs of coves where tributary streams enter the reservoir, and in very patchy, small (<0.01 ac) areas along the shoreline.

In general, emergent wetlands (marshes) are common around ash disposal ponds and water treatment ponds at power generation facilities. Forested wetlands occur on lower-lying, undisturbed areas and along tributary streams on power generation sites. LULC data indicated forested and scrub-shrub wetlands comprise approximately 11 percent of the total LULC status of the power properties. Emergent wetlands are much less common, comprising less than 0.4 percent of total land use (TVA 2011a).

2.8.2 Other Water Features

The Tennessee River watershed contains all except one of TVA's dams. A series of nine locks and dams built mostly in the 1930s and 1940s regulates the entire length of the Tennessee River and allows navigation from the Ohio River to Knoxville. Virtually all the major tributaries have at least one dam, creating 14 multi-purpose storage reservoirs and seven single-purpose power reservoirs. In addition to the nine reservoirs on the mainstem of the Tennessee River, TVA operates 39 tributary dams for various combinations of power generation, flood control, pumped storage, navigation, recreation, water supply, economic development, and fish and wildlife habitat. Water quality is generally good in the TVA region. There are approximately 42,000 perennial stream miles in the Valley (TVA 1971). Most beneficial uses (as designated by the states) are supported in most water bodies, including fish and aquatic life, public and industrial water supply, waste assimilation, agriculture, and water-contact recreation. The Final EIS and supplemental EIS for TVA's 2011 NRP (TVA 2011b and TVA 2019) provides further detail on water quality and monitoring in the TVA region.

CHAPTER 3 – DESCRIPTION OF PROPOSED ACTIONS

3.1 Overview

This chapter describes actions routinely conducted by TVA, and activities routinely used to carry out these actions. As described in Chapter 2, the Action Area is characterized by variable land ownership and land allocation. As such, implementation of actions on the landscape naturally and strategically aligns closely with land ownership and allocation. While some activities (e.g., access roads) occur as a component of multiple actions, other activities (e.g., prescribed burns) are unique to a particular action. Activities are described first (Section 3.1.3), and then listed with each action in subsequent sections (3.2-3.11).

3.1.1 Summary of Proposed Actions and Associated Activities

As stated in Chapter 2, the 20-year Action Area is 1,015,221 ac in size. Estimated cumulative affected acreage within the Action Area is 461,564 ac, much of which is on a cyclical maintenance cycle and already in a disturbed or maintained state. Approximately 100,000 ac (range of 100,008-101,757 ac) across the Action Area would be affected annually. Table 3-1 provides a summary of affected acreage by land type and action. Affected acreage is defined as the estimated acreage on which one or more activities will be carried out to complete an action. Analysis at the action level rather than activity level is more programmatically meaningful and feasible to forecast over such a long time period.

Tree removal is a component of each action and is programmatically calculated at the action level. The proportion of affected acreage where tree removal may occur is estimated to be 47,204 ac over a 20-year period, and will range from 2,010 to 3,759 ac annually (Table 3-1). Annual tree removal would impact 0.006 to 0.011 percent of available forest cover; cumulative tree removal would impact 0.13 percent of available forest cover (NLDC 2011).

Based on action, proportion of tree removal that would result in a permanent change in habitat type (e.g., area permanently maintained as early-successional habitat following tree removal) and proportion of tree removal that is expected to result in a temporary change in habitat type (e.g., area allowed to naturally regenerate, trees planted following removal of hazard trees) was estimated. Actions on TVA Reservoir Lands (i.e., those associated with biodiversity, public use, cultural resource protection, and permitting actions) have potential for tree removal to be a temporary change in habitat (Table 3-2). For other actions, tree removal is conservatively estimated to be permanent, although there are anticipated exceptions (e.g., temporary establishment of access roads that naturally regenerate in tree cover, retirement of TL ROW along which tree regeneration is not prevented, retirement of power plants such that vegetative maintenance is reduced or eliminated).

TVA also determined level of flexibility by action as to when tree removal would need to occur. Some actions have greater flexibility in timing of tree removal than others such as compliance with other regulations, safety liability, work load constraints, budget constraints and limitations due to weather. This flexibility is reflected as proportion of total tree removal by action(s) divided across three seasonal clearing windows relevant to bat presence on the landscape. These seasonal clearing windows for northern long-eared bat and Indiana bat vary across the TVA region as detailed in below and in the footnote for Table 3.2.

Swarming season (when bats are present surrounding hibernacula) is defined as September 16 – November 15 (Virginia); October 1 through November 14 (Mississippi); and October 15 – November 14 (Alabama, Georgia, Kentucky, North Carolina, Tennessee). *Winter season* (when bats are not present on the landscape) is defined as November 15 through March 15 (Alabama); November 15 through March 31 (Georgia, Kentucky, Tennessee); November 15 – April 14 (Mississippi); November 15 through April 15 (North Carolina); and November 16 through April 14 (Virginia). *Non-winter season* (when bats are present on the landscape) is defined as March 16 through October 14 (Alabama); April 1 through October 14 (Georgia); April 1 through October 14 (Kentucky, Tennessee); April 15 through September 15 (Virginia); April 15 through September 30 (Mississippi); and April 16 through October 14 (North Carolina). The *range-wide pup season* (i.e., primary maternity period when non-volant pups are most vulnerable) is defined as June 1 - July 31 (USFWS 2017b). Georgia has developed a Bat Conservation Strategy that defines pup season as May 15 through July 31. All actions are able to conduct some proportion of tree removal during winter. Several actions anticipate that having to clear during June 1 - July 31 may be unavoidable and with no practicable alternative (Table 3-2).

3.1.2 Actions outside the Scope of this Biological Assessment

Any activities associated with the following actions and that warrant consultation under ESA Section 7 will be conducted on a project-specific basis. While not necessarily a comprehensive list, actions that fall outside the scope of this BA are as follows:

- Activities associated with construction of, or purchase of power from, a wind farm
- Activities associated with utility-scale solar projects (i.e., projects that generate and feed solar power directly into the grid, supplying a utility with energy)
- Activities associated with TVA's ownership of mineral reserves
- Activities associated with nuclear relicensing (the Nuclear Regulatory Commission typically serves as lead agency)

3.2 Description of Activities Associated with Proposed Actions

This section includes descriptions of the 96 activities analyzed in this BA. If a picture of the activity is available in Appendix A, this is indicated parenthetically next to the name of the activity. Multiple activities routinely are combined to carry out an action at a particular site or for a particular project. To the extent feasible, the definition of each activity aims to describe the activity itself, independent of its potential to be combined with other activities. The objective is to allow for a clearer effects analysis (Chapter 5) of each activity. "Restoration of sites following human use and abuse (Activity #27)," for example, sometimes may be combined with "mechanical vegetation removal, includes trees three inches or greater in diameter (Activity #34)." Potential effects of implementing Activity #34 would be described as part of the analysis for #34 (versus #27). If an activity itself does not involve ground disturbance or tree removal, this is stated as part of the activity description.

1. Loans and/or grant awards
This includes financial transactions with no primary impact on the physical environment (including no tree removal). Examples include an existing mortgage, permanent financing, refinancing of debt, and financial transactions for loan and grant programs. These transactions are conducted as requested upon approval by the TVA Loan and Program Committees & program committees under their respective processes.

Table 3-7. Annual and Cumulative Affected Acreage for Proposed Actions, in the Context of Forest Cover[1] in the TVA Region

Breakdown of Action Area (Acreage)	Action	Estimate of Annual Affected Acreage	Estimate of Annual Tree Removal	Proportion of Forest[1] in TVA Region Removed Annually	Estimate of Total Affected Acreage over 20-Year Term	Estimate of Total Tree Removal over 20-Year Term	Proportion of Trees in Action Area Removed over 20-Year Term	Proportion of Forest in TVA Region Removed over 20-Year Term
TVA Retained Land: Reservoir Land (293,000)	1. Biodiversity, Public Use	11,338	59	0.0001%	36,760	1,186	0.117%	0.003%
	2. Protect Cultural Res.	500	0	0	10,000	0	0	0
	3. Manage Land Use, Disposal	630	630	0.002%	12,600	12,600	1.241%	0.035%
	4. Manage 26a Permitting	314	104	0.0002%	6,280	2,080	0.205%	0.006%
TVA Retained Land: Power Prop. (38,000)	5a. Operate and Maintain Plants	1,089	35	0.0001%	10,888	700	0.069%	0.002%
	5b. Retire, Construct and Expand Plants		75	0.0002%		1,500	0.148%	0.004%
TVA Transmission Easements: Existing ROW (237,300)+100ft Maint. Buf. (307,901)	6. Maintain existing Electric Trans. Assets 7. Convey Electric Transmission Property	79,186 - 80,935[2]	1835 / 86[3]	0.005% / 0.0002%[3]	246,016[2]	8,716	0.859%	0.024%
TVA Transmission Easements: New TL ROW (23,800)	8. Expand/Construct New Trans. assets (Lines, ROWs, Substations Telecommunications)	1,190	595	0.002%	23,800	11,900	1.172%	0.033%
Public Land: Eco. Dev. Sites (75,220)	9. Promote Economic Development	3,761	376	0.001%	75,220	7,522	0.741%	0.021%
Private Land: Solar Sites (40,000)	10. Promote Solar Generation	2,000	50	0.0001%	40,000	1,000	0.099%	0.003%
Total Action Area: (1,015,221)	**Total Affected Acreage:**	**100,008 - 101,757**	**3759 / 2010[3]**	**0.011% / 0.006%[3]**	**461,564**	**47,204**	**4.650%**	**0.13%**

[1]Total Forest Cover in TVA region = 36,236,078 ac (sum of LULC categories: deciduous forest, evergreen forest, mixed forest, woody wetlands. Based on subset of classifications to characterize potentially suitable Indiana bat habitat (NiSource's Multispecies HCP 2013).
[2]Accounts for change in estimated tree removal over time and is independent of new ROW to be added to annual maintenance cycle over time. By term's 20th year, annual effected acreage of existing TL ROW is estimated at 86,453 (one third of existing ROW by 2037).
[3]First and second numbers reflect years 2018-2021 and 2022-2037, respectively.

Table 3-8. Proportion of Permanent versus Temporary Removal and Seasonal Flexibility in Removal by Action

Action	Annual Tree Removal in Acres (Est.)	Total Tree Removal over 20-Year Period in Acres (Est.)	Proportion of tree removal that is permanent	Proportion of tree removal that is temporary[1]	Proportion of tree removal that can occur in winter[2]	Proportion of tree removal that has to occur outside of winter[2] but can avoid pup season	Proportion of tree removal that may occur in pup season due to no flexibility	Number of acres with potential to regenerate to forest cover over time
1. Manage for Biodiversity, Public Use	59	1186	60%	40%	20%	50%	30%	474
2. Protect Cultural Resources	0	0	N/A	N/A	N/A	N/A	N/A	0
3. Manage Land Use, Disposal	630	12,600	80%	20%	50%	30%	20%	2520
4. Manage 26a Permitting (Shoreline)	104	2,080	70%	30%	80%	10%	10%	624
5a. Operate and Maintain Plants	35	700	100%	0	80%	15%	5%	0
5b. Retire, Construct, Expand Plants	75	1,500	100%	0	80%	15%	5%	0
6. Maintain Existing TL Assets 7. Convey Electric TL Property	1835 / 86[3]	8,716	100%	0	40%	25%	35%	0
8. Expand or Construct New TL Assets	595	11,900	100%	0	60%	20%	20%	0
9. Promote Economic Development	376	7,522	100%	0	90%	10%	0%	0
10. Promote Solar Generation	50	1,000	100%	0	80%	20%	0%	0

[1]After tree removal, area is allowed to naturally regenerate or trees are planted.
[2]Seasonal ranges vary across TVA region (see below). Although pup season is variably defined (e.g., May 15 – Jul 31 in GA's Bat Conservation Strategy), "pup season" in this BA is defined as range-wide primary maternity period when non-volant pups are most vulnerable (USFWS 2017b).
[3]First and second numbers reflect years 2017-2020 and 2021-2036, respectively. Due to legal injunctions acreage removal in the first 5-years was much lower than anticipated but the overall estimate across the 20-years of the BPC remains the same.

Table 3-3. Suitable Bat Tree Removal by Acreage by Season Over the First 5 years of the Original 20-year Consultation

Action	Total Tree Removal over 20-Year Period in Acres (Est.)	Total Bat Tree Removal to Date (2023)[1]	Proportion of Total Estimate Used to Date	Proportion of Bat Tree Removal that has Occurred in Winter[2]	Proportion of Bat Tree Removal that has Occurred Outside of Winter[2] but Can Avoid Pup Season (Volant Season)	Proportion of Bat Tree Removal that has Occurred in Pup Season
1. Manage for Biodiversity, Public Use	1186	17.62	1.5%	82.6%	10.5%	6.9%
2. Protect Cultural Resources	0	N/A	N/A	N/A	N/A	N/A
3. Manage Land Use, Disposal	12,600	144.07	0.9%	83.9%	9.3%	6.7%
4. Manage 26a Permitting (Shoreline)	2,080	67.49	3.2%	85.3%	7.5%	7.2%
5a and 5b. Operate,Maintain,Retire, Construct, Expand Plants	2,200	593.01	27.0%	94.7%	4.2%	1%
6. Maintain Existing TL Assets 7. Convey Electric TL Property	8,716	175.16	2%	38.2%	34.2%	27.6%
8. Expand or Construct New TL Assets	11,900	544.55	4.6%	30.1%	46.3%	23.4%
9. Promote Economic Development	7,522	100.6	1.3%	41.5%	58.5%	N/A
10. Promote Solar Generation	1,000	0.63	0.06%	100%	0%	0%

[1]Acreage calculations as of 2/24/2023.

2. Purchase of property
This refers to the financial transaction of purchasing property by TVA and does not include ground disturbance or tree removal.

3. Purchase of equipment for industrial facilities
This refers to the financial transaction of purchasing equipment and does not include ground disturbance or tree removal.

4. Environmental education (photos, Appendix A, pages 3-4)
This varies from direct interactions or campaigns with the public, to supplying information for other programs to utilize in outreach efforts, to collaboration with partners and other stakeholders in conducting public events. This may occur on or off TVA-retained land. Examples include Community Day (trash clean-up), Earth Day programs at local schools (classroom-based), annual Public Lands Day events, and the Thousand Eyes archaeological outreach program.

5.Transfer of ROW easement and/or ROW equipment
This is a paperwork transaction that documents transfer, sale, etc., of ROW and/or equipment between TVA and LPCs. The property is staying as is (i.e., status quo will be maintained). Environmental studies may be an associated activity. No ground disturbance or tree removal is involved.

6. Property and/or equipment transfer
This paperwork transaction documents transfer, sale, etc., of property and/or equipment between TVA and an LPC or other entity. Status quo of the property is maintained as is upon transfer. No ground disturbance or tree removal is involved.

7. Easement on TVA property (photos, Appendix A, pages 6-8)
This paperwork transaction is a recordable document that is used to convey interest in TVA property. The easement can be term or permanent (e.g., utility lines, roads, industrial, etc.). TVA may accept and begin processing 5 to 10 requests per year, but projects can take six to nine months to complete so there may be rollover to the following fiscal year (FY). Easement terms typically range from 10 years to permanent establishment (e.g., water intakes have 10 to 30 year terms). Approximately 5 to10 easements are initiated annually. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.

8. Sale of TVA property (photos, Appendix A, page 9)
This paperwork transaction is a recordable instrument that is used to convey fee ownership of TVA property (e.g., industrial property). Instruments are permanent, with less than one sale per year. This includes auctions. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.

9. Lease of TVA property
This paperwork transaction is a term contract agreement used to transfer possession and authorize specific uses of TVA land (e.g., public and commercial recreation). Term lengths typically are 19 years. As these lease agreements expire, they are being replaced with easements. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.

10. Deed modification associated with TVA rights or TVA property
This paperwork transaction refers to modification of a deed to release or modify rights, covenants, or restrictions contained in the deed provisions (e.g. modification to TVA's retention navigation or flowage easement rights). Deed modification and abandonment are very similar. Disposal (not revocable) of any TVA land, land rights, facilities or equipment must be approved by either the CEO or the TVA Board of Directors, depending on value of asset. Deed modifications are permanent; approximately 5 to 10 are completed annually. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.

11. Abandonment of TVA retained rights
This paperwork transaction is the release by TVA of certain land rights previously acquired by TVA (e.g. abandonment of certain flowage rights). Disposal (not revocable) of any TVA land, land rights, facilities or equipment must be approved by either the CEO or the TVA Board of Directors. Abandonment is permanent, with approximately 5 to 10 completed annually. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.

12. Sufferance agreement
This paperwork transaction is a revocable agreement that is used to allow unauthorized structures (e.g., deck, corner of a house) to remain on TVA land under specific conditions. The term of the agreement is up to 10 years; less than one sufferance agreement is issued per year. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment (e.g., tree removal is unlikely and minimal at most.

13. Engineering or environmental planning or studies
This includes nondestructive site characterization, data collection, study, inventory, planning, and monitoring activities. Any bat presence/absence surveys will be conducted by permitted bat biologists (i.e., covered under ESA Section 10 Recovery Permit). No ground disturbance or tree removal is involved.

14. Harbor limits
This is a paperwork or electronic transaction in which harbor limits are delineated on a map to identify the area a commercial marina or large industrial operation is eligible to use for constructing facilities. Issuance of harbor limits does not mean the operator has permission to build anything without first obtaining a permit. Harbor limits define the boundary that has been reviewed and determined by TVA's navigation staff as acceptable for current and/or future operation. No ground disturbance or tree removal is involved.

15. Windshield and ground surveys for archaeological resources
Windshield surveys are systematic observations made from a moving vehicle. Ground or walking surveys are systematic observations made on foot. These surveys are conducted to determine presence of archaeological sites. Survey locations sometimes include rock shelters and caves. Activity includes use of sieves, small shovels, small hand-held augers and limited ground disturbance. No tree removal is involved. Activity at one site typically lasts 1 to 2 days, with 10 to 25 surveys occurring annually. Archaeological surveys in caves that are inhabited by bats are coordinated with bat biologists to avoid or minimize impacts to roosting bats.

16. Drilling (photos, Appendix A, page 11)
This includes the transport and set up of drill rigs for use in subsurface conditions (e.g., for the purposes of pond closures, new construction, siting new dry ash landfills). Activity includes analysis, design, construction and repair of foundations, slopes, retaining structures, embankments, roadways, tunnels, levees, landfills, and other systems that are made or supported by soil or rock. This typically involves installation of guy wires/screw anchors. Equipment could include all-terrain vehicles (ATV), 4-wheel drive trucks, process water trucks, air rotary rigs, and rock if a platform must be established. Test pit installation may entail use of a rubber-tired or tracked back-hoe.

Water from drilling/boring may be discharged to ground, a tank, or a water body. Sandbags may be used to form a berm around the hole being drilled. Small pieces of plywood may be used to keep 'burps' from flying into the air. 'Burps' occur when the drill hits hard rock. Pressure builds and mud can come flying out. When drilling begins, mud may ooze into the berm. Additional pieces of plywood may be placed to deflect any flying mud. For especially "productive" holes, an additional suction hose may be placed inside the berms if needed and hooked to a vacuum truck. Vacuum trucks can pull through two different hoses at once. The benched area below where a hole is drilled is sloped back to contain any spoil If work is occurring near water, holes are drilled farthest away from the waterbody first, working towards the water to drill any subsequent holes. This allows the maximum area possible to buffer any communication between holes. Nonporous material such as plastic is placed underneath hydraulic hoses on the rig to contain any hydraulic hose leaks in the event these occur. Bore holes typically are plugged with soil and bentonite clay. When a hole is deep enough, angle irons may be welded on to hold the casing in place while the area is vacuumed and cleaned up.

Vacuum trucks are used to remove spoil or grout and keep the area clean. A collection area for drill water is established (e.g., berm with sandbags) so that it can be vacuumed up or routed into a pit to dewater. When drilling in a fractured rock, karst area holes often communicate with one another via "spew water". Sandbag berms are required around drilling areas to help collect spoil and reduce surface travel of materials. Exposed hydraulic lines are wrapped when possible. Biodegradable hydraulic fluids are used. Screens are used to reduce flying sediment or spray.

Activity occurs during daytime, may last days to weeks at a site, and may occur near roost trees, caves, bridges, or water features. This activity may be combined with other activities (e.g., mechanical vegetation removal (#27 or #34) or access corridor maintenance (#25) or construction (#36). Tree removal typically is unlikely and minimal.

17. Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (photos, Appendix A, pages 13-17)

Mechanical vegetation management is part of grounds-keeping activities, weed management, habitat management, and to maintain regulatory/safety clearance under TLs and associated areas (e.g., substations, access roads) and avoid risk to human safety, outages, and NERC fines caused by vegetation that threatens the integrity of the operation and maintenance of the TL. This activity may include use of a feller buncher, bull dozer, bush-hog, tractor, limited hand clearing, etc. This activity includes mowing, bush-hogging, or other types of mechanical removal, landscaping, snow and ice removal, removal of trees up to a diameter of less than three inches, and leaf and litter collection and removal.

Equipment used to control invasive/exotic vegetation may include a string trimmer or weed wrench. Activity occurs during the day.

18. Erosion control, minor (photos, Appendix A, pages 18-19)
Minor erosion control includes activities such as gravel or riprap placement on slopes, where minimal grading or preparation is required and no tree removal is required. May include soil stabilization measures (e.g., reseeding and revegetation). Activity is conducted during the daytime over one to several days.

19. Site-specific enhancements in streams and reservoirs for aquatic animals (photos, Appendix A, page 20)
Examples of this activity include spawning benches (e.g., rough sawn board attached to cinder blocks and submerged in an area where habitat is good for specific fish species), fish attractors (e.g., typically recycled Christmas trees or manmade structures with polyvinyl chloride (PVC) pipe secured in a 5-gallon bucket of concrete, sunken in various water depths and locations along stream channels or large flats to provide cover where none exists), and mussel culturing rafts (not in demand, none have been permitted in several years, consist of PVC pipe or other marine grade tubing that floats on surface with a network of cable and other manmade habitat attached for mussels to cling to)). Typical permittees would be commercial operators in the pearl industry (mussel culturing rafts), or wildlife agencies, but others also could request approval. Tree removal isn't necessary. Activity takes 1-2 days.

20. Nesting platforms
Nesting platforms historically have been installed by state fish and game agencies or TVA over open water to provide an artificial roost structure for bird nesting. Structures also may include wood duck boxes located on land adjacent to waterways. TVA does not allow the public to install nesting platforms and demand for them by wildlife agencies is not high. No tree removal is required. Occurs (typically) near water and establishment takes 1-2 days.

21. Herbicide use (photos, Appendix A, pages 21-23)
This refers to application of herbicide to control invasive and/or exotic vegetation, maintain herbaceous vegetation, or reduce sprouting of woody vegetation. Examples of herbicide use include maintaining regulatory clearance under TL wires; protecting native, rare and/or protected plants (e.g., on Natural Areas), improving wildlife habitat, maintaining pedestrian and vehicular access (e.g., power plant properties, commercial campgrounds). Herbicide is applied to vegetation either with a hand sprayer or backpack applicator.

Herbicides sometimes are used on stumps and low-growing brush during ROW clearing for TL construction projects. Herbicides routinely are used along with mechanical mowing as an integrated form of vegetation management during ROW maintenance. Herbicides can be liquid, granular, pellets, or powder; applied by ground equipment; and, may be selectively applied or broadcast (rarely) depending on site requirements, species present, and condition of vegetation. "Applicators" must be trained and licensed; and follow manufacturers' label instructions, U.S. Environmental Protection Agency (USEPA) guidelines, and respective state regulations and laws; including National Pollutant Discharge Elimination System general permit requirements for any discharge to surface waters. Water quality considerations include measures taken to keep herbicides that are not approved for aquatic use from reaching streams whether by direct application or through runoff of or flooding by surface water.

When herbicides are used, their potential adverse impacts are considered in selecting the compound, formulation, and application method. Conditions that contribute to offsite migration of an herbicide are avoided. Herbicides that are designated "Restricted Use" by the USEPA require application by or under the supervision of applicators certified by the respective state control board. They also require detailed records of application developed on a timely basis. Transmission ROW Vegetation Management staff began tracking surfactants associated with herbicide application two years ago. Surfactants associated with glyphosate-based herbicides can be more difficult to track as mixing typically is conducted by source company at time of production.

Transportation regulations for herbicides are followed. Disposal of herbicide containers are in accordance with directions given on the label. Herbicide containers or applicator equipment is never cleaned in or near streams, water bodies, or ground water infiltration zones. Application equipment is properly maintained and adjusted to prevent spillage and excessive application of vegetation control materials.

Pellet application normally will not occur when surface wind speeds exceed ten miles per hour or on frozen or water saturated soils. Liquid application will cease when temperature reaches 95 degrees (F) or above. Application during unstable, unpredictable, or changing weather patterns will be avoided. Equipment and techniques will be used that are designed to ensure maximum control of spray swath with minimum drift. Under no circumstances will herbicides or herbicide related fertilizers be applied to the surface of water bodies, wetlands or groundwater infiltration zones unless specifically labeled for aquatic use. Filter and buffer strips will conform at least to federal and state regulations and any label requirements. Use of broadcast application of herbicides is not allowed in any streamside management zone or shoreline management zone (SMZ) adjacent to perennial streams, ponds, and other water sources. Hand application of certain herbicides may be labeled for use within SMZs; however, will be used only selectively.

Buffers and filter strips are required next to agricultural crops, gardens, farm animals, orchards, apiaries, horticultural crops, and other valuable vegetation (including areas within 200 ft of cave entrances). During all ground applications, applicator will periodically calibrate application equipment to ensure that herbicide is being applied at proper rate. Herbicides used for stump treatments and tree growth regulators are applied according to specimen label.

Herbicides are not applied:

- Around trees that would fall and hit a conductor or support structure;
- In fence rows and other areas where cattle might eat wilted cherry leaves;
- In city, state, and national parks or forests or other special areas without written permission and/or required permits from the proper governmental officials;
- Areas adjacent to and off the ROW;
- During rainy periods or during the 48-hour interval prior to rainfall predicted with a 20 percent or greater probability by local forecasters (this applies when soil-active herbicides are used); or,
- In areas where soil erosion might occur or soil might be mechanically relocated (this applies when soil-active herbicides are used).

Accurate and up-to-date records are maintained concerning the plan for and application of all herbicides. The locations, herbicide applied, amount of herbicide applied, application method, and size of area treated are recorded. There is potential for tree removal associated with some actions (i.e., removal of invasive and/or exotic tree species as part of biodiversity management protocols), but not others (e.g., application along TL ROW). Activity could occur near caves, bridges, and water during daytime. Duration is variable across actions and across the TVA region.

22. Grubbing
Removal and disposal of brush, stumps, roots, to a depth of approximately 12 inches.

23. Prescribed burns (photos, Appendix A, page 24)
Prescribed burns are implemented on portions of TVA Reservoir Lands and serve as a valuable tool for protecting and improving natural resources. Prescribed burning offers cost-effective benefits to productive and responsible land stewardship. Controlled fires maintain and establish high quality wildlife habitat, reduce leaf litter and ground cover that fuel wildfires, stimulate growth of targeted vegetation and recycle nutrients back into the soil.

The main objective for prescribed burning on TVA reservoir lands is to maintain land in an early-successional stage (e.g., herbaceous vegetation). Prescription burning helps suppress undesirable woody growth in managed open, grass-forb dominated lands. Other objectives include exotic, invasive species suppression in the understory and mid-story of mature pine-oak forests. TVA currently is exploring data that show historic remnants of shortleaf pine communities on TVA lands. TVA hopes to initiate prescription burns to potentially promote shortleaf regeneration by suppressing competition and stimulating seedbanks. Prescribed burning also plays a role in local wildfire suppression by reducing localized, heavy ground fuel buildup that has potential to carry and spread wildfires. Most burns are conducted in early winter to early spring (approximately November – April). Conducting prescribed burns at specific sites in September or October for the benefit of woody suppression has been considered. The likelihood of this is reduced, however, due to limited desirable weather conditions for prescribed burning during September and October.

Within the last five years, the average annual amount of prescribed burning for TVA has been approximately 750 to 1,000 ac. A fair percentage of average burn acreage per year is in open lands (i.e., approximately 60 percent open lands and 40 percent forested lands). Due to budget and staff limitations, prescribed burning varies from year to year. TVA partners with other agencies to help accomplish burn objectives. Partners include Alabama Department of Conservation and Natural Resources, Alabama Forestry Commission, Tennessee Department of Forestry, Tennessee Wildlife Resources Agency, various universities and local fire departments. It would be very unusual for TVA to conduct prescribed burns on more than 1,500 ac in any given year.

Affected acreage for prescribed burning is estimated at 26,247 ac over the next 20 years, this is included in the calculation of total affected acreage for TVA Reservoir Lands (Table 3-1). Acreage estimates for prescribed burning fall within two categories:

1. Active and/or Planned Acreage - Acreage currently managed with fire or planned for fire management within the next 5 years. This is estimated to be 8,570 ac across 66 parcels that range in size from 2.6 ac to 1,659 ac.

2. Potential Acreage - Acreage identified for prescribed burning within the next 20 years but not currently included in a plan due to budget and staff limitations. This is estimated at 17,677 ac across 86 ac that range in size from 2.43 to 4,649 ac.

A GIS-based review of prescribed burn forecast sites, cave occurrence and documented bat occurrence within caves indicated that 74 caves occur within one mile of the active, planned or potential burn sites. Eleven caves with documented bat occurrence (extant or historic) are located within 1 mile of active or potential burn sites. Twenty-five caves are within 500 ft of prescribed burn sites. Fifteen caves occur within proposed burn sites; bat occurrence has been documented in three of these caves.

Burn frequency on any given parcel ranges from annual, biannual, every 2-3 years, every 3-5 years. Burn seasons include Fall-Winter-Spring, Spring, Winter-Spring. Site-specific objectives vary (Table 3-44).

Table 3-4. Seasonality and Example Objectives of Prescribed Burning on TVA Lands

SEASON	OBJECTIVES
Fall-Winter-Spring; Spring	Invasive control - conversion to native early successional - maintain early successional (in partnership with state agency at some locations)
Fall-Winter; Winter-Spring; Spring	Maintain early successional seral stage (e.g., dam safety level protection; hay/row crop production; Native warm season grass production; research partnership with local university, state agency or non-profit organization; reduce encroaching canopy - expanding barrens habitat; reduction of density coverage; understory maintenance- shortleaf pine initiative)
Fall-Winter	Maintain Pine-savannah - early successional seral stage
Winter-Spring	Mix upland hardwood selective thinning and understory control-Partnership research with Mississippi State University
Fall-Winter-Spring	Mixed hardwood-pine local wildfire suppression-understory maintenance-Shortleaf Initiative
Spring	Pine-Cedar local wildlife suppression-invasive and woody suppression-revert to early succession
Fall-Winter-Spring	Pine-hardwood local wildfire suppression-understory maintenance-hardwood regeneration
Fall-Winter-Spring; Fall-Winter	Pine-Oak local wildfire suppression (invasive understory control; early succession maintenance; shortleaf initiative; afforestation preparation)
Fall-Winter-Spring	Planted shortleaf (understory maintenance; maintain early successional seral stage
Winter-Spring	Site prep (conversion to native, early successional stage; maintain early successional seral stage
Fall-Winter-Spring	Undesirable woody suppression - desirable woody regeneration maintenance; early-successional conversion and maintenance)
Fall-Winter; Spring	Upland hardwood local wildfire suppression (undesirable woody control; understory maintenance; invasive control)

TVA personnel that participate within the burn operational area have successfully completed Interagency Wildland Fire Training (S-130 Firefighter & S-190 Introduction to Wildland Fire Behavior). Burn teams identify vegetation types to be burned and why, describe chosen burn method, chart weather conditions and include maps that show possible wind patterns and fire control lines. TVA receives proper permitting and notifies local, county, and state authorities, as well as local residents, before a prescribed burn (Appendix B, TVA's Prescribed Fire Job Safety Analysis). TVA has established standard best management practices (BMPs) for conducting prescribed burns (Appendix C, BMPs for Silviculture Activities on TVA Land).

Additional avoidance and minimization measures include the following:

1. Landscape level and long-term planning has identified active and potential burn sites that are near known caves. These sites are considered smoke-sensitive. As soon as possible following discovery of previously unknown caves, accessible caves are surveyed to determine use by bats. Until caves have been surveyed for use by bats, it is assumed that federally listed bats are present.

2. Prescribed burn managers take into consideration site-specific conditions (e.g. surface and transport wind direction and speed, ventilation factor, dispersion index, mixing height, temperature, fuel moisture, etc.) to ensure smoke is limited and adequately dispersed away from sensitive sites, including documented, known, or obvious caves or cave entrances, such that smoke does not enter caves or cave-like structures when bats are present.

3. Breaking acreage down into smaller units where feasible helps keep amount of smoke produced at one particular time to a minimum and provide lesser risk for smoke entering sensitive sites.

4. Tractor-constructed fire breaks, mechanical site preparation, vegetation cutting, and construction of new roads (including temporary) are prohibited within 200 ft of portals associated with caves, cave collapse areas, mines and sinkholes. Wider buffers are identified through site-specific analysis when necessary to protect caves and mines from subterranean and surface impacts such as sedimentation and other adverse effects to water quality and changes to air temperature and flow.

5. Existing barriers (e.g., streams, lakes, wetlands, roads, and trails) are used as firelines for prescribed fire whenever possible to reduce the need for fireline construction and to minimize resource impacts (e.g., increased sedimentation).

6. To avoid injury to non-volant young Indiana bats or northern long-eared bat, prescribed burning of known and potential maternity roosting habitat between June 1 and July 31 is prohibited except where site-specific inventories indicate these species are not likely to be present.

24. Tree planting - (photos, Appendix A, pages 25-26)
Tree planting is conducted to replace trees identified as a safety hazard and removed, to minimize or control erosion, to create or enhance habitat, or for other possible reasons. Planting of saplings and seedlings may involve shovels, a tractor, or bush-hogging. This activity may be combined with other activities (e.g., herbicide) and occurs during the day.

25. Maintenance, improvement or construction of pedestrian or vehicular access corridors (photos, Appendix A, pages 27-31)
This activity refers to maintenance, improvement, or construction of access roads (temporary or permanent), parking areas, or trails (vehicular or pedestrian). May include routine road or trail maintenance, repair, and resurfacing where work is confined to previously maintained surfaces, ditches, culverts, and cut and fill slopes where proposed work is clearly within disturbed context. Improvements to trails include re-routes, structures, erosion control measures for public safety and trail sustainability. Newly created pathways may be used to access new construction or maintenance sites, public recreation areas or areas where existing roads are not otherwise available. Activity includes clearing, paving or

graveling of a road or driveway and may include use of a bulldozer, boom truck, track hoe, addition of rock, chainsaw or other hand tools, small bobcats, tractors, chainsaws, erosion control structures, and hand tools. TVA's trail database maintains trail mileage and a mapping program. Activity occurs during daytime and occurs throughout the year. Duration is two to five times per year; from two days to six weeks at one site depending on the action. Activity may be combined with other activities such as vegetation removal (#27, #33, #34) or grading (#36).

26. Maintenance or construction of access control measures (photos, Appendix A, pages 32-34)

Access control measures include placement and maintenance of gates, establishment of wiring, fences, gates, boulders, barriers, other types of barricades, cave gates, watering lanes for cattle, maintenance/improvement/control of access to areas within power properties (security); protection of sensitive resources (plant populations, caves with listed species or archaeological resources); ensuring safety related to hazardous or sensitive infrastructure (substations). Access control may be carried out to: keep unauthorized users (e.g., vehicles on pedestrian-only trails) out of particular sites, balance public use and safety with resource conservation, manage road accessibility, seasonally restrict access, protect property from overuse and abuse, and/or enhance and protect sensitive resources from disturbance. Equipment may include heavy-gauge steel and welding materials, heavy equipment, post-hole drivers, light duty trucks, hand-held auger, hand-held equipment, bobcats, tractors, downed trees, concrete, ballards, guard rails, rebar, trenches/tank traps. Activity occurs during daytime, from two days to six weeks per site, and two to five times per year. This activity may be combined with other activities such as tree or vegetation removal (#27, #33, #34).

27. Restoration of sites following human use and abuse (photo, Appendix A, page 35)

In this activity sites (e.g., recreation sites) in poor condition from human use (e.g., rutting and damage from ATV abuse, erosion, vegetation loss, looting of archaeological resources) are identified, prioritized based on level of use and abuse, and restored to repair any damage done. Activity may involve landscaping, application of gravel, use of bobcats, tractors, hand tools and be combined tree removal (#27 or #34). Restoration occurs during the daytime and may take one-two weeks to complete at a single site.

28. Removal of debris (e.g., dump sites, hazardous material, unauthorized structures) (photos, Appendix A, pages 36-38)

Removal of illegal dump sites, hazardous material and unauthorized structures on TVA-managed land is conducted for habitat restoration and enhancement, public health, public safety, and public enjoyment. Dump sites (e.g., accumulation of household trash or furniture) seem to be increasing in number. Hazardous materials (e.g., old shingles, televisions, car batteries, gas tanks) make up a small percentage of dump sites. Unauthorized structures include items such as rope swings, houses, sheds, decks, and dog lots. This activity may involve tractors and bobcats. Removal may take two days to two weeks at a single site, depending on severity of dump site and amount of material. It is rare that tree removal is needed, unless required as part of removal of hazardous materials. The expected duration for cleanup of an individual site ranges from two days to two weeks. Cleanup of approximately 10 dump sites, five to six hazardous material sites, and two to five unauthorized structures are conducted annually.

29. Acquisition and use of fill/borrow material (photos, Appendix A, pages 39-41)
Earthen material (e.g., soil, sand, gravel, decomposed granite, or rock) is acquired on or off-of a project site and used to reach a desired elevation. Borrow material may be obtained by subsurface excavation. Examples include preparation of an area for use as a swim beach or that may need clearing and grading for infrastructure or structures (e.g. public camping pads, substations, access roads, crane pads, operational buildings, and economic development sites). Activity may include use of heavy equipment (e.g., bulldozer, track hoe, backhoe, feller buncher, bush-hog, scrapper). Most swim beaches occur on existing developed shoreline and tree removal is not part of a request. Swim beach development typically involves placement of sand fill on open shoreline. This activity may be combined with tree removal (#34) but this is not likely. Activity occurs during daytime with a duration of days to weeks.

30. Dredging and excavation; recessed harbor areas (photos, Appendix A, pg 42-43)
Dredging and excavation typically affect inundated substrate to deepen a channel or harbor for boat access to residential, commercial or operational facilities (TVA and non-TVA). This also can occur inland to create additional shoreline but typically this is prohibited on TVA land. It could take place on private property without any TVA input if TVA jurisdiction is not triggered. TVA and USACE typically only allow dredging/excavation to within 10-ft of normal summer pool contour for residential use. These practices are conducted to improve and extend duration of navigability in shallow areas of reservoirs that are made impassable during drawdown periods. Gravel dredging operations also occur on the river but typically in areas of private property ownership and TVA typically does not assert jurisdiction to regulate these activities because there is no obstruction or impact on land or land rights. Though unlikely, this activity could be combined with Activity #34 (minor tree removal) if someone wanted to do an inland excavation that triggers TVA jurisdiction. Recessed harbor areas are an expansion of commercial or industrial operations to provide increased water surface at strategic geographic locations. This activity typically occurs during daytime.

31. Stream/wetland crossings (photos, Appendix A, pages 44-46)
This activity may occur on agricultural property (e.g., permitting request) adjacent to streams, but may serve other purposes as well (e.g., access to TL ROW, though this is avoided where possible and limited to existing crossings). Activity typically consists of a stabilized area or structure constructed across a stream or wetland to provide a travel way for people, livestock, equipment or vehicles. Stream crossings are used and promoted by the Natural Resource Conservation Service to improve water quality, reduce erosion, or manage livestock (fencing along streams that prevents cattle from degrading stream and increasing erosion, but allows access to a portion of the stream for watering). Occasionally TVA will review requests in or near wetlands and the only option for avoiding impacts is to construct a crossing over a wetland. These typically are wooden or steel posts driven into the substrate with decking constructed above the existing vegetation. Tree removal in these situations typically is not allowed via permitting due to the sensitive nature of the habitat. Crossings for vehicular access are 20-ft-wide or less. New crossings for new TLs would be based on structure type and voltage. Activity occurs during daytime. This activity may be combined with Activity #27 or #34 (for tree removal) but this is unlikely to minimal.

32. Clean-up following storm damage (photos, Appendix A, pages 47-49)
This activity involves removal of downed and wind-thrown trees that occurs following storms resulting in impacts to vegetation and infrastructure. Storm-damage cleanup efforts are conducted to address public safety concerns and reliability and can require various types of small and heavy equipment. Activity occurs during the day and can range from two to five

days or longer. May involve ground disturbance and vegetation modification (removal of downed or wind-thrown trees), and small and heavy equipment. Frequency of activity occurrence is associated with severity of weather events, though the need to address vegetation associated with storm damage has been fairly consistent over the last several years. May be combined with Activity #27 or #34 (i.e., potential for tree removal).

33. Removal of hazardous trees or tree branches (photos, Appendix A, pages 50-52)
Removal of hazardous trees is conducted as deemed necessary throughout the year to address threats to public safety, human facilities, or private property. Examples include removal of trees on campgrounds, day use areas, within access corridors linking private property to a TVA reservoir that have been identified as a risk to human safety or property, or along TL ROWs. Hazard tree removal may include use of feller buncher, bulldozer, bush-hog, chainsaw, other hand tools, and hand clearing.

Transmission Line Right-of-Ways
On or adjacent to TLs, a hazard tree is a tree that is tall enough to fall within an unsafe distance of TLs under maximum sag and blowout conditions and/or are also dead, diseased, dying, and/or leaning. Hazard tree removal includes removal of trees that 1) currently are tall enough to threaten the integrity of operation and maintenance of a TL or 2) have the ability in the future to threaten the integrity of operation and maintenance of a TL. Danger trees are the same as hazard trees, minus the health aspects.

TVA Reservoir Lands
On TVA-retained reservoir lands, most requests for hazard tree removal occur during spring storms and immediately following the time of leaf-out; many requests also are received summer. Requests typically either are an adjacent landowner seeking permission to remove a hazard tree on TVA property that poses a threat to a personal facility along the reservoir shoreline, or for TVA to fell a tree that poses a hazard to private structures located on private property.

Once the owner of a tree is notified that a neighbor feels the tree is a threat to human safety and/or to private property, the owner of that tree is responsible by law for any damage that might occur from the point of notification onward. If it is determined that a tree is a threat to private structures on private property or to human safety, the tree is dropped as soon as possible and left on TVA property. If it is determined that a tree is a danger to permitted private structures on TVA property, TVA will issue a Tree Removal License granting permission to the owner of the private structures to remove the tree.

Many factors are assessed as part of review of requests for hazard tree removal, and some requests subsequently are denied. TVA staff tasked with inspecting hazard tree requests are educated based on principles defined TVA's checklist for hazard trees or downed trees (Appendix D). The only clearly definitive observation that can be made is the "target" of the tree should it fail. TVA staff limits approval for removal to trees that pose a serious threat to human health or private property. Removal is not permitted when 1) TVA land is the target due to lean of the tree, 2) other healthy trees are present that would prevent the target from being private property, or 3) the tree looks bad aesthetically, but is still healthy and sound. Thirty percent of tree removal within the range-wide pup season represents those remaining requests that must be addressed due to confirmation of threat or liability. Due to liability, TVA is required to address these requests (either issuance of a Tree Removal License or removal by TVA).

34. Mechanical vegetation removal, includes trees or tree branches three inches or greater in diameter (photos, Appendix A, pages 53-58)
Vegetation removal may be for a variety of purposes, including public/recreational use, habitat management/enhancement (e.g., wildlife openings); establishment of a building or road; maintenance of a lawn; or to support construction of TLs, substations, and access roads. Vegetation removal also occurs along existing ROW and access roads to ensure integrity of the operation and maintenance of TLs as well as reduce risks to human safety, prevent outages and avoid NERC fines. Possible equipment use includes feller buncher, bulldozer (tracked or untracked), track or bucket hoe, scrapper, bush-hog, mower, logging and boom trucks, chainsaw and limited hand clearing. This activity occurs during daytime throughout the year with possible duration of days to weeks.

35. Stabilization (major erosion control) (photos, Appendix A, pages 59-61)
Stabilization is used to address undercutting along reservoir shoreline and stream banks or to provide protection to marinas from wave/wake action. This activity also may be used to address erosion, seeps, sinkholes, other breeches, need to alleviate standing water, and exposure of cultural remains. Stabilization may include excavation, grading, shaping, riprap, retaining walls, breakwaters, use of a barge, dump truck, track hoe, hauler. Work occurs during the daytime over two days to two weeks, several times per year. This activity may be combined with other activities such as mechanical vegetation removal (#27 or #34) but this is avoided to the extent practical.

36. Grading (photos, Appendix A, pages 62-64)
In this activity, earthen material is excavated to reach a desired elevation. This may be done to prepare area for a project (e.g. to facilitate public access and public use, create public camping pads, restore and manage habitat, build substations, access roads, crane pads, or operational buildings). Involves ground disturbance and possibly heavy equipment (e.g., bulldozer, track hoe, backhoe, feller buncher, bush-hog, scrapper). Occurs during daytime, two to five days to several weeks at a site, several times a year. May be combined with other activities such as vegetation removal (#27, #33, #34) or access corridors (#25).

37. Installation of soil improvements (photo, Appendix A, page 65)
This is installation of material (either delivered or available onsite) such as grout or concrete below the surface to increase stability at operational facilities. This activity typically is conducted in concert with drilling (#16). When drillers have completed holes, they move away from casing and grouting team moves in.] Grouters place a kiddie pool onto the hole identified for grouting as well as any adjacent holes (if not already grouted). This is an effective BMP and allows drillers to see if any grout starts to communicate with any other hole, place a vacuum hose inside these holes and ensure no unplanned material escapes. As grout displaces water the kiddie pools collect the water mixture and the vacuum trucks suck it up. If the grouter starts to see a 100 - 125 percent plus of grout going into the hole but it is not filling, workers begin to explore adjacent areas and water bodies to see if there is any evidence of this material flowing into the water.

Once a hole is complete the line is crimped to avoid any material spilling onto the ground and the hose is moved to the next hole location. The vacuum truck will continually suck up any excess grout and water while setting the bars. This activity occurs during the day, may take several weeks to complete, and may be combined with other activities such as drilling (#16) and vegetation removal (#27, #33, #34).

38. Drain installations for ponds (photos, Appendix A, page 66)
This activity is to repair existing or install new drains at new and existing ponds. Activity includes detention, retention and piping and enables pond closure, improvements to safety, and creation of a new pond. A backhoe, pipes, trucks, and rock may be used. Occurs during daytime, from several days to several weeks. This activity may be combined with other activities such as vegetation removal (#27, #33, #34).

39. Berm development (photo, Appendix A, page 67)
This activity is the development of an earthen or sod wall and typically is completed during the daytime across several days to several weeks. This activity may be combined with other activities such as vegetation removal (#27, #33, #34), acquisition and use of soil/borrow material (#29), and grading (#36).

40. Closed loop heat exchangers (heat pumps)
This primarily is a permitting request by an adjacent residential landowner. The system involves connection of a water line from a heat exchanger coil system to a home heat pump. The line would be placed in a trench on TVA land but either would be located within an approved access corridor or across already-cleared property. Coil systems are often placed beneath boat docks. Installation occurs during the daytime throughout the year.

41. Minor water-based structures (photos, Appendix A, page 69)
Examples of this activity include floating play equipment (typically associated with commercial marinas and contained within a buoy line near a beach area), slalom courses and floating ski jumps (used for recreation, typically weighted with anchors, placed over deep water, typically away from shore, inflatable slides to trampolines), and floating signs (marketing, advertising, instructional, directional, or safety signage on anchored floating platforms anchored typically at the mouth of an embayment to direct and advertise boaters to commercial facilities or direct and inform boaters near plant sites about hazards or restricted areas). Installation occurs during daytime, includes typical dock building and anchoring equipment, and does not involve tree removal. Structures may remain in place seasonally or permanently.

42. Internal renovation or internal expansion of an existing facility (photos, Appendix A, pages 70-72)
This activity refers to internal improvements to existing facilities with no changes to surrounding landscape. Activity may occur anytime throughout the year over several days to several months.

43. Replacement or removal of TL poles (photos, Appendix A, pg 73)
Replace or remove individual power poles along TL ROW. Activity is a component of maintenance or upgrade of infrastructure. Use of utility trucks and crane typically is involved. Activity occurs during daytime over days to weeks. This activity may be combined with other activities such as vegetation removal or hazard trees (#27, #33, #34).

44. Conductor and overhead ground wire installation and replacement (photos, Appendix A, pages 74-75)
This is a component of TL maintenance, upgrades, or installation of transmission infrastructure. Reels of conductor and overhead ground wire (OHGW) are typically delivered to various staging areas along the ROW, and temporary clearance poles installed at road crossings to reduce interference with traffic. A rope is pulled from structure to structure. It is connected to the conductor and ground wire and used to pull them down the

line through pulleys suspended from insulators. A bulldozer and specialized tensioning equipment is used to pull conductors and ground wires to the proper tension. Crews then clamp wires to the insulators and remove the pulleys. This also may involve use of a helicopter. The process for replacement of OHGW and conductor is similar that used during new construction. Activity occurs during daytime over days to weeks.

45. Stream monitoring equipment - placement and use
TVA occasionally receives requests from the U.S. Geological Survey, non-profit watershed groups or universities to install stream monitoring equipment for research purposes. Equipment typically is affixed during the day to bridges.

46. Floating boat slips within approved harbor limits
Slips are located within the reservoir pool and associated with a community facility or commercial marina. Installation occurs during daytime and may occur throughout the year.

47. Conduit installation (photos, Appendix A, page 76)
This activity involves the installation of conduit and/or cable trench to provide a pathway for fiber optic cable, control cable, metering equipment, etc., at telecommunications or substations sites. Installation involves the use of a vibratory plow, ditch witch, and other equipment. Activity occurs during daytime over days to weeks. This activity may be combined with other activities such as vegetation removal (#27 and #34) at newly constructed sites.

48. Laydown areas (photos, Appendix A, pages 77-78)
Laydown areas are used for worker assembly and vehicle parking, as well as for material and equipment storage. The selected site usually is an existing graveled area and may include additional gravel placement and fence construction. Tree removal is unlikely to very rare. Activity occurs during daytime across days to weeks. If tree removal is needed, this activity would be combined with vegetation removal (#27 or #34).

49. Non-navigable houseboats (photos, Appendix A, page 79)
These are located within the reservoir pool. TVA has a new policy in the process of being implemented. No new non-navigable houseboats will be allowed. Permitting from this point forward will involve resolution of existing non-navigable houseboats that are built outside of 26a regulations or not previously approved. This primarily is a paperwork transaction with no ground disturbance involved.

50. Minor land based structures (photos, Appendix A, pages 80-82)
Examples of minor land-based structures include steps, walkways, landings, patios, picnic tables, gazebos, terraces, enclosed storage space, benches, pavilions, trash containers (sometimes bear proof), bird boxes, unconventional bat roosts, and fish cleaning stations (e.g., located on floating docks or under pavilions). This activity may require minor ground disturbance and include use of special infrastructure (e.g., to prevent access into containers by bears), bobcat, tractor, shovel, hammer, nails. Structures typically are built during the daytime across one to several days. This activity may be combined with vegetation removal (#27, #34) although tree removal is not common.

51. Signage installation (photos, Appendix A, pages 83-84)
This refers to the installation of signage or kiosks (either permitted, paid for and/or carried out by TVA) for the following purposes: serving as information (e.g., identification of site) and providing direction, instruction, interpretation, or advertisement. Examples of locations

include within road ROW, in front of industrial parks, on TVA-managed public lands, on property under license or lease to commercial operators of TVA-managed or state-managed public access areas, and signage along TVA-managed lands informing the public of penalties under the Archaeological Resources Protection Act (ARPA). May include installation of wooden or metal posts and involve use of a tractor, shovel, posthole diggers or power take-off (PTO) augers to install posts. Installation occurs during daytime, typically takes one day, and occurs several times per year at different locations. Activity may be combined with vegetation removal (#27 or #34) for brush removal with hand tools. Typically no tree removal is involved, ranging from none to unlikely to minimal.

52. Floating buildings (photos, Appendix A, page 85)

Floating buildings are constructed in the reservoir along shoreline (e.g., restaurants, shipstores, storage, restrooms, boat houses). Installation occurs during daytime. This activity may be combined with vegetation removal (#27 or #34) where new construction or shoreline vegetation removal is needed to construct a walkway; potential for tree removal is low.

53. Mooring buoys or posts (photos, Appendix A, page 86)

Mooring buoys or posts are placed in reservoirs adjacent to the shoreline for mooring of deep draft watercraft and are used as a low-cost alternative for moorage for smaller vessels. Installation occurs during daytime and may occur throughout the year. If vegetation removal (including trees) is needed activity would be combined with #27, #33 or #34. Potential for tree removal is low to unlikely.

54. Maintenance of water control structures (dewatering units, spillways, levees) (photos, Appendix A, page 87)

The purpose is to maintain good working condition of existing water control structures used for flood control, wildlife management and safety. Structures include sub-impoundments, dewatering units, levees, spillways, gate valves. Activity may include structural maintenance (gate valves, spillways), management of vegetation growing on levee, and placement of material to fix eroded areas (e.g., rock armoring). May involve use of trucks, rock, bulldozer, barge, track hoe, backpack or UTV sprayers, bush-hogs, cranes, concrete trucks, other heavy equipment (bobcats, tractors) and include replacement or modification to modern standards. Tree removal ranges from none to minor. Occurs annually near water, during the day, across half a day to several days per water control structure.

55. Solar panels

While not a typical request, TVA does consider permit approvals for rooftop solar panels on private floating docks or approved land-based structures, which would more likely be associated with a commercial operation. Installation occurs during the day, throughout the year. There is low potential for tree removal, as most requests come after the structure is approved and built. Tree removal would only be required if the structure receiving the panels requires it. If needed, this activity would be combined with #27 or #34.

56. Culverts

Culvert installation occurs in perennial, intermittent and/or ephemeral streams or drainage ditches for both pedestrian and vehicular use. Placement facilitates access to public use areas, operational facilities, and infrastructure. Installation occurs during the day, could occur anytime throughout the year, and may include use of a backhoe.

57. Water intake - non-industrial
Non-industrial intakes typically have a pumping capacity of less than 50,000 gallons per day. These may be smaller farm irrigation systems that are portable and operated with a tractor's PTO. Small residential pumps for watering that are attached to docks or other water-use facilities could fall into this category as well. Activity is seasonal, installation occurs during daytime. There is a low potential to involve ground disturbance or vegetation modification including tree removal. If so, this activity would be combined with #27 or #34.

58. Wastewater outfalls
Outfalls typically are permitted to municipalities or to specialized industries that produce a treated wastewater effluent. Locations depend on property ownership and proximity to treatment facilities and occur in and near water typically with a minimal construction footprint (i.e., not wide). Vegetation removal typically limited but a small laydown area may be needed as well as the need to clear vegetation along a path to the shoreline. If so, this activity would be combined with #27 or #34.

59. Marine fueling facilities (photos, Appendix A, page 88)
These facilities typically are located on the water and associated with commercial marinas but may be associated with industrial operations for fueling equipment. Marina owners are the primary permit applicant of these facilities. Installation occurs during the daytime. Tree removal may be required to install aboveground tanks and underground piping, but the pumps themselves are usually on floating docks when associated with marinas. If needed this activity would be combined with #27 or #34.

60. Commercial water-use facilities (e.g., marinas) (photo, Appendix A, page 89)
These are located along shoreline of TVA-managed reservoirs. Facilities may include docks, access walkways, piers, boathouses, launch ramps, and marine rails. Not all requests for facilities involve new development. When new development is involved, minor vegetation management could be required and include use of chainsaw or other hand tools and boom trucks. Installation typically occurs during the daytime. May be combined with other activities such as #27 and #34.

61. Septic fields
Activity involves installation or repair of septic tank or field lines. Activity also may involve installation of subsurface septic drainage system for wastewater treatment/disposal at substations and other operations facilities. The intent is to provide a properly functioning septic system. Equipment use includes backhoe, ditch witch, truck, and other possible tools. Installation occurs during daytime and may last days to weeks. There is very low potential for tree removal. Areas with trees are avoided due to complications with impacting soil structure. If necessary, activity would be combined with #27 or #34.

62. Blasting
Anytime excavation (e.g., for a structure, pipeline) is required in hard rock environments, there is potential for blasting. Blasting projects can occur below water and on dry ground, and usually is only needed where typical trenching, directional bore or tunneling methods cannot be utilized due to solid or significant rock. Blasting is expensive, so most project proponents or external applicants try to minimize its use. The decision to blast often primarily is an economic decision involving amount and depth of excavation, relative percentage of rock in excavated material, rock hardness, equipment access, and blasting safety.

Examples of TVA projects in which blasting has been involved include channel excavation for a new lock at Kentucky Dam, tunneling for a low-level water outlet at Blue Ridge Dam, water intake structures and pipelines by Huntsville Utilities, and bridge construction downstream of Fort Loudon Dam by TN Department of Transportation. Other projects that may involve blasting include subsurface rock removal for grading or foundation construction of electric transmission substations and structures, highway construction, bridge construction and bridge removal. Pier construction for bridges may require blasting to ensure a solid footer on bed rock. Blasting to remove old bridge truss and piers by dropping these structures into the water is a common practice in large water bodies.

TVA conducts blasting in accordance with CFR Title 30: Mineral Resources, section 715.19 - Use of Explosives, the technical requirements of the local city or state's blasting ordinance, and site-specific limits that are based on proximity to any resource with potential for sensitivity to velocity impacts (e.g., ground vibration) and air overpressure (e.g., structures, equipment, historic or wildlife resources). Transportation, storage, and handling of explosives and blasting agents on TVA property and ROWs is conducted in compliance with O.S.H..A. Standard 1910.109. External applicants who propose blasting also are required to adhere to relevant statues and ordinances.

A pre-blast survey of the project area (including any TVA facilities) is conducted (or required) to document the pre-blast baseline condition and provided (if developed by an external party) to TVA at least 30 days prior to start of blasting. Relevant facilities will be determined by expected size of blast charges and their proximity to TVA structures. It may be determined that monitoring site-specific select locations with ground vibration and air overpressure sensors and recorders is warranted. Examples of monitoring locations include the nearest TVA transmission tower, a nearby historic stone, a nearby flood control wall, powerhouse control room near critical relays, and nearby caves known to be occupied by federally listed bats. Depending on proximity to sensitive resources, baseline data (e.g., seismograph and audio) may be collected prior to any blasting to document typical ground vibration and noise levels at a given site.

As part of a blast ramp-up plan, the amount of explosives initially is restricted to prevent operational problems from blast vibrations. The amount of explosives used per delay initially are set to no more than one-fourth the amount that the site-specific vibration attenuation curve (scaled distance relation) predicts as allowable for production blasting. Ramp-up test blasts will be timed to occur at periods of low electric power usage to reduce any impact to public if a transmission relay should trip. Each stage of the ramp-up is coordinated with TVA if blasting is conducted by an external party. Once it has been demonstrated that vibrations can be kept within acceptable levels using test phase amounts of explosives, the amount of explosives is allowed to be increased, and site-specific blast monitoring data is used to determine the amount of explosives that is acceptable for production blasting.

Blast plans (either developed by TVA or external applicants) include, at a minimum, the following information: 1) specific vibration and air blast limit criteria; 2) specific location, type and number of ground motion and air overpressure monitoring instruments; 3) specific location(s) of blasting, type of explosives to be used, maximum charge size, blast delays, spatial pattern, stemming, and other aspects of blast design. Blast plans developed by external applicants are reviewed at least 60 days prior to start of blasting operations.

Blasting operations are controlled such that no flyrock (i.e., blasting debris) cast from the blasting site shall impact TLs, structures, foundations, or any other identified sensitive features. No blasting is permitted within 500 ft of a concrete foundation which has not cured for at least 7 days.

In a previous project (Huntsville Utilities water intake structure and pipeline near Guntersville Dam and within one mile of Hambrick Cave (inhabited during summer by gray bats)), two steps were taken to minimize velocity impacts: 1) number of shots per blast hole per round of blasting was minimized and 2) poundage of explosive in each shot per hole for each round of blasting was minimized. Delays between shots also were required (i.e., instead of all the explosives going off at the exact same time there were millisecond delays between each shot so that the result was more of a ripple). To minimize concussive air effects as well as flyrock a combination of soil and blasting mats was used over each blast site. Vibration sensors were placed at Hambrick Cave to detect any deviation from required vibration limits. Roost loggers also were placed at Hambrick Cave to record acoustic bat response. Data in this case demonstrated no impacts from blasting.

The nature of rock within which blasting is occurring, as well as presence of seams between rock, impact velocity of the blast. Underwater blasting tends to have minimal air concussions as water acts to minimize (similar to blasting mats). Depth of water also is a factor.

In the case of excavation for a TL structure, blasts are very controlled and often completed with a single blast. Blasting related to substation construction may be more extensive (multiple blasts depending on site characteristics). Any tree removal is addressed as part of vegetation management activities. Blasting typically occurs during daytime over days to weeks.

63. Foundation installation for transmission support (photos, Appendix A, page 90)
Installation of foundations that support TL substations, structures and/or equipment. Involves use of heavy equipment including typical excavation techniques (e.g., use of an auger) and concrete truck. Activity occurs during daytime over days to weeks. If tree removal is needed this activity would be combined with #27 or #34.

64. Installation of steel structure, overhead bus, equipment, etc. (photos, Appendix A, page 91)
Installation of substation structure and equipment. This may involve use of a forklift, crane, or other heavy equipment. Activity occurs during daytime over days to months. If tree removal is needed this activity would be combined with #27 or #34.

65. Pole and/or tower installation and/or extension (photo, Appendix A, page 92)
This is the installation of a new TL pole or structure to support a TL conductor (e.g., a change-out of classes of poles for a taller structure to allow for more clearance). Activity may involve use of a crane, aerial lift equipment, typical excavation techniques (e.g., auger). Activity occurs during daytime over days to weeks. Will be combined with #27 or #34 if tree removal is needed.

66. Private, residential docks, piers, boathouses (photos, Appendix A, pages 93-94)
These structures typically occur on reservoirs and are constructed on shoreline with deeded or implied access rights to TVA-managed lands (i.e., shoreline allocated for residential use in a TVA land management plan, or shoreline that is privately owned and owners have

riparian rights to apply for facilities). Construction of facilities may involve medium-sized equipment (i.e., tractors, small excavators with buckets, pile driving equipment). Activity has potential to include, electrical connections, water intake, boat lifts, and ground disturbance. Installation typically occurs during daytime and may occur throughout the year. If vegetation removal is needed activity will be combined with #27 or #34.

67. Siting of temporary office trailers
Office trailers are temporarily placed on the ground to support work at a site. Trailers provide office facilities, restrooms, and meeting space. Bulldozer, trucks, and rock are involved in trailer placement. Whenever possible, open areas that do not require clearing are sited. Any tree clearing (minor potential) would be addressed as part of #27 or #34.

68. Financing for speculative building construction (photos, Appendix A, page 95)
Building is constructed by the funding recipient for lease or option to purchase and may include establishment of a building pad. Buildings typically are constructed in existing industrial property that already has been prepped (where suitable habitat typically is either lacking or can be avoided). Activity occurs during daytime over days to months. Activity involves potential for removal of suitable roost trees, but this is rare and would be addressed as part of #27 or #34.

69. Renovation of existing structures
This activity is to carry out upgrades to existing structures that involve changes to surrounding landscape. May involve use of bull dozer, track hoe, other heavy equipment. Activity occurs during the day and may take weeks to months to complete. Any vegetation removal would be addressed as part of #27 or #34.

70. Lock maintenance and construction (photos, Appendix A, pages 96-97)
This activity is conducted to improve navigability, increase lock times and improve safety of locks located on TVA-managed reservoirs. Activity includes expansion of existing locks, construction of locks to increase navigation, and maintenance of existing locks. May involve use of laydown areas. Construction activities occur during the day, throughout the year. Any vegetation removal would be addressed as part of #27 or #34.

71. Concrete dam modification (photos, Appendix A, pages 98-99)
Dam modifications are carried out to address structural issues (e.g., seepage), minimize potential for failure from overtopping, and prevent an increase in flooding. Installation of concrete floodwalls or raised earthen embankments are examples. Appropriate BMPs in accordance with Stormwater Pollution and Prevention Plans are implemented to manage erosion and storm water drainage. This may involve installation of silt fence, erosions eels, straw waddles, rock check dams, and concrete washout areas, as well as application of seeding and mulch to restore vegetation as construction activities within specific areas are completed. Shallow, narrow excavations will be performed to install the silt fence in a trenched configuration. Grouting for structural support downstream of a dam to protect other infrastructure also may be needed. Any vegetation removal would be addressed as part of #27 or #34.

72. Ferry landings/service operations
Ferry landings typically are constructed of concrete ramps with access roads and a small parking area, and occur at historical ferry locations where water depth and width of the river accommodate the use. New landings are not in high demand but reestablishing service or upgrades of existing landings could result in the need for some vegetation management

along the shoreline to improve access and visibility. There is a potential for tree removal. Activity (services and upgrades) occurs during daytime throughout the year. Any vegetation removal would be addressed as part of that type of activity (e.g., #27, #34).

73. Boat launching ramps (photos, Appendix A, pages 100-101)
Boat launching ramps (typically concrete) are established along the shoreline to allow entry/exit into the reservoir by boat. Activity requires road access (e.g., driveways) and parking areas. Some projects require parking expansion or improved stabilization around the launch ramp. Placement of ramps occurs during daytime, throughout the year. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

74. Recreational vehicle campsites (photo, Appendix A, page 8)
Recreational vehicle (RV) campsites typically consist of gravel or concrete pads with a utility post for water and electric hookup, and possibly waste disposal utilities. These exist on TVA property but may also be approved on private property subject to 26a jurisdiction. Tree removal could be involved if an operator has permission to use forested property via a land use agreement and wants to use that property for expansion. Land use agreements, however, do not give operators approval to remove trees. Establishment typically occurs during the daytime throughout the year. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

75. Utility lines/light poles
This refers to requests for installation of power lines and poles to serve minor water-use facilities (e.g., residential boathouse). Lines may be located underground or aerially placed. Connection crosses TVA lands. Trenchers may be used for underground placement of lines. Installation typically occurs during daytime, throughout the year. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

76. Concrete sidewalks (photo, Appendix A, page 100)
Concrete sidewalks may be established or maintained at operational facilities, or requested by landowners adjacent to TVA-managed land as a type of proposed pathway across TVA-managed land to reach shoreline. Installation typically occurs during daytime over several days.

77. Construction or expansion of land-based buildings (photos, Appendix A, pages 102-103)
This refers to construction of buildings that support operations or that are requested via Land Use or 26a permitting. Examples include industrial buildings, restrooms, buildings for storage, maintenance equipment, and recreational watercraft. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

78. Wastewater treatment plants
Requests for this activity are received through Land Use and/or 26a permitting. Activity has potential for ground disturbance, installation of new infrastructure, water use and modification of vegetation. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

79. Swimming pools and associated equipment
Requests for swimming pools are received via permitting requests by adjacent landowners (typically residential). Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

80. Barge fleeting areas (photos, Appendix A, page 104)
Barge fleeting areas may be permitted to the marine industry, industrial loading and offloading operations, federal mooring operations (i.e. safety landings), or be used by TVA facilities. Fleeting areas occur along reservoir shoreline where barges can park safely and are secured through spud poles, lashings or mooring posts. Fleeting areas may consist of several types of mooring structures (e.g., mooring cells made of steel sheet piles backfilled with aggregate, pile-driven mooring posts, or concrete dead men anchors buried on the shoreline that are used to secure barges to the shore with large cables). Some designs could require vegetation removal along the shoreline but it is not likely for mooring cells or other structures that can be anchored into the substrate independent of the shoreline. Construction typically occurs during daytime. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).

81. Water intakes - industrial (photos, Appendix A, page 105)
Industrial water intakes may be requested by large farm operations, golf courses, municipalities or industrial operations. Intakes may be considered industrial if they exceed 50,000 gallons per day. Intake pipes typically are a minimum of three inches in diameter but usually greater than six inches. Industrial intakes may require a path of vegetation removal across TVA property and path size could depend on use and distance of destination from reservoir. Directional boring operations could be used to minimize impacts but this method could be more costly, leaving surface trenching and tree removal as a favored option. Activity may include tree removal but could be avoided in certain situations. Activity may be combined with other activities (directional boring, #83, or vegetation removal, #27 or #34).

82. Construction of dam/weirs/levees
TVA or one of its partnering development agencies (Beech River Watershed Development Authority, Bear Creek Development Authority, Tellico Reservoir Development Agency) would be the only entities involved in construction of dams or weirs on reservoir; however, TVA does occasionally receive off-reservoir requests from private land owners or wildlife agencies to construct or repair large levees or dams for recreation use, flood control, wildlife management or farm ponds. Construction and maintenance activities may be triggered by the need to replace structures or modify existing structures to meet modern standards. This would likely involve tree removal and use of heavy earth-moving equipment (e.g., cranes, track hoes, concrete trucks), typically with daytime installation. Occurs on/near water, with potential to occur near caves and bridges. Activity would be combined as needed with appropriate vegetation removal activity (e.g., #27, #34).

83. Submarine pipeline, directional boring operations
Submarine pipelines are typically requested by municipalities for water lines or natural gas lines. These are constructed using directional boring equipment (big and small). Depending on size of project, there could be a need for an extensive laydown area to stage drilling equipment which could involve tree removal. These could be stream crossings or major river crossings. Activity takes place during the day. Activity would be combined as needed with drilling (#16) stream crossings (#31), access corridors (#25) and vegetation removal (e.g., #27, #34).

84. On-site/off-site public utility relocation or construction or extension
This activity is conducted to accommodate site development as part of economic development efforts or as a component of establishing a new TL. May include tree removal. Occurs during the daytime over several days to several weeks. Activity would be combined as needed with other activities such as vegetation removal (e.g., #27, #34).

85. Playground equipment - land-based
TVA permits playground equipment at marinas, campgrounds and public parks. Trees may need to be removed depending on site conditions and availability of flat ground but is often avoidable Installations occur during the day and may occur throughout the year. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

86. Landfill construction (photos, Appendix A, pages 106-107)
Activity involves bulldozers, track hoes, dump trucks and water trucks. Grubbing is an associated activity. Installation of liner may require seaming machines. New landfill may be needed to replace an existing landfill that is closing or for new/additional waste, or for storage of dry coal ash. There is potential for tree removal. Construction occurs during daytime and may take weeks to months to complete. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34, grading - #36).

87. Aboveground storage tanks
Aboveground storage tanks (ASTs) may be installed at operational facilities (tanks will be 20,000 gallons or less, a level area will be graded using a bull dozer, set with a crane) or permitted by TVA. ASTs (as TVA permits them) typically are used for storing fuel at marinas but an applicant could request approval for an AST to store some other product. This typically is related to an industrial operation and contents could range from water to chemicals. Spill plans are required for fuel tanks with capacity above 1320 gallons. For bulk storage of chemicals, proper records shall be maintained for inventories, inspections of storage sites, MSDSs, storage and disposal of out-of-date chemicals, and recycling of chemical containers through vendor or manufacturer contracts. Potential for tree removal is low but possible if the AST is associated with new development. Installation occurs during daytime throughout the year. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

88. Underground storage tanks
Underground storage tanks (USTs) are 20,000 gallons or less, involve excavation of a hole, and setting of the tank with a crane. Placement occurs during anytime throughout the year. For bulk storage of chemicals, proper records shall be maintained for inventories, inspections of storage sites, MSDSs, storage and disposal of out-of-date chemicals, and recycling of chemical containers through vendor or manufacturer contracts. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

89. Structure demolition (photos, Appendix A, pages 108-110)
This includes demolition and removal of selected structures. Along retired TL ROW, this may include poles, structures, or conductor. For new construction, building demolition may occur to abandoned barns or other buildings. Demolition of a coal-fired plant facility involves removal of retired or abandoned structures, concrete foundations, slab, roads, and parking lots. This may include the powerhouse, associated equipment and systems such as electrostatic precipitators, selective catalytic reduction systems, flue gas desulfurization units, coal handling facilities, ancillary buildings, water intake structures, water treatment buildings, powerhouse transformer yards, coal rail and barge unloading facilities, and facility chimneys. Buildings would be removed, including portions of, or all of, the foundations. Structures may be removed down to surrounding grade. Basements may be backfilled, pits and trenches brought up to surrounding grade, and disturbed areas vegetated with topsoil and grass seed. Any remaining electrical manholes may be plugged and abandoned. Decontamination (i.e., removal of solid and hazardous waste and materials) of all buildings would occur. The extent to which concrete slabs and foundations would be removed would

vary depending on site. Demolition may occur either by dismantlement, controlled explosive demolition, or a combination of the two approaches. There is potential for tree removal and handling of hazardous and non-hazardous materials. Following structure demolition, there is potential for natural regeneration of vegetation or planting of trees. Activity typically occurs during daytime; completion could take weeks to months. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

90. Pond closure (photos, Appendix A, pages 111-113)
A variety of power plant ponds may be subject to closure over the next 20 years, including water treatment ponds, gypsum ponds, and chemical ponds. Pond closures typically involve several phases. Preliminary site exploration may include water sampling, test pits, bush-hogging of high grass areas and selective removal of vegetation (less than three inches in diameter). Subsequent steps include dewatering, decommissioning upstream mechanical systems, disconnecting, sealing, and/or removal of mechanical equipment (e.g., influent/effluent lines, pump station, support structure), sediment stabilization, and placement of engineered fill (e.g., river dredge material, off-site borrow soil from a state-permitted soil borrow location or commercial rock quarry, or a combination of materials).

A chemical pond is dewatered by discharging accumulated rainwater into a water treatment pond on site via existing ditches and per existing standard operating procedures. Monitoring is conducted to demonstrate dewatering does not result in degradation to surrounding surface waters. Decommissioning is conducted by removing and disconnecting recirculation pumps, pump stations, discharge lines, and other structures associated with operation of pond prior to pond closure. Piping is removed to a point beyond the perimeter of the pond footprint. Additional underground utilities (i.e., electrical lines) also are identified and removed. A chemical pond is disconnected from its influent source and from its associated outfall. Both influent source lines and effluent lines between a chemical pond and active coal yard runoff ditch are permanently removed and disconnected. During removal of effluent lines, the pump station is removed and power cable and conduit demolished to a point beyond the perimeter of the pond footprint. Additional considerations may include salvage of electrical and mechanical equipment, proper drainage of equipment containing oil, identification and disconnection of existing electric lines traversing outer dike prior to closure.

Existing sediment is stabilized and left in-place as part of closure. As sediments are encountered, they are disked, temporarily stockpiled, or otherwise dewatered and dried to allow for compacting in place. All drying and dewatering activities are completed within embankments to contain decant water. A site is restored by placing and compacting several feet of engineered fill above stabilized sediments. Materials to be used include river dredge material and off-site borrow materials from a state permitted soil borrow location or from a commercial rock quarry or a combination. Fill is placed at the appropriate elevation and graded to drain generally from north to south. A site is restored by applying a combination of paving and/or gravel base on entire area to minimize potential for erosion of the final surface.

This activity may include capping and revegetating ponds. Tree planting or natural regeneration have the potential to occur as part of site restoration activities. Activity is conducted during daytime and may take weeks to months to complete. Activity would be combined as needed with other activities (e.g., tree planting - #24, vegetation removal - #27, #34).

91. Bridge replacement (photos, Appendix A, page 114)
Bridge replacement may occur at operational facilities with bridge crossings or proposals for this activity may be submitted via 26a permitting requests associated with transportation projects (e.g., state departments of transportation). Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

92. Return of archaeological remains to former burial sites
Archaeological remains that were formerly removed are returned to original burial locations, including caves. Includes use of shovels if needed, but usually remains are simply placed back in the cave. No tree removal is involved. This activity happens during the day, over the course of one day per site, with two to five repatriations per year.

93. Standard License
This type of license allows ongoing but revocable use of TVA land for commercial, private, and public projects that do not require long-term tenure (e.g. temporary construction laydown area, parking lot, etc.). Minimal amount of infrastructure and investment is involved. Agreements are 30/60 day revocable and can be active for several months up to several years. These occur throughout the TVA region with approximately five -10 licenses issued annually. The number of actions varies from one year to the next. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

94. Special Use License
This license is used to authorize short-term events on TVA land where no land rights exist (e.g. fishing tournaments, marathons, etc.). No tree removal is involved. These licenses typically are active for one-two days, with approximately 15-20 licenses issued annually.

95. Recreation License
This license allows ongoing but revocable use of TVA land for commercial or public recreation projects that do not require long-term tenure. There is a minimal amount of infrastructure and investment. There is potential for tree removal. Agreements of this type are 30/60 day revocable and can be active for several months up to several years. Approximately five-10 recreational licenses are issued annually. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

96. Land Use Permit
This permit grants permission to authorize construction of land-based facilities and/or to perform specific activities on TVA property where outstanding rights exist (e.g. land-based facilities such as a bathhouse, pavilion, etc.). To reduce administrative burden, if a land use permit request accompanies a 26a request, these processed together. It's rare that TVA receives a request for a land use permit without an associated request for a 26a permit. Land use permits are revocable only under certain terms and conditions and typically stay active for years. Approximately two-five land use permits are issued annually. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).

3.3 Manage Biological Resources for Biodiversity and Public Use on TVA Reservoir Lands

3.3.1 Objectives

TVA manages biological resources in a holistic, ecologically sound manner to maintain biological diversity while supporting multiple uses to meet stakeholder expectations. Expected benefits to this approach include improved understanding of land and resource conditions, increased protection of biologically diverse habitats, enhanced public awareness, promotion of sustainable use of TVA-managed lands, and development of partnerships to further resource management efforts in the TVA region (TVA 2011a).

TVA's natural resource management programs focus on protecting and enhancing biological resources of the TVA region. This is accomplished through continued evaluation of biological resources. This evaluation allows TVA to prioritize and then preserve sensitive (e.g., threatened and endangered species) and unique (e.g., old growth bottomland hardwood stands) resources, and conserve renewable resources (e.g., forests and native warm season grasses) in a sustainable manner. Dispersed recreation, such as camping, bank fishing, and hiking, can create positive and negative impacts on natural resources. TVA takes a proactive approach to reduce negative impacts (e.g., damage to habitat or species) while providing users with sustained, high-quality recreational experiences.

Four key objectives comprise TVA's management of biological resources:

- Land stewardship
    - Routine assessment of land condition enables prioritization of management needs (safety, quality, signage, maintenance, access).
- Habitat and species management
    - TVA has over 200,000 ac of manageable forested reservoir properties targeted for forest resource management.
    - TVA manages 157 Natural Areas throughout the TVA region that occupy approximately 16,000 ac. These areas protect some of the most biologically diverse and sensitive habitats occurring on TVA-managed lands, including unique plant, animal, cultural and scenic habitats.
    - TVA manages for populations of threatened and endangered species on TVA-managed lands in accordance with ESA. TVA plays a leadership role in protection and management of several terrestrial species and their habitats and continues to examine additional opportunities to proactively manage threatened and endangered resources nationally and regionally.
    - TVA-managed waterways and reservoirs create extensive year-round, temporal, seasonal, migratory and over-wintering habitat for hundreds of forest, aquatic and wetland migratory bird species. Management of these resources improves wildlife-focused dispersed recreation opportunities.
    - TVA's long-running dewatering program on Kentucky and Wheeler Reservoirs provide high-quality waterfowl habitat and significant opportunities for hunting and observation.
- Dispersed recreation
    - TVA's reservoir properties attract more than 6 million visits annually, which generate local and regional economic benefits. Unintended consequences of this heavy use are impacts to public land that need to be managed to ensure that environmental and social conditions remain sustainable.
    - TVA identifies high priority tracts, evaluates dispersed recreation opportunities and impacts, and then prioritizes and implements remediation activities.

- Public outreach and awareness
    - TVA conducts proactive, integrated efforts not only with other resource areas, but also with state and other federal agencies and nongovernmental organizations to educate the public about the importance of biological resources and their positive effects on the quality of life in the TVA region.

3.3.2 Comprehensive TVA Land Condition Assessments

TVA manages public lands for multiple benefits, striving to keep them in good environmental health while balancing the need for sustainable development. TVA protects natural resources while providing recreational opportunities across the TVA region (TVA Environmental Policy 2008). TVA staff conduct field-based land condition assessments of reservoir properties to determine presence or absence of desired conditions, compare land condition assessment ratings among parcels and over time, and document occurrence of unusual conditions or public safety and use concerns (See Appendix E, Land Conditions Assessment Protocol).

Priority areas for resource management are determined by known presence of threatened and endangered species, rare ecological communities, wetlands, archaeological resources, prior investment projects, cost sharing partnerships, land stewardship needs, public health and safety, and resources required for project completion. On-site parcel field assessments assess four key land conditions categories that address 1) public safety and use, 2) resource protection, 3) soil and water, and 4) vegetation and wildlife. Assessments target parcels allocated as Zone 3 or 4 (See Section 2.3.2). Field assessment checklists (See Appendix F, Land and Water Stewardship Reservoir Properties Land Conditions Assessment and Appendix G, Land and Water Stewardship Reservoir Properties Maintenance Needs) are used to document and characterize respective land conditions based on criteria and professional judgment from experienced specialists in TVA land, water, wildlife, watershed, and other stewardship programs.

TVA staff categorize parcels into tiers to further prioritize areas for resource management. The lifespan for a tier categorization is five years due to dynamic nature (i.e., ecological, land use, partnership changes) of lands and their associated resources (five years accounts for finer changes in land use). This facilitates establishment of a cycle for conducting land conditions assessment, development of an asset catalog, prioritization of where and what natural resource management activities are carried out, and maximization of efficiencies (assurance that efforts yield the most value). See Appendix H, Land Asset Tiering.

3.3.3 TVA Natural Areas Program

TVA adopted as policy Code XII Identification and Protection of Areas or Features of Natural and Scenic Significance in 1983. This code provides for direct and cooperative actions by TVA in identifying significant natural and scenic areas of the region and in developing protection for these resources. Sites with exceptional natural, scenic, or aesthetic qualities; that are suitable for ecological research; that harbor listed threatened and endangered species; or that contain unique biological communities or geological sites may be defined as Natural Areas (Appendix I, Tennessee Valley Authority Natural Areas Procedures Manual).

Goals and activities are as follows:

- Identify and protect significant Natural Areas on TVA lands that include habitat or rare or endemic species, unique or exemplary geological features or biological communities, or significant scenic areas;
- Provide opportunities for outdoor recreation in areas of natural beauty that incorporate a feeling of solitude and provide opportunities for wildlife observation;
- Cooperate with other partners in establishing and protecting Natural Areas suitable for ecological research and environmental education;
- Promote cooperative preservation efforts by establishing partnerships with state and federal agencies; and
- Increase public awareness of the importance of preserving Natural Areas and the diversity they contain.

Designated TVA Natural Areas are to be protected and managed indefinitely for the purpose of preserving their ecological integrity and represent the highest and best use of these tracts of lands and waters.

Natural Areas management objectives include:

- Maintaining ecological integrity of natural communities;
- Protecting fragile and rare habitats from potentially destructive impacts of human visitation while allowing compatible and appropriate types of public use;
- Providing habitat structure and conditions for rare, threatened or endangered species of plants and animals within the context of natural community health; and
- Controlling invasive plants (e.g., reinstating historic disturbance processes, removing invasive species, or constructing and maintaining well-designed hiking trails that minimize recreational impacts.

3.3.4 Field-Level Proactive Stewardship Efforts

Figures 3-1, 3-2 and 3-3 depict summary data for stewardship projects in 2016. This is followed by a list of example stewardship projects from fiscal year (FY, 09/01-10/30) 2014 through FY 2017.

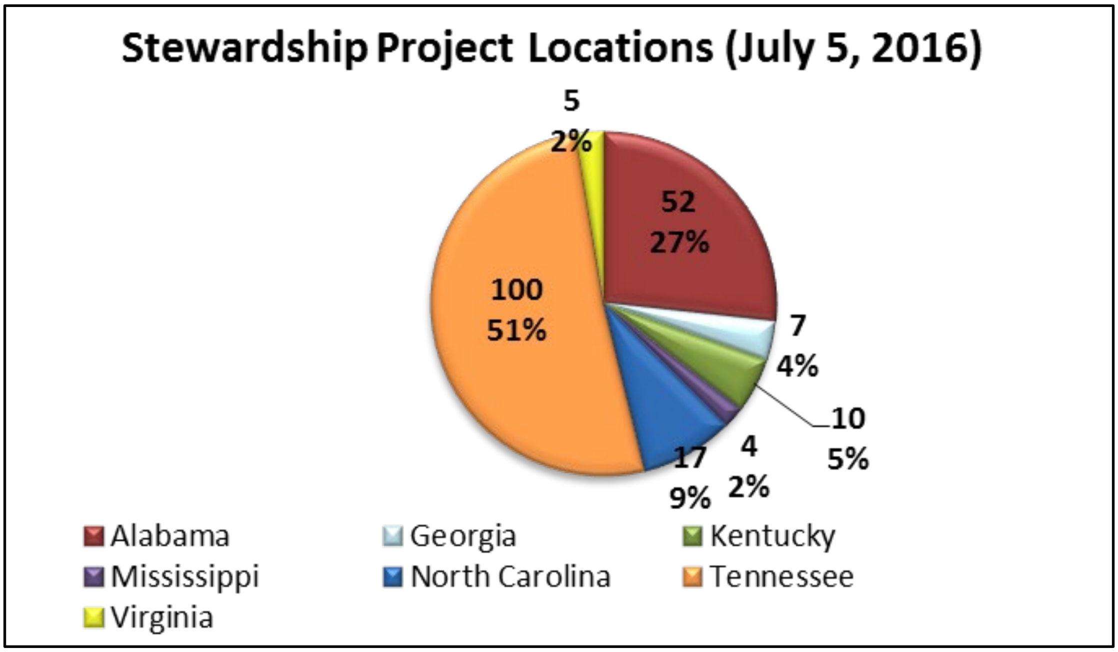


Figure 3-5. **TVA Stewardship Projects grouped by Partnership Type during Fiscal Year 2016 (as of July 5, 2016)**

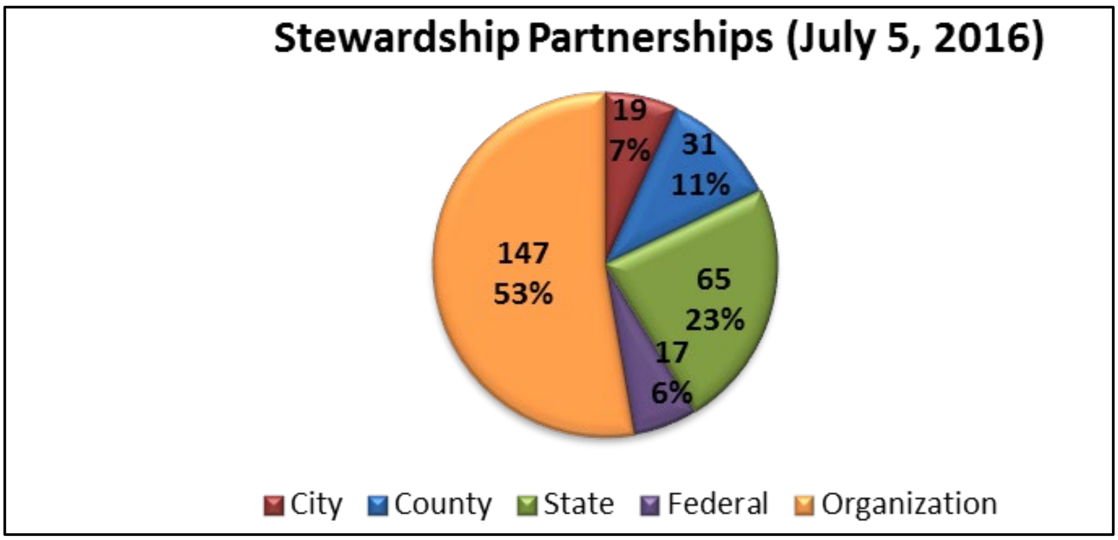


Figure 3-6. **TVA Stewardship Projects grouped by Partnership Type during Fiscal Year 2016 (as of July 5, 2016)**

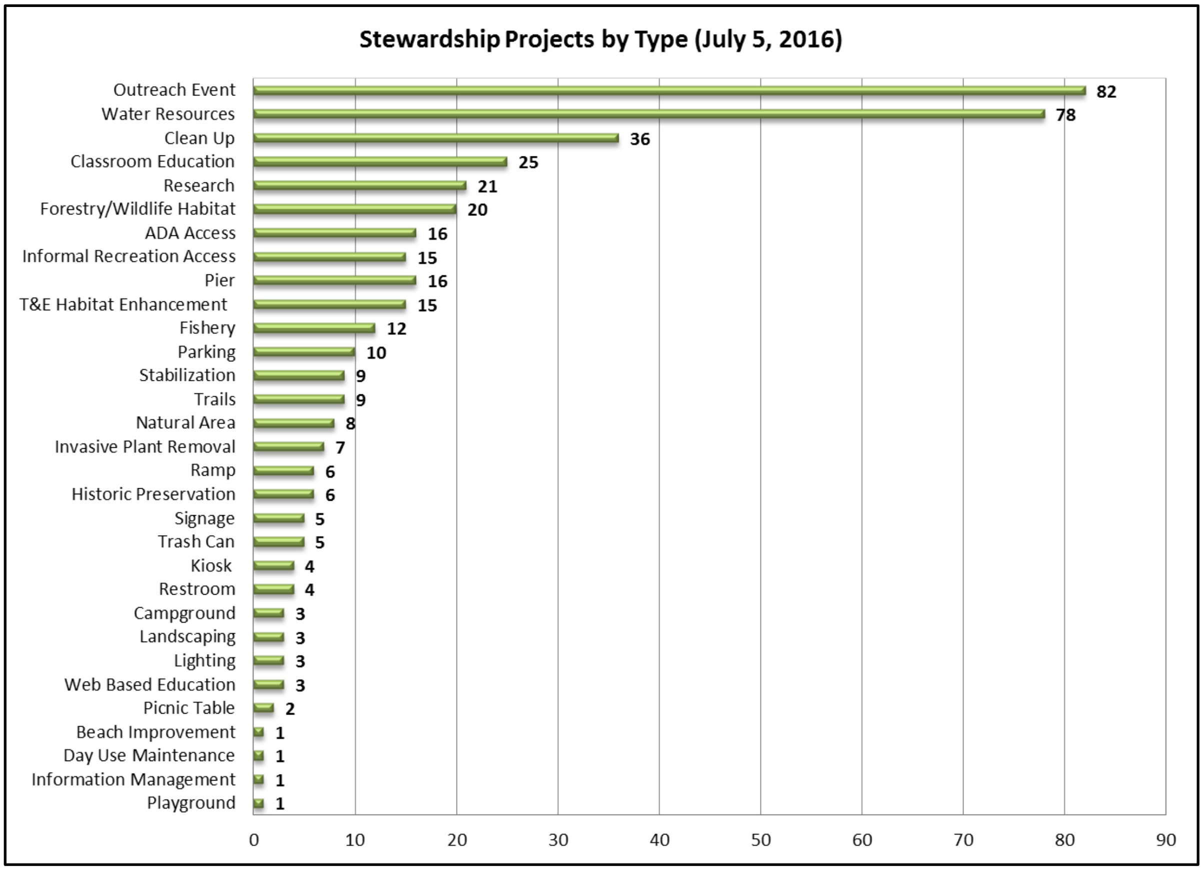


Figure 3-7. Stewardship Projects Organized by Type for Fiscal Year 2016

Example Stewardship Projects on TVA Natural Areas and elsewhere in the TVA Region (Fiscal Years 2014 -2022)

- *Video documentary of Indiana bat spring migration:* Provided funding to develop documentary video in collaboration with multiple state and federal agencies, universities, environmental consultants, and other stakeholders. Assisted with transmitter attachment and location of day roosts. Completed at natural area caves and sites in the TVA region (FY 2014).
- *Blowing Wind Habitat Protection Area (Sauta Cave National Wildlife Refuge, Jackson County, Alabama):* Forest management and invasive species control efforts were implemented to improve habitat for federally listed Indiana bat and Price's potato bean through mulching, tree canopy thinning and targeted herbicide application. Bat acoustic surveys and mist netting also were also conducted. Efforts were in partnership with the USFWS and Alabama Department of Conservation and Natural Resources (FY 2014-2015).
- *Natural Area Signage Campaign:* Installation or replacement needed at several locations. Interpretive signs are important tools in increasing visitor knowledge of TVA Natural Areas with information on natural, cultural, and historic features and stories for Natural Areas visitors. Signs may also be used to interpret management activities of TVA public lands and to showcase Natural Areas features. Signs were installed at various locations (FY 2015-2016).

- *Blythe Ferry Cave Gate Installation (Meigs County, Tennessee):* Installed cave gate perimeter fence at Blythe Ferry to enhance and restore use by a summer colony of gray bats (FY 2015). An addition to the existing cave gate perimeter fence is proposed for FY18 to further ensure that bats are not disturbed; there have been several incidences of individuals climbing up the bluff from the reservoir to reach the cave.
- *Biocultural Inventories (Natural Areas on Guntersville and Wheeler Reservoir Lands, Alabama):* Conducted to determine areas that might be suitable for HPA status (FY 2015).
- *Installation of Unconventional Bat Roosts:* TVA has installed 50 artificial bat roosts (ABR) at nine locations throughout the Tennessee Valley to provide more permanent suitable habitat for tree roosting bats. The initial study consisted of installing 25 bat roosts at four locations in 2016 (Tennessee: Big Sandy - Benton County and Loyston Point - Union County; Alabama: Cave Mountain Cave – Marshall County and Marbut Bend – Limestone County). In 2019, five poles were installed at each of five additional locations (Kentucky: Tupelo Gum Habitat Protection Area - Marshall County and Bayou Creek Habitat Protection Area - McCracken County; Georgia: Nottley Dam - Union County; North Carolina: Chatuge Dam - Clay County; and Tennessee: Rankin Bottoms Wildlife Management Area - Cocke County) for a total of 50 roosts throughout the TN Valley. Annual surveys have occurred at each site since initial installation (FY 2016-2022).
- *Signage and Gate Repairs at Caves:* Determine signage in need of replacement or new signage for protection due to sensitive species or cultural resources present. Determine caves that need repairs to existing cave gates. Many TVA caves reside within TVA Natural Areas (FY 2017 and FY 2020).
- *Funding for Tracking and Monitoring of Bats in Alabama*: TVA helped partially fund radio tagging, tracking and monitoring of Indiana bats from winter hibernacula in Alabama and northern long-eared bats during the spring and summer. This was in partnership with the USFWS, Alabama Bat Working Group, Alabama Department of Transportation, Alabama Department of Conservation and Natural Resources, US Forest service and other partners. Goal was to track bats from specific caves in Alabama to document migration routes and roost stops (FY 2017).
- *Study of Imperiled Forest Bats:* A study of imperiled forest bats has been proposed at Loyston Point Recreation Area (Norris Reservoir, Union County, TN). This would include mist net surveys and radio tagging bats for tracking purposes (proposed for FY 2018).
- *Key Cave Gate Installation:* Installed cave gate perimeter fence at Key Cave in Lauderdale County, Alabama to provide more protections to gray bats and tricolored bats roosting in the cave as well as other endangered species managed on the USFWS Key Cave Wildlife Refuge (FY2021).
- *Collier Cave Gate Installation:* Installed a chute style cave gate at Collier Cave in Lauderdale County, Alabama to protect a previously large colony of tricolored bats and a gray bat summer roost. This site was frequently visited by humans prior to gating. It is hoped that the tricolored bat populations at this cave will be able to rebound faster without human disturbance (FY 2022).
- *Graduate Student Research- Understanding Female Tri-colored Bat Summer*

Roosting and Foraging Ecology to Benefit Species Survival and Reproduction: TVA funded research conducted by the University of Tennessee to explore the roosting and foraging ecology of pregnant, lactating, and non-reproductive female *Perimyotis subflavus* (tri-colored bat) during the spring/summer maternity season of 2019-2021. This study is a multi-year phased project and will help to fill gaps in current knowledge of the species' life history, aid in recovery planning, allow development of regulatory mechanisms and mitigation strategies that promote species persistence, and permit establishment of management alternatives that conserve, maintain and improve critical spring/summer habitat (FY 2019-FY2022).

3.3.5 Activities Associated with Management for Biodiversity and Public Use

Activities associated with management for biodiversity and public use are listed below and described in Section 3.2

- Environmental education (#4)
- Environmental planning (#13)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Minor erosion control (#18)
- Site-specific enhancements in streams and reservoirs for aquatic animals (#19)
- Nesting platforms (#20)
- Herbicide use (#21)
- Grubbing (#22)
- Prescribed burns (#23)
- Tree planting (#24)
- Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Restoration of sites following human use and abuse (#27)
- Removal of debris (dump sites, hazardous material, unauthorized structures) (#28)
- Acquisition and use of fill/borrow material (#29)
- Stream/wetland crossings (#31)
- Clean up following storm damage (#32)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Stabilization (major erosion control) (#35)
- Grading (#36)

- Berm development (#39)
- Internal renovation or internal expansion of existing facility
- Stream monitoring equipment - installation and use (#45)
- Laydown areas (#48)
- Minor land-based structures (#50)
- Signage installation (#51)
- Maintenance of water control structures (dewatering units, spillways, levees) (#54)
- Renovation of existing structures (#69)
- Boat launching ramps (#73)
- Construction of dam/weirs/Levees (#82)

3.3.6 Context within Action Area

Activities used to manage biological resources for biodiversity and public use are estimated to involve 36,760 ac over the course of 20 years on TVA reservoir lands (Tables 3-1 and 3-5). Tree removal may occur on 1,186 ac (approximately 3 percent), which is 0.003 percent of total available forest cover in the TVA region. Forty percent (approximately 475 ac) of this tree removal is expected to be temporary in nature, such that areas either will be allowed to natural regenerate or trees will be replanted. It is estimated that 20 percent of tree removal can occur during winter, 50 percent needs to occur outside of winter, but can avoid the range-wide pup season, and 30 percent has to occur within pup season. Over the first 5 years of the BPC approximately 17.62 ac of suitable bat habitat removal has occurred. This is 1.5% of the estimated tree removal for managing biological resources for biodiversity and public use over the 20-year duration of the BPC. Of this tree removal, 82.6% occurred in winter, 10.5 % in the volant season (outside of winter but avoiding pup-season), and 6.9% during pup season (Table 3-3).

Table 3-5. Estimated Acreage associated with Management of Biological Resources

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Habitat Management (including grassland and agricultural sites)	10,000	0	10,000	0
Maintenance and Construction	1,319	40	26,380	806
Hazard Tree Removal/Permitting	19	19	380	380
Total	**11,338**	**59**	**36,760**	**1,186**

3.4 Protect Cultural Resources on TVA-Retained Land

3.4.1 Objectives

The earliest TVA-related archaeological surveys began in 1933 with the building of the first TVA dam in Norris, Tennessee. The National Historic Preservation Act (NHPA), passed in 1966, requires federal agencies to consider potential effects of a proposed action on historic properties and outlines an approach for agencies to consider preservation of cultural resources. As of 2011, TVA has documented an estimated 11,500 archaeological sites on and adjacent to its reservoir and power properties. Approximately 5,320 historic structures have been identified on or near TVA-managed public lands. Of these, about 235 are considered either eligible or potentially eligible for listing in the National Register of Historic Places and 85 historic structures are listed in the Register. TVA manages a number of significant archaeological sites that have made important contributions to the understanding of prehistory in the southeastern U.S.

The majority of cultural activities performed by TVA are required under legal or regulatory statutes. TVA's management of cultural resources historically has been focused on regulatory compliance. Since 2011, TVA has worked to strengthen the integration of cultural resources with other resource areas, helping to gain efficiencies in enforcement, identification and protection efforts.

TVA‘s strategy for protecting cultural resources focuses on the following aspects:

- Enforcement - TVA has two ARPA officers and conducts coordinated enforcement efforts to monitor reservoir properties and inundated lands periodically exposed in TVA reservoir drawdowns.
- Protection - TVA began enhancing efforts in 2011 to monitor and protect archaeological resources to prevent looting and shoreline erosion through ARPA enforcement and the Thousand Eyes archaeological outreach program.
- Data management - TVA also will continue to collect data through its preservation program to support the identification and protection of historic sites.
- Public outreach and awareness - TVA will continue to increase educational outreach to provide long-term protection by encouraging public interest in resource protection.

The following are goals for cultural resources to be reached over a 20-year period that were established in 2011 and are relevant to this BA:

- Protect 30-40 percent of critically eroding sites
- Conduct archaeological surveys on TVA land
- Annually conduct ARPA inspections.
- Conduct reviews required by the NHPA Section 106
- Comply with the Native American Graves Protection and Repatriation Act

3.4.2 Activities Associated with Protection of Cultural Resources

Activities associated with protection of cultural resources are listed below and described in Section 3.2.

- Environmental education (#4)
- (Engineering or) environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)
- Erosion control, minor (#18)

- Maintenance or construction of access control measures (#26)
- Restoration of sites following human use and abuse (#27)
- Stabilization (major erosion control) (#35)
- Signage installation (#51)
- Return of archaeological remains to former burial sites (#92)

3.4.3 Context within Action Area

Activities used to protect cultural resources are estimated to involve 10,000 ac (500 ac annually) over the course of 20 years on TVA reservoir lands (Tables 3-1 and 3-6). Tree removal is not expected to occur. Cultural surveys sometimes occur in caves that also are inhabited by bats. Cultural surveys and cultural protection efforts (shoreline stabilization to protect remains) also often occur adjacent to water bodies. Relevant cultural activities thus are included in review of routine actions in this BA.

Table 3-6. Estimated Acreage associated with Protection of Cultural Resources

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Surveys, Re-Interment	500	0	10,000	0
Total	**500**	**0**	**10,000**	**0**

3.5 Manage Land Use and Disposal of TVA-Retained Land

3.5.1 Objectives

TVA's Land Policy (See 1.2.5 TVA Land Policy) spells out exactly how the agency manages the reservoir system and its 293,000 ac of surrounding lands to maximize public enjoyment, flood control, navigation, power production and economic growth. TVA's RLMPs reflect the application of its Land Policy in regard to the management of its reservoirs and the lands that surround them (See 2.3.2 Comprehensive Valley-wide Land Plan). RLMPs govern decisions about whether land is disposed of or retained and establish how the land may be used and by whom. RLMPs also detail tactics on a reservoir-by reservoir basis—and help TVA make decisions when it receives requests for use of TVA public land. RLMPs are developed with participation by public agencies and officials as well as private individuals and organizations. By providing a clear vision for how TVA will manage public land, an RLMP minimizes conflicting interests and guides decisions on land-use requests.

Land use and land disposal requests typically begin with review of the land use allocation relevant to the request's location as well as property deeds associated with the tract of land in question. This is to ensure proposed requests align with requirements in the deeds and with the land use allocation. If needed, an onsite inspection is conducted to review the proposed use. The time needed to complete review of a land use request depends on the nature of the request, the type of land rights needed, and the level of environmental review required. Decision timeframe ranges from four to eight weeks for minor actions (e.g., licenses and land use permits) to six months or longer for proposals that involve disposal of land or land rights. Approval by the TVA Board of Directors is required for requests for disposal of TVA land or land rights (e.g., easement, abandonment, deed modification, lease, transfer, or sale) but not necessarily for requests for permissions associated with use of TVA land (e.g., special use licenses, land use permits, sufferance agreements, etc.).

3.5.2 Activities Associated with Managing Land Use and Land Disposal

Activities associated with managing land use and disposal of TVA-retained land are listed below and described in Section 3.2.

- Easement on TVA property (#7)
- Sale of TVA property (#8)
- Lease of TVA property (#9)
- Deed modification associated with TVA rights or TVA property (#10)
- Abandonment of TVA rights (#11)
- Sufferance agreement (#12)
- Engineering or environmental planning or studies (#13)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Nesting platforms (#20)
- Herbicide use (#21)
- Grubbing (#22)
- Tree planting (#24)
- Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Restoration of sites following human use and abuse (#27)
- Removal of debris (dump sites, hazardous material, unauthorized structures) (#28)
- Acquisition and use of fill/borrow material (#29)
- Dredging and excavation; recessed harbor areas (#30)
- Stream/wetland crossings (#31)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Grading (#36)
- Closed loop heat exchangers (heat pumps) (#40)

- Internal renovation or internal expansion of an existing facility (#42)
- Laydown areas (#48)
- Minor land-based structures (#50)
- Signage installation (#51)
- Maintenance of water control structures (dewatering units, spillways, levees) (#54)
- Solar panels (#55)
- Culverts (#56)
- Water intake - non-industrial (#57)
- Wastewater outfalls (#58)
- Marine fueling facilities (#59)
- Commercial water-use facilities (e.g., marinas) (#60)
- Blasting (#62)
- Lock maintenance and construction (#70)
- Ferry landing/service operations (#72)
- RV campsites (#74)
- Utility Lines/Light Poles (#75)
- Construction or expansion of land-based buildings (#77)
- Wastewater treatment plant (#78)
- Swimming pools and associated equipment (#79)
- Water intakes - Industrial (#81)
- Submarine pipeline, directional boring operations (#83)
- Playground equipment, land-based (#85)
- ASTs (#87)
- USTs (#88)
- Bridge replacement (#91)
- Standard license (#93)
- Special use license (#94)
- Recreation License (#95)
- Land use permit (#96)

3.5.3 Context within Action Area

Activities used to manage land use and disposal of TVA-retained land are estimated to involve 12,600 ac over the course of 20 years on TVA reservoir lands (Tables 3-1 and 3-77). Tree removal conservatively has been estimated to potentially occur on all of these acres, which accounts for 0.035 percent of total available forest cover within the TVA region. Twenty percent (approximately 2,520 ac) of this tree removal is expected to be temporary in nature, such that areas either will be allowed to naturally regenerate or trees will be replanted. TVA managers of land use and disposal activities estimate that 50 percent of tree removal can occur during winter, 30 percent needs to occur outside of winter, but can avoid the range-wide pup season, and 20 percent likely has to occur within the pup season. Over the first 5 years of the BPC approximately 144.07 ac of suitable bat habitat removal has occurred. This is 0.9% of the estimated tree removal for managed land use and disposal over the 20-year duration of the BPC. Of this tree removal, 83.9% occurred in winter, 9.3 % in the volant season (outside of winter but avoiding pup-season), and 6.7% during pup season (Table 3-3).

Table 3-7. Estimated Acreage associated with Managing TVA Land Use and Disposal

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Land Use	350	350	7,000	7,000
Land Disposal	280	280	5,600	5,600
Total	**630**	**630**	**12,600**	**12,600**

3.6 Manage Permitting under Section 26a of the TVA Act

3.6.1 Objectives

In accordance with Section 26a, TVA approval is required for proposed obstructions along or in the Tennessee River or its tributaries (See Sections 2.2 and 2.3). Obstructions may include such things as boat docks, piers, boathouses, rafts, buoys, floats, boat-launching ramps, fills, nonnavigable houseboats, as well as other structures. This section of the TVA Act is designed to ensure that construction along the shoreline and in the waters of the Tennessee River system does not adversely impact or compromise TVA's capability for managing the river system. Typically, TVA reviews and approves approximately 1,600 construction permits annually to ensure compatibility of the proposed construction activity with flood control, navigation, reservoir recreation, power generation, land management, and environmental protection mandates.

Typical commercial and public facilities that require Section 26a permits include barge terminals, water intake or discharge structures, mooring cells, bridges, culverts, commercial docks, and marinas. Of the 1,600 Section 26a permit requests which TVA approves annually, about 1,360, or more than 85 percent, are for the construction of private docks or other alterations fronting waterfront residential property.

TVA's SMP, made effective in 1999 and discussed in detail in Section 1.2.6, provides the framework for how TVA reviews and permits activities associated with Section 26a permitting. Key elements of the SMP include the following:

- TVA allows docks and other alterations along shorelines where access rights exist.
- Permits for existing facilities remain in effect.
- Vegetation management plans are required on TVA land.

- A maximum allowable footprint of 1,000-sq-ft applies to new residential water-use facilities.
- All constructed facilities will be contained within a 1,000-sq-ft rectangular or square area at the lakeward end of the access walkway that extends from shore to dock.
- A 50-ft-deep SMZ will be retained on TVA land that adjoins newly-developed residential areas where sufficient TVA land is available.
- An access/view corridor up to 20-ft-wide can be requested within an SMZ.
- Use of BMPs is promoted for the construction of docks, management of vegetation, stabilization of shoreline erosion, and other shoreline alterations.

3.6.2 Standards

TVA established standards (Table 3-8) for type, size and design of boat docks in response to requests voiced by stakeholders. Managing the density and size of structures not only protects property values, but also protects important public values such as scenic beauty, water quality, and natural resources, all of which are potentially affected by shoreline development. The standards do not result in a "one-style-fits-all" appearance. Rather, there are several design options within the allowable footprint. Unless there are sensitive resources that must be protected or other site-dependent constraints such as proximity to the navigation channel, the decision regarding configuration of proposed facilities is left to the homeowner, provided the maximum standards are not exceeded. When limiting factors exist, TVA works with homeowners to explore alternative ways to meet their needs. The SMP also provides flexible standards for erosion control. Homeowners may choose among the options of riprap, biostabilization, gabions, or a combination of these approaches, as long as TVA standards for the selected technique are met. TVA promotes awareness among homeowners about the benefits of plant systems for erosion control.

Table 3-8. TVA Shoreline Management Policy: Summary of Construction and Land Use Standards for New Development (as of November 1, 1999)

STANDARD	SHORELINE MANAGEMENT POLICY
Maximum allowable footprint	Up to 1,000-sq-ft, not including walkways[1]
Covered boat slips	One or more covered slips per lot, within 1,000-sq-ft footprint; exterior siding allowed[1]
Flotation	If foam is used, it must be encased and commercially manufactured.
Shoreline management zone[2] (SMZ)	50-ft-deep SMZ where TVA owns the land
Management of woody understory[2]	Clearing of poison ivy, Japanese honeysuckle, and other specified plants may be allowed within 50-ft-deep SMZ and elsewhere on TVA property
Tree cutting[2]	Selective thinning of trees up to 3-in.-diameter at ground level may be allowed outside 50-ft-deep SMZ. Tree cutting may be allowed within SMZ to clear access/view corridor. Pruning of some side limbs also may be allowed.
Shoreline stabilization	Applicants choose between riprap, biostabilization, or gabions
Community facilities	Required in small coves with insufficient shoreline to accommodate individual docks or where needed for resource protection
Boat launching ramps/marine railways	Individual marine railways or ramps are allowed within access/view corridor
Channel excavation[3]	Individual boat channels considered (<150 cu. yds. of dredging)

[1] Construction standards for residential water-use facilities apply to all structures requiring 26a approval on TVA land and on flowage easement property. A maximum allowable footprint of 1,000-sq-ft applies to all residential water-use facilities. Docks, slips, boathouses, and other water use facilities associated with a particular lot will be contained within a 1,000-sq-ft square or rectangular area at lakeward end of access walkway that extends from shore to dock. Access walkways may not exceed six-ft-wide and are not included in 1,000-sq-ft footprint.
[2] These standards are required on TVA-owned residential access shoreland. TVA approval is not required for management of vegetation on flowage easement or other private property.
[3] Channel excavation in flowage easement associated with a water-use facility requires approval.

3.5.3 Grandfathering Provisions

Under the SMP, existing permitted uses of shoreline are allowed to be continued by current and subsequent property owners. Grandfathering provisions apply to existing permitted development and uses along shorelines that are open for access and uses in existence prior to November 1, 1999. The following provisions apply:

Mowing and Vegetation Management under Grandfathering Provisions

- Mowing of established, preexisting lawns on TVA-owned residential access shoreland is allowed to continue. In situations where established mowing is not now specifically included as an authorized use in an existing permit, TVA will add mowing as a permitted use in the next permit action involving that site. This could be done during the following:
    - When reviewing a permit application for existing structures and other uses that had not been previously permitted
    - When reviewing proposals for additional shoreline alterations at the site
    - When ownership of adjacent property changes and new owner requests a permit to continue existing uses
- Mowing and other vegetation management practices on flowage easement shoreland or other privately owned property do not require TVA approval.
- Removal of trees or other vegetation on TVA property requires TVA's prior written approval.

Existing Structures under Grandfathering Provisions

- Existing shoreline structures previously permitted by TVA are automatically grandfathered.
- SMP does not require grandfathered docks or other permitted alterations to be modified to conform to new standards.
- It is homeowner's responsibility to ensure all existing shoreline alterations are permitted.

3.6.3 Vegetation Management

The SMP provides for a 50-ft-deep (begins at normal summer pool elevation and extends up to 50 ft inland) SMZ to protect the shoreline and water quality. This applies to new areas developing next to TVA land with approved shoreline access, but not to flowage easement shoreland, other private land, or where lawns existed before November 1, 1999. When an adjacent property owner (26a applicant) requests TVA's permission for a dock or other shoreline alternations on TVA-managed residential access shoreland, TVA works with landowners to ensure the application includes a plan for management of vegetation on

TVA-managed land, unless an approved vegetation management plan already exists. The plan must meet the following vegetation management standards:

- Clearing of selected trees and other vegetation may be considered to create and maintain an access/view corridor up to 20-ft-wide that extends from the common boundary between TVA and adjacent landowner to water at normal summer pool.
- The access/view corridor is delineated to minimize removal of trees or other vegetation with high wildlife value on TVA land. Grass may be planted within the corridor, and stone, brick, concrete, mulch or wooden paths, walkways, and/or steps may be considered.
- An SMZ that is at least 50-ft-deep will be defined along shoreline where TVA owns property. Where TVA ownership is less than 50 ft, SMZ is only required on TVA property and does not extend onto private property. SMZ begins at normal summer pool elevation and extends up to 50 ft inland.
- TVA's goal in establishing an SMZ is to conserve trees and other woody vegetation to the maximum practical extent. To accomplish this goal, cutting of trees within SMZ is only allowed to clear access/view corridor and to make the site suitable for erosion control projects. When trees are removed in preparation for erosion control projects, replacement planting of native trees is required.
- Within SMZ and elsewhere on TVA land, clearing of specified plants (poison ivy, Japanese honeysuckle, kudzu) and other plants approved by TVA may be considered.
- Pruning of side limbs on trees to enhance view of the reservoir may be considered within SMZ and elsewhere on TVA-managed land.
- On TVA-managed land situated above the SMZ (more than 50 ft from normal summer pool), selective thinning of trees or other vegetation under 3 inches in diameter at ground level may be considered.
- Forest floor must be left undisturbed except for removal of specified plants and/or planting of native vegetation.

3.6.4 Shoreline Conservation

TVA conducts and maintains shoreline inventory data to document presence of threatened and endangered species, wetlands, and cultural resources. This information is used in TVA's reservoir land management planning process to categorize shorelines that should be protected because of the existence of sensitive resources. Reservoir plans define goals for management of TVA lands and identify specific land use allocations for each parcel. In developing reservoir plans, TVA relies upon public involvement and resource inventories to identify appropriate uses for each parcel. During the planning process, maps are prepared for each reservoir to show land ownership patterns and areas with access rights. The planning process includes the shoreline categorization system. TVA also promotes conservation easements. TVA will actively partner with lake user organizations, property owner associations, land trusts, individual property owners, conservation organizations, state and local agencies, and others in seeking voluntary donations of conservation easements for protection of privately owned shoreline. Conservation easements allow land to remain in private ownership. These easements will be custom-tailored to meet the needs of property owners who want to ensure sound stewardship of their lands today and into the future.

3.6.5 Activities Associated with Managing Section 26a Permitting

Activities associated with managing 26a permitting are listed below and described in Section 3.2.

- Engineering or environmental planning or studies (#13)
- Harbor limits (#14)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Site-specific enhancements in streams and reservoirs for aquatic animals (#19)
- Nesting platforms(#20)
- Herbicide use (#21)
- Grubbing (#22)
- Tree planting (#24)
- Maintenance, improvement, or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Acquisition and use of fill/borrow material (#29)
- Dredging and excavation; recessed harbor areas (#30)
- Stream/wetland crossings (#31)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Stabilization (major erosion control) (#35)
- Grading (#36)
- Closed loop heat exchangers (heat pumps) (#40)
- Minor water-based structures (#41)
- Stream monitoring equipment (#45)
- Floating boat slips within approved harbor limits (#46)
- Laydown areas (#48)
- Non-navigable houseboats (#49)
- Minor land-based structures (#50)
- Signage installation (#51)
- Floating buildings (#52)
- Mooring buoys or posts (#53)

- Maintenance of water control structures (dewatering units, spillways, levees) (#54)
- Solar panels (#55)
- Culverts (#56)
- Water intake - non-industrial (#57)
- Wastewater outfalls (#58)
- Marine fueling facilities (#59)
- Commercial water-use facilities (e.g., marinas) (#60)
- Septic fields (#61)
- Blasting (#62)
- Private, residential docks, piers, boathouses (#66)
- Renovation of existing structures (#69)
- Lock maintenance and construction (#70)
- Ferry landing/service operations (#72)
- Boat launching ramps (#73)
- RV campsites (#74)
- Utility Lines/Light Poles (#75)
- Concrete sidewalks (#76)
- Construction or expansion of land-based buildings (#77)
- Wastewater treatment plant (#78)
- Swimming pools and associated equipment (#79)
- Barge fleeting areas (#80)
- Water intakes - Industrial (#81)
- Construction of dams/weirs/levees (#82)
- Submarine pipeline, directional boring operations (#83)
- Playground equipment, land-based (#85)
- ASTs (#87)
- USTs (#88)
- Bridge replacement (#91)

3.6.6 Context within Action Area

Activities used to manage Section 26a permitting are estimated to involve 6,280 ac over the course of 20 years on TVA reservoir lands (Tables 3-1 and 3-9). Tree removal may occur on an estimated 2,080 (approximately 33 percent) of these acres, which accounts for 0.006 percent of total available forest cover within the TVA region. Thirty percent (approximately 1,884 ac) of this tree removal is expected to be temporary in nature, such that areas either will be allowed to natural regenerate or trees will be replanted. TVA managers of 26a permitting activities estimate that 80 percent of tree removal can occur during winter, 10 percent needs to occur outside of winter, but can avoid the range-wide pup season, and 10 percent likely has to occur within the pup season. Over the first 5 years of the BPC approximately 67.49 ac of suitable bat habitat removal has occurred. This is 3.2% of the estimated tree removal for 26a permitting over the 20-year duration of the BPC. Of this tree removal, 85.3% occurred in winter, 7.5 % in the volant season (outside of winter but avoiding pup-season), and 7.2% during pup season (Table 3-3).

Table 3-9. Estimated Acreage associated with Managing Section 26a Permitting

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Manage 26a Permitting	314	104	6,280	2,080
Total	**314**	**104**	**6,280**	**2,080**

3.7 Operate, Maintain, Retire, Expand, or Construct Power Plants

3.7.1 Objectives

This section describes actions implemented at power plant properties. These actions include activities associated with operation, maintenance, expansion or construction of a variety of power plants (e.g., coal-fired, nuclear and natural gas plants, and hydroelectric dams). TVA's objective is to generate low-cost power in accordance with TVA's IRP (Section 1.2.3) to meet future electricity needs while supporting TVA's equally important mandates for environmental stewardship and economic development. Emphasis is on continuing to move away from traditional coal-based production and toward cleaner forms of power generation. TVA is decommissioning some of the oldest, least-efficient coal-fired units and replacing them with low- or zero-emission electricity sources, including renewable energy, natural gas, nuclear power, and energy efficiency programs. Generation facilities are depicted in Figure 3-4.

At some of TVA's plant sites, for example, this has resulted in replacement of coal-fired units with natural gas generators. Retirement, replacement, and conversion activities are such that construction and expansion activities often occur within existing (previously disturbed) power plant footprints and overlap with operation and maintenance activities. Activities associated with maintenance, expansion, construction, and retirement are thus described together.

3.7.2 Coal-Fired Plants

Coal-fired plants have formed the backbone of the TVA power system since TVA first started using them in the 1950s. However, in keeping with our commitment to generate safer, cleaner energy, TVA is beginning to retire older, less efficient coal-fired plants and replacing them with low- or zero-emission electricity sources. Units at coal-fired plants produce electricity by burning coal in a boiler to heat water to produce steam. The steam, under tremendous pressure, flows into a turbine, which spins a generator to produce electricity. Burning coal creates coal combustion residuals (CCR). Separated CCR is marketed through contracts to be recycled into building materials, abrasives, cement, and other products.

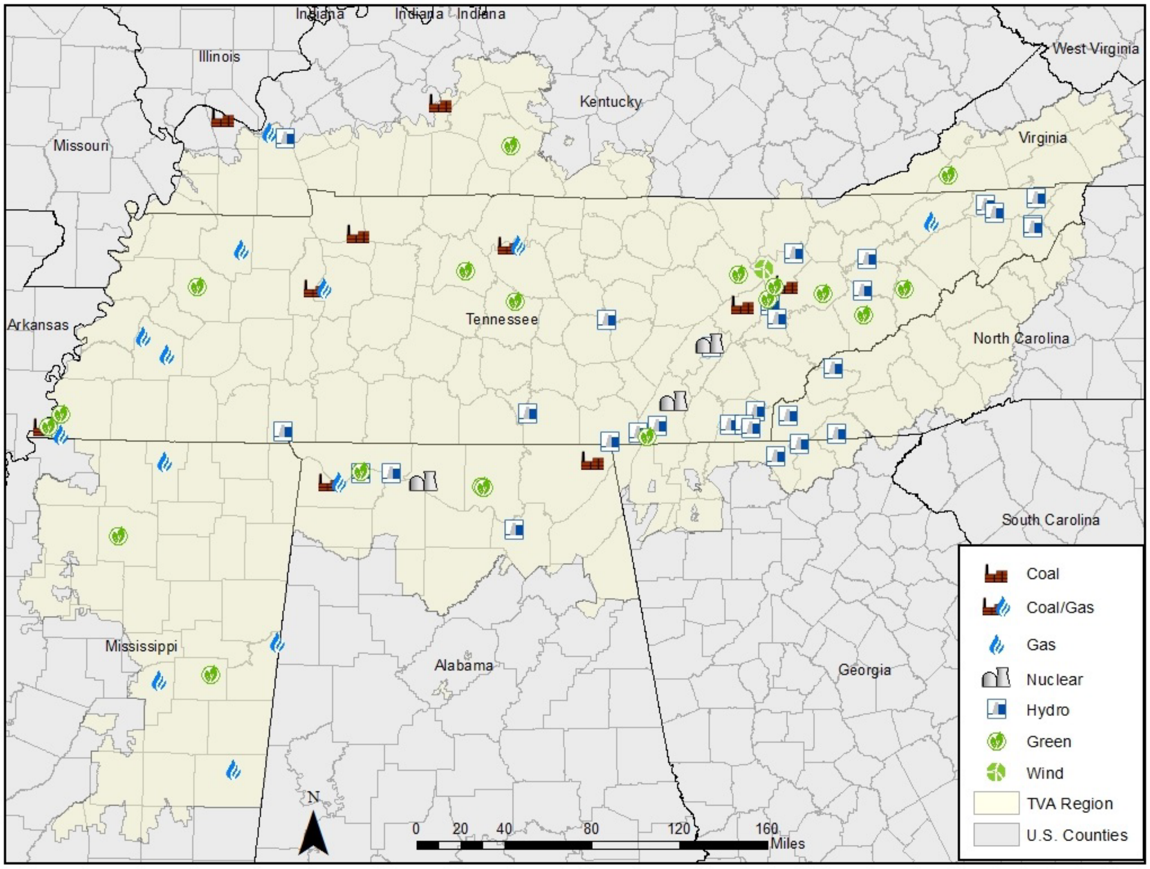


Figure 3-8. TVA Generation Facilities

3.7.3 Nuclear Plants

TVA’s nuclear plants generate enough low-cost, clean, and reliable energy to power more than 4.5 million homes and businesses. TVA operates three nuclear plants capable of generating an average of 7,800 MW of electricity each day. This includes Browns Ferry (near Athens, AL), Sequoyah (Soddy Daisy, TN), and Watts Bar (near Spring City, TN).

3.7.4 Hydroelectric Plants

TVA's hydroelectric system consists of 29 power-generating dams throughout the Tennessee River system, a pumped-storage plant near Chattanooga (Raccoon Mountain), and purchased power from eight dams on the Cumberland River operated by the USACE. The Tennessee River system on which these dams are located includes a number of feeder rivers: Holston, Clinch, Ocoee, Little Tennessee, Hiwassee, Elk, Duck, Nolichucky, Nottely, Nantahala, French Broad, Pigeon, Cheoah, Powell and Cumberland rivers, among others. The hydroelectric dams and their reservoirs provide additional benefits to the TVA region, including flood control, river navigation and popular recreational opportunities.

3.7.5 Natural Gas Plants

TVA operates 106 natural gas- and fuel oil-fired generators at 14 sites: seven in Tennessee, five in Mississippi, one in Alabama and one in Kentucky. Together, they have a generation capacity of about 7,000 MW, enough to power 4 million homes. In 2015, natural gas accounted for 19 percent of TVA’s generation portfolio, as compared to 10 percent in

2007. In 2020, natural gas will account for 23 percent of TVA's total generation. Meanwhile, coal-fired generation will drop to 22 percent; by contrast, coal made up 58 percent of total generation in 2007.

3.7.6 Activities Associated with Actions at Power Plants

Activities associated with operating, maintaining, retiring, expanding, or constructing power plants are listed below and described in Section 3.2.

- Purchase of property (#2)
- Property and/or Equipment Transfer (#6)
- Engineering or environmental planning or studies (#13)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Herbicide use (#21)
- Grubbing (#22)
- Tree planting (#24)
- Maintenance, improvement, or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Restoration of site following human use and abuse (#27)
- Removal of debris (dump sites, hazardous material, unauthorized structures) (#28)
- Acquisition of fill/borrow material (#29)
- Dredging and excavation; recessed harbor areas (#30)
- Stream/wetland crossings (#31)
- Cleanup following storm damage (#32)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches 3 inches in diameter or greater (#34)
- Stabilization (major erosion control) (#35)
- Grading (#36)
- Installation of soil improvements (#37)
- Drain installations for ponds (#38)
- Berm development (#39)
- Minor water-based structures #41)
- Internal renovation or internal expansion of existing facility (#42)

- Stream monitoring equipment (#45)
- Laydown areas (#48)
- Minor land-based structures (#50)
- Signage installation (#51)
- Mooring buoys or posts (#53)
- Maintenance of water control structures (dewatering units, spillways, levees) (#54)
- Culverts (#56)
- Wastewater outfalls (#58)
- Septic fields (#61)
- Blasting (#62)
- Siting of temporary office trailers #67)
- Renovation of existing structures (#69)
- Lock maintenance and construction (#70)
- Concrete dam modification (#71)
- Construction or expansion of land-based buildings (#77)
- Barge fleeting areas (#80)
- Water intakes - Industrial (#81)
- Construction of dams/weirs/levees (#82)
- Submarine pipeline, directional boring operations (#83)
- Landfill construction (#86)
- ASTs (#87)
- USTs (#88)
- Structure demolition (#89)
- Pond closure (#90)
- Bridge replacement (#91)

3.7.7 Context within Action Area

Activities used to operate, maintain, retire, expand, or construct power plants are estimated to involve 10,888 ac over the course of 20 years (Tables 3-1 and 3-10). Tree removal may occur on an approximately 2,200 ac (20 percent of total affected acreage for these actions), which accounts for 0.006 percent of total available forest cover within the TVA region. All proposed tree removal is expected to be permanent. TVA managers of activities associated with power plant actions, however, estimate that 80 percent of tree removal can occur during winter, 15 percent needs to occur outside of winter, but can avoid the range-wide pup season, and 5 percent likely has to occur within the pup season. Further, natural regeneration or tree planting is within the framework of a number of activities following completion of the activity, totaling up to 1,206 ac over the 20-year term. This 1,206 ac is based on tree planting or natural regeneration following pond closures at several power plant locations. Over the first 5 years of the BPC approximately 593.01 ac of suitable bat habitat removal has occurred. This is 27% of the estimated tree removal for activities used to operate, maintain, retire, expand, or construct power plants over the 20-year duration of the BPC. Of this tree removal, 94.7% occurred in winter, 4.2 % in the volant season (outside of winter but avoiding pup-season), and 1% during pup season (Table 3-3).

Table 3-10. Estimated Acreage associated with Actions at Power Plants

<table>
<tr><th>Action Objectives</th><th>Estimated Annual Affected Acreage</th><th>Estimated Annual Tree Removal</th><th>Cumulative Affected Acreage Over a 20-Year Term</th><th>Cumulative Tree Removal Over 20-Year Term</th></tr>
<tr><td>Operate and Maintain Plants</td><td rowspan="2">1,089</td><td>35</td><td rowspan="2">10,888</td><td>700</td></tr>
<tr><td>Retire, Construct and Expand Plants</td><td>75</td><td>1,500</td></tr>
<tr><td>Total</td><td>1,089</td><td>110</td><td>10,888</td><td>2,200</td></tr>
</table>

3.8 Maintain Existing Electric Transmission Assets

3.8.1 Objectives

TVA operates and maintains one of the largest single-owner transmission systems in the United States, serving approximately 9 million residents in an 80,000-square-mile area that spans portions of seven states. TVA's transmission system, approximately 16,000 miles of line, moves electric power from generating plants, where it is produced, to local distributors of TVA-generated electricity as well as to industrial and federal customers. Since 2000, the TVA system has delivered 99.999 percent reliability. Trees and other vegetation that grow too high or too close to power lines are the primary threats to safety and reliability of electric power. TVA thus works hard to keep trees, shrubs and other plants away from TLs, towers and other transmission structures by operating within an established set of guidelines and specifications (TVA 2017b).

Most of TVA's transmission system is located on non-TVA property and is managed by TVA under easement agreements. Easement agreements limit activities by landowners that may impede access to lines or structures for maintenance or repairs. Landowners are responsible for complying with city, county, and subdivision regulations regarding maintenance of their land, including that within a ROW. TVA has the perpetual right under most easement documents to clear ROWs and keep them clear of trees (including hazard trees), brush, buildings, structures and fire hazards. These rights were acquired to allow for construction, operation, maintenance, and rebuilding of TLs.

Most TVA TL ROWs range from 75- to 200-ft-wide. ROWs for multiple TLs are generally wider. In instances where a TVA TL is located near a property line, a portion of the width of the ROW may be on adjacent property. Existing TL structures are usually, but not always, located at the center of the ROW.

Of TVA's approximately 16,000 miles of TL, about 13,000 miles are 161-kV or higher. Although ROW widths can vary, generally:

- 500-kV lines with two underbuilds commonly use a 200-ft-wide ROW. (underbuilds are TLs built under existing lines, using existing poles or structures as support).

- 500-kV lines with a single underbuild or no underbuild commonly use a 175- to 200-ft-wide ROW.
- 230-kV lines commonly use a 100 to 150-ft-wide ROW.
- 161-kV single- or double-circuit lines commonly use a 150-ft-wide ROW (new 161-kV lines typically are built on 100-ft-wide ROW).
- 69-kV single steel-pole lines commonly use a 75-ft-wide ROW.

3.8.2 Vegetation Management

TVA takes an integrated vegetation management approach based on a carefully planned, multidimensional strategy developed in consultation with forestry and habitat experts. Integrated vegetation management aims to improve safety and prevent power outages by creating healthy and self-sustaining ecosystems in ROWs while ensuring compliance with regulatory standards (NERC 2006). These ecosystems foster beneficial, attractive and low-maintenance habitat where tall trees won't grow and other, more benign forms of vegetation can thrive. Integrated vegetation management encourages early successional native habitats that pose less threat to power reliability yet offer safe havens for desirable plants and animals. By combining selective use of herbicides with mechanical removal, integrated vegetation management can more thoroughly eradicate problem vegetation and allow more compatible species to fill in, making it harder for tall-growing trees to reestablish.

TVA recognizes two zones within a transmission ROW: wire zones and border zones. Only low-growing, non-woody plants are allowed in the wire zone (i.e., floor area, directly under wires) and are maintained by a combination of mechanical removal (e.g., mowing, chain saws, feller bunchers) and limited use of herbicides. This combination reduces the frequency of maintenance, discourages re-growth of undesirable hardwoods, and encourages growth of grasses and other non-woody, low-growing native plants that require less maintenance and are beneficial to wildlife.

Low-growing trees and shrubs are allowed within the border zone (i.e., area between edge of ROW and lines) with prior approval from TVA (Figure 3-5). To reduce risk of trees or branches falling onto lines, or lines sagging or swaying into trees, incompatible vegetation within border zones is removed. Additionally, trees planted within border zones cannot have any portion of their canopies under lines (Figure 3-6).

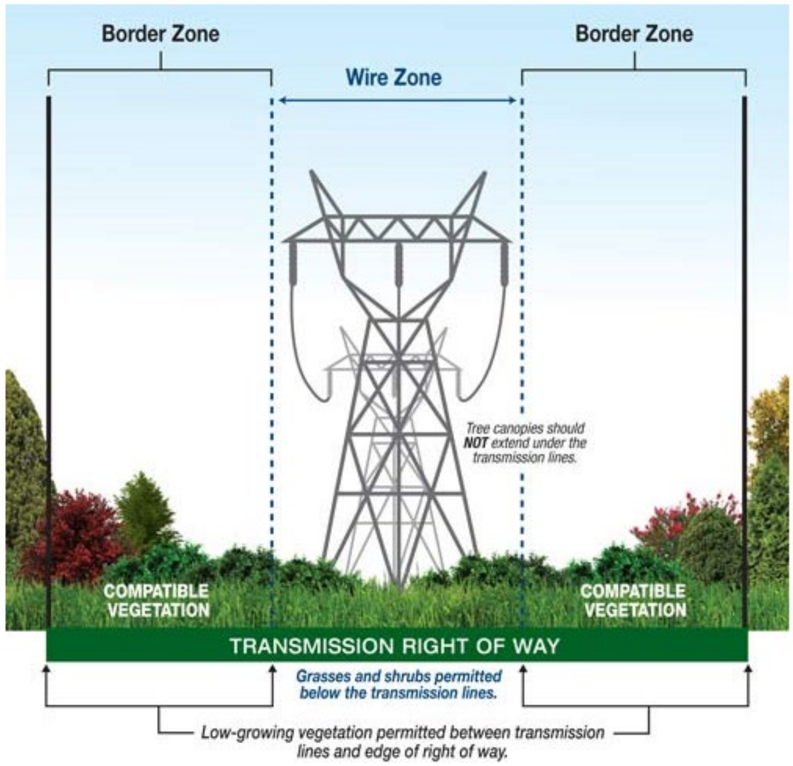


Figure 3-9. Compatible Vegetation for Transmission Line Rights-of-Way

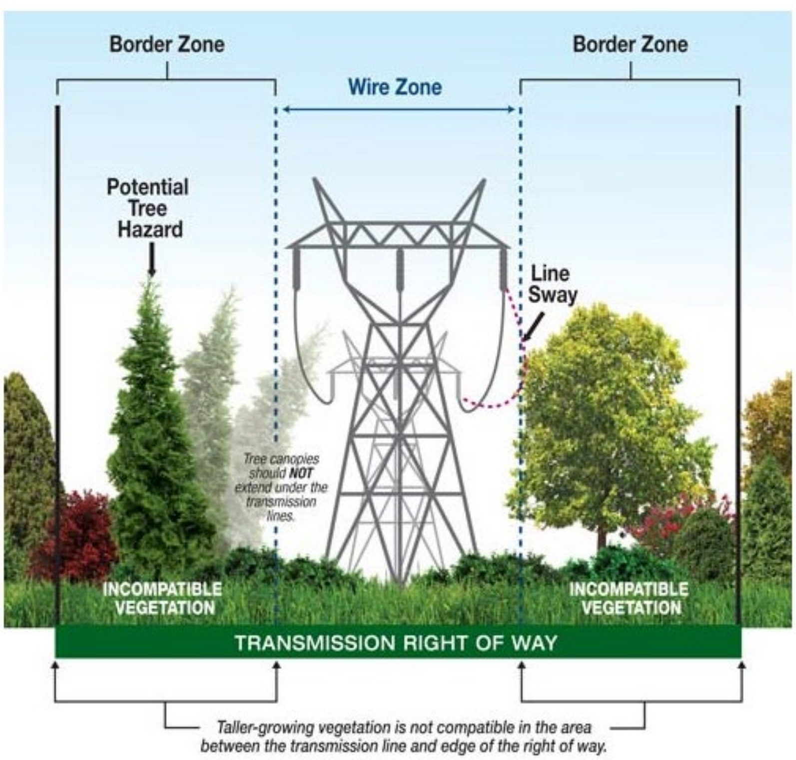


Figure 3-10. Incompatible Vegetation for Transmission Line Rights-of-Way

Herbicides are selectively applied in areas where woody vegetation is occurring on the ROW. Mechanical removal is used where herbicide application is not practical. Herbicides are selectively applied from the ground with backpack sprayers or vehicle-mounted sprayers. Any herbicides used are applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the USEPA are used. Herbicides currently used by TVA in ROW management may be found in TVA's ROW Vegetation Management Guidelines (Appendix J). This list may change over time as new herbicides are developed or new information on presently approved herbicides becomes available.

When trees or branches get too close to high-voltage TLs, electricity can arc through the air like a lightning bolt, seeking the nearest path to ground. When that path is a tree, it can short out the line, severely damage or destroy nearby property and structures, and present a risk to public safety. Trees or branches don't have to touch the lines for this to happen. At the extremely high voltages that TVA TLs carry, electricity can flashover through the air to any branch or tree that gets too close. Contact and flashovers can occur when a tree or branch grows too close to (or into) a line, when a tree or branch falls or blows onto a line, when power lines sag into trees or branches that normally would be out of reach, or when lines sway into trees or branches in windy weather.

Hazard trees typically are removed rather than trimmed for several reasons. Trimming is more costly, more dangerous and more time-consuming than removal. Trimming also has to be done repeatedly and can encourage more rapid re-growth. Further, trimming is not always healthy for trees, is labor intensive, and is not feasible given the scope and size of TVA's transmission system. When trees have to be removed in maintained residential areas, the area is left in the same condition as it was found. Downed limbs, trunks, and top layers of stumps are removed. The area is then cleaned and, if necessary, re-seeded.

Outside of TL ROWs, a hazard tree is defined as a tree that typically would 1) come within five ft of an electric power line if it fell, 2) would hit a TL structure if it fell, or 3) would come within five ft of a transmission structure if it fell (some easement documents provide for a 10-ft distance). Almost all easement documents give TVA the right to remove such trees for protection of the TL. TVA also has the permanent right under most easement documents to remove any portion of a tree that is located outside the ROW, but extends over the ROW, regardless of height of the tree.

Vegetation maintenance within TL ROWs is conducted on a two-, three-, or four-year rotation based on data that is acquired by various inspection methods including aerial patrols, ground patrols, photogrammetry, and (Light Detection and Ranging) LIDAR surveys that identify the extent of any tree removal needed. Three-dimensional imagery is attained using aerial photography, remote sensing methods, photogrammetry, and LIDAR data. Using these techniques, the height of vegetation growing within the transmission ROW (wire and border) can be measured and assessed to determine its potential to be a current or near-term threat to transmission lines or structures and thus, to reliability. Use of these tools allows TVA to implement a targeted approach to vegetation removal. Review of historic data indicates that hazard tree removal within 100 ft of the outside edge of ROW accounts for one percent of total acreage present within the 100-ft-wide area adjacent to the ROW.

Existing access roads are commonly employed for maintenance activities. A small percentage must be improved for appropriate and safe access. It is uncommon for TVA to build, construct or create new vehicular access for vegetation maintenance activities.

3.8.3 Maintenance of Transmission Infrastructure

Periodic inspections of TLs are performed by helicopter aerial surveillance. Foot patrols or climbing inspections are performed to locate damaged conductors, insulators, or structures, and to discover any abnormal conditions that might hamper normal operation of the line or adversely affect the surrounding area. During these inspections, the condition of vegetation within and immediately adjoining the ROW is noted. These observations are then used to plan corrective maintenance and routine vegetation management.

Other than vegetation management, relatively little maintenance work is generally required. TL structures and other components typically last several decades. In the event a structure needs to be replaced, the structure typically is lifted out of the ground by crane-like equipment, and the replacement structure is inserted into the same hole or an adjacent hole. Access to the structures would be via existing roads. Depending on the type of equipment needed to conduct maintenance of transmission infrastructure, activities along the access road to accommodate movement of equipment may be needed (e.g., placement of gravel, installation of a culvert, vegetation removal for equipment clearance). Replacement of structures may require leveling the area surrounding replaced structures, but additional area disturbance would be minor compared to initial installation of the structure.

3.8.4 TL Retirement and Demolition

The decision to retire and demolish a TL may be based on integrity of the line, integrity of pole structures supporting the line, potential for outages and safety hazards, or that the TL is no longer needed. Retirement and demolition of TLs involve removal of structures and line hardware. Existing access roads typically are utilized to conduct the work. Structures in cultivated fields are removed. Other structures may be cut off above grade. There is some potential for vegetative overgrowth along TLs that have been out of service for a while, and for which the ROW has not been maintained. In these cases, minor vegetative clearing, an activity not usually associated with TL demolition projects, may be involved. Signage is installed to mark ROW throughout the areas where lines are retired. In inaccessible areas and areas of standing water, hardware is removed and poles are left in place to minimize excessive ground disturbance.

3.8.5 Activities Associated with Maintaining Existing TL Assets

Activities associated with maintaining existing electric transmission assets are listed below and described in Section 3.2.

- Engineering or environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Herbicide use (#21)
- Grubbing (#22)

- Maintenance, improvement, or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Removal of debris (dump sites, hazardous material, unauthorized structures) (#28)
- Acquisition and use of fill/borrow material (#29)
- Stream/wetland crossings (#31)
- Cleanup following storm damage (#32)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Grading (#36)
- Berm development (#39)
- Internal renovation or internal expansion of existing facility (#42)
- Replacement or removal of TL poles, or cutting of poles to 4-6 ft above ground (#43)
- Conductor and OHGW installation and replacement (#44)
- Conduit installation (#47)
- Laydown areas (#48)
- Signage installation (#51)
- Culverts (#56)
- Renovation of existing structures (#69)

3.8.6 Context within Action Area

In 2018, TVA had about 237,300 ac of TL ROW easement in its PSA. This constituted 0.29 percent of the BA programmatic footprint (82,818,834 ac). Vegetation maintenance of the wire zone of TVA's ROWs is conducted on a three-year rotation. This means that approximately 80,000 ac (one-third of ROW) is annually maintained with a combination of herbicide and mechanical removal. It was estimated that a combined 1,834 ac of trees (i.e., primarily hazard trees, but also tree removal for equipment clearance) would need to be conducted on an annual basis across TVA's PSA for the first four years of the consultation term. This estimate included hazard trees that could occur within the wire and border zones as well as within 100 ft of the ROW exterior edge. The estimate for tree removal reduces to 85 ac per year during the subsequent 16 years. This is based on the expectation that the majority of ROWs with incompatible vegetation within the border zone will have been addressed and then subsequently will be maintained in an early-successional state as part of the three-year maintenance rotation. The cumulative estimate of tree removal within TVA ROWs totals 8,716 ac ((1,835*4) + (86*16)) over the course of the 20-year term, which accounts for 0.024 percent of total available forest cover within the TVA region (Tables 3-1 and 3-11). Due to a legal injunction that has been in place since the signing of the original BPC in 2018, the estimates for removal of 1,835 ac of trees for the first 4 years of the consultation were not met. Roughly 85 acres were removed in each of those years. Once the injunction is lifted, TVA anticipates the need to address the same total acreage of tree removal over the remaining duration of the consultation. Tree removal acreages would be more evenly split over a longer duration but still result in the same overall amount of tree removal by the end of the consultation.

All proposed tree removal is expected to be permanent in nature for the life of the TL. TVA managers of activities associated with ROW maintenance estimate that 40 percent of tree removal can occur during winter, 25 percent needs to occur outside of winter, but can avoid the range-wide pup season, and 35 percent likely has to occur within the pup season. Natural regeneration has the potential to occur on inactive or vacant TL ROW, which is currently estimated at 31,000 ac. Annual estimate of demolitions (in terms of total miles) ranges from 25-30 miles across the PSA. This is highly variable from year to year.

Minimal to no maintenance work is typically required to utilize existing access roads for maintenance of existing ROWs. Often access roads are located on the ROW. Such work was thus estimated to include potential for one ac of work annually, totaling 20 ac of work related to road maintenance related to accessing existing TL ROWs over the 20-year term.

Total TVA TL ROW is expected to increase to about 259,100 ac (237,300 ac [existing ROW] + 1,200 ac [upgrades] + 20,600 ac [new ROW] ac) by the end of the 20-year term. By 2037, annual affected acreage associated with TL ROW maintenance is estimated at 86,453 (259,100 ac/3 [one-third of ROW] + 85 [tree work] + 1 [access road maintenance]).

Over the first 5 years of the BPC approximately 175.16 ac of suitable bat habitat removal has occurred. This is 2% of the estimated tree removal for ROW vegetation maintenance over the 20-year duration of the BPC. Of this tree removal, 38.2% occurred in winter, 34.2 % in the volant season (outside of winter but avoiding pup-season), and 27.6% during pup season (Table 3-3).

Table 3-11. Estimated Acreage associated with ROW Vegetation Maintenance

Objective	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
(Years 2018-2021) Tree work within ROW and up to 100 feet from ROW exterior edge	1,834	1,834	7,336	7,336
(Years 2022-2037) Tree work within ROW and up to 100 feet from ROW exterior edge	85	85	1,360	1,360
Management of ROW Vegetation	79,100	0	237,300	0
Access Road Maintenance	1	1	20	20
Total	**79,186-80,935**	**1,835 / 86**[1]	**246,016**	**8,716**

3.9 Convey Property associated with Electric Transmission

3.9.1 Objectives

TVA may at times have facilities (e.g., substations or transmission equipment) and/or property (e.g., TL ROW) that are no longer needed and TVA may be willing to sell (convey) to an LPC. Once the determination to sell property is made, the fair market value of the facilities and land estimate is provided to the LPC with the understanding that additional administrative costs may need to be paid by the LPC for the transfer. If prices are acceptable to the LPC, a letter of understanding is signed between the LPC and TVA.

To convey TVA property, appropriate NEPA reviews, land rights research, property surveys and documentation updates must be performed by TVA staff. When the work is completed and reviewed, the information is packaged and presented to the TVA Chief Executive Officer for final approval. Once approved, TVA provides a Bill of Sale and invoice to the LPC which makes payment to complete the transaction. Outside of any warranted property surveys or environmental surveys which may involve observational visits to the site, these activities are paperwork transactions.

3.9.2 Activities Associated with Conveying Electric Transmission Property

Activities associated with this Action are listed below and described in Section 3.2.

- Transfer of ROW easement and/or ROW equipment (#5)
- Property and/or equipment transfer (#6)
- Sale of TVA property (#8)
- Deed modification associated with TVA rights or TVA property (#10)
- Abandonment of TVA retained rights (#11)
- Sufferance agreement (#12)
- Engineering or environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)

3.9.3 Context within Action Area

Property conveyance associated with electric transmission assets has the potential to occur anywhere within the TVA PSA (247,046 ac).

3.10 Expand or Construct New Electric Transmission Assets (Lines, Rights-of-Way, Substations, Telecommunications)

3.10.1 Objectives

Continued investment in TVA's transmission system helps TVA meet the daily challenge of moving power to where it is needed, regardless of weather, time of day or competing demand. Construction of new TL enables TVA to continuously improve reliability, resolve overload issues, and address growing load in local communities across TVA's PSA.

3.10.2 Right-of-Way Acquisition and Clearing

A ROW utilizes an easement (see Section 3.8.1) that is designated for a TL and associated assets. The easement requires vegetation maintenance to avoid risk of fires and other accidents. The ROW provides a safety margin between high-voltage conductors and surrounding structures and vegetation. ROW widths vary based on voltage of TL to be installed within the ROW corridor (see Section 3.8.1).

Because of the need to maintain adequate clearance between tall vegetation and TL conductors, as well as provide access for construction equipment, most trees and shrubs initially are removed from the entire width of new ROW. Equipment used during ROW clearing can include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller bunchers. Marketable timber is salvaged where feasible; otherwise, woody debris and other vegetation would be piled and burned, chipped, or taken off site. In some instances, vegetation may be windrowed along the edge of the ROW to serve as sediment barriers.

Vegetation removal in streamside management zones and wetlands is restricted to trees that are or will be tall enough to interfere with conductors. Clearing in streamside management zones is accomplished using hand-held equipment or remote-handling equipment, such as a feller buncher, to limit ground disturbance.

TVA's ROW Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, Transmission Construction Guidelines Near Streams (Appendices K, L, and M), and Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (Appendix N) are followed in clearing and construction activities.

Following clearing and construction, vegetative cover on the ROW is restored or established, utilizing appropriate seed mixtures as described in Appendix N or working with property owners with crop land to ensure ground restoration supports or minimizes impacts to crop production. Erosion controls remain in place until plant communities become fully established. Streamside areas are revegetated as described in Appendices K, L, M, and N. Failure to maintain adequate clearance can result in dangerous situations, including ground faults. As such, native vegetation or plants with favorable growth patterns (slow growth and low mature heights) are maintained within the ROW following construction.

3.10.3 Access Roads

Both permanent and temporary access roads are needed to allow vehicular access to each structure and other points along the ROW. Typically, new permanent or temporary access roads used for TLs are located on the ROW itself wherever possible, are designed to avoid severe slope conditions and to minimize stream crossings. Access roads typically are surfaced with dirt or gravel. Culverts and other drainage devices, fences, and gates are installed as necessary. Culverts installed in any permanent streams are removed following construction. Other culverts may be left or removed, depending on wishes of landowner or applicable permit conditions. If desired by property owner, TVA will restore new temporary access roads to previous conditions. Additional applicable ROW clearing and environmental quality protection specifications are listed in Appendices K and L.

3.10.4 Construction Assembly/Laydown Area Selection

A construction assembly area (or laydown area) typically is required for worker assembly, vehicle parking, and material storage. This area may be on existing substation property or leased from a private landowner for duration of construction period. Properties such as existing parking lots or areas used previously as car lots are ideal laydown areas because site preparation is minimal. Selection criteria used for locating potential laydown areas include an area typically five acres in size; relatively flat; well drained; cleared; graveled and fenced; wide access points with appropriate culverts; sufficiently distant from streams, wetlands, or sensitive environmental features; and located adjacent to an existing paved road near the transmission asset. TVA attempts to use or lease properties that require no site preparation. At times, however, property may require minor grading and installation of drainage structures (e.g., culverts). Likewise, the area may require graveling and fencing. Trailers used for material storage and office space would be parked on the site. Following completion of construction activities, all trailers, unused materials, and construction debris are removed from the site. Removal of TVA-installed fencing and site restoration is performed by TVA at the discretion of the landowner.

3.10.5 Structures and Conductors

Types of TL structures used vary depending on voltage of the line as well as terrain and surrounding land use. TVA utilizes a variety of structures including, but not limited to, single-, double-, and three-pole steel structures as well as laced-steel towers. OHGW cable is installed along the TL, running between the tops of TL structures.

Poles at angles (i.e. angle points) in the TL may require supporting screw, rock, or log-anchored guys. Some angle structures, as well as structures at road crossings requiring additional clearance, may be self-supporting poles or double steel-pole structures. Most poles are directly imbedded in holes augured into the ground to a depth equal to 10 percent of the pole's length plus an additional two ft. Holes normally are backfilled with excavated material, but in some cases gravel or a concrete-and-gravel mixture is used.

Equipment used during the construction phase includes trucks, truck-mounted augers, drills, and excavators, as well as tracked cranes and bulldozers. Low ground-pressure-type equipment is used in specified locations (such as areas with soft ground) to reduce potential for environmental impacts.

3.10.6 Substations and Telecommunications

Substation construction activities include clearing vegetation on the site, removal of topsoil, and grading the property in accordance with TVA's Site Clearing and Grading Specifications (Appendix O). Equipment used during clearing is similar to TL construction and includes chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller bunchers. Marketable timber is salvaged if it occurs on site and is economically feasible. Otherwise, any woody debris and other vegetation likely will be piled and burned, chipped, or taken off site. Prior to burning, TVA will obtain any necessary permits. In some instances, vegetation may be windrowed along the edge of the project site to serve as sediment barriers. TVA's ROW Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, Transmission Construction Guidelines Near Streams (Appendices K, L, and M), and A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (Appendix N) govern the substation construction process.

The topography of the site will dictate the extent of grade work, but typically a site is leveled through a cut and fill process to help achieve a design elevation. Areas of the site that are too high (sloped) will be "cut" down to a level elevation, and other areas that are too low require "fill" to raise the elevation. Any additional fill required is obtained from an approved/permitted borrow area. Once the site has been graded, excess soil (i.e., "spoil") is removed in preparation for foundations. Silt fences, site drainage structures, and any necessary detention pond(s) are installed during construction. The substation yard is then covered with crushed stone and enclosed with chain link fencing. The site will be provided with a permanent access road to facilitate ingress/egress, typically linked to a nearby existing public road.

Following clearing and construction, disturbed areas on the property, excluding the substation, are restored to the extent practicable to pre-construction conditions, utilizing appropriate seed mixtures as described in Appendix N. Erosion controls remain in place site-wide until plant communities become fully established. A switch house and electrical equipment, including transformers and breakers, will be installed within the substation.

As described in TVA's Substation Lighting Guidelines (Appendix P), all lights at the substation would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixtures at angles above the horizontal plane. TVA's Environmental Quality Protection Procedures for Transmission Substation or Communications Construction (Appendix Q) would be utilized during the construction of the substation.

3.10.7 Transmission Line Upgrades

TL upgrades include the following:

1. Removing physical objects that interfere with line clearance;
2. Replacing and/or modifying existing structures to increase clearance;
3. Installing intermediate structures;
4. Replacing existing conductor with another to accommodate higher power flows;
5. Modifying the existing conductor to increase ground clearance;
6. Adding fill rock or dirt around the base of existing structures; and
7. Working with LPCs to modify their lines where they cross under TVA TLs.

Typical modifications to existing conductor, installations of intermediate structures, additions of tower extensions, or replacements of existing structures are performed with standard TL construction and maintenance equipment such as crane trucks, bulldozers, bucket or boom trucks, and forklifts. Disturbance is usually limited to approximately a 100-ft radius around a TL structure.

Modifications to existing conductor include in the general order of lower to higher difficulty and cost: conductor slides, cuts, and/or installation of floating dead-ends to increase ground clearance by increasing height of conductor where it sags to its minimum clearance, or "belly," between structures. A slide involves relocating the conductor clamp on the adjacent structure a certain distance toward the area of concern (i.e., "sliding" the clamp). A cut involves cutting the conductor, removing a small piece of it, and then splicing the conductor ends back together. A floating dead-end shortens the vertical (or "suspension") insulator string that attaches a conductor to a "suspension" (or, "tangent") structure to raise the height of its conductor. A suspension structure is one that is designed to provide primarily vertical support for a conductor, but not to take the full tension of the conductor, which would require that the structure also provide significant horizontal support. For a suspension structure, the horizontal force of the conductor on one side of the structure essentially offsets the horizontal force from the other side. When a floating dead-end is added, the reduced length (insulating capacity) of the suspension insulator is compensated by adding two essentially horizontal strain insulators that connect to the clamp on the end of the shortened suspension insulator or to a clamp on the structure's arm. Re-tensioning within a span is a means for increasing ground clearance of power line without replacing conductor. A worker is raised between the conductor and attaches two chain hoists to a section of line and ratchets the sections together. The slack between hoists is then cut out and the line rejoined via compression joint. Ground disturbance is minimal and confined to the immediate area of the conductor, conductor clamp, or insulators.

3.10.8 Activities Associated with Expanding or Constructing Transmission Assets

Activities associated with expanding or constructing new electric transmission assets are listed below and described in Section 3.2

- Engineering or environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Herbicide use (#21)
- Grubbing (#22)
- Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Removal of debris (dump sites, hazardous material, unauthorized structures) (#28)
- Acquisition and use of fill/borrow material (#29)
- Stream/wetland crossings (#31)
- Removal of Hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Grading (#36)
- Internal renovation or internal expansion of existing facility (#42)
- Conductor and OHGW installation and replacement (#44)
- Conduit installation (#47)
- Laydown areas (#48)
- Signage installation (#51)
- Culverts (#56)
- Blasting (#62)
- Foundation installation (#63)
- Installation of steel structure, overhead bus equipment, etc. (#64)
- Pole and/or tower installation and/or extension (#65)
- Construction or expansion of land-based buildings (#77)
- On-site/off-site public utility relocation or construction or extension (#84)
- Structure demolition (#89)
- Bridge replacement (#91)

3.10.9 Context within Action Area

It is estimated that 1,190 ac would be involved on an annual basis over the 20-year duration of the consultation in construction of new TLs. This annual estimate is based on the following assumptions: annual construction of 85 miles of new TL ROW that is 100-ft-wide (1,030 ac); annual upgrades to 20 miles of existing ROW that requires 25-ft-wide of additional ROW (60 ac): annual construction of 10 miles of access roads that are 16-ft-wide (20 ac); annual construction or expansion of new substations (80 ac). TL and access road lengths are based on historic records. It is further assumed that future construction will trend the same as past years and that 50 percent of new acreage acquired for ROW will be forested, such that 595 ac will require clearing (Tables 3-1 and 3-12).

Thus, over the20 years of this consultation, 23,800 ac of TL ROW is anticipated to be acquired and constructed within TVA's programmatic footprint (82,818,834 ac). This constitutes 0.03 percent of the footprint. Of the 23,800 ac, 11,900 ac are estimated to require tree removal (50 percent of total affected acreage for new transmission assets), which accounts for 0.033 percent of total available forest cover within the TVA region. All proposed tree removal is expected to be permanent for the life of the TL. TVA managers of activities associated with construction of new transmission assets estimate that 60 percent of tree removal can occur during winter, 20 percent needs to occur outside of winter, but can avoid range-wide pup season, and 20 percent likely has to occur within pup season. While it is common practice for new construction associated with TLs to target the winter clearing window for removal of potentially suitable roost trees, TVA also is commonly up against LPC customer need dates and regulatory compliance outage dates. Over the first 5 years of the BPC approximately 544.55 ac of suitable bat habitat removal has occurred. This is 4.6% of the estimated tree removal for expanding or constructing new electric transmission assets over the 20-year duration of the BPC. Of this tree removal, 30.1% occurred in winter, 46.3 % in the volant season (outside of winter but avoiding pup-season), and 23.4% during pup season (Table 3-3).

Table 3-12. Estimate of Acreage associated with Construction of New Electric Transmission Assets within TVA's Programmatic Footprint

New Transmission Assets	Estimated Affected Annual Acreage	Estimated Annual Tree Removal (acres)	Cumulative Affected Acreage Over 20 Years	Cumulative Estimated Tree Removal Over 20 Years (acres)
New TL ROW	1,030	515	20,600	10,300
TL ROW Upgrades	60	30	1,200	600
Access Roads	20	10	400	200
Substations	80	40	1,600	800
Total	**1,190**	**595**	**23,800**	**11,900**

3.11 Promote Economic Development

3.11.1 Objectives

TVA helps promote capital investment and job growth in the TVA region through partnerships with other economic development organizations. TVA works to attract new companies and to engage existing businesses and industries to help them grow in a sustainable way. TVA is committed to serving its communities and corporate citizens to help them achieve lasting success. Working in concert with TVA's partners—regional, state and community organizations—TVA offers site selection services, product development assistance, incentives, research and technical assistance to help companies locate, stay and expand existing operations in the TVA region. In 2016, for example, TVA recruited 248 companies, resulting in 72,100 jobs and 7.3 billion invested in the TVA region.

3.11.2 Activities Associated with Promoting Economic Development

Activities associated with promoting economic development are listed below and described in Section 3.2.

- Loans and/or grant awards (#1)
- Purchase of property (#2)
- Purchase of equipment for industrial facilities (#3)
- Engineering or environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)
- Drilling (#16)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Herbicide use (#21)
- Grubbing (#22)
- Tree planting (#24)
- Maintenance, improvement, or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Acquisition and use of fill/borrow material (#29)
- Stream/wetland crossings (#31)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Grading (#36)
- Drainage installations for ponds (#38)
- Berm development (#39)
- Internal renovation or internal expansion of existing facility (#42)
- Laydown areas (#48)
- Minor land-based structures (#50)
- Signage installation (#51)
- Culverts (#56)
- Financing for speculative building construction (#68)
- Renovation of existing structures (#69)
- Construction or expansion of land-based buildings (#77)

- On-site/off-site public utility relocation or construction or extension (#84)
- Structure demolition (#89)

3.11.3 Context within Action Area

Activities used to promote economic development in the TVA region were estimated to involve 75,220 ac over the course of 20 years (Tables 3-1 and Table 3-13). Tree removal may occur on 7,522 ac (approximately 10 percent), which is 0.021 percent of total available forest cover within the TVA region. All tree removal is expected to be permanent in nature. It is estimated that 90 percent of tree removal can occur during winter, 10 percent needs to occur outside of winter, but can avoid the range-wide pup season, and no tree removal is expected to occur within the pup season (Table 3-2). Over the first 5 years of the BPC approximately 100.6 ac of suitable bat habitat removal has occurred. This is 1.3% of the estimated tree removal for promoting economic development over the 20-year duration of the BPC. Of this tree removal, 41.5% occurred in winter, 58.5 % in the volant season (outside of winter but avoiding pup-season), and none occurred during pup season (Table 3-3).

Table 3-13. Estimated Acreage associated with Promoting Economic Development

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Promote Economic Development	3,761	376	75,220	7,522
Total	**3,761**	**376**	**75,220**	**7,522**

3.12 Promote Small and Mid-Scale Solar Generation

3.12.1 Objectives

In 2018, TVA annually solicited purchase power plan proposals for a combined total of 10 MW of solar capacity. This included generation that ranges from 50 kw to no more than 2 MW of solar capacity at one site. The majority of small and mid-scale solar projects are constructed on previously cleared land (mostly cropland).

PV facilities vary by type of installation. Building-mounted systems typically no not require additional land. Ground-mounted systems may be on canopies that provide shelter. Land requirements for stand-alone ground-mounted systems vary by project.

Since 2018, TVA has projected that most of the future solar development within the TVA region will be utility-scale solar and would fall outside of the scope of this consultation.

3.12.2 Activities Associated with Promoting Small and Mid-Scale Solar Generation

Activities associated with promoting solar development are listed below and described in Section 3.2.

- Loans and/or grant awards (#1)
- Purchase of property (#2)

- Purchase of equipment for industrial facilities (#3)
- Engineering or environmental planning or studies (#13)
- Windshield and ground surveys for archaeological resources (#15)
- Mechanical vegetation removal, does not include trees or tree branches three inches in diameter or greater (#17)
- Erosion control, minor (#18)
- Herbicide use (#21)
- Grubbing (#22)
- Maintenance, improvement, or construction of pedestrian or vehicular access corridors (#25)
- Maintenance or construction of access control measures (#26)
- Acquisition and use of fill/borrow material (#29)
- Stream/wetland crossings (#31)
- Removal of hazardous trees or tree branches (#33)
- Mechanical vegetation removal, includes trees or tree branches three inches in diameter or greater (#34)
- Grading (#36)
- Drain installations for ponds (#38)
- Laydown areas (#48)
- Minor land-based structures (#50)
- Signage installation (#51)
- Culverts (#56)
- Financing for speculative building construction (#68)
- Renovation of existing structures (#69)
- Construction or expansion of land-based buildings (#77)
- On-site/off-site public utility relocation or construction or extension (#84)
- Structure demolition (#89)

3.12.3 Context within Action Area

Activities associated with promoting small and mid-scale solar generation were estimated to involve 40,000 ac over the course of 20 years (Tables 3-1 and Table 3-144). Tree removal may occur on 1,000 ac, which is 0.003 percent of total available forest cover within the TVA region. All tree removal is expected to be permanent. It is estimated that 80 percent of tree removal can occur during winter, 20 percent needs to occur outside of winter, but can avoid the range-wide pup season, and no tree removal is expected to occur within the pup season (Table 3-2). Over the first 5 years of the BPC approximately 0.63 ac of suitable bat habitat removal has occurred. This is 0.06% of the estimated tree removal for activities associated with promoting solar development over the 20-year duration of the BPC. Of this tree removal, 100% occurred in winter (Table 3-3).

All of the tree clearing for solar facilities is long-term (typically 20 years), but not permanent, as the sites could become forested after removal of the solar facilities.

Table 3-14. Estimated Acreage associated with Promoting Small and Mid-Scale Solar Generation

Action Objectives	Estimated Annual Affected Acreage	Estimated Annual Tree Removal	Cumulative Affected Acreage Over a 20-Year Term	Cumulative Tree Removal Over 20-Year Term
Promote Mid-Scale Solar Generation	2,000	50	40,000	1,000
Total	**2,000**	**50**	**40,000**	**1,000**

This page intentionally left blank

CHAPTER 4 – STATUS OF LISTED SPECIES AND CRITICAL HABITAT WITHIN THE ACTION AREA

4.1 Indiana Bat

4.1.1 Range and Life History

Indiana bats are so named because the first described specimen in 1928 was based on an individual found in Wyandotte Cave (southern Indiana) in 1904. Indiana bats have been found over most of the eastern half of the United States (Figure 4-1). States within the current range of Indiana bat include Alabama, Arkansas, Connecticut, Indiana, Iowa, Maryland, Michigan, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia.

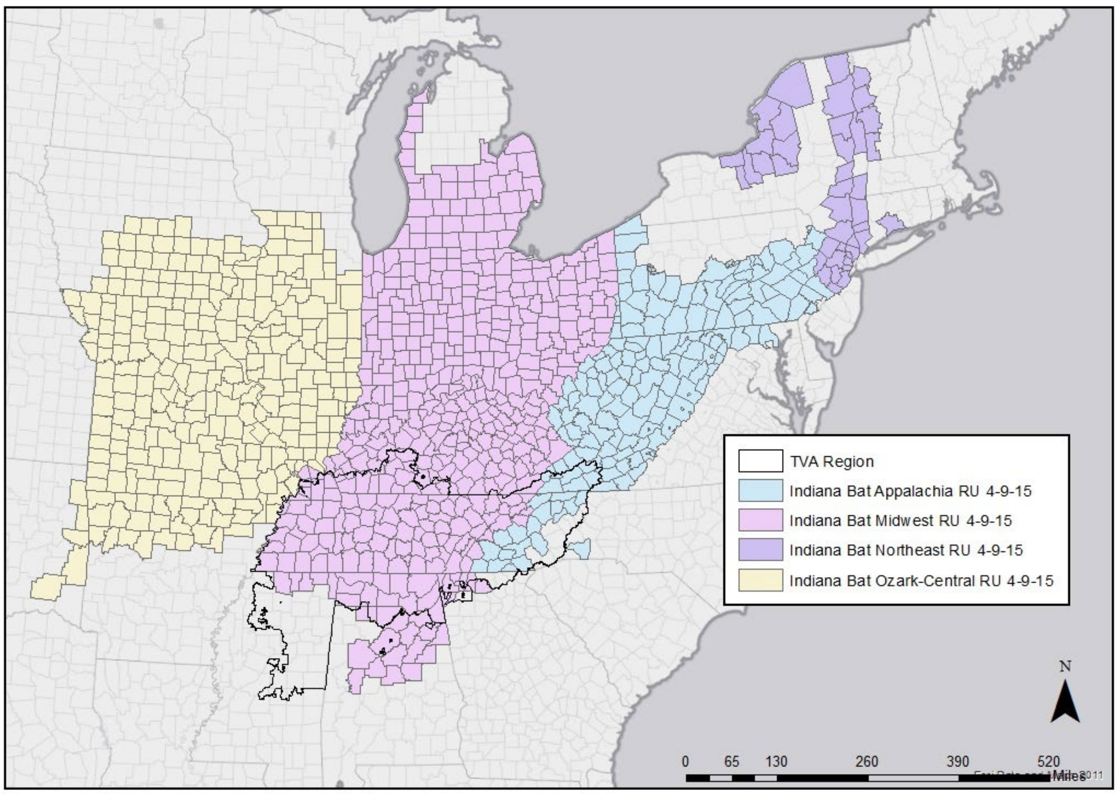


Figure 4-11. TVA Region in Relation to Range (subdivided into Recovery Units) of Indiana Bat

Indiana bats hibernate during winter (generally October through April) in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions. In 2013, the 10 largest known hibernacula held 80 percent of the rangewide population. Indiana bats typically roost in large clusters (300 to 500 bats per square foot) on open ceilings and walls, but sometimes roost in cracks and sometimes in small clusters and solitarily as well. Railroad tunnels, dams, aqueducts, or other structures that resemble caves also may be used (USFWS 2007).

During spring (March 15 to May 15 in the TVA Region), Indiana bats migrate from hibernacula to roost elsewhere on the landscape, typically under loose tree bark on dead or dying trees. Use of unconventional roosts including utility poles, bridges, and artificial bark also has been documented. Migration distances vary across the range and have been documented to be as long as 575 km (357 miles); much shorter migration distances are also known to occur. The gestation period for females is April 1-June 1, such that pregnancy overlaps with migration (USFWS 2007).

During summer (generally May 15 to August 15 in the TVA Region), males tend to stay closer to hibernacula and roost alone or in small groups, while females tend to migrate farther distances and roost in larger groups (i.e., maternity colonies), with an average maximum size of 60 to 100 bats. Maternity colonies tend to occupy dead trees (greater than 5 inches dbh) with large pieces of exfoliating bark that receive direct sunlight for more than half the day. At least 33 species of trees have been used as roosts by maternity colonies, which can occur in riparian areas, bottomland and floodplain habitats, wooded wetlands, and upland communities. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 ft of other wooded habitat. Maternity colonies typically use 10 to 20 trees within one summer season, switching roosts every one to three days, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer (Callahan 1993, Callahan et al. 1997). Roost trees, although ephemeral in nature, may be occupied by a colony for a number of years until they are no longer available or suitable. There has been documentation of an Indiana bat maternity colony in a bridge in Indiana (M. Armstrong, personal communication, 2017). Each female in the colony gives birth to one pup per year (June). Young are unable to fly (non-volant) during the first two months of life (approximately June 1 through July 31 in the TVA Region) and remain with the maternity colony throughout their first summer Maternity colonies of Indiana bats appear to be faithful to their foraging areas within and between years (USFWS 2007).

Indiana bats typically forage up to 2.5 miles from roosts. Streams associated with floodplain forests, and impounded water bodies (ponds, wetlands, reservoirs, etc.) where abundant supplies of flying insects are likely found provide preferred foraging habitat for Indiana bats. Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures (USFWS 2007). Indiana bats hunt primarily around the tree canopy, but occasionally descend to the subcanopy and shrub layers. While Indiana bats appear to forage in a wide variety of habitats, they seem to tend to stay fairly close to tree cover. Indiana bats return to hibernacula in late summer or early fall (i.e., August 15 to October 15) to mate (swarming period) and then enter into hibernation. Tree roosting during the swarming period can occur up to 10 miles from hibernacula (USFWS 2014). Occurrence of Indiana bat across all life history stages (hibernation/cave use, seasonal migration, establishment of summer roosts in trees including maternity colonies, summer foraging) has been documented within the TVA region and Action Area.

4.1.2 Listing History under Endangered Species Act

Indiana bat was listed as endangered in 1967. At the time of listing, the range-wide population was estimated at approximately 880,000 bats. Listing of the species primarily was based on large numbers of Indiana bat deaths caused by human disturbance during hibernation. In 1976, 11 caves and two mines across six states were designated as critical habitat for the Indiana bat; no additions have been made since that time. Two of the thirteen hibernacula listed as critical habitat occur within the Action Area: Coach Cave in Edmonson County, KY and White Oak Blowhole Cave in Blount County, TN.

Based on the 1983 Recovery Plan, active conservation measures throughout the 1980s and into the mid-1990s concentrated on protection of winter habitat and research into life history of the species, especially summer habitat requirements. By 2001, over 35 caves and mines used as hibernacula had been acquired and protected, many with gates or fences, by governmental agencies or private conservation organizations. Since publication of the 1983 recovery plan, a vast amount of new research and survey data have been generated, resulting in a draft revised Recovery Plan issued in 2007. The draft synthesized and presented new research literature and updated information on the bat's life history, status and threats. Threats, in addition to human disturbance at hibernacula, included cave commercialization, loss of summer habitat, pesticides and other contaminants. When the draft 2007 Plan was released, the USFWS had records of extant winter populations at approximately 281 hibernacula in 19 states and 269 maternity colonies in 16 states and the range-wide population estimate was 425,000 bats. As of the 2009 5-year review, Indiana bat was considered to have a moderate degree of threat and a high recovery potential.

The latest identified threat to Indiana bat is mortality due to WNS, first identified in a New York cave in 2006. Declines in population estimates (see below) over the last 16 years have been primarily attributed to WNS. WNS was first documented in the TVA region in 2009-2010 in Sullivan and Carter counties, Tennessee. Since 2007, there has been a 19.2% decline in Indiana bat populations across the range. Within the TVA Region, Kentucky and Tennessee were ranked as having some of the largest net losses of Indiana bats since 2007. Kentucky saw the fourth highest reduction in Indiana bats (21% of the state population). Tennessee saw the sixth highest reduction in Indiana bats (73% of the state population) primarily due to significant declines seen at White Oak Blowhole Cave.

4.1.3 Indiana Bat Recovery Units

The Indiana bat range is divided into four Indiana Bat Recovery Units (RU). Of the 307,019,804 ac comprising the total Indiana bat range, 43,627,858 ac (14.2 percent) overlap the TVA region (Figure 4-1). The overlap is limited to portions of the Midwest and Appalachia RUs. Table 4-1 provides a breakdown of acreage by RU and areas of overlap, and resulting proportion.

Table 4-9. Overlap of Indiana Bat Range and Recovery Units with the TVA Region

Indiana Bat Geographic Recovery Unit (RU)	Acreage
Indiana Bat Ozark-Central RU	105,831,811
Indiana Bat Midwest RU	131,228,894
Indiana Bat Appalachia RU	51,401,010
Indiana Bat Northeast RU	18,558,089
Total Size (ac) of Indiana Bat Range (sum of acreage across RUs)	**307,019,804**
Acreage of Ozark-Central RU within TVA Region	0
Acreage of Midwest RU within TVA Region	36,776,907
Acreage of Appalachia RU within TVA Region	6,850,951
Acreage of Northeast RU within TVA Region	0
Total Size (ac) of Indiana Bat Range in TVA Region (Midwest + Appalachia RU)	**43,627,858**
Proportion of Midwest RU within TVA Region (36,776,907 / 131,228,894)	**28%**
Proportion of Appalachia RU within TVA Region (6,850,951 / 51,401,010)	**13.3%**
Proportion of Indiana Bat Range within TVA Region (43,627,858 / 307,019,804)	**14.2%**

4.1.4 Current Population Estimate

Population estimates are derived from bi-annual winter surveys conducted in January and February of known Priority 1 and 2 hibernacula (and Priority 3 and 4 when available). The 2015 population estimate of 523,636 Indiana bats, is approximately 10 percent less than the 2013 population estimate (580,717), and 40 percent less than the initial federal listing as endangered was in 1967 (880,000 bats). Seventy percent of all Indiana bats hibernate in caves in southern Indiana (185,720 in 2015) and Missouri (185,693 in 2015). Other states which supported populations of over 15,000 hibernating individuals in 2015 included Kentucky (66,024), Illinois (56,055) and New York (15,564). The 2019 Indiana Bat Population Status Update estimated 537,297 bats occurring within 223 hibernacula across 16 states. However, there are 344 hibernacula that are still deemed extant hibernacula for this species (defined as having at least one bat within the last 10 years). Kentucky had the highest number of hibernacula across states (126). Tennessee had the third highest number of hibernacula across states (54) (USFWS 2019).

The initial programmatic consultation used 2015 population estimates to determine that 96 percent of the total Indiana bat population hibernated within the Ozark-Central RU (243,142, ~46 percent), and Midwest RU (259,508, 50 percent). The Appalachia RU (5,258) and Northeast RU (15,728) accounted for one percent and three percent, respectively, of the total population in 2015. Each RU experienced a decline in numbers compared to 2013 estimates, the greatest decline occurring in the Appalachia RU, from 17,584 in 2013 to 5,258 in 2015 (USFWS 2015a). Based on 2013 population estimates (Table 4.2), 4.4 percent of hibernating Indiana bats were located within the Action Area. Data from 2013 was used due to lack of available cave specific data for 2015 at the time of writing this document.

2019 population estimates (Table 4.3) established that states within the TVA Region account for 11 percent of population of Indiana bats across two Recovery Units (Midwest and Appalachia). Kentucky accounts for 10.4% at 55,946 bats, while Tennessee accounts for the remaining 0.5% (divided between both RUs) and Virginia accounts for 0.1%. 2019 population estimates show a four percent decline in species since 2017 with the most dramatic declines occurring in the northeast and Appalachia RUs.

Table 4-10. Indiana Bat Population Estimates, based on 2013 winter hibernacula surveys, for Portions of States within the TVA Region[1]

State	Recovery Unit	Counties (Estimates) within TVA Region with Known Hibernacula	Number of Priority Caves	Population Estimate
AL	Midwest	Jackson (138), Lauderdale[2], Lawrence (101), Marshall (9), Morgan[2]	P3 (n=3 [historic=1]) P4 (n=6 [historic=1])	248
GA	Midwest	Dade (N/S)	P4 (n=2 [historic=1])	0
KY	Midwest	Adair[2], Barren[2], Breckinridge (31), Christian (1), Edmonson (3,284), Hardin[2], Hart (58), Letcher (4,871), Livingston[2], Trigg[2], Warren (0), Wayne (3,537), Whitley[2]	P1 (n=4); P2 (n=4); P3 (n=14 [historic=2]) P4 (n=9 [historic=2])	11,782
MS	Midwest	None	None	0
NC	Appalachia	Haywood (0), Jackson (N/S), Rutherford (1), Swain (N/S)	None	1
TN	Midwest	Campbell (75), Cumberland (3), Fentress (1602), Franklin (27); Grainger (0), Hawkins[2], Marion (0), Montgomery (0), Perry (19), Stewart (137), Van Buren (175), Warren (133), White (42), Hickman (49), Grundy (18), Union[2],	P2 (n=6 [historic=2]) P3 (n=14 [historic=2]) P4 (n=19 [historic=3])	2,280
TN	Appalachia	Blount (10,709)	P1 (n=1) P2 (n=2) P3 (n=1) P4 (n=2)	10,709
VA	Appalachia	Lee (214), Wise (200)	P2 (n=2) P3 (n=1) P4 (n=1)	414
Total Population Estimate (2013) within Action Area				25,434
Total Range-wide Estimate (2013)				580,717
Proportion of Range-wide Estimate within Action Area during winter (2013)				4.4%

[1]Summation of estimates by cave across counties with hibernacula for each state and Recovery Unit. Data source: Andy King, USFWS, 2016, personal communication.
[2] No caves within this county were surveyed in 2013.

Table 4-3. Indiana Bat Population Estimates, based on 2019 winter hibernacula surveys, for Portions of States within the TVA Region[1]

State	Recovery Unit	Counties (Estimates) within TVA Region with Known Hibernacula	Number of Priority Caves	Population Estimate
AL	Midwest	DeKalb[2], Jackson (21), Lauderdale[2], Lawrence (3), Limestone[2], Marshall[2], Morgan[2]	P3 (n=5 [historic=?]) P4 (n=8 [historic=?])	24
GA	Midwest	Dade[2]	P4 (n=2 [historic=?])	0
KY	Midwest	Adair[2], Barren[2], Breckinridge[2] Christian[2], Edmonson (1,196), Hardin[2], Hart (45), Lee (4,619), Letcher (3,122), Livingston[2], Trigg[2], Warren(6), Wayne[2], Whitley[2]	P1 (n=3; [historic=?]) P2 (n=10); P3 (n=21 [historic=?]) P4 (n=18 [historic=?])	8,988
MS	Midwest	None	None	0
NC	Appalachia	Haywood[2], Jackson[2], Rutherford[2], Swain[2]	P4(n=5)	0
TN	Midwest	Bedford[2], Campbell (3434), Cumberland (1818), Dekalb (1), Fentress (1,072072), Franklin (2828); Grainger[2],, Gundy (2),), Hickman[2], Marion[2],, Montgomery (11), Perry (44), Pickett (6), Stewart (7373), Union[2], Van Buren (2323), Warren (149149), Wayne (0), White (134),134),	P2 (n=6 [historic=?])=?]) P3 (n=1717 [historic=?])=?]) P4 (n=2929 [historic=?])=?])	11,545
TN	Appalachia	Blount (799799), Hawkins (1)	P1 (n=1) P2 (n=33) P3 (n=1) P4 (n=2)	800800
VA	Appalachia	Lee (108108), Wise (332332)	P2 (n=2) P3 (n=1) P4 (n=22)	440440
Total Population Estimate (20192019) within Action Area				1179711797
Total Range-wide Estimate (20192019)				537,297297
Proportion of Range-wide Estimate within Action Area during winter (20192019)				4.4%

[1]Summation of estimates by cave across counties with hibernacula for each state and Recovery Unit. Data source: USFWS 2022 IBat Winter Population Data Request, King, USFWS, April 14, 2022, personal communication.
[2] No caves within this county were surveyed in 2019.

In 2016, a new Indiana bat hibernaculum of 93 Indiana bat individuals was discovered at Stanley-Carden Cave in Fort Payne, Alabama (DeKalb County), during late winter (February-March) 2016. This is now the largest and only the fourth known major Indiana bat hibernacula in Alabama. WNS was confirmed in DeKalb County during this survey period.

In March 2017, as part of a migration and habitat study, 15 Indiana bats from Stanley-Carden cave were radio-tagged. Two of the bats migrated to the Oakmulgee Ranger District of the Talladega National Forest, a distance of approximately 151 miles. It is expected that five (three definitely, two were headed in the same direction) of the bats migrated to the Shoal Ranger District of the Talladega National Forest, distance of approximately 48 miles. One bat remained around Stanley-Carden for at least eleven days (beyond window of tracking). Seven bats were not successfully tracked.

Indiana bats have seen declines in the TVA region, though not within TVA managed caves, due to the lack of Indiana bat hibernacula. There are historical records of Indiana bat in Norris Dam Cave and Nickajack Cave. Despite decades of surveys, records of Indiana bat in Nickajack cave is limited to observations made in 1976 by Merlin Tuttle. This record therefore has been questioned by numerous individuals and is not included on the occurrence map (Figure 4.2). Also in 1976, Tuttle reported Norris Cave as an important Indiana bat hibernacula. However, TVA staff has not witnessed this species in this cave.

Overall, the most significant declines in Indiana bat populations in the TVA region occurred prior to the completion of the original 2018 consultation. Based on data from the 2020 Tennessee Bat Working Group's White Nose Syndrome Monitoring report the most dramatic declines in winter populations of Indiana bat were first visible in 2014 (drop from 13,047 bats in 2013 to 4,018 bats in 2014). Since 2014/2015, there has been a slow decline in populations across the TVA Region in those states with extant Indiana bat hibernacula. Since the submission of TVA's original Biological Assessment in 2017, winter Indiana bat populations in Tennessee overall have decreased roughly 12 percent. However, some caves in Tennessee and Kentucky are seeing a slight increase in numbers since 2019. Anecdotal evidence from Kentucky suggested that summer colonies of Indiana bat are still present and are successfully reproducing. The summer maternity roost known from Holly Springs National Forest in Mississippi may no longer be present, despite repeated efforts to locate the colony. However, a new record for this species was recently discovered under a bridge in a nearby county in northern Mississippi (Kelly Morris, USFWS, personal communication). No significant changes in Alabama, Georgia, and Virginia Indiana bat populations have been documented (personal communications with Shannon Holbrook, USFWS, Laci Pattavina, USFWS, and Sumalee Hoskin, USFWS). In Virginia there have been acoustic detections of the species in the TVA action area since 2018 (Taylor et al. 2023).

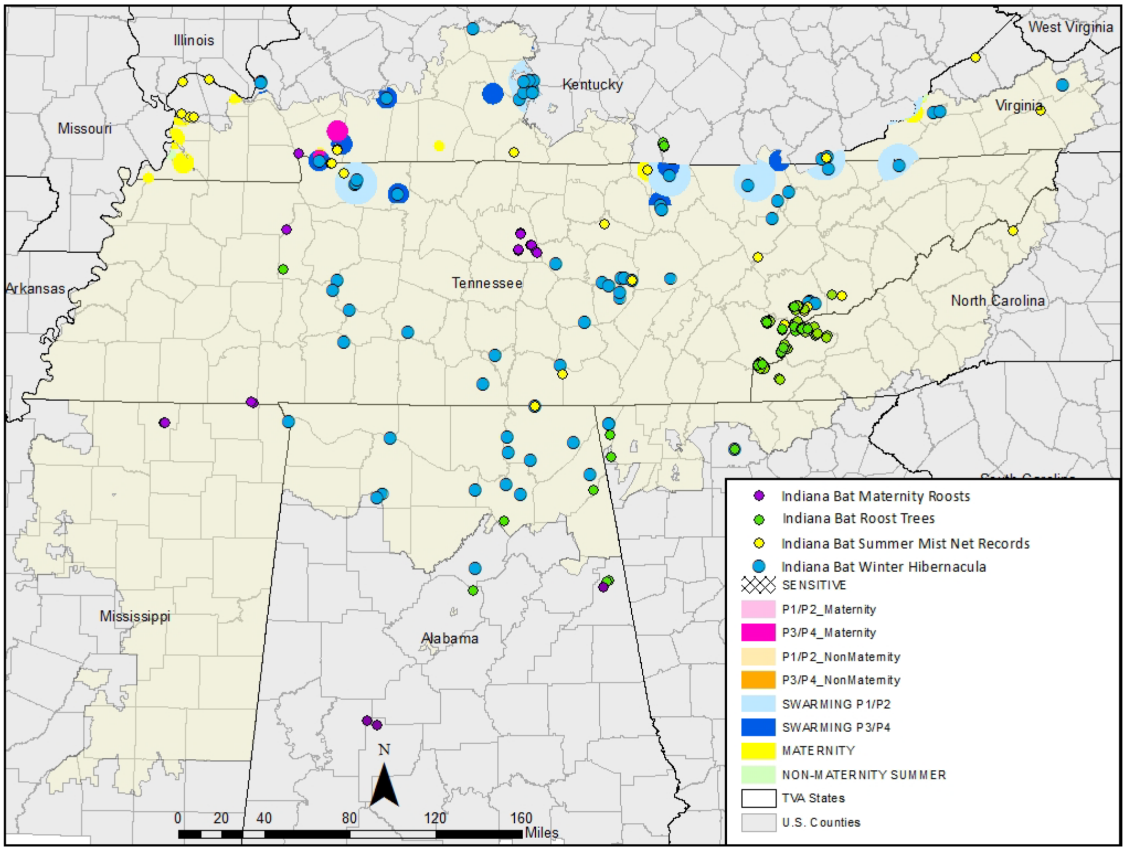


Figure 4-12. Documented occurrences of Indiana Bat in the TVA Region, Source: TVA Regional Natural Heritage Database

Since WNS first was documented within the TVA region in 2009, TVA has recorded Indiana bat in only one cave, Quarry Cave in Marshall County, Alabama. This included observation of one confirmed individual and two potential individuals during winter WNS surveillance surveys in 2013.

Multiagency radio tracking efforts (lead by Copperhead Environmental Consulting, Inc.) of Indiana bats during the spring migration season began in 2009. These efforts have resulted in the discovery of eight maternity roosting sites. These sites are located in Wilson, Benton, and McNairy Counties, Tennessee; Trigg County, Kentucky; Benton County, Mississippi; Hale and Perry Counties, Alabama; and Gilmer County, Georgia. Five of these sites are within the TVA Region. Connections have been made between at least six caves within the TVA Region and these eight maternity roosting sites.

Artificial roosting structures have been erected throughout the TVA region in nine locations on TVA lands as well as two others funded by TVA. Locations on TVA lands include Big Sandy Wildlife Management Area in Benton County, Tennessee; Loyston Point in Union County, Tennessee; Rankin Bottoms in Cocke County, Tennessee; Cave Mountain Cave Small Wild Area in Jackson County, Alabama; Marbut Bend in Limestone County, Alabama; Nottley Dam in Union County, Georgia; Chatuge Dam in Clay County, North Carolina; Tupelo Gum in Marshall County Kentucky; and Bayou Creek in McCracken County, Kentucky. Seven of these nine sites have had signs of bat use. Thus far, TVA has only been able to document use by big brown bats and evening bats. Two sites have documented maternity roosts of these species. TVA provided funding for the installation of artificial roosts at two additional sites off TVA lands. One was in McNairy County, Tennessee near a previously documented Indiana bat maternity roost. The other was in Wilson County, Tennessee where TVA provided funding to TWRA for the lease of land for research and installation of artificial roosting structures near a known Indiana bat maternity roost. This site was used by Indiana bats within the same year of installation.

TVA also partnered with the Nature Conservancy (TNC) to install gate at Cooper Creek Cave in West Tennessee and provide manual labor support for the installation of gates at Tobacco Port Saltpeter cave and Grassy Cove Saltpeter Cave, both documented Indiana bat hibernacula in Tennessee.

Additionally, TVA partnered with Fall Creek Falls State Park (TDEC) to purchase additional lands to be managed by the Park that may serve as suitable roosting habitat for Indiana bat.

TVA staff continues to monitor caves on TVA-managed lands and partner with other agencies to monitor caves in the TVA region. These efforts are conducted in order to monitor Indiana bat populations, monitor the spread of WNS, understand the mechanics behind the spread of WNS (i.e., TVA participated in collaborative continent-wide surveys for five years with Dr. Winifred Frick and Dr. Tina Cheng and is currently partnering with Dr. Joseph Hoyt to understand the impacts of WNS on tricolored bat) and to improve understanding of cave ecology (i.e., TVA partnered with Dr. Donald Walker to monitor WNS and cave microbiomes and is currently partnering with Dr. Matthew Niemiller and Dr. Skylar Hopkins to better understand cave microclimates).

Several universities (i.e., University of West Georgia, Indiana State, and UT) continue to monitor Indiana bat populations within, or adjacent to, the TVA region (e.g., Talledega and Cherokee National Forests, and the Great Smoky Mountains National Park).

Occurrence data for Indiana bat within the TVA region is depicted in Figure 4.2.

4.2 Northern Long-eared Bat

4.2.1 Range and Life History

The northern long-eared bat is found in the United States from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, extending southward to parts of southern states from Georgia to Louisiana, and reaching into eastern Montana and Wyoming. In Canada it is found from the Atlantic Coast westward to the southern Yukon Territory and eastern British Columbia. Historically, the species has been found in greater abundance in the northeast and portions of the Midwest and Southeast and has been less frequently encountered along the western edge of the range (USFWS 2014, Figure 4-3).

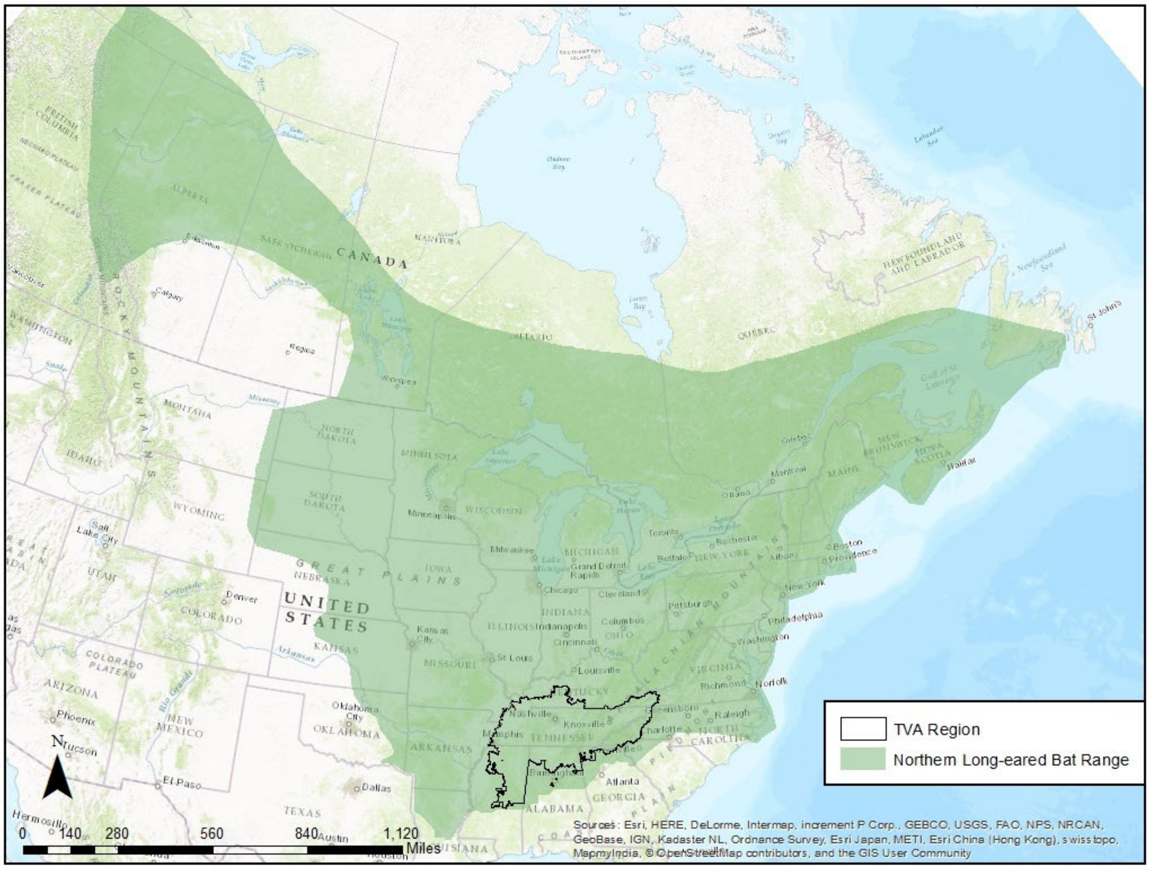


Figure 4-13. TVA Region in Relation to Range of Northern Long-eared Bat

Suitable hibernacula for the northern long-eared bat includes underground caves and cave-like structures (e.g. abandoned or active mines, railroad tunnels). Hibernacula typically have large passages with significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius), high humidity, and minimal air currents. Specific areas where they hibernate have very high humidity such that droplets of water often are seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only nose and ears visible. Northern long-eared bats typically will hibernate between mid-fall through mid-spring (dates vary by location). Other landscape features may be used by northern long-eared bats during winter that have yet to be documented (USFWS 2014).

Northern long-eared bats migrate between winter hibernacula and summer habitat. Spring migration likely runs from mid-March to mid-May, with fall migration likely between mid-August and mid-November. Overall, northern long-eared bat is not considered to be a long-distance migrant (typically 40-50 miles) although known migratory distances vary greatly between 5 and 168 miles. During spring staging and fall swarming, northern long-eared bats typically roost, forage, and travel within 5 miles of a hibernaculum. Northern long-eared bats typically occupy summer habitat from mid-May through mid-August each year (exact dates vary by location; USFWS 2014).

Suitable habitat during spring, summer, and fall consists of a wide variety of forests or woodlots where they roost, forage, and travel. This may include adjacent and interspersed non-forested habitats (e.g., emergent wetlands, adjacent edges of agricultural fields, old fields, and pastures) as well as linear features (e.g., fencerows, riparian forests, and other wooded corridors). Wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Northern long-eared bats emerge at dusk to forage in woodlots and tree-lined corridors, feeding on insects, which they catch while in flight using echolocation. Northern long-eared bat also feeds by gleaning insects from vegetation and water surfaces. Home ranges for this species, consisting of maternity, foraging, roosting, and commuting habitat, typically occur within three miles of a documented capture or within 1.5 miles of a known suitable roost tree (USFWS 2014).

During spring, summer, or fall, northern long-eared bats roost in trees (live or dead) with a diameter at breast height of three inches or greater that exhibit cavities, cracks, crevices, or exfoliating bark. Northern long-eared bats roost within or underneath these features, which seems to drive selection of roost trees (versus species of tree). Individual trees potentially may be suitable roosts when they exhibit these features and are within 1000 ft of the next nearest suitable roost tree or forested area that contains suitable roost trees. Males and non-reproductive females also may roost in cooler places such as caves and mines. Northern long-eared bat has also been observed roosting in buildings, barns, sheds, bridges, and bat houses, particularly when suitable roost trees are unavailable. Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable roost trees for this species (USFWS 2014).

Breeding begins in late summer or early fall when males begin swarming near hibernacula. After copulation, females store sperm during hibernation until spring, when they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg (delayed fertilization). After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Adult bats can live up to 19 years.

Occurrence of northern long-eared bat across two life history stages (hibernation/cave use and summer foraging) has been documented within the TVA region and Action Area.

4.2.2 Listing History under Endangered Species Act

The USFWS listed northern long-eared bat as a threatened species under the ESA on April 2, 2015. WNS is the main threat to this species and has caused a precipitous decline in bat numbers (in many cases, 90–100 percent of one colony) where the disease has occurred. Declines in numbers of northern long-eared bat are expected to continue as WNS extends across the species' range, provided no cure to the disease is found (USFWS 2015b).

The USFWS on January 14, 2016, finalized a rule under section 4(d) of the ESA that provided measures tailored to the understanding of the conservation needs of northern long-eared bat at that time. Thee species-specific 4(d) rule prohibited purposeful take of northern long-eared bat throughout the species' range, except in instances of removal of this species from human structures, defense of human life, removal of hazardous trees for protection of human life and property, and authorized capture and handling of northern long-eared bats by individuals permitted to conduct these activities. Take of northern long-eared bats in their hibernacula was prohibited in areas affected by WNS, unless permitted under ESA section 10(a)(1)(A). Take of northern long-eared bat inside of hibernacula may have included disturbing or disrupting hibernating individuals when they are present as well as the physical or other alteration of the hibernaculum's entrance or environment when bats are not present if the result of the activity will impair essential behavioral patterns, including sheltering northern long-eared bats. Incidental take of northern long-eared bats outside of hibernacula that resulted from activities other than tree removal was not prohibited. Incidental take resulting from tree removal was prohibited if it: (1) Occurred within a 0.25 mile (0.4 kilometer) radius of known northern long-eared bat hibernacula; or (2) cut or destroyed known occupied maternity roost trees, or any other trees within a 150-foot (45-meter) radius from the known maternity tree during the range-wide pup season (June 1 through July 31). Incidental take of northern long-eared bats as a result of the removal of hazardous trees for the protection of human life and property also was not prohibited (USFWS 2016a).

On April 27, 2016, the USFWS determined that designating critical habitat for northern long-eared bat was not prudent. Designating winter habitat as critical habitat likely would increase the threat from vandalism and disturbance and could potentially increase the spread of WNS. In addition, designating summer habitat as critical habitat would not be beneficial to northern long-eared bat because there are no areas within summer habitat that meet the definition of critical habitat (USFWS 2017a).

On November 29, 2022, the USFWS announced a final rule to reclassify the northern long-eared bat from Threatened to Endangered under the ESA (Federal Register citation placeholder). A Species Status Assessment determined that since its listing as Threatened in 2016, the species has continued to decline (USFWS 2022). The primary factor influencing this decline is WNS. Populations have declined 97-100% across 79% of the range of this species. Wind-energy related mortality, climate change, and habitat loss were also identified as stressors on the species. The Service determined this species now meets the definition of an endangered species under the ESA (Federal Register citation placeholder). The rule will become effective on March 31, 2023 (Federal Register citation placeholder). On this effective date the exemptions allowed under the 4(d) ruling would be nullified.

4.2.3 Current Population Estimate

Prior to the introduction of WNS to the U.S., northern long-eared bat was considered abundant and widespread throughout most of its range, though it was thought that this species was more common in the northern part of the range than in the south, and it was rare in the northwestern portion of the range. It was reported as very rare in Alabama, uncommon in Indiana, Kentucky, Tennessee, and Wisconsin, more common in northern Michigan than in southern Michigan, and quite common in New York. However, surveys using mist nets in upland areas revealed that this species was much more common in the Tennessee-Kentucky-Arkansas-Missouri parts of its range than previous work indicated (Nature Serve 2017).

Prior to the incidence of WNS, there were approximately 737 known, occupied hibernacula with at least 38,181 documented bats. Due to its roosting behavior in caves (deep within cracks and crevices) this species is likely undercounted as it is notoriously hard to count in caves. Despite this challenge, winter hibernacula counts still provide the most consistent, long-term data on which to base impacts from WNS (USFWS 2022). In 2017, there were 74 caves that were either extant or historical hibernacula for northern long-eared bat in the TVA region. In Tennessee, the 2022 Tennessee Bat Working Group's White Nose Syndrome Monitoring report documented 354 northern long-eared bats at the peak of monitoring post-WNS in 2013. Northern long-eared bats were documented in four TVA caves this same year. This high count was immediately followed by a rapid decline to only 6 bats counted in 2015. Since 2018, annual counts reported between 0 and 8 northern long-eared bats over the entire state. Notably, the only northern long-eared bats documented during winter surveys in Tennessee after 2020 have been a single individual in TVA's Norris Dam Cave seen in 2021 and 2022.

Summer records (mist-netting and acoustic) are used to compliment hibernacula counts when determining population size. Stationary acoustic results showed an average decline of 40% across the eastern US between 2010 and 2019. In Tennessee, summer occupancy declined roughly 58% between those years (Udell et al. 2022). Kentucky summer capture rates declined roughly 50% after 2013 (Mike Armstrong, USFWS, personal communication). Since the signing of the original consultation documents, there have been no new records of northern long-eared bat in Georgia (Laci Pattavina, USFWS, personal communication) or in the areas of western North Carolina that fall within the TVA region (based on data from the North Carolina Natural Heritage Program). In Alabama, record for this species continue to come primarily from National Forest lands where ongoing research has occurred for several years (Shannon Holbrook, USFWS, personal communication). Mississippi has had one new record of this species, but it falls outside of the TVA Region (Kelly Morris, USFWS, personal communication). The status of the NLEB in Virginia is expected to be the same as the current status of the species range-wide (declining; Sumalee Hoskin, USFWS personal communication). However, there have been acoustic detections of the species in the TVA action area that falls within Virginia since 2018 (2023 Taylor et al. 2023).

Northern long-eared bat tracking efforts on the coast of North Carolina have revealed winter populations that do not appear to have hibernation patterns typical of other northern long-eared bat populations in the southeastern U.S. These bats appear to be very active in winter and have not been tracked to winter roosting caves where WNS typically has been acquired. There is hope that these coastal populations will not succumb to the effects of WNS and may provide the genetic diversity needed to help this species recover.

Several universities (i.e., University of West Georgia, Indiana State University, and the University of Tennessee) have and are continuing to monitor northern long-eared bat populations within, or adjacent to the TVA region (e.g., Talledega and Cherokee National Forests, TVA Reservoirs, and the Great Smoky Mountains National Park).

Figure 4.4 depicts known occurrences of northern long-eared bat within the TVA region and Action Area post-WNS as of March 2023. The year defined as post-WNS varies by state and is determined by each state's ES FO office. This is intended to represent the locations where populations have persisted following the major population declines due to WNS.

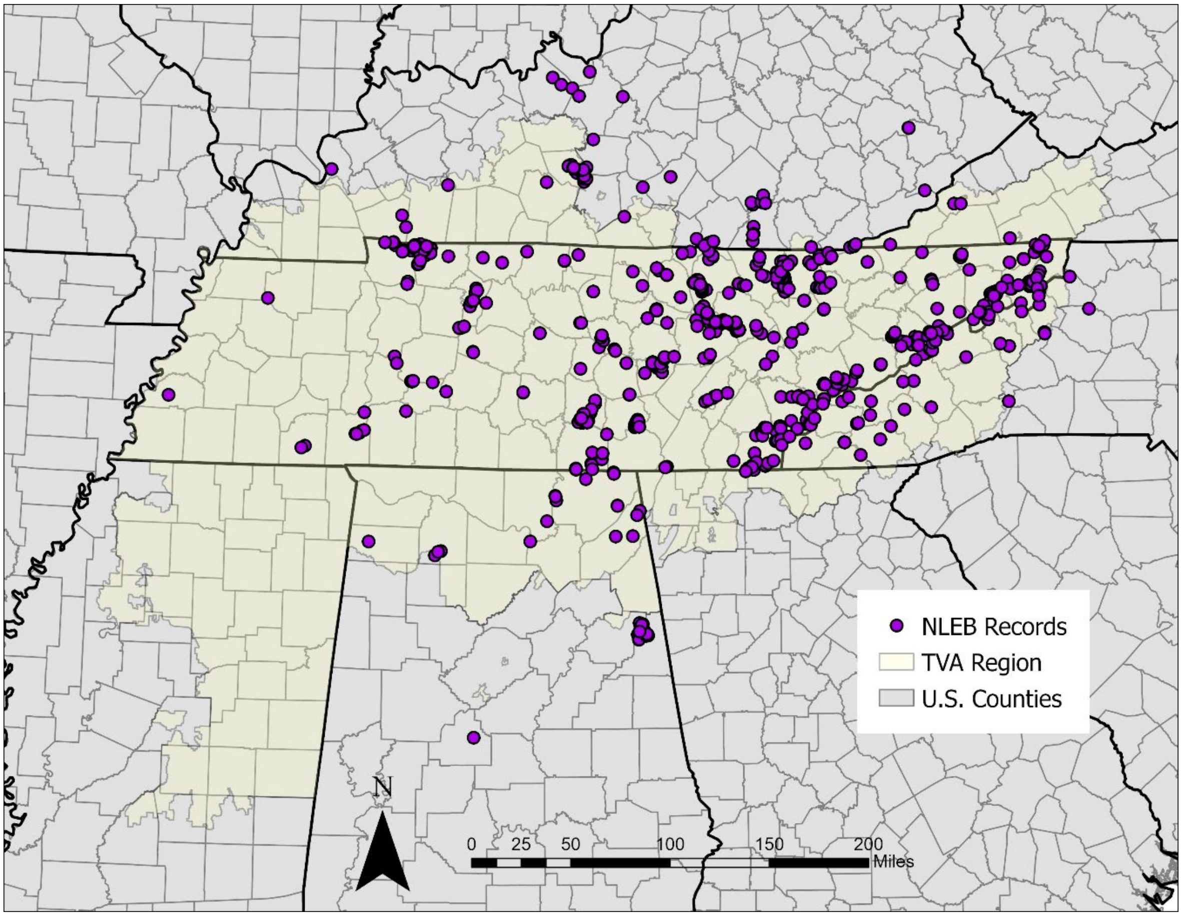


Figure 4-14. Documented occurrences of Northern Long-eared Bat in the TVA Region. Source: TVA Regional Natural Heritage Database

4.3 Gray Bat

4.3.1 Range and Life History

The gray bat range extends from southeastern Kansas and central Oklahoma east to western Virginia and western North Carolina, and from Missouri, Illinois, and Indiana south to southern Alabama and northwestern Florida (Decher and Choate 1995); occurs primarily in the cave region of Missouri, Arkansas, Kentucky, Tennessee, and Alabama. Summer and winter ranges are essentially the same (Figure 4.5) (USFWS 2016b).

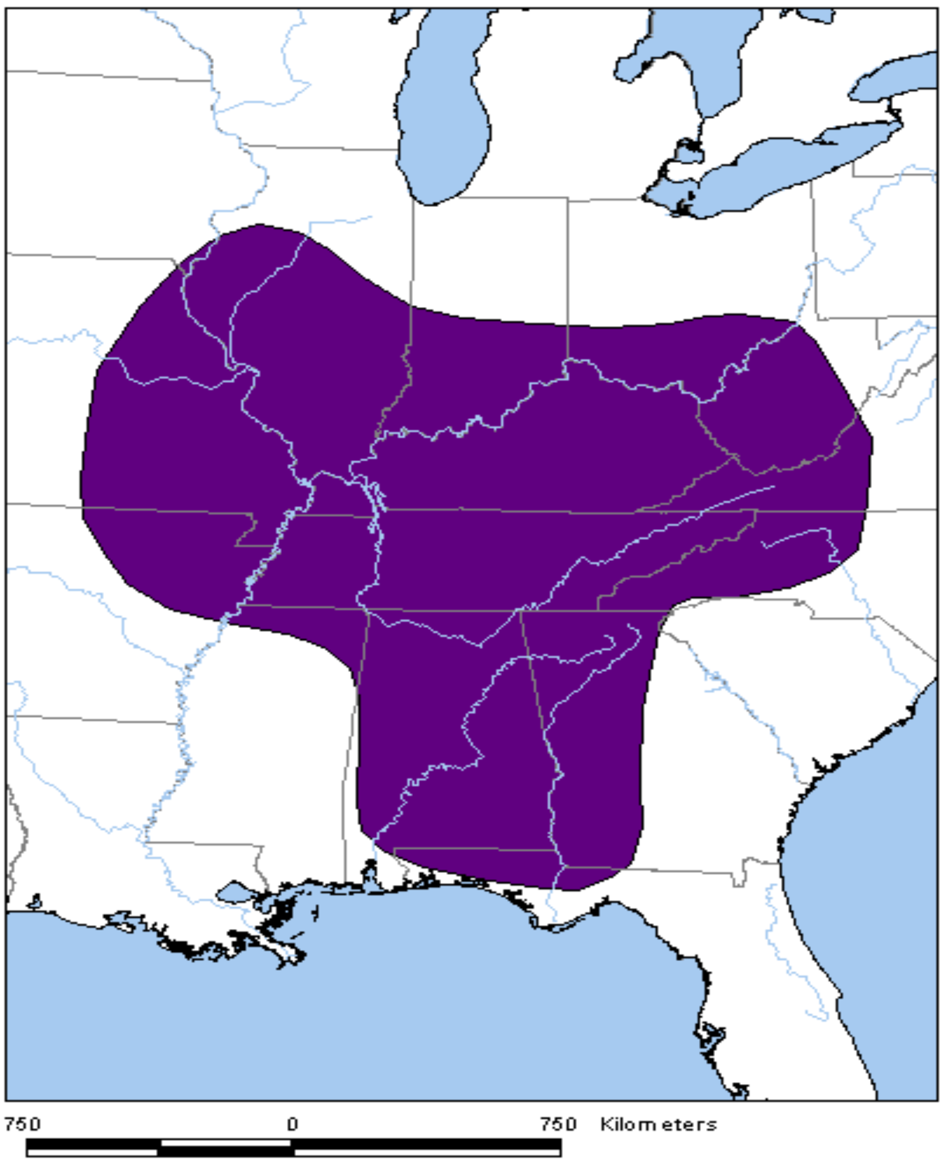


Figure 4-15. Range of Gray Bat

Wintering caves often are hundreds of kilometers from summer range. Individuals regularly migrate 17-437 kilometers between summer maternity sites and winter hibernacula, with some individuals moving as much as 689-775 kilometers. In some areas the same caves are used in winter and summer; in other areas many caves used in summer are vacant in winter. Migration occurs mostly in September-October, some as early as August or as late as November or December, females preceding males. Females depart wintering caves in March and early April, males in late April and May. Evidence suggests that bats migrate in small colonies. Small caves may be used as rest stops (Nature Serve 2017). Gray bats, including lactating females and juveniles, also have been documented using bridges during the summer. One example of this is under a bridge downstream of Woods Reservoir in Tullahoma, Tennessee. TVA staff has been involved with monitoring, netting and banding gray bats roosting, including reproductive females and juveniles, at this site for several years.

Female gray bats give birth to a single young in late May or early June. Gray bats eat a variety of aquatic and terrestrial insects present along rivers or lakes. Gray bats primarily forage over open water of rivers, streams, lakes or reservoirs as far as 35 kilometers away from occupied caves. Maternity colonies are typically 1-4 kilometers from foraging areas (USFWS 2009a).

4.3.2 Listing History under Endangered Species Act

The USFWS listed the gray bat as an endangered species under the ESA on April 28, 1976 (USFWS 1976). A recovery plan for gray bat was issued in 1982. Gray bats essentially are restricted to the cave region of the eastern and central United States; many occupied caves (hundreds) exist, and population size is large (a few million), but relatively few caves hold most of the population, which make gray bats extremely vulnerable to disturbance. Gray bats are especially vulnerable due to high fidelity to particularly favored caves, and heightened sensitivity to disturbance, including the mere presence of humans with lights; disturbance may result in bats moving to less favorable roosting places (Nature Serve 2017).

Gray bat abundance declined by at least 50% from the 1960s to the early 1980s. Cave disturbance was considered the major factor in the decline. Decline began with cave disturbance associated with saltpeter production during the Civil War. Some of the largest colonies were lost as a result of cave commercialization. In addition, some caves were improperly gated. Improved gating techniques and other cave protection efforts have greatly reduced this threat (Arroyo-Cabrales and Timm 2008).

The total population and number of occupied caves has increased in recent decades, due to ongoing cave protection efforts, but some occupied caves remain vulnerable to disturbance. Despite their large population size and good recovery, the species is regarded as potentially vulnerable to mortality from WNS. While this species has had documented fungal infection from Pd, significant mortality due to WNS has not been documented in the gray bat.bat. Other threats include pesticides, deforestation, impoundment of waterways, and subsequent cave inundation (Nature Serve 2017).

In the recovery plan for gray bat, the criteria for down-listing this species from endangered status to threatened status includes documentation of permanent protection of 90% of Priority 1 hibernacula and documentation of stable or increasing populations at 75% of Priority 1 maternity caves during a period of five years. Recent studies indicate that these criteria have been met. According to the most recent 5-year status review for gray bat, the gray bat had recovered in many areas and the overall range-wide estimate continues to increase. At the time of listing, the estimated population of the species was approximately 1.6 million. The species increased approximately 104% between 1982 and 2007. Some of the reclassification and delisting criteria listed in the 1982 recovery plan have been achieved: all but one Priority 1 hibernacula have been protected, 73% of Priority 2 caves have been protected, and 33% of Priority 2 caves have exhibited a stable or increasing population. Although some threats to various caves remain, overall the species has exhibited an increase in population numbers and distribution (USFWS 2009).

Despite achievements in recovery for this species, at the time of the 5-year status review, the potential threat of WNS to populations of gray bat was considered to be of such a magnitude that any recommendation of a species classification change was withheld due to the need to learn more about WNS and possible impacts to gray bat (USFWS 2009).

4.3.3 Current Population Estimate

The number of distinct occurrences has not been determined using standardized criteria. Data from 2007 indicate that gray bat has been documented in 384 caves across 11 states (not including Indiana). Summering populations of gray bats use multiple caves, and movement between caves is considerable. Accurate population data is difficult to obtain, due to problems inherent with using various census techniques, complications associated with differences in observers' counting abilities, movements of bats between transient and permanent hibernacula or maternity sites, seasonality (e.g., counts at maternity sites before or after birth of young), inability to census all sites during the same year, and the potential of disturbing hibernating bats at critical hibernacula (USFWS 2009). Total population was estimated at 1.5 million in the early 1980s, and approximately 3.4 million in 2005-2007 Nature Serve 2017, USFWS 2009).

Gray bat populations in TVA caves typically are restricted to summer roosting sites. TVA-managed caves are typically are found along reservoirs and tend to be too warm to support winter roosting gray bat populations. As a result, TVA has focused cave gating efforts on known summer maternity roosting sites. To date, TVA has installed gates or fences at eight known maternity roosting sites (Norris Dam Cave, Nickajack Cave, Blythe Ferry, and Featherfoot Cave in Tennessee; Collier Cave, Quarry Cave, Hambricks Cave, and Key Cave in Alabama. In 2021, the chain-link fence surrounding Key Cave was replaced with a 10-foot steel perimeter fence. TVA is providing funds to The Nature Conservancy to clean up an enormous amount of trash in a recently acquired and heavily impacted gray bat roosting site, Piper Cave in Smith County, Tennessee. TVA is also providing funds to Hawkins County, Tennessee to protect former TVA property that has since been transferred to the county and has also become a summer roosting site for gray bats.

Based on long-term monitoring efforts, gray bat populations within the Action Area appear to be relatively stable, if not increasing. Certain caves have been dynamic between years, but overall representative of "normal fluctuations" that have been observed over time. Multi agency efforts to survey caves for WNS have resulted in some discoveries of some larger hibernacula than previously known. On TVA-managed lands, this includes one cave on Normandy Reservoir (Crumpton Creek) and one cave on Tim's Ford Reservoir (Pennington Cave), and an abandoned nuclear facility on the Holston River (Phipps Bend). On TWRA-managed lands, this includes one cave in Cocke County, TN (Rattlin' Pit Cave), http://www.chattanoogan.com/2017/2/23/342523/TWRA-Surveys-Sizable-Gray-Bat.aspx. On USFWS lands, this includes recent winter survey efforts at Fern Cave in Jackson County, Alabama, where almost two million gray bats were counted. A maternity colony of about 10,000 gray bats was also documented for the first time by TVA Terrestrial Zoologists in 2017, just outside of Knoxville, Tennessee on private property. This maternity cave is now surveyed annually by TVA biologists. Several new colonies of gray bats have been recently discovered roosting under bridges in North Carolina (Etchinson and Weber 2020). Another new colony of gray bats was documented under a bridge in Alcorn County, Mississippi in recent years (Kelly Morris, USFWS, personal communication). Acoustic records in the TVA Region within Virginia show an increase in gray bat activity between 2018 and 2020. However, this study indicates this increase in detections is likely not solely attributable to population growth (Taylor et al. 2023).

Band recovery efforts during winter hibernacula surveys have resulted in an increased understanding of the complexity of cave connections across the southeast. Multi-agency efforts to attach bands and radio transmitters to bats at major gray bat summer roosts (i.e., Pearsons Cave, Bellamy Cave and Beth's Page Bridge) are contributing to this increase in knowledge. The Nature Conservancy is spearheading an effort to map these cave connections in the southeast (Holliday et. al. 2022). TVA is currently funding efforts to attach MOTUS tags to gray bats roosting on the Tennessee/Virginia state line to document foraging patterns along the rivers of this region. Although other agencies seem to have stopped using the thermal infrared cameras (and may have reduced overall efforts to monitor summer emergence counts), TVA still actively monitors up to 12 maternity gray bat roosts each year. Recent advancements in software to process the footage collected during these emergence counts may encourage a return to these efforts across the gray bat range. Signage installation and cave gating efforts on TVA lands continue as biologists identify more roost sites. Occurrence data for gray bat roost sites and mist net captures is reflected in Figure 4-6.

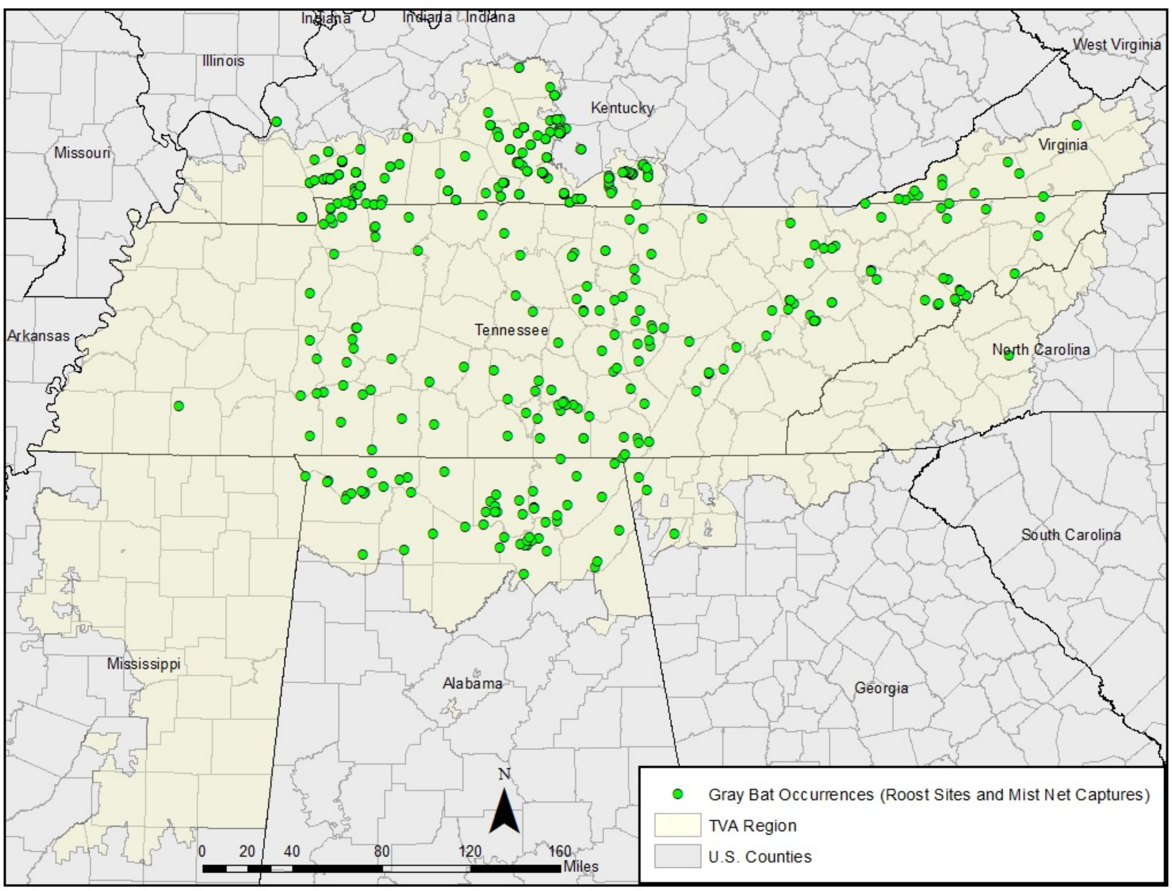


Figure 4-16. Occurrence Records for Gray Bat. Source: TVA Regional Natural Heritage Database

4.4 Virginia Big-eared Bat

4.4.1 Range and Life History

Virginia big-eared bats roost in a wide range of caves, rock shelters, and other karst features throughout the year and typically are located in karst regions dominated by oak-hickory or beech-maple-hemlock associations. At the time of listing in 1979, the Virginia big-eared bat was documented from Jackson, Lee, Powell, and Rowan Counties, KY; Tazewell County, VA; and Pendleton, Grant, Randolph, Hardy, Tucker, and Preston Counties, WV. Currently, the population is documented from four States: Kentucky, North Carolina, Virginia, and West Virginia (Figure 4-7). Virginia big-eared bats are known to have significant active colony sites in Lee County, KY; Avery County, NC; Tazewell and Highland Counties, VA; and Pendleton, Grant, Tucker, and Fayette Counties, WV, with occasional or low-level use of sites in West Virginia (Hardy and Randolph Counties), Virginia (Bath, Bland, Highland, Rockingham, and Shenandoah Counties) and Kentucky (Bath, Estill, Jackson, Menifee, Morgan, Powell, Rockcastle, Rowan, and Wolfe Counties) (Loeb et al. 2011).

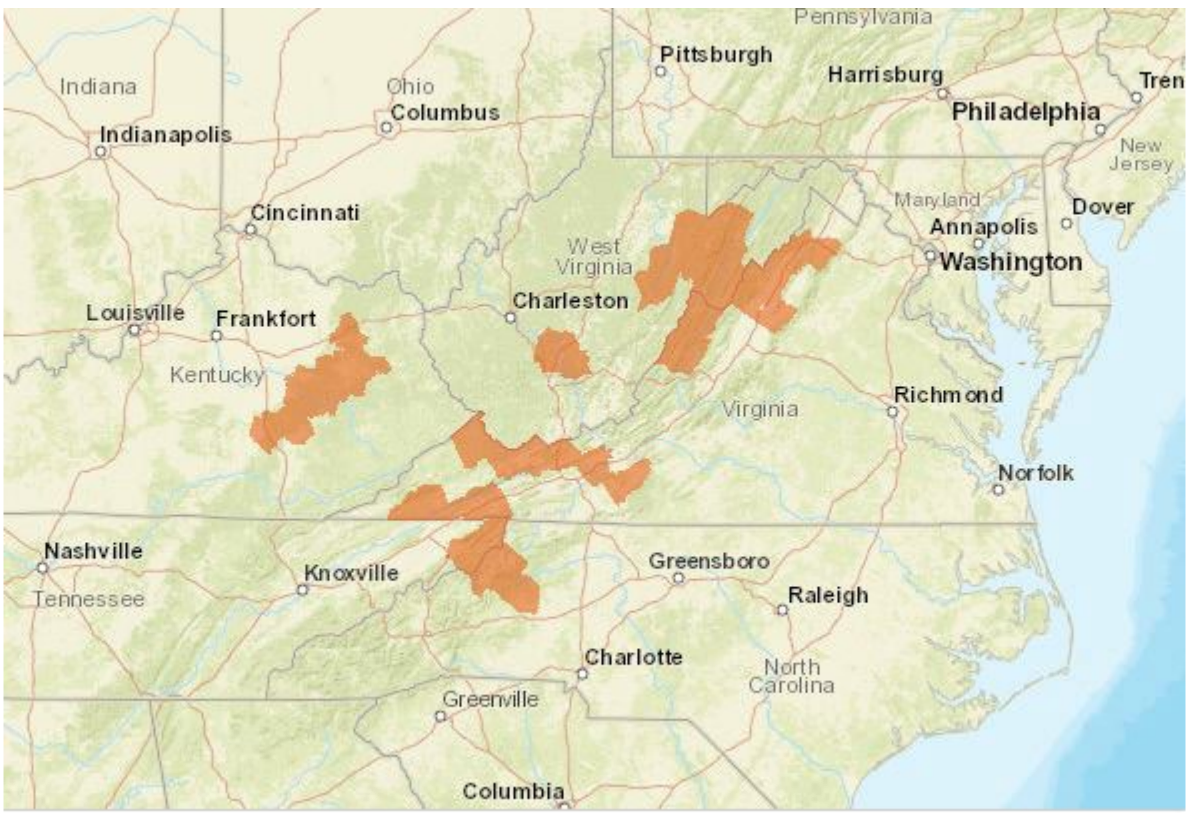


Figure 4-17. Range of Virginia Big-eared Bat (orange polygons). Source: Environmental Conservation Online System/Species Profile for Virginia Big-Eared bat

Caves typically are located in limestone karst regions dominated by mature hardwood forests of hickory, beech, maple, and hemlock. Virginia big-eared bats prefer cool, wellventilated caves for hibernation. Roost sites within caves often are near cave entrances or in places where there is considerable air movement. During winter Virginia big-eared bats hibernate solitarily, in small clusters, or sometimes in large, tight clusters of several hundred individuals. Both males and females hibernate together (Nature Serve 2017). Virginia big-eared bats also have been documented in Tennessee roosting in two natural rock roosts, three barns, and one Virginia pine tree in 2015 (Joe McGuiness, personal communication, 2016).

Mating begins in late summer/early autumn and continues into winter. Ovulation and fertilization are delayed until late winter/early spring. Maternity colonies form as early as late winter (March) or as late as late spring (June), apparently depending on when the roost site reaches a suitably warm temperature. During summer females form nursery colonies while males roost separately (either solitary or in large bachelor groups) during this time. Maternity colonies settle deep within caves, far from the entrance. Maternity caves are warmer than those used for hibernation. One pup is born per female in late spring/early summer. Young bats can fly at about 2.5-3 weeks, are weaned by 6-8 weeks, and leave the nursery cave to forage by the end of July or early August. Most individuals leave the nursery cave by mid- to late September. Virginia big-eared bats are fairly sedentary and are not known to migrate more than about 64 km between hibernation and maternity caves. Individuals may move from one roost to another at any season (Nature Serve 2017).

Virginia big-eared bats feed principally on moths and forage over fields and woods, with individuals routinely traveling 3-5 miles from roost cave to foraging area. Foraging activity usually begins well into the night, which is late relative to other bats. After an initial feeding period, Virginia big-eared bats roost and rest presumably before an additional feeding bout later in the night. Virginia big-eared bat commonly arouses in winter, changing position within a hibernaculum or moving to a nearby cave or mine (Nature Serve 2017).

Occurrence of Virginia big-eared bat has been documented within the TVA region and Action Area. Occurrence is limited to six counties across three states in the northeastern corner of the Action Area.

4.4.2 Listing History under Endangered Species Act

Virginia big-eared bat had a population of about 3,500 bats when it was listed as an endangered species in 1979 due to its small range (USFWS 1979). This species occurs only in approximately 15 caves, of which about 5 caves contain the bulk of the population. Other colonies have either declined or disappeared. Virginia big-eared bats also are vulnerable to, and highly intolerant of, disturbance by humans.

In 1979, five caves in West Virginia were designated as critical habitat for Virginia big-eared bat. A recovery plan was finalized in 1984. Habitat loss, disturbance, predation, and pollutants are among the identified threats in the recovery plan, which outlined criteria for down-listing this species to threatened status. The USFWS believed this could be achieved through long-term roost site protection, subsequent stable or increasing populations over a 5-year period, protection of foraging areas, and establishing a monitoring program.

A five year status review was completed in 2008 that resulted in the recommendation to retain the endangered listing classification. The rationale was that gains made in cave protection and population increases do not sufficiently offset continuing and emerging threats to the species. Mortality from wind turbines, WNS, predation, vandalism, and natural changes in cave conditions pose potential emerging threats to Virginia big-eared bats in addition to those threats that originally were listed. Recommended future actions included genetic research, telemetry and tracking studies, cave mapping, surveys for additional cave roosts, operational changes at wind farms, long-term protection (signage and gates), and WNS surveillance (USFWS 2008).

4.4.3 Current Population Estimate

When the recovery plan was drafted, the known population of Virginia big-eared bats within maternity colonies was approximately 3,600, and the known hibernating population was approximately 2,585 (USFWS 2008). Since listing, all states within the range of the Virginia big-eared bat have implemented a periodic monitoring program at both hibernacula and maternity sites, but a standardized survey protocol has not been formalized. Estimates derived during 2009 hibernacula surveys approximate the Virginia big-eared bat population at 15,000 individuals; approximately 12,000 of these bats hibernate in West Virginia. Summer estimates at range-wide maternity colonies the same year accounted for 8,400 individuals (Bayles et al 2011). Thirteen caves support hibernating colonies of ≥ 20 Virginia big-eared bats, and only 8 of these contain over 100 hibernating individuals. Maternity sites are limited to 17 caves and 6 other caves support summer bachelor colonies with ≥ 20 individuals. The USFWS determined in their 5-year review that although there have been fluctuations and population declines within individual caves, the range-wide population within both hibernacula and maternity colonies has increased since the time of listing (USFWS 2008). They further note that the documented range of the species has expanded with discovery of additional occupied caves, including one significant hibernaculum in Avery County, NC (Bayless et al. 2011). Pd has been detected on Virginia big-eared bats, but no diagnostic sign of WNS has yet been documented on this species. No significant changes in population size have been documented since 2018 when the original programmatic consultation was signed.

Within the TVA region, occurrence of Virginia big-eared bat has been documented Tazewell County, Virginia, Carter and Johnson Counties, Tennessee, and Avery and Watauga Counties, North Carolina. No Virginia big-eared bats have ever been documented in a TVA-managed cave. A new Virginia big-eared bat hibernacula occurrence record in Carter County, Tennessee was confirmed using hair samples in January 2023. Three bats were found in this cave. Occurrence records for Virginia big-eared bats within the TVA region and Action Area are shown in Figure 4.8.

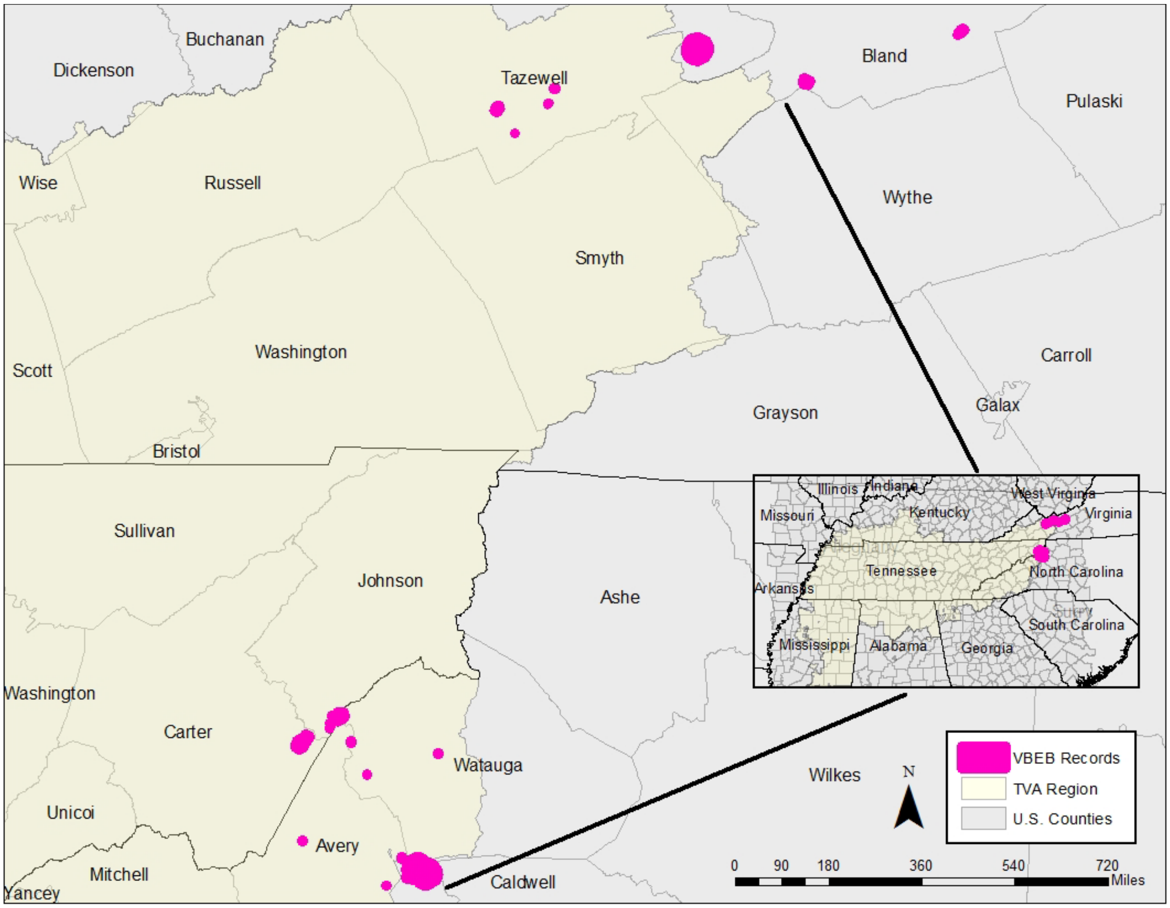


Figure 4-18. Occurrence Records for Virginia Big-eared Bat. Source: TVA Regional Natural Heritage Database

CHAPTER 5 – EFFECTS OF PROPOSED ACTIONS AND IMPLEMENTATION OF CONSERVATION MEASURES

5.1 Effects Analysis Overview

This chapter includes analysis of direct and indirect effects of proposed actions on listed species, as well as on interrelated and interdependent activities. Direct effects occur to an individual during implementation of an action. Effects that result from an action and occur later in time are indirect effects. Both direct and indirect effects must be caused by the action and be reasonably certain to occur. The only difference between direct and indirect effects is timeframe. An interrelated activity is part of, is associated with, or depends on the proposed action for its justification. An interdependent activity has no independent utility apart from the proposed action under consultation or is being carried out because of the proposed action.

By virtue of TVA's multifaceted mission, the 96 routine activities are a mix of interrelated and interdependent activities that serve to carry out the ten overarching routine actions. There is potential for unforeseen adverse impacts to occur as a result of some interrelated and interdependent activities. Attempting to identify these programmatically would be too speculative. Project-specific environmental reviews will allow for identification of potential adverse effects that may result from interrelated and interdependent activities (e.g., transfer of land from TVA to another landowner). If necessary, additional project-specific consultation would be carried out. The effects analysis focuses on the 96 activities defined in Section 3.2 (versus the ten overarching routine actions in Sections 3-3 through 3-12).

Stressors that could result from implementation of each activity are described in Section 5.2, along with the method of potential exposure (e.g., life stage, activity intensity, duration) of each bat species to stressors and possible bat response (e.g., startling, altered behavior, death). For each stressor, avoidance and minimization measures that TVA would implement are listed, followed by an overall determination of effect for each stressor. An analysis of effects for each of the 96 activities is detailed in Table 5-1 and includes a reference to the conservation measures applicable to each activity. The effects determination is based on implementation of conservation measures and resulting avoidance or minimization of exposure to stressors associated with each activity.

Section 5.3 describes additional conservation measures that TVA will continue to carry out, based on conservation goals and objectives that are broader than project-specific avoidance and minimization measures, and that are in intended to provide benefits to listed bats at the population or regional level.

Section 5.4 summarizes effects determinations by each bat species. Section 5.6 summarizes cumulative effects.

5.2 Stressors with Potential Direct or Indirect Effects to Bats and Minimization or Avoidance Conservation Measures

5.2.1 Noise/Vibration

Exposure of any of the four bat species to noise and vibration has potential to occur when machinery or heavy equipment is in use as part of an activity and the activity is taking place near an occupied roost during the day or near a foraging area or travel corridor occupied by bats in flight at night (the latter is less likely due to the diurnal time frame of the majority of activities). Bats may respond to the stress of noise or vibration by altering their normal behavior patterns (e.g., frequency of arousal, sudden flushing from roost). This may result in potentially depleted energy stores, predation, or mortality. Any activity that occurs outside, involves human presence and/or use of some type of equipment has the potential to generate noise. Many of the proposed activities occur outside and thus have the potential to generate noise. A couple of activities, in particular, blasting and drilling, have the potential to also create vibration.

TVA would implement the following measures associated with noise/vibration:

- NV1 = Noise is expected to be short-term, transient, and not significantly different from urban interface or natural events (i.e., thunderstorms) that bats are frequently exposed to when present on the landscape; bats thus are unlikely to be disturbed.

- NV2 = Drilling, blasting, or any other activity that involves continuous noise (i.e., longer than 24 hours) disturbances greater than 75 decibels measured on the A scale (e.g., loud machinery) within a 0.5 mile radius of documented winter and/or summer roosts (caves, trees, unconventional roosts) will be conducted when bats are absent from roost sites, recognizing that certain caves or other roosts are used year-round by bats.

- NV3 = Drilling or blasting within a 0.5 mile radius of documented cave (or unconventional) roosts will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the roost site.

- NV4 = Drilling or blasting within 0.5 miles of a documented roost site (cave, tree, unconventional roost) that needs to occur when bats are present will first involve development of project-specific avoidance or minimization measures in coordination with the USFWS. The likelihood of this is highly infrequent.

While magnitude and duration of noise varies by activity, the majority of noise and vibration that occurs as a result of proposed activities is expected to be short-term and not significantly different from urban interface or natural events that bats are frequently exposed to when present on the landscape (e.g., boats, barges, trains, storms). Bats are unlikely to be adversely disturbed by additional but similar noise from TVA activities. With TVA's implementation of the above measures, adapted from NiSource (2013), noise or vibration associated with proposed activities are NLAA any of the bat species addressed in this BA.

5.2.2 Human Presence

Exposure of any of the four bat species to human presence has potential to occur when humans come in close proximity to an occupied roost site. Bats may respond to the stress of human presence (detected by smell, movement and/or noise) by altering their normal behavior patterns (e.g., frequency of arousal, sudden flushing from roost, avoidance of a flight path or foraging area). This may result in potentially depleted energy stores, predation, or mortality.

TVA would implement the following measures associated with human presence:

- HP1 = Site-specific cases in which potential impact of human presence is heightened (e.g., conducting environmental or cultural surveys within a roost site) will be closely coordinated with staff bat biologists to avoid or minimize impacts below any potential adverse effect. Any take from these activities would be covered by TVA's Section 10 permit.
- HP2 = Entry into roosts known to be occupied by federally listed bats will be communicated to the USFWS when impacts to bats may occur if not otherwise communicated (i.e., via annual monitoring reports per TVA's Section 10 permit). Any take from these activities would be covered by TVA's section 10 permit.

While the magnitude (i.e., number of people) and duration (i.e., length of time) of human presence will vary, the majority of human presence is expected to be short-term. Bats therefore are unlikely to be adversely disturbed. With TVA's implementation of HP1 and HP2, human presence associated with proposed activities is NLAA any of the bat species addressed in this BA.

5.2.3 Smoke/Heat/Fire

Exposure of any of the four bat species to smoke inhalation, heat, or fire while roosting in caves or trees has potential to occur when prescribed burns are conducted in close proximity to a roost site. Bats may respond to smoke, heat or fire by having difficulty breathing, flushing from roost sites, or sustaining burns. This may result in increased energy expenditure, harm or death. Use of fire and preparation of fire breaks may damage or destroy roost trees, which may result in increased energy use to locate new roost trees. Sediment generated by plowing of fire breaks may migrate to water sources, which may result in degrading water quality, and subsequent degraded drinking water and prey availability.

Conducting controlled burns on the landscape also has potential to create snags and forest openings, resulting in additional roost sites, improved foraging opportunities and overall increased habitat availability for Indiana bat or northern long-eared bat.

TVA would implement the following avoidance and minimization measures associated with smoke, fire or heat:

- SHF1 = Fire breaks are used to define and limit burn scope.
- SHF2 = Site-specific conditions (e.g., acres burned, transport wind speed, mixing heights) are considered to ensure smoke is limited and adequately dispersed away from caves so that smoke does not enter cave or cave-like structures.
- SHF3 = Acreage is divided into smaller units to keep the amount of smoke at any one time or location to a minimum and reduce risk for smoke to enter caves.
- SHF4 = Planned timing for prescribed burns minimally overlaps with time of potential occupancy by bats (See Table 3-3).). If burns need to be conducted during April and May, when there is some potential for bats to present on the landscape and more likely to enter torpor due to colder temperatures, burns will only be conducted if the air temperature is 55° or greater, and preferably 60° or greater.
- SHF5 = Fire breaks are plowed immediately prior to burning, are plowed as shallow as possible and are kept to minimum to minimize sediment.

- SHF6 = Tractor-constructed fire lines are established greater than 200 ft from cave entrances. Existing logging roads and skid trails are used where feasible to minimize ground disturbance and generation of loose sediment.
- SHF7 = Burning will only occur if site specific conditions (e.g. acres burned, transport wind speed, mixing heights) can be modified to ensure that smoke is adequately dispersed away from caves or cave-like structures. This applies to prescribed burns and burn piles of woody vegetation.
- SHF8 = Brush piles will be burned a minimum of 0.25 mile from documented, known, or obvious caves or cave entrances and otherwise in the center of newly established ROW when proximity to caves on private land is unknown.
- SHF9 = A 0.25 mile buffer of undisturbed forest will be maintained around documented or known gray bat maternity and hibernation colony sites, documented or known Virginia big-eared bat maternity, bachelor, or winter colony sites, Indiana bat hibernation sites, and northern long-eared bat hibernation sites. Undisturbed forest is important for gray bats to regulate temperatures at the mouth of the cave, and provide cover for bats as they emerge from the cave. Prohibited activities within this buffer include cutting of overstory vegetation, construction of roads, trails or wildlife openings, and prescribed burning. Exceptions may be made for maintenance of existing roads and existing ROW, or where it is determined that the activity is compatible with species conservation and recovery (e.g., removal of invasive species).

Smoke, heat, and fire associated with prescribed burns are NLAA any of the bats species addressed in this BA when these bats are roosting in caves. While implementation of the above measures will significantly reduce this, there is some potential that prescribed burns may adversely affect bats that may be roosting in trees at the time of the prescribed burn (i.e., a few burn plans span into March-April or September-October time frames, when there is potential for bats to be roosting in trees).

5.2.4 Tree Removal

Indiana bats and northern long-eared bats roost in trees outside of the winter season. Exposure of these two species to the effects of tree removal has the potential to occur when bats are roosting in trees during time of removal, or when bats return to a previously occupied tree (i.e., previously occupied either earlier in the same season or during a previous year) to find that the tree is no longer present. Bats may respond to the stress of roost tree removal by flushing during tree removal, falling out of the tree during tree removal (if startled or unable to fly at the time the tree is removed), being crushed during tree removal, or selecting a different tree if previously used tree is no longer present. This may result in depleted energy stores, possible mortality from injury or inability to fly, and additional use of energy to locate other roost trees.

Tree removal is a common, necessary and often unavoidable activity for actions addressed in this BA. Flexibility in tree removal across season and landscape varies across proposed actions due to other regulations, safety, and inclement weather conditions, as well as the large amount of acreage that needs to be managed over a short period of time (e.g., annual or 3-year cycle). For many activities, removal of suitable roost trees can occur during winter season (when Indiana bats or northern long-eared bats likely are not present on the landscape). For safety and liability reasons, hazard trees typically have to be addressed immediately, regardless of season. Removal of (or granting approval to remove) hazard trees is limited to trees with a defined target (e.g., threat to a TL, adjacent private property, or human safety in a public use area). The need to remove trees during time of occupancy by Indiana bat and northern long-eared bat, including when non-volant juveniles are present on the landscape, has been minimized to the extent possible within the constraints of proposed actions over the course of the 20-year term (see Table 3-2).

TVA would implement the following avoidance and minimization measures for tree removal:

- TR1 = Removal of potentially suitable summer roosting habitat during time of potential occupancy has been quantified and minimized programmatically. TVA will track and document alignment of activities that include tree removal (i.e., hazard trees, mechanical vegetation removal) with the programmatic quantitative cumulative estimate of seasonal removal of potentially suitable summer roost trees for Indiana bat and northern long-eared bat.
- TR2 = Removal of suitable summer roosting habitat within 0.5 mile of Priority 1/Priority 2 Indiana bat hibernacula, or 0.25 mile of Priority 3/Priority 4 Indiana bat hibernacula or any northern long-eared bat hibernacula will be prohibited, regardless of season, with very few exceptions (e.g., vegetation maintenance of TL ROW immediately adjacent to Norris Dam Cave, Campbell County, TN).
- TR3 = Removal of suitable summer roosting habitat within documented habitat (i.e., within 10 miles of documented Indiana bat hibernacula, within five miles of documented northern long-eared bat hibernacula, within 2.5 miles of documented Indiana bat summer roost trees, within five miles of Indiana bat capture sites, within 1.5 miles of documented northern long-eared bat summer roost trees, within three miles of northern long-eared bat capture sites) will be tracked, documented, and included in annual reporting.
- TR4 = Removal of suitable summer roosting habitat within potential habitat for Indiana bat or northern long-eared bat hibernacula will be tracked, documented, and included in annual reporting.
- TR5 = Removal of any trees within 150 ft of a documented Indiana bat or northern long-eared bat maternity summer roost tree during non-winter season, range-wide pup season or swarming season (if site is within known swarming habitat), will first require a site-specific review and assessment. If pups are present in trees to be removed (determined either by mist netting and assessment of adult females, or by visual assessment of trees following evening emergence counts), TVA will coordinate with the USFWS to determine how to avoid direct and minimize indirect impacts to pups to the extent possible. This may include establishment of artificial roosts before loss of roost tree(s).
- TR6 = Removal of a documented Indiana bat or northern long-eared bat roost tree that is still suitable and that needs to occur during non-winter season, range-wide pup season, or swarming season (if site is within known swarming habitat) will first require a site-specific review and assessment. If pups are present in trees to be removed (determined either by mist netting and assessment of adult females, or by visual assessment of trees following evening emergence counts), TVA will coordinate with the USFWS to determine how to avoid direct and minimize indirect impacts to pups to the extent possible. This may include establishment of artificial roosts before loss of roost tree(s).
- TR7 = Tree removal within 100 ft of existing transmission ROWs will be limited to hazard trees as defined in Section 3-2.

- TR8 = Requests for removal of hazard trees on or adjacent to TVA reservoir land are inspected by staff knowledgeable in identifying hazard trees per International Society of Arboriculture and TVA's checklist for hazard trees. Approval is limited to trees with a defined target.
- TR9 = Internal controls will be in place to further reduce potential for site-specific direct adverse effects to Indiana bat and northern long-eared bat associated with tree removal. This includes promoting presence/absence surveys (mist netting or emergence counts) that allows for positive detections but without resulting in increased constraints in cost and project schedule. Internal controls are intended to facilitate willingness and financial feasibility to conduct surveys amidst increasing budget constraints without the risk for increased financial penalty if Indiana bat or northern long-eared bat individuals are caught. This enables TVA to contribute to increased knowledge of bat presence on the landscape while continuing to carry out TVA's broad mission and responsibilities.

Implementation of the above measures will avoid or minimize direct adverse effects to Indiana bat and northern long-eared bat in most cases. There will be instances, however, when presence/ absence surveys cannot be conducted, tree removal needs to occur outside of winter (i.e., bats present on the landscape) and bats potentially are roosting in trees identified for removal. Tree removal therefore has potential to adversely affect Indiana bat and northern long-eared bat.

5.2.5 Alteration or removal of unconventional roosts (Bridges or Human Structures)

All four bat species are known to use unconventional roosts. Indiana bats and gray bats have been documented in bridges with suitable roost characteristics and Virginia big-eared bat and northern long-eared bat have been observed in old buildings with suitable roost characteristics. Exposure of these species to alteration of unconventional roost sites may occur when modification or demolition to a building or bridge occurs while bats are occupying the structure. Bats are more likely to be found in buildings, structures or sites that are close to suitable foraging habitat (e.g., woodlands, mature trees and hedgerows, water features).

Bats may respond to the stress of structural alteration or demolition by flushing during alteration or demolition, falling to the ground or floor during structure modification or demolition activities (if startled or unable to fly at the time of activity), or being crushed during the activity. This may result in depleted energy stores, possible mortality from injury or inability to fly, and additional use of energy to locate another roost site.

TVA will implement the following avoidance and minimization measures associated with alteration or removal of unconventional bat roosts:

- AR1 = Projects that involve structural modification or demolition of buildings, bridges, and potentially suitable box culverts, will require assessment to determine if structure has characteristics that make it a potentially suitable unconventional bat roost. If so a survey to determine if bats may be present will be conducted. Structural assessment will include:
    - Visual check that includes an exhaustive internal/external inspection of building to look for evidence of bats (e.g., bat droppings, roost entrance/exit holes); this can be done at any time of year, preferably when bats are active.

- o Where accessible and health and safety considerations allow, a survey of roof space for evidence of bats (e.g., droppings, scratch marks, staining, sightings), noting relevant characteristics of internal features that provide potential access points and roosting opportunities. Suitable characteristic may include: gaps between tiles and roof lining, access points via eaves, gaps between timbers or around mortise joints, gaps around top and gable end walls, gaps within roof walling or around tops of chimney breasts, and clean ridge beams.
- o Features with high-medium likelihood of harboring bats but cannot be checked visually include soffits, cavity walls, space between roof covering and roof lining.
- o Applies to box culverts that are at least 5 feet (1.5 meters) tall and with one or more of the following characteristics. Suitable culverts for bat day roosts have the following characteristics:
  - ▪ Between 5 and 10 feet (1.5 and 3 meters) tall and 300 feet (100 meters) or more long
  - ▪ Openings protected from high winds
  - ▪ Not susceptible to flooding
  - ▪ Inner areas relatively dark with roughened walls or ceilings
  - ▪ Crevices, imperfections, or swallow nests
- o Bridge survey protocols will be adapted from the Programmatic Biological Opinion for the Federal Highway Administration (Appendix D of USFWS 2016c, which includes a Bridge Structure Assessment Guidance and a Bridge Structure Assessment Form).
- o Bat surveys usually are NOT needed in the following circumstances:
  - ▪ Domestic garages and sheds with no enclosed roof space (with no ceiling)
  - ▪ Modern flat-roofed buildings
  - ▪ Metal framed and roofed buildings
  - ▪ Buildings where roof space is regularly used (e.g., attic space converted to living space, living space open to rafters) or where all roof space is lit from skylights or windows. Large/tall roof spaces may be dark enough at apex to provide roost space.

- AR2 = Additional bat P/A surveys (e.g., emergence counts) conducted if warranted (i.e., when AR1 indicates that bats may be present).
- AR3 = Bridge survey protocols (per Appendix D in USFWS 2016c) will be implemented, either by permittee (e.g., state DOT biologists) or qualified personnel. If a bridge is being used as an unconventional roost, subsequent protocols will be implemented.
- AR4 = Removal of buildings with suitable roost characteristics within six miles of known or presumed occupied roosts for Virginia big-eared bat would occur between November 16 and March 31. Buildings may be removed other times of the year once a bat biologist evaluates a buildings' potential to serve as roosting habitat and determines that this species is not present and/or is not using structure(s).

- AR5 = If evidence of bat use warrants seasonal modification or removal, TVA will strive to (and in most cases anticipates being able to) accommodate seasonal modification or removal. Risk to human safety, however, will take priority. For project-specific cases in which TVA is unable to accommodate seasonal modification or removal, and federally listed bat species are present, TVA will consult with the USFWS to determine the best approach in the context of the project-specific circumstance. This may include establishment of artificial roosts before demolition of structures with bats present.

Potential impacts from alteration or removal of unconventional roost structures associated with proposed activities are avoided or reduced with implementation of the above measures. Alteration or removal of unconventional roost structures is NLAA bats addressed in this BA.

5.2.6 Sedimentation/Spills/Pollutants/Contaminants

All four bat species rely on water sources for drinking water and (to some extent) prey availability. Inputs of sediment or other pollutants into water sources resulting from adjacent land use activities has the potential to alter water quality, which may in turn degrade drinking water and abundance or quality of available prey sources that require water for a portion of their life cycle (e.g., larval hatching and development in water bodies). Bats may be exposed to the adverse impacts of sedimentation and pollutants when activities with ground disturbance or use of chemicals (or fuels) are conducted near to or adjacent to water sources that these bats use for foraging and drinking. Bats also may be exposed to sediment or pollutants if either of these enter subterranean aquifers and alter the quality of cave roost sites in a way that renders the roost site less inhabitable. Bats may respond to these stressors by experiencing reduced health, reduced feeding success, death, or by seeking alternate sources for drinking, foraging and roosting, which may result in increased energy expenditures.

TVA would implement a variety of BMPs to avoid or reduce inputs of sediment into waterways and cave/cave-like entrances:

- SSPC1 = Transmission actions and activities will continue to Implement A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (Appendix N). This focuses on control of sediment and pollutants, including herbicides. The following are key measures:
    - BMPs to minimize erosion and prevent/control water pollution in accordance with state-specific construction storm water permits. BMPS are designed to keep soil in place and aid in reducing risk of other pollutants reaching surface waters, wetlands and ground water. BMPs will undertake the following principles:
        - Plan clearing, grading, and construction to minimize area and duration of soil exposure.
        - Maintain existing vegetation wherever and whenever possible.
        - Minimize disturbance of natural contours and drains.
        - As much as practicable, operate on dry soils when they are least susceptible to structural damage and erosion.

  - Limit vehicular and equipment traffic in disturbed areas.
  - Keep equipment paths dispersed or designate single traffic flow paths with appropriate road BMPs to manage runoff.
  - Divert runoff away from disturbed areas.
  - Provide for dispersal of surface flow that carries sediment into undisturbed surface zones with high infiltration capacity and ground cover conditions.
  - Prepare drainage ways and outlets to handle concentrated/increased runoff.
  - Minimize length and steepness of slopes. Interrupt long slopes frequently.
  - Keep runoff velocities low and/or check flows.
  - Trap sediment on-site.
  - Inspect/maintain control measures regularly and after significant rain.
  - Re-vegetate and mulch disturbed areas as soon as practical.
- Application of herbicide is in compliance with USEPA, state water quality standards, and state permits. Areas in which covered species are known to occur on existing transmission line ROW are depicted on referenced, applicable spreadsheets and include specific guidelines to follow for impact minimization or avoidance. During pre-job briefings, the ROW Forester will review the location of these resources with contractors and provide guidelines and expectations from TVA's BMP Manual (Appendix N). Herbicides labeled for aquatic use are utilized in and around wetlands, streams, and SMZs. Unless specifically labeled for aquatic use, measures are taken to keep herbicides from reaching streams whether by direct application or through runoff or flooding by surface water. Hand application of certain herbicides labeled for use within SMZs is used only selectively.
- Specific guidelines regarding sensitive resources and buffer zones:
  - Extra precaution (wider buffers) within SMZs is taken to protect stream banks and water quality for streams, springs, sinkholes, and surrounding habitat.
  - BMPs are implemented to protect and enhance wetlands. Select use of equipment and seasonal clearing is conducted when needed for rare plants; construction activities are restricted in areas with identified rare plants.
  - Standard requirements exist to avoid adverse impacts to caves, protected animals, and unique and important habitat (e.g., protective buffers around caves, restricted herbicide use, seasonal clearing of suitable habitat).

- SSPC2 = Operations involving chemical or fuel storage or resupply and vehicle servicing will be handled outside of SMZs and in such a manner as to prevent these items from reaching a watercourse. Earthen berms or other effective means are installed to protect the stream channel from direct surface runoff. Servicing will be done with care to avoid leakage, spillage, and subsequent stream, wetland, or ground water contamination. Oil waste, filters, and other litter will be collected and disposed of properly. Equipment servicing and chemical or fuel storage will be limited to locations greater than 300-ft from, sinkholes, fissures, or areas draining into known sinkholes, fissures, or other karst features.

- SSPC3 = Power plant actions and activities will continue to implement standard environmental practices. These include:
    - BMPs in accordance with regulations:
    - Construction Site Protection Methods
        - Sediment basin for runoff - used to trap sediments and temporarily detain runoff on larger construction sites
        - Storm drain protection device
        - Check dam to help slow down silt flow
        - Silt fencing to reduce sediment movement
    - SWPP Control Strategies
        - Minimize storm water contact with disturbed soils at construction site
        - Protect disturbed soil areas from erosion
        - Minimize sediment in storm water before discharge
        - Prevent storm water contact with other pollutants
        - A storm water permit may be required at construction sites (>1 ac)
    - Each site has a Spill Prevention and Control Countermeasures (SPCC) Plan. Several hundred pieces of equipment often are managed at the same time on power generation properties; goal is to minimize fuel and chemical use.
- SSPC4 = Woody vegetation burn piles associated with transmission construction will be placed in the center of newly established ROWs to minimize wash into any nearby undocumented caves that might be on adjacent private property and thus outside the scope of field survey for confirmation. Brush piles will be burned a minimum of 0.25 miles from documented caves and otherwise in the center of newly established ROW when proximity to caves on private land is unknown.
- SSPC5 = Section 26a permits and contracts associated with solar projects, economic development projects or land use projects include standards and conditions that include standard BMPs for sediment and contaminants as well as measures to avoid or minimize impacts to sensitive species or other resources consistent with applicable laws and Executive Orders.
- SSPC6 = Herbicide use will be avoided within 200 ft of portals associated with caves, cave collapse areas, mines and sinkholes that are capable of supporting cave-associated species. Herbicides are not applied to surface water or wetlands unless specifically labeled for aquatic use. Filter and buffer strips will conform at least to federal and state regulations and any label requirements.
- SSPC7 = Clearing of vegetation within a 200-ft radius of documented caves will be limited to that conducted by hand or small machinery clearing only (e.g., chainsaws, bush-hog, mowers). This will protect potential recharge areas of cave streams and other karst features that are connected hydrologically to caves.

Potential impacts from sedimentation or other contaminants (chemicals, fuels) to the four bat species are avoided or reduced by implementation of the above measures. Sediment and contaminants are NLAA bats species addressed in this BA.

5.2.7 Lighting

Bat behavior may be affected by artificial lighting when traveling between roosting and foraging areas. Foraging in lighted areas may increase risk of predation or it may deter bats from flying in those areas. Bats that significantly alter their foraging patterns may increase their energy expenditures that result in reduced reproductive rates. This depends on the context (e.g., duration, location, extent, type) of the lighting (USFWS 2016c).

Artificial light attracts insects that are phototactic (drawn to light). Some insectivorous bats may be able to identify and exploit insect accumulations and insect clusters at artificial lights and thus may benefit from artificial lighting because resource predictability and high insect densities increase foraging efficiency. Insectivorous bats that hunt in open spaces above the canopy (open-space foragers) or along vegetation edges such as forest edges, tree lines or hedgerows (edge foragers) appear to be those most tolerant of artificial lighting. When foraging at street lights, open-space foragers typically fly above the lamps, diving into the light cone to catch insects, whereas edge foragers generally use echolocation calls (Rowse et al. 2016).

Studies suggest that bat response to artificial lighting is highly variable across species, and attributed to physiology (e.g., wing morphology, size, flight speed), foraging habitat (e.g., open, forest edge, dense vegetation), use of echolocation, and type, duration, and intensity of lighting (Rowse et al. 2016, USFWS 2016c).

TVA would implement a variety of BMPs to avoid or reduce inputs of sediment into waterways and cave/cave-like entrances:

TVA would implement a variety of BMPs to avoid or reduce impacts from artificial lighting:

- L1 = Direct temporary lighting away from suitable habitat during the active season.
- L2 = Evaluate the use of outdoor lighting during the active season and seek to minimize light pollution when installing new or replacing existing permanent lights by angling lights downward or via other light minimization measures (e.g., dimming, directed lighting, motion-sensitive lighting).

Potential impacts from artificial lighting to the four bat species are avoided or reduced by implementation of the above measures. Artificial lighting is NLAA bats species addressed in this BA.

5.2.8 Additional Avoidance and Minimization Measures

TVA would implement the following measures to avoid or minimize the stressors listed above.

- ED1 = Continue to implement a siting process for proposed actions by prospective economic development applicants. This includes the following measures:
    - Landscape-level review on front end to determine existing land use, property ownership, and presence of natural and cultural resources to site an action in a location that results in impact avoidance or minimization

  - Targeted use of sites that have been previously disturbed for use as economic development sites, laydown areas, substations, ROWs.
  - Screening of prospective economic development applicants that targets sites for which environmental due diligence has been completed
  - If potential impacts are identified, actions are modified to avoid impacts to the extent possible.
  - Project-specific habitat assessments are conducted as needed.
- SUR1 = When feasible for a site-specific project, conduct presence/absence summer bat surveys based on the following criteria:
  - Appropriate for projects not located in areas with documented bat occurrence
  - Implement current species-specific USFWS survey guidelines
  - Negative survey results valid for a minimum of two years, subject to new information on habitat suitability; bat-specific conservation measures not mandatory if negative survey results.
- SUR2 = Conduct habitat surveys of suitable cave, karst, or structure (e.g., building, bridge) within project boundaries based on the following criteria:
  - Survey can be conducted any time of year; results are valid for two years if a bridge or other non-natural structure.
  - Survey can include on-site visits and/or review of aerial photos, maps, mining records, forest inventories, or previous surveys.
  - Applies to caves, sinkholes, karst fissures, quarries, mine portals, bridges
  - Applies to ground openings greater than one ft in diameter (and where feasible and where human safety is not at risk).
  - Applies to underground passages that continue beyond dark zone and do not end within 40 ft of entrance.
  - Entrances that are flooded or prone to flooding (i.e., debris on ceiling), collapsed, or otherwise inaccessible to bats are excluded.
  - Ground openings that have occurred recently (i.e., within the past 12 months) or suddenly appear (e.g., sinkholes) due to creation or subsidence are excluded. However, document site with written description and photographs of opening for reporting purposes.
- SUR3 = Conduct seasonal bat presence/absence surveys in suitable cave/ karst/ structural habitat located within project boundaries based on the following criteria:
  - Implement species-specific or habitat-specific survey protocol based on the most current guidance provided by the USFWS.
  - If surveys fail to detect bats, conservation measures for this habitat type are not required.

5.3 Additional Conservation Measures

In addition to implementation of site-specific avoidance and minimization measures to avoid or minimize harm to individual gray, Indiana, northern long-eared, or Virginia big-eared bats, TVA would continue to carry out conservation measures at larger scales. These include population-level initiatives that promote recovery of one or more bat species (e.g., land acquisition, habitat improvement and protection) as well as mission-level holistic and strategic steps that strive to keep environmental stewardship in check with operational and economic goals (e.g., managing lands specifically for sensitive resources).

5.3.1 Population-level Conservation Measures for Recovery and Enhancement

- TVA will continue annual gray bat population census counts at select caves across the TVA region in coordination with other state, federal and non-governmental partners. TVA will continue to provide data annually to the USFWS.

Table 5-11. Monitoring Schedule for Gray Bat Caves on TVA-Managed Lands

Cave	State	Monitoring Frequency		
		Annual	Every Two Years	Every Three Years
Hambrick's	AL	X		
Nickajack	TN	X		
Featherfoot	TN	X		
Norris Dam	TN	X		
Collier	AL			X
Ghost	TN	X		
Quarry	AL		X	
Gross-Skelton	AL			X
Marble Bluff	TN			X
Blythe Ferry	TN		X	
Pennington Cave	TN			X

- TVA will continue to collaborate with partners to survey bridges as requested by partners with known or potential summer use (e.g., maternity colonies) by federally listed partners.
- TVA will develop and continue local/regional cooperative partnerships and support monitoring efforts to learn more about how bats are utilizing communities within the TVA region (e.g., spring migration radio tagging and tracking, location and assessment of roost trees).

- TVA will conduct bat monitoring following bat habitat enhancement projects and establishment of artificial roosts on TVA-managed lands to assess use of habitat and roosts by bats.
- TVA will monitor and maintain gates and signage at caves inhabited by protected bat species and determine the need for establishment of new gates, fences, or signage at other caves important to federally listed bats on TVA lands.
- Continue to serve as a member of state WNS planning committees (e.g., AL, TN). WNS planning efforts will continue to be supported by TVA staff. As information available about WNS is ever changing, current planning and management efforts will be reviewed and revised as appropriate.
- Continue to maintain a database of known locations (i.e., mist net captures, cave, bridge, and tree roosts, etc.) of gray bat, northern long-eared bat, Indiana bat and Virginia big-eared bat within the TVA region. This database will continue to be updated as new information becomes available and used to inform project-specific environmental reviews and BAs.
- Continue to manage invasive plants, including those protect high priority sites where plant invasions threaten rare species habitats (e.g., cave entrances):
    - Identify and prioritize distributions, rates and modes of population expansions, sources of introduction, and ecological significance of invasive species;
    - Identify and prioritize areas requiring invasive species control;
    - Eradicate known substantial seed sources of invasive plants;
    - Develop management alternatives, using native species, to prevent further introduction of non-native species;
    - Employ prescribed burning, manual removal, and chemical control as appropriate for managing invasive species.
- Bat habitat identification workshops will continue to be offered to TVA staff interested in assisting with conducting habitat assessments. TVA bat biologists will continue to maintain oversight in identification and determination of suitable habitat.

5.3.2 Mission-Driven Conservation Measures as part of Policies, Plans and Processes

TVA will continue to carry out its three-pronged mission (Section 1.2.1) of providing low-cost electricity, robust economic development and proactive environmental stewardship, striving to meet environmental standards (including conservation of federally listed species) across the board. TVA will continue to abide by its Environmental Policy (Section 1.2.2), enhancing land and water resources to provide multiple benefits in the TVA region and operating as a steward of the region's natural resources. TVA's IRP (Section 1.2.3) will continue to direct TVA's generation of electricity to meet long-term energy needs of the TVA region while supporting TVA's mandates for environmental stewardship and minimizing environmental impacts from its operations. TVA will continue to work within the framework of its NRP (Section 1.2.4) to balance land use, human activity and conservation of resources to achieve the greatest public benefit. Seventy-eight percent (228,540 ac) of TVA-managed land is allocated for natural and sensitive resource management. Cave gating and protection, habitat improvement and enhancement, and management of Natural Areas important to rare species are focal areas within the NRP framework.

TVA will continue to implement its Land Policy (Section 1.2.5) which spells out exactly how TVA manages the reservoir system and surrounding lands to maximize and balance multipurpose objectives. Reservoir lands remaining under TVA's control are preserved in public ownership except in rare instances where public benefits would be so significant that transferring lands from TVA control to private ownership or another public entity is justified. TVA will continue to implement its SMP (Section 1.2.6) to protect shoreline and aquatic resources while allowing reasonable access to the water by adjacent residents or property owners. Residential development is limited to 38 percent of reservoir shoreline. TVA will continue to carry out a rigorous environmental review process (Section 1.2.7) at multiple levels to ensure compliance with the NEPA, ESA, and other environmental regulations.

While, these plans and policies do get revised from time to time, the underlying mission of environmental stewardship will remain.

Table 5-2. Summary of Effects Analysis

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
1	Loans and/or grant awards	Financial transaction	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
2	Purchase of property	Financial transaction	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
3	Purchase of equipment for industrial facilities	Financial transaction	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
4	Environmental education	Varies (e.g., public interactions, campaigns, supply of info for other outreach programs).	Intermittent, Daytime, Nighttime	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
5	Transfer of ROW easement or equipment	Paperwork transaction that documents transfer between TVA and LPCs. Property stays as is (status quo maintained). Environmental studies may be an associated activity.	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
6	Property and/or Equipment Transfer	Paperwork transaction that documents transfer, between TVA and recipient. Status quo will be maintained as is.	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
7	Easement on TVA property	Paperwork transaction. Recordable document (term or permanent) to convey interest (e.g. utility lines, roads, industrial, etc.).	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
8	Sale of TVA property	Paperwork transaction. Recordable instrument used to convey fee ownership (e.g. industrial).	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE
9	Lease of TVA property [LANUSEDIS]	Paperwork transaction. Term contract agreement used to transfer possession and authorize specific uses of TVA land (e.g., public and commercial recreation).	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE
10	Deed modification of TVA rights or property	Paperwork transaction to release or modify rights, covenants, or restrictions contained in deed provisions (e.g. modification of navigation or flowage easement rights).	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE
11	Abandonment of TVA retained rights	Paperwork transaction that releases certain TVA land rights (e.g., abandonment of flowage rights).	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE
12	Sufferance Agreement	Paperwork transaction and revocable agreement that allows unauthorized structures to remain on TVA land under specific conditions.	None. This activity does not affect the physical environment but may be combined with other activities that affect the physical environment.	None	N/A	*IB*:NE *NB*:NE *GB*:NE *VB*:NE

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
13	Engineering or environmental planning or studies	Nondestructive site characterization, data collection, study, inventory, planning, and monitoring activities.	No ground disturbance or tree removal. Variable: Intermittent, Daytime, Nighttime. May occur near water or roosts.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
14	Harbor limits	Delineation via map (paperwork or electronic transaction) that identifies area a commercial marina or large industrial operation is eligible to use for constructing facilities. Defines boundary that has been reviewed and determined by TVA navigation staff as acceptable for current and/or future operation.	No ground disturbance or tree removal.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
15	Windshield or ground surveys for archaeological resources	Conducted to determine presence of archaeological sites. Survey locations sometimes include rock shelters and caves. Includes sieves, small shovels, and small hand-held augers	Limited ground disturbance. No tree removal. Typically lasts 1 to 2 days/site, with 10 to 25 surveys/year.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Bats may respond to the stress of human presence (detected by smell, movement and/or noise) by altering their normal behavior patterns (e.g., frequency of arousal, sudden flushing from roost, avoidance of a flight path or foraging area). This may result in potentially depleted energy stores, predation, or mortality.	1. NV1 2. HP1, HP2	*IB:*NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
16	Drilling	Transport, set up and use of drill rigs in subsurface conditions. Includes analysis, design, construction, repair of foundations, slopes, retaining structures, embankments, roadways, tunnels, levees, landfills, and other systems made or supported by soil or rock.	May occur near water or roosts (caves or trees).	1. Noise (vibrations) may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Potential impacts to integrity of roost site (e.g., fractures to cave) that compromises use or quality of cave for roosting, resulting in the need for bats to find an alternate site. 3. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 4. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2, NV4 2. NV3 3. SSPC1, SSPC2, SSPC3 4. L1, L2	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA
17	Mechanical vegetation removal; does not include removal of trees or tree branches three inches in diameter or greater.	Component of grounds-keeping activities, habitat or weed management, maintenance pf regulatory/safety clearance under transmission lines (TLs), substations, and access roads; risk avoidance to human safety and outages.	Daytime, one to several days. May occur near roost trees, caves, bridges, roads.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sedimentation and contaminants that degrade drinking water and reduce insect prey availability, resulting in reduced feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5, SSPC7	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
18	Erosion control - minor	Gravel, riprap placement, reseeding, or revegetation on slopes, where minimal grading or preparation is required.	Daytime, year-round. One to several days. No tree removal. May occur near caves, bridges, roost trees.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sediment input that degrades drinking water and reduces insect prey availability, resulting in reduced feeding success. 3. Sediment decrease into water sources by tree planting that stabilizes ground, improves water quality, drinking water and prey availability.	1. NV1 2. SPCC1, SSPC2, SSPC3, SSPC5	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA
19	Site-specific enhancements in streams and reservoirs for aquatic animals	Spawning benches, fish attractors, mussel culturing rafts, typically used by commercial operators in pearl industry or wildlife agencies.	Daytime, 1-2 days. No tree removal. Potential to occur near caves, bridges or water.	None	None	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
20	Nesting platforms	Typically installed over open water as an artificial nest structure for birds. Also may include wood duck boxes along shoreline.	1 to 2 days to build. No tree removal. Typically near water, could occur near caves and bridges.	None	None	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
21	Herbicide use	Vegetation maintenance. Applied with a hand sprayer or backpack applicator. May be combined with other activities (e.g., removal of exotic trees, addressed in #27 or #34).	Duration varies across actions. Could occur near caves, bridges, water, roost trees.	1. Reduction in woody vegetation could create forest openings and roost trees (snags), resulting in habitat improvement and creation. 2. Herbicide that is not approved for use around water could degrade water quality and harm aquatic fauna, reducing prey	2. SSPC1, SSPC2, SSPC3, SSPC5, SSPC6, SSPC7	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				availability and quality of drinking water.		
22	Grubbing	Removal (to a depth of approximately 12 inches) and disposal of brush, stumps, and roots.	Daytime, days to weeks. No removal of standing trees. Could occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sedimentation that degrades drinking water and reduces insect prey availability, resulting in reduced feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5	*IB:* NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
23	Prescribed burns	Maintain/establish wildlife habitat, reduce leaf litter and ground cover that fuel wildfires, stimulate growth of targeted vegetation, recycle nutrients back into soil, suppress woody growth and exotic plants Burn: 750-1000 ac/yr; Cumulatively:26,247 ac (8,570 ac planned; 17,677 ac potential).	Daytime; 1-5 days up to 2 weeks per burn, 5-10 burns/yr. Fall, winter, spring; Primarily early winter to early spring (Nov–Mar). Possibly Sep - Oct for woody suppression but limited by weather. May occur near bridges, caves, roost trees.	1. Exposure to smoke inhalation, heat and fire while roosting in trees or caves may result in increased energy expenditure (flushing), harm (trouble breathing or burns), or death (fatal burns). 2. Fire throughout the year (even when bats are not present on the landscape) may create roost sites (snags, tree damage) and improved foraging (forest openings), increasing habitat availability. 3. Fire and preparation of fire breaks throughout the year (even when bats are not present on the landscape) may damage/destroy roost trees increasing energy use to locate a new tree. 4. *S*ediment into aquatic features may occur during plowing of fire breaks, degrading water quality and subsequent drinking water and prey availability.	1. SHF1, SHF2, SHF3 3. SHF4 4. SHF5, SHF6	*IB:* LAA *NB:*LAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
24	Tree planting	May involve use of shovels, tractor, bush-hog, saplings, seedlings. May be combined with other activities (e.g., herbicide (#22), tree removal (#34)	Daytime. Potential for tree removal and to occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal, flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment increase into waterways and caves may occur during planting, degrading water quality, drinking water and prey availability. 3. Sediment decrease into waterways via tree planting that stabilizes the ground, improving water quality, drinking water and prey availability. 4. Increase in forest cover that eventually may become suitable habitat (roost trees, foraging sites).	1. NV1 2. SSCP1, SSPC2, SSPC3, SSPC5	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA
25	Maintenance, improvement or construction of pedestrian or vehicular access corridors	Access roads, parking areas, trails. Includes clearing, paving, or graveling. May include bulldozer, boom truck, track hoe, rock, chainsaw, small bobcats, tractors, chainsaws, erosion control structures, hand tools. May be combined with vegetation removal (#27, #33, #34) or grading (#36).	Daytime, 2-5 times/year; 2 days-6 weeks. Potential to occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal, flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment into waterways and caves may occur during plowing of fire breaks, degrading water quality and subsequent drinking water and prey availability.	1. NV1, NV2 2. SSPC1, SSPC2, SSPC3, SSPC5, SSPC7	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
26	Maintenance or construction of access control measures	Placement and maintenance of barricades to maintain, improve or control access for safety, security, protection of sensitive resources; Equipment may include heavy-gauge steel, welding materials, heavy equipment, post-hole drivers, light duty trucks , hand-held auger or other equipment, bobcats, tractors, downed trees, concrete, ballards, guard rails, rebar, trenches/tank traps. May be combined with vegetation removal (#27, #33, #34).	Occurs during daytime, 2 days-6 weeks at one site, and 2-5 times per year. Potential to occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal, flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Bats may respond to the stress of human presence (detected by smell, movement and/or noise) by altering their normal behavior 3. *S*ediment into waterways and caves may occur during plowing of fire breaks, degrading water quality and subsequent drinking water and prey availability. 4. Placement of control measure (e.g., cave gate) may improve fitness by reducing disturbance resulting from frequent human entry. 5. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2, NV3, NV4 2. HP1, HP2 3. SSPC1, SSPC2, SSPC3, SSPC5, SSPC7 5. L1, L2	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA
27	Restoration of sites following human use and abuse	Sites in poor condition from human use are restored. May involve landscaping, gravel, bobcats, tractors, hand tools. May be combined with another activity tree removal (#27 or #34).	Occurs during the daytime, over 1-2 weeks/site. May occur near caves, bridges, water, roost trees.	1. Noise may alter normal behavior pattern (flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment increase into waterways may occur, degrading water quality, drinking water and prey availability. 3. Sediment decrease into waterways via restoration that stabilizes ground, improves water	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC7	*IB:* NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				quality, drinking water, prey availability.		
28	Removal of debris (e.g., dump sites, hazardous material, unauthorized structures)	Removal/disposal of debris. May involve tractors, bobcats. May be combined with vegetation removal (#27 or #34) though unlikely.	Daytime. Potential to occur near caves, bridges, water, roost trees.	1. Noise may alter normal behavior pattern (flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment increase into waterways and caves may occur, degrading water quality, drinking water and prey availability. 3. Sediment decrease into waterways via restoration that stabilizes the ground, improving water quality, drinking water and prey availability.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC7	*IB:* NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
29	Acquisition and use of fill/borrow material	Earthen material used to reach desired elevation. May include use of bulldozer, track hoe, backhoe, feller buncher, bush-hog, scrapper. May be combined with other activities such as vegetation removal (#34). Tree removal possible but unlikely.	Activity occurs during daytime with a duration of days to weeks. . Potential for occurrence near caves, bridges, water, roost trees.	1. Noise may alter normal behavior pattern (flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment increase into aquatic features may occur, degrading water quality, drinking water and prey availability.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC7	*IB:* NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
30	Dredging and excavation; recessed harbor areas	Targets inundated substrate to deepen a channel or harbor for boat access. Can occur inland to create additional shoreline. Recessed harbor areas are expansion of commercial or industrial operations to provide increased water surface. Minor potential to	Occurs during daytime. May occur near caves and bridges.	1. Noise may alter normal behavior pattern (flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. *S*ediment increase into aquatic features may occur, degrading water quality, drinking water and prey availability.	1. NV1 2. SSPC2, SSPC3, SSPC5	*IB:* NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		combine with activity #34 (tree removal).				
31	Stream/wetland crossings	Stabilized area or structure across a stream or wetland to provide a pathway for people, livestock, equipment or vehicles. Can improve water quality and reduce erosion, or manage livestock. Vehicular access crossings are up to 20-ft-wide. May be combined with #27 or 34 (tree removal), but this is unlikely to minimal.	Activity occurs during daytime. Potential to occur near caves and bridges.	1. Noise may alter normal behavior pattern (flushing from roost), resulting in potential depleted energy stores, predation and mortality. 3. Sedimentation and contaminants that degrade drinking water and reduce prey availability, resulting in reduced feeding success.	1. NV1 3. SSPC1, SSPC2, SSPC3, SSPC5, SSPC7	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
32	Clean-up following storm damage	Removal of downed and wind-thrown trees. May involve ground disturbance, vegetation modification, and small and heavy equipment. May be combined with #27 or #34 (potential for tree removal).	Daytime, 2-5 days or longer. Frequency based on weather, May occur near caves, bridges, water, roost trees.	1. Noise may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation, mortality. 2. Sediment and contaminants that degrade drinking water and reduce prey availability, resulting in reduced feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC4, SSPC7	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
33	Removal of hazardous trees or tree branches	Conducted to address threats to public safety, human facilities, private property, integrity of TL operation and maintenance. May occur at day use areas, campgrounds, access corridors to TVA reservoirs, ROWS, etc. May include use of feller buncher, bulldozer, bush-hog, chainsaw, other hand tools, limited hand clearing.	Occurs during daytime throughout the year, with potential to occur near caves, bridges water, roost trees.	1. Noise may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Removal of roost tree(s) throughout the year (even when bats are not present on the landscape) may cause arousal, flushing, and habitat loss, resulting in depleted energy stores, possible mortality from injury or inability to fly (non-volant juveniles), and additional use of energy to locate	1. NV1 2. TR1, TR2, TR3, TR4, TR5, TR6, TR7, TR8, TR9 3. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5, SSPC7	*IB*:LAA *NB*:LAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				other roost trees. 3. Sedimentation and contaminants that degrade drinking water and reduce prey availability, resulting in reduced feeding success.		
34	Mechanical vegetation removal, includes trees or tree branches three inches or greater in diameter	Vegetation removal for public or recreational use, habitat management or enhancement; building or road establishment; lawn maintenance; construction of TLs, substations, and access roads. Equipment includes feller buncher, bull dozer (tracked or untracked), track or bucket hoe, bush-hog, scrapper, mower, logging and boom trucks, and chainsaw.	Daytime, Year-round, days to weeks. May occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Removal of roost tree(s) throughout the year (even when bats are not present on the landscape) may cause arousal, flushing, and habitat loss, resulting in depleted energy stores, possible mortality from injury or inability to fly (non-volant juveniles), and additional use of energy to locate other roost trees. 3. Sediment and contaminant input that degrade cave habitat and drinking water and reduce prey availability, resulting in reduced feeding success.	1. NV1 2. TR1, TR2, TR3, TR4, TR5, TR6, TR7, TR8, TR9 3. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5, SSPC7	*IB:*LAA *NB:*LAA *GB:*NLA A *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
35	Stabilization (major erosion control)	For erosion, shoreline undercutting, protection wave/ wake action, seeps, sinkholes, breeches, standing water, exposed archaeological resources. May include excavation, shaping, riprap, barge, dump truck, retaining walls, breakwaters track hoes. May be combined with other activities (veg. removal: #27, #34; or grading: #36)	Daytime; two days to two weeks. Several times a year at different locations with potential to occur near caves, bridges water, roost trees.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sediment input that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5, SSPC7	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
36	Grading	Excavation of earthen material to reach a desired elevation (e.g. to facilitate public access, use, camping pads, habitat restoration and management, substations, access roads, crane pads, buildings). Involves ground disturbance and possibly heavy equipment. May be combined with vegetation removal (#27, #33, #34) or access (#25).	Occurs during daytime, 2-5 days to 2 weeks/site, several times a year. May occur near caves, bridges, water, roost trees.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC4, SSPC5, SSPC7 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
37	Installation of soil improvements	Installation of material (grout, concrete) below the surface to increase stability at operational facilities. May be combined with drilling (#16) and vegetation removal (#27, #33, #34).	May occur near water. Occurrence near caves or bridges is unlikely. Occurs during day over several weeks.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sediment runoff and contaminant input that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2 2. SSPC1, SSPC2, SSPC3, SSPC7 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
38	Drainage installations (including for ponds)	To repair/install drains at ponds. Includes detention, retention, piping; enables pond closure, safety improvements, and creation of a new pond. A backhoe, pipes, trucks, and rock may be used. NOTE: May be combined with other activities (vegetation removal: #27, #33, or #34).	Occurs during daytime, from several days to several weeks.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Sediment runoff that degrades drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC7 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
39	Berm development	Earthen or sod wall. May be combined with other activities (e.g., vegetation removal: #27, #33, #34.	May occur near caves, bridges, water, roost trees. Daytime, days to weeks.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water	1. NV1 2.SSPC1, SSPC2, SSPC3 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.		
40	Closed loop heat exchangers (heat pumps)	Involves connection of a water line from a heat exchanger coil system to a home heat pump. Line would be placed in a trench on TVA land within an approved access corridor or across already-cleared property. Coil systems often are placed beneath boat docks.	Potential to occur near caves, bridges or water. Installation occurs during the daytime throughout the year.	1. Sediment runoff and contaminant input that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
41	Minor water-based structures	Examples: floating play equipment (e.g., within a buoy line near a beach area), slalom courses and floating ski jumps (e.g., weighted with anchors, placed over deep water, away from shore), inflatable slides, trampolines, floating signs (e.g., on floating platforms anchored at mouth of an embayment).	Installation occurs during daytime, includes typical dock building and anchoring equipment, and does not involve tree removal. Structures may remain in place seasonally or permanently.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
42	Internal renovation or internal expansion of existing facility	Internal improvements to existing facilities. No changes to surrounding landscape.	May occur anytime throughout the year over several days to several months.	None	None	*IB:* NE *NB:* NE *GB:* NE *VB:* NE

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
43	Replacement or removal of TL poles	Replace or remove individual power poles along TL ROW. Component of infrastructure maintenance or upgrade. Use of utility trucks and crane typically is involved. This activity may be combined with other activities such as vegetation removal or hazard trees (#27, #33, #34).	Occurs during daytime over days to weeks.	None	None	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
44	Replace or install TL conductor or overhead ground wire	Replacement or repair of conductor. Involves use of utility trucks, a crane, helicopter, pulling equipment.	Occurs during daytime over days to weeks.	None	None	*IB:* NE *NB:* NE *GB:* NE *VB:* NE
45	Stream monitoring equipment-placement, use	Installed for research purposes, typically to bridges.	Occurs near/on bridges and water; may occur near caves, roost trees. Daytime installation.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality.	1. NV1	*IB:* NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA
46	Floating boat slips within approved harbor limits	Located within the reservoir pool as part of a community facility or commercial marina.	No tree removal. Daytime installation, year-round. May occur near caves and bridges.	1. Sediment runoff and contaminant input degrading cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. SSPC5	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA
47	Conduit installation	Installation of conduit and/or cable trench to provide pathway for fiber optic cable, control cable, metering equipment, etc., at telecommunications or substations sites. Involves use of vibratory plow, ditch witch, and other equipment. May be combined with other activities such as vegetation	Occurs during daytime over days to weeks.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality.	1. NV1, NV2	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		removal. (#27 and #34) at new sites.				
48	Laydown areas	Typically an existing graveled area for worker assembly, vehicle parking, material storage. May include additional gravel placement, fence construction. May be combined with veg removal (27, 34).	Occurs during daytime across days to weeks. May occur near bridges, water caves, roost trees.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff and contaminant input that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC1, SSPC2, SSPC3 3. L1, L2	*IB:*NLAA *NB:*NLAA *GB:*NLA A *VB:*NLAA
49	Non-navigable houseboats	Permitting (paperwork) transaction to resolve existing non-navigable houseboats built outside of 26a regulations or not previously approved. Located within reservoir pool. No new non-navigable houseboats will be allowed.	No ground disturbance is involved. There is potential to occur near caves and bridges.	None	N/A	*IB:* NE *NB:* NE *GB:* NE *VB:* NE

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
50	Minor land-based structures	Steps, walkways, landings, patios, picnic tables, gazebos, terraces, enclosed storage space, benches, pavilions, trash containers, bird boxes, unconventional bat roosts, fish cleaning stations. May require minor ground disturbance and use of bobcat, tractor, shovel, hammer, nails. May be combined with vegetation removal (#27, #34) although tree removal unlikely to rare and minimal.	Structures typically built during daytime over one to several days, may occur near caves, bridges or water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant input that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NNV1 2. SSPC1, SSPC2, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
51	Signage installation	To inform, identify, direct, instruct, interpret, advertise. Locations include within road/TL ROW, industrial parks, public lands, licensed/leased property. May include wooden or metal posts, use of a tractor, shovel, posthole diggers or PTO augers, hand tools. May be combined with vegetation removal (#27 or #34) for brush removal with hand tools. Typically no tree removal involved, ranging from none to unlikely to minimal.	Daytime installation over 1 day, several times/ year, different locations. May occur near caves, bridges, or water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
52	Floating buildings	Constructed in reservoir or along shoreline (e.g., restaurants, shipstores, storage, restrooms, boathouses). Potential for tree removal is low but possible if needed to construct a walkway. May be combined with vegetation removal (#27 or #34) where construction or shoreline vegetation removal is needed for a walkway; potential for tree removal is low.	May occur near caves and bridges. Installation occurs during daytime.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2 2. SSPC2, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
53	Mooring buoys or posts	Placed in reservoirs adjacent to shoreline for mooring of deep draft watercraft and used as low-cost alternative for moorage for smaller vessels. If vegetation removal (including trees) is needed activity will be combined with #27, #33 or #34. Potential for tree removal is low to unlikely.	Potential to occur near caves and bridges. Installation occurs during daytime and may occur year-round.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
54	Maintenance of water control structures (dewatering units, spillways, levees)	May include structural maintenance, vegetation management, and material placement to fix eroded areas (e.g., rock armoring). May involve trucks, rock, bulldozer, barge, track hoe, backpack or UTV sprayers, bush-hogs, cranes, concrete trucks, other heavy equipment (bobcats, tractors) and include replacement or modification to modern standards.	Occurs annually (one-half to several days per structure or site), during daytime, and near water. May occur near caves, bridges, or roost trees. Tree removal ranges from none to minor.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Roost tree removal that causes arousal, flushing, and habitat loss, resulting in depleted energy stores, possible mortality from injury or inability to fly (non-volant juveniles), and additional use of energy to locate other roost trees. 3. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. TR1, TR2, TR3, TR4, TR5, TR6, TR9 3. SSPC2, SSPC3, SSPC5, SSPC6, SSPC7	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA
55	Solar panels	Rooftop solar panels on private floating docks or land-based structures. If needed, would be combined with #27 or #34.	Potential to occur near caves, bridges, water. Installation during daytime throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 3. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC2, SSPC3, SSPC5, SSPC7	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
56	Culverts	Occurs in perennial, intermittent and/or ephemeral streams or drainage ditches for pedestrian and vehicular use to access public use areas, operational facilities, and infrastructure.	Installation occurs during the day, could occur anytime throughout the year, and may include use of a backhoe. Occurs in water. No tree removal.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2.Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC1, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
57	Water intake - non-industrial	Examples include small portable farm irrigation systems and residential pumps for watering (typical pumping capacity is less than 50,000 gallons/day. Low potential for ground disturbance and vegetation modification. Low potential for tree removal. Combined with #27 or #34 if needed.	Potential to occur near caves and bridges. Potential to occur near water. Activity is seasonal, installation occurs during daytime.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 3. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1. 3. SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
58	Wastewater outfalls	Typically permitted to municipalities or specialized industries that produce treated wastewater effluent. Removal of shoreline vegetation fairly limited but possible. Vegetation removal typically limited unless laydown area and access corridor are needed. If so, would be combined with #27 or #34.	Occurs in and near water. Potential to occur near caves and bridges.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
59	Marine fueling facilities	Associated with commercial marinas or industrial operations for fueling equipment. Pumps usually on floating docks. If vegetation removal needed this activity would be combined with #27 or #34.	Occur on water and have potential to occur near caves and bridges. Installation occurs during the daytime.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC2, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
60	Commercial water-use facilities (e.g., marinas)	Docks, access walkways, piers, boathouses, launch ramps, and marine rails that are located along reservoir shoreline. When new development is involved, minor vegetation management could be required (chainsaw, hand tools, boom trucks). May be combined with other activities (e.g., #27, #34).	May occur near caves and bridges. Installation typically occurs during daytime.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC2, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
61	Septic fields	Installation or repair of septic tank or field lines, and/or installation of subsurface septic drainage system for wastewater treatment/disposal at substations and other operations facilities. Includes use of backhoe, ditch witch, truck, other possible tools. Areas with trees are avoided due to complications with impacting soil structure. If needed, would be combined with #27 or #34	Very low potential for tree removal. Installation occurs during daytime and may last days to weeks. .	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
62	Blasting	Method to excavate in hard rock environments where other methods cannot be used due to solid or significant rock. Examples: channel excavation for new lock, tunneling for low level water outlet at a dam, water intake, bridge construction or removal, grading, foundation construction for substations and structures, highway construction.	May occur near water or roosts (caves or trees).	1. Noise (vibrations) may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Potential impacts to integrity of roost site (e.g., fractures to cave) that compromises use or quality of caves for roosting, resulting in the need for bats to find an alternate site. 3. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 4. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2, NV4 2. NV3 3. SSPC1, SSPC2, SSPC3 4. L1, L2	*IB:* NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
63	Foundation installation	Installation of foundations that support substations, structures, equipment. Involves heavy equipment including auger and concrete truck. Any tree removal is addressed as a vegetation removal activity (#27, #34).	Occurs during daytime over days to weeks.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2. SSPC1, SSPC2, SSPC3,	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
64	Installation of steel structure, overhead bus, equipment, etc.	Substation structure and equipment installation. May involve use of forklift, crane, or other heavy equipment. Any tree removal addressed as vegetation removal (#27, #34).	Occurs during daytime over days to months.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NNV1, NV2 2. SSPC1, SSPC2, SSPC3	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
65	Pole and/or tower installation and/or extension	Installation of new TL pole or structure to support TL conductor (change out of pole size for a taller structure to allow for more clearance). Involves use of crane and typical excavation techniques).	Occurs during daytime over days to weeks.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2. SSPC1, SSPC2, SSPC3	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
66	Private, residential docks, piers, boathouses	Typically occur on reservoir, constructed on shoreline with deeded or implied access rights to TVA-managed lands. Construction may involve medium-sized equipment (i.e., tractors, small excavators with buckets, pile	Occurs on or near water; may occur near roost trees, caves, bridges. Installation typically occurs during daytime, anytime during the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey	1. NV1 2. SPCC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		driving equipment). Activity has potential to include, electrical connections, water intake, boat lifts, ground disturbance. If vegetation removal needed will be combined with #27 or #34.		availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.		
67	Siting of temporary office trailers	Temporarily placed on the ground to support work at a site and provide office facilities, restrooms, meeting space. Bulldozer, trucks, and rock are involved in trailer placement. When possible, open areas that do not require clearing are sited. Any tree clearing (minor potential) would be addressed as part of #27 or #34.	Some potential work near water or roost trees, but not near caves or bridges.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC1, SSPC2, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
68	Financing for speculative building construction	Building constructed by funding recipient for lease or option to purchase. May include building pad establishment. The need for tree is rare and would be addressed as part of #27 or #34.	Buildings typically constructed in existing industrial property already prepped. Occurs during daytime over days - months. May occur near water, roost trees or caves.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
69	Renovation of existing structures	Upgrades to existing structures; may involve changes to surrounding landscape and use of bull dozer, track hoe, other heavy equipment. Any vegetation removal addressed in #27 or #34	May occur near caves, bridges, or water, or roost trees. Occurs during day and may take weeks to months to complete.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1a. NV1 1b. AR1, AR2, AR4, AR5 2.SSPC1, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
70	Lock maintenance and construction	Conducted to improve navigability, increase lock times and improve safety. Includes expansion of existing locks, construction of locks to increase navigation, and maintenance of existing locks. Any vegetation removal would be addressed in #27 or #34.	May occur near caves and bridges. Occurs during the day, throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2.SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
71	Concrete dam modification	Address structural issues (seepage), minimize potential for failure from overtopping, prevent increase in flooding (e.g., concrete floodwalls, raised earthen embankments. May involve silt fence, straw waddles, erosions eels, rock check dams, concrete	May occur near bridges, and work near water features.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2.SSPC2, SSPC3	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		washout areas, seeding and mulch to restore vegetation. May be combined with grouting (#37) structural support downstream and vegetation removal (#27 or #34).				
72	Ferry landings/service operations	Typically concrete ramps, access road, small parking area. Primarily would be reestablishing service or upgrades of existing landings. May be combined with vegetation removal activity (e.g., #27 or #34).	Potential to occur near caves, bridges or water. during daytime throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2. SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
73	Boat launching ramps	Established perpendicular shoreline to allow boat entry/exit into reservoir. Typically concrete with road access and parking areas, with potential parking expansion or stabilization around ramp. Any vegetation removal addressed as part of relevant veg removal activity (e.g., #27, #34).	Placement of ramps occurs during daytime, throughout the year, with potential to occur near roost trees, caves and bridges.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2.SSPC2, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
74	Recreational vehicle campsites	Gravel or concrete pads with utility post for water and electric hookup, and possibly waste disposal utilities. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).	Potential to occur near caves, bridges and water. Establishment typically occurs during daytime throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SPCC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
75	Utility lines/light poles	Requests for installation of power lines and poles to serve minor water-use facilities. May be underground or aerial. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).	Lines may be established near caves, bridges or water. Installation typically occurs during daytime, throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1 2.SPCC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
76	Concrete sidewalk	May be established or maintained at operational facilities, or requested by landowners adjacent to TVA-managed land as a means to cross TVA-managed land to reach shoreline.	Potential to occur near caves, bridges or water. Installation typically occurs during daytime over several days.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
77	Construction or expansion of land-based buildings	Construction of buildings that support operations or are requested via Land Use or 26a permitting (e.g., industrial buildings, restrooms, buildings for storage, maintenance equipment, and recreational watercraft). Any vegetation removal addressed as part of the relevant activity (e.g., #27, #34).	Could occur near roost trees, caves, bridges and water. Occurs during daytime.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1a. NV1 1b. AR1, AR2, AR5 2.SSPC2, SSPC3, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
78	Wastewater treatment plants	May include ground disturbance, installation of new infrastructure, water use and vegetation modification. Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).	There is potential for activity to occur near water, and although unlikely, near caves and bridges.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. NV1, NV2 2.SSPC2, SSPC5 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
79	Swimming pools and associated equipment	Requests for swimming pools are received via permitting requests by adjacent landowners (typically residential). Any vegetation removal would be addressed as part of the relevant activity (e.g., #27, #34).	May occur near roost trees, caves, bridges, or water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Pool and associated lighting may serve as source of drinking water and insect foraging. 4. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy expenditures and reduced reproduction.	1. Noise expected to be short-term and not significantly different from urban interface or natural events that bats are frequently exposed to when present on landscape; bats thus are unlikely to be disturbed. 2.SSPC5 4. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
80	Barge fleeting areas	Permitted to marine industry, industrial, federal mooring operations or used by TVA facilities. Occurs along reservoir shoreline where	May occur near caves and bridges. Construction typically occurs during daytime	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades	1. NV1, NV2 2.SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		barges can safely park. Secured through spud poles, lashings or mooring posts. Several types (e.g., mooring cells made of steel sheet piles backfilled with aggregate, pile-driven mooring posts, or concrete deadmen anchors buried on shoreline and used to secure barges to shore with large cables). Vegetation removal may be required. Not likely for mooring cells or other structures that can be anchored into substrate independent shoreline. Any vegetation removal would be addressed as part of other activities (e.g., #27, #34).		cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.		
81	Water intakes - Industrial	May be requested by large farms, golf courses, municipalities or industrial operations. Intakes are considered industrial if 50,000 gallons/day exceeded. Intake pipe diameter is minimum 3 in. but usually greater than 6 in. May be combined with other activities (directional boring, #83, or vegetation removal, #27 or #34).	Potential to occur near roost trees, caves and bridges and will be close to water. Installation during the day.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC2, SSPC3, SSPC5	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
82	Construction of dam/weirs/ Levees	Either on-reservoir (TVA or a partnering development agency) or off-reservoir (private land owners or wildlife agencies for recreation use, flood control, wildlife management, farm ponds). Purpose may be to replace or modify structures to meet modern standards. Heavy earth-moving equipment (e.g., cranes, track hoes, concrete trucks) likely involved. Would be combined as needed with appropriate vegetation removal activity (e.g., #27, #34).	Typically with daytime installation. Occurs on/near water, with potential to occur near caves and bridges.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2.SPCC2, SPCC3, SPCC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
83	Submarine pipeline, directional boring operations	Typically requested by municipalities for water or natural gas lines that are constructed using directional boring equipment (big and small) to cross streams or rivers. Could include use of a laydown area to stage drilling equipment. Activity would be combined as needed with drilling (#16) stream crossings (#31) and vegetation removal (e.g., #27, #34).	Activity has potential to occur near roost trees, caves, bridges and water and takes place during the day.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2 2.SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
84	On-site/off-site public utility relocation or construction or extension	Conducted to accommodate site development as part of economic development efforts. May also occur as component of establishing a new TL. Activity would be combined as needed with other activities such as vegetation removal (e.g., #27, #34).	Occurs during daytime over several days to several weeks. May occur near roost trees, caves, bridges or water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC1, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
85	Playground equipment - land-based	Permitted at public parks, marinas, and campgrounds. Trees may need to be removed depending on site conditions and availability of flat ground, but is often avoidable. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	Potential to occur near roost trees, caves, bridges, and water. Installations occur during day, year round.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2. SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
86	Landfill construction	Involves bulldozers, track hoes, dump trucks, water trucks. Installation of liner may require seaming machines. New landfill may be needed to replace an existing landfill, for additional waste, or storage of dry coal ash. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34, grading - #36).	May occur near water, caves or bridges. Construction occurs during daytime and may take weeks to months to complete.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success. 3. Lighting may increase predation or alter behavior (deterrence) resulting in increased energy	1. NV1, NV2 2. SSPC2, SSPC3 3. L1, L2	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				expenditures and reduced reproduction.		
87	Aboveground storage tanks	May be installed at operational facilities or permitted by TVA. Typically are used for storing fuel at marinas but requests for approval to store a different product is possible. Storage typically is for an industrial operation; contents range from water to chemicals. Spill plans are required for fuel tanks with capacity above 1,320 gallons. Potential for tree removal is low but possible if associated with new development. Would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	Potential to occur near roost trees, caves, bridges or water. Installation during daytime throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NNV1 2. SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLAA *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
88	Underground storage tanks (USTs)	Tanks are 20,000 gallons or less, involve excavation of a hole, and setting of tank with a crane. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	Potential to occur near roost trees, caves, bridges, water. Placement occurs during anytime throughout the year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC2, SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
89	Structure demolition	Structure demolition down to (or up to) surrounding grade. May occur along TL ROW or plant facility. Disturbed areas would be vegetated with topsoil, grass seed. Incudes removal of hazardous material. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	May occur near caves, bridges, or water. Following demolition, there is potential for natural regeneration of vegetation or planting of trees. Typically occurs during daytime; completion could take weeks to months.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Post-demolition natural regeneration or tree planting may provide future suitable roost habitat, increasing roost options. 3. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. AR1, AR2, AR4, AR5 3.SSPC1, SSPC2, SSPC3	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
90	Pond closure	Include water treatment, gypsum and chemical ponds. Involve several phases: preliminary site exploration, dewatering, decommissioning, disconnecting. May include capping and revegetation. Activity would be combined as needed with other activities (e.g., tree planting -	May occur near caves, bridges, other water bodies. Conducted during daytime. May take weeks-months to complete.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Post-pond closure natural regeneration or tree planting may provide future suitable roost habitat, increasing roost options. 3. Sediment and contaminant runoff that degrades cave habitat and drinking water and reduces	1. NV1 3.SSPC2, SSPC3	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		#24, vegetation removal - #27, #34).		prey availability, resulting in reduced health and feeding success.		
91	Bridge replacement	May occur at TVA operational facilities or submitted as a 26a permit request as part of a transportation project (e.g., state departments of transportation). Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	May occur near roost trees and caves. By nature of activity, will occur near bridges and water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1, NV2, AR1, AR2, AR3, AR5 2.SSPC3, SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLAA *VB*:NLAA
92	Return of remains to former burial sites	Archaeological remains formerly removed are returned to original burial locations (e.g., caves). Shovels used if needed, but remains typically simply placed back at site.	Daytime, 1 day/site, 2-5 sites/year. No tree removal.	1. Noise that may alter normal behavior pattern (arousal and flushing from roost), resulting in potential depleted energy stores, predation and mortality. 2. Bats may respond to the stress of human presence (detected by smell, movement and/or noise) by altering their normal behavior patterns (e.g., frequency of arousal, sudden flushing from roost, avoidance of a flight path or foraging area). This may result in potentially depleted energy stores, predation, or mortality.	1. NV1 2. HP1, HP2	*IB*:NLAA *NB*:NLAA *GB*:NLAA *VB*:NLAA
93	Standard license	Allows ongoing but revocable use of TVA land for commercial, private, and public projects that do not require long-term tenure (e.g. temporary construction laydown area, parking lot, etc.). Minimal amount of	Agreements are 30/60 day revocable and can be active for several months up to several years. Occur across TVA-region, approximately 5-10 licenses issued/year	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment or contaminant runoff that degrades cave habitat and drinking water and reduces prey	1. NV1 2. SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLAA *VB*:NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		infrastructure and investment in involved. Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	Potential to occur near caves, bridges and water.	availability, resulting in reduced health and feeding success.		
94	Special use license	Used to authorize short-term events on TVA land where no land rights exist (e.g. fishing tournaments, marathons, etc.).	May occur near caves, bridges or water. Typically active for 1 to 2 days, with approximately 15 to 20 licenses issued/yr. No tree removal.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality.	1. NV1	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
95	Recreation license	Allows ongoing but revocable use of TVA land for commercial or public recreation projects that do not require long-term tenure. Minimal amount of infrastructure and investment. Would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	Agreements are 30/60 day revocable and can be active for several months to several years. Approx. 5 to10 recreational licenses are issued/year. May occur near caves, bridges or water.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA
96	Land use permit	Permission to authorize construction of land-based facilities and/ or perform specific activities on TVA property where outstanding rights exist (e.g. bathhouse, pavilion). Activity would be combined as needed with other activities (e.g., vegetation removal - #27, #34).	May occur near caves, bridges, or water. Revocable only under certain terms and conditions. Typically active for years; Approximately 2 to 5 issued per year.	1. Noise may alter normal behavior pattern (arousal, flushing), resulting in potentially depleted energy stores, predation and mortality. 2. Sediment runoff that degrades cave habitat and drinking water and reduces prey availability, resulting in reduced health and feeding success.	1. NV1 2.SSPC5	*IB*:NLAA *NB*:NLAA *GB*:NLA A *VB*:NLAA

[1] Activities are described in detail in Section 3.2. Description of Activities Associated with Proposed Actions.

[2] *Stressor* resulting from the activity; *exposure* (e.g., life stage, activity intensity, duration) of bats to potential stressors resulting from actions; *response* (e.g., startling, altered behavior, death) by bats that results from exposure.
[3] Conservation measures are discussed in Sections 5.2.
[4] IB= Indiana bat, NB = northern long-eared bat, GB = gray bat, VB = Virginia big-eared bat, NE = No effect, NLAA = Not likely to adversely affect, LAA = Likely to adversely affect,

5.4 Activities Grouped by Species and Effects Determination

5.4.1 Effects Determination for Indiana Bat

The most significant declines in Indiana bat populations due to WNS in the TVA region occurred prior to the completion of the original consultation. Therefore, the environmental baselines used to evaluate impacts in the original consultation were already low. Given that the actions themselves and action area has not changed, effects determinations for this 2023 reinitiation are the same as those previously determined below. It was determined that 21 activities will have no effect (NE) on Indiana bat. Seventy-two activities have the potential to affect Indiana bat but are NLAA this species. Three activities have the potential to adversely affect Indiana bat (Table 5-2). No adverse effects are expected to occur to Indiana bat during hibernation or to Indiana bat hibernacula.

Table 5-3. Routine TVA Activities Grouped by Effects Determination for Indiana Bat

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Indiana Bat	Loans and/or grant awards (#1)	NE
Indiana Bat	Purchase of property (#2)	NE
Indiana Bat	Purchase of equipment for industrial facilities (#3)	NE
Indiana Bat	Environmental education (#4)	NE
Indiana Bat	Transfer of ROW easement or equipment (#5)	NE
Indiana Bat	Property and/or Equipment Transfer (#6)	NE
Indiana Bat	Easement on TVA property (#7)	NE
Indiana Bat	Sale of TVA property (#8)	NE
Indiana Bat	Lease of TVA property (#9)	NE
Indiana Bat	Deed modification of TVA rights or property (#10)	NE
Indiana Bat	Abandonment of TVA retained rights (#11)	NE
Indiana Bat	Sufferance Agreement (#12)	NE
Indiana Bat	Engineering or environmental planning or studies (#13)	NE
Indiana Bat	Harbor limits (#14)	NE
Indiana Bat	Site-specific enhancements in streams and reservoirs for aquatic animals (#19)	NE
Indiana Bat	Nesting platforms (#20)	NE
Indiana Bat	Minor water-based structures (#41)	NE
Indiana Bat	Internal renovation or internal expansion of existing facility (#42)	NE
Indiana Bat	Replacement or removal of TL poles (#43)	NE
Indiana Bat	Replace or install TL conductor or overhead ground wire (#44)	NE
Indiana Bat	Non-navigable houseboats (#49)	NE
Indiana Bat	Windshield or ground surveys for cultural artifacts (#15)	NLAA
Indiana Bat	Drilling (#16)	NLAA
Indiana Bat	Mechanical vegetation removal; does not include removal of trees or tree branches 3 inches in diameter or greater (#17)	NLAA
Indiana Bat	Erosion control - minor (#18)	NLAA
Indiana Bat	Herbicide use (#21)	NLAA
Indiana Bat	Grubbing (#22)	NLAA
Indiana Bat	Tree planting (#24)	NLAA
Indiana Bat	Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)	NLAA
Indiana Bat	Maintenance or construction of access control measures (#26)	NLAA
Indiana Bat	Restoration of sites following human use and abuse (#27)	NLAA
Indiana Bat	Removal of debris (e.g., dump sites, hazardous material, unauthorized structures) (#28)	NLAA

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Indiana Bat	Acquisition and use of fill/borrow material (#29)	NLAA
Indiana Bat	Dredging and excavation; recessed harbor areas (#30)	NLAA
Indiana Bat	Stream/wetland crossings (#31)	NLAA
Indiana Bat	Clean-up following storm damage (#32)	NLAA
Indiana Bat	Shoreline stabilization (major erosion control) (#35)	NLAA
Indiana Bat	Grading (#36)	NLAA
Indiana Bat	Installation of soil improvements (#37)	NLAA
Indiana Bat	Berm development (#39)	NLAA
Indiana Bat	Drainage installations (including for ponds) (#38)	NLAA
Indiana Bat	Closed loop heat exchangers (heat pumps) (#40)	NLAA
Indiana Bat	Stream monitoring equipment- placement, use (#45)	NLAA
Indiana Bat	Floating boat slips within approved harbor limits (#46)	NLAA
Indiana Bat	Conduit installation (#47)	NLAA
Indiana Bat	Laydown areas (#48)	NLAA
Indiana Bat	Minor land-based structures (#50)	NLAA
Indiana Bat	Signage installation (#51)	NLAA
Indiana Bat	Floating buildings (#52)	NLAA
Indiana Bat	Mooring buoys or posts (#53)	NLAA
Indiana Bat	Maintenance of water control structures (dewatering units, spillways, levees) (#54)	NLAA
Indiana Bat	Solar panels (#55)	NLAA
Indiana Bat	Culverts (#56)	NLAA
Indiana Bat	Water intake - non-industrial (#57)	NLAA
Indiana Bat	Wastewater outfalls (#58)	NLAA
Indiana Bat	Marine fueling facilities (#59)	NLAA
Indiana Bat	Commercial water-use facilities (e.g., marinas) (#60)	NLAA
Indiana Bat	Septic fields (#61)	NLAA
Indiana Bat	Blasting (#62)	NLAA
Indiana Bat	Foundation installation (#63)	NLAA
Indiana Bat	Installation of steel structure, overhead bus, equipment, etc. (#64)	NLAA
Indiana Bat	Pole and/or tower installation and/or extension (#65)	NLAA
Indiana Bat	Private, residential docks, piers, boathouses (#66)	NLAA
Indiana Bat	Siting of temporary office trailers (#67)	NLAA
Indiana Bat	Financing for speculative building construction (#68)	NLAA
Indiana Bat	Renovation of existing structures (#69)	NLAA
Indiana Bat	Lock maintenance and construction (#70)	NLAA
Indiana Bat	Concrete dam modification (#71)	NLAA
Indiana Bat	Ferry landings/service operations (#72)	NLAA
Indiana Bat	Boat launching ramps (#73)	NLAA
Indiana Bat	Recreational vehicle campsites (#74)	NLAA
Indiana Bat	Utility lines/light poles (#75)	NLAA
Indiana Bat	Concrete sidewalk (#76)	NLAA
Indiana Bat	Construction or expansion of land-based buildings (#77)	NLAA
Indiana Bat	Wastewater treatment plants (#78)	NLAA
Indiana Bat	Swimming pools and associated equipment (#79)	NLAA
Indiana Bat	Barge fleeting areas (#80)	NLAA
Indiana Bat	Water intakes - Industrial (#81)	NLAA
Indiana Bat	Construction of dam/weirs/Levees (#82)	NLAA
Indiana Bat	Submarine pipeline, directional boring operations (#83)	NLAA
Indiana Bat	On-site/off-site public utility relocation or construction or extension (#84)	NLAA

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Indiana Bat	Playground equipment - land-based (#85)	NLAA
Indiana Bat	Landfill construction (#86)	NLAA
Indiana Bat	Aboveground storage tanks (#87)	NLAA
Indiana Bat	Underground Storage Tanks (#88)	NLAA
Indiana Bat	Structure demolition (#89)	NLAA
Indiana Bat	Pond closure (#90)	NLAA
Indiana Bat	Bridge replacement (#91)	NLAA
Indiana Bat	Return of remains to former burial sites (#92)	NLAA
Indiana Bat	Standard license (#93)	NLAA
Indiana Bat	Special use license (#94)	NLAA
Indiana Bat	Recreation license (#95)	NLAA
Indiana Bat	Land use permit (#96	NLAA
Indiana Bat	Prescribed burns (#23)	LAA
Indiana Bat	Removal of hazardous trees or tree branches (#33)	LAA
Indiana Bat	Mechanical vegetation removal, includes trees or tree branches 3 in or greater in diameter (#34)	LAA

[1]NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = May affect, likely to adversely affect

5.4.2 Effects Determination for Northern Long-eared Bat

The most significant declines in northern long-eared bat populations in the TVA region occurred prior to the completion of the original consultation. Therefore, the environmental baselines used to evaluate impacts in the original consultation were quite low. Given that the actions themselves and action area has not changed, effects determinations for this 2023 reinitiation are the same as those previously determined below. It was determined that 21 activities will have NE on northern long-eared bat. Seventy-two activities have the potential to affect northern long-eared bat, but are NLAA this species. Three activities have the potential to adversely affect northern long-eared bat when they occur in proximity to known hibernacula and summer occurrences documented post-WNS (Table 5-3). No adverse effects are expected to occur to northern long-eared bat during hibernation or to northern long-eared bat hibernacula.

Table 5-4. Routine TVA Activities Grouped by Effects Determination for Northern Long-eared Bat

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
NLEB	Loans and/or grant awards (#1)	NE
NLEB	Purchase of property (#2)	NE
NLEB	Purchase of equipment for industrial facilities (#3)	NE
NLEB	Environmental education (#4)	NE
NLEB	Transfer of ROW easement or equipment (#5)	NE
NLEB	Property and/or Equipment Transfer (#6)	NE
NLEB	Easement on TVA property (#7)	NE
NLEB	Sale of TVA property (#8)	NE
NLEB	Lease of TVA property (#9)	NE
NLEB	Deed modification of TVA rights or property (#10)	NE
NLEB	Abandonment of TVA retained rights (#11)	NE
NLEB	Sufferance Agreement (#12)	NE
NLEB	Engineering or environmental planning or studies (#13)	NE
NLEB	Harbor limits (#14)	NE

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
NLEB	Site-specific enhancements in streams and reservoirs for aquatic animals (#19)	NE
NLEB	Nesting platforms (#20)	NE
NLEB	Minor water-based structures (#41)	NE
NLEB	Internal renovation or internal expansion of existing facility (#42)	NE
NLEB	Replacement or removal of TL poles (#43)	NE
NLEB	Replace or install TL conductor or overhead ground wire (#44)	NE
NLEB	Non-navigable houseboats (#49)	NE
NLEB	Windshield or ground surveys for cultural artifacts (#15)	NLAA
NLEB	Drilling (#16)	NLAA
NLEB	Mechanical vegetation removal; does not include removal of trees or tree branches 3 inches in diameter or greater (#17)	NLAA
NLEB	Erosion control - minor (#18)	NLAA
NLEB	Herbicide use (#21)	NLAA
NLEB	Grubbing (#22)	NLAA
NLEB	Tree planting (#24)	NLAA
NLEB	Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)	NLAA
NLEB	Maintenance or construction of access control measures (#26)	NLAA
NLEB	Restoration of sites following human use and abuse (#27)	NLAA
NLEB	Removal of debris (e.g., dump sites, hazardous material, unauthorized structures) (#28)	NLAA
NLEB	Acquisition and use of fill/borrow material (#29)	NLAA
NLEB	Dredging and excavation; recessed harbor areas (#30)	NLAA
NLEB	Stream/wetland crossings (#31)	NLAA
NLEB	Clean-up following storm damage (#32)	NLAA
NLEB	Shoreline stabilization (major erosion control) (#35)	NLAA
NLEB	Grading (#36)	NLAA
NLEB	Installation of soil improvements (#37)	NLAA
NLEB	Berm development (#39)	NLAA
NLEB	Drainage installations (including for ponds) (#38)	NLAA
NLEB	Closed loop heat exchangers (heat pumps) (#40)	NLAA
NLEB	Stream monitoring equipment- placement, use (#45)	NLAA
NLEB	Floating boat slips within approved harbor limits (#46)	NLAA
NLEB	Conduit installation (#47)	NLAA
NLEB	Laydown areas (#48)	NLAA
NLEB	Minor land-based structures (#50)	NLAA
NLEB	Signage installation (#51)	NLAA
NLEB	Floating buildings (#52)	NLAA
NLEB	Mooring buoys or posts (#53)	NLAA
NLEB	Maintenance of water control structures (dewatering units, spillways, levees) (#54)	NLAA
NLEB	Solar panels (#55)	NLAA
NLEB	Culverts (#56)	NLAA
NLEB	Water intake - non-industrial (#57)	NLAA
NLEB	Wastewater outfalls (#58)	NLAA
NLEB	Marine fueling facilities (#59)	NLAA
NLEB	Commercial water-use facilities (e.g., marinas) (#60)	NLAA
NLEB	Septic fields (#61)	NLAA
NLEB	Blasting (#62)	NLAA
NLEB	Foundation installation (#63)	NLAA
NLEB	Installation of steel structure, overhead bus, equipment, etc. (#64)	NLAA

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
NLEB	Pole and/or tower installation and/or extension (#65)	NLAA
NLEB	Private, residential docks, piers, boathouses (#66)	NLAA
NLEB	Siting of temporary office trailers (#67)	NLAA
NLEB	Financing for speculative building construction (#68)	NLAA
NLEB	Renovation of existing structures (#69)	NLAA
NLEB	Lock maintenance and construction (#70)	NLAA
NLEB	Concrete dam modification (#71)	NLAA
NLEB	Ferry landings/service operations (#72)	NLAA
NLEB	Boat launching ramps (#73)	NLAA
NLEB	Recreational vehicle campsites (#74)	NLAA
NLEB	Utility lines/light poles (#75)	NLAA
NLEB	Concrete sidewalk (#76)	NLAA
NLEB	Construction or expansion of land-based buildings (#77)	NLAA
NLEB	Wastewater treatment plants (#78)	NLAA
NLEB	Swimming pools and associated equipment (#79)	NLAA
NLEB	Barge fleeting areas (#80)	NLAA
NLEB	Water intakes - Industrial (#81)	NLAA
NLEB	Construction of dam/weirs/Levees (#82)	NLAA
NLEB	Submarine pipeline, directional boring operations (#83)	NLAA
NLEB	On-site/off-site public utility relocation, construction, or extension (#84)	NLAA
NLEB	Playground equipment - land-based (#85)	NLAA
NLEB	Landfill construction (#86)	NLAA
NLEB	Aboveground storage tanks (#87)	NLAA
NLEB	Underground Storage Tanks (#88)	NLAA
NLEB	Structure demolition (#89)	NLAA
NLEB	Pond closure (#90)	NLAA
NLEB	Bridge replacement (#91)	NLAA
NLEB	Return of remains to former burial sites (#92)	NLAA
NLEB	Standard license (#93)	NLAA
NLEB	Special use license (#94)	NLAA
NLEB	Recreation license (#95)	NLAA
NLEB	Land use permit (#96	NLAA
NLEB	Prescribed burns (#23)	LAA
NLEB	Removal of hazardous trees or tree branches (#33)	LAA
NLEB	Mechanical vegetation removal, includes trees or tree branches 3 in or greater in diameter (#34)	LAA

[1]NLEB = Northern long-eared bat
[2]NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = May affect, likely to adversely affect

5.4.3 Effects Determinations for Gray Bat

Gray bat populations in the TVA region have not seen significant declines since the completion of the original consultation. Therefore, the environmental baselines used to evaluate impacts in the original consultation are not significantly different than those used for the reinitation of this consultation. Given that the actions themselves and action area has not changed either, effects determinations for this 2023 reinitiation are the same as those previously determined below. It was determined that 21 activities will have NE on gray bat. The remaining 75 activities have potential to affect gray bat but are NLAA this species (Table 5-4). The majority of these 75 activities, in fact, are conducted in such a manner that any potential impacts to caves are avoided, thus rendering NE to gray bat in the majority of site-specific cases. None of the proposed activities are expected to adversely affect gray bat.

Table 5-5. Routine TVA Activities Grouped by Effects Determination for Gray Bat

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Gray bat	Loans and/or grant awards (#1)	NE
Gray bat	Purchase of property (#2)	NE
Gray bat	Purchase of equipment for industrial facilities (#3)	NE
Gray bat	Environmental education (#4)	NE
Gray bat	Transfer of ROW easement or equipment (#5)	NE
Gray bat	Property and/or Equipment Transfer (#6)	NE
Gray bat	Easement on TVA property (#7)	NE
Gray bat	Sale of TVA property (#8)	NE
Gray bat	Lease of TVA property (#9)	NE
Gray bat	Deed modification of TVA rights or property (#10)	NE
Gray bat	Abandonment of TVA retained rights (#11)	NE
Gray bat	Sufferance Agreement (#12)	NE
Gray bat	Engineering or environmental planning or studies (#13)	NE
Gray bat	Harbor limits (#14)	NE
Gray bat	Site-specific enhancements in streams and reservoirs for aquatic animals (#19)	NE
Gray bat	Nesting platforms (#20)	NE
Gray bat	Minor water-based structures (#41)	NE
Gray bat	Internal renovation or internal expansion of existing facility (#42)	NE
Gray bat	Replacement or removal of TL poles (#43)	NE
Gray bat	Replace or install TL conductor or overhead ground wire (#44)	NE
Gray bat	Non-navigable houseboats (#49)	NE
Gray bat	Windshield or ground surveys for cultural artifacts (#15)	NLAA
Gray bat	Drilling (#16)	NLAA
Gray bat	Mechanical vegetation removal; does not include removal of trees or tree branches 3 inches in diameter or greater (#17)	NLAA
Gray bat	Erosion control - minor (#18)	NLAA
Gray bat	Herbicide use (#21)	NLAA
Gray bat	Grubbing (#22)	NLAA
Gray bat	Prescribed burns (#23)	NLAA
Gray bat	Tree planting (#24)	NLAA
Gray bat	Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)	NLAA
Gray bat	Maintenance or construction of access control measures (#26)	NLAA
Gray bat	Restoration of sites following human use and abuse (#27)	NLAA
Gray bat	Removal of debris (e.g., dump sites, hazardous material, unauthorized structures) (#28)	NLAA
Gray bat	Acquisition and use of fill/borrow material (#29)	NLAA
Gray bat	Dredging and excavation; recessed harbor areas (#30)	NLAA
Gray bat	Stream/wetland crossings (#31)	NLAA
Gray bat	Clean-up following storm damage (#32)	NLAA
Gray bat	Removal of hazardous trees or tree branches (#33)	NLAA
Gray bat	Mechanical vegetation removal, includes trees or tree branches 3 in or greater in diameter (#34)	NLAA
Gray bat	Shoreline stabilization (major erosion control) (#35)	NLAA
Gray bat	Grading (#36)	NLAA
Gray bat	Installation of soil improvements (#37)	NLAA

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Gray bat	Berm development (#39)	NLAA
Gray bat	Drainage installations (including for ponds) (#38)	NLAA
Gray bat	Closed loop heat exchangers (heat pumps) (#40)	NLAA
Gray bat	Stream monitoring equipment- placement, use (#45)	NLAA
Gray bat	Floating boat slips within approved harbor limits (#46)	NLAA
Gray bat	Conduit installation (#47)	NLAA
Gray bat	Laydown areas (#48)	NLAA
Gray bat	Minor land-based structures (#50)	NLAA
Gray bat	Signage installation (#51)	NLAA
Gray bat	Floating buildings (#52)	NLAA
Gray bat	Mooring buoys or posts (#53)	NLAA
Gray bat	Maintenance of water control structures (dewatering units, spillways, levees) (#54)	NLAA
Gray bat	Solar panels (#55)	NLAA
Gray bat	Culverts (#56)	NLAA
Gray bat	Water intake - non-industrial (#57)	NLAA
Gray bat	Wastewater outfalls (#58)	NLAA
Gray bat	Marine fueling facilities (#59)	NLAA
Gray bat	Commercial water-use facilities (e.g., marinas) (#60)	NLAA
Gray bat	Septic fields (#61)	NLAA
Gray bat	Blasting (#62)	NLAA
Gray bat	Foundation installation (#63)	NLAA
Gray bat	Installation of steel structure, overhead bus, equipment, etc. (#64)	NLAA
Gray bat	Pole and/or tower installation and/or extension (#65)	NLAA
Gray bat	Private, residential docks, piers, boathouses (#66)	NLAA
Gray bat	Siting of temporary office trailers (#67)	NLAA
Gray bat	Financing for speculative building construction (#68)	NLAA
Gray bat	Renovation of existing structures (#69)	NLAA
Gray bat	Lock maintenance and construction (#70)	NLAA
Gray bat	Concrete dam modification (#71)	NLAA
Gray bat	Ferry landings/service operations (#72)	NLAA
Gray bat	Boat launching ramps (#73)	NLAA
Gray bat	Recreational vehicle campsites (#74)	NLAA
Gray bat	Utility lines/light poles (#75)	NLAA
Gray bat	Concrete sidewalk (#76)	NLAA
Gray bat	Construction or expansion of land-based buildings (#77)	NLAA
Gray bat	Wastewater treatment plants (#78)	NLAA
Gray bat	Swimming pools and associated equipment (#79)	NLAA
Gray bat	Barge fleeting areas (#80)	NLAA
Gray bat	Water intakes - Industrial (#81)	NLAA
Gray bat	Construction of dam/weirs/Levees (#82)	NLAA
Gray bat	Submarine pipeline, directional boring operations (#83)	NLAA
Gray bat	On-site/off-site public utility relocation or construction or extension (#84)	NLAA
Gray bat	Playground equipment - land-based (#85)	NLAA
Gray bat	Landfill construction (#86)	NLAA
Gray bat	Aboveground storage tanks (#87)	NLAA
Gray bat	Underground Storage Tanks (#88)	NLAA
Gray bat	Structure demolition (#89)	NLAA
Gray bat	Pond closure (#90)	NLAA
Gray bat	Bridge replacement (#91)	NLAA
Gray bat	Return of remains to former burial sites (#92)	NLAA

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
Gray bat	Standard license (#93)	NLAA
Gray bat	Special use license (#94)	NLAA
Gray bat	Recreation license (#95)	NLAA
Gray bat	Land use permit (#96	NLAA

[1]NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = May affect, likely to adversely affect

5.4.4 Effects Determination for Virginia Big-eared Bat

Virginia big-eared bat populations in the TVA region have not seen significant declines since the completion of the original consultation. Therefore, the environmental baselines used to evaluate impacts in the original consultation are not significantly different than those used for the reinitiation of this consultation. Given that the actions themselves and action area has not changed either, the effects determinations for this 2023 reinitiation are the same as those previously determined below. It was determined that 21 activities will have NE on Virginia big-eared bat. The remaining 72 activities have potential to affect Virginia big-eared bat but are NLAA this species (Table 5-5). As discussed in Chapter 4, the range of Virginia big-eared bat is limited to six counties in the northeastern corner of the TVA region, where activities associated with power generation and transmission are minimal to none. This factor significantly reduces the likelihood of co-occurrence of Virginia big-eared bat (or its habitat) and any stressors resulting from proposed activities (exposure). None of the activities are expected to adversely affect Virginia big-eared bat.

Table 5-6. Routine TVA Activities Grouped by Effects Determination for Virginia Big-eared Bat

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
VBEB	Loans and/or grant awards (#1)	NE
VBEB	Purchase of property (#2)	NE
VBEB	Purchase of equipment for industrial facilities (#3)	NE
VBEB	Environmental education (#4)	NE
VBEB	Transfer of ROW easement or equipment (#5)	NE
VBEB	Property and/or Equipment Transfer (#6)	NE
VBEB	Easement on TVA property (#7)	NE
VBEB	Sale of TVA property (#8)	NE
VBEB	Lease of TVA property (#9)	NE
VBEB	Deed modification of TVA rights or property (#10)	NE
VBEB	Abandonment of TVA retained rights (#11)	NE
VBEB	Sufferance Agreement (#12)	NE
VBEB	Engineering or environmental planning or studies (#13)	NE
VBEB	Harbor limits (#14)	NE
VBEB	Site-specific enhancements in streams and reservoirs for aquatic animals (#19)	NE
VBEB	Nesting platforms (#20)	NE
VBEB	Minor water-based structures (#41)	NE
VBEB	Internal renovation or internal expansion of existing facility (#42)	NE
VBEB	Replacement or removal of TL poles (#43)	NE
VBEB	Replace or install TL conductor or overhead ground wire (#44)	NE
VBEB	Non-navigable houseboats (#49)	NE
VBEB	Windshield or ground surveys for cultural artifacts (#15)	NLAA
VBEB	Drilling (#16)	NLAA

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
VBEB	Mechanical vegetation removal; does not include removal of trees or tree branches 3 inches in diameter or greater (#17)	NLAA
VBEB	Erosion control - minor (#18)	NLAA
VBEB	Herbicide use (#21)	NLAA
VBEB	Grubbing (#22)	NLAA
VBEB	Prescribed burns (#23)	NLAA
VBEB	Tree planting (#24)	NLAA
VBEB	Maintenance, improvement or construction of pedestrian or vehicular access corridors (#25)	NLAA
VBEB	Maintenance or construction of access control measures (#26)	NLAA
VBEB	Restoration of sites following human use and abuse (#27)	NLAA
VBEB	Removal of debris (e.g., dump sites, hazardous material, unauthorized structures) (#28)	NLAA
VBEB	Acquisition and use of fill/borrow material (#29)	NLAA
VBEB	Dredging and excavation; recessed harbor areas (#30)	NLAA
VBEB	Stream/wetland crossings (#31)	NLAA
VBEB	Clean-up following storm damage (#32)	NLAA
VBEB	Removal of hazardous trees or tree branches (#33)	NLAA
VBEB	Mechanical vegetation removal, includes trees or tree branches 3 in or greater in diameter (#34)	NLAA
VBEB	Shoreline stabilization (major erosion control) (#35)	NLAA
VBEB	Grading (#36)	NLAA
VBEB	Installation of soil improvements (#37)	NLAA
VBEB	Berm development (#39)	NLAA
VBEB	Drainage installations (including for ponds) (#38)	NLAA
VBEB	Closed loop heat exchangers (heat pumps) (#40)	NLAA
VBEB	Stream monitoring equipment- placement, use (#45)	NLAA
VBEB	Floating boat slips within approved harbor limits (#46)	NLAA
VBEB	Conduit installation (#47)	NLAA
VBEB	Laydown areas (#48)	NLAA
VBEB	Minor land-based structures (#50)	NLAA
VBEB	Signage installation (#51)	NLAA
VBEB	Floating buildings (#52)	NLAA
VBEB	Mooring buoys or posts (#53)	NLAA
VBEB	Maintenance of water control structures (dewatering units, spillways, levees) (#54)	NLAA
VBEB	Solar panels (#55)	NLAA
VBEB	Culverts (#56)	NLAA
VBEB	Water intake - non-industrial (#57)	NLAA
VBEB	Wastewater outfalls (#58)	NLAA
VBEB	Marine fueling facilities (#59)	NLAA
VBEB	Commercial water-use facilities (e.g., marinas) (#60)	NLAA
VBEB	Septic fields (#61)	NLAA
VBEB	Blasting (#62)	NLAA
VBEB	Foundation installation (#63)	NLAA
VBEB	Installation of steel structure, overhead bus, equipment, etc. (#64)	NLAA
VBEB	Pole and/or tower installation and/or extension (#65)	NLAA
VBEB	Private, residential docks, piers, boathouses (#66)	NLAA
VBEB	Siting of temporary office trailers (#67)	NLAA
VBEB	Financing for speculative building construction (#68)	NLAA
VBEB	Renovation of existing structures (#69)	NLAA
VBEB	Lock maintenance and construction (#70)	NLAA

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
VBEB	Concrete dam modification (#71)	NLAA
VBEB	Ferry landings/service operations (#72)	NLAA
VBEB	Boat launching ramps (#73)	NLAA
VBEB	Recreational vehicle campsites (#74)	NLAA
VBEB	Utility lines/light poles (#75)	NLAA
VBEB	Concrete sidewalk (#76)	NLAA
VBEB	Construction or expansion of land-based buildings (#77)	NLAA
VBEB	Wastewater treatment plants (#78)	NLAA
VBEB	Swimming pools and associated equipment (#79)	NLAA
VBEB	Barge fleeting areas (#80)	NLAA
VBEB	Water intakes - Industrial (#81)	NLAA
VBEB	Construction of dam/weirs/Levees (#82)	NLAA
VBEB	Submarine pipeline, directional boring operations (#83)	NLAA
VBEB	On-site/off-site public utility relocation or construction or extension (#84)	NLAA
VBEB	Playground equipment - land-based (#85)	NLAA
VBEB	Landfill construction (#86)	NLAA
VBEB	Aboveground storage tanks (#87)	NLAA
VBEB	Underground Storage Tanks (#88)	NLAA
VBEB	Structure demolition (#89)	NLAA
VBEB	Pond closure (#90)	NLAA
VBEB	Bridge replacement (#91)	NLAA
VBEB	Return of remains to former burial sites (#92)	NLAA
VBEB	Standard license (#93)	NLAA
VBEB	Special use license (#94)	NLAA
VBEB	Recreation license (#95)	NLAA
VBEB	Land use permit (#96	NLAA

[1]VBEB = Virginia big-eared bat
[2]NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = May affect, likely to adversely affect

5.5 Cumulative Effects

Cumulative effects under the ESA are those of future state, private, and other non-federal activities that are reasonably certain to occur within the Action Area. TVA recognizes that many types of state, private and non-federal activities within the Action Area have potential to occur over the next 20 years, and that these will have varying levels of impact on environmental resources. Such actions may include state highway maintenance and improvement projects, airport operations and expansions, rail development projects, and industrial and mining operations. Other actions may include routine management and/or improvement of public lands by state and local agencies or an influx of new companies that leads to new infrastructure. As well, future routine operations and maintenance activities by TVA have the potential to trigger state, private and non-federal actions. One example is a successful partnership with a local development organization that results in creation of several hundred new jobs, which leads to an influx of new residents that begin contributing to a local economy. Another is working with local power companies to maximize distributed energy options for end-use customers who seek increased access to renewable energy sources. A further example is establishment of a substation and transmission line that leads to further energy load capacity and thus further residential, commercial, and industrial development. Indeed, these concepts are fundamental to TVA's mission in many respects.

There also could be cumulative effects that result from implementation of a TVA activity or activities that is as yet unforeseen. One example is the transfer of land from TVA to another landowner. In some cases, TVA knows what is planned for the land following the transfer and can incorporate potential impacts into the project-specific environmental review and analysis. If necessary, additional consultation under ESA would be carried out at the project-specific level. In other cases, TVA does not know the future plans. In these cases, TVA never-the-less identifies sensitive resources on the land in question, communicates the presence of those resources to the future landowner, and informs the landowner of subsequent steps to take if federally listed species may be impacted. TVA's goal in carrying out its threefold mission is to do so in a manner that maintains balance with impact on the environment.

CHAPTER 6 – DOCUMENTATION AND REPORTING

TVA began implementing its programmatic bat strategy upon completion of original consultation in 2018. Throughout the 20-year term of the BA, TVA will track alignment of proposed projects with the scope for the BA by conducting steps as described in Table 6-1. Project-specific activities will be correlated with the best available information on covered species.

Table 6-1. Steps to Document and Report Alignment of TVA Activities with Biological Assessment and Consultation

#	STEP
1.	Site-specific project will be screened via TVA's environmental review process.
2.	Project will be reviewed to determine if associated activities are within the scope of TVA's bat programmatic consultation (BPC).
3a.	Projects with activities that are outside BPC scope will be subject to project-specific consultation if warranted. ***END***
3b.	Projects with activities that are within BPC scope will be reviewed for potential to impact covered species. ***Go to 4.***
4a.	Project-specific activities that are determined in the BPC to have No Effect will be documented as aligning with the BPC and documented in TVA's environmental management system. ***END***
4b.	Project-specific activities determined in the BPC to have potential to NLAA covered species will be reviewed further to determine if project exposes covered species to stressors. If so, conservation measures identified in the BPC will be implemented and documented. If no exposure to stressors will occur as part of the project, activity will be documented as having no effect on covered species. In either case, documentation of the proposed project, alignment with the BPC, and project-specific determinations will be saved in TVA's administrative record. All projects with effects determinations of these types will be summarized in annual reporting associated with the BPC. ***END***
4c.	Project-specific activities determined in the BPC to have potential to LAA covered species will be reviewed further to determine if project exposes covered species to stressors. ***Go to 5.***
5a.	If no exposure to stressors will occur as part of this project-specific activity, activity will be documented as aligning with the BPC, having no effect on covered species, and will be included in annual reporting associated with the BPC. ***END***
5b.	If project-specific activity aligns with LAA determination, project conducts presence/ absence surveys, and detections are negative, TVA will document a NLAA determination and alignment with BPC and save documentation in TVA's administrative record. All projects with effects determinations of these types will be summarized in BPC annual reporting. ***END***
5c.	If project-specific activity aligns with LAA determination, project assumes presence, or project conducts presence/absence surveys and detections are positive, TVA will document a LAA determination and alignment with BPC. If surveys are positive or if the proposed actions are within known habitat, TVA will notify the appropriate USFWS FO (via email or letter) of the proposed project, alignment with BPC, survey outcome (if surveys conducted), and determination. Documentation will be recorded in TVA's administrative record. All projects with effects determinations of these types will be summarized by species in annual reporting associated with the BPC. ***END***

As new bat species occurrence data is acquired, this information will be incorporated in TVA’s species database and utilized during the environmental review process. In addition to data exchanges between state and regional Natural Heritage programs, TVA's biological staff routinely incorporate data collected directly or provided directly by sources other than state Natural Heritage Programs (e.g., US Forest Service, TWRA, Copperhead, Research conducted by college graduate students) into TVA’s database. Cooperative survey and research efforts between TVA biological staff and other state, federal and non-governmental partners facilitates regular communication regarding newly discovered or newly available species data. TVA is pursuing a Memorandum of Agreement with USFWS to acquire bat records that inform the Service’s Information for Planning and Consultation website to ensure all pertinent records are captured. Implementation of conservation measures with regard to proximity of known occurrence therefore are not limited to one specific point in time in which data was collected.

CHAPTER 7 – PROGRAMMATIC CONCLUSION/DETERMINATIONS

With respect to Indiana bat and northern long-eared bat, TVA has determined that 21 activities covered under the programmatic BA will have no effect on those species; 72 activities covered under the programmatic BA may affect but are not likely to adversely affect those species; three activities covered under the programmatic BA are likely to adversely affect those species.

With respect to gray bat and Virginia big-eared bat, TVA has determined that 21 activities covered under the programmatic BA will have no effect on those species and 75 activities may affect but are not likely to adversely affect those species.

While several activities could result in beneficial effects to these bats, all adverse effects cannot be avoided. Potential adverse effects to Indiana bat and northern long-eared bat could result from tree removal or prescribed fire.

Over the next 20 years, TVA anticipates that proposed actions could directly or indirectly affect approximately 461,564 ac. Of this acreage, 47,204 ac trees (0.13 percent of forest cover in the TVA region) may need to be removed, some of which may be suitable summer bat habitat for Indiana bat or northern long-eared bat. TVA is committed to implementing conservation measures to avoid and minimize impacts associated with proposed actions and to benefit or promote the recovery of the Indiana bat, northern long-eared bat, gray bat, and Virginia big-eared bat. These conservation measures are identified in Chapter 5.

Consultation would be reinitiated with the USFWS if an activity is modified in a way that causes an affect not previously considered in the BA, or if new information reveals that an activity may affect a covered species in a way not previously considered in this BA.

CHAPTER 8 – LITERATURE CITED

Arroyo-Cabrales, J. & Timm, R. 2008. *Myotis grisescens*. The IUCN Red List of Threatened Species 2008: e.T14132A4403493. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T14132A4403493.en. Downloaded on 10 May 2017.

Bayless, M.L., M. K. Clark, R. C. Stark, B. S. Douglas, S. M. Ginger. 2011. Distribution and Status of Eastern Big-eared Bats (*Corynorhinus* spp.). In: Loeb, S.C.; Lacki, M.J.; Miller, D.A., eds. Conservation and management of eastern big-eared bats: a symposium. Gen. Tech. Rep. SRS-145. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station: 13-25.

Currie, R. 2000. Federally listed threatened and endangered species of concern to mining. Paper presented at Bat Conservation and Mining: A Technical and Interactive Forum, November 14-16, St. Louis, MO.

Dyer, J. M. 2006. "Revisiting the Deciduous Forests of Eastern North America." Bioscience 56:341-352.

Etchinson, K. L. C. and J. A. Weber. 2020. The discovery of gray bats (*Myotis grisescens*) in bridges in western North Carolina. Southeastern Naturalist, 19(3) N53-N56.

Hefner, J. M., B. O. Wilen, T. E. Dahl, and W. E. Frayer. 1994. Southeast Wetlands, Status and Trends. Cooperative Publication by U.S. Department of the Interior, U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency.

Holliday, C., J. P Wisby, P. L. Roby, S. T. Samoray, J. M. Vannatta. 2022. Modeling migration and movement of gray bats. The Journal of Wildlife Management. Available at: < https://wildlife.onlinelibrary.wiley.com/doi/10.1002/jwmg.22364>.

Jenkins, M. 2009. Deep Southern Caves. National Geographic. Accessed October 19, 2016 at: <http://ngm.nationalgeographic.com/2009/06/tag-caves/jenkins-text/1>.

Luther, E. T. 1977. Our Restless Earth: The Geologic Regions of Tennessee. University of Tennessee Press. Knoxville, TN, 94 pp.

National Land Cover Database. 2011. Accessed May 11, 2015 <http://www.mrlc.gov/nlcd2011.php>.

Miller, J. H. 2003. Nonnative Plants of Southern Forest. Asheville, N.C.: USDA, Forest Service Tech. Rep. SRS-62.

Miller, J. H., E. B. Chambliss, and C. M. Oswalt. 2008. Maps of Occupation and Estimates of Acres Covered by Nonnative Invasive Plants in Southern Forests, created by using SRS Forest Inventory and Analysis data posted on March 15, 2008. Retrieved from <http://www.invasive.org/fiamaps/> (June 9, 2010).

NatureServe. 2009. NatureServe Explorer: An Online Encyclopedia of Life, Version 7.1. Arlington, Virginia: NatureServe. Retrieved from http://www.natureserve.org/explorer (June 4, 2010).

_____. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: May 10, 2017).

NiSource. 2013. NiSource Multi-Species Habitat conservation Plan. Accessed October 4, 2016, at <https://www.fws.gov/Midwest/Endangered/permits/hcp/nisource/2013NOA/NiSourceHCPfinalJune2013.html>.

North American Electric Reliability Corporation (NERC). 2006. Transmission Vegetation Management Program, Standard FAC-003-1. Accessed September 22, 2015 at: <http://www.nerc.com/files/FAC-003-1.pdf>.

Obama, B. 2016. Executive Order 13751: Safeguarding the Nation from the Impacts of Invasive Species. Federal Register (December 8, 2016), v.81 no.236, p.88609 - 88614. Available at <https://www.hsdl.org/?abstract&did=797231>.

Omernik, J. M. 1987. Level III Ecoregions of the Conterminous United States Map (scale 1:7,500,000). *Annals of the Association of American Geographers* 77(1):118-125. Retrieved from <http://www.epa.gov/wed/pages/ecoregions/level_iii.htm#Ecoregions> (06/15/2010).

Oswalt, C. M., S. N. Oswalt, T. G. Johnson, J. L. Chamberlain, K C. Randolph, and J. W. Coulston. 2009. Tennessee's Forests, 2004. USDA Forest Service Resource. Bull. SRS-144. Asheville, NC. Available at <http://www.srs.fs.usda.gov/pubs/32506.>

Reynolds, R. 2005. *Corynorhinus townsendii virginianus*: Survey Counts for Virginia. Unpublished report, Virginia Department of Game and Inland Fisheries.

Rowse, E. G., D. Lewanzik, E. L. Stone, S. Harris, and G. Jones. 2016. Dark Matters: The effects of artificial lighting on bats. In: Voigt, C. C. and Kingston, T., (eds.), Bats in the Anthropocene: Conservation of Bats in a Changing World. DOI 10.1007/987-3-319-25220-9_7.

Stein, B. A., L. S. Kutner, and J. S. Adams (eds.). 2000. Precious Heritage: The Status of Biodiversity in the United States. New York: Oxford University Press.

Stihler, C. 2005. Virginia big-eared bat summer colony censuses. Draft report by Craig Stihler, West Virginia Department of Natural Resources, November 28, 2005.

Taylor, H., K. E. Powers, W. D. Orndorff, R. J. Reynolds, E. M Hallerman, and W. M. Ford. 2023. Sources of yearly variation in gray bat activity in the Clinch River Watershed, Virginia. Journal of the Southeastern Association of Fish and Wildlife Agencies 10:107-113.

Tennessee Valley Authority (TVA). 1933. Tennessee Valley Authority Act of 1933. 48 Stat. 58-59, 16 U.S.C. sec. 831. Available at

<https://www.tva.com/file_source/TVA/Site%20Content/About%20TVA/TVA_Act.pdf>.

______. 1971. Stream Lengths in the Tennessee River Basin. Chattanooga, TN.

______. 1999. Tennessee Valley Authority Shoreline Management Policy. Available at <https://www.tva.com/Environment/Environmental-Stewardship/Environmental-Reviews/Shoreline-Management-Policy>.

______. 2006. Tennessee Valley Authority Land Policy. Available at <https://www.tva.com/Environment/Environmental-Stewardship/Land-Management/TVA-Land-Policy>.

______. 2011a. Tennessee Valley Authority Natural Resource Plan. Available at <https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/environmental-reviews/nrp/nrp_complete.pdf?sfvrsn=1e6f3739_4>.

______. 2011b. Tennessee Valley Authority Natural Resource Plan Final Environmental Impact Statement. Available at: <https://tva.com/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/Environmental%20Reviews/NRP/nrp_feis_volume1.pdf>.

______. 2017a. Distributed Solar Solutions TVA Pilot Program. Accessed May 3, 2017, at https://www.tva.com/Energy/Renewable-Energy-Solutions/Distributed-Solar-Solutions.

______. 2017b. Tennessee Valley Authority, Transmission. Current TVA Transmission System Projects. Related Guidelines and Specifications. Chattanooga, TN. Available to the public at < https://www.tva.gov/Energy/Transmission-System/Transmission-System-Projectshttps://www.tva.gov/Energy/Transmission-System/Transmission-System-Projects>.

______. 2019a. Tennessee Valley Authority Integrated Resource Plan - 20199 Final Report. Available at <https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/irp/2019-documents/tva_executivesummary_final_20190628-spreads.pdf?sfvrsn=939819db_4 >.

______. 2019b. Update of TVA's Natural Resource Plan Supplemental Environmental Impact Statement. Available at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/environmental-reviews/nrp/tva_natural_resource_plan_supplemental_final_eis_issued_february_7_2020.pdf?sfvrsn=adc8d277_44.

______. 2020a. Tennessee Valley Authority Environmental Policy. Available at < https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/environmental-stewardship/environmental-policy-5-7-2020.pdf?sfvrsn=ee4bdc08_2>.

_____. 2020b. Tennessee Valley Authority Natural Resource Plan. Available at <https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/environmental-stewardship/nepa-environmental-reviews/tva-2020-natural-resource-plan.pdf?sfvrsn=91830f7c_2>.

Udell, B.J. et al. 2022. Status and trends of North American bats summer occupancy analysis 2010-2019. North American Bat Monitoring Program. Accessed from < https://doi.org/10.5066/P92JGACB>.

U. S. Department of Agriculture. 2007a. *Risk Assessments*. USDA, Forest Service, Forest Health Protection Pesticide Management and Coordination. Retrieved from <http://www.fs.fed.us/foresthealth/pesticide/risk.shtml> (n.d.)

U. S. Fish and Wildlife Service (USFWS). 1976. Determination that Two Species of Butterflies are Threatened Species and Two Species of Mammals are Endangered Species; 41 FR 17742 17747 (Schaus swallowtail; Bahama swallowtail; Mexican wolf, Canis lupus baileyi; gray bat, Myotis grisescens). 41 FR 17736 17740. Accessed May 10, 2017 at: https://ecos.fws.gov/docs/federal_register/fr95.pdf

_____. 1979. Listing of Virginia and Ozark Big-eared Bats as Endangered Species and Critical Habitat Determination, November 30, 1979 (44 FR 69206 69208)

_____. 1982. Endangered and Threatened Species of the Southeastern United States. U.S. Fish and Wildlife Service, Atlanta, GA. (www.fws.gov/endangered/i/a/saa7r-.html)

_____. 2003. Programmatic Consultation Guidance. Accessed July 15, 2015 at <http://twswest.org/events/2013/esa_workshop/Part_C/1_2003%20Programmatic%20guidance.pdf>.

_____. 2008. Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service. Accessed on May 10, 2017 at: https://ecos.fws.gov/docs/five_year_review/doc1963.pdf

_____. 2009. Gray bat (*Myotis grisescens*) 5 -Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Midwest Region, Missouri Ecological Services Field Office, Columbia, Missouri.

_____. 2014. Northern Long-eared Bat Interim Conference and Planning Guidance. U.S. Fish and Wildlife Service.

_____. 2015a. Fungus that Causes Bat Disease Detected in Nebraska. News Release. November 12, 2015. Accessed at: https://www.whitenosesyndrome.org/sites/default/files/files/wns_fungus_ne_news_release_final.pdf>.

_____. 2015b. Threatened Species Status for the Northern Long-Eared Bat with 4(d) Rule. U.S. Fish and Wildlife Service. 80 FR 17973 18033. Accessible at: https://www.gpo.gov/fdsys/pkg/FR-2015-04-02/pdf/2015-07069.pdf

______. 2016a. 4(d) Rule for the Northern Long-Eared Bat; Final Rule. U.S. Fish and Wildlife Service. 81 FR 1900 1922. Accessible at: https://www.gpo.gov/fdsys/pkg/FR-2016-01-14/pdf/2016-00617.pdf

______. 2016b. Gray Bat (Myotis grisescens) Fact Sheet. U.S. Fish and Wildlife Service. Accessed on May 10, 2017 at https://www.fws.gov/midwest/endangered/mammals/grbat_fc.html

______. 2016c. Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-eared Bat. U.S. Fish and Wildlife Service. Consultation Code: 09E00000-2016-F-0001.

______. 2017a. Determination That Designation of Critical Habitat Is Not Prudent for the Northern Long-Eared Bat: Critical Habitat Determination. U.S. Fish and Wildlife Service. 81 FR 24707 24714. Accessible at https://www.gpo.gov/fdsys/pkg/FR-2016-04-27/pdf/2016-09673.pdf

______. 2017b. 2017 Range-wide Indiana bat Summer Survey Guidelines. U.S. Fish and Wildlife Service. Accessed on September 6, 2017 at https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2017INBASummerSurveyGuidelines9May2017.pdf

______. 2022. Species Status Assessment Report for the Northern long-eared bat (*Myotis septentrionalis*) Version 1.2. U.S. Fish and Wildlife Service. Accessed on February 2, 2022 at https://www.fws.gov/sites/default/files/documents/Species%20Status%20Assessment%20Report%20for%20the%20Northern%20long-eared%20bat-%20Version%201.2.pdf

U. S. Forest Service. 2009. “Invasive Plants.” *Eastern Forest Environmental Threat Assessment Center,* page 9. Retrieved from <http://www.forestthreats.org/invasive-plants> (June 11, 2010).

Appendix A – Photo Log of Associated Activities

Photo Log of Associated Activities

Financial Assistance, Technical Assistance, Education Activities

|2

Environmental Education

Before

During

After

Community Day

Earth Day Program, Spring City Elementary School

|3

Environmental Education

Annual Public Lands Day event at Worthington Cemetery |4

Property and Equipment Transactions

|5

TVA

Easements on TVA Property

Easement for barge terminal – before (left photo) and after (right photo)

|6

Easements on TVA Property

Easement for utility ROW – before (left photo) and after (right photo)

|7

Easements on TVA Property

Easement for gas ROW (left photo) and campground (right photo)

|8

Sale of TVA Property

Sale of Fee property before (left photo) and after (right photo)

|9

Site Characterization, Site Studies, Identification of Operational Boundaries

|10

Subsurface drilling

|11

Maintenance and Modifications to Ground and Vegetation on Land, Shoreline or Below Water

|12

Mechanically remove herbaceous vegetation/brush *(mower, bushhog, bull dozer, landscaping hand clearing,, feller buncher, snow/ice removal, tree removal < 3" DBH, weed wrench, string trimmer)*

During

After

Bushhogging for wildlife habitat

Before

After

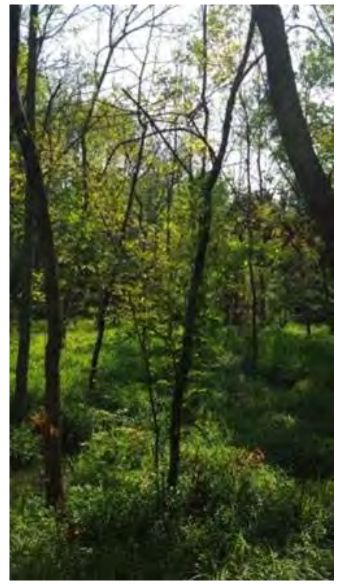
Transporting machinery

|13

Mechanically remove herbaceous vegetation/brush *(mower, bushhog, bull dozer, landscaping hand clearing,, feller buncher, snow/ice removal, tree removal < 3" DBH, weed wrench, string trimmer)*

Before

During

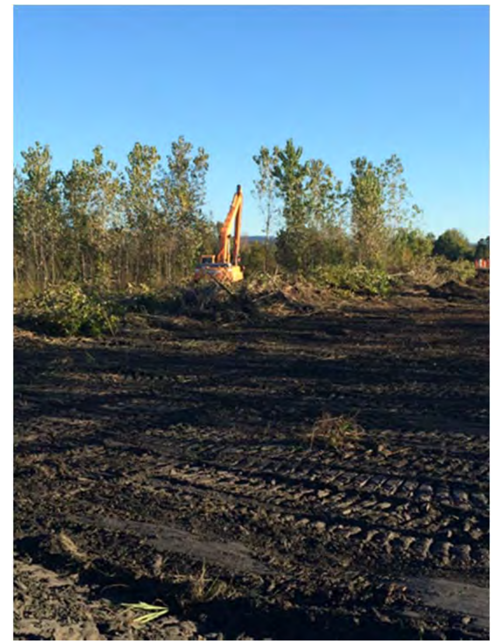


After

Worthington Cemetery Ecological Study Area (Melton Hill) is packed with nonnative invasive plants. This project's goal was to remove all invasive plants by hand over a 5-acre area.

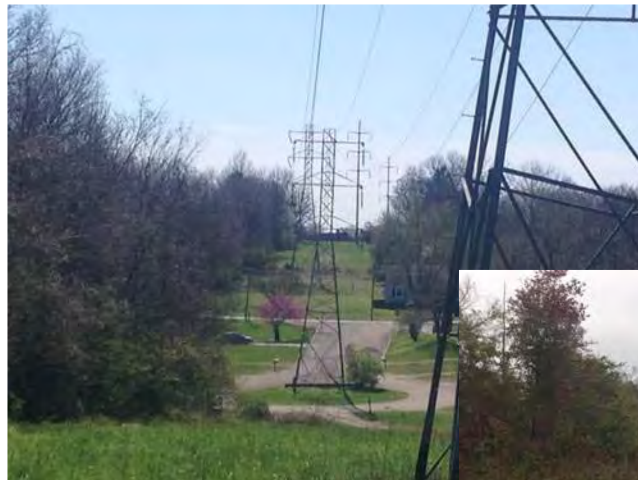
|14

Mechanically remove herbaceous vegetation/brush *(mower, bushhog, bull dozer, landscaping hand clearing, feller buncher, snow/ice removal, tree removal < 3" DBH, weed wrench, string trimmer)*



|15

Mechanically remove herbaceous vegetation/brush *(mower, bushhog, bull dozer, landscaping hand clearing,, feller buncher, snow/ice removal, tree removal < 3" DBH, weed wrench, string trimmer)*



Vegetation maintenance of brush.

Before and after of brush removal under a ROW in a residential area.

|16

Mechanically remove herbaceous vegetation/brush *(mower, bushhog, bull dozer, landscaping hand clearing,, feller buncher, snow/ice removal, tree removal < 3" DBH, weed wrench, string trimmer)*

Before and after of mechanical re-clearing of brush on ROW. In this instance we mowed the entire ROW to remove invasive Bush Honeysuckle and Autumn Olive from the ROW.

|17

TVA

Erosion Control – Minor *(ravel or riprap placement on slopes, where minimal grading or preparation is required; soil stabilization measures such as reseeding and revegetation)*

|18

Erosion Control – Minor *(ravel or riprap placement on slopes, where minimal grading or preparation is required; soil stabilization measures such as reseeding and revegetation)*

Soil amendments

|19

Site-specific enhancements in streams and reservoirs for aquatic animals *(spawning benches, fish attractors, and mussel culturing rafts)*

|20

Herbicide Use *(Control of invasive/exotic vegetation, ROW vegetation maintenance, hand-held/Backpack herbicide application on vegetation.*

Oriental bittersweet

Callery Pear

Before and After Application

|21

***Herbicide Use** (Control of invasive/exotic vegetation, ROW vegetation maintenance, hand-held/Backpack herbicide application on vegetation.*

Four "after" pictures of herbicide applications. Areas were treated using backpack sprayers targeting specific incompatible vegetation in the ROW.

|22

Herbicide Use *(Control of invasive/exotic vegetation, ROW vegetation maintenance, hand-held/Backpack herbicide application on vegetation.*

One month after (first photo) and one year (second photo) after backpack sprayer herbicide application.

|23

Conduct Prescribed Burns

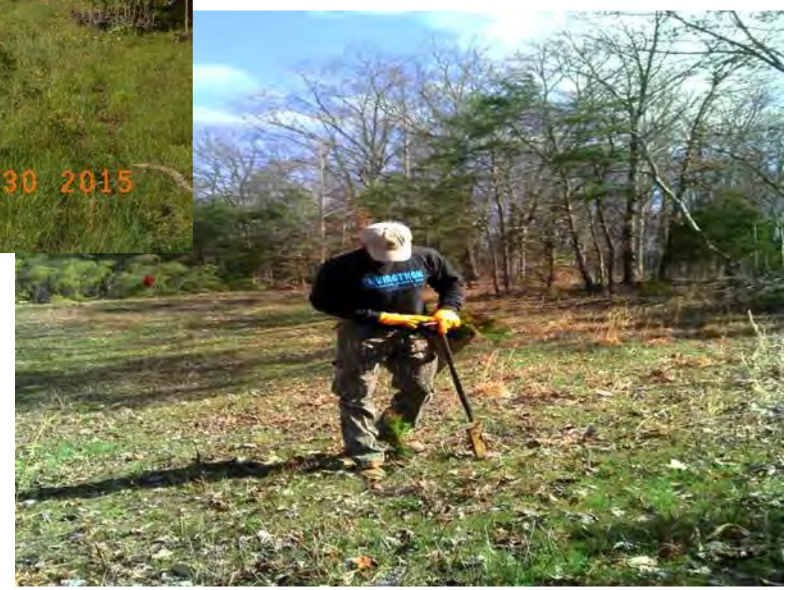
Controlling vegetation for planned prescribed burn

Constructing fire lines for planned burn

|24

Planting of Trees

Site adjacent to Chatuge Reservoir, before and after tree planting



Planting shortleaf pine trees

|25

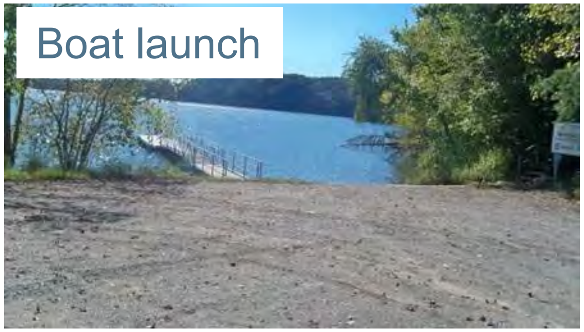
Planting of Trees

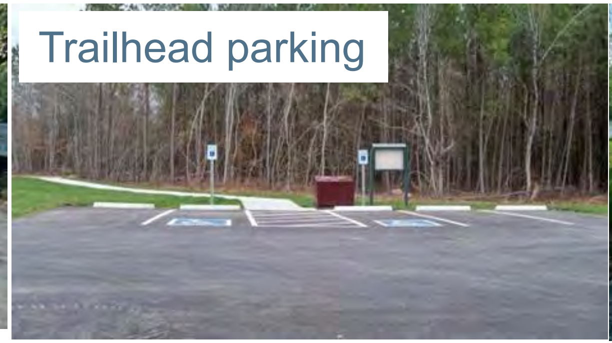
Tree planting on Parcel 3, adjacent to Chatuge

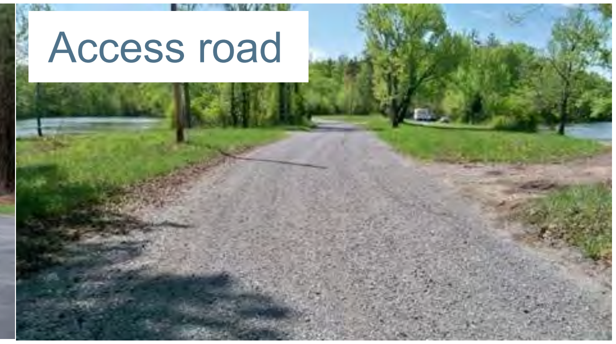
Tree planting on Parcel 3, adjacent to Chatuge, three years later

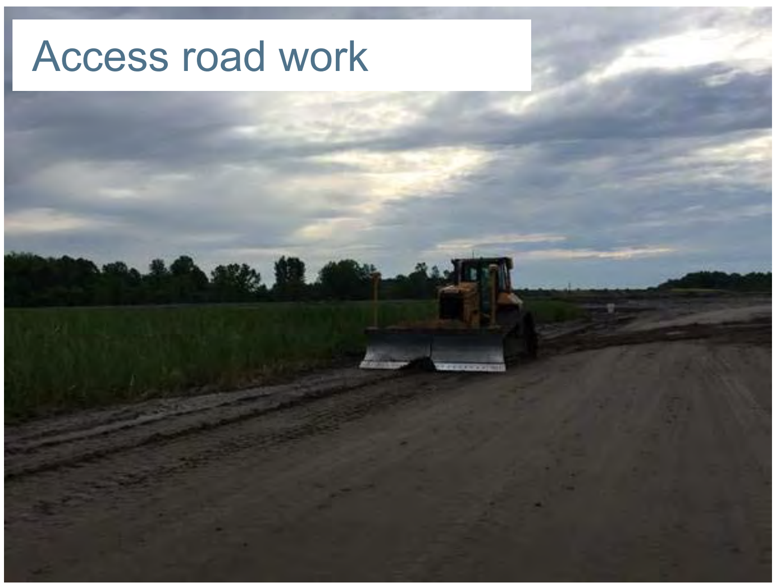
|26

Maintain/Construct Roads, Trails, Parking Areas *(old/new footprint, w/ or w/o tree removal)*


Boat launch


Trailhead parking

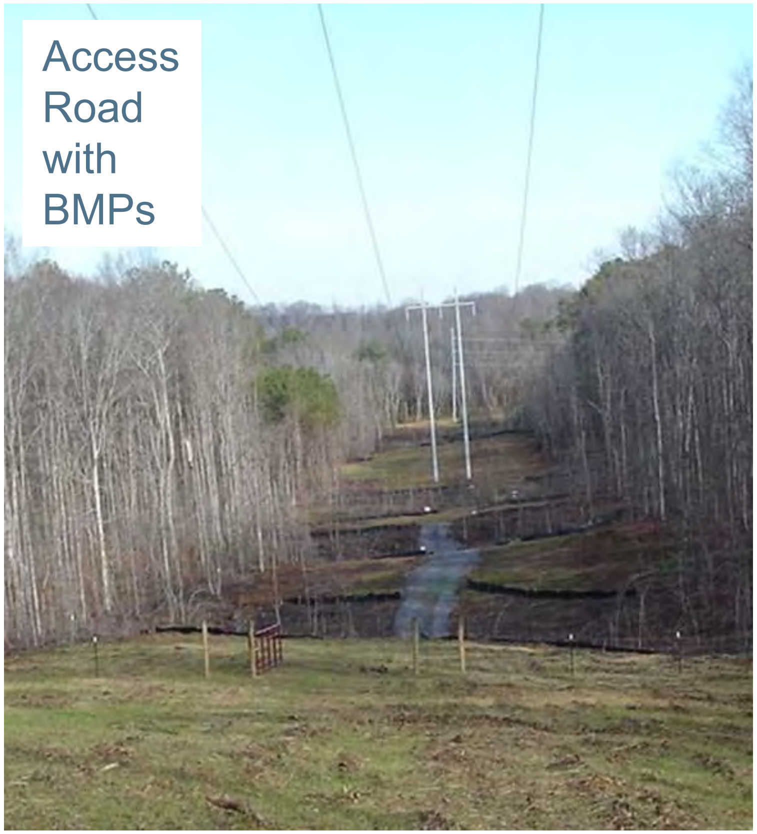

Access road


Access road work


Access road construction

|27

Maintain/Construct Roads, Trails, Parking Areas *(old/new footprint, w/ or w/o tree removal)*



|28

Maintain/Construct Roads, Trails, Parking Areas *(old/new footprint, w/ or w/o tree removal)*

Access Road within existing Industrial Sites

|29

Maintain/Construct Roads, Trails, Parking Areas *(old/new footprint, w/ or w/o tree removal)*

Access Roads within existing footprints

|30

Maintain Roads, Trails, Parking Areas *(old/new footprint, w/ or w/o tree removal)*

Before

During

After

Trailheads/Trails

Before work

After work

|31

Maintain/Construct Access Control/Site Protection (old/new footprint, *w/-w/o tree removal)*

Vehicle restriction

Measures to protect milkweed

Ensure protection of essential groundwater monitoring program

|32

Maintain/Construct Access Control/Site Protection (old/new footprint, *w/-w/o tree removal)*

Maintain cave gate protecting bats

Archaeological Monitoring and Protection

Access control measures to decrease abuse of public land – before/after

|33

Maintain/Construct Access Control/Site Protection (old/new footprint, *w/-w/o tree removal)*

Protection of sensitive habitat

Fencing around industrial site

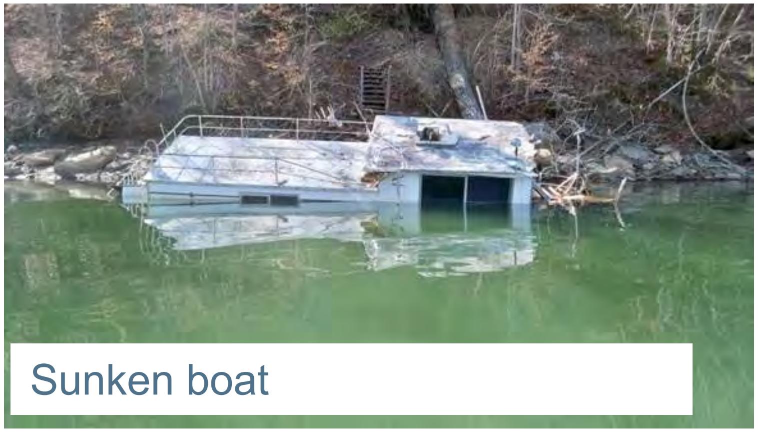
|34

Restore site following human use and abuse

Install measures to decrease ATV abuse, e.g, vehicle barriers

|35

Remove debris, dump sites, hazardous material, unauthorized structures


Sunken boat


Site after removal of sunken boat


Hired divers to hook removal equipment to sunken boat

Remove debris, dump sites, hazardous material, unauthorized structures

Remove abandoned objects

Annual clean-up in partnership w/ Melton Hill Users Group

Unauthorized fence

Site after fence was removed

37

Remove debris, dump sites, hazardous material, unauthorized structures

Building and debris removal – before (2 photos on left) and after (photo on right)

|38

Fill/Borrow Material

|39

Fill/Borrow Material

|40

Fill/Borrow Material

Swim beach (sand)

Dredging/Excavation

|42

Dredging/Excavation

Commercial Marina

|43

Stream/Wetland crossings

Agricultural Stream Crossing

|44

Stream/Wetland crossings

Wildlife viewing pier in Ecological Study Area

Tracked equipment used when crossing a wetland cannot be avoided

Erosion BMPs – ditch crossing

|45

Stream/Wetland crossings

Tree removal spanning ravine - BMP

|46

Clean-up following Storm Damage

|47

Clean-up following Storm Damage

|48

Clean-up following Storm Damage

Before

Removing downed trees across trail

After

|49

Hazard Tree Removal

The above pictures are areas that have been identified as needing corrective maintenance because they will not meet clearance specifications before the next TL ROW preventative maintenance cycle. Typically these areas are identified via the air or during ground inspections and a crew is sent out to remove the individual trees or brush.

|50

Hazard Tree Removal

Yard tree removal involves cutting incompatible species of trees and brush from maintained lawn areas during our preventative maintenance or on corrective maintenance TL ROW work.

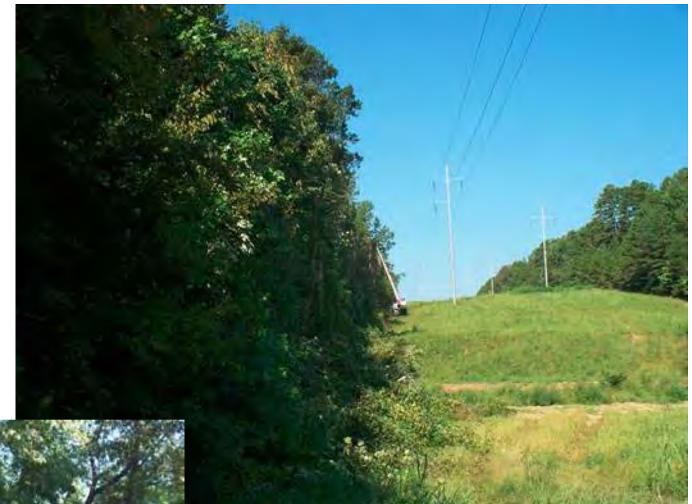
|51

Hazard Tree Removal

Before (left) and after (right) of a potentially suitable hazard tree that was cut down over winter

|52

Mechanical Removal of Vegetation that May include trees $\geq$ 3 inches dbh (e.g., feller buncher, bull dozer, bush hog, hand clearing)



This is a before (left), during (middle), and after (right) of side trimming. All trees along the ROW edge are trimmed and the limbs and branches mulched.

|53

Mechanical Removal of Vegetation that May include trees ≥ 3 inches dbh (e.g., feller buncher, bull dozer, bush hog, hand clearing)

Here are a few after pictures of side trimming where all trees along the ROW edge have been trimmed and you can see where limbs and branches have been mulched.

|54

Mechanical Removal of Vegetation that May include trees ≥ 3 inches dbh

Wildlife openings - enhancement

|55

Mechanical Removal of Vegetation that May include trees ≥ 3 inches dbh

Forest management – thinning – before and after

|56

Mechanical Removal of Vegetation that May include trees ≥ 3 inches dbh

Removal and mulching of trees along an existing TL ROW that are encroaching on the easement

|57

Mechanical Removal of Vegetation that May include trees $\geq$ 3 inches dbh

Sediment BMPs associated with tree removal along TL ROWs

|58

Erosion Control – Stabilization

Before

During

After

|59

Erosion Control – Stabilization

Sediment BMPs associated with tree removal along TL ROWs

|60

Erosion Control - Stabilization

|61

Grading


Grading at a trailhead

Re-graveling/re-grading along access road

Construction of camping pads during (top row) and after (bottom row)






|62

Grading

Industrial park

|63

Grading

|64

Installation of soil improvements *(installation of grout/concrete below the surface)*

BTR 1651.5 - LMG grouting rig B setup and started LMG grouting.

Crest Drilling and Grouting Looking East

Crest Drilling and Grouting Looking West

BSC 1379 - Sonic rig 3 completed sonic drilling down to 117.3'.

|65

Drain installations for ponds

|66

Berm development

Temp slope protection, work platform, bank restoration

|67

Facilities, Buildings, Structures - Installation, Construction, Maintenance, Upgrades, Demolitions

Water-based Structures - Minor *(e.g., floating play equipment, slalom courses, floating skip jumps, floating signs)*

|69

Internal renovation or internal expansion of an existing facility *(no changes to surrounding landscape, no tree removal)*

Renovation of internal walls - before and after

|70

Internal renovation or internal expansion of an existing facility *(no changes to surrounding landscape, no tree removal)*

Internal Renovation - restrooms - before and after

|71

Internal renovation or internal expansion of an existing facility *(no changes to surrounding landscape, no tree removal)*

Renovation of internal tool room - before and after

|72

Remove and/or Replace Transmission Line Poles *(Use of trucks, crane, no tree removal)*

|73

Replace TL Overhead Ground Wire *(pulling equipment, helicopter, no tree removal)*

|74

Replace/ Install Transmission Conductor *(pulling equipment, helicopter, no tree removal)*

|75

Conduit Installation*(establishment of trench/placement of cable and metering equipment)*

Laydown Area *(worker assembly, vehicle parking, material storage, sometimes gravel/fencing*

|77

Laydown Area *(worker assembly, vehicle parking, material storage, sometimes gravel/fencing*

|78

Non-navigable boathouses *(resolution of existing structures built outside of 26a regulations or not previously approved)*

Before and after example

|79

TVA

Land-Based Structures - Minor *(Steps, walkways, landings, patios, picnic tables, gazebos, terraces, storage space, benches, pavilions, trash containers, bird boxes, fish cleaning stations)*

|80

Land-Based Structures - Minor *(Steps, walkways, landings, patios, picnic tables, gazebos, terraces, storage space, benches, pavilions, trash containers, bird boxes, fish cleaning stations)*

Before

During

After

Installation of steps in trail

Land-Based Structures - Minor *(Steps, walkways, landings, patios, picnic tables, gazebos, terraces, storage, benches, pavilions, trashcans, bird boxes, bat roosts, fish cleaning stations)*

Installation of artificial bat roosts

|82

Signage installation

|83

Signage installation

Boundary marking

|84

Floating Buildings

Floating dock – before (left photo) and after (2 right photos)

Mooring Buoys or posts

Moorage for smaller vessels

Barge fleeting area – mooring site for deep draft watercraft

|86

Maintain Water-control structures *(dewatering units, spillways, levees)*


Levee enhancement

Spillway repair


Erosion BMPs – silt fence- levee repair

|87

Marine fueling facilities

Marina fuel station

Marina slips and fuel station

|88

Commercial water-use facilities

Marina boat slips with riprap in foreground

|89

Foundation installation

|90

Substation structure and equipment installation *(e.g. overhead bus)*

|91

Pole and/or tower installation and/or extension.

|92

Private residential docks, piers, boathouses

Boat lift, marine rail, jet ski lift

|93

Private residential docks, piers, boathouses

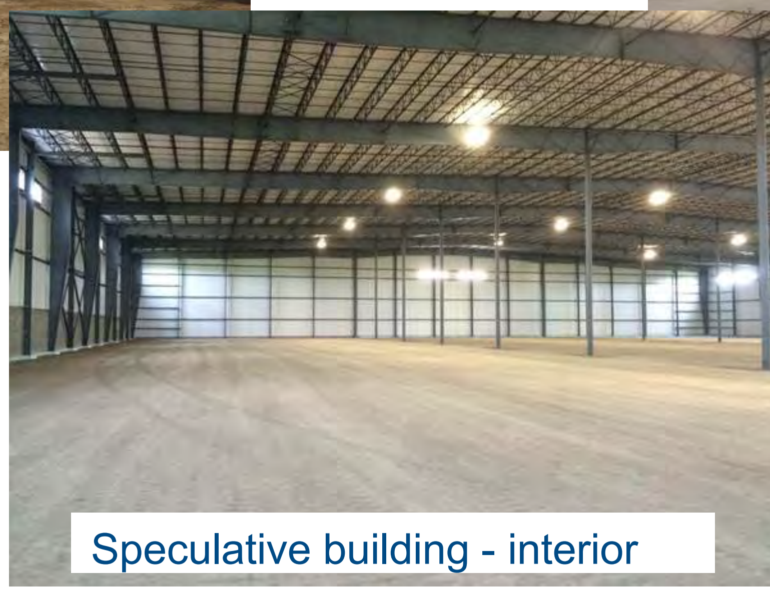
Land-based boat garage

|94

Financing for speculative building construction


Industrial building construction


Spec. building on concrete pad


Speculative building - interior

|95

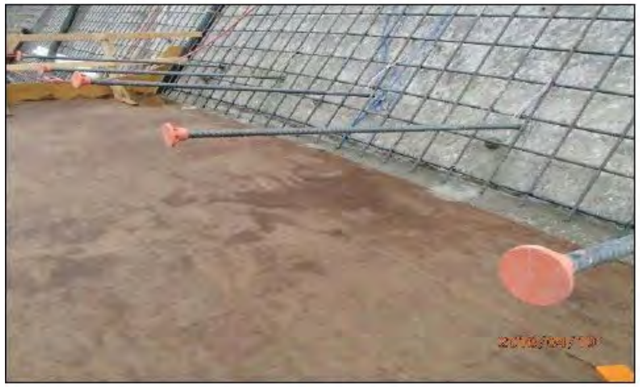
Lock maintenance and construction

Construction – Lock at Kentucky Dam

|96

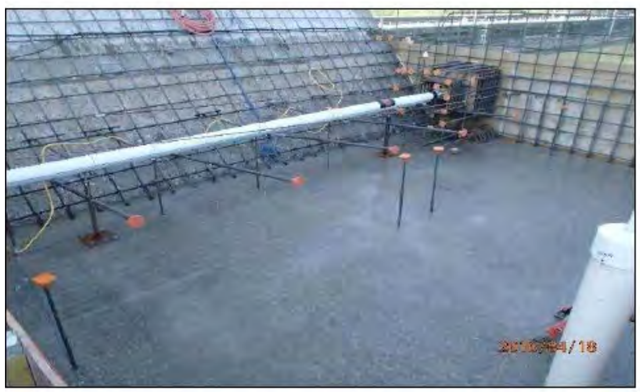
Lock maintenance and construction

Wilson Dam – Main Lock Land Wall Post Tensioning



17A - #14 dowels fully grouted Lift 5

L17A Lift 5 mid-placement.



L 17C Lift 5 clean up prior to the start of the pour

L17C Lift 5 mid-placement

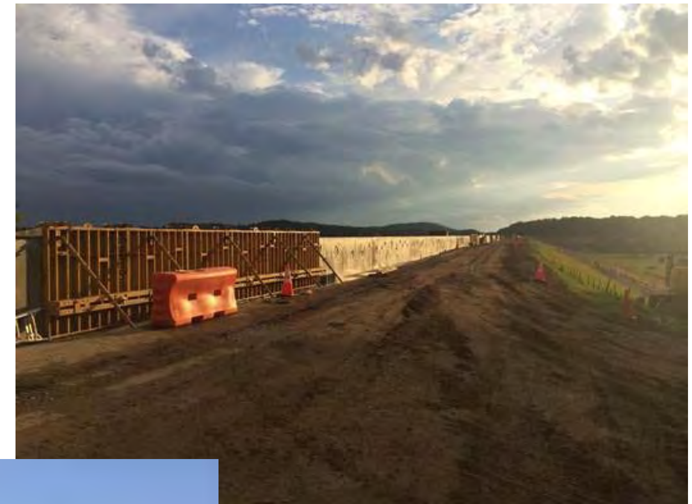
|97

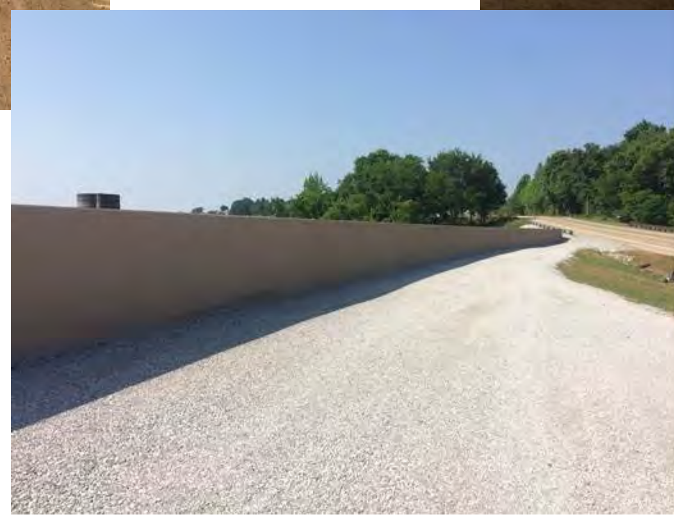
Concrete Dam modification

Fort Loudon Dam

|98

Concrete dam modification





Tellico Dam

|99

Boat launching ramps, driveways, sidewalk

|100

Boat launching ramps, driveways, sidewalk

Launching ramp pre-construction (left) and post-construction (right)

|101

Construction or expansion of land-based structures

Parking area with pavilion – before (left) and after (right)

|102

Construction or expansion of land-based structures

Construction of barge terminal – before (left) and after (right)

|103

Barge fleeting areas

|104

Water Intakes - Industrial

Before

During construction

|105

Landfill Construction

Coal Ash Landfill - Operation

|106

Landfill Construction

Gypsum Landfill - Operation

|107

Structure demolition

Fort Loudon Dam

Gallatin FP – ductwork demolition

Structure demolition

John Sevier FP – Demolition of Chemical Treatment Pond

|109

Structure demolition

John Sevier FP – Demolition of CY

|110

Pond closure

Widows Creek Fossil Plant

|111

Pond closure

|112

Pond closure

Final closure of ash pond of John Sevier FP – placing topsoil (left) and placing sod (right)

|113

Bridge replacement

Before

Construction In progress

|114

Appendix B – Job Safety Analysis Worksheet: Prescribed Fire Use on TVA Natural Resource Management Reservoir Lands

This page intentionally left blank

Job Safety Analysis Worksheet

Number:	**Job:** Prescribed Fire Use		
Date: March 21, 2019	**Supervisor:** Certified Prescribed Burn Manager	**Plant / Facility:** Natural Resources	**Analysis By:** Jack A. Muncy
Skills Required: TVA personnel that particapte within the burn operational area/fireline must have successfully completed 1.) S-130 Firefighter, 2.) S-190 Introduction to Wildand Fire Behavior, 3.) Field Day, 4.) Fire Shelter Deployment Excercises, 5.) Physically Fit, 6.) Annual "hands-on" field based fire shelter deployment excercises. TVA personnel that do not meet these standards can serve in supportive non-fireline roles located safely away from the burn operational area.		**Reviewed By:** RJ Moore, D Simbeck, R Short, J Burnette, K Young, B Stewart, M Morrissey, E Anderson	**Approved By:** Hugh E. Standridge Wildland fires are categorized into two distinct types: 1.) Wildfires - unplanned ignitions or prescribed fires that are declared wildfires 2.) Prescribed Fires - planned ignitions

Required Personal Protective Equipment:
Interagency Adopted Wildland Firefighter PPE: 1.) nomex fire resistant pants & long sleeves shirt, 2.) leather lace type boots at least 8 inches high with skid resistant soles, 3.) wildland hard hat/helment with chin strap & ratchet suspension, 4.) safety glasses/goggles, 5.) leather gloves, 6.) underclothing 100% cotton, 7.) carry fire shelter & night head lamp, 8.) use Special PPE as condition/activity/exposure dictates including chainsaw chaps, dust/particulate masks, neck shrouds, hearing/ear protection where noise level exceeds 90dba, Nomex brush coat, flashing helment safety light during night operations. Note: All applicable PPE must meet standards & requirements outlined in the TVA Safe Work Requirements Manual.

Tools and Equipment Required:
Resources identified within the site specific written Prescribed Burn Plan as follows: 1.) heavy equipment, 2.) farm tractors with implements, 3.) utility terrian vehicle with water delivery/tanks, 4.) firing apparatus (drip torch/fusees), 5.) water engine 4X4, 6.) portable pumps, 7.) leaf blowers, 8.) chainsaw, 9.) collapsible backpack water hand pump, 10.) special hand tools designed for constructing fireline, burnout, holding/mop-up/patrol & pre-identified safety zones including Council fire rake, Pulaski-Forester axe, firefighting shovel, McLeod rake (rakehoe), Adze/hazel hoe, Rouge hoe, Council fire swatterflap, combination pick/shovel tool.

Job Preparation:
TVA Certified Prescribed Burn Manager must prepare a written Prescribed Burn Plan in accordance with respective state requirements & completeness. When conducting a prescribed burn in partnership with local/state/federal agencies, nongovernmental organizations, contractors and/or others, the written plan can be completed by that partner(s); however, TVA's Prescribed Burn Manager must review, concur, and sign.

Hazardous Materials:
1.) Drip torch fuel mixture of gasoline & diesel fuel; mixture ratio based on expected on-site temperature range 2.) chainsaw & leaf blower fuel

Special Requirements:
Prescribed Burns are managed by the respective state Certified Prescribed Burn Manager that maintains currency through state approved continiung education requirements.

1. Struck By (**SB**)
2. Struck Against (**SA**)
3. Contact By (**CB**)
4. Contact With (**CW**)
5. Caught On (**CO**)
6. Caught In (**CI**)
7. Caught Between (**CBT**)
8. Foot Level Fall (**FLF**)
9. Fall to Below (**FB**)
10. Overexertion (**OE**)
11. Exposure (**E**)

Job Safety Analysis Worksheet

Number	Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures
1.	Personnel must be qualified for assigned position(s) including burn manager, fireline, heavy equipment, firing apparatus, holding, mop-up, chainsaw, UTV/ATV, water handling, "safety lookout"	Lack of training, experience, injuries	Ensure personnel meet required training/experience/certification
2.	Travel to, from and on-site; trailering	Motor vehicle accidents, slippery road surfaces, soft shoulders, unimproved narrow roadways, weather darkness, smoke	Drive defensively: use seat belts; identify road conditions during briefings; post road guards; maintain communications; mark hazards; use headlights; perform pre-use inspections on equipment; scout roads & identify turnouts before ignition begins; provide road system map of burn area; use backers & chock vehicle tires; park all vehicles & equipment facing out.
3.	Conduct on-site briefing with **all** resources in attendance (no on-site briefing = no participation)	Lack of communications	Provide complete on-site briefing before burning to outline organizational responsibilities; firing sequence/order; site specific hazards; weather; expected fire behavior & other proactive measures such as medical plan; location of emergency medical care; escaped fire plan; adjacent landowners & road system; locked gates; water sources; backup resources.
4.	Review proper use of PPE, tools, equipment, UTV/ATVs & radios	Injuries, hit by equipment or hazard tree snag	Inspect tools for use (handle, sharpness); wear PPE; maintain adequate spacing between workers when tools in use; maintain sheaths & tool guards when tools are not in use; tools are not transported in same compartment as personnel; chainsaw use covered under separate JSA. Stay alert when working around equipment such as UTV/ATVs; engines & dozers; maintain visual contact & ensure communications with all equipment operators; stay at least 100' in front or 50' behind equipment; stay alert to equipment operator safety concerns including wetlands, steep slopes, fences, electrical lines; remain situational aware of surroundings including hazardous snags, fuels & fire environment; wear

1. Struck By (**SB**)
2. Struck Against (**SA**)
3. Contact By (**CB**)
4. Contact With (**CW**)
5. Caught On (**CO**)
6. Caught In (**CI**)
7. Caught Between (**CBT**)
8. Foot Level Fall (**FLF**)
9. Fall to Below (**FB**)
10. Overexertion (**OE**)
11. Exposure (**E**)

Job Safety Analysis Worksheet

Number	Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures
			safety flashing helmet light during night operations within 100’ of heavy equipment. Know communications plan.
5.	Mix & handle drip torch fuel	Burns, spills, fuel saturated clothing & boots	No smoking within 25’ of mixing & filling area; do not fill or mix fuel in truck and/or equipment beds; avoid use of cellular telephones in & around fill or mixing area; avoid fuel contact with bare hands, clothing & boots; provide pour spouts; use only approved fuel containers; follow correct fuel mixture ratio based on expected temperature range.
6.	Implement Prescribed Burn	Back & eye injuries, cuts, slips, trips, falls, hazard tree snags, stinging insects, snakes, ticks, smoke, burns, rolling material/rocks or cut logs	Always have Escape Routes; maintain Lookouts & Communications, “Escape Routes & Safety Zones (LCES)”; follow “Standard Fire Orders & Watch Out Situations”; communicate with lighters & holders; all lighters use hand held radios; do not fill drip torches near ignition sources; do not spill burn fuel mix on ground or clothing.
7.	Hold/Mop-Up/Patrol Prescribed Burn	Back & eye injuries, cuts, slips, trips, falls, hazard tree snags, stinging insects, snakes, ticks, smoke, burns, rolling materials/rocks or cut logs, poison ivy/oak, heat stress, dehydration, CO exposure	Wear required PPE & use special PPE as condition/activity/exposure dictates; obtain complete briefing; maintain LCES & follow “Standard Fire Orders & Watch Out Situations”; identify hazards in work area; flag hazards for others; use warning lights & provide traffic control on roadways during smoky conditions & night operations; protect against heat stress; drink water & sports drink 5 to 1 ratio before, during & after shift; rotate personnel from areas with high smoke levels to areas of less smoke; take breaks away from potential hazards such as vehicular traffic flow, falling trees and rocky bluffs.
8.	Conduct after action review	Questions should be asked after each shift	What did we set out to do? What actually happened? Why did it happen that way? What should be sustained? What can be improved?
9.			
10.			

1. Struck By (**SB**)
2. Struck Against (**SA**)
3. Contact By (**CB**)
4. Contact With (**CW**)
5. Caught On (**CO**)
6. Caught In (**CI**)
7. Caught Between (**CBT**)
8. Foot Level Fall (**FLF**)
9. Fall to Below (**FB**)
10. Overexertion (**OE**)
11. Exposure (**E**)

This page intentionally left blank

Appendix C –Best Management Practices for Silviculture Activities on TVA Lands

This page intentionally left blank

Best Management Practices

for

Silvicultural Activities on TVA Lands

Land Management

Tennessee Valley Authority

Norris, Tennessee 1994

Best Management Practices for Silvicultural Activities on TVA Lands

Land Management
Tennessee Valley Authority
Norris, Tennessee 1994

INTRODUCTION

TVA has adopted these Best Management Practices (BMPs) to address the growing awareness of environmental issues and TVA's commitment to protect water quality within the Tennessee River Valley. TVA foresters are committed to support the mission to protect water quality and control nonpoint source pollution from silvicultural activities. This desire is reinforced by our mission as directed in the 1933 TVA Act "to aid the proper use, conservation, and development of the natural resources" of the Tennessee River Valley.

The Tennessee River Valley includes parts of seven states. These states, by Act of Congress, have the power, authority, duty, and responsibility to establish and adopt water quality standards. This led each state within the TVA region to publish forestry Best Management Practices top help control erosion and sedimentation. Each of the Valley states has also adopted a voluntary compliance approach for forest operators. TVA and other Federal agencies are under state authority governing water quality and are focusing efforts to aid states in the most appropriate manner.

TVA reservoir properties are unique compare to other private or governmental land holdings. Their proximity to water resources and vast multiple use mandates greater conservation efforts. However, many questions have developed as a result of dealing with multiple BMP documents from the various states. This led TVA to compile and develop a separate set of BMP guidelines that will be acceptable and consistent across state boundaries. These guidelines were developed to address TVA's responsibilities to practice good stewardship as well as conserve and develop forest resources associated with multiple use on reservoir properties.

BMPs are included for harvesting plans, forest roads, skid trails, and vegetation control activities with specific reference to areas of special concern (e.g., wetlands). These BMPs are the result of many years of research in civil engineering, geology, soil science, hydrology, forest ecology, watershed management, and agronomy. In addition, special environmental concerns from TVA foresters and resource specialists not addressed by existing state and Federal guidelines have been included. This document is dynamic in the sense that multiagency cooperation will provide enough resources to monitor, research, and develop new innovations and methods that will continuously update these guidelines for the benefit of the environment, the industry, and the Valley as a whole.

With the adoption of these BMPs, trained TVA foresters are taking a leadership role in demonstrating silvicultural activities that minimize environmental and water quality impacts. Hopefully, BMP compliance will become the norm with the examples set forth by TVA, the states, and other operators concerned with the "proper use, conservation, and the development of the natural resources" of the Tennessee River Valley.

TABLE OF CONTENTS

PREHARVEST PLANNING

A preharvest plan will be prepared. Depending on the site and nature of the harvest, the plan will include any or all of the following: property boundaries, streams and drainages, soil restrictions, slope, environmental concerns, approximation of main haul road and skid trail locations, potential log landings, portable sawmill locations, stream and drainage crossings, drainage structure spacings, and streamside management zones. Timing of harvest and timber sale contract specifications will be included. The objective of pre-harvest planning is for the forester to determine, based on conditions found on the site, which BMPs are necessary to protect water and site quality and how those BMPs will be implemented. These preharvest plans can be used to determine sites where BMP compliance may be difficult. In these areas, stand boundaries or forest management activities may have to be altered or additional protective measures may have to be implemented.

TRUCK HAUL ROADS

Access roads are constructed to connect the harvesting or other forest activity site with a farm or public system road. Temporary or infrequent periodic use is assumed. Higher construction standards for permanent use roads may be desirable.

LOCATION

1. Proper location of roads may be the most important factor in preventing water pollution caused by forest activities. For this reason, road location will be carefully planned prior to construction. Topography, boundary lines, and economic limits on skidding dictate the desired location and extent of the road system. Primary and potential alternative locations will be identified and then marked or agreed upon with the construction operator.

2. Roads should be located as high above and far away from streams as possible and still perform their intended function. Where possible, locate roads on side slopes and avoid level ridgetops to assure adequate side drainage.

3. Roads should follow contour as much as possible with grades between 3% and 10%. Gradients that exceed 10% are permissible for distances usually not exceeding 200 feet or as long as measures are taken to prevent erosion, such as additional cross drainage structures or aggregate surfacing. On soils with severe erosion hazard, grades should be 8% or less, but grades exceeding 8% may be acceptable as long as measures are taken to prevent erosion.

4. A Streamside Management Zone (SMZ) for trapping sediment and other eroded materials will be established between roads and watercourses. Width of SMZs varies according to the steepness of the terrain starting with a minimum of 50 feet (75 feet for wetlands). SMZ widths for varying slopes are listed in the SMZ section.

5. Minimize the number of stream crossings because they are potential sources for large amounts of sediment. However, when crossings are necessary use culverts or bridges. Fords must receive prior approval by district foresters. Regardless of the type, crossings should be made at right angles to streams and should not interfere with normal streamflow.

6. In some cases, harvesting units may already have old access roads which were constructed prior to BMP awareness. These roads may be used again assuming measures can be taken to minimize erosion. However, existing roads which cannot be converted to a sound and stable access should be abandoned and alternative avenues of access should be explored.

CONSTRUCTION

1. After carefully planning road location, rights-of-way must be cleared of trees and understory. Trees, logs, and other debris (if not recovered) should be pushed to the downhill side of the rights-of-way and spread out as evenly as possible. This material will serve as a filter, trapping soil and organic matter which may be washed from the road surface.

2. In order to minimize maintenance problems, roads should be constructed several weeks (sooner if possible) in advance of use to allow time for settling. Plan the timing of the actual road construction to occur during the milder, drier seasons of the year. Winter construction should be avoided.

3. Minimum road width should be 16 feet where possible, allowing at least 10 feet for the tread width and 3 feet of clearance on either side. Increase width as necessary at curves and turnouts. Turnouts should be constructed on gentle grades and should be at least twice the length of trucks. Cuts and fills should be balanced to the practical extent to minimize soil disturbance. Stumps, trees, and other logging debris should not be incorporated into the fill material.

5. Side slopes on cuts and fills should be stable and should vary in length according to the soil type present. Generally, cuts and fills should be sloped 2:1 unless an analysis shows steeper slopes to be stable. Vertical cuts up to 5 feet in depth may also be used provided the soil is stable and proper drainage is assured. However, roads requiring high cut banks should be used only when no alternative is feasible. Where slide hazards exist, provide flatter back slopes and better drainage. All fill material should be kept above stream flood levels with the exception of **wetlands (see page 14)**.

6. Dams constructed of geotextiles, plastic sheets, bales of hay or straw, or even brush can be placed at the toe of the fill, culvert outlets, turnouts, or dips to entrap sediment and release water.

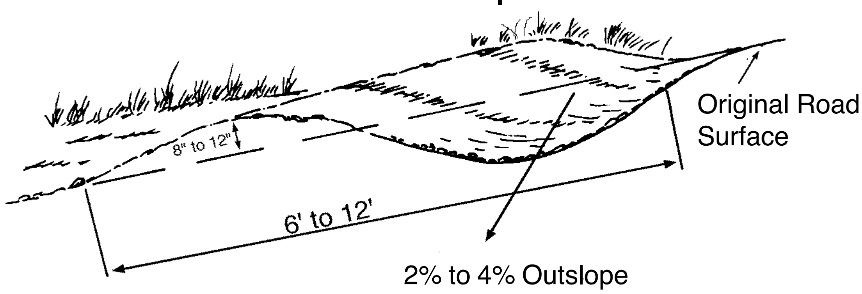
7. Drainage structures are designed to get the water off the road as quickly as possible. These types of structures are dependent on topography, slope, type of equipment and overall objective of the road and include narrow- and broad-based dips, water turnouts, culverts, and bridges. The outlet from any structure should be as far from any water course as practical.

8. Narrow-based dips (or water bars) are appropriate on temporary roads which carry relatively low volumes of water or on roads and skid trails which will be closed after forest operations. Shallow dips may be constructed prior to and during logging use. Deep dips are utilized when the access is to be retired. Proper spacing and illustrations are on the following pages.

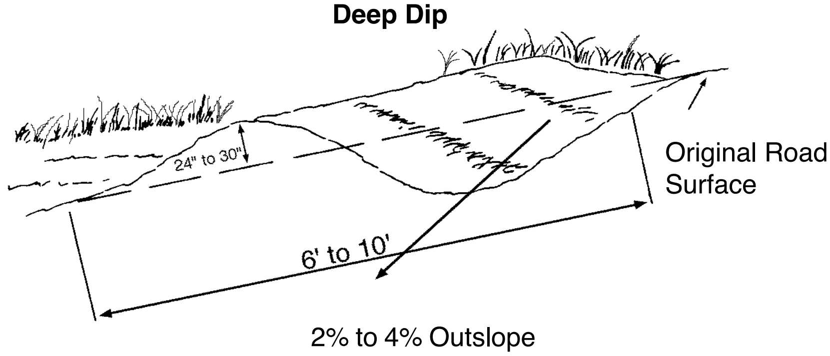
NARROW-BASED DIP SPACING AND ILLUSTRATIONS [1]

Road Grade (%)	Distance Between Dips (ft)
1	400
2	245
5	125
10	80
15	60
20	45
25	40
30	35

Shallow Dip



Deep Dip

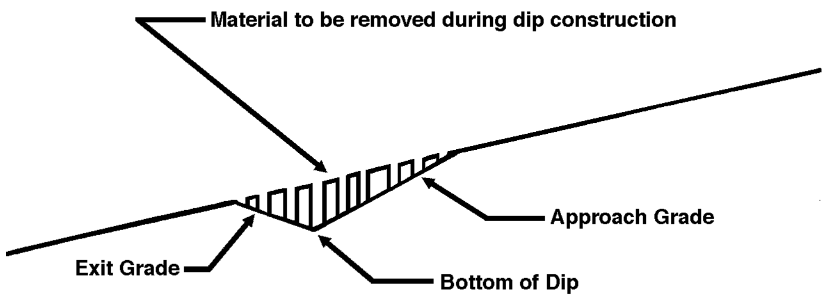


9. Broad- based dips are much longer than narrow-based and are more suited to roads which receive repeated use. These dips should not be used to carry water from springs, seeps, or live streams. Broad-based dips are installed during road construction and should not be used on roads whose gradient exceeds 10 percent. In order to prevent washout, broad-based dips should be surfaced with large crushed rock, gravel, or other suitable riprap material. Areas which receive the discharge should be well protected with heavy slash, grass sod, rock, or other material which will reduce the speed and force of water. Recommended spacings, specifications, and an illustration are on the following pages.

1 - Hartung, R. E. and J. E Kress. 1977. Woodlands of the Northeast, Erosion & Sediment Control Guides, USDA SCS Northeast Technical Service Center, Broomall, PA and Forest Service, Northeast Area, State and Private Forestry, Upper Darby, PA, 25 p.

RECOMMENDED BROAD-BASED DIP SPACING [1,2]

Road Grade (%)	Distance between Dips (ft)
2	300
3	233
4	200
5	180
6	167
7	157
8	150
9	144
10	140



Note: The elevation difference between bottom of dip and designed grade line is always .75 feet.

RECOMMENDED SPECIFICATIONS FOR BROAD-BASED DIPS [1]

Designed Grade(%)	Approach Grade(%)	Approach Distance(ft)	Exit Grade(%)	Exit Distance(ft)
2	3	75	3	15
3	4.5	50	3	13
4	6	38	3	11
5	7.5	30	3	10
6	9	25	3	9
7	10.5	22	3	8
8	12	19	3	7
9	13.5	17	3	7
10	15	15	3	6

1 - Best Management Practices for Silvicultural and Other Forest Activities in Tennessee, 1989, Tennessee Department of Conservation, Division of Forestry, Nashville, TN.

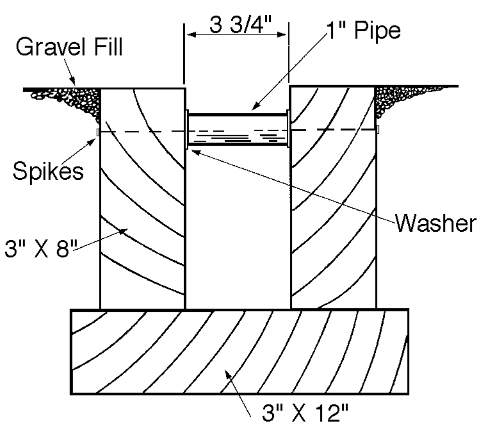
2 - Computed from the formula: Spacing in feet = 400/Slope% + 100 feet.

10. A water turnout is a diversion ditch to move water away from the road. Water turnouts should be constructed to collect and direct road surface runoff from the road into undisturbed areas. The turnout should intersect the ditch line at an equal depth, be outsloped 1 percent to 3 percent, and be directed 30 to 45 degrees downslope. Runoff water should be spread, retained, or brush filtered at the outlet of the turnout and never fed directly into adjacent drainages or channels. Spacing of turnouts corresponds with narrow-based dip spacings.

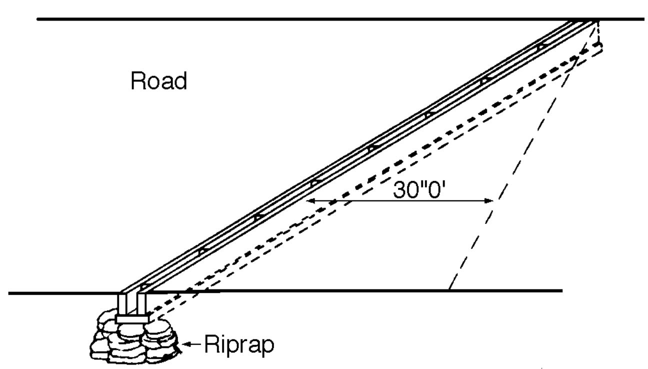
11. Open-top culverts can be used to intercept water running along a road and direct it to the downhill side. Like narrow-based dips, open-topped culverts are more suited to temporary roads or roads which get only occasional use, and they are usually adequate to drain small sources of water such as seeps and springs. Open-top culverts serve the same purpose as pipe culverts but may be constructed of less expensive rough lumber or poles. However, they are also less effective than pipe culverts because they are easily damaged by vehicle traffic and usually require frequent cleaning to permit proper drainage. Recommended spacings and illustrations follow.

SPACING FOR OPEN-TOP CULVERTS [1]

Road Grade (%)	Distance between Culverts (ft)
1	400
2	245
5	125
10	78
15	58
20	47



BOX CULVERT DESIGN



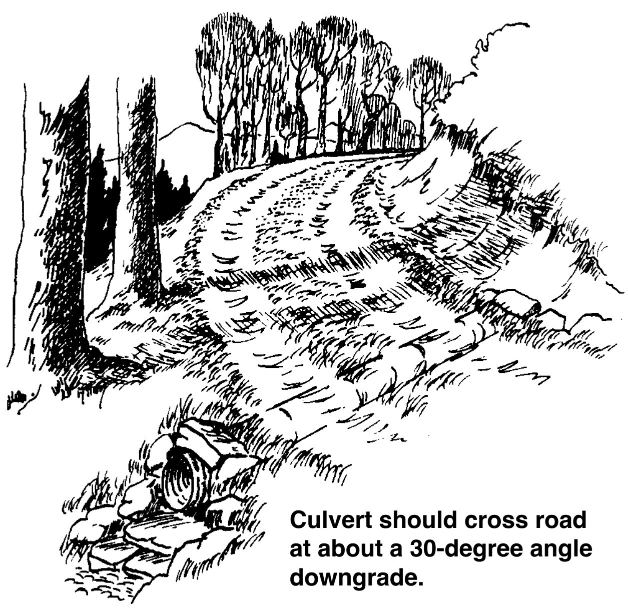
OPEN-TOP CULVERT LAYOUT

1 - Hartung, R. E. and J. E. Kress. !977. Woodlands of the Northeast, Erosion & Sediment Control Guides, USDA SCS Northeast Technical Service Center, Broomall, PA and Forest Service, Northeast Area, State and Private Forestry, Upper Darby, PA, 25 p.

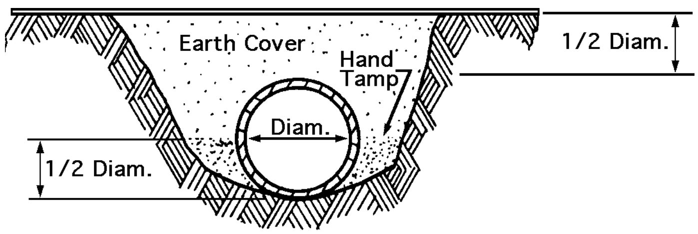
12. Pipe culverts made of steel, plastic, or concrete are recommended for more permanent roads where traffic may be relatively heavy. Pipe culverts are used in natural drains and small streams to channel water across roadways from upslope drainages and to divert water in side ditches across the road. Culverts should be installed during construction of the road.

13. Pipe culverts installed in natural drainages should be bedded in the channel and on the same grade as the stream or drainageway. The culvert should extend at least one foot beyond the fill on both ends and a short fall should be provided on the outlet end so water will move away from the pipe.

14. Pipe culverts should be outsloped 2-4 percent to prevent clogging. A stable headwall, or dam, must be provided to force water through the culvert. Rocks, logs, sandbags, or other suitable material should be used to prevent erosion of the headwall and to break the force of the water at the outlet.



Culvert should cross road at about a 30-degree angle downgrade.



Culvert Installation

15. When installing culverts, compact soil tightly around the pipe to a depth of at least one-half its diameter. Fill over culverts should be at least one-half the culvert diameter but never less than one foot.

16. When installation of a larger culvert is not practical, two or more smaller pipes may be used. The space between the pipes should be one-half the diameter of the pipe.

17. Spacing for culverts used in cross drainages vary with grade. (Reference the broad- based dip spacing table for distances.)

18. Pipes with diameters less than 18 inches are subject to occasional plugging. All pipes require occasional inspection for debris.

19. Take precautions to install proper sized culverts.

CULVERT SIZING [1]
Diameter of pipe needed in inches

Acres Drained	Light Soils[2] Flat 0-5%	Light Soils Mod. -15%	Light Soils Steep 15%+	Medium Soils Flat 0-5%	Medium Soils Mod. -15%	Medium Soils Steep 15%+	Heavy Soils Flat 0-5%	Heavy Soils Mod. -15%	Heavy Soils Steep 15%+
2	15	15	15	15	15	15	15	18	18
4	15	15	15	15	15	18	21	21	21
6	15	15	15	15	18	21	21	27	27
8	15	15	15	15	18	21	24	27	30
10	15	15	15	18	21	24	27	30	36
20	15	15	15	21	24	30	30	36	42
30	15	15	15	21	27	36	36	42	48
40	15	15	15	24	30	36	42	48	54
50	15	15	18	27	36	42	42	48	
60	15	15	18	27	36	42	42	54	
70	15	18	18	27	36	42	48	54	
80	15	18	21	30	36	48	48		
90	15	18	21	30	42	48	48		
100	15	18	21	30	42	48	48		
150	18	21	24	36	42	54	54		
200	21	21	27	36	48				
250	21	24	27	42	48				

20. Fording streams is not recommended and should be avoided whenever possible but may be used (with prior district forester approval) when streams banks are stable and stream bottoms hard. Stream approaches and banks should be stabilized with aggregate to preserve bank integrity and minimize sedimentation.

21. Install water turnouts or diversion ditches 20 to 30 feet prior to a stream crossing to direct road and runoff water into undisturbed areas of the Streamside Management Zone (SMZ).

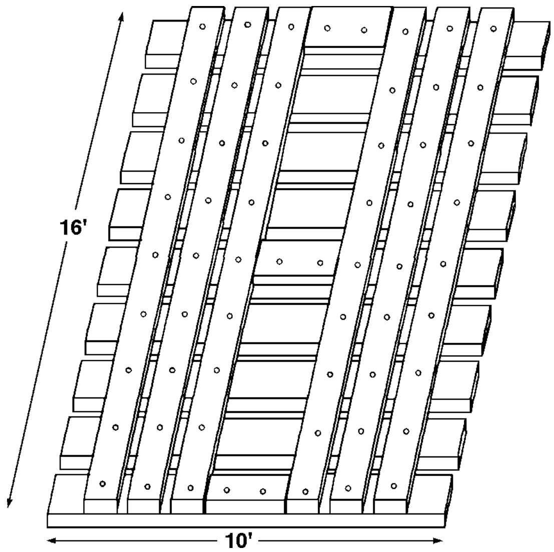
22. Bridges should be used when streams are too large to be carried by culverts or if other crossing methods would develop sediment or pollution problems. Bridges may be constructed of low grade hardwood lumber, timbers, concrete, or steel.

Illustrations - Hartung, R. E. and J. E. Kress. !977. Woodlands of the Northeast, Erosion & Sediment Control Guides, USDA SCS Northeast Technical Service Center, Broomall, PA and Forest Service, Northeast Area, State and Private Forestry, Upper Darby, PA, 25 p.

1 - Forestry Best Management Practices for Water Quality in Virginia, 1989, Virginia Department of Forestry.

2 - Soils which have a dominate coarse-textured, sand component are termed light compared to heavy soils which are fine textured and mostly silt and clay. Light soils are more permeable then heavy soils.

23. Bridge crossing should be located where the stream channel is straight with an unobstructed flow of water. Abutments should be parallel to the stream flow and embedded in good foundation materials. Approaches should be reasonably level for a minimum of 50 feet on both sides.



Logging Mat

24. Wooden mats, constructed of undressed 2" x 8" hardwood lumber, can be used as a replacement for surface aggregate to protect culverts, bridges, and soft soils.

25. Geotextiles or fabric materials may be used to increase soil-bearing capability. Geotextiles placed under borrow or fill will reduce soil failure or deep rutting. Geotextiles reduce the thickness of base material needed, reduce deep road compaction and allow natural flow of groundwater.

26. Outsloping is an effective way to rapidly drain excess water from roads constructed on gentle and moderate slopes. Outsloped roads also reduce the number of other structures needed for proper drainage. Roads constructed in this manner should be outsloped away from the cut bank at the rate of 1/4- inch per foot of road width or 2-3 percent.

27. Roads should be insloped 2-3 percent on steep sections, sharp turns, and slippery soils as a safety measure. Drainageways or ditches should be constructed to collect inslope drainage, and closed-top culverts or other cross-drainage structures should be installed to carry drainage to the downhill side of the road.

28. Roads or road sections constructed on gently sloping or flat land should be built with a high center or crowned, and side ditches should be provided to catch water draining from the surface. Provide water turnouts to divert water onto the adjacent undisturbed forest floor.

29. Avoid long, sustained grades by varying the degree of slope, using short segments of reverse grade, or with properly spaced narrow- or broad-based dips.

30. Stabilization of road surface and/or adequate water diversion by cross drainage (interception of surface water on the road) must be considered for roads steeper than recommended gradients.

MAINTENANCE

Conduct periodic inspections of all active roads, especially in early spring and after large storms.

1. Any blockage or damage to drainage structures, cuts and fills, or the roadbed should be repaired immediately.

2. Hauling should be suspended on wet roads before rutting destroys the effectiveness of drainage structures.

3. Occasional grading may be necessary to reshape and keep roads free from ruts, mud holes, and debris which may interfere with natural drainage. Gravel or other aggregates may be needed in specific sections to prevent washing and rutting.

4. Ditches require periodic maintenance. However, avoid disturbing stable, vegetated ditches and roadways unless drainage is clearly reduced or obstructed. Disturbing stable areas actually can increase erosion and maintenance problems.

5. Gravel, wooden mats, or other means should be used to keep mud off public roads.

6. Roads may dry faster when trees along the right-of-way are removed because of increased sunlight and airflow.

RETIREMENT

After logging activity has ceased, roads should be regraded and smoothed. Dips, side ditches, and turnouts should be reshaped. Sediment and debris should be removed to promote proper drainage. All open-top culverts should be replaced with narrow-based dips or water bars. Insloped roads should be converted to outsloped for reduced maintenance. For wetlands, additional cross-drainage structures or fill removal may be required to insure unrestricted water movement.

Most roads will revegetate naturally within one to four years following disturbance, however, problem areas, such as slopes greater than 5% or erodible soils may produce serious problems and should be reseeded in season. (**See revegetation guidelines**.)

Unless it is necessary to keep them open, roads should be closed to all but emergency or occasional traffic, especially during periods of wet weather. Difficulties in restricting post-logging traffic further justify proper road construction procedures.

HARVESTING

Foresters should give careful consideration to the design and planning of a timber harvesting transportation system - access roads, log landings, skid trails, and portable mill location - before logging begins. Careful preplanning will minimize adverse impacts on water quality and save time and construction costs.

LOG LANDINGS

1. Locate possible sites for landings and portable mill locations in advance of road construction.

2. Landings should be located at least 50 feet and portable mills at least 150 feet from the Streamside Management Zone (SMZ) so as to minimize the impact of operations on natural drainage.

3. Landings should have a slight (2 to 5%) slope to allow for drainage and should be on well-drained soils which dry quickly.

4. Water turnouts should be constructed around the uphill side of landings as needed to divert water onto the adjacent forest floor. Adequate drainage on approach roads and trails should be provided.

5. Locate equipment fueling and servicing areas away from SMZs. Servicing equipment onsite should be done in such a way that waste oil, etc. will be drained into containers and disposed of properly. All accidental fuel or oil spills will be contained and will be reported to the district forester. Trash and all materials resulting from servicing will be removed from the site and disposed of properly.

6. Locate residue piles (limbs, sawdust, slabs, etc.) 100 feet outside of wet weather drainages so that water from residue will not drain directly into adjacent streams or bodies of water.

7. Following logging operations, revegetate landings to prevent movement of soil from the site. Since landings usually become heavily compacted with repeated use by heavy equipment and logs, these sites should be ripped, subsoiled, or disked for preparation of a suitable seedbed and/or planting site. (See **guidelines for revegetation**)

SKID TRAILS

1. Since skidding may effect up to 20 percent of logged areas, extra planning and care should be exercised in the location of and operation on skid trails to minimize erosion and soil movement and to maintain site productivity. Generally, staying on a few well laid-out, primary skid trails used repeatedly will cause less impact to an area than many well-dispersed skid trails because most of the soil disturbance and compacting occurs within the first few passes of the skidder.

2. Gradients should not be steeper than 10 percent with the exception that steeper segments may be required to avoid boundary lines, sensitive areas, or other areas not accessible using skid roads of lesser grade. If steeper grades are necessary, practices must be used to prevent concentrated water flow, e.g. additional water bars. If it is impossible to limit exposure of mineral soil, alternative harvesting systems should be considered such as high lead, boom cable or others.

3. Locate skid trails outside SMZs. Skidding through streams should be avoided. If streams must be crossed, a minimum number of bridges or culverts should be constructed at right angles to the stream and all skidder turns should be brought to these crossings. Temporary crossings of drains and small streams may be made with logs, but do not cover logs with soil.

4. When skidding on steep ground, skid uphill as much as possible following a slanting course in order to promote dispersion of waterflow during rains; downhill skidding tends to concentrate waterflow into a single point.

5. Skidding should be stopped in extremely wet conditions to prevent excessive soil compaction, rutting, and channelized erosion.

6. Water bars for skid trails should be installed at a 30- to 45-degree angle downslope, with ends open to prevent water accumulation behind them. Water bar spacing is below.

Water Bar Spacing for Skid Trails

Grade (%)	Distance (ft)
2	250
5	135
10	80
15	60
20	45
30	35

7. Skid trails should be retired at the end of logging operations by installing and repairing water bars, removing stream crossing structures, shaping and smoothing, and revegetating any exposed areas on slopes greater than 5 percent or subject to erosion. Scattered logging slash or other mulch material which covers the trail may supplement water bars and seedings.

STREAMSIDE MANAGEMENT ZONE

Streamside Management Zones (SMZs) will be maintained along all streams, lakes, ponds, natural springs, and all springs and reservoirs serving as domestic water supplies. These areas will serve to protect stream channels and banks from disturbance and form the "last line of defense" to filter sediment from surface runoff. SMZs also provide shade for streams to minimize thermal pollution.

Streams may be classified as perennial, intermittent, or ephemeral. SMZs will be maintained for all stream classifications. The level of forestry activity within an SMZ will reflect the degree of potential water quality impact. The greatest protection will be given to perennial streams followed by intermittent and ephemeral streams.

1. SMZ horizontal width is measured in lineal feet from the pond, lake, or stream to the toe of the road, skid trail, or other surface disturbance. The following table indicates recommended SMZ widths between disturbed areas and water courses.

Streamside Management Zone Widths

Slope of Adjacent Land (%)	Width for Common Water Courses (ft)	Width for Municipal Watersheds and Critical Areas (ft)
0	50[1]	100
10	50	100
20	65	150
30	85	170
40	105[1]	210
50	125	250
60	145	290
70	165	330
80	185	370
90	205	410
100	225	450

1 - Minimum SMZ width for wetland sites is 75 feet.

2. Forestry activities need not be eliminated within SMZs but should be modified to ensure that the intended function of such areas is maintained. Commercial harvest of trees is acceptable, but when possible, remove logs by winching or animal skidding. Limit equipment operation in SMZs to prevent disturbance of the protective forest floor. Also avoid felling trees in streams or lakes, but when necessary, winch trees out of the water and far enough away to prevent tops and branches from getting back into the water during heavy rains and high water.

3. Trees directly on the banks, in the stream channels, or on very steep slopes leading directly into the water should not be cut if their removal would destabilize the soil.

4. 50 to 75 percent of the existing crown canopy shading perennial and intermittent streams should be left undisturbed in order to maintain normal water temperatures.

5. Natural regeneration of trees in SMZs should be accomplished without disturbing protective ground cover and soil by cutting undesirable vegetation with chain saws or other hand tools.

6. Timber stand improvement by cutting or basal application of herbicides is permissible.

WETLANDS

Utilize temporary roads in forested wetlands. Do not attempt to construct permanent roads in wetlands except to:

(1) Serve large and frequently used areas
(2) Serve as approaches to watercourse crossings
(3) Serve as access for fire protection

1. Construct fill roads in forested wetlands only when absolutely necessary for access. Road fills should be no more than two feet above the natural ground level with cross drains for surface water flow. Fill roads should not restrict the flow patterns or volumes of water movement through forested wetlands. Cross drains (bridges, culverts, fords, etc.) should be established at low areas or depressions and placed no more than 100 feet apart.

2. Road fills should be constructed parallel to the flow of the main channel and no closer than 200 feet from the minimum 75 foot SMZ along the main channel, except when the road is built for the purpose of crossing a main channel. Exceptions to this may be dredged channels or elevated stream banks where the spoil and/or elevation is to be utilized for the road. In these cases, the construction must ensure the road surface drains, initially, to the off-channel side. This exception must be approved by the U.S. Army Corps of Engineers and the appropriate state agency.

3. Where natural stabilization will not occur quickly, fill material must be appropriately stabilized with grass or other material. Side slopes must be sufficient to allow stabilization to occur. Fill approaches in the immediate vicinity (within 35') of a watercourse crossing should be stabilized during construction.

4. Avoid or minimize use of equipment in SMZs and never skid logs through streams or sloughs

5. Roads and stream crossing within wetlands and other waters of the U.S. <u>must</u> be constructed and maintained in accordance with the following U.S. Army Corps of Engineer baseline BMPs (from section 404, Corps of Engineers Permit Requirements, 40 CFR Part 233.22) in order to retain exemption status for the road operation:

   (1) Permanent roads, temporary access roads and skid trails (all for forestry) in waters of the U.S. shall be held to the minimum

feasible number, width, and total length consistent with the purpose of specific silvicultural operations, and local topographic and climatic conditions;

(2) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

(3) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(4) The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(5) Discharges of dredged or fill material into waters of the U.S. to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within the waters of the U.S. (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(6) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

(7) The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(8) Borrow material shall be taken from upland sources whenever feasible;

(9) The discharge shall not take, or jeopardize the continued existence of a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(10) Discharges into breeding and nesting areas for waterfowl, spawning, and wetlands shall be avoided if less harmful alternatives exist;

(11) The discharge shall not be located in the proximity of a public water supply intake;

(12) The discharge shall not occur in areas of concentrated shellfish production;

(13) The discharge shall not occur in a component of the National Wild and Scenic River System;

(14) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts;

(15) All temporary fills shall be removed in their entirety and the area restored to its original elevation.

SITE PREPARATION

Careful consideration should be given to the type and intensity of site preparation chosen to treat areas scheduled for reforestation in order to minimize adverse water quality impacts. Methods selected should be based on the amount, size, and type of vegetation present, slope gradient, and erodibility of the soil.

In selecting site preparation methods, choose one that will expose and disturb as little soil as possible and still achieve the desired results. Favor chemical methods over mechanical methods on steep slopes and highly erodible soils. When possible, mechanical methods should be confined to sites with gradients less than 30 percent.

1. More intensive site preparation methods pose greater risks for sedimentation. The following list of site preparation methods is presented in order of increasing hazard to water quality.

   1) Herbicide
   2) Lopping with Chain saw
   3) Chopping
   4) Chopping and Burning
   5) Shearing and Windrowing
   6) Bulldozing
   7) Disking

2. Maintain Streamside Management Zones (SMZs) between streams and site-prepared areas.

CHEMICAL APPLICATIONS

1. Always use chemicals in accordance with label instructions, and adhere to all federal, state, and agency policies and regulations governing chemical use.

2. Chemicals should be stored where there is no danger of being spilled or released into the environment. When solutions are mixed in field locations, stay as far as possible from springs, streams, and lakes to prevent contamination in the event of accidental spills.

3. Make sure that atmospheric conditions are such that a maximum amount of chemical reaches target species, especially during aerial or spray applications.

4. Maintain buffer strips to avoid drift or accidental application of chemicals. For aerial application maintain 100- foot wide buffer zones between treated areas and perennial or intermittent streams. For ground vehicle application maintain 50-foot buffer strips; for hand spray, 25 feet; and for hand dispersion, 15 feet. Herbicide injection does not require buffer strips.

5. Clean equipment away from streams and other water sources. Dispose of chemical containers according to directions on the label.

6. Dispose of empty containers as directed on the label.

DRUM CHOPPING

Maximum benefits result from drum chopping up and down the slope so the depressions made by the cleats and chopper blades are on the contour, reducing the occurrence of channeled surface flow. However, since limited mineral soil is exposed by drum chopping, chopping direction should be based on safe equipment operation.

PRESCRIBED BURNING

1. Prescribed burning must be carried out under exacting conditions of wind, humidity, and temperature to achieve desired results while preventing removal of all surface duff and root mat and maintaining control of the fire. A plan should be prepared defining objectives and conditions under which burning will be conducted.

2. When possible, avoid hot burns on pure pine stands and erodible sites during drought periods. Hot burns consume most of the protective litter on the forest floor which will increase the chance of raindrop erosion of bare mineral soil. Burns conducted in the early morning or after a rain are more likely to leave a portion of the surface duff in place.

3. The greatest threat to water quality in prescribed burning is from the construction of fire lines by heavy equipment. Lines should only be plowed immediately prior to burning and should be kept to a minimum. Utilize logging roads and skid trails where feasible.

4. Plow fire lines as straight as possible and, to the extent possible, on the contour. When it is necessary to cross contours, construct firelines around the slope or follow a zigzag path to promote dispersion of water flow during rains. Plow lines as shallow as possible to minimize soil disturbance.

5. When possible, fire lines should have a maximum gradient of 10 percent; however, lines on slopes over 10 percent are acceptable for up to a few hundred feet.

6. When plowing a line to connect into a drainage, turn the line uphill about 15 to 20 feet from the drainage so that the plowed line parallels the drainage. This will keep surface water from flowing directly into the drainage. Use hand tools to finish constructing the line to the drainage.

7. Fire lines should have water bars and turnouts, as prescribed for skid trails, or backdragged and leveled after use. Fire lines on slopes should be revegetated as needed.

8. Avoid fire in SMZ areas, however, light burns may cause less damage than constructing additional fire lines.

SHEARING, RAKING, BULLDOZING, WINDROWING

1. Raking in combination with shearing should be confined to stable soils and level terrain. Tooth-type rakes, especially the spring-tooth versions, should be favored over straight bulldozer blades for raking and piling. Soil disturbance should be kept to a minimum.

2. The topsoil, including the root mat, should be left in place to preserve site quality and minimize water quality impact. Stumps should be left in place. The presence of considerable soil in the windrow is a sign of improper equipment operation.

3. Bulldozing should be limited to slopes of 30 percent or less and the distance between windrows should be minimized.

4. When a sloping site is raked and windrowed, the windrows should be placed on the contour to act as an interceptor and filter of any surface runoff. Locate windrows well away from drains to prevent materials from being washed into streams.

5. Occasional breaks should be provided in the windrows to permit access by fire suppression and other vehicles and to prevent damming of water which might cause gullying whenever water breaks through.

DISKING

Because it is the most site disturbing, disking should be avoided unless the site dictates no other management alternative. Disking should be done on the contour where possible and limited to slopes of 10 percent. Disking on slightly steeper slopes is permissible on nonfragile soils when the slope length is less than 50 feet.

BEDDING

Bedding should be done on the contour if the slope is discernible. Usually bedding on flat sites is not a problem and water absorption is improved by the soil cultivation.

MACHINE PLANTING

Machine planting should be done on the contour. Maintain SMZs. Steep slopes, which exceed 20 percent, should be hand planted.

WOODLAND GRAZING

Woodland grazing causes more loss of soil from Tennessee Valley forest-land than any other activity. Erosion and reduction of site productivity can be prevented by excluding domestic livestock from woodlands.

To provide shade and protection for animals, construct fences 25 to 100 feet inside short sections of woodland edges on flat or gentle slopes. To minimize movement of soil and organic matter, deny access to animals along woods edges where slopes exceed 10 percent. Monitor the areas of access frequently. When soil becomes bare through wearing or washing away of organic litter, exclude animals from the area and provide access to other areas. Exclude livestock from all Streamside Management Zones (SMZs). Limit livestock access to streams and lakes to designated watering areas.

REVEGETATION

Skid trails, log landings and other areas disturbed by harvesting, including road surfaces, cuts, fills, and ditches, that slope a minimum 5% or are considered erodible should be revegetated as soon as possible after logging operations cease.

1. Select plants or plant mixtures adapted to the site and use the recommended rate of application and optimum seeding dates.

2. Road surfaces should be shaped and smoothed prior to seeding. Heavily compacted areas such as road and skid trail surfaces and log landings may require scarification or disking to promote infiltration of water and create suitable seedbed conditions. However, avoid loosening soil on steeper slopes.

3. Lime and fertilizer should be applied in accordance with soil test results. Application rates are determined by soil type and soil acidity. When possible, incorporate lime and fertilizer into the top 2 to 4 inches of soil. Shallower mixing is advisable on slopes to prevent washing. On steep slopes apply lime and fertilizer to surface only.

4. Selected seed mixture may be broadcast or drilled. Successful seedings are usually in the spring and fall. Broadcast seed may be incorporated into the soil by dragging a chain, brush, disk, or harrow. A long-term perennial, fine-rooted seed mixture should be used for effective erosion control.

**Suggested Seeding Mixtures and Rates for Revegation of[1]
Areas Disturbed by Silvicultural Activities in the Tennessee River Valley**

Seeding Group	Seeding Rate Total Pounds Per Acre	Seeding Rate Total Pounds Per 1,000 Sq Ft	Seeding Dates	Remarks
I. Temporary Cover				
Cereal Wheat or Rye (100%)	20 - 25	.5 - .6	Oct 15 - Nov 30	Temporary cover should be disked or mowed before permanent vegetation is established.
Sudan Grass Hybrid (100%)	20	.5	Apr 15 - Aug 15	
Annual Rye Grass	30	.7	Feb 15 - Apr 15	
II. Permanent Cover*				
Orchard Grass (100%)	30	.7	Feb 15 - Apr 15 Aug 15 - Oct 15	Should be fertilized annually to maintain an adequate cover.
Orchard Grass (90%)	30	.7	Feb 15 - Apr 15	Should be fertilized annually to maintain an adequate copver.
White (Ladino) Clover (10%)	3	.1	Aug 15 - Oct 15	
Perennial Rye (86%)	30	.7	Feb 15 - Apr 15	Crown vetch should not be used on areas which will receive heavy traffic. Use on sloped areas for added stabilization.
Crown Vetch (14%)	5	.1	Aug 15 - Oct 15	
Appalow Sericea Lespedeza (scarified) (60%)	30	.7	Mar 1 - Apr 15	Sericea lespedeza is good cover for droughty sites. Appalow is a short growing variety and is useful on road banks or intersections because it doesn't require mowing. However, it is not recommended for quail food plots.
Orchard Grass (30%)	15	.3		
Annual Lespedeza (10%)	5	.1		
Appalow Sericea Lespedeza (79%)	30	.7	Mar 1 - Apr 15	Sericea lespedeza is good cover for droughty sites. Appalow is a short growing variety and is useful on road banks or intersections because it doesn't require mowing. However, it is not recommended for quail food plots.
Weeping Lovegrass (8%)	3	.1		
Annual Lespedeza (13%)	5	.1		

* Tall fescue may be substituted for orchard grass or perennial rye where wildlife benefits are not a major concern.

1 - Adapted from Hartung, R. E. and J. E. Kress, 1977, "Woodlands of the Northeast, Erosion &Sediment Control Guides," USDA SCS Northeast Technical Service Center, Broomall, PA, and Forest Service, Northeast Area, State and Private Forestry, Upper Darby PA, 25 pp.

5. When desirable, mulch can be used in revegetating disturbed areas to hold seed, fertilizer, and lime in place, maintain moisture, and prevent extreme temperatures on the soil surface.

6. Bush hogging can be utilized to maintain roads which will be used in the future and/or maintain open areas for wildlife. Seeded areas must be protected from livestock grazing and unrestricted vehicle traffic, particularly during wet periods if rutting is to be prevented. Freshly seeded roads are particularly vulnerable to damage.

BMPs DURING EMERGENCIES

In the event of wildfire, insect or disease epidemic, or other catastrophe, BMPs may, with proper approval, be temporarily relaxed to allow proper suppression or salvage techniques to be used as well as to promote rapid site recovery.

Harvesting guidelines which apply to the Streamside Management Zone (SMZ) may, with proper approval, be relaxed to allow salvage of any damaged or downed timber. Firelines and road construction will be unrestricted during emergencies, but stabilized according to BMPs following the salvage and regeneration process. Mechanical site preparation may be conducted within the SMZ when necessary to return the site to a productive, protective condition.

GLOSSARY

The list of terms that follows is a representative (incomplete) sample of those used by foresters, lumbermen, loggers, soil scientists, biologists, engineers, conservationist planners, etc. The terms may not be used in the text but are commonly used in conservation matters.

Access Road - A temporary or permanent woods road over which timber is transported from a loading site to a public road. Also known as a haul road.

Barriers - Obstructions to pedestrian, horse, and/or vehicular traffic. They are intended to restrict such traffic to specific locations.

Bearing Capacity - Maximum load that a material (soil) can support before failing.

Bedding - A site preparation technique whereby a small ridge of surface soil is formed to provide an elevated planting or seed bed. It is used primarily in wet areas to improve drainage and aeration for seedling.

Best Management Practice (BMP) - A practice, or combination of practices, that is determined after problem assessment and examination of alternatives, to be the most effective, practical means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality.

Borrow Pit - An excavation site outside the limits of construction to provide materials necessary to that construction, such as fill materials for road construction.

Bottomlands - A term often used to define lowlands adjacent to streams.

Broad -Based Dip - A surface drainage structure specifically designed to drain water from an access road while vehicles maintain normal travel speeds.

Buffer Strip - A barrier of permanent vegetation established or left undisturbed downslope from disturbed forest areas to filter out sediment from runoff before it reaches a watercourse.

Channel - The bed of a stream or watercourse.

Check Dam - A small dam constructed in a gully or other small watercourse to decrease the stream flow velocity, minimize channel scour and promote deposition of sediment.

Chopping - A mechanical treatment whereby vegetation is concentrated near the ground and incorporated into the soil to facilitate burning or seedling establishment.

Clearcutting - A silvicultural system in which all trees are harvested over a specified area to create an even-age stand .

Contamination - A general term signifying the introduction into water of microorganisms, chemical, organic, inorganic wastes or sewage, which renders the water unfit for its intended use.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting the points of the same elevation.

Cross Ditch - A shallow depression built diagonally across a light duty road or trail for the purpose of diverting surface water.

Culvert - A metal, wooden, plastic, or concrete conduit through which surface water can flow under or across roads.

Cut - Portion of land surface or area from which earth has been removed or will be removed by excavation; the depth below original ground surface to excavated surface.

Cut-and-fill - Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

Dispersion (soil) - The breaking down of soil aggregate into individual particles, resulting in single - grain structure. Ease of dispersion is an important factor influencing the erodibility of soils. Generally speaking, the more easily dispersed the soil, the more erodible it is.

Diversion - A channel with a supporting ridge on the lower side constructed across or at the bottom of a slope for the purpose of intercepting surface runoff.

Diversion Ditch - A drainage depression or ditch built across the top of a slope to divert surface water from that slope.

Drainage Crossing - Location where a stream (perennial or ephemeral) must be crossed.

Drainage Structure - Any device or land form constructed to intercept and/or aid surface water drainage.

Ephemeral Streams (Dry Wash) - A channel that carries water only during and immediately following rainstorms.

Erodible Soils - Those soils identified as being subject to erosion.

Erosion - The process by which soil particles are detached and transported by water and gravity to some downslope or downstream point.

Erosion Classes - A grouping of erosion conditions based on the degree of erosion or on characteristic patterns. Applied to accelerated erosion, not to normal, natural or geological erosion. Four erosion classes are recognized for water erosion.

Felling - The process of cutting down standing trees.

Fertilizers - Any substance or combination of substances used principally as a source of plant food or soil amendment.

Fill Slope - The surface formed where earth is deposited to build a road or trail.

Filter Strip - **1.** SMZs. **2.** An area on the downhill side of a road construction site where slash removed during right-of-way clearing is placed to reduce water velocity and filter sediment.

Firebreaks - Naturally occurring or man-made barriers to the spread of fire.

Fire line - A barrier used to stop the spread of fire constructed by removing fuel or rendering fuel inflammable by use of water or fire retardants.

Ford - Submerged stream crossing where tread is reinforced to bear intended traffic.

Forest Chemicals - Chemical substances or formulations that perform important functions in forest management, e.g. fertilizers, herbicides, repellents, and other chemicals.

Forest Land - Land bearing forest growth or land from which the forest has been removed but which shows evidence of past forest occupancy and which is not now in other use.

Forest Landowner - An individual, combination of individuals, partnership, corporation, foundation, non governmental agency, or association of whatever nature that holds an ownership interest in forest land.

Forest Practice - An activity related to the growing, protecting, harvesting, or processing of forest tree species on forest land and other aspects such as wildlife, recreation, etc.

Grade (Gradient) - The slope of a road or trail expressed as a percentage of change in elevation per unit of distance traveled.

Gully Erosion - Erosion process whereby water accumulates in narrow channels, and over short periods removes soil from this narrow area to considerable depths (one foot plus).

Harrowing (Disking) - A mechanical method of scarifying the soil to reduce completing vegetation and to prepare a site to be seeded or planted.

Harvesting - The felling, skidding, processing, loading, and transporting of forest products.

Haul Road - See Access Road.

Herbicide - Any substance or mixture of substances intended to prevent the growth of or destroy unwanted trees, bushes, weeds, algae, and other aquatic weeds.

Herbicide Mobility - The ease with which the active ingredients can move away from the area of application whether by drift, evaporation, rain, runoff or through the soil.

Impoundment Areas - Those areas in which water is artificially stored.

Intermittent Streams - A watercourse that flows in a well defined channel during the wet seasons of the year, but not the entire year.

Landing - A place where logs are gathered in or near the forest for further processing or transport, sometimes called a "deck".

Logging Debris - The unwanted, unutilized and generally unmerchantable accumulation in the forest of woody material, such as large limbs, tops, cull logs, and stumps that remain as forest residue after timber harvesting.

Mineral Soil - Organic-free soil that contains rock less than 2 inches in maximum dimension.

Mulch - A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Mulching - Covering forest soil with any loose cover of organic residues, such as grass, straw, bark or wood fibers, to check erosion and stabilize exposed soil.

Municipal Water Source - Any body of water impounded for the sole purpose of supplying a specific populace or the specified area of a larger body of water surrounding the intake for supplying a specific populace.

Narrow- Based Dip - A diversion ditch and/or hump across a trail or road tied into the uphill side for the purpose of carrying water runoff into the vegetation, duff, or ditch so that it does not gain the volume and velocity which causes soil movement and erosion.

Nonpoint Source Pollution - Water pollution which is: (1) induced by natural processes, including precipitation, seepage, percolation, and runoff; (2) not traceable to any discrete or identifiable facility; and (3) better controlled through the utilization of Best Management Practices.

Nutrients - Mineral elements in the forest ecosystem such as nitrogen, phosphorus, or potassium, that are naturally present or may be added to the forest environment by forest practices such as fertilizers or fire retardant applications. Substances necessary for the growth and reproduction of organisms. In water, those substances that promote growth of algae and bacteria; chiefly nitrates and phosphates.

Organics - Particles of vegetation or other biological material which can degrade water quality by decreasing dissolved oxygen and by releasing organic solutes during leaching.

ORVs (Off-Road Vehicles) - Includes any motorized vehicle when driven on surfaces other than public roads. Can include, but not limited to, automobiles, trucks, motorcycles and farm implements.

Oxidization - The process of breaking down organics into basic chemicals.

Perennial Stream - A watercourse that flows throughout the year or nearly so (90 percent) in a well defined channel.

Permeability, Soil - The quality of a soil horizon that enables water or air to move through it. The permeability of a soil may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Persistence - The relative ability of a pesticide to remain active over a period of time.

Pesticides - Chemical materials that are used to control undesirable insects, animals, diseases, vegetation or other forms of life.

Pollutant - "Dredged soil, solid wastes, incinerator residue, sewage, garbage, sewage sludge, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water". (P.L. 92-500, Section 502(6).

Pollution - The presence in a body of water of substances of such character and in such quantities that the natural quality of the environment is impaired or rendered harmful to health and life or offensive to the senses.

Prescribed Burning - The practice of using controlled fires or reduce of eliminate the unincorporated organic matter of the forest floor, or low, undesirable vegetation.

Puncheon - A structure used to cross wet locations on a trail; constructed of logs and/or lumber.

Refuse - Inorganic waste materials such as metal, rubber, plastic and glass.

Regeneration - The young tree crop replacing older trees removed by harvest or disaster; the process of replacing old trees with young.

Residual Trees - Live trees left standing after the completion of harvesting.

Retirement - Preparing a structure for a long period of non-use. Methods include seeding, fertilizing, installing water bars, etc.

Rill Erosion - An erosion process in which numerous small channels only several inches deep are formed. Occurs mainly on disturbed and exposed soils.

Riprap - Aggregate placed on erodible sites to reduce the impact of rain or surface runoff.

Rolling Dip - See Narrow-Based Dip.

Rotation - The period of time to establish , grow, and harvest a crop of trees to a specified condition of maturity.

Runoff - In forest areas, that portion of precipitation that flows from a drainage area on the land surface or in open channels.

Ruts - A depression in access roads made by continuous passage of logging vehicles.

Salvage Harvest - Removal of trees that are dead, damaged, or imminently threatened with death or damage in order to utilize the wood before it is rendered valueless by natural decay agents.

Sanitation Harvest - Removal of trees that are under attack by or highly susceptible to insect and disease agents in order to check the spread of such agents.

Sediment - Solid material that is in suspension, is being transported, or has been moved from its site of origin.

Seedbed - The soil prepared by natural or artificial means to promote the germination of seeds and the growth of seedlings.

Seed Tree Method - Removal of the mature timber in one cutting, except for a limited number of seed trees left singly or in small groups.

Selection Method - Removal of timber, usually but not always the oldest and largest, either as single scattered individuals or in small groups, at relatively short intervals repeated indefinitely in order to encourage continuous reproduction and uneven-aged stands.

Sensitivity Class - An index of an area's susceptibility to erosion and sediment production based on soils and slope.

Sheet Erosion - The removal of a fairly uniform layer of soil from the land surface by water runoff.

Shelterwood Method - Removal of the mature timber in a series of cuttings which extend over a relatively short portion or the rotation in order to encourage the establishment of essentially even-aged reproduction under the partial shelter of seed trees.

Side cast - The act of moving excavated material to the side and despositing such material.

Silviculture - The science and art of growing forest crops. More particularly, the principles, theories and practices for protecting and enhancing the regeneration, growth, development, and utilization of forests for multiple benefits.

Site Preparation - A silvicultural activity to remove unwanted vegetation and other material, and o cultivate or prepare the soil for regeneration.

Skid - Short-distance moving of logs or felled trees along the surface of the ground from the stump to the landing.

Skid Trail - A temporary, nonstructural pathway over forest soil to drag felled trees or logs to the landing.

Slash - Wood residue, usually tree limbs and tops, left on the ground after harvesting.

Slope - Degree of deviation of a surface from the horizontal, measured as a numerical ratio, percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), as 2:1. A 2:1 slope is a 50 percent slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90 degree slope being vertical (maximum) and 45 degree being a 1:1 slope.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil Conservation - Using soil within the limits of its physical characteristics and protecting it from unalterable limitations of climate and topography.

Soil Productivity - The output or productive capability of a forest soil to grow timber crops.

Stream - A continually, frequently, or infrequently flowing body of water that follows a defined course.

Streamside Management Zone (SMZ) - An area of 50 feet or more on both sides of the banks of bodies of open water, perennial streams, and some intermittent and ephemeral streams where extra precaution is used in carrying out forest practices in order to protect bank edges and water quality.

Stream banks - The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.

Susceptibility - The likelihood of soil erosion or of attack or infection of vegetation by a destructive insect or disease organism.

Swale - A gently sloping channel designed to transport intermittent runoff from storm events.

Switchbacks - A 180-degree direction change in a trail or road used to climb steep slopes.

Thermal Pollution - A temperature rise in a body of water sufficient to be harmful to the aquatic life.

Toxicity - The characteristic of being poisonous or harmful to plant or animal life; the relative degree or severity of this characteristic.

Tread - Load bearing surface of a trail or road.

Turnout - 1. A widened space in a road to allow vehicles to pass one another. 2. A drainage ditch which drains water away from roads and road ditches.

Waste - Materials and substances usually discarded as worthless to the user.

Water Bar - Terminology often given to narrow based dips for the purpose of trail or road retirement. See Narrow-Based Dip.

Water Body - An area where water stands with relatively little or slow movement (ponds, lakes, bays).

Water Control Structure - Any structure used to regulate surface or subsurface water levels.

Water Courses - A definite channel with bed and banks within which concentrated water flows continuously, frequently or infrequently.

Water Pollution - Any introduction of foreign material into water or other impingement upon water which produces undesirable changes in the physical, biological, or chemical characteristics of that water.

Water Quality - A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Water Quality Standards - Minimum requirements of purity of water for various uses; for example, water for agricultural use in irrigation systems should not exceed specific levels of sodium bicarbonate, pH, total dissolved salts, etc. In most states, these standards are set by some form of a state water control board.

Watershed Area - All land and water within the confines of a drainage divide or a water problem area consisting in whole, or in part, of land needing drainage or irrigation.

Wetlands - Geographic areas characteristically supporting hydrophytes, hydric soils and some saturation or flooding during the growing season.

Wildfire Control - Actions taken to contain and suppress uncontrolled fires.

Wildfires - Uncontrolled fires occurring in forestland, brushland, and grassland.

Windrow - Logging debris and unmerchantable woody vegetation which has been piled in rows to decompose or be burned; or the act of constructing these piles.

Notes

Notes

Appendix D – TVA Hazard Tree / Downed Tree Checklist

This page intentionally left blank

 TVA Hazard Tree / Down Tree Checklist

1. Is the tree located on TVA fee property?
   No – No TVA action is necessary.
   Yes – Go to Question 2.
   Unable to determine – see page 2 or request assistance or survey.

2. Is the tree down (on the ground) and in a non-hazardous position, and causing damage or obstruction to a structure/facility/maintained area?
   No - Go to Question 3.
   Yes - Go to question 5.

3. If the tree falls from its own weight (no wind) will it hit a structure or cause an obstruction on TVA or private property?
   No - No TVA action is necessary.
   Yes – Go to Question 4.
   Unable to determine – see page 2 or request assistance from forester.

4. Has the condition of the tree recently changed? (dying, dead, structural decay/damage.)
   No – Go to Question 9.
   Yes – Go to Question 5.
   Unable to determine – see page 2 or request assistance from forester.

5. Is the structure or maintained area on private property?
   No – Go to Question 7.
   Yes – Go to Question 6.
   Unable to determine – see page 2 or request assistance or survey.

6. Is the individual willing to remove the tree at their expense?
   Yes – Issue tree removal permit for portion of the tree originating on TVA property; no permit needed for the portion on private property.
   No – TVA will arrange for mitigation of the tree hazard or, if tree is down and TVA had prior notice of a hazardous tree, TVA will remove tree to TVA property.

7. Is the structure/facility/maintained area on TVA property at a location where it can permitted?
   No – Inform appropriate Program Manager (do not issue tree removal permit).
   Yes – Go to question 8.

8. Is the structure/facility/maintained area permitted?
   No – Inform appropriate Program Manager; issue tree removal permit.
   Yes – Issue tree removal permit (subject to SMP or pertinent guidelines).

9. Is the position of the tree such that it is not currently a hazard, but could become a hazard to a structure/facility/maintained area on private property?
   No – No TVA action is necessary.
   Yes – TVA can (at its discretion) issue a permit, however, replacement tree(s) will be required; see page 2 for replacement tree requirements.
   Unable to determine – request assistance from forester.

SEE DETAILS ON PAGE 2

1. Be aware of TVA boundary marking standards, (for example, if tree has 2 spots of paint, boundary line goes through the tree, the tree is jointly owned by both parties, and cannot be removed by either party without the other's permission. If tree has one spot of paint (line witness tree), the line passes within approximately 3 feet of that tree, on the side that is painted. If the painted tree is a line witness tree on the private side of the line, it can be removed by the owner with no permission needed from TVA) Also, limbs of trees that overhang private property can be trimmed up to the line, with no permission from TVA.
2. TVA has no liability for damage caused by "an act of God or nature". This is defined as some inevitable accident which could not have been prevented by human care, skill and foresight, but which results exclusively from nature's cause, such as lightning, tempest and floods. If the tree or limbs fall from their own weight (gravity) and would not hit a structure, it is not a hazard by definition. TVA is not liable (via recreational user statutes) for injury to people who walk on our property.
3. Oftentimes trees that landowners are concerned about have a natural lean toward a structure, but the condition has not changed recently and the tree is no more hazardous at the present time than in the past. However, all trees eventually die, and either break down gradually, with parts falling to the ground, or, if they are leaning, they <u>will</u> fall in the direction of the lean. (see also 8.)
4. TVA, as any landowner, is responsible to respond to potential hazards to structures on adjacent private properties. Damage will not be viewed as an act of God if it could have been prevented by the exercise of reasonable diligence or ordinary care.
5. If the individual is willing to remove the tree at his expense, he will be permitted to do so. This may be preferable to the individual in cases where he has a preference on the method of removal or the individual or company he prefers to do the work. It may also be a means to get the work done more expeditiously. Mitigation of the hazard includes cutting of the tree or limbs that constitute the hazard by a TVA designated contractor that meets the TVA insurance and other requirements. Where necessary, the tree debris will be placed on the TVA tract, and TVA payment will not include cleanup or other removal. Contact forester for details, if necessary.
6. Removals will not be permitted in the case of hazards to unauthorized structures. If the structure is at a location where it can be permitted (for example the structure was permitted to a previous owner and has not been transferred), a hazard tree permit should be issued if there is a possibility of damage before a permit (with associated Vegetation Management Plan) can be issued. Otherwise, the potential hazard can be addressed in the Vegetation Management Plan.
7. For permitted structures, General and Standard Conditions of a 26a permit state that TVA has no liability to the applicant or any third party for any injury or damages connected with the construction, operation or maintenance of the facility.
8. Recognize that all trees will die eventually, and, if the tree is tall enough to cause significant damage to private property *on* private property (*not facilities)*, block private road access, etc., AND is a concern to the property owner, AND they are willing to provide significant replacements for what the public has lost, that such permitting/replacement may result in a future cost savings to TVA, by eliminating the cost of a future removal at TVA expense. Replacement trees will be one 2-inch caliper ball & burlap native tree for EACH four inches of trees removed (example, one 12-inch tree removed requires 3, 2-inch replacement trees. Replacement requirement may be waived at TVA's discretion where undisturbed natural woodlands are present and will remain undisturbed. Survival of replacement trees will be guaranteed by permitee.

1-19-12

Appendix E – TVA Land Conditions Assessment Protocol

This page intentionally left blank

Land Conditions Assessment Protocol

Revised: **November 12, 2009**

GUIDING PRINCIPLE

TVA manages public lands for multiple benefits, striving to keep them in *good environmental health* while balancing the need for sustainable development. TVA protects natural resources while providing recreational opportunities across the Valley (TVA Environmental Policy, 2008).

WHY

A land condition assessment of selected TVA reservoir properties is needed to determine if these lands meet "desired conditions." The parcel's overall condition will be rated - "good", "fair", or "poor."

Objectives:

1. To determine the presence or absence of the listed desired conditions.
2. To compare land condition assessment ratings among parcels and over time.
3. To document the occurrence of unusual conditions or public safety and use concerns.

Assessment data will be incorporated into business planning activities. Activities to improve or maintain conditions will be identified during field assessments. Identified maintenance needs will be documented on the new checklist developed for Stewardship and Watershed Protection Maintenance.

Priorities will be determined by the known presence of threatened and endangered species, rare ecological communities, wetlands, or cultural resources, and prior investment projects, cost sharing partnerships, land stewardship needs, public health and safety, and resources required for project completion. Projects (activities) will be integrated, when appropriate, to achieve efficiency.

Activities required by regulations (e.g., threatened and endangered species monitoring and cultural resources inventory) would not be directly driven by this assessment and would continue to be guided by regulatory and stewardship needs.

WHAT

On-site parcel field assessments will assess four key land conditions categories that address 1) Public Safety and Use, 2) Resource Protection, 3) Soil and Water, and 4) Vegetation and Wildlife. Under each category are specific conditions that are key integral components of land conditions.

WHERE

The assessment area covers select reservoir properties (zones 3 and 4). The assessment unit is the entire acreage of an individual parcel or common parcels that are linked together. A selected number of acres will be assessed on an annual rotational basis as determined during annual business planning.

HOW
A field assessment checklist has been developed to document and characterize respective land conditions. Conditions criteria have been developed to make decisions. Decision-making will also require using professional judgment from experienced specialists in TVA land, water, wildlife, watershed, and other stewardship and management programs.

Respective parcel(s') conditions will be identified as "good" (5 points), "fair" (3 points), or "poor" (1 point). An overall parcel condition score will be totaled. A cumulative parcel score will indicate a corresponding "good", "fair", or "poor" condition rating of the parcel. If a physical condition is not present it will be scored in the "fair" category. This guideline applies to the following categories: Sensitive Resources, Species Protection, Access Road BMPs, and Shoreline Conditions.

The parcel(s) will be assessed by vehicle, boat, and/or foot. Complete assessment will be made of the boundary lines, shorelines, hiking trails, ATV routes, roads, and other identified undeveloped public use areas. Resources will be concurrently assessed while assessing the above specific areas as well as by randomly assessing by foot inaccessible interior areas of the parcel(s).

The checklist will be "red flagged" if one or more of the following special conditions are found on a parcel so that immediate management needs can be prioritized:

- Immediate threats to public health and safety
- Unauthorized uses affecting at least 5 acres (or 25% or greater of the parcel's acreage)
- Immediate threats to state- or federal-listed species or cultural resources
- Any criminal activities, including timber theft

Offsite impacts negatively affecting a parcel, and requiring immediate action, can also be red flagged. Examples include potential violations of state air and/or water quality standards.

WHO
A small team of "seasoned" natural resource professionals and/or specialists will conduct the field assessments. Other specialists will be consulted as needed. All parcels assessments will be conducted by at least two team members.

WHEN
On-the-ground prototype development will be conducted in early second quarter of FY09 just prior to implementation. The assessment process will continue until the dormant vegetation breaks dormancy and the reservoirs reach summer recreational full pool levels. The optimum assessment period is mid-October to mid- April when reservoirs are at winter pool levels and the vegetation is still dormant (leaves off). However, vegetative based assessments such as forest stand health may need to be made during the growing season.

TIME REQUIREMENTS
A two-person team can assess approximately 40 acres per day when vegetation is dormant. The team could assess approximately 25 acres per day during the growing season. This is not a “windshield” assessment but rather a representative in-the-field and hands-on assessment that will document current conditions. Where parcel access is poor and/or rugged terrain exists more time may be required. Assessment survey time (including checklist completion time) for each parcel will be recorded on the checklist. Assessment time includes actual field time as well as time needed to consult specialists on ratings. It does not include time for planning, office preparation, database check, and travel.

REQUIRED FIELD SUPPLIES
Topographic maps with C- or D-stage polygon (attach to final checklist)
Aerial photos with C- or D-stage polygon (attach to final checklist)
GPS with boundary corners downloaded
Compass

RECOMMENDED DATABASE CHECKS PRIOR TO FIELD ASSESSMENT
Heritage and Wetlands
Land Records: 26a, Agricultural License, Boundary Marker
Dispersed Recreation Database
Shoreline Conditions
Violations and Encroachments
Cultural Resources
Property Boundary Records

ASSESSMENT CRITERIA
The following conditions and assessment criteria will be used to assess individual parcels.

PUBLIC SAFETY AND USE	Good	Fair	Poor
Access, Boundary, and Signage TVA lands are identifiable if they have access, their boundary is maintained, and they contain appropriate signage.	The parcel has improved or unimproved overland access, the boundary can be identified by a routine field check; and signage is in place if needed under any of the following conditions: 1) the parcel experiences high public use, 2) uncertainty or conflict regarding land TVA ownership exists, or 3) sensitive resources occur on the parcel.	The parcel's improved or unimproved overland access, boundary marking and/or signage have maintenance needs.	The parcel's improved or unimproved overland access needs re-established; or boundary marking needs re-established; or one of the following conditions exist and signage is needed: See 1-3 in "good" category.
Dispersed Recreational Impacts Dispersed recreation refers to recreation opportunities that are passive and unconfined and occur on TVA managed lands not associated with developed facilities (e.g., camping, bank fishing, and hiking). Note: consider the Limits of Acceptable Change (LAC) score, if available and applicable.	Limited, if any, impacts. OR if LAC data exists, score for the parcel is below the LAC.	Monitoring needed; some minor issues present. OR if LAC data exists, score for the parcel is .75 or below.	Degrading; impacts are degrading both the resource and/or user experience. Corrective action needed. OR if LAC data exists, score for the parcel is .76 or above.
Public Safety Some examples of public safety considerations are hazards trees, hazardous materials (e.g., meth. lab dumping), target shooting, and user conflicts.	No concerns.	Monitoring needed. Some minor issues may be present.	Concerns that need to be addressed.
Unauthorized Use(s) Some examples of unauthorized use are: dump sites, trash and litter, vegetation disturbance and/or removal, ATV/OHV/ unauthorized vehicle access and site abuse, vandalism, structures, landscaping, and overstaying camping length. Note: included an estimate affected acres	Limited, if any, impacts.	Workable issues; impacts could be addressed with typical land management action or maintenance (e.g., gating, signage, and TVAP patrols).	Degrading; impacts are degrading both the resource and/or user experience. Corrective action needed.

RESOURCES PROTECTION	Good	Fair	Poor
Sensitive Resources Natural features that are rare, uncommon, or unique and are often easily damaged. Examples include: wetlands, geologic features (caves), rare plant communities, cultural resources, and nesting sites.	No action needed.	Monitoring needed. Minor issues present. OR no sensitive resources known from the parcel.	Action needed; ongoing activities or ability of the site to support its known sensitive resources requires action.
Species Protection Measure of protection for organisms (and their habitats) that are state- or federal-listed.	No action needed.	Monitoring needed; minor issues present (e.g., vegetation impacts). OR no state - or federal-listed species known from the parcel.	Action needed; ongoing activities or ability of the site to support its known listed species requires action.
SOIL AND WATER	Good	Fair	Poor
Access Road BMPs Measure of resources in place to minimize non-point source pollution.	Drainage and access control measures are installed and properly functioning; no maintenance needs.	Routine maintenance needs Examples: re-enforce silt fencing, modify surface water drainage patterns (e.g., diversions, ditches, water bars, and culverts). OR no authorized roads present.	Reestablishing/regrading, resurfacing, and/or new BMPs needed.
Shoreline Conditions Measure of the state of the shoreline interface where the water meets the land at normal summer pool elevation.	Acceptable erosion rate; adequate vegetative cover; natural rock outcropping(s), natural rocky bluff(s), properly installed rock riprap and/or other hard armoring measure in place; no stabilization needed.	Bank vertical height 2-6 feet; limited to no woody vegetative cover; trees uprooted; combination type stabilization measures needed. OR no shoreline property present.	Bank vertical height greater than 6 feet; bank failure; group trees collapsing; hard armoring (e.g., rock rip-rap and or wire-filled gabion baskets) needed.
Watershed Protection Benefits Measure of resources in place to protect the watershed. Note: roads are not included here.	BMPs in place; livestock exclusion fencing and watering lanes maintained; limited exposed soil.	Routine maintenance needs (e.g., livestock fencing in need of repair).	BMPs not in place; free roaming livestock; spots greater than 1 acre in need of re-vegetation; significant soil erosion occurring (e.g., sheet, rill, and gully erosion).

VEGETATION AND WILDLIFE	Good	Fair	Poor
Invasive Exotic Plants Invasive exotic plants are not native to a given area and they compete with and displace native plant communities. Examples: Common Privet, Autumn Olive, Japanese Honeysuckle, Kudzu, Multiflora Rose, Sericea Lespedeza, Oriental Bittersweet, Tree of Heaven, Amur Bush Honeysuckle, Japanese/ Nepal Grass, Japanese Wisteria, and Purple Loosestrife as well as other noxious plants.	Limited. Establishment is less than 5% coverage of one or more invasive, exotic plants.	Monitoring needed for possible control efforts. Between 5-25% coverage of one or more invasive exotic plants.	Establishment is greater than 25% and/or is degrading parcel(s') biodiversity and ecosystem health; controls needed.
Nuisance or Exotic Animals Nuisance animals are considered a menace because they can damage property, including natural resources. Exotic animals are not native to a given area. Examples: Armadillo, Beaver, Black Vulture, Turkey Vulture, Double-crested Cormorant, Canada Goose, Muskrat, Groundhog, Feral Hog, Feral Cat, White-tailed Deer, and Red Imported Fire Ant.	Limited, if any, impacts.	Monitoring needed for possible control efforts. Nuisance or exotic animals present and/or using the site but not degrading it.	These animals are degrading the parcel biodiversity and ecosystem health, and /or threatening public safety and adjacent public and private lands; controls needed.
Vegetation Impacts Measures natural impacts to vegetation. Some examples are insect infestations, diseases, long-term drought, damaging wildfire, and storms.	Limited, if any, impacts.	Monitoring is needed for possible control efforts. Vegetation impacts present, but not degrading the site.	Impact(s) are degrading parcel(s') biodiversity and ecosystem health, and/or threatening public safety and adjacent public and private forest lands. For example, an active insect infestation is present (e.g., southern pine bark beetle) or the parcel is being affected by disease that requires immediate action to reduce or prevent the spread of the infestation or to minimize the impact.

VEGETATION AND WILDLIFE	Good	Fair	Poor
Wildlife Habitat Consider the parcel's capability to offer wildlife habitat given its size, location, and topography. Potential enhancement measures might include: brush piles and windrows, food plots, mowing and disking, native warm season grasses, native wildflower meadows, nest boxes, openings, plantings, seeding, snags and cavity trees, and improving vegetation diversity.	Minimal action efforts needed, including partnerships with stakeholders ongoing. OR adequate mix of wildlife habitat types present with no action efforts identified; visual observation of wildlife or wildlife usage high.	Monitoring needed. Marginal efforts ongoing. OR moderate mix of habitat types present; visual observation of wildlife or wildlife usage moderate.	Planning and action efforts needed; minimal, if any, efforts ongoing. OR inadequate mix of habitat types present; or partnerships needed or desired; visual observation of wildlife or wildlife usage low.

Appendix F – TVA Land and Water Stewardship Reservoir Properties Land Conditions Assessment Checklist

This page intentionally left blank

Land & Water Stewardship
Reservoir Properties Land Conditions Assessment

Watershed Team ___________________________ Reservoir ________________________ Zone______

Parcel(s) Number/Local Name _________________________________ Acres ________ RM________

Circle one rating in each row then assign associated points. If physical condition is not present assign Fair rating/3 points.*

	Good (5 points.)	*Fair (3 points)*	*Poor (1 point)*	Score
Public Safety & Use				
Access, Boundary, Signage	Good	Fair	Poor	
Dispersed Recreational Impacts	Limited	Monitoring Needed	Degrading	
Public Safety	No Concerns	Monitoring Needed	Concerns	
Unauthorized Use(s)	Limited	Workable Issues	Degrading	
(UU Estimated Acres ____)				
Resources Protection				
Sensitive Resources*	No Action Needed	Monitoring Needed	Action Needed	
Species Protection*	No Action Needed	Monitoring Needed	Action Needed	
Soil & Water				
Access Road BMPs*	Good	Fair	Poor	
Shoreline Conditions*	Good	Fair	Poor	
Watershed Protection Benefits	Good	Fair	Poor	
Vegetation & Wildlife				
Invasive Exotic Plants	Limited	Monitoring Needed	Degrading	
Nuisance or Exotic Animals	Limited	Monitoring Needed	Degrading	
Vegetation Impacts	Limited	Monitoring Needed	Degrading	
Wildlife Habitat	Minimal Action Efforts Needed	Monitoring Needed	Planning & Action Efforts Needed	
			Parcel(s) Total	

Score (Circle One): *Good* 65-55 pts (100-85 %), *Fair* 54-46 pts (84-70 %), *Poor* 45 pts or less (69 % or less); Red Flag Yes/No

Field Assessment Start Time ________________ Finish Time_______________ Field Assessment Date ________________

Assessor(s) ____ Checklist Date 3/27/09

Supportive Comments: (required for all categories)

ABS –

DRI –

PS –

UU –

SR –

SP –

AR BMPs –

SC –

WPB –

IEP –

NEA –

VI –

WH –

RED FLAG –

Provide sources of data used or additional comments such as the following: adjacent landowners (name(s) & numbers); aerial photographs (year, photo number, location); agricultural licensee (name(s), & numbers); dispersed recreational data base; heritage data base; property boundary records; shoreline conditions; unauthorized use(s).

Appendix G – TVA Land and Water Stewardship Reservoir Properties Maintenance Needs Checklist

This page intentionally left blank

Land & Water Stewardship
Reservoir Properties Maintenance Needs

Watershed Team: Reservoir: Zone:

Parcel Number/Local Name: Acres: RM:

STEWARDSHIP & WATERSHED PROTECTION NEEDS	Assessed? ✓	Need? ✓
Abuse/Misused Sites – ATVs, OHVs, Vandalism	☐	☐
Access Roads & Parking Areas – Access Control, Blockage Removal, Bushhogging, Drainage Controls, Seeding, Surfacing	☐	☐
Agricultural Fields – Amendments, Disking, Field Buffers, Mowing	☐	☐
Boundary – Remarking, Reestablishment	☐	☐
Dispersed Recreational Sites – Camp Sites, Features	☐	☐
Bank Fishing Sites – Access, Benches, Fish Attractors	☐	☐
Public Access Sites – Reservoirs, Streams	☐	☐
Nuisance Wildlife Controls – Beaver Dam Removal, Vulture Control	☐	☐
Public Health & Safety – Dumpsters, Hazard Tree/Hazardous Materials Removal, Litter/Trash/Dump Sites, Portajohns, Target Shooting	☐	☐
Sensitive Resources – Cultural, Natural Areas, Wetlands	☐	☐
Shoreline Conditions – Geotextiles, Hard Armoring, Woody Plantings	☐	☐
Signage & Interpretive – Displays, Gazebos, Kiosks, Signs	☐	☐
Species Protection – State, Federal	☐	☐
Trails – Amenities, Blockage Removal, Drainage Controls, Foot Bridges	☐	☐
Vegetation – Diversity, Damage Rehabilitation, Invasive Exotics Controls, Prescribed Burns, Reforestation	☐	☐
Visual Values – Vistas/Overlooks	☐	☐
Watershed Protection – BMPs, Drainage Controls, Livestock Fencing & Corridors, Soil Erosion Control, Riparian Buffers, Road Stream Crossings	☐	☐
Wildlife Habitat – Food Plots, Nest Boxes, Openings, Prescribed Burns, Seeding, Snags & Cavity Trees, Windrows, Woody Plantings, NWSGs	☐	☐
Other – Public Communication, Enforcement, Partnership Projects, Proactive Measures, Stakeholder Concerns	☐	☐

(Continued on back)

Land & Water Stewardship
Reservoir Properties Maintenance Needs
(continued)

Recommended Action Tasks and Estimated Costs:
Time Sensitivity per Task:
Parcel(s) Description and Conditions Comments:
Watershed Team Priority: High ☐ Medium ☐ Low ☐ TBD ☐
Technical Support:
Assessor(s): **Date:** **Approval:** **Date:**

Revision Date 03/12/09

Appendix H – TVA Land Asset Tiering for Natural Resource Management

This page intentionally left blank

Land Asset Tiering for Natural Resource Management

Version 16 August 28, 2009

GOAL

The goal/purpose of Land Assets Team is to categorize land into asset types (Tiers). The lifespan for a Tier categorization is five years due to the dynamic nature (i.e., ecological, land use, partnership changes) of the lands and their associated resources (five year accounts for finer changes in land use versus zoning for land planning process).

OBJECTIVES

1. Reduce scope of NRM lands to set land conditions assessment cycle.
2. Develop an asset catalog (Maximo)
3. Set prioritization of where we work and what we do
4. Maximize efficiencies (assure efforts yield the most value)

HIGH LEVEL FILTER

1. Reservoir Lands (Universe)
2. Recently Planned Reservoir Lands (using current zoning 1-7 methodology)
3. **Addition**: all Dam Reservation Lands, Natural Areas and Unit Planned lands are Tier I assets, regardless of reservoir and zone
4. All land managed by federal and state agencies is considered Tier II

TIERING BY ZONES (1-7)

Zones 1 and 7 – Non-TVA Shoreland and Shoreline Access: These lands are categorized as Tier III assets because they are managed via TVA's flowage easement rights and/or permitting authority. Zone 7 parcels are generally narrow, linear, and front residential development, thus limiting land and water stewardship activities. Basic stewardship activities (e.g., vegetation management and water quality protection) on Zone 7 lands are guided by TVA's Shoreline Management Policy.

Zone 3 – Sensitive Resource Management: All zone 3 lands are categorized as Tier I.

Zone 2 – TVA Project Operations,
Zone 4 – Natural Resource Conservation,
Zone 5 – Industrial (undeveloped)*, and
Zone 6 – Developed Recreation (undeveloped)*:
Step 1: Parcels 50 acres or greater?
Step 2: Recreation and Stewardship questions

A. Does parcel receive a single intensive recreational use or multiple recreational uses?

B. Does parcel have a prior stewardship investment within last five years including labor and/or in-kind services (shoreline enhancement, boundary marking, and agricultural licenses not included) valued at $5K or greater by TVA and/or partners?

Step 3: Special considerations

A. Are there other parcels regardless of size/acreage that should be included due to special consideration?

* Parcels fronting developed Zone 5 and 6 lands should be considered developed, respectively.

<u>If the parcel falls within steps 1 and 2 (A or B) or step 3, it is considered a Tier I asset (exception: Zone 5 are Tier II because of their interim use). Zone 4 and 6 parcels not meeting the criteria are considered Tier II. Zone 2 and 5 parcels not meeting the criteria are considered Tier III.</u>

Zone 5 – Industrial (developed) – These lands are categorized as Tier III assets because they are managed for economic development. These sites are not suitable for conducting land and water stewardship activities.

Zone 6 – Developed Recreation (developed) – Tiering for this category will be determined by the recreation asset team.

Definitions and Justifications

Dam Reservations - all dam reservations are included as Tier I assets, regardless of reservoir, because of their high visibility and high public use.

Natural Areas - all natural areas are included as Tier 1 assets, regardless reservoir and zone, because TVA's most rare and sensitive resources occur on these parcels.

Unit plans - unit planned lands are included as Tier 1 assets, regardless reservoir and zone, because of the high stewardship value and considerable prior investment in these assets. These stakeholder-driven plans involve lands that are highly used and visible by the public. Unit planned lands include: Boone, Davis Creek, Fullerton Bend, Harmon Creek, Lower Flint, Lower Sequatchie, Lower Watts Bar, Noeton, and Upper Chickamauga.

Recently Planned Reservoirs - were selected as priority lands in the Tiering process because these lands were planned using the current zoning methodology. Land data for the plans are most up-to-date, are organized in a similar fashion, and are readily available electronically. Recently planned reservoirs include: Bear Creeks, Guntersville, Melton Hill, Norris, Pickwick, Tellico, and Tims Ford and (not yet Board approved Watts Bar, Mountain Reservoirs, and Tributary Reservoirs.)

Land Managed by Federal and State Agencies - lands managed by others (e.g., state wildlife managed areas) is considered Tier II because other federal or state agencies have been given management authority for these lands. TVA has limited opportunity to affect the condition of these assets through direct management.

50 Acres - the asset team used a prioritization matrix to determine the size of parcels most appropriate for Tier 1. Using five criteria (multiple use potential, economy of scale, adjacent land use compatibility, ecological value, and visibility) the team determined that 50 acres is the smallest parcel size where all five of these criteria can be consistently met.

Fifty acres fulfills another role in the Tiering process. This acreage size helped the team to identify parcels of highest ecological value (i.e., larger parcels have higher potential for ecological functions and associated values). Dispersed recreation and ecological value are components of capability/suitability criteria for Natural Resource Conservation Lands in the land planning process.

To be categorized a Tier one asset "yes" must be answered to one of two following questions:

A. Does parcel receive a single intensive recreational use or multiple recreational uses?

Recreational Use examples include bank fishing, camping, hiking, hunting, wildlife observation, and reservoir access for swimming.

Possible indicators of intensity include a high LAC score (site qualifies for management action), user established trails (one mile or greater), known conflicts with recreational users (i.e. horseback riders and mountain bikers), or inquiries (three or more same parcel).

B. Does parcel have a prior stewardship investment within last five years including labor and/or in-kind services (shoreline enhancement and boundary activities not included) valued at $5K or greater by TVA and/or partners?

Shoreline is not to be included since it is a separate process area. Boundary is also not to be included because it is considered a basic land management activity as well as being a separate budgetary item.

Prior stewardship investments could include roads, trails, dispersed recreation enhancement or mitigation, wildlife habitat enhancement measures, resource protection activities, access control, best management practices, vegetation management, forest protection (fire control, insects and diseases), nuisance wildlife controls, as well as other significant investments.

<u>Justification for $5K value</u>
Levels of prior parcel investments/management (how the $5K was selected) are as follows:
Administrative level – keeping files minimal costs = limited $
Custodial level – trash and litter pick up, signage = $1-3 K
Stewardship – demonstrates clear investment commitment toward responsible stewardship = $5k or greater

Special considerations for Tier I - use only in a limited way for one or two parcels per reservoir.

A. Are there other parcels regardless of size/acreage that should be included due to special consideration?

Consider parcels that are special such as:

- "one-of-kind" (e.g., cypress swamp), or

- Unique location (e.g., Douglas where there are limited public lands, or
- Corridors (e.g., parcel's relationship with USDA Forest Service lands on Hiwassee), or
- High value resources identified since the last planning process (e.g., endangered species)

STEWARDSHIP MAINTENANCE NEEDS [Notes for future discussion]
Stewardship Maintenance Checklist Needs are identified through both Land Conditions Parcel Assessments and routine parcel management activities.

Considerations for prioritization of these needs are as follows:
<u>All Parcels</u> (regardless of stratification)
Public Health and Safety
Compliance Related
Need related to high value resources

<u>Tiered Parcels</u>
Protection needs such as access control
Projects with prior investments valued at $5K or greater

Appendix I – Tennessee Valley Authority Natural Areas Procedures Manual

Transmission Environmental Protection Procedures
Right-Of-Way Vegetation Management Guidelines

1.0 Overview

A. The Tennessee Valley Authority (TVA) must manage the vegetation on its rights-of-way and easements to ensure emergency maintenance access and routine access to structures, switches, conductors, and communications equipment. In addition, TVA must maintain adequate clearance, as specified by the National Electrical Safety Code, between conductors and tall growing vegetation and other objects. This requirement applies to vegetation within the right-of-way (ROW) as well as to trees located off the right-of-way.

B. Each year TVA assesses the conditions of the vegetation on and along its rights-of-way. This is accomplished by aerial inspections, ground inspections, periodic field inspections, aerial photography, LiDAR data and information from TVA personnel, property owners andthe general public. TVA utilizes this data to evaluate vegetation clearances and identifies vegetation on and off ROW that does or could potentially pose a risk to reliability.

C. TVA transmission foresters develop a vegetation re-clearing plan that is specific to each line segment and is based on terrain conditions, species mix, growth, and density.

2.0 Right-of-Way Management Methods

A. TVA takes an Integrated Vegetation Management (IVM) approach that is based on a carefully planned, multi-dimensional strategy developed in consultation with forestry and habitat experts. Integrated vegetation management aims to improve safety and prevent power outages by creating healthy and self-sustaining ecosystems in ROWs while ensuring compliance with regulatory standards (NERC 2006). These ecosystems foster beneficial, attractive and low-maintenance habitat while discouraging tall, woody species and other, more benign forms of vegetation can thrive. Integrated vegetation management encourages early successional native habitats that pose less threat to power reliability yet offer safe havens for desirable plants and animals.By combining selective use of herbicides with physical removal, integrated vegetation management can more thoroughly eradicate unsuitable vegetation and allow more compatible species to fill in, making it more difficult for tall-growing trees to re-establish.

TVA executes its transmission vegetation maintenance on a 3-year cycle based on data that is acquired by various inspection methods. LiDAR, ground inspection andaerial inspection data are utilized to evaluate the next year's scheduled work to determine the annual vegetation maintenance work scope. LiDAR technology provides a detailed vegetation threat analysis that can be used to assess risk as well as prioritize vegetation management work plans. This detailed analysis supports TVA's efforts to target incompatible species as well as promote the growth of compatible vegetation. This precision management approach is effective in reducing overall environmental impact by limiting work to specific areas of incompatibility.

B. TVA uses a variety of herbicides specific to the species present with a variety of possible application techniques. The method most often implemented is selective application from the ground with backpack sprayers or vehicle-mounted sprayers. However, other techniques and methods, such as those described in section 3.0, may be utilized when circumstances dictate. Any herbicides used are applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the United States Environmental Protection Agency (USEPA) are used.

C. In very steep terrain, in sensitive environmental areas, in extensive wetlands, at stream banks, and in sensitive property owner land use areas, hand clearing may be utilized. Hand clearing is recognized as one of the most hazardous occupations documented by the Occupational Health and Safety Administration.

D. TVA does not encourage tree re-clearing by individual property owners because of the high hazard potential of hand clearing, possible interruptions of the line, and electrical safety considerations for untrained personnel that might do the work.

E. Mechanical mowers not only cut the tall saplings and seedlings on the right-of-way, it also shatters the stump and the supporting near-surface root crown. The tendency of resistant species to re-sprout from the root crown and shattered stumps can produce a multi-stem dense stand in the immediate area. Repeated use of mowers on short cycle re-clearing with many original stumps re-growing in the above manner can create a single species thicket or monoculture. With the original large root system and multiple stems, the resistant species can produce re-growth at the rate of 5-10 feet in a year. In years with high rainfall, the growth can reach 12-15 feet in a single year. These dense, monoculture stands can become nearly impenetrable for even large tractors. Such stands have low diversity, little wildlife food or nesting potential, and become a property owner concern. Selective herbicide application may be used to control monoculture stands.

3.0 Herbicide Program

A. TVA has worked with universities (such as Mississippi State University, University of Tennessee, Purdue University and others), chemical manufacturers, other utilities, U.S. Department of Transportation, U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS) personnel to explore options for vegetation control. The results have provided strong recommendations to use species-specific, low volume herbicide applications in more situations. Research, demonstrations, and other right-of-way programs show a definite improvement of rights-of-way treated with selective low-volume applications of new herbicides using a variety of application techniques and timing. Table 1 below identifies herbicides currently used on TVA rights-of-way.Table 2 identifies pre-emergent herbicides currently being used on bare ground areas on TVA rights-of-way and in substations. Table 3 identifies TGRs that may be used on tall trees that have special circumstances that require trimming on a regular cycle, e.g., restrictions on complete removal. The rates of application utilized are those listed on the U.S. Environmental Protection Agency (USEPA) approved label and consistent with utility standard practice throughout the Southeast.

Table 1 - Herbicides Currently Used on TVA Rights-of-Way

Trade Name	Active Ingredient	Label Signal Word
Accord/Accord XRT II	Glyphosate/Liquid	Caution
Arsenal	Imazapyr/Liquid/Granule	Caution
Chopper	Imazapyr/RTU	Caution
Clearstand	Imazapyr/Metsulfuron Methyl/Liquid	Caution
Escort	Metsulfuron Methyl/Dry Flowable	Caution
Garlon 4 Ultra	Triclopyr/Liquid	Caution
Habitat	Imazapyr/Liquid	Caution
Krenite S	Fosamine Ammonium	Caution
Milestone VM	Aminopyralid/Liquid	Caution
Pathfinder II	Triclopyr/RTU	Caution
Polaris	Imazapyr/Liquid	Caution
Rodeo	Glyphosate/Liquid	Caution
Roundup	Glyphosate/Liquid	Caution
Roundup Pro	Glyphosate	Caution
Stalker	Imazapyr/Liquid	Caution
Streamline	Aminocyclopyrachlor/ Metsulfuron Methyl/Liquid	Caution
Transline	Clopyralid/Liquid	Caution
Viewpoint	Imazapyr/Aminocyclopyrachlor/ Metsulfuron Methyl/Liquid	Caution

Table 2 - Pre-Emergent Herbicides Currently Used for Bare Ground Areas TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal Word
Arsenal 5G	Imazapyr/Granule	Caution
Sahara	Diuron/Imazapyr	Caution
SpraKil SK-26	Tebuthiuron/Diuron/Granules	Caution
SpraKil S-5	Tebuthiuron/Granules	Caution
Topsite	Diuron/Imazapyr	Caution

Table 3 - Tree Growth Regulators (TGRs) Currently Used on TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal Word
Profile 2SC	TGR-paclobutrazol	Caution
TGR	Flurprimidol	Caution

B. The herbicides listed in Table 1 and 2 and TGRs listed in Table 3 have been evaluated in extensive studies in support of registration applications and label requirements. Many have been reviewed in the USFS vegetation management environmental impact statements (EISs), and those evaluations are incorporated here by reference (USFS 1989a, 1989b, 2002a, and 2002b). Electronic copies can be accessed at https://cdxnodengn.epa.gov/cdx-enepa-public/action/eis/search. The result of these reviews has been a consistent finding of limited environmental impact beyond that of control of the target vegetation. All the listed herbicides have been found to be of low environmental toxicity when applied by trained applicators that are following the label and registration procedures, including prescribed measures, such as buffer zones, to protect threatened and endangered species.

C. Low volume herbicide applications are recommended since research demonstrates much wider plant diversity after such applications. There is better ground erosion protection and more wildlife food plants and cover plants develop. In most situations, there is increased development of wild flowering plants, pollinator plants and shrubs. In conjunction with herbicides, the diversity and density of low-growing plants provide control of tall-growing species through competition.

D. Herbicides are used in place of rotary mowing to avoid damage to nesting and tunneling wildlife. This method retains ground cover year around with a better mix of food species and associated high- protein insect populations for birds in the right seasons. Most also report less damage to soils (even when compared with rubber-tired equipment).

E. Best Management Practices (BMPs) governing application of herbicides are contained within *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (TVA 2017) which is incorporated by reference. Herbicides can be liquid, granular, or powder and can be applied aerially or by ground equipment and may be selectively applied or broadcast, depending on the site requirements, species present, and condition of the vegetation.Water quality considerations include measures taken to keep herbicides from reaching streams whether by direct application or through runoff of or flooding by surface water. “Applicators” must be trained, licensed, and follow manufacturers’ label instructions, USEPA guidelines, and respective state regulations and laws.

F. When herbicides are used, their potential adverse impacts are considered in selecting the compound,formulation, and application method. Herbicides that are designated “Restricted Use” by USEPA require application by or under the supervision of applicators certified by the respective state control board. Applications are done either by TVA or by contractors in accordance with the following guidelines identified in the TVA BMP manual (TVA 2017):

1. The sites to be treated are selected and application directed by the appropriate TVA official.
2. A pre-flight walking or flying inspection is made within 72 hours prior to applying herbicides aerially. This inspection ensures that no land use changes have occurred, that sensitive areas are clearly identified to the pilot, and that buffer zones are maintained.
3. Aerial application of liquid herbicides will normally not be made when surface wind speeds exceed 5 miles per hour, in areas of fog, or during periods of temperature inversion.

4. Pellet application will normally not be made when the surface wind speeds exceed 10 miles per hour or on frozen or water saturated soils.
5. Herbicide application should follow manufacturers' label specifications.
6. Application during unstable, unpredictable, or changing weather patterns is avoided. Equipment and techniques are used that are designed to ensure maximum control of the spray swath with minimum drift.
7. Herbicides are not applied to surface water or wetlands unless specifically labeled for aquatic use. Filter and buffer strips will conform at least to federal and state regulations and any label requirements. The use of aerial or broadcast application of herbicides is not allowed within a streamside management zone (SMZ) adjacent to perennial streams, ponds, and other water sources containing sensitive aquatic resources. Hand application of aquatic use herbicides are used only selectively for use within SMZs containing sensitive aquatic resources.
8. For aerial applications, buffers and filter strips (200 feet minimum width) are maintained next to agricultural crops, gardens, farm animals, orchards, apiaries, horticultural crops, and other valuable vegetation.
9. Herbicides are not applied in the following areas or times: (a) in city, state, and national parks or forests or other special areas without written permission and/or required permits; (b) off the right-of-way; and (c) during rainy periods or during the 48-hour interval prior to rainfall predicted with a 20 percent or greater probability by local forecasters when soil active herbicides are used.

G. TVA currently uses primarily low volume applications of foliar and basal applications, e.g., Accord (Glyphosate), Arsenal (Imazapyr), Clearstand (Imazapyr/ Metsulfuron Methyl), Milestone VM (Aminopyralid) and Streamline (Aminocyclopyrachlor / Metsulfuron Methyl).

4.0 Benefits

A. Proper maintenance—including vegetation management—of the ROW and its supporting facilities is crucialto ensuring the reliable transmission of affordable electrical power. Unmanaged and poorly maintained vegetation can cause electricity outages, wildfires, soil erosion, and water quality issues. Utility companies that adopt long-term IVM approaches often benefit from significant vegetation management cost savings, which can be reflected in customer rates.

B. ROW also provides important wildlife habitats. As wildlife habitats in the United States are lost to development, these ROWs become increasingly important. The IVM approach can create natural, diverse, and sustaining ecosystems, such as a meadow transition habitat. A variety of wildlife species (including threatened and endangered species) consider these habitats home, such as butterflies, songbirds, small mammals, and deer. These habitats also encourage the growth of native plant species and can increase plant diversity.

C. Invasive and exotic species are often a problem on the ROW, and, consequently, the surrounding land. IVM techniques (such as selective herbicide application) can minimize this problem, while ensuring native and endangered species are not affected.

5.0 References

Integrated Vegetation Management (IVM) on Rights-of-Way Fact Sheet. (2012, May) Retrieved from http://www.epa.gov/pestwise/htmlpublications/row_fact_sheet.html

Tennessee Valley Authority. 2017. A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 3.Edited by G. Behel, S. Benefield, R. Brannon, C. Buttram, G. Dalton, C. Ellis, C. Henley, T. Korth, T. Giles, A. Masters, J. Melton, R. Smith, J.Turk, T. White, R. Wilson. Chattanooga, TN.: Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects>.

U.S. Forest Service. 1989a. Vegetation Management in the Coastal Plain/Piedmont Final Environmental Impact Statement, Volumes I and II. Southern Region Management Bulletin R8-MB-23, January 1989. Atlanta, Ga.: USDA Forest Service.

———. 1989b. Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, Volumes I and II. Southern Region Management Bulletin R8-MB-38, July 1989. Atlanta, Ga.: USDA Forest Service.

———. 2002a. Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement Supplement. Southern Region Management Bulletin R8-MB-97A, October 2002. Atlanta, Ga.: USDA Forest Service.

———. 2002b. Vegetation Management in the Coastal Plain/Piedmont Final Environmental Impact Statement Supplement. Southern Region Management Bulletin R8-MB-98A, October 2002. Atlanta, Ga.: USDA Forest Service.

Appendix J – TVA Transmission Environmental Protection Procedures Right-of-Way Vegetation Management Guidelines

This page intentionally left blank

Tennessee Valley Authority Right-of-Way Clearing Specifications

1. **General** - The clearing contractor shall review the environmental evaluation documents (categorical exclusion checklist, environmental assessment, or environmental impact statement) for the project or proposed activity, along with all clearing and construction appendices, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and management practices as outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible.

   If the contractor fails to use BMPs or to follow environmental expectations discussed in the prebid or prework meeting or present in contract specifications, TVA will order corrective changes and additional work as deemed necessary in TVA's judgment to meet the intent of environmental laws and regulations or other guidelines. Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other remedial action is taken at the contractor's expense. Penalty clauses may be invoked as appropriate.

2. **Regulations** - The clearing contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances including without limitation all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances. The contractor shall secure or ensure that TVA has secured all necessary permits or authorizations to conduct work on the acres shown on the drawings and plan and profile for the contract. The contractor's designated project manager will actively seek to prevent, control, monitor, and safely abate all commonly recognized forms of workplace and environmental pollution. Permits or authorizations and any necessary certifications of trained or licensed employees shall be documented with copies submitted to TVA's ROW forester or project environmental person before work begins. The contractor will be responsible for meeting all conditions specified in permits. Permit conditions shall be reviewed in prework discussions.

3. **Land and Landscape Preservation** - The clearing contractor shall exercise care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material shall be placed to prevent erosion and sedimentation of water bodies or conveyances to surface water or groundwater. In areas outside the clearing, use, and access areas, the natural vegetation shall be protected from damage. The contractor and his employees must not deviate from delineated access routes or use areas and must enter the site at designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the

vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones shall be observed and the methods of clearing or reclearing modified to protect the buffer and sensitive area. Some areas may require planting native plants or grasses to meet the criteria of regulatory agencies or commitments to special program interests.

4. **Streamside Management Zones** - The clearing contractor must leave as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. In such streamside management zones (SMZ), tall-growing tree species (trees that would interfere with TVA's National Electrical Safety Code clearances) shall be cut, and the stumps may be treated to prevent resprouting. Low-growing trees identified by TVA as marginal electrical clearance problems may be cut, and then stump treated with growth regulators to allow low, slow-growing canopy development and active root growth. Only approved herbicides shall be used, and herbicide application shall be conducted by certified applicators from TVA's Transmission, Operations, and Maintenance (TOM) organization after initial clearing and construction. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment, such as a feller-buncher. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Disturbed soils in SMZs must be stabilized by appropriate methods immediately after the right-of-way is cleared. Stabilization must occur within the time frame specified in applicable storm water permits or regulations. Stumps within SMZs may be cut close to the ground but must not be removed or uprooted. Trees, limbs, and debris shall be immediately removed from streams, ditches, and wet areas using methods that will minimize dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at locations designated by TVA after the application of appropriate erosion control BMPs consistent with permit conditions or regulatory requirements.

5. **Wetlands** - In forested wetlands, tall trees will be cut near the ground, leaving stumps and roots in place. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision will be situationally made based on existing ground cover, wetland type, and tree species since tall tree removal may "release" understory species and allow them to grow quickly to "electrical clearance problem" heights. In many circumstances, herbicides labeled for water and wetland use may be used in reclearing.

6. **Sensitive Area Preservation** - If prehistoric or historic artifacts or features that might be of archaeological significance are discovered during clearing or reclearing operations, the activity shall immediately cease within a 100-foot radius, and a TVA ROW forester or project environmental person and the Cultural Resources Program manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program. Work may continue beyond the finding zone and the 100-foot radius beyond its perimeter.

7. **Water Quality Control** - The contractor's clearing and disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainage ways, surface water, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body. Open burning debris will be kept away from streams and ditches and shall be incorporated into the soil.

   The clearing contractor will erect and (when TVA or contract construction personnel are unable) maintain BMPs such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. BMPs will be inspected by the environmental technician or other designated TVA or contractor personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections will be conducted in accordance with permit requirements. Records of all inspections will be maintained on site, and copies of inspection forms will be forwarded to the project environmental person.

8. **Turbidity and Blocking of Streams** - If temporary clearing activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls shall be provided to avoid erosion and siltation of streams and other water bodies or water conveyances. Turbidity levels in receiving waters or at storm water discharge points shall be monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps shall be installed as soon as practicable after initial access, site, or right-of-way disturbance in accordance with applicable permit or regulatory requirements.

   Mechanized equipment shall not be operated in flowing water except when approved and, then, only to construct necessary stream crossings under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies shall be removed as soon as possible. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained for stream crossings.

9. **Air Quality Control** - The clearing or reclearing contractor shall take appropriate actions to limit the amount of air emissions created by clearing and disposal operations to well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land crops, dwellings, highways, or people.

10. **Dust and Mud Control** - Clearing activities shall be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

11. **Burning** - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification, or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be temporarily stopped by TVA's ROW forester or project environmental person. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

12. **Smoke and Odors** - The contractor will properly store and handle combustible and volatile materials that could create objectionable smoke, odor, or fumes. The contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

13. **Vehicle Exhaust Emissions** - The contractor shall maintain and operate equipment in a manner that limits vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturers' recommended limits and tolerances. Excessive exhaust gases will be eliminated, and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

14. **Vehicle Servicing** - Routine maintenance of personal vehicles will not be performed on the right-of-way. However, if emergency or "have to" situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the right-of-way, except in designated sensitive areas. The clearing or reclearing contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the project environmental person will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

15. **Noise Control** - The contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the site and adjacent property owners. Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

16. **Noise Suppression** - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

17. **Sanitation** - A designated representative of TVA or the clearing contractor shall contact a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal

will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

18. **Refuse Disposal** - The clearing or reclearing contractor shall be responsible for daily cleanup and proper labeling, storage, and disposal of all refuse and debris on the site produced by his operations and employees. Facilities that meet applicable regulations and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used.

19. **Brush and Timber Disposal (Reclearing)** - The reclearing contractor shall place felled tree boles in neat stacks at the edge of the right-of-way, with crossing breaks at least every 100 feet. Property owner requests shall be reviewed with the project manager or right-of-way specialist before accepting them. Lop and drop activities must be specified in the contract and on plan and profile drawings with verification with the right-of-way specialist before conducting such work. When tree trimming and chipping is necessary, disposal of the chips on the easement or other locations on the property must be with the consent of the property owner and the approval of the right-of-way specialist. No trees, branches, or chips shall remain in a surface water body or be placed at a location where washing into a surface water or groundwater source might occur.

20. **Brush and Timber Disposal (Initial Clearing)** - For initial clearing, trees are commonly part of the contractor's contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood, or they may be chipped or stacked and burned. All such activities must be coordinated with the TVA ROW forester, and the open burning permits, notifications, and regulatory requirements must be met. Trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way.

21. **Restoration of Site** - All disturbed areas, except for farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's ROW forester or project environmental person specify a different method:

    a. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

    b. If needed, appropriate soil amendments will be added.

    c. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and

Maintenance Activities (TVA, 2022). Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

d. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

Appendix K – TVA Right-of-Way Clearing Specifications

Tennessee Valley Authority Right-of-Way Clearing Specifications

1. **General** - The clearing contractor shall review the environmental evaluation documents (categorical exclusion checklist, environmental assessment, or environmental impact statement) for the project or proposed activity, along with all clearing and construction appendices, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and management practices as outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible.

   If the contractor fails to use BMPs or to follow environmental expectations discussed in the prebid or prework meeting or present in contract specifications, TVA will order corrective changes and additional work as deemed necessary in TVA's judgment to meet the intent of environmental laws and regulations or other guidelines. Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other remedial action is taken at the contractor's expense. Penalty clauses may be invoked as appropriate.

2. **Regulations** - The clearing contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances including without limitation all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances. The contractor shall secure or ensure that TVA has secured all necessary permits or authorizations to conduct work on the acres shown on the drawings and plan and profile for the contract. The contractor's designated project manager will actively seek to prevent, control, monitor, and safely abate all commonly recognized forms of workplace and environmental pollution. Permits or authorizations and any necessary certifications of trained or licensed employees shall be documented with copies submitted to TVA's ROW forester or project environmental person before work begins. The contractor will be responsible for meeting all conditions specified in permits. Permit conditions shall be reviewed in prework discussions.

3. **Land and Landscape Preservation** - The clearing contractor shall exercise care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material shall be placed to prevent erosion and sedimentation of water bodies or conveyances to surface water or groundwater. In areas outside the clearing, use, and access areas, the natural vegetation shall be protected from damage. The contractor and his employees must not deviate from delineated access routes or use areas and must enter the site at designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the

vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones shall be observed and the methods of clearing or reclearing modified to protect the buffer and sensitive area. Some areas may require planting native plants or grasses to meet the criteria of regulatory agencies or commitments to special program interests.

4. **Streamside Management Zones** - The clearing contractor must leave as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. In such streamside management zones (SMZ), tall-growing tree species (trees that would interfere with TVA's National Electrical Safety Code clearances) shall be cut, and the stumps may be treated to prevent resprouting. Low-growing trees identified by TVA as marginal electrical clearance problems may be cut, and then stump treated with growth regulators to allow low, slow-growing canopy development and active root growth. Only approved herbicides shall be used, and herbicide application shall be conducted by certified applicators from TVA's Transmission, Operations, and Maintenance (TOM) organization after initial clearing and construction. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment, such as a feller-buncher. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Disturbed soils in SMZs must be stabilized by appropriate methods immediately after the right-of-way is cleared. Stabilization must occur within the time frame specified in applicable storm water permits or regulations. Stumps within SMZs may be cut close to the ground but must not be removed or uprooted. Trees, limbs, and debris shall be immediately removed from streams, ditches, and wet areas using methods that will minimize dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at locations designated by TVA after the application of appropriate erosion control BMPs consistent with permit conditions or regulatory requirements.

5. **Wetlands** - In forested wetlands, tall trees will be cut near the ground, leaving stumps and roots in place. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision will be situationally made based on existing ground cover, wetland type, and tree species since tall tree removal may "release" understory species and allow them to grow quickly to "electrical clearance problem" heights. In many circumstances, herbicides labeled for water and wetland use may be used in reclearing.

6. **Sensitive Area Preservation** - If prehistoric or historic artifacts or features that might be of archaeological significance are discovered during clearing or reclearing operations, the activity shall immediately cease within a 100-foot radius, and a TVA ROW forester or project environmental person and the Cultural Resources Program manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program. Work may continue beyond the finding zone and the 100-foot radius beyond its perimeter.

7. **Water Quality Control** - The contractor's clearing and disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainage ways, surface water, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body. Open burning debris will be kept away from streams and ditches and shall be incorporated into the soil.

   The clearing contractor will erect and (when TVA or contract construction personnel are unable) maintain BMPs such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. BMPs will be inspected by the environmental technician or other designated TVA or contractor personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections will be conducted in accordance with permit requirements. Records of all inspections will be maintained on site, and copies of inspection forms will be forwarded to the project environmental person.

8. **Turbidity and Blocking of Streams** - If temporary clearing activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls shall be provided to avoid erosion and siltation of streams and other water bodies or water conveyances. Turbidity levels in receiving waters or at storm water discharge points shall be monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps shall be installed as soon as practicable after initial access, site, or right-of-way disturbance in accordance with applicable permit or regulatory requirements.

   Mechanized equipment shall not be operated in flowing water except when approved and, then, only to construct necessary stream crossings under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies shall be removed as soon as possible. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained for stream crossings.

9. **Air Quality Control** - The clearing or reclearing contractor shall take appropriate actions to limit the amount of air emissions created by clearing and disposal operations to well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land crops, dwellings, highways, or people.

10. **Dust and Mud Control** - Clearing activities shall be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

11. **Burning** - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification, or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be temporarily stopped by TVA's ROW forester or project environmental person. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

12. **Smoke and Odors** - The contractor will properly store and handle combustible and volatile materials that could create objectionable smoke, odor, or fumes. The contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

13. **Vehicle Exhaust Emissions** - The contractor shall maintain and operate equipment in a manner that limits vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturers' recommended limits and tolerances. Excessive exhaust gases will be eliminated, and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

14. **Vehicle Servicing** - Routine maintenance of personal vehicles will not be performed on the right-of-way. However, if emergency or "have to" situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the right-of-way, except in designated sensitive areas. The clearing or reclearing contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the project environmental person will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

15. **Noise Control** - The contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the site and adjacent property owners. Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

16. **Noise Suppression** - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

17. **Sanitation** - A designated representative of TVA or the clearing contractor shall contact a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal

will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

18. **Refuse Disposal** - The clearing or reclearing contractor shall be responsible for daily cleanup and proper labeling, storage, and disposal of all refuse and debris on the site produced by his operations and employees. Facilities that meet applicable regulations and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used.

19. **Brush and Timber Disposal (Reclearing)** - The reclearing contractor shall place felled tree boles in neat stacks at the edge of the right-of-way, with crossing breaks at least every 100 feet. Property owner requests shall be reviewed with the project manager or right-of-way specialist before accepting them. Lop and drop activities must be specified in the contract and on plan and profile drawings with verification with the right-of-way specialist before conducting such work. When tree trimming and chipping is necessary, disposal of the chips on the easement or other locations on the property must be with the consent of the property owner and the approval of the right-of-way specialist. No trees, branches, or chips shall remain in a surface water body or be placed at a location where washing into a surface water or groundwater source might occur.

20. **Brush and Timber Disposal (Initial Clearing)** - For initial clearing, trees are commonly part of the contractor's contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood, or they may be chipped or stacked and burned. All such activities must be coordinated with the TVA ROW forester, and the open burning permits, notifications, and regulatory requirements must be met. Trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way.

21. **Restoration of Site** - All disturbed areas, except for farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's ROW forester or project environmental person specify a different method:

    a. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

    b. If needed, appropriate soil amendments will be added.

    c. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and

Maintenance Activities (TVA, 2022). Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

d. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

This page intentionally left blank

Appendix L – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Line Construction

Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Line Construction

1. **General** - Tennessee Valley Authority (TVA) and/or the assigned contractor shall plan, coordinate, and conduct operations in a manner that protects the quality of the environment and complies with TVA's environmental expectations discussed in the preconstruction meeting. This specification contains provisions that shall be considered in all TVA and contract construction operations. If the contractor fails to operate within the intent of these requirements, TVA will direct changes to operating procedures. Continued violation will result in a work suspension until correction or remedial action is taken by the contractor. Penalties and contract termination will be used as appropriate. The costs of complying with the Environmental Quality Protection Specifications are incidental to the contract work, and no additional compensation will be allowed. At all structure and conductor pulling sites, protective measures to prevent erosion will be taken immediately upon the end of each step in a construction sequence, and those protective measures will be inspected and maintained throughout the construction and right-of-way rehabilitation period.

2. **Regulations** - TVA and/or the assigned contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances related to environmental protection and prevention, control, and abatement of all forms of pollution.

3. **Use Areas** - TVA and/or the assigned contractor's use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas. The construction contractor shall submit plans and drawings for their location and development to the TVA engineer and project manager for approval. Secondary containment will be provided for fuel and petroleum product storage pursuant to 29CFR1910.106(D)(6)(iii) (OSHA).

4. **Equipment** - All major equipment and proposed methods of operation shall be subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way, access routes, or structure, pole, or tower sites will not be permitted without permission of the environmental technician or ROW forester. Heavy equipment use on steep slopes (greater than 20 percent) and in wet areas will be held to the minimum necessary to construct the transmission line. Steps will be taken to limit ground disturbance caused by heavy equipment usage, and erosion and sediment controls will be instituted on disturbed areas in accordance with state requirements.

   No subsurface ground-disturbing equipment or stump-removal equipment will be used by construction forces except on access roads or at the actual structure, pole, or tower sites, where only footing locations and controlled runoff diversions shall be created that disturb the soil. All other areas of ground cover or in-place stumps and roots shall remain in place. (Note: Tracked vehicles disturb surface layer of the ground due to size and function.) Some disking of the right-of-way may occur for proper seedbed preparation.

Unless ponding previously occurred (i.e., existing low-lying areas), water should not be allowed to pond on the structure sites except around foundation holes; the water must be directed away from the site in as dispersed a manner as possible. At tower or structure sites, some means of upslope interruption of potential overland flow and diversion around the footings should be provided as the first step in construction-site preparation. If leveling is necessary, it must be implemented by means that provide for continuous gentle, controlled, overland flow or percolation. A good grass cover, straw, gravel, or other protection of the surface must be maintained. Steps taken to prevent increases in the moisture content of the in-situ soils will be beneficial both during construction and over the service life of any structure.

5. **Sanitation** - A designated TVA or contractor representative shall contact a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

6. **Refuse Disposal** - Designated TVA and/or contractor personnel shall be responsible for daily inspection, cleanup, and proper labeling, storage, and disposal of all refuse and debris produced by his operations and by his employees. Suitable refuse collecting facilities will be required. Only state-approved disposal areas shall be used. Disposal containers such as dumpsters or roll-off containers shall be obtained from a proper waste disposal contractor. Solid, special, construction/demolition, and hazardous wastes as well as scrap are part of the potential refuse generated and must be properly managed with emphasis on reuse, recycle, or possible give away, as appropriate, before they are handled as waste. Contractors must meet similar provisions on any project contracted by TVA.

7. **Landscape Preservation** - TVA and its contractors shall exercise care to preserve the natural landscape in the entire construction area as well as use areas, in or outside the right-of-way, and on or adjacent to access roads. Construction operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural vegetation and surroundings in the vicinity of the work.

8. **Sensitive Areas Preservation** - Certain areas on site and along the right-of-way may be designated by the specifications or the project environmental person as environmentally sensitive. These areas include but are not limited to areas classified as erodible, geologically sensitive, scenic, historical and archaeological, fish and wildlife refuges, water supply watersheds, and public recreational areas such as parks and monuments. Contractors and TVA construction crews shall take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include suspension of work or change of operations during periods of rain or heavy public use; hours may be restricted, or concentrations of noisy equipment may have to be dispersed. If prehistoric or historic artifacts or features are encountered during clearing or construction operations, the

operations shall immediately cease for at least 100 feet in each direction, and TVA's ROW forester, project environmental person , construction superintendent and Cultural Resources Program shall be notified. The site shall be left as found until a significance determination is made. Work may continue elsewhere beyond the 100-foot perimeter.

9. **Water Quality Control** - TVA and contractor construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing caves, sinkholes, streams, dry watercourses, lakes, ponds, and underground water sources.

   The clearing contractor will erect and (when TVA or contract construction personnel are unable) maintain best management practices (BMPs) such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. Additional BMPs may be required for areas of disturbance created by construction activities. BMPs will be inspected routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections will be conducted in accordance with permit requirements. Records of all inspections will be maintained on site, and copies of inspection forms will be forwarded to the permit preparer.

   Acceptable measures for disposal of waste oil from vehicles and equipment shall be followed. No waste oil shall be disposed of within the right-of-way, on a construction site, or on access roads.

10. **Turbidity and Blocking of Streams** - Construction activities in or near SMZs or other bodies of water shall be controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. All conditions of a general storm water permit, aquatic resource alteration permit, or a site-specific permit shall be met including monitoring of turbidity in receiving streams and/or storm water discharges and implementation of appropriate erosion and sediment control measures.

    Appropriate drainage facilities for temporary construction activities interrupting natural site drainage shall be provided to avoid erosion. Watercourses shall not be blocked or diverted unless required by the specifications or the TVA engineer. Diversions shall be made in accordance with TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). Mechanized equipment shall not be operated in flowing water except when approved and then, only to construct crossings or to perform required construction under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained.

    Wastewater from construction or dewatering operations shall be controlled to prevent excessive erosion or turbidity in a stream, wetland, lake, or pond. Any work or placing of equipment within a flowing or dry watercourse requires the prior approval of TVA.

11. **Clearing** - No construction activities may clear additional site or right-of-way vegetation or disturb remaining retained vegetation, stumps, or regrowth at locations other than the structure sites and conductor setup areas. TVA and the construction contractor(s) must provide appropriate erosion or sediment controls for areas they have disturbed that have previously been restabilized after clearing operations. Control measures shall be implemented as soon as practicable after disturbance in accordance with applicable federal, state, and/or local storm water regulations.

12. **Restoration of Site** - All construction disturbed areas, except for farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

    A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.
    B. If needed, appropriate soil amendments will be added.
    C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.
    D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

13. **Air Quality Control** - Construction crews shall take appropriate actions to minimize the amount of air pollution created by their construction operations. All operations must be conducted in a manner that avoids creating a nuisance and prevents damage to lands, crops, dwellings, or persons.

14. **Burning** - Before conducting any open burning operations, the contractor shall obtain permits or provide notifications as required to state forestry offices and/or local fire departments. Burning operations must comply with the requirements of state and local air pollution control and fire authorities and will only be allowed in approved locations and during appropriate hours and weather conditions. If weather conditions such as wind direction or speed change rapidly, the contractor's burning operations may be temporarily stopped by the TVA ROW forester. The debris for burning shall be piled and shall be kept as clean and as dry as possible, then burned in such a manner as to reduce smoke. No materials other than dry wood shall be open burned. The ash and debris shall be buried away from streams or other water sources and shall be in areas coordinated with the property owner.

15. **Dust and Mud Control** - Construction activities shall be conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used subject to TVA's approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

16. **Vehicle Exhaust Emissions** - TVA and/or the contractors shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles that show excessive emissions of exhaust gasses and particulates due to poor engine adjustments or other inefficient operating conditions shall not be operated until corrective repairs or adjustments are made.

17. **Vehicle Servicing** - Routine maintenance of personal vehicles will not be performed on the right-of-way. However, if emergency or "have to" situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the right-of-way except in designated sensitive areas. The Heavy Equipment Department within TVA or the construction contractor will properly maintain these vehicles with approved spill prevention controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the project environmental person will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

18. **Smoke and Odors** - TVA and/or the contractors shall properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The contractor shall not burn refuse such as trash, rags, tires, plastics, or other debris.

19. **Noise Control** - TVA and/or the contractor shall take measures to avoid the creation of noise levels that are considered nuisances, safety, or health hazards. Critical areas including but not limited to residential areas, parks, public use areas, and some ranching operations will require special considerations. TVA's criteria for determining corrective measures shall be determined by comparing the noise level of the construction operation to the background noise levels. In addition, especially noisy equipment such as helicopters, pile drivers, air hammers, chippers, chain saws, or areas for machine shops, staging, assembly, or blasting may require corrective actions when required by TVA.

20. **Noise Suppression** - All internal combustion engines shall be properly equipped with mufflers as required by the Department of Labor's Safety and Health Regulations for Construction. TVA may require spark arresters in addition to mufflers on some engines. Air compressors and other noisy equipment may require sound-reducing enclosures in some circumstances.

21. **Damages** - The movement of construction crews and equipment shall be conducted in a manner that causes as little intrusion and damage as possible to crops, orchards, woods, wetlands, and other property features and vegetation. The contractor will be responsible for erosion damage caused by his actions and especially for creating conditions that would threaten the stability of the right-of-way or site soil, the structures, or access to either. When property owners prefer the correction of ground cover condition or soil and subsoil problems themselves, the section of the contract dealing with damages will apply.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

This page intentionally left blank

Appendix M – Tennessee Valley Authority Transmission Construction Guidelines Near Streams

Tennessee Valley Authority Transmission Construction Guidelines Near Streams

Even the most carefully designed transmission line project eventually will affect one or more creeks, rivers, or other type of water body. These streams and other water areas are protected by state and federal law, generally support some amount of fishing and recreation, and, occasionally, are homes for important and/or endangered species. These habitats occur in the stream and on strips of land along both sides (the streamside management zone [SMZ]) where disturbance of the water, land, or vegetation could have an adverse effect on the water or stream life. The following guidelines have been prepared to help Tennessee Valley Authority (TVA) Transmission Construction staff and their contractors avoid impacts to streams and stream life as they work in and near SMZs. These guidelines expand on information presented in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (TVA, 2022).

Three Levels of Protection

During the preconstruction review of a proposed transmission line, the TVA Environmental Biological Compliance staff will have studied each possible stream impact site and will have identified it as falling into one of three categories: (A) standard streamside management protection, (B) protection of important permanent streams, springs, and sinkholes, or (C) protection of unique habitats. These category designations are based on the variety of species and habitats that exist in the stream, as well as federal requirements to avoid harming certain species.

As early as possible after field surveys are completed by the TVA Biological Compliance Staff, any streams that have been designated as either Category B or C will be discussed with the environmental project person. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams during design and construction. The category designation for each stream site will then be marked on the transmission line plan and profile sheets. Construction crews are required to protect streams and other identified water habitats using the following pertinent set(s) of guidelines:

(A) Standard Stream Protection

This is the standard (basic) level of protection for streams, springs, sinkholes, and the habitats around them. The purpose of the following guidelines is to minimize the amount and length of disturbance to the water bodies without causing adverse impacts on the construction work.

Guidelines:

1. All construction work around streams, springs, and sinkholes will be done using pertinent best management practices (BMPs) such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, “Structural Controls Standards and Specifications” (TVA, 2022).

2. All equipment crossings of streams and shorelines must comply with appropriate state permitting requirements. Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement as a result of clearing operations by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. Shorelines that must be disturbed must be stabilized as soon as feasible.

(B) Protection of Important Permanent Streams, Springs, and Sinkholes

This category will be used when there is one or more specific reason(s) why a permanent (always-flowing) stream, spring, or sinkhole requires protection beyond that provided by standard BMPs. Reasons for requiring this additional protection include high potential for occupancy by federally listed or significant state-listed species, federally designated critical habitat, or areas designated as special use classification (e.g., trout waters). The purpose of the following guidelines is to minimize the disturbance of the banks and water in the flowing stream(s) where this level of protection is required.

Guidelines:

1. Except as modified by Guidelines 2-4 below, all construction work around streams will be done using pertinent BMPs, such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, “Structural Controls Standards and Specifications” (TVA, 2022).

2. All equipment crossings of streams must comply with appropriate state (and, at times, federal) permitting requirements. Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Category B designations will be discussed with the TVA Environmental Transmission staff as early as possible in the process, to allow time to discuss possible avoidance or minimization of impacts with design and construction.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-

specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams must be limited to those required to meet National Electrical Safety Code and danger tree requirements. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. Shorelines that must be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

(C) Protection of Unique Habitats

This category will be used when, for one or more specific reasons, a temporary or permanent aquatic habitat requires special protection. This relatively uncommon level of protection will be appropriate and required when a unique habitat requiring special protection is present (for example, the spawning area of a rare species), the stream is known to be occupied by a federally listed or significant state-listed species, or when required as a special condition resulting from consultation with the United States Fish and Wildlife Service to avoid project effects on a listed species or designated critical habitat. The purpose of the following guidelines is to avoid or minimize any disturbance of the unique aquatic habitat.

Guidelines:

1. Except as modified by Guidelines 2-4 below, all construction work around the unique habitat will be done using pertinent BMPs, such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, “Structural Controls Standards and Specifications” (TVA, 2022).

2. Category C designations would be discussed with the project environmental person as early as possible following field surveys to allow time to discuss possible avoidance or minimization of impacts with design and construction. Environmental Energy Delivery staff would discuss construction activities to take place in the SMZ with the Environmental Biological Compliance staff. On-site planning sessions would be conducted as needed. All crossings of streams also must comply with appropriate state (and, at times, federal) permitting requirements.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams should be limited to those required to meet National Electrical Safety Code, Federal Energy Regulatory Commission standards, and danger tree requirements. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near the unique habitat must be disturbed as little as possible during construction. Soil disturbance by plowing, disking, blading, or grading must be kept at a minimum. Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

5. Special SMZ requirements will be coordinated with Environmental Biological Compliance staff.

Maintenance

During ongoing operations, SMZs will be inspected frequently, and during inactive periods, occasionally. Damaging or failing situations that may cause unacceptable water quality impacts will be corrected as soon as practical.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

Comparison of Guidelines Under the Three Stream and Water Body Protection Categories [1] (page 1)

Guidelines	A: Standard Stream Protection	B: Protection of Important Permanent Streams, Springs, and Sinkholes	C: Protection of Unique Habitats
1.Reference	• All TVA construction work around streams, springs, and sinkholes will be done using pertinent Best Management Practices (BMPs) such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, "Structural Controls Standards and Specifications."	• Except as modified by Guidelines 2-4, all construction work around streams will be done using pertinent BMPs such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, "Structural Controls Standards and Specifications."	• Except as modified by Guidelines 2-4, all construction work around the unique habitat will be done using pertinent BMPs such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities,* especially Chapter 5, "Structural Controls Standards and Specifications."
2. Equipment Crossings	• All equipment crossings of streams and shorelines must comply with appropriate state permitting requirements. • Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.	• All equipment crossings of streams also must comply with appropriate state (and, at times federal) permitting requirements. • Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • All construction activity would be discussed with the TVA Environmental Transmission staff as early as possible in the process to allow time to discuss possible avoidance or minimization of impacts with design and construction.	• All crossings of streams also must comply with appropriate state (and, at times federal) permitting requirements. • All construction activity would be discussed with the TVA Environmental Transmission staff as early as possible following field surveys to allow time to discuss possible avoidance or minimization of impacts with design and construction. • On-site planning sessions would be conducted as needed.

[1] Source: *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (TVA, 2022)

Comparison of Guidelines Under the Three Stream and Water Body Protection Categories [1] (page 2)

Guidelines	A: Standard Stream Protection	B: Protection of Important Permanent Streams, Springs, and Sinkholes	C: Protection of Unique Habitats
3. Cutting Trees	• Cutting of trees within streamside management zones (SMZs) must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Stumps can be cut close to ground level, but must not be removed or uprooted.	• Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Cutting of trees near permanent streams must be limited to those meeting National Electrical Safety Code (NESC) and danger tree requirements. • Stumps can be cut close to ground level, but must not be removed or uprooted.	• Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Cutting of trees near permanent streams must be limited to those meeting NESC, Federal Energy Regulatory Commission standards, and danger tree requirements. • Stumps can be cut close to ground level, but must not be removed or uprooted.
4. Other Vegetation	• Other vegetation near streams must be disturbed as little as possible during construction. • Soil displacement because of clearing operations by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. • Shorelines that have to be disturbed must be stabilized as soon as feasible.	• Other vegetation near streams must be disturbed as little as possible during construction. • Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. • Shorelines that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.	• Other vegetation near the unique habitat must be disturbed as little as possible during construction. • The soil disturbance by plowing, disking, blading, or grading must be kept at a minimum. • Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible. Special SMZ requirements will be coordinated with Environmental Biological Compliance staff.

[1] Source: *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (TVA, 2022)

This page intentionally left blank

Appendix N – A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities

A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities

Revision 4 – 2022

Prepared for
Tennessee Valley Authority

1101 Market Street
Chattanooga, TN 37402
(865) 632-2101
tvainfo@tva.com

Recommended citation:

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN.: Retrieved from <https://www.tva.com/Energy/Transmission- System/Transmission-System-Projects> (Insert date accessed).

Revision 4: Edited by Sam Benefield, Rick Brannon, Zachary Buecker, Chris Buttram, Bryson Dalton, George Dalton, Casey Henley, Will Martin, Anita Masters, Craig Phillips, Chad Suttles, Robby Wilson
Chattanooga, Tennessee 2022

Changes in 2022 BMP Manual

Page on Revised Version	**Description**	**Section**
ALL	Changed: Reference for Material Safety Data Sheets (MSDS) to Safety Data Sheets (SDS).	ALL
5	Edited: Chapter 2 for clarity.	Chapter 2
7	Added: Examples of a plan. CEC, SWPPP, CBMPP.	3-A
7	Edited: SMZ section. Info added on vegetation removal within an SMZ.	3-B
8	Edited: Water Quality Control section. Added straw wattles as a sediment control option.	3-B
9	Edited: Brush and Timber Disposal section. Added wood chips as an option for sediment barriers along the edge of the ROW.	3-B
11	Added: New section for spoil material to align with TVA SPP 05.053 on Soil Placement and Disposal.	3-E
14	Added: Requirement that portable sanitary units should be 100 feet away from watercourses.	3-G
14	Added: Inspection frequency and rainfall driven inspections are determined by each state.	3-H
17	Edited: Section 4-A Streamside Management Zone for clarity.	4-A
24	Edited: Section 4-B to change reference to Nationwide Permit 57 instead of 12 due to a change from the USACE.	4-B
65	Added: Requirement for an ARAP permit on permanent stream crossings in Design Criteria section.	5-L
81	Changed: Section name to Soil Sampling from Seeding and Stabilization Techniques to better reflect content.	6-A

Table of Contents

Tables

Figures

Chapter 1 - Introduction

This Guide for Environmental Protection and Best Management Practices (BMPs) has been prepared and revised to serve as a practical resource document for Tennessee Valley Authority (TVA) personnel and contractors when planning and conducting construction and maintenance activities (TVA 2022; TVA 2017; Muncy 2012; Muncy 1999; Muncy 1992). Projects covered under a state National Pollutant Discharge Elimination System (NPDES) construction stormwater general permit or Municipal Separate Sewer System (MS4) permit would adhere to any state or MS4-specific BMP manual in lieu of this manual, as required by the permit. This Guide can and will be used by TVA personnel and contractors in conjunction with other TVA guidelines and specifications (i.e., TVA 2016).

Where disturbance does not meet or exceed the state and/or local permitted threshold, standard routine BMPs, as provided in this Guide, should still be used to minimize impacts from erosion and sedimentation. The environmental review package or CEC/EA/EIS for the project would contain non-routine BMPs that should be used, if required. Notification to the project environmental representative should be completed before the amount of disturbance from a small project meets or exceeds the threshold of state and/or local permitting requirements.

BMPs are practices chosen to minimize erosion and prevent or control sedimentation and other pollutants from land disturbance and land management activities. If properly applied, BMPs would help protect the quality of surface waters and groundwater. BMPs are economical and effective methods for ensuring that TVA's construction and maintenance forces and contractors contribute to a high standard of water quality throughout the Tennessee River Watershed and the TVA Power Service Area (PSA).

The recommended BMPs outlined herein are based on current knowledge and the best judgement of experts. Other BMPs not listed, or modifications of these practices may be used if allowed by state and/or local regulations and when known to be effective through personal knowledge and experience.

Designed BMPs that appear in site-specific stormwater plans will take precedence over information contained in this manual.

Chapter 2 - Sediment and Erosion Control Processes and Principles

Sediment transport can contribute both nutrients and contaminants trapped on the soil particles when flushed into water bodies. Suspended sediment in surface waters reduces their beneficial uses, increases water treatment costs, and harms the growth of aquatic life. Sediment deposition can block navigation channels, springs and groundwater infiltration zones, reduce water storage capacities of surface waters and wetlands, increase flooding, and adversely impact sensitive plants and animals.

Because sediment is the major potential pollutant, and because sediment is a product of soil erosion, the major emphasis of this BMP manual will be on those practices designed to reduce or prevent erosion. Practices that keep the soil in place also aid in reducing the risk of other pollutants reaching surface waters, wetlands, and groundwater.

Factors Influencing Erosion:

Climate - The frequency, intensity and duration of rainfall and temperature extremes are principal factors influencing the volume of runoff from a given area. As the volume and intensity of rainfall increase, the ability of water to detach and transport soil particles increases. When storms are frequent, intense, and of long duration, the potential for erosion of bare soils is high.

Topography - The size, shape and slope characteristics of a watershed influence the amount and duration of runoff. The greater the slope, length, and gradient are, the greater the potential for both runoff and erosion will be.

Soils - The soil type will determine its vulnerability to erosion. Properties determining the erodibility of a soil are texture, structure, organic matter content and permeability. Soil containing high percentages of fine sands and silt are normally the most erodible. Clays act as a binder to soil particles, and therefore reduce erodibility. Although clays tend to resist erosion, they are easily transported by water once eroded. Well-graded and well-drained gravels are usually the least erodible soils. The high infiltration rates and permeability either prevent or delay runoff.

Vegetative Cover - Vegetative cover is an extremely important factor in reducing erosion from a site.

It will:

- Absorb energy of rain drops.
- Slow velocity of runoff.
- Increase the ability of a soil to absorb water

By limiting the amount of vegetation disturbed and the exposure of soils to erosive elements, soil erosion can be greatly reduced. In areas of a project where ground disturbance cannot be avoided, temporary cover should be installed as soon as possible to reduce the possibility of erosion.

Chapter 3 - Best Management Practices for Construction and MaintenanceActivities

BMPs are practices chosen to minimize erosion and prevent or control water pollution resulting from land disturbance and land management activities. BMPs that are properly applied will protect the quality of our waters. The best stormwater management strategy is to use BMPs thatare the most appropriate for the type of runoff we are treating or controlling.

The basic principles of erosion and sediment control which must be considered when selecting appropriate BMPs are:

1. Plan clearing, grading, and construction to minimize the area and duration of soil exposure.
2. Maintain existing vegetation wherever and whenever possible.
3. Minimize disturbance of natural contours and drains.
4. As much as practicable, operate on dry soils when they are least susceptible to structural damage and erosion.
5. Limit vehicular and equipment traffic in disturbed areas.
6. Keep equipment paths dispersed or designate single traffic flow paths with appropriate road BMPs to manage runoff.
7. Divert runoff away from disturbed areas.
8. Provide for dispersal of surface flow that carries sediment into undisturbed surface that have high infiltration capacity and ground cover conditions.
9. Prepare drainage ways and outlets to handle concentrated or increased runoff.
10. Minimize length and steepness of slopes and interrupt long slopes frequently.
11. Keep runoff velocities low and/or check flows.
12. Trap sediment on-site.
13. Inspect and maintain control measures on a regular basis and after significant rain events.
14. Revegetate and mulch disturbed areas as soon as practical after each disturbance.

Some measures or controls can be used independently, while others must be used jointly. Erosion and sediment controls are not limited to the following practices. However, alternative measures must be at least as effective in controlling erosion and sedimentation.

3 - A. Preconstruction Planning

Prior to any ground disturbing activity, a plan (Ex: CEC, SWPPP, CBMPP) should be developed that addresses any erosion, sediment, or stormwater control issues. The issues should be clearly conveyed to all parties involved in the ground disturbing activity during a preconstruction meeting before project work begins. Preconstruction planning includes the collection and use of information about the project site(s), borrow areas, laydown areas, and access roads.

An effective plan will

1. Consider any site clearing, construction, and maintenance activities that could causeerosion or degrade water quality.
2. Identify the specific BMPs needed to minimize any adverse effects and show theproposed location for implementation.
3. Address regulatory requirements of each state and any applicable federal agency.
4. Clearly outline responsibility for overseeing BMP plan implementation and designate that responsibility to individuals on each project site.

Individuals responsible for overseeing BMP plan implementation have the authority to make decisions based on field conditions for BMP locations. A copy of the plan should be kept on-siteand be made available upon request. Field changes to the plan should be communicated and approved by the plan preparer to ensure all necessary revisions are made.

3 - B. Clearing Practices

General - Clearing operations should be conducted in a manner that will prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones should be observed, and the methods of clearing or reclearing should be modified to protect the buffer and sensitive area. The condition of cleared soils should be preserved to the maximum extent practical by avoiding compacting and deep scarring. As soon as possible after initial disturbance of the soil, temporary cover material should be placed to prevent erosion of soiland sedimentation of water bodies or conveyances to surface waters. Vegetation will be protected from damage in areas beyond the boundary of any clearing work or access roads.

Streamside Management Zone(s) (SMZs) - Refer to Section 4-A Streamside Management Zone for clearing specifications. Equipment should cross streams, ditches, and wet areas only at designated locations after appropriate BMPs have been installed. Steps should also be taken to protect ephemeral streams (sometimes referred to as wet weather conveyances or WWC) even when they are not identified as such on project or topographic maps. Removal of vegetation within an SMZ is limited to only tall-growing incompatible species. Low growing vegetation should be preserved within the SMZ. To minimize ground disturbance, stumps should be left in place and all debris from vegetation removal should be removed from the SMZ.

Wetlands - See Section 4-C In-Wetland Clearing, Construction, and Restoration Techniques for clearing specifications.

Historic Area Preservation - If prehistoric or historic artifacts or features that might be of archaeological significance are discovered during ground disturbing operations, the activity should immediately cease within a 100-foot radius, and the responsible environmental support person should be notified. The site should be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Biological and Cultural Compliance specialists. Work may continue beyond the perimeter of the 100-foot radius encircling the finding zone.

Water Quality Control - Erosion and sediment control measures such as straw wattles, silt fences, water bars, and sediment traps should be installed as soon as practicable after initial ROW disturbance in accordance with applicable permit or regulatory requirements. BMP inspections will be conducted and documented in accordance with permit requirements. If temporary clearing activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls should be provided to avoid erosion and siltation in streams and other waterbodies or water conveyances. Turbidity levels in receiving waters or at stormwater discharge points should be monitored, documented, and reported if required by the applicable permit. Mechanized equipment should not be operated in flowing water except when expressly approved by TVA beforehand, and then, only to construct necessary stream crossings under direct guidance of TVA. Construction of stream fords or other crossings will be permitted only at approved locations and to current TVA construction access road standards. Material should not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies should be removed as soon as possible. TVA will secure appropriate U.S. Army Corps of Engineers (USACE) and state or local permits for stream crossings.

Air Quality Control – Burning of clearing debris is allowed if local burning permit and forestry or local fire department requirements are met. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land, crops, dwellings, roads, or people. If weather conditions such as wind speed or wind direction change rapidly, the burning operation should cease until weather conditions improve. Residue from burning will be disposed of according to permit stipulations. Oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris should not be burned anywhere on the job site.

Dust Control - Clearing activities should be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, or similar measures may be used subject to approval. On new construction sites and easements, refer to Section 5-N ConstructionEntrance/Exit for specifications.

Brush and Timber Disposal - Trees may be cut and left in place in specified areas with approval from the appropriate regulatory agency. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or very rugged terrain where windrowed trees, or wood chips are used as sediment barriers along the edge of the ROW.

3 - C. Construction Site Measures

Where possible, large construction projects should be staged or phased to minimize exposure time of cleared soils. Stabilization should be accomplished by temporary or permanent protection of the disturbed soil surface from rainfall impacts and runoff.

Grading activities should be avoided to the maximum extent practical during months of highly erosive rainfall.

Initial erosion and sediment control measures must be in place and functional before earth moving operations begin. All control measures must be properly constructed, maintained, and inspected throughout the construction and stabilization period.

Construction debris must be kept from entering surface waters, wetlands, drainage ditches, ephemeral streams, and other types of access points to existing water bodies or groundwater.

Stockpiled soil should be located far enough from streams, wetlands, and drainage ways so that runoff cannot carry sediment downstream or into adjacent wetlands.

3 - D. Good Housekeeping

BMPs minimize the movement of most pollutants other than sediments. Those pollutants that are mixed in solution, or are carried on fine grained sediments, may pass through all BMPs and eventually reach downstream water bodies. The only practical control option available to prevent the pollutants from reaching runoff or flood waters is by proper application techniques and good housekeeping practices.

Used oil, grease, and rags must be disposed of in proper receptacles and kept out of contact with rainfall or runoff water.

Dumping or burying waste materials at the construction site is prohibited.

Liquid and solid waste must be collected in containers and regularly transported from the construction site to applicable storage or disposal facility.

Equipment repairs and washing must be undertaken at designated locations. Routine maintenance of personnel vehicles will not be performed on the ROW. However, if emergency situations arise, minimal/temporary maintenance to personnel vehicles is acceptable to mobilize the vehicle to an off-site maintenance shop. Heavy equipment may be serviced on the ROW except in designated sensitive areas. In this situation, proper ground cloths, matting, or plastic sheeting must be used to prevent releases of oil, fuel, or grease into the environment.

Construction personnel will properly maintain these vehicles with approved spill protection controls and countermeasures (SPCC) plan. If emergency maintenance in a sensitive or questionable area arises, environmental personnel will be consulted. Used oil and waste will be recycled or disposed of properly. Equipment should not be temporarily stored in stream floodplains overnight, on weekends, or on holidays.

All on-site vehicles must be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage.

Any petroleum products, paints, or chemicals present at the site must be stored in tightly sealed containers that are clearly labeled and are properly stored when not in use.

Mobile and/or portable oil or fuel storage tanks should be positioned or located to prevent spilled oil from reaching watercourses. Containment should be provided for oil or fuel storage tanks according to the project’s SPCC plan. The tank(s) should be located where it will not be subjected to periodic flooding or washout.

Spill response equipment and sufficient absorbent material to contain and clean up fuel or chemical spills or leaks must be maintained on-site or be readily available. Spills of paint, chemicals, oil, etc., must be immediately cleaned up, and contaminated soil and absorbent materials must be promptly removed and placed into appropriate waste containers. A spill notification form should also be filled out and sent to the environmental support person for theproject. The wastes must then be properly characterized to determine the required method ofdisposal.

3 - E. Waste Disposal

Solid waste - All trash and construction debris from the site will be hauled to an approved landfill. No construction waste material will be buried or burned on-site. Clearing debris (brush and timber) may be burned on-site in accordance with local fire regulations. Employee waste andother loose materials will be collected and properly disposed of to prevent the release of floatables during runoff or flood events. Liquid wastes will be properly collected in a Department of Transportation (DOT) approved container on-site. A responsible environmental person will be designated to characterize the waste and coordinate and manage the disposal with the appropriate permitted facilities according to applicable regulations, as necessary.

Hazardous Waste - In general, hazardous wastes are not expected to be generated or encountered in these projects. However, the hazardous materials used do present the potentialfor hazardous waste generation (e.g., painting/stripping, chemical spills, fuel spills). If hazardous waste is generated, the responsible environmental person for the project should be notified immediately. All wastes will be properly collected, managed, and disposed of according to the U.S. Environmental Protection Agency (EPA), state, and/or local regulations.

Sanitary Waste - Portable sanitary units will be provided for use by all workers throughout the life of construction projects. They should not be located closer than 100 feet to any watercourse,waterbody, or wetland. The facilities should be required to have proper servicing and maintenance, and the waste disposal contractor should verify in writing that the waste disposal will be in state-approved facilities. If a unit is tipped over and sanitary waste is spilled, the responsible environmental person for the project should be notified. Containment may be required depending on local regulations.

Spoil Material – Any spoil accumulated from grading, trenching, foundation work, or line structures / poles would be spread back onsite and area re-graveled/re-surfaced. Offsite spoil areas are subject to environmental review and compliance requirements. If any spoil is taken offsite, it would be tested, handled, and disposed of per TVA SPP 05.053 (Soil Placement and Disposal).

Concrete Waste - Concrete that is delivered to the site but remains unused should be transported offsite by the concrete vendor. Concrete trucks should use a designated concrete washout area to clean their mixer chute if necessary. It is not permissible to discharge concretewash directly onto the ground including areas within 50 feet of streams, storm drains, or areas with potential for runoff directly into streams and/or storm drains.

3 - F. Herbicide Use

Herbicides are sometimes used on stumps and low growing brush during construction, maintenance, and other types of TVA projects. Herbicides are routinely used during ROW maintenance along with mechanical mowing and hand clearing as an integrated form of vegetation management. Herbicides used by TVA can be liquid, granular, pellets, or powder; canbe applied aerially or by ground equipment; and may be selectively applied or broadcast depending on the site requirements, species present, and condition of the vegetation.

Regardless of the project in which TVA uses herbicides, "applicators" must be trained, licensed,and follow manufacturers' label instructions, EPA guidelines, and respective state regulations and laws, including NPDES pesticide general permit requirements for any discharge to surface waters. Water quality considerations include measures taken to keep herbicides that are not approved for aquatic use from reaching streams whether by direct application or through runoff of or flooding of surface water.

When herbicides are used, their potential adverse impacts must be considered in selecting thecompound, formulation, and application method. Conditions that contribute to the offsite migration of herbicide should be avoided. For example, herbicide that is hand-applied in pelletized form can be very mobile and adversely impact non-target areas. A list of herbicides commonly used on TVA ROWs can be found on TVA’s Transmission website in a document titled “ROW Vegetation Management Guidelines.”

Herbicides that are designated "Restricted Use" by the EPA require application by or under the supervision of applicators certified by the respective state control board. They also require detailed records of application developed on a timely basis.

Knowledge of the chemical being used and adherence to the manufacturer's specifications and directions are essential to the protection of water quality. The label contains information regarding applicator safety, species for which the chemical is registered, the application rate or concentration, appropriate weather conditions during application, environmental impacts, and proper container disposal. Safety Data Sheets (SDSs), available from the chemical manufacturer, provide toxicological data.

Transportation regulations for herbicides must be followed. Accidents that result in spillage must be promptly reported to proper authorities and immediately cleaned up.

Disposal of herbicide containers must be in accordance with directions given on the label.

Herbicide containers or applicator equipment must never be cleaned in or near streams, water bodies, or groundwater infiltration zones.

Mixing of herbicides must be done with care to avoid spillage and to ensure that excessive amounts of chemicals are not being applied.

Application equipment will be properly maintained and adjusted to prevent spillage and excessive application of vegetation control materials. Frequent inspection and calibration of equipment are recommended.

Guidelines for aerial application and ground application of liquid, granular, pellet, or powder formulations

For all applications (by contractors or TVA forces), the sites to be treated should be selected and the application directed by the appropriate TVA official (e.g., contract administrator, Transmission Service Center manager, ROW forester, or line foreman).

A preflight walking or flying inspection must be made within 72 hours prior to applying herbicide aerially. This inspection should ensure that no land use changes have occurred, sensitive areas are clearly pointed out to the pilot, and proper buffer zones are maintained.

Aerial application of liquid herbicides normally will not occur when surface wind speeds exceed five miles per hour, in areas of fog, or during periods of temperature inversion or when other conditions exist that the label restricts.

Pellet application normally will not occur when surface wind speeds exceed ten miles per hour or on frozen or water-saturated soils.

Liquid application will cease when the temperature reaches 95 degrees (F) or above. Applicationduring unstable, unpredictable, or changing weather patterns will be avoided. Equipment and techniques will be used that are designed to ensure maximum control of the spray swath with minimum drift.

Under no circumstances will herbicides or herbicide-related fertilizers be applied to the surface ofwater bodies, wetlands, or groundwater infiltration zones unless specifically labeled for aquatic use. Filter and buffer strips must conform at least to federal and state regulations and any label requirements. The use of aerial or broadcast application of herbicides is not allowed in any SMZ adjacent to perennial streams, ponds, or other water sources. Hand application of certain herbicides may be labeled for use within SMZs; however, they should be used only selectively.

For additional information on SMZs, see Section 4-A Streamside Management Zone of this guide.

Buffers and filter strips (200 feet minimum width) are required next to agricultural crops, gardens,farm animals, orchards, apiaries, horticultural crops, and other valuable vegetation.

During all ground applications, the applicator should periodically calibrate the application equipment to ensure that the herbicide is being applied at the proper rate.

Herbicides used for stump treatments and tree growth regulators must be applied according tothe specimen label.

Herbicides are not to be applied to the following locations:

- Around trees that would fall and hit a conductor or support structure.
- In fence rows and other areas where livestock might eat wilted cherry leaves.
- In city, state, and national parks or forests or other special areas without written permission and/or required permits from the proper governmental officials.
- Areas adjacent to and off the ROW.
- During rainy periods or during the 48-hour interval prior to rainfall predicted with a 20 percent or greater probability by local forecasters (this applies when soil-active herbicides are used); or,
- In areas where soil erosion might occur, or soil might be mechanically relocated (this applies when soil-active herbicides are used).

Accurate and up-to-date records are to be maintained concerning the plan for, and the application of, all herbicides. The locations, herbicide applied, amount of herbicide applied, application method, and size of the area treated are to be recorded on the appropriate form.

3 - G. Stormwater Discharge Management

All potential sources of pollution which could affect the quality of stormwater discharges must be identified, and the appropriate control measures must be implemented to ensure that the following conditions are met both during and after construction activities.

1. There should be no distinctly visible floating scum, oil, or other matter contained in the stormwater discharge.

2. The stormwater discharge must not cause an objectionable color contrast in the receiving stream.

3. The stormwater discharge must not result in materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, terrestrial life, plant life, and/or aquatic lifein the receiving stream.

4. Portable sanitary units should be more than 100 feet away from any watercourse to prevent potential discharge issues.

3 - H. Inspection, Recordkeeping, and Reporting

Regular maintenance is vital to the success of an erosion and sediment control system. All control measures should be checked and repaired, as necessary. Discharge monitoring and stream sampling may be required to verify minimal site sediment contribution to water bodies.

Inspections for permitted sites shall be performed as directed by the state permit guidelines. Inspectors performing the state inspection shall be certified as an inspector for that state.

Inspections should be conducted (at the frequency determined by the state) during dry periods and following rainfall events (in states that require rainfall inspections, AL, GA, and NC). During prolonged rainfall, daily checking and repairing may be necessary. Discharge monitoring and stream sampling may be required to verify minimal site sediment contribution to water bodies.

Records must be kept on all inspections and repairs to erosion and sediment control measures.These records are to be maintained on-site or at a nearby office.

Inspection records and information resulting from water quality monitoring activities required bystate and/or local regulations must be retained per the Environmental Management System (EMS) records management process.

3 - I. Field Change Documentation Guidance

Minor Changes

For this document, a minor change is defined as the addition of 100 feet or less of any perimeter control BMP (e.g., silt fence, wattle, etc.) or the maintenance and repair of existing BMPs.

For minor Stormwater Pollution Prevention Plan (SWPPP) changes:

- No notification to SWPPP preparer is required
- BMP drawings in SWPPP shall be redlined to reflect change

Major Changes

All other addition, subtraction, or changing of BMPs as shown in the project SWPPP and/or changes made by TVA to the project (e.g., new access roads, design change, etc.) shall be coordinated with and approved by the SWPPP preparer and environmental technician. Any approved changes shall be documented on the revision log located in the SWPPP for the project. Additionally, the BMP drawings that are onsite should reflect the actual field conditions. These drawings should be red lined with changes by field personnel, or a revised set may be provided by the SWPPP preparer.

To determine a need for additional BMPs or to discuss project changes, an onsite meeting should occur between the environmental technician and ROW forester. The location and scope of the additional work will be determined from this meeting.

For major SWPPP changes:

- The proposed changes shall be sent (email, phone call, or text) to the SWPPP preparer for review and approval or denial.
- The SWPPP preparer will analyze proposed changes and determine if changes are compliant with environmental regulations. Once a determination is made, the SWPPP preparer will notify the environmental technician and ROW forester if the change is approved or denied.
- The SWPPP preparer will determine if any additional review isnecessary by environmental resource specialists (subject matter experts).
- If changes are approved, the SWPPP preparer will make the necessary revision to the SWPPP which may include updating TVA construction project information (e.g., access road maps). The SWPPP preparer in coordination with the environmental technician will ensure all approved changes are documented in the SWPPP. This may include red-lining BMP drawings and updating SWPPP revision log.
- If the changes are approved, the ROW forester will coordinate the completion of the work with the resources that are available.

Chapter 4 - Sensitive Resources and Buffer Zones

4 - A. Streamside Management Zone

Definition
An area or zone, covered with vegetation on both sides of perennial and intermittent streams andalong the margins of bodies of open water, where extra precaution is used in carrying out construction activities to protect stream banks, instream aquatic habitat, and water quality. The zone also functions as a buffer when herbicides, fertilizers, etc., are applied to adjacent lands.

Purpose
To slow down and spread out the surface water flow.

To trap and filter out suspended sediment before these particulates reach the stream channel.

To protect stream bank and floodplain integrity.

To protect stream water temperature for aquatic ecosystems. To improve impacts from biologicalpollution agents.

To protect instream habitat utilized by aquatic species from changes and impacts resulting fromsediment and siltation.

Conditions Where Practice Applies
Along watercourses (perennial and intermittent streams) and the edges of permanent bodies ofwater where disturbances occur and where surface runoff, flooding, or back flows may carry sediment loads to the watercourse.

Specifications
Establish an SMZ along each intermittent and perennial stream and permanent waterbody.

The width of the SMZs may vary (increase or decrease in width) depending on type of watercourse, primary use of the water resource, topography, or existing features or land use (i.e.,existing roads or agricultural fields) (See Table 1).

Table 1: Recommended Minimum Width of Streamside Management Zone.

SMZ Category	% Slope of Adjacent Lands				
	1-10	11-20	21-30	31-40	41+
	SMZ Width each side (feet)				
A - Standard	50	70	90	110	130
B - Important	70	90	110	130	150
C - Unique	90	110	130	150	170

SMZ width is measured along the slope in linear feet on each side from the edge of the water body to the toe of road or other surface disturbance.

The SMZ width increases 20 feet for each 10 percent increase in slope. However, state and local requirements should be consulted and implemented when they are more restrictive than these TVA guidelines.

Regardless of the width, the SMZ must provide effective sediment protection for the watercourse.

Limited construction and maintenance activities are allowed within most SMZs. Where activitiesare allowed, additional and more effective BMPs may be required to fully protect the stream channel or other water body and water quality. Extra care is recommended within SMZs near public water supplies (streams and reservoirs), springs, and sinkholes to reduce the risk of sudden and severe contamination due to failure of BMPs with unusual storms.

Projects with coverage under state stormwater NPDES general permits or coverage under Municipal Separate Storm Sewer System (MS4) permits may also have buffer requirements.These buffer requirements could also be more restrictive.

Unnecessary canopy removal along streams is discouraged during clearing. Fell trees away from the watercourse. Remove trees and tops with extreme care. Leave as many rooted groundcover plants as possible in the buffer zone such that it is essentially undisturbed. Construction or maintenance activities will result in no more than 20 percent bare disturbed ground, evenly distributed, within SMZ areas along perennial streams and no more than 40 percent bare disturbed ground, evenly distributed, along intermittent streams. On those areas where bare disturbed ground exceeds the 20 or 40 percent limit, a groundcover must be established. Seeding or planting native materials that stabilize the soil surface and benefit wildlife should be considered. See Section 6-A Seeding/Stabilization Techniques for details on vegetation specifications.

The Energy Policy Act of 2005 granted Federal Energy Regulatory Commission (FERC) the authority to oversee mandatory reliability standards for the nation’s bulk power system. TVA is required to comply with these regulations.

FERC sets vegetation management standards for large interstate transmission facilities. Clearance between power lines and trees along the entire ROW must ensure reliable operation of the bulk power system and includes accounting for future tree growth, movement of trees or conductor due to wind, and sag. Trees with the potential to interfere with the TVA transmission line clearances and violate FERC standards should be removed. The stumps within the ROW may be treated to prevent re-sprouting. Cutting of trees within SMZs would follow Guidelines A (3), B (3), or C (3) as listed below, and the stumps would be left in place. Tall growing species include maple, oak, walnut, spruce, pine, etc. Lower growing trees identified by TVA as having marginal electrical clearance may be cut then stump treated with growth regulators to allow low, slow growing canopy development and active root growth. Smaller trees with mature tree heightsof approximately ten feet may be left in place to provide canopy to the stream.

All construction debris resulting from clearing and re-clearing ROW maintenance operations, construction or removal of transmission line structures, or any other TVA projects must be keptout of intermittent and perennial stream channels, wetlands, or groundwater infiltration zones. Should debris reach these areas, it should be promptly removed.

Broadcast application of herbicides and fertilizers or spraying of herbicides (except those labeledfor aquatic use) will be conducted so that chemicals are not applied directly into intermittent and perennial streams and perennial waterbodies or allowed to drift into such watercourses.

Broadcast application of chemicals should not be applied to the land surface closely adjacent towater surfaces or channels or to the surface of ephemeral streams or drainage channels within SMZs where direct wash off into the stream or waterbody could occur. Hand application of certain herbicides may be labeled for use within SMZs; however, they should be used only selectively. Refer to Section 3-F Herbicide Use for more information.

Operations involving chemical or fuel storage or resupply and vehicle servicing will be handled outside of SMZs and in such a manner as to prevent these items from reaching the watercourse.Earthen berms or other effective means must be installed to protect the stream channel from chemical/fuel storage. Servicing will be done with care to avoid leakage, spillage, and subsequentstream, wetland, or groundwater contamination. Oil waste, filters, and other litter will be collectedand disposed of properly. Refer to Section 3-D Good Housekeeping for further discussion.

Locate roads outside of SMZs except where stream crossings are necessary and where physicalrestrictions cause roads to be within the SMZ. Where restrictions exist (existing roads, trails, ROW boundary, property boundary, agricultural crops, existing land use, topography, etc.) insidean SMZ that would potentially reduce the width of the SMZ, alternate techniques or measures must be employed to effectively protect the stream channel.

Establish right-angle crossings to stream channels. Avoid the use of fill material placed overconstruction debris as a stream crossing.

Promptly revegetate or provide adequate ground cover for bare soil areas within an SMZ (roads,ditches, crossings, cut and fill banks). See Section 6-A Seeding and Stabilization Techniques fordetails on vegetation specifications. SMZ planning can include the development and enhancement of wildlife habitat.

During the environmental review of transmission line, substation, or telecommunication projects,TVA Environmental Biological Compliance staff will have studied each possible stream impact and identified it as falling into one of three categories: (A) standard SMZ protection; (B) protection of important permanent streams, springs, and sinkholes; or (C) protection of unique habitats that exist in the stream. These category designations are based on the variety of species and habitats that exist in the stream as well as federal requirements to avoid harming certain species.

Standard SMZ Protection (Category A)

This is the standard (basic) level of protection for streams, springs, sinkholes, and the habitats around them. The purpose of the following guidelines is to minimize the amount and length of disturbance to the water bodies without causing adverse impacts to the construction activity.

Guidelines**:**

1. All construction work around streams, springs and sinkholes will be done using pertinent BMPs such as those described in Chapter 5, "Structural Controls Standards and Specifications."

2. All equipment crossings of streams and shorelines must comply with appropriate state permitting requirements. Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selectedbased on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Stumps can be cut close to ground level but must not be removed or uprooted.

Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement because of clearing operations by the actions of plowing, disking, blading, othertillage, or grading equipment will be minimized in SMZs. Shorelines that are disturbed must be stabilized as soon as feasible.

Protection of Important Permanent Streams, Springs, and Sinkholes (Category B)

This category will be used when there is one or more specific reason(s) why a permanent (always-flowing) stream, spring, or sinkhole requires protection beyond that provided by standardBMPs. Reasons for requiring this additional protection include high potential for occupancy by federal-listed or significant state-listed species, the presence of suitable habitat for federal-listed or significant state-listed species, federally designated critical habitat, or areas designated as a special use classification (e.g., trout waters). The purpose of the following guidelines is to minimize the disturbance of the banks and water in the flowing stream(s) where this level of protection is required.

Designation of this category should be discussed with the TVA Environmental Energy Deliverystaff as early as possible after field survey by the TVA Biological Compliance Staff.

Guidelines**:**

1. Except as modified by guidelines 2-4 below, all construction work around streams would be done using pertinent BMPs such as those described in Chapter 5, “Structural ControlsStandards and Specifications.”

2. All equipment crossings of streams must comply with appropriate state (and, at times, federal) permitting requirements. Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Category B designations will be discussed with the TVA Environmental Energy Delivery staff as early as possible in the process to allow time to discuss possibleavoidance or minimization of impacts with design and construction.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method would be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams should be limited to those required to meet National Electrical Safety Code, FERC standards, and danger tree requirements. Stumps can be cut close to ground level but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction.Soil displacement because of clearing operations by the actions of plowing, disking, blading, other tillage, or grading equipment would be minimized in SMZs. Shorelines that are disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

Protection of Unique Habitats (Category C)

This category would be used when, for one or more specific reasons, a temporary or permanent aquatic habitat requires special protection. This relatively uncommon level of protection would beappropriate and required when a unique habitat requiring special protection is present (for example, the spawning area of a rare species), the stream is known to be occupied by a federal-listed or significant state-listed species, or when required as a special condition resulting from consultation with the U.S. Fish and Wildlife Service to avoid project effects on a listed species or designated critical habitat. The purpose of the following guidelines is to avoid or minimize any disturbance of the unique aquatic habitat.

Designation of this category should be discussed with the TVA Environmental Energy Deliverystaff as early as possible after field survey by the TVA Biological Compliance Staff.

Guidelines**:**

1. Except as modified by Guidelines 2-4 below, all construction work around the uniquehabitat would be done using pertinent BMPs such as those described in Chapter 5, “Structural Controls Standards and Specifications.”

2. Category C designations would be discussed with the TVA Environmental Energy Delivery staff as early as possible in the process to allow time to discuss possible avoidance or minimization of impacts with design and construction. Environmental Energy Delivery staff would discuss construction activities to take place in the SMZ withthe TVA Biological Compliance staff. On-site planning sessions would be conducted as needed. All crossings of streams also must comply with appropriate state(and, at times, federal) permitting requirements

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method would be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams should be limited to those required to meet National Electrical Safety Code, FERC standards, and danger tree requirements. Stumps can be cut close to ground level but must not be removed or uprooted.

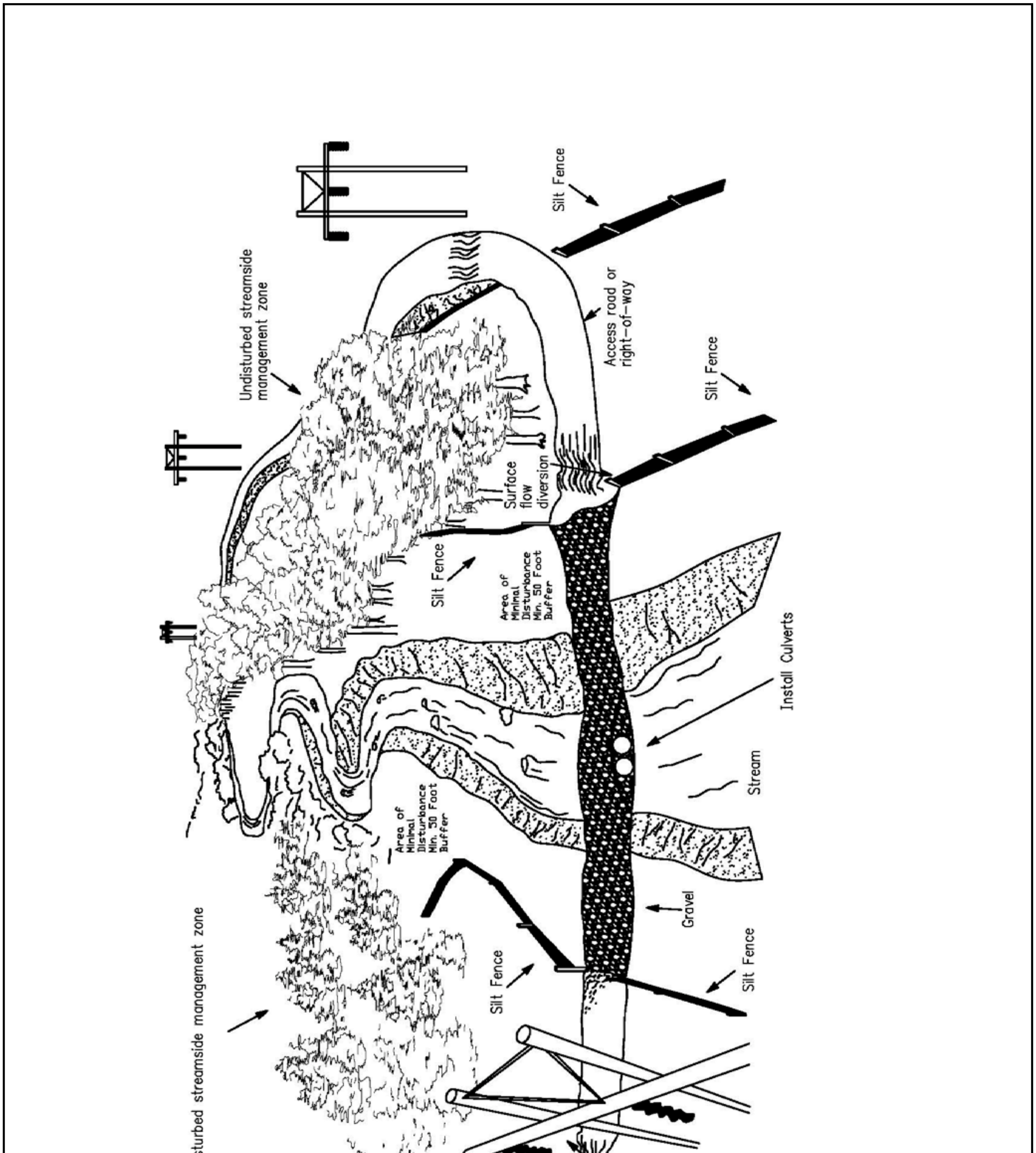
4. Other vegetation near the unique habitat must be disturbed as little as possible during construction. Soil disturbance by plowing, disking, blading, or grading must be kept to a minimum. Areas that are disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

5. Special SMZ requirements would be coordinated with TVA BiologicalCompliance staff.

Maintenance

During ongoing operations, inspect SMZs frequently; and inspect occasionally during inactive periods. Check for potentially damaging or failing situations that may cause unacceptable waterquality impacts. Correct failing situations as soon as practical.

Figure 1 - Streamside Management Zone.



4 - B. Wetlands

Wetlands are protected under Sections 404 and 401 of the Clean Water Act and by Executive Order 11990. To conduct specific activities in wetlands, authorization under a Section 404 Nationwide General Permit or Individual Permit from the United States Army Core of Engineers (USACE) is required. Nationwide General Permit (NWP) #57 authorizes activities related to utility line projects and contains conditions to ensure that impacts to wetlands are minimal. Link to document is below. https://www.swt.usace.army.mil/Portals/41/docs/missions/regulatory/2021%20NWP/2021%20nwp-57.pdf?ver=F7mNZTBZMvLsS64liMcieg%3D%3D Section 401 gives states the authority to certify whether activities permitted under Section 404 are in accordance with state water quality standards. E.O. 11990 requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying the agency's responsibilities.

The USACE and the EPA define wetlands as "*areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, (wetlands dominated by trees or shrubs), marshes, (a frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions) bogs, (a peat accumulating wetland that has nosignificant inflows or outflows and supports acidophilic mosses particularly Sphagnum). Wetland location can vary greatly, from inland to coastal wetlands and from rural to urban regions and other similar areas."* Wetlands can also be less obvious areas such as flats and bottoms that do not appear wet, in isolated depressions surrounded by dry land (i.e., "pot-holes") shallow marsh likeponds, along the margins of lakes or ponds, and in other low-lying areas where precipitation sufficiently saturates the soil (vernal pool sand bogs). Inland wetlands, such as those found in the TVA service area, include marshes and wet meadows (grassland with waterlogged soil nearthe surface but without standing water for most of the year), dominated by herbaceous plants, swamps dominated by shrubs, and wooded swamps dominated by trees.

Properly and carefully implemented BMPs would protect and enhance important wetland functions on most sites under most weather conditions. On extremely sensitive sites or in extremely severe weather conditions, more stringent measures may be required, including complete avoidance of such sites.

A national standard exists that help reduce some of the confusion about identifying wetlands areas and delineating their boundaries. The methodology is found in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. According to federal guidelines the structure of a wetland will have three essential characteristics: (1) wetland hydrology, (2) hydrophytic vegetation, and (3) hydric soils. Each characteristic is described in the following text.

Wetland Hydrology

Areas with wetland hydrology are periodically inundated or have soils saturated to the surface at some point during the growing season. This situation usually creates anaerobic (oxygen depleted) conditions in the soil which affect the type of plants that can grow and the types of soils that develop. All wetlands usually have an abundance of seasonal water that may come fromdirect precipitation, overbank flooding, surface water runoff, or groundwater discharge. Factors that influence the wetness of an area include precipitation, stratigraphy, topography, soilpermeability, and plant cover.

Evidence of periodic presence of inundation typically seen in wetlands are water marks, driftlines, water-borne sediment deposits, surface scouring, and morphological plant adaptations such as cypress knees and buttressed trunks on trees.

Hydrophytic Vegetation

Hydrophytic plants are adapted to growing in water, soil, or on a substrate that is at least periodically deficient in oxygen because of excessive water content. There are five basic groups of plants commonly called “wetland indicator status” based on a plant species frequencyof occurrence in a wetland. They are (1) obligate wetland, (2) facultative wetland, (3) facultative, (4) facultative upland, and (5) obligate upland (see table 2). An area has met the hydrophytic vegetation criteria when, under normal circumstances, more than 50 percent of the compositionof the dominant species from all the strata (trees, shrubs, grasses) are obligate wetland (OBL), facultative wetland (FACW), and /or facultative (FAC) species.

There are five hydrophytic vegetation indicators which are listed in Table 2 below along with theirdefinitions. Hydrophytic vegetation is present if any of the indicators is satisfied.

Table 2: Hydrophytic Vegetation Indicators.

Wetland Indicator Status	**Definition**
Obligate Wetland (OBL)	Almost always occur in wetlands
Facultative Wetland (FACW)	Usually occur in wetlands, but may occur innon-wetlands
Facultative (FAC)	Occur in wetlands or non-wetlands
Facultative Upland (FACU)	Usually occur in non-wetlands, but may occurin wetlands
Obligate Upland (UPL)	Almost never occur in wetlands

The USACE assumed administrative responsibilities for the National Wetland Plant List (NWPL)in 2006. In 2008, the USACE began to update the NWPL as a cooperative effort with the U.S. Fish and Wildlife Service (USFWS), the EPA, and the Natural Resources Conservation Service (NRCS). The 2018 update of the NWPL integrates the current state of the science with an expanded effort by many professionals nationally to improve the wetland ratings. The list can beviewed at the following web address: https://cwbiapp.sec.usace.army.mil/nwpl_static/v34/home/home.html

Hydric Soils

Most soils in TVA’s Power Service Area are thermic with a growing season of March to October.Site-specific soil types, including hydric, have been delineated at the county level and can be viewed at the following web address: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

If the name of the soil in your area is not known, an examination of the soil may genericallyindicate the presence of hydric soil.

Hydric Soil General Characteristics

1. Soil consists predominantly of decomposed plant material (peats or mucks).

2. Soil has a thick layer of decomposing plant material on the surface.

3. Soil has a bluish gray or gray color below the surface, or the major color of the soil at this depth is dark (brownish black or black) and dull.

4. Soil has the odor of rotten eggs.

5. Soil is sandy and has a layer of decomposing plant material at the soil surface.

6. Soil is sandy with dark stains or dark streaks of organic material in the upper layer below the soil surface. These streaks are decomposed plant material attached to the soil particles. Soil from these streaks when rubbed between the fingers will leave a dark stain on the fingers.

4 - C. In-Wetland Clearing, Construction, and Restoration Techniques

The most desirable BMP pertaining to wetlands is avoidance with preservation of intact naturalized wetland buffers. Once all avoidance strategies are explored, employed, and/or eliminated due to other constraints, then properly and carefully implemented BMPs are used to minimize wetland impacts and protect important wetland functions.

Work in wetland areas may be subject to approval from local, state, and/or federal regulatory agencies. Use of these methods may be subject to approval by the appropriate regulatory agencies (USACE, state water pollution control agency, etc.) and must be carefully selected on asite-by-site basis. Any of these methods may be modified or eliminated by a regulatory agency atany time.

To evaluate the appropriate BMPs to be implemented, the following approach is in place.

1. Identify and delineate wetland area on-site, according to current acceptable definitions.

2. Evaluate alternatives; implement wetland and wetland buffer avoidance strategies to the extent practicable; determine wetland area/location/type of unavoidable wetland impact(s).

3. Map wetland area on all site plans and include a 50-foot minimum wetland buffer.

4. Implement a site-specific clearing/construction/restoration plan designed by a qualified wetland biologist for each project which involves work in wetlands. This plan would outline the selected BMPs that would be used as the project proceeds.

5. Incorporate Integrated Vegetation Management strategies in cleared wetland areas on new lines, wherever practicable, to reduce maintenance costs in the long-term.

General BMP rules for work in wetlands

Pre-job briefing would be conducted such that TVA employees, TVA contractors, and/or TVA subcontractors will know where wetland resources are located within the project footprint, how activities will be conducted in wetlands and wetland buffers, and/or how wetlands will be crossed.

Silt fence is installed where soil disturbance is proposed within 50 feet of wetland buffer. Silt fence is installed along wetland buffer or limits of soil disturbance (whichever is further from wetland boundary) where disturbance takes place within 50 feet of wetland buffer. Silt fence should not constrict flow. Refer to Section 5-C Silt Fence for more information.

Adhere to a dry season schedule for work activities in wetlands (September to mid-November), when practicable.

Only low ground pressure equipment or other vehicles such as those with rubberized tracks, wide tires, or lightweight equipment (ATVs) should enter delineated wetland areas. Matting should be used when heavy equipment entry is necessary.

Woody debris should be removed a minimum of 50 feet outside any wetland boundary or drainage feature when possible and damage to the wetland will not occur. When necessary to minimize soil disturbance and water quality impacts, woody debris may be allowed to remain inthe wetland. In these circumstances, the USACE would be contacted if necessary.

Woody vegetation should be cut less than 12 inches from ground level.

Stumps are not removed or grubbed unless stated otherwise according to approved project plans.

Where potential for soil ruts greater than 12 inches deep is present, temporary wetland crossings are to be used for equipment access: wood mats, pipe mats, panels or pallets, metal grating, cut-and-cross lay road, pole road, etc. All temporary crossings should be removed following completion of work.

Flow into or out of the wetland should not be restricted during work activities, unless stated otherwise according to approved project plans.

All contours or elevations within wetland and wetland buffer are to be restored to preconstruction grades unless stated otherwise according to approved project plans.

No mechanical bed preparation or fertilization for restoration purposes should take place within wetlands unless stated otherwise according to approved project plans.

All disturbed and exposed soils within wetlands or wetland buffers should be seeded with the approved vegetation seed mix within 14 days of exposure or immediately afterthe cessation of work activities, whichever comes first.

Only aquatic approved herbicides will be used within wetlands and wetland buffers. Refer toSection 3-F. Herbicide Use for more information.

Possible Wetland and Wetland Buffer Clearing Methods (WCM)

WCM-1**:** Wetland Avoidance
The wetland and wetland buffer are a scrub-shrub, emergent, or grazed wetland with no clearing required, and all vehicular traffic can navigate around the wetland. No heavy equipment would be used in the site.

WCM-2: Manual Clearing Using Hand Carried Tools (selective)
Using hand carried tools, brush and timber would be cut less than 12 inches from ground level or trimmed to a height which eliminates electrical clearance and safety problems. Timber would be removed by standard forestry practices with minimal ground disturbance (no rutting deeper than 12 inches). Woody stumps would be treated with an approved herbicide to prevent re-sprouts. A follow-up restoration plan may be necessary to establish an early successive herbaceous/scrub- shrub vegetative community to minimize long-term maintenance efforts and associated costs.

WCM-3**:** Clearing Using Low Ground Pressure Equipment (non-selective)
Using low-ground pressure equipment, brush and timber would be cut less than 12 inches from ground level or trimmed to a height which eliminates electrical clearance and safety problems. Timber would be removed by standard forestry practices with minimal ground disturbance (no rutting deeper than 12 inches). Woody stumps would be treated with an approved herbicide to prevent re-sprouts. A follow-up restoration plan may be necessary to establish an early successive herbaceous/scrub-shrub vegetative community and deter long-term maintenance efforts and associated costs.

WCM-4**:** Herbicide Application, Individual Stems (selective)
Using an approved herbicide, individual brush and timber within the wetland and wetland buffer would be selectively treated such that electrical clearance and safety problems are eliminated and a low growing vegetative community is maintained. A follow-up restoration plan may be necessary to establish an early successive herbaceous/scrub-shrub vegetative community anddeter long-term maintenance efforts and associated costs.

WCM-5**:** Herbicide Application, Broadcast (non-selective)
Using an approved herbicide, the wetland and wetland buffer within the ROW would be broadcast treated such that electrical clearance and safety problems are eliminated and a low growing vegetative community is maintained. A follow-up restoration plan may be necessary to establish an early successive

herbaceous/scrub-shrub vegetative community and deter long- term maintenance efforts and associated costs.

WCM-6: Herbicide Application, Aerial Spray (non-selective)
Using an approved herbicide, the wetland and wetland buffer within the ROW would be broadcast treated such that electrical clearance and safety problems are eliminated and a low growing vegetative community is maintained. A follow-up restoration plan may be necessary toestablish an early successive herbaceous/scrub-shrub vegetative community and deter long- term maintenance efforts and associated costs.

Possible Wetland Access Methods (WAM)

WAM-1: Wetland Avoidance
No access will be conducted across wetland areas.

WAM-2: Cut and Cross-lay (Pole) Road
Cut and cross-lay (pole) road may be constructed for access through wetland areas to complete vegetation clearing and transmission line construction and maintenance activities. If a cut and cross-lay road is constructed, the road should be removed once line construction or maintenance activities are completed. The cut and cross-lay road may be allowed to remain based upon the USACE District determination to minimize soil disturbance and water quality impacts.

WAM-3: Temporary Crossings - Matting
Wood mats, pipe mats, panels or pallets, metal grating, or similar materials may be laid for temporary crossings or access through wetlands. All temporary crossings are removed following the completion of work.

Possible Wetland and Wetland Buffer Transmission Structure Placement Methods (WSP)

WSP-1: Wetland and Wetland Buffer Avoidance
No transmission structures will be located within the boundaries of the wetland or wetland buffer.

WSP-2: Low Ground Pressure Equipment
Transmission structure placement would be accomplished using low ground pressure equipment.Rutting would not exceed 12 inches within the boundaries of the wetland. Visual inspections of soil/hydraulic conditions will be used to determine appropriate times for ingress and egress.

WSP-3: Standard Construction with Matting
Transmission structure placement will be accomplished using standard construction techniques,with access accomplished from upland sites adjacent to the wetland. Matting would be used in wetland areas to minimize soil disturbance in the immediate vicinity of structure. When the ground is not saturated and when rutting would be less than 12 inches, mats may be omitted from use.

Possible Wetland and Wetland Buffer Restoration Methods (WRM)

WRM-1: Re-grading
Following vegetation clearing and soil disturbance, the original contours within the wetland or buffer area would be restored to preconstruction conditions. All separated topsoil would be placed on top of excavated/restored soils.

WRM-2: No Vegetation Restoration
Brush and timber clearing activity does not result in soil disturbance, such that understory vegetation is allowed to remain, and gaps are allowed to be filled in with existing naturalized vegetation present in the existing soil seed banks.

WRM-3: Temporary Vegetation Restoration
For temporary exposure of disturbed soils approved plant species are seeded by hand or broadcast methods, or hydroseeding and then covered with a seed-free mulch to encourage establishment and prevent erosion.

WRM-4: Permanent Vegetation Restoration
Following the end of construction, approved native species are seeded by hand or broadcast methods, or hydroseeding and then covered with a seed-free mulch to encourage establishment and prevent erosion. No mechanical seedbed preparation (disking) would be done, and no fertilizer would be used, unless approved and permitted by the USACE.

WRM-5: Integrated Vegetation Management
A detailed wetland restoration plan will be developed and implemented for short-term construction activity and/or long-term ROW maintenance; the plan will be approved by a qualifiedwetland biologist in the Biological and Cultural Compliance Group. The restoration plan includes a low-growing herbaceous or scrub-shrub plant community within the wire zones (below the wires and 10 feet out), and a small tree or scrub-shrub plant community outside the wire zone within the ROW. Wetland and wetland buffer vegetation is established via re-growth from the soils existing seed bank, introduction of native seed (hand, broadcast, hydroseeding), and/or installation of bare root or balled and burlapped woody wetland species.

Possible Transmission Line and Structure Retirement (Demolition/Removal) Methods(WSR):

WSR-1: Existing transmission lines or poles/structures in wetlands would be retired (demolished/removed) by using low-ground pressure equipment. If soil rutting potential is greaterthan 12 inches, other wetland access BMPs (mats or dry season work schedules) would be in place to minimize wetland impacts.

WSR-2: Conventional equipment (dozers, trucks, etc.) would be used to take down the existing line. If heavy equipment is required to enter delineated wetland area and soil rutting potential is greater than 12 inches, wetland access BMPs (mats or dry season work schedules) would be inplace to minimize wetland impacts.

WSR-3: Precision cutting, and helicopter removal would be used to remove the line andtransmission structures. No wheeled equipment would be allowed in the wetland area.

4 - D. Endangered/Threatened Plant Species

Construction involving New TVA property or Easements

When federally listed threatened or endangered plant species occur in areas where construction activities will occur, the following avoidance measures may be used to minimize damage to the species. Project-specific commitments (including avoidance of significant state listed species) willbe included in the environmental review under the National Environmental Policy Act (NEPA) and will be decided on a project-by-project basis.

1. Areas containing federally or state listed threatened or endangered plants would be recorded on construction planning/design drawings, plan and profile sheets, and/ordetailed on maps that are specific to the proposed project.

2. The person responsible for overseeing clearing and construction would notify personnel at the pre-construction meeting that the threatened or endangered plant species occurs in the project area.

3. Heavy equipment would not be used to re-contour, remove tree stumps, or otherwise intentionally disturb the soil profile in areas containing the threatened or endangered plants species.

4. Temporary fencing would be erected as needed around areas where threatened orendangered plant species occur.

5. Specific requirements for the protection of sensitive resources and/or threatened or endangered plant species may be outlined in the environmental NEPA reviews and/ordetailed on maps and construction drawings.

Construction or Maintenance Occurring on Existing TVA property or Easements

Federally and state listed threatened and endangered plant species can occur on TVA property and on TVA transmission line ROW easements. When these species occur in areas where work would occur, special precautions must be taken into consideration to avoid impacts. Some general precautions are listed below.

- Heavy equipment would not be used to re-contour, remove tree stumps, or otherwise intentionally disturb the soil profile in areas containing threatened or endangered plant species.

- Temporary fencing would be erected as needed around areas where threatened or endangered plant species occur.

- Specific requirements for the protection of threatened or endangered plant species may be outlined in the environmental NEPA reviews and/or detailed on maps and construction drawings.

4 - E. Other Sensitive Resources

Site preparation, construction, and subsequent maintenance activities must not directly or indirectly cause adverse impacts to areas that possess certain unique values. Often these areas are collectively referred to as “sensitive resources.” Sensitive resources can include, but are not limited to, caves, threatened/endangered or special status species (plants and animals),public water supplies, groundwater, and critical or unique wildlife or plant habitat (e.g., trout streams, waterfowl habitat, wading-bird nesting areas, heronies, caves, sinkholes). If sensitive resources are identified by desktop or field reviews, specific buffer requirements and BMPs would be recommended by TVA’s environmental staff on a case-by-case basis to avoid or reduce the impact associated with that specific resource.

Additionally, to avoid adverse impacts, resources with archaeological, historical, ecological, geological, recreational, and scenic value may need protection during site preparation, construction, and maintenance activities. Examples of these special sites or areas include archaeological sites and historic structures or sites, state parks, forests, wildlife managementareas and refuges, designated critical habitat, monuments, designated natural areas, recreational areas, and scenic rivers or parts of the National Wild and Scenic River System.

Sensitive resources that have been identified would be marked on maps and construction drawings. Specific requirements for the protection of sensitive resources would be outlined in theenvironmental NEPA reviews and/or detailed on the maps and construction drawings. If a potentially sensitive resource is encountered in the field, and not marked on a map or detailed in the environmental review, contact your environmental support staff.

Chapter 5 - Structural Controls, Standards and Specifications

5 - A. Wattles

Definition

Wattles are flexible tubular barriers made of biodegradable netting or geotextile fabric filled with natural fibers, hardwood mulch, or other porous material. They can be used as velocity reduction or sediment control.

Come in a variety of sizes, most commonly 9 - 20 inches in diameter and generally 10 - 20 feet in length.

Can vary in strength and density of compaction (Figure 2).

Purpose

Wattles may be utilized on slopes or in small ditches to reduce flow velocities. While they are generally used at regular intervals on a slope, they may also be placed at the top or toe of the slope or at breaks in grade. Wattles act to slow flow velocities so that sediments being carried inthe runoff can drop out.

Conditions where practice applies

Wattles can be installed as a grade control structure, or dam constructed across a swale, drainage ditch, or area of concentrated flow.

Wattles can be installed on slopes to slow sheet flow, promote infiltration, trap sediment, and reduce runoff volume.

Wattles can be installed around storm drain inlets and as perimeter control.

Due to staking requirements, wattles on pavement and rock are not appropriate.Wattles cannot be used in streams.

Construction Specifications

Always refer to manufacturer's guidelines prior to installing wattles. Manufacturer's guidelines take precedence over specifications listed below.

Excavate a 2 - 3 inches deep by 9 inches wide (width should equal diameter of wattle) trench along the contour of the slope.

Place excavated soil up-slope of trench, and place wattle in trench ensuring good contact to soil surface.

Compact any loose soil against wattles on the uphill side. Secure wattle with 18 – 24 inch stake every 2 feet with a stake on each end.

Stakes should be driven through middle of the wattle leaving at least 2 - 3 inches extending above the wattle (Figure 2).

The middle section of the wattle should be lower than the ends to prevent scour around the ends.Wattles should be installed on contour.

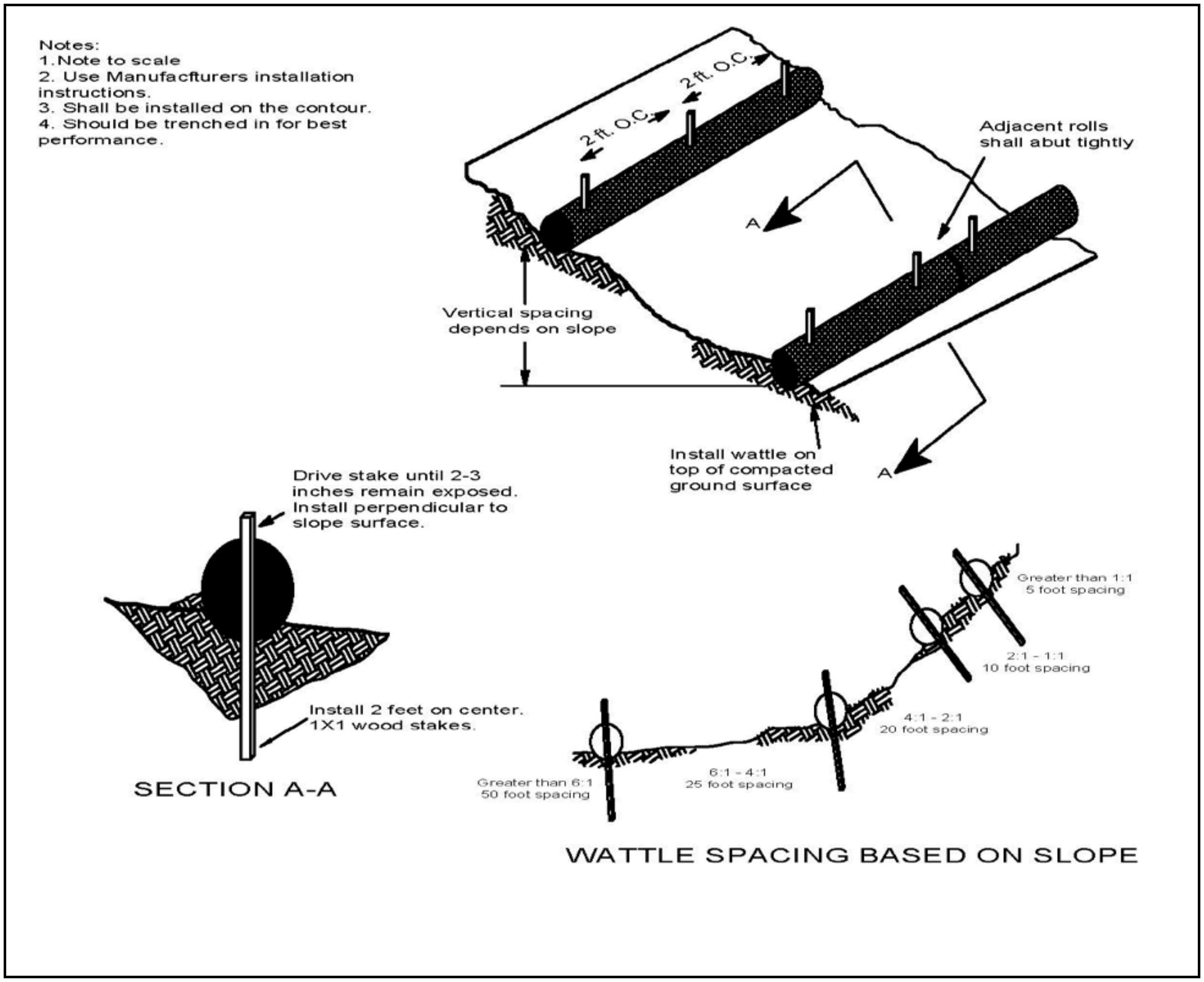
Wattles should overlap when placed linearly to ensure no gapping between individual wattles.

Inspection and Maintenance

Wattles should be inspected regularly, and maintenance should be expected as they deteriorate.All wattles should be removed once all project areas have been fully stabilized.

Remove deposited sediments when 50 percent of the storage height is filled. Sediment can be spread out on the project site and revegetated or disposed of in another appropriate manner.

Figure 2 - Wattles.



5 - B. Mulch Berms

Definition
An embankment composed of mulch from trees, brush, grass, and other materials because of land clearing activities

Purpose
To capture sediment carried by sheet flow from disturbed areas by slowing and filtering construction stormwater.

Conditions where practice applies
Mulch berms should be used on contour of disturbed slopes, therefore diminishing the velocity of surface runoff from up-slope areas. Mulch berms are 'temporary' in nature and are not to be placed in high flow areas

Construction Specifications
The type and, density of material, and the width/height of the berm must all be considered when selecting the desired location.

Mulch berms are generally built 2 - 3 feet in height and 3 - 5 feet in width. Within ROW easements, the height of mulch berms should not violate transmission line clearances. Mulch berms are oriented to intercept sediment and stormwater runoff.

Mulch berms should be used in conjunction with other BMPs to be most effective.

Compaction may be required depending upon the material used and uphill slope. Windrow on contour as practicable.

Inspection and Maintenance
Mulch berms should be inspected regularly, and maintenance should be expected as the mulch deteriorates.

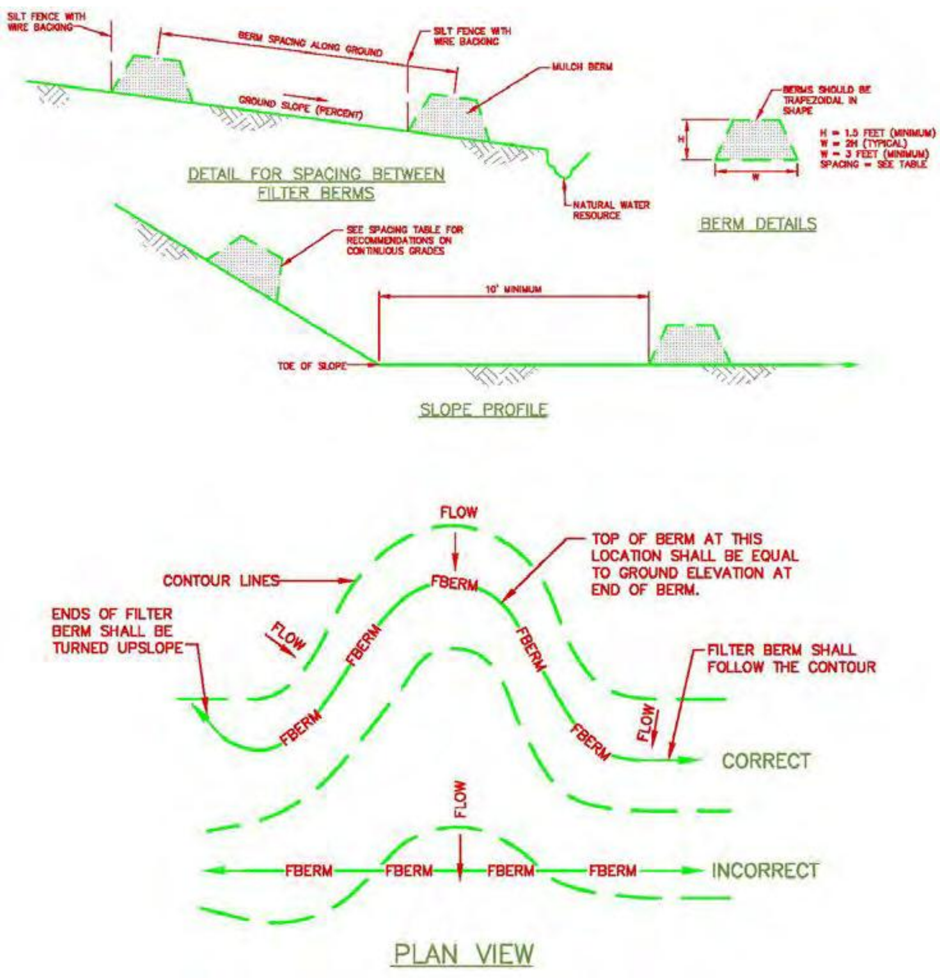
All mulch berms should be removed once all project areas have been fully stabilized.

Wood Mulch Use Guidelines

In areas where it is not practical to put a silt fence (i.e., extremely rocky soil), wood mulch berms can be used instead. The berms should be 5 - 6 feet wide at the base, 3 - 4 feet tall, and 3 - 4 feet wide at the top. The wood mulch can be used as temporary groundcover if it is not spread so deep that re-vegetation of the area is not possible. Wood mulch can be left in place or incorporated into the soil as final restoration if it does not impede the establishment of permanent vegetation.

If permanent vegetation is going to be planted in an area where wood mulch has been spread, lime should be supplemented at 2 - 3 tons per acre.

Figure 3 - Mulch Berm.



FILTER BERM SPACING	
GROUND SLOPE (%)	RECOMMENDED SPACING BETWEEN BERMS ALONG GROUND (FT)
<2	110
2–5	100
5–10	75
10–20	25
>20	NOT ALLOWED

5 - C. Silt Fence

Definition
A temporary sediment barrier consisting of a woven, synthetic filtration fabric supported by steel or wood posts and entrenched into the soil (Figures 5 and 6).

Purpose
To capture sediment carried by sheet flow from disturbed areas by ponding water to allow sediment to fall out of the flow.

Conditions Where Practice Applies
Below disturbed areas where erosion would occur in the form of sheet and rill erosion.

In areas where sheet flow runoff can be stored by silt fence without damaging the silt fence or the submerged area behind the silt fence.

Silt fence should not be installed across streams, ditches, waterways, or other areas of concentrated flow.

Design Criteria
No formal design is required.

Silt fence should be installed along the contour of the slope with J hooks (Figure 4) on the ends.
See Table 3 below for typical criteria of silt fence installed vs. slope length.

Table 3: Typical Criteria for Silt Fence Placement.

Land Slope	**Maximum Slope Length Above Fence**
Percent	Feet
<2	100
2 - 5	75
5 - 10	50
10 - 20	25
>20*	15
*In areas where the slope is greater than 20%, a flat area length of 10 feet between the toes of the slope to the fence should be provided.	

Normally, the drainage area should not exceed 0.25 acres per 100 feet of silt fence.

For long runs of silt fence, use J-hooks where appropriate to slow stormwater flow and avoid silt fence failure. See Figure 4.

If possible, provide offset from toe of slope and silt fence for access and maintenance.

Silt fences used by TVA are divided into two categories: Type A and Type C Silt Fence. The design criteria for each type are listed below. Refer to the applicable state BMP Manual for state specific silt fence criteria (e.g., Tennessee Type C silt fence mirrors the specifications for Alabama Type A silt fence):

<u>Type A silt fence</u> - This 36-inch-wide filter fabric should be used on projects with a duration equal to or greater than 6 months. See Figure 5.

<u>Type C silt fence</u> - Like Type A silt fence, this filter fabric is 36 inches wide. It is installed on steel posts and includes wire reinforcement which allows a flow rate of almost 3 times the flow rate of Type A silt fence. Type C silt fence should be used on areas that produce high stormwater velocity, sensitive environmental areas, and/or steep slopes. See Figure 6.

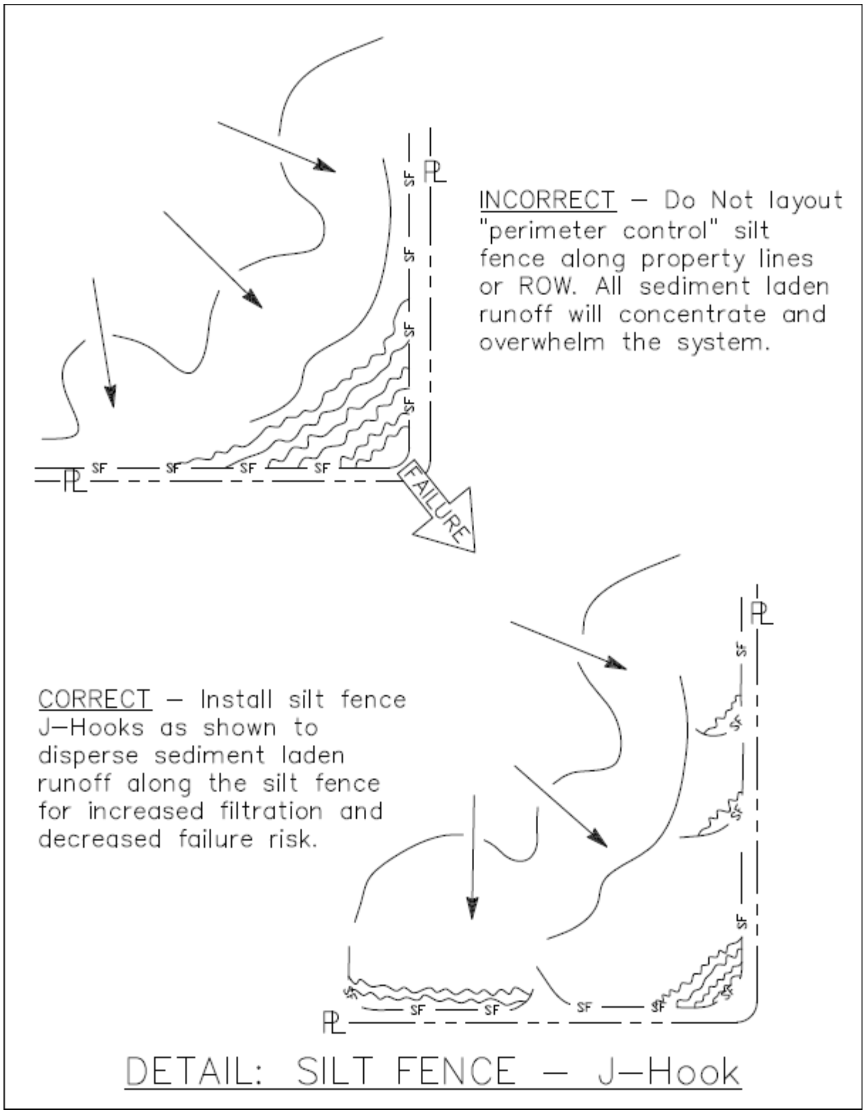


Figure 4 - J-Hook Details.

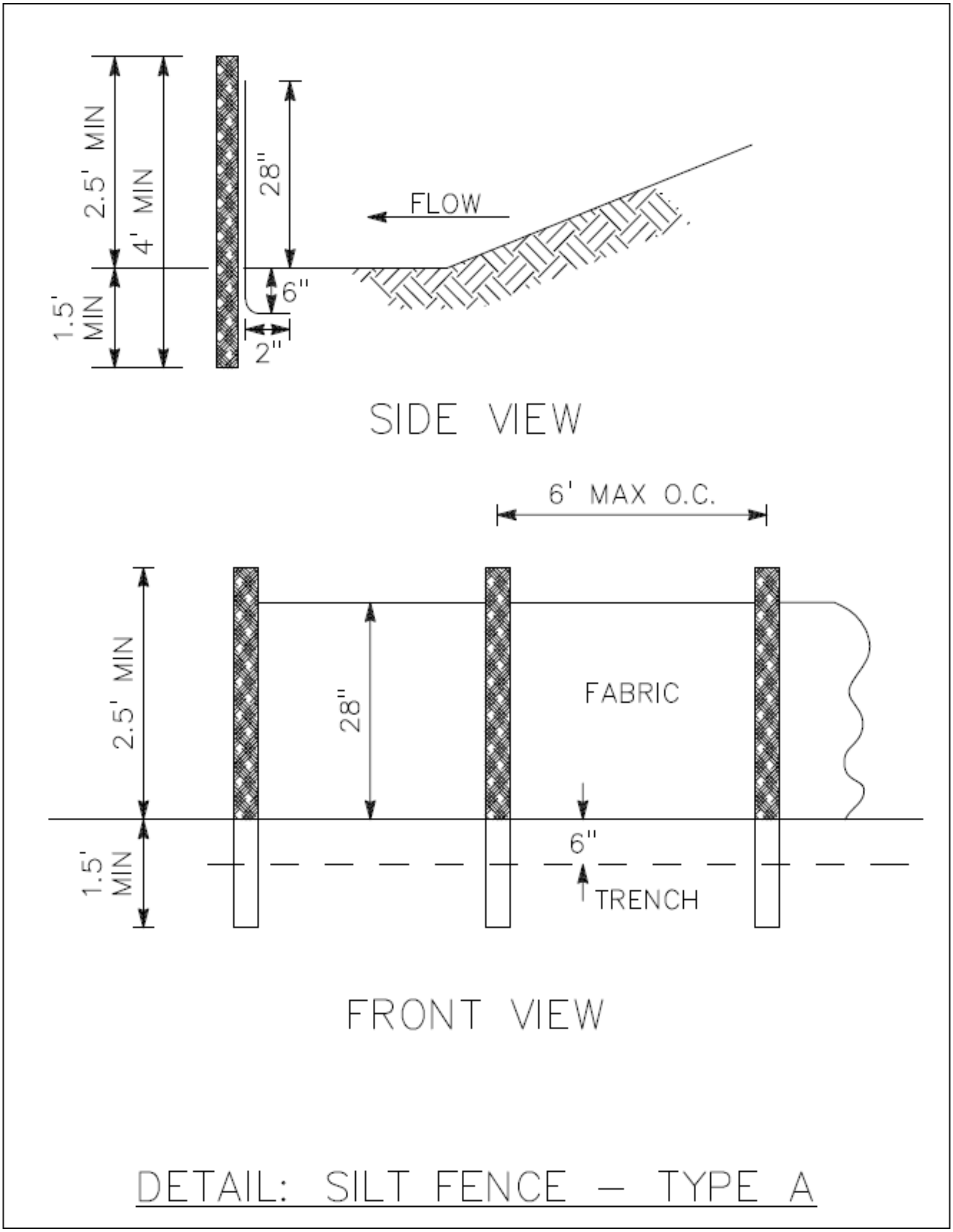


Figure 5 - Type A Silt Fence.

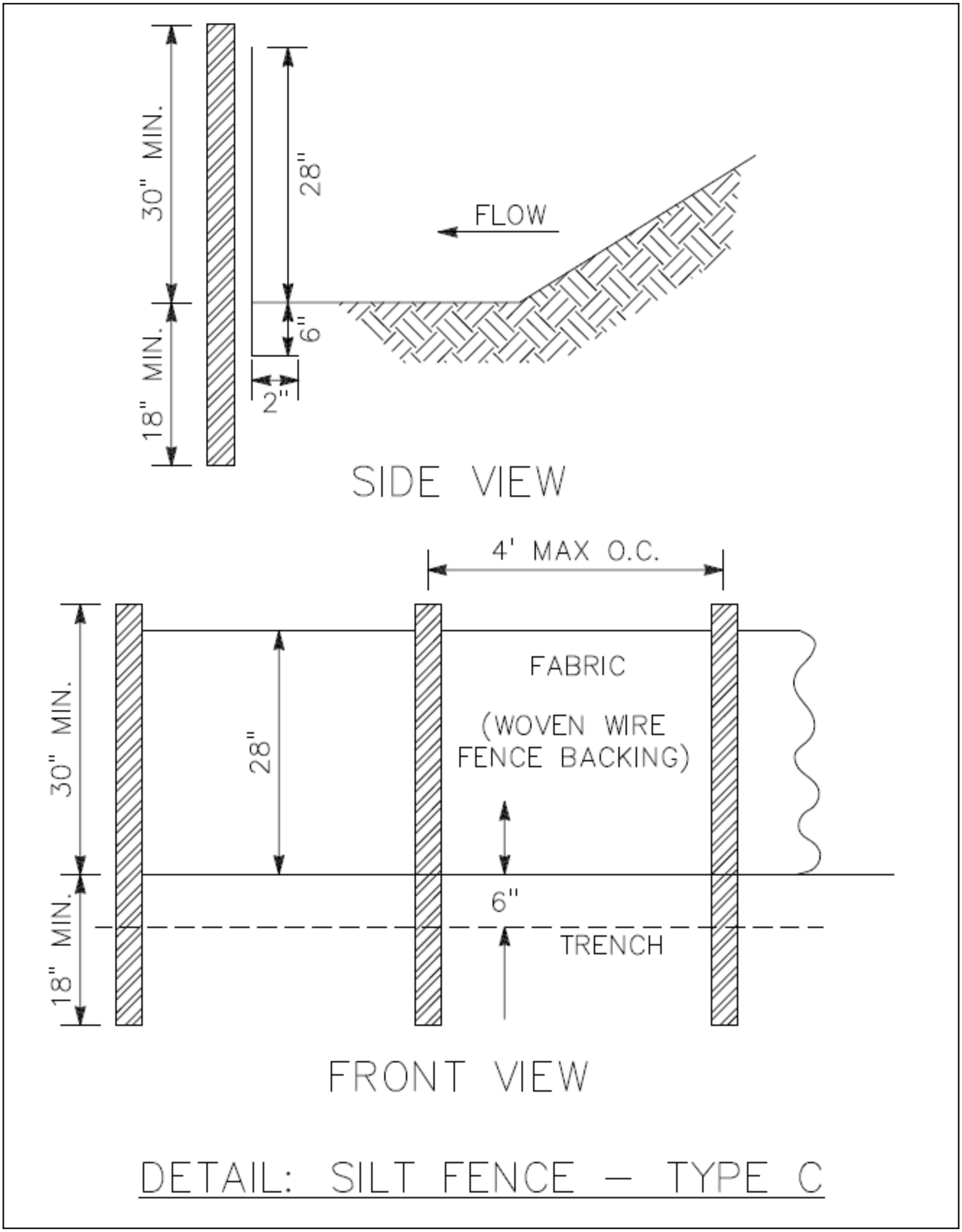


Figure 6 - Type C Silt Fence.

Construction Specifications

Silt fence is typically installed according to Figures 4, 5, and 6. For Type A silt fence, postsshould be staked 6 feet apart and can be either wood or steel. For Type C silt fence, postsshould be staked 4 feet apart and must be steel due to higher flow rates. See Table 4 for recommended post specifications.

Table 4: Silt Fence Post Specifications.

	Minimum Length	Type of Post	Size of Post
Type A	4’	Wood or Steel	3” dia. or 2x4 1.5” x 1.5” 1.3lb./ft. min
Type C	4’	Steel	1.3lb./ft. min.

The filter fabric should be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth is usually spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed. See Figure 7 for joint details.

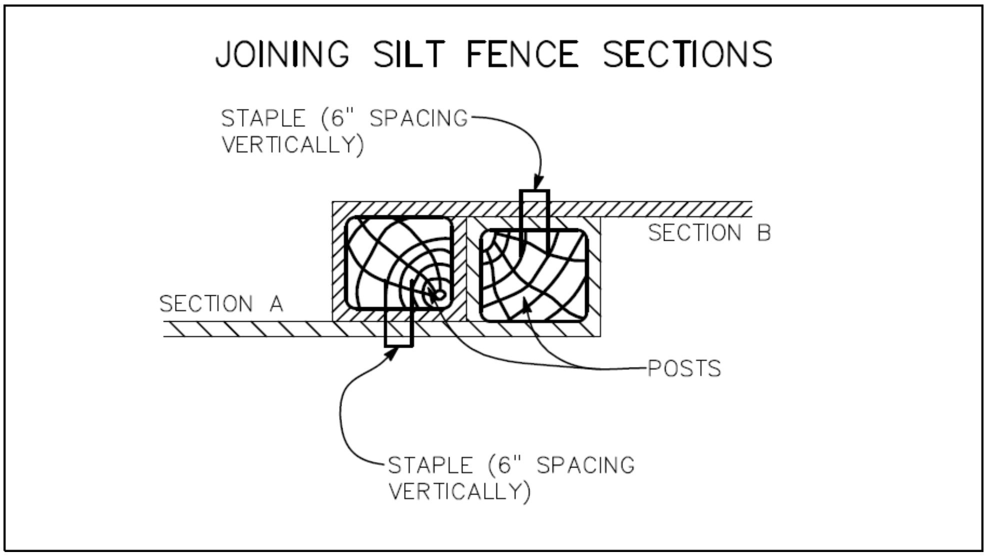


Figure 7 - Silt Fence Joint Detail.

Wire fence reinforcement for Type C silt fence using standard strength filter cloth is typically aminimum of 14 gauge and should have a maximum mesh spacing of 6 inches.

Post and/or wire reinforcement should be installed on the downhill side of the fabric.

Silt fence must be entrenched and backfilled with compacted soil to be effective in collectingsediment.

The ends of the silt fence should be turned uphill or otherwise configured to prevent end-aroundstormwater bypass.

Inspection and Maintenance

Silt fence fabric that has deteriorated to such an extent that renders the silt fence ineffective should be replaced in areas that have not undergone final stabilization.

Sediment deposits should be removed when deposits reach approximately one-half the height of the barrier.

Any sediment accumulated by the silt fence must be properly removed to a secure area (e.g., spoil pile) and stabilized before the silt fence can be removed.

All silt fences should be removed once the project areas have been finally stabilized.

5 - D. Check Dams

Definition
A small temporary barrier or center-overflow dam constructed across a swale, drainage ditch, or area of concentrated flow (Figures 8 and 9).

Purpose
To minimize the erosion rate by reducing the velocity of stormwater in areas of concentrated flow.

To pond turbid water and allow sediment to drop out for capture.

Conditions where practice applies
Check dams are applicable for use in small open channels and should not be used in a stream.

Temporary or permanent ditches or swales which need protection during the establishment of grass linings.

Temporary or permanent ditches or swales which, because of their short length of service, cannot receive a non-erodible lining but still need some protection to reduce erosion.

Other locations where small, localized erosion and resulting sedimentation problems exist.

Design Criteria
Formal design is not required.

Typical check dams must be limited to use in small, open ditches that drain 5 acres or less.

The center of the check dam should be lower than its outer edges. Normally, the maximum check dam height is 2 feet measured from the center of the check dam. Ensure that edges of the dam tie into the upper portion of the ditch or channel to prevent bypass. See Figure 8.

When two or more check dams are used in series, the toe of the upstream check dam should be at the same elevation as the top of the downstream check dam. See Figure 9.

Check dam side slopes typically should not exceed 2:1.

A woven or nonwoven geotextile should be used as a separator between the stone and subgrade. This will prevent the migration of soil particles from the subgrade into the stone. Geotextile should be keyed into the subgrade on the upstream side.

Construction Specifications

Riprap should be used for check dams with rock diameter ranging from 6 to 12 inches. This riprap should be clean of any fines.

Mechanical and/or hand placement of stone should be used to ensure proper height, spacing,etc. of check dams.

Inspection and Maintenance

Check dams should be monitored for sediment accumulation after each significant rainfall. Sediment should be removed from behind the check dams when it has accumulated to one-half of the original height of the dam.

Check dams should be removed once all upstream drainage areas have been permanently stabilized. This can be accomplished by smoothing out the rock to create a rock lined ditch. If thearea where the check dam is located is to be landscaped and mowed, then it should be removed completely. Any disturbed areas that remain should be seeded and mulched immediately (Chapter 6 – Seeding and Stabilization Techniques).

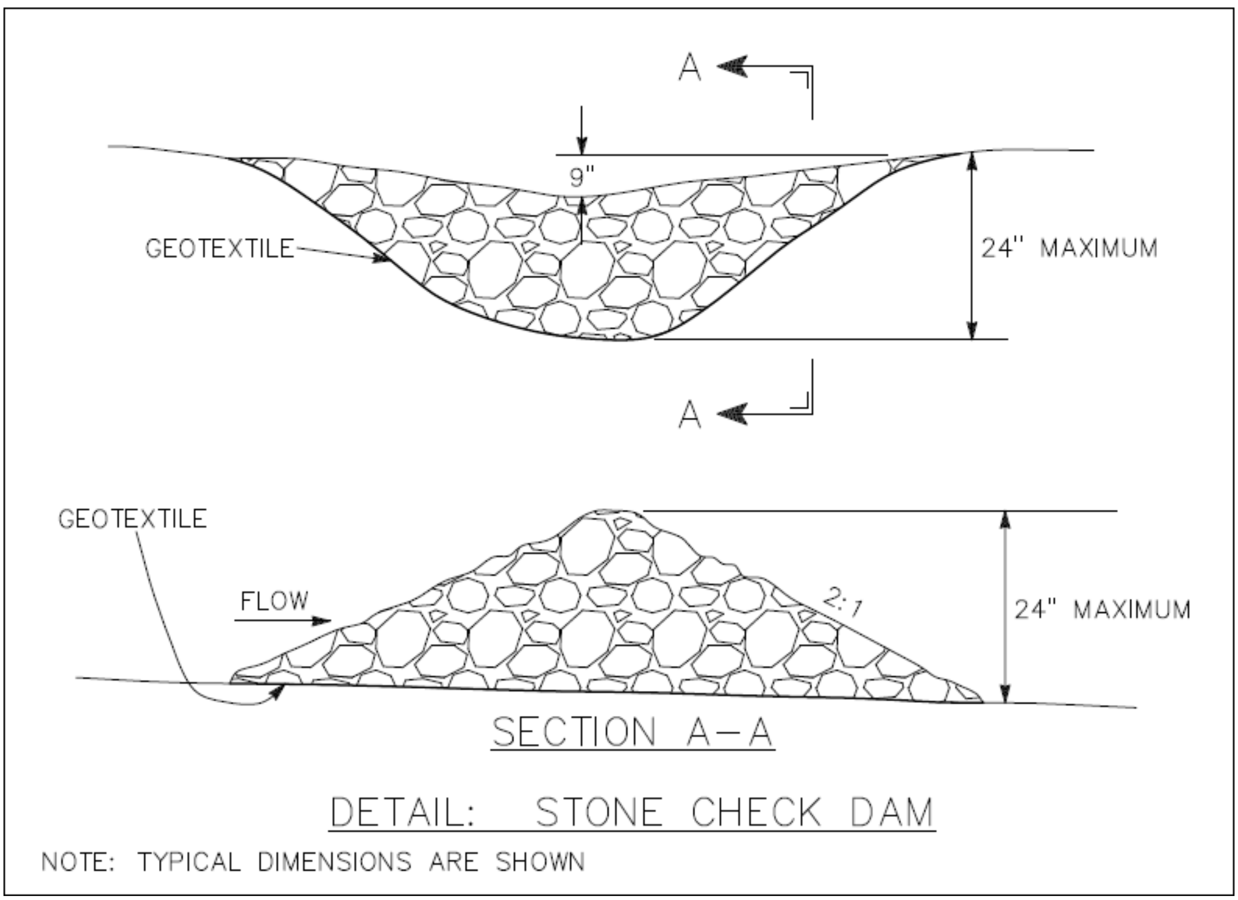


Figure 8 - Rock Check Dam.

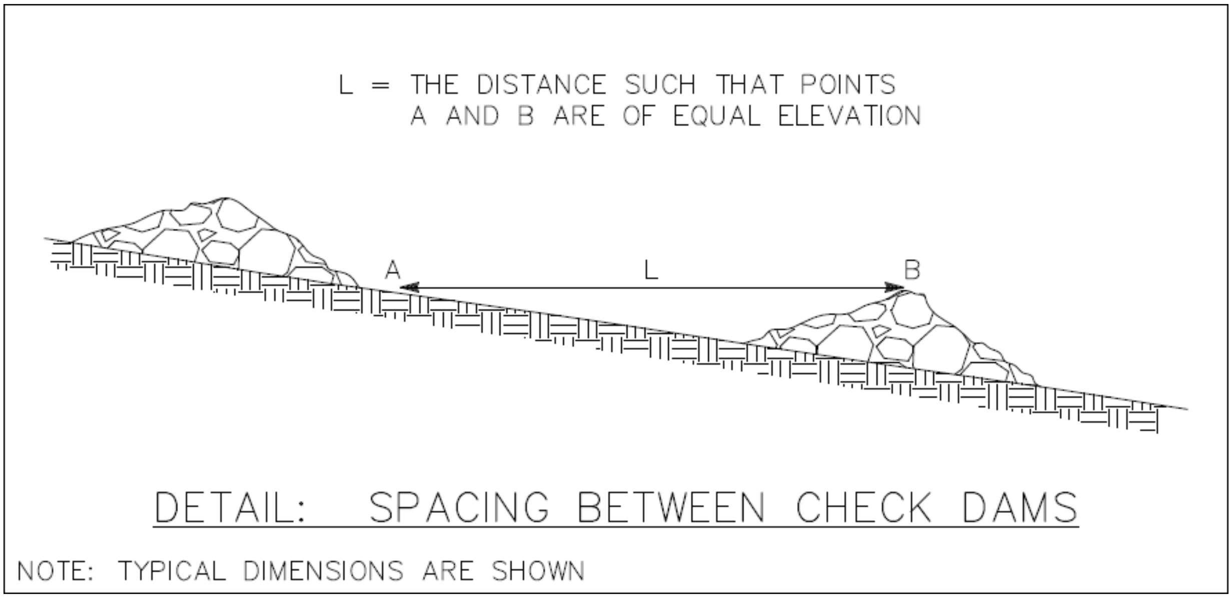


Figure 9 - Check Dam Spacing.

5 - E. Rock Filter Dam

Definition
A temporary or permanent stone filter dam installed across small streams or drainage ways. (Figure 10)

Purpose
To minimize the erosion rate by reducing the velocity of stormwater. To filter turbid water and capture sediment.

Conditions where practice applies
Rock filter dams are applicable for use in small streams and natural or constructed drainage ways on construction sites.

Because rock filter dams may be installed in state waters, all local, state, and federal laws and regulations must be followed during design, installation, and maintenance of rock filter dams.

These structures should be designed so that impounded water behind the structures would not overtop adjacent stream banks or otherwise encroach on adjoining property owners.

Design Criteria
Formal design is not required, but it is recommended that a qualified engineer be consulted for permanent rock filter dams and/or rock filter dams installed in state waters.

Rock filter dams should be installed as close to the disturbed area as possible to decrease the upstream drainage area and reduce the filtered stormwater volume.

The center of the dam should be 9 inches lower than its outer edges. Ensure that edges of the dam tie into the upper portion of the ditch or channel to prevent bypass. See Figure 10.

The width across the top of the dam should be no less than 4 feet. Rock filter dam side slopes should not exceed 2:1.

Geotextile: A woven or nonwoven geotextile should be used as a separator between the large and small stone as well as the stone and subgrade. This will aid in filtration and prevent the migration of soil particles from the subgrade into the stone. Geotextile should be keyed into the subgrade on the upstream side.

Construction Specifications
Riprap should be used as the base for rock filter dams with rock diameter ranging from 6 to 12inches. This riprap should be clean of any fines.

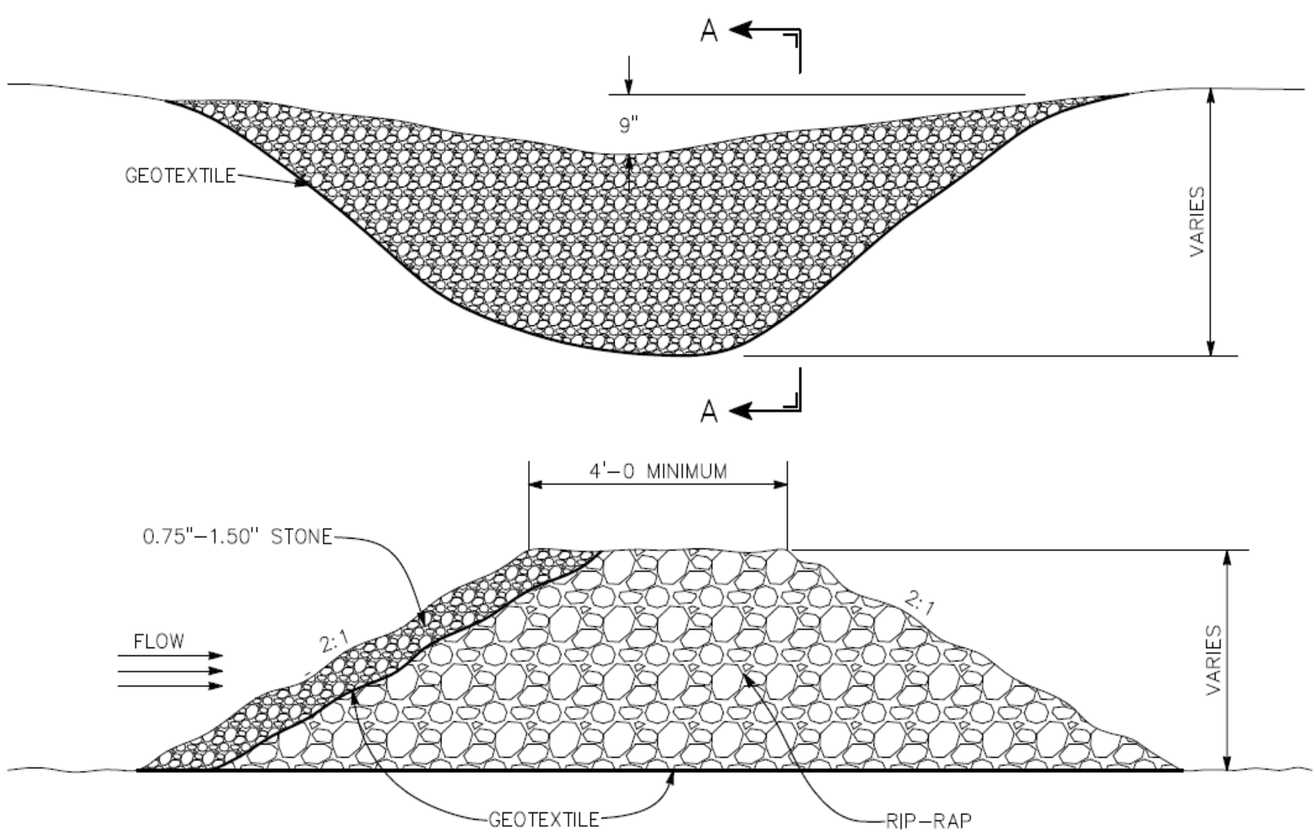
Stone ranging from 0.75 inches to 1.50 inches should be used as the smaller stone on the upstream side of the rock filter dam. This stone should be clean of any fines.

Mechanical and/or hand placement of stone should be used to ensure proper height, spacing,etc. of the dams.

Inspection and Maintenance

Rock filter dams should be monitored for sediment accumulation after each significant rainfall. Sediment should be removed from behind the dams when it has accumulated to one-half of the original height of the dam.

Rock filter dams should be removed once all upstream drainage areas have been permanently stabilized. This can be accomplished by smoothing out the rock to create a rock lined ditch. If the area where the dam is located is to be landscaped and mowed, then it should be removed completely. Any disturbed areas that remain should be seeded and mulched immediately (Chapter 6 – Seeding and Stabilization Techniques).



SECTION A–A

DETAIL: ROCK FILTER DAM

Figure 10 - Rock Filter Dam.

5 - F. Diversion

Definition
A temporary or permanent ridge of compacted soil, combined with an excavated channel, located at the top or base of a sloping disturbed area.

A diversion may consist of only a ridge of compacted soil or an excavated channel, but typically both are present. (Figure 11)

Purposes
To divert stormwater runoff from higher drainage areas away from unprotected slopes to a stabilized outlet.

To divert sediment-laden runoff from a disturbed area to a sediment trapping facility. To redirect stormwater runoff on long slope lengths.

Conditions Where Practice Applies
Wherever stormwater runoff must be temporarily diverted to protect disturbed slopes or retain sediment on-site during construction.

Where runoff from higher areas may damage property, cause erosion, or interfere with the establishment of vegetation on lower areas.

Where the slope length needs to be reduced to minimize soil loss.

Planning Considerations
When used at the top of a slope, the structure protects exposed slopes by keeping upland runoff away. On moderately sloping areas, they may be placed at intervals to trap and divert sheet flow before it has a chance to concentrate and cause rill and gully erosion. When used at the base of a slope, the structure protects adjacent and downstream areas by diverting sediment- laden runoff to a sediment trapping facility. They can be used to protect structures, parking lots, adjacent properties, bodies of water, and other areas from flooding.

Adequate vegetation should be established as soon as possible after installation. It is equally important to stabilize the drainage area above the diversion so that sediment would not enter and accumulate in the diversion channel.

Design Criteria
No formal design is required for temporary diversions. Permanent diversions require design by aqualified professional. Diversion location should be determined by considering outlet conditions, topography, land use, soil type, length of slope, etc. The diversion channel may be parabolic, trapezoidal, or V-shaped. See Figure 11.

The maximum suggested allowable drainage area is 5 acres.

The typical minimum allowable height measured from the upslope side of the dike is 18 inches. A settlement factor of 10 percent should be considered.

Side slopes are typically 2:1 or flatter with a typical minimum ridge base width of 4.5 feet.

Typical freeboard, measured between the top of the channel design flow depth and the top of the compacted ridge is 0.3 feet.

On steeper slopes, narrow and deep channels may be required. On more gentle slopes, broad and shoulder channels are usually more appropriate. Channels should be sloped to ensure drainage and to avoid ponding.

The diverted runoff, if free of sediment, must be released through a stabilized outlet or channel. Sediment-laden runoff must be diverted and released through a sediment trapping structure.

Construction Specifications

Whenever feasible, the dike should be built before project construction begins. The dike should be adequately compacted to prevent failure.

All trees, brush, stumps, obstructions, and other objectionable material should be removed to allow the proper functioning of the diversion

Temporary or permanent seeding and mulch should be applied to the dike following its construction.

The dike should be located to minimize damages by construction operations and traffic.

Inspection and Maintenance

Before final stabilization, the diversion should be inspected after every significant rainfall.

Sediment should be removed from the ditch line and repairs made, as necessary. Seeded areas which fail to establish a vegetative cover should be reseeded, as necessary.

Damages caused by construction traffic or other activity must be repaired quickly for diversion to operate properly.

Diversions may be removed after all disturbed areas have been stabilized.

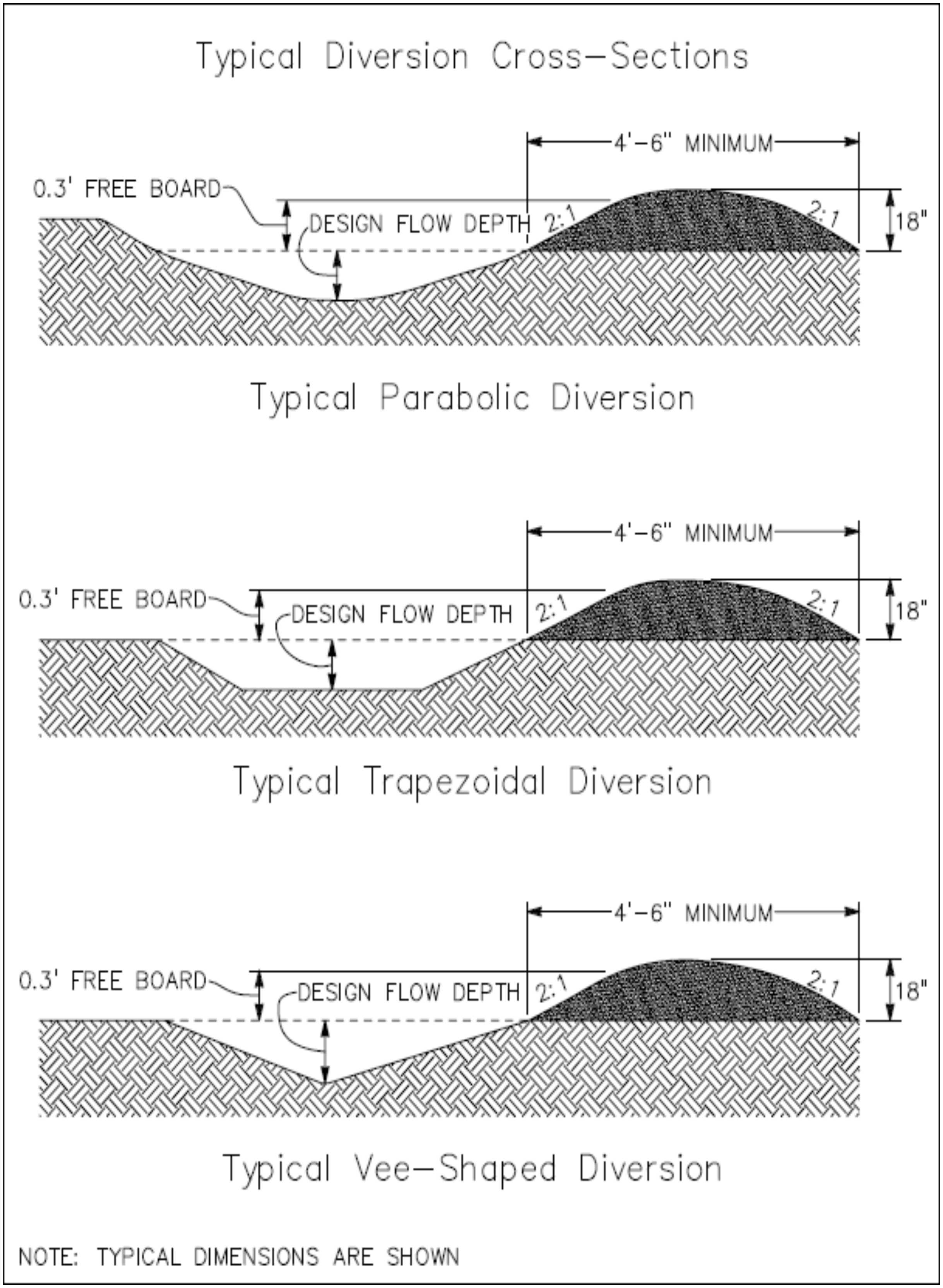


Figure 11 - Diversions.

5 - G. Riprap

Definition
A permanent, erosion-resistant ground cover of large, loose, angular stone.

Purposes
To protect the soil surface from the erosive forces of concentrated runoff.

To slow the velocity of concentrated runoff while enhancing the potential for infiltration. To stabilize slopes with seepage problems and/or non-cohesive soils.

Conditions Where Practice Applies
Wherever the soil conditions, water turbulence and velocity, expected vegetative cover, etc. are such that the soil may erode under the design flow conditions.

Riprap may be used, as appropriate, at storm drain outlets, on channel banks and/or bottoms, roadside ditches, drop structures, at the toe of slopes, etc.

Planning Considerations

Graded vs. Uniform Riprap
Riprap is classified as either graded or uniform. A sample of graded riprap would contain a mixture of stones which vary in size from small to large. A sample of uniform riprap would contain stones which are all close in size.

Graded riprap is cheaper to install, requiring only that the stones be dumped so that they remainin a well-graded mass. Hand or mechanical placement of individual stones may be necessary to achieve the proper thickness and line. Uniform riprap requires placement in a uniform pattern, requiring more hand or mechanical labor.

Riprap sizes can be designated by either the diameter or the weight of the stones. However, it is simpler to specify the diameter of an equivalent size of spherical stone.

Sequence of Construction
Because riprap is used where erosion potential is high, construction must be sequenced so that the riprap is put in place with the minimum possible delay. Disturbance of areas where riprap is to be placed should be undertaken only when final preparation and placement of the riprap can follow immediately behind the initial disturbance. Where riprap is used for outlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that it is in place when the pipe or channel begins to operate.

Gradation

The riprap should be composed of a well graded mixture down to the one-inch size particles such that 50 percent of the mixture by weight should be larger than the d_{50} size as determined from the design procedure. A well graded as used herein is defined as a mixture composed primarily of the larger stone sizes but with a sufficient mixture of other sizes to fill the progressively smaller voids between the stones.

Thickness

The minimum thickness of the riprap layer should be 1.5 times the maximum stone diameter but not less than 6 inches for most applications

Quality of Stone

Stone for riprap should consist of clean or washed field stone or rough unhewn quarry stone of approximately rectangular shape. The stone should be hard and angular and of such quality that it would not disintegrate on exposure to water or weathering, and it should be suitable in all otherrespects for the purpose intended. The specific gravity of the individual stones should be at least 2.5. Riprap stone must not adversely impact water chemistry of streams.

Riprap at Outlets

A stabilized discharge structure must be provided. Design criteria for sizing the stone and determining the dimensions of riprap pads used at the outlets of drainage structures should be based on best engineering practices and comply with any applicable permits. Geotextile shouldbe used as an underlayment between the stone and bare ground.

Riprap for Channel Stabilization

State water pollution control departments require that they be contacted prior to any stream channel disturbance. USACE notification may be required as well.

Riprap for channel stabilization should be designed to be stable for the condition of bank-full flow in the reach of the channel being stabilized. Riprap should extend up the banks of the channel to a height equal to the maximum depth of flow or to a point where vegetation can be established to adequately protect the channel. Placement of riprap is most effective at slopes of 1.5:1 or less.

A filter blanket, of sand, gravel, and/or geo-textile material should be placed between the riprap and the base material.

The riprap size to be used in a channel bend should extend upstream from the point of curvatureand downstream from the point of tangence. The riprap should extend across the bottom and up both sides of the channel.

Where riprap is used only for bank protection and does not extend across the bottom of the channel, riprap should be keyed into the bottom of the channel to a minimum depth equal to the thickness of the layer of riprap, and it should extend across the bottom of the channel the samedistance.

Riprap for Slope Stabilization

Riprap for slope stabilization should be designed so that the natural angle of repose of the stone mixture is greater than the gradient of the slope being stabilized.

Inspection and Maintenance

A riprap installation should require very little maintenance. It should, however, be inspected periodically to determine if high flow events have caused scour beneath the riprap or dislodge any stone. If repairs are needed, they should be done immediately.

5 - H. Access Road and Parking Area Stabilization

Definition
The temporary stabilization of access roads, parking areas, and other on-site vehicle transportation routes with stone immediately after grading in preparation of excessive use.

Purposes
To reduce the erosion of temporary roadbeds caused by construction traffic during wet weather.

To reduce erosion and any re-grading of permanent roadbeds between the time of initial grading and final stabilization.

Conditions Where Practice Applies
Wherever stone-base roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic.

Construction Specifications

Temporary Access Roads and Parking Areas
The goal should be to drain water off the roads as soon as possible within practical and economical limits. Several drainage structures and techniques are available. The type, number, and mix needed are dependent upon topography, length of slope, soil types, equipment usage,and objectives for road use. Locations and types of drainage structures should be identified before road construction begins.

Temporary roads should follow the contour of the natural terrain to the extent possible. Slopes should not exceed ten percent except in very short distances.

Temporary parking areas should be located on naturally flat areas to minimize grading. Grades should be sufficient to provide drainage but should not exceed 4 percent.

Access road corridors should be cleared to a width of 16 feet wide by 12 feet high, to allow passage of transport vehicles and heavy equipment.

Clearing includes removal of limbs, trees, downed timber, snags, and underbrush which obstruct the prescribed corridor, as well as the disposal of any debris.

Access roads should be graded to a width of 16 feet and have a smooth surface and uniform cross section. This item includes the installation of appropriate access road BMPs including but not limited to broad based drainage dips and/or water turnouts.

All cuts and fills should be 2:1 or flatter.

Drainage ditches should be provided as needed and should be designed and constructed to carry anticipated storm flows.

The roadbed or parking surface should be cleared of all vegetation, roots, and other objectionable material.

In select areas, a 3-inch (or more depending on field conditions) layer of clean aggregate should be placed, spread, and shaped on the graded access roads.

In some locations, conditions may warrant the use of geotextile underlayment in conjunction with crushed stoneto increase soil bearing capacity. The geotextile fabric underlayment should be placed and covered with crushed stone in a manner which minimizes tearing (fabric specification: 15 feet wide, woven synthetic, and 8-ounce or more per square yard).

All roadside ditches, cuts, fills, and disturbed areas adjacent to parking areas and roads should be stabilized with appropriate temporary or permanent vegetation.

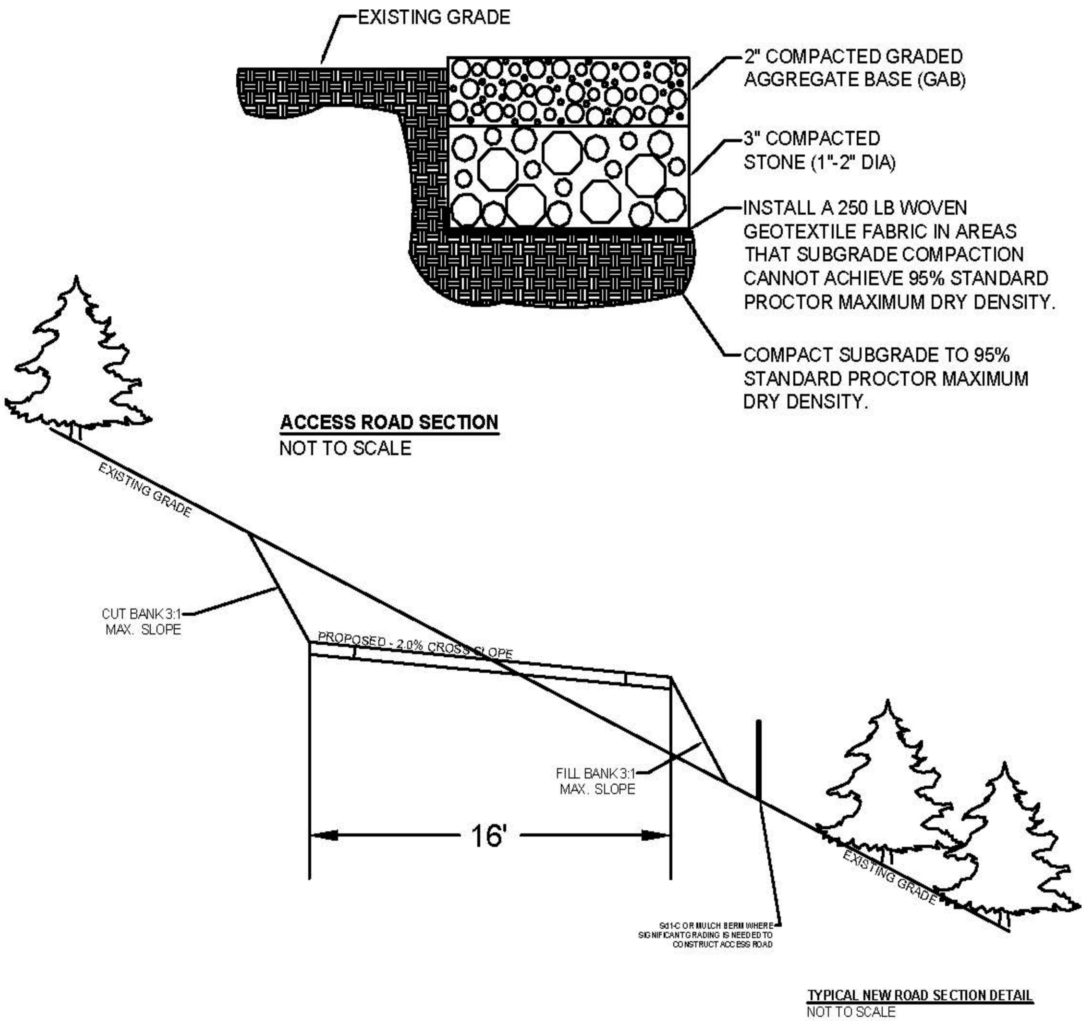
Permanent Roads and Parking Areas
Should be designed and constructed in accordance with applicable state DOT or local criteria except that an initial base course of gravel of at least 6 inches should be applied after grading.

Inspection and Maintenance
Both temporary and permanent roads and parking areas may require periodic top dressing with new gravel.

Seeded areas adjacent to the roads and parking areas should be checked periodically to ensure that a vigorous stand of vegetation is maintained.

Roadside ditches and other drainage structures should be checked regularly to ensure that they do not become clogged with silt or other debris.

Figure 12 - Typical Access Road Construction.



5 - I. Water Turnouts

Definition
A ditch, trench, or waterway that diverts water away from the road and/or side ditch. The turnout is usually formed of on-site soil material. Shape and size vary to meet site-specific needs.

Purpose
To carry water into undisturbed areas and to disperse surface flow to prevent energy build-up.

Conditions Where Practice Applies
Usually, any road or ditch section where water accumulates. Turnouts are used to dissipate water energy, velocity, and volume.

Construction Specifications
A turnout should intersect the ditch line at the same depth and be out sloped 1 to 3 percent.

On sloping roads, a turnout should be 30 to 45 degrees downslope. Turnouts should not empty directly into adjacent drainages or channels of any type.

Inspection and Maintenance
Inspect frequently during on-going operations and immediately following significant rain events to evaluate their effectiveness.

Promptly correct conditions or situations that are ineffective.

5 - J. Water Bars

Definition
A combination "mound-trench" built into an access road and placed on a downslope angle across the travel way. Water bars can provide conditions suitable for natural or artificial vegetative coverand are typically installed after regular use of the road has ended.

Purpose
To intercept and divert surface water off the access road and minimize excessive erosion and/or gullying.

Conditions Where Practice Applies
This practice can be used on road grade where runoff may cause erosion of the exposed soil.Water bars are usually installed after regular use of the road has ended.

Construction Specifications
Water bars should be at an angle of 15 to 30 degrees downslope to turn surface water off the road, depending on the terrain.

The uphill end of the bar should extend into the side ditch line of the road and tie into the bank to fully intercept any ditch flows.

The outlet end of the bar is to be fully open and extend far enough to safely disperse runoff onto an undisturbed area.

Place energy absorbers, such as riprap or a level spreader, at water bar outlets when the potential for gullying is evident.

Table 5: Proper Spacing of Water Bars.

Road Grade (percent slope)	Distance Between Water Bars (feet)
5	135
10	80
15	60
20	45
30	35

Inspection and Maintenance
Inspect water bars after major rainstorms or during inspections until area becomes adequately stabilized.

Promptly correct failing conditions.

5 - K. Broad-based Drainage Dips

Definition
A technique used to form a reverse slope in a road surface with an out sloped cross drain Usually not used on steep roads.

Purpose
To provide cross drainage on flat and in sloped access roads to prevent buildup of excessive surface runoff and subsequent erosion.

Conditions Where Practice Applies
Usually used on access roads having gradient of 12 percent or less. They should not be used for cross draining of spring seeps or intermittent or perennial streams.

Broad-based drainage dips in the road surface are very effective in collecting surface water and directing it safely off the road. This type of structure allows normal truck speed with minimal stress to the vehicle.

Construction Specifications
Install broad-based drainage dips following basic clearing and grading of roadway.

An approximately 20-foot-long, 3 percent reverse grade is formed using cut material from the upper side of the dip.

The bottom of the dip would be out sloped 2 to 3 percent maximum and extend the full width of the roadway. For maximum self-cleaning, angle cross drain 10 to 25 degrees downslope.

An energy absorber such as riprap or a level spreader should be installed at the outlet of the dip to dissipate water velocity ensuring minimal erosion of cast materials.

The dip and reverse grade section may require bedding with 3-inch crushed stone in some soils to stabilize and avoid unacceptable rutting (i.e., grades over 10 percent and/or areas having highly erosive soils).

This structure consists of two planes rather than one unbroken plane. One plane is the 15- to 20-foot reverse grade toward the uphill grade and outlet. The second plane is the long grade from the top of a hump or start of a down grade and ends at the outlet of the dip.

Neither the dip nor the hump should have a sharp, angular break but should be rounded to allow a smooth flow of traffic. Only the dip itself should be out sloped to provide sufficient break in grade to turn the water.

Spacing of broad-based drainage dips may be determined by the following formula:
Spacing in feet - 400 feet + 100 feet * Slope percent

Table 6: Recommended Spacing of Broad-Based Drainage Dips.

Road Grade (percent)	Distance Between Dips (feet)
4	200
5	180
6	165
7	155
8	150
9	145
10	140
12	135

Inspection and Maintenance
During on-going operations, inspect frequently. Check for erosion, rutting, plugging, and general effectiveness.

Correct unacceptable situations promptly.

5 - L. Temporary Stream Crossings

Definition
Temporary stream crossings allow construction or maintenance equipment to cross a stream without negatively impacting the stream. They should be installed anywhere construction activity crosses a stream channel, even when the channel is dry.

Structures may include bridges, round pipes, oval pipes, or pipe arches (Figure 13). Nonstructural is a ford-type crossing (Figure 14).

Purposes
To provide a means for traffic to cross streams without damaging the stream channel or banks or causing flooding.

To keep sediment generated by traffic out of the stream.

To cross waterways with minimal negative impact to the stream.

Conditions Where Practice Applies
When working in Tennessee, refer to TN's Aquatic Resource Alteration Permit (ARAP) requirements. All state and local requirements must be met.

Generally applicable to flowing streams with drainage areas less than one square mile. Non-structural crossings are applicable for streams with maximum bank heights of 5 feet.

Temporary stream crossings are generally applicable to flowing streams with drainage areas less than one square mile. See Table 7 for sizing temporary stream crossings.

Table 7: Pipe Diameters for Stream Crossings.

Drainage Area (Acres)	Average Slope of Watershed			
	1%	4%	8%	16%
1-25	24	24	30	30
26-50	24	30	36	36
51-100	30	36	42	48
101-150	30	42	48	48
151-200	36	42	48	54
201-250	36	48	54	54
251-300	36	48	54	60

301-350	42	48	60	60
351-400	42	54	60	60
401-450	42	54	60	72
451-500	42	54	60	72
501-550	48	60	60	72
551-600	48	60	60	72
601-640	48	60	72	72

Assumptions for determining the table: USDA-SCS Peak Discharge Method; CN = 65; RainfallDepth = 3.5 inches for 2-year frequency storm.

Planning Considerations
Temporary stream crossings are necessary to prevent vehicles and heavy equipment from damaging stream banks and continually tracking sediment and other pollutants into the watercourse. However, these structures are also undesirable in that they represent a channel constriction that can cause flow backups or washouts during periods of high flow. For this reason, the temporary nature of stream crossings is stressed. They should be planned to be inservice for the shortest practical period and to be removed as soon as their function is completed.

Temporary stream crossings greater than 25 feet and permanent crossings will require an ARAP permit in Tennessee. The permit must be in hand before construction of the stream crossing can begin.

Design Criteria
The culvert should be large enough to convey the bank full flow expected from a 2-year, frequency storm without appreciably altering the stream-flow characteristics. Multiple culverts may be used in place of one large culvert if they have the equivalent capacity of the larger oneand should be separated by one-half the pipe diameter or 12 inches, whichever is greater. Theminimum-sized culvert that may be used is 24 inches.

Where culverts are installed, clean crushed stone should be used to form the crossing. The depth of soil cover over the culvert should be equal to 1/2 of the diameter of the culvert or 12 inches, whichever is greater. To protect the sides of the fill from erosion, riprap should be used.

The length of the culvert should be adequate to extend the full width of the crossing, including side slopes.

The slope of the culvert should be at least 0.25 inch per foot.

The culvert should be placed on or as close as possible to the stream bed to prevent impoundment.

The approaches to the structure should consist of stone pads meeting the following specifications:

1. Stone--Class I -- Average 2-4 inches
2. Minimum thickness--6 inches
3. Minimum width equal to the width of the structure
4. Minimum approach lengths--25 feet unless physical or ROW restraints preclude

Keep stream crossings at right angles, if possible. The temporary stream crossing may vary upto 15 degrees from perpendicular with stable banks and channel bottoms.

The invert elevation should be installed on the natural streambed grade to minimize interference with movement of fish and aquatic life.

Construction Specifications

Clearing, grubbing, excavation, and other disturbance to the riparian vegetation of the stream bed and banks should be kept to a minimum.

Fords are "minimum use" crossings where the stream system has an existing or applied firm base. To avoid unacceptable impacts, apply adequate riprap stone or other effective material to crossings to stabilize road banks and stream channel. The final surface of the stone in the bottom of the watercourse should be the same elevation as the watercourse bottom to eliminateany overflow and possible scour problems. Riprap stone must not adversely impact water chemistry of streams.

Geotextile filter fabric cloth should be placed on the streambed and stream banks prior to placement of aggregate. This would prevent migration of soil particles from the subgrade into the graded stone.

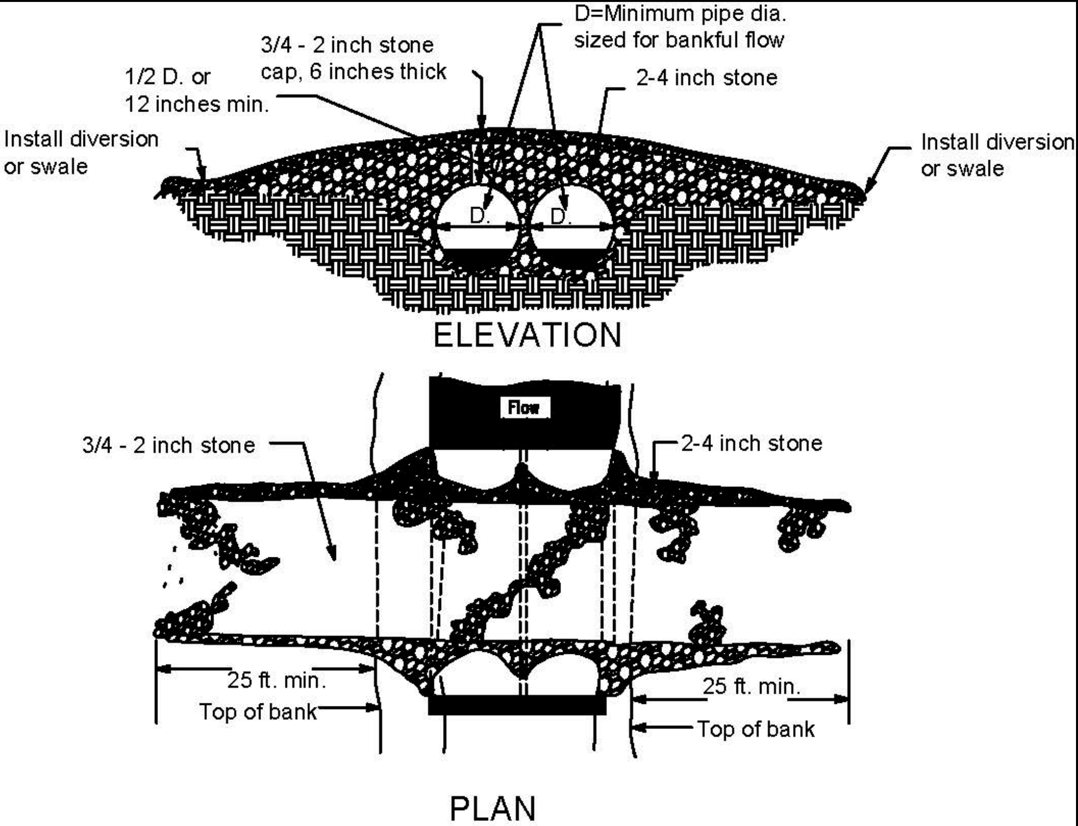
Only clean stone may be used to ensure fines do not pollute the stream.

Inspection and Maintenance

Ford-type crossings require frequent inspections to determine their functional condition. Culverts should be inspected frequently, and all damages repaired immediately.

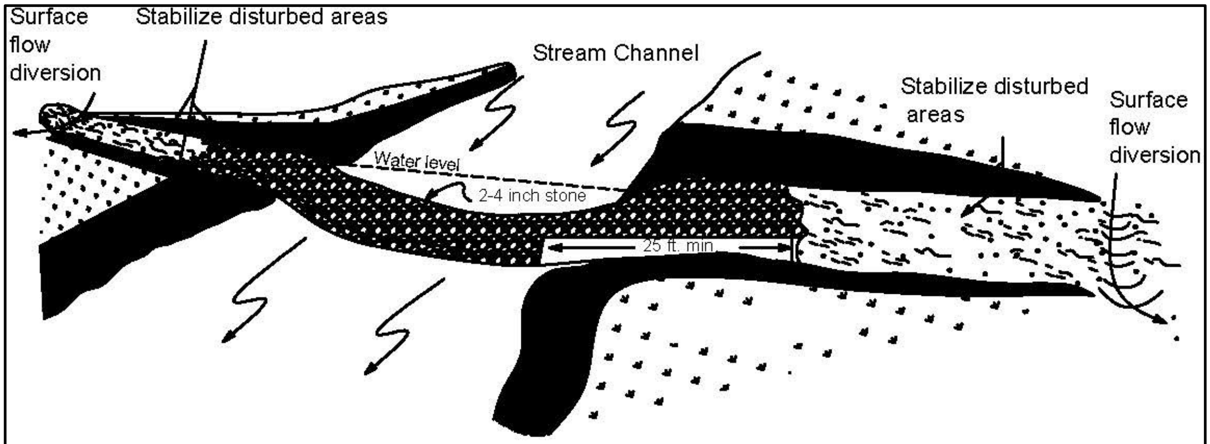
The culverts should be removed after construction is finished, and the streambed and banks must be stabilized and restored to pre-construction conditions.

Figure 13 - Temporary Stream Crossing.



Notes:
1. Not to scale.
2. Typical dimensions are shown.
3. Geotextile may be used under stone placed outside the stream channel.
4. No fines, soils, or other contaminates shall be placed in the stream.
5.Remove upon project completion.
6. Install perpendicular to stream or no more than 15 degree deviation.

Figure 14 - Ford Crossing.



Notes:

1. Not to scale.
2. Typical dimensions are shown.
3. 2-4 inch stone should be used.
4. 25 foot minimum gravel approach to stream.
5. Stone approach section sploe 5:1 max. on road.
6. Install surface flow diversion in road.

5 - M. Culvert

Definition
A conduit installed for the movement or transfer of water.

A culvert may be installed across a flowing watercourse or channel (Figure 13) for use by construction or maintenance traffic or may be installed across a road for crossroad drainage (Figures 15).

Purposes
To provide cross drainage or ditch-to-ditch transfer of surface water.

Conditions Where Practice Applies
When working in Tennessee, refer to TN's Aquatic Resource Alteration Permit (ARAP) requirements. All state and local requirements must be met.

Crossroad drainage is recommended on any road where stormwater runoff, ditch-to-ditch transfer, or overland seepage might create wet areas and erosion.

For cross-drainage culvert sizing, Table 8 may be utilized for temporary drainage structures in drainage areas less than 400 acres.

Table 8: Pipe Culvert Sizing for Access Roads.

Acres Drained	Light Soils			Medium Soils			Heavy Soils		
	Flat 0-5%	Moderate 6 - 15%	Steep +15%	Flat 0-5%	Moderate 6 - 15%	Steep +15%	Flat 0-5%	Moderate 6 - 15%	Steep +15%
2	18 in	18 in	18 in	18 in	18 in	18 in	18 in	18 in	18 in
4	18 in	18 in	18 in	18 in	18 in	18 in	21 in	21 in	21 in
6	18 in	18 in	18 in	18 in	18 in	21 in	21 in	27 in	27 in
8	18 in	18 in	18 in	18 in	18 in	21 in	24 in	27 in	30 in
10	18 in	18 in	18 in	18 in	21 in	24 in	27 in	30 in	36 in
20	18 in	18 in	18 in	21 in	24 in	30 in	30 in	36 in	42 in
30	18 in	18 in	18 in	21 in	27 in	36 in	36 in	42 in	48 in
40	18 in	18 in	18 in	24 in	30 in	36 in	42 in	48 in	54 in
50	18 in	18 in	18 in	27 in	36 in	42 in	42 in	48 in	
60	18 in	18 in	18 in	27 in	36 in	42 in	42 in	54 in	
70	18 in	18 in	18 in	27 in	36 in	42 in	48 in	54 in	
80	18 in	18 in	21 in	30 in	36 in	48 in	48 in		
90	18 in	18 in	21 in	30 in	36 in	48 in	48 in		

100	18 in	18 in	21 in	30 in	42 in	48 in	48 in		
150	18 in	21 in	24 in	36 in	42 in	54 in	54 in		
200	21 in	21 in	27 in	63 in	48 in				
250	21 in	24 in	27 in	42 in	48 in				
300	21 in	27 in	30 in	42 in	54 in				
350	24 in	27 in	30 in	42 in	54 in				
400	24 in	27 in	36 in	48 in					

Temporary structures that must handle flow from larger drainage areas should be designed by an engineer with methods which more accurately define the actual hydrologic and hydraulic parameters.

All permanent structures should also be designed by an engineer and should consider greater frequency storm events to ensure adequate sizing whereas flooding could not cause public harm, environmental and safety hazards, economic damage, etc.

Planning Considerations

The specifications contained in this practice pertain primarily to flow capacity and resistance to washout of the structure. From a safety and utility standpoint, the designer must also be sure that the span can withstand the expected loads from heavy equipment and that the width of the crossing be wide enough for the construction equipment to safely use.

Design Criteria

Pipe culverts are usually installed on access roads at the time of construction and/or maintenance. They are used where access is required by vehicles and/or heavy construction equipment.

Pipe culverts should be long enough so both ends extend beyond the toe of the fill slopes. Culvert sizing is determined by the area to be drained. However, pipe sizes of less than 18 inches in diameter tend to clog easily with floating leaves, twigs, etc. For this reason, cross-drain pipe culverts should be 18 inches or larger.

A culvert should be placed on grade at 2 percent more than the grade of the ditch it drains.

On steep slopes, installation should be skewed 15 to 30 degrees downgrade to provide better entrance conditions at inlet end.

Table 9: Spacing of Pipe Culverts.

Road Gradient, %	Spacing (ft.)
2-5	300-500
6-10	200-300
11-15	100-200
16-20	100

Construction Specifications

Erosion protection may be needed at inlet and outlet ends of the pipe. Where channel scouring and gullying is excessive, riprap stone or other material or techniques may be used to function as an energy absorber.

Earth cover (compacted) over a pipe culvert must be at least 1/2 the pipe diameter but never less than 12 inches.

Raise cross-drain culvert above ground level on the inlet end to allow sediment to settle. Provide a short fall at the outlet end so water would move away from culvert.

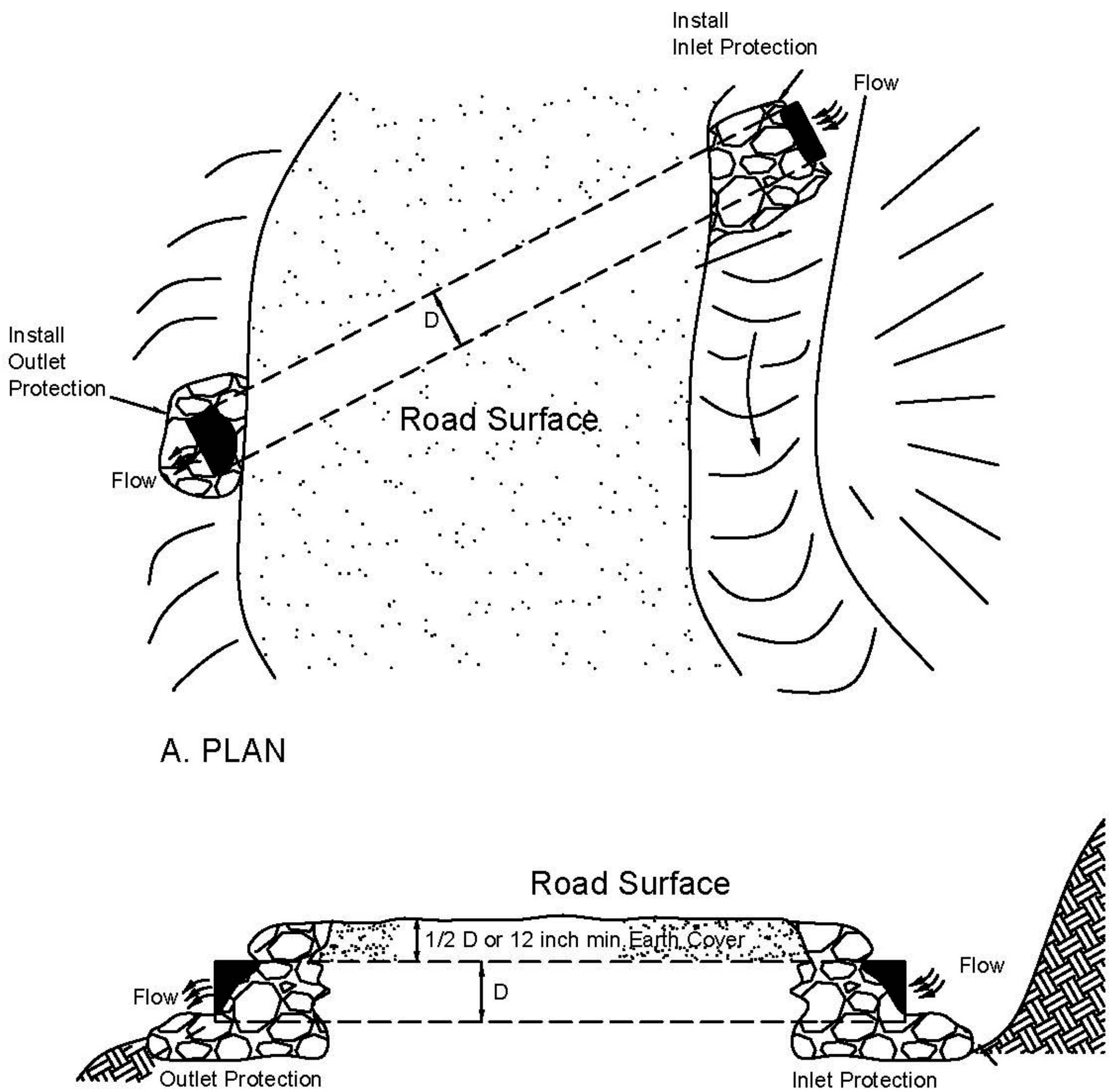
Inspection and Maintenance

Culverts should be inspected frequently for clogging, plugging, collapsed or broken structures, and general effectiveness.

Culverts should be inspected after significant rainfall. Remove debris, trash, and other materials that restrict flow.

Damages or ineffective conditions should be repaired immediately.

Figure 15 - Culvert Installation.



B. CROSS-SECTION

Notes:
1. Not to scale.
2. D= Pipe Diameter.
3. Culvert should cross at 30 degree angle downgrade.
4. Install inlet and outlet protection.
5. Culvert should be placed on approx. 2% grade greater than the ditch it is draining.

5 - N. Construction Entrance/Exit

Definition

A pad of stone at any point where traffic will be leaving a construction site to a public ROW or adjacent to the public ROW.

Purpose

A construction entrance/exit is intended to reduce off-site sedimentation and improve public safety by eliminating the tracking or other movement of sediment onto public ROW.

Setting back a construction entrance/exit may occur if conditions cause a safety concern of installation of larger stone directly abutting a public ROW.

Specifications

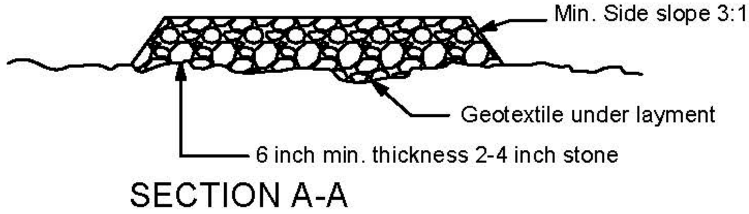
The entrance/exit must be designed using angular stone approximately 2 to 4 inches in diameter. Geotextile filter fabric must be used as an underliner between the soil and the stone. At a minimum, the construction pad must measure 20 feet wide by 50 feet in length with a minimum thickness of 6 inches. The exit can be extended to include an additional section of smaller stone at the paved highway crossing to provide greater traction when entering the paved road. Refer tostate specific guidelines on minimum size of stone as size may vary. (See Figure 16) The stone pad is not required to be directly abutting the public ROW and can be setback as needed. If a setback occurs along a gravel road the stone pad is still required meeting the specs above and installed such that sediment tracking will be minimized.

Inspection and Maintenance

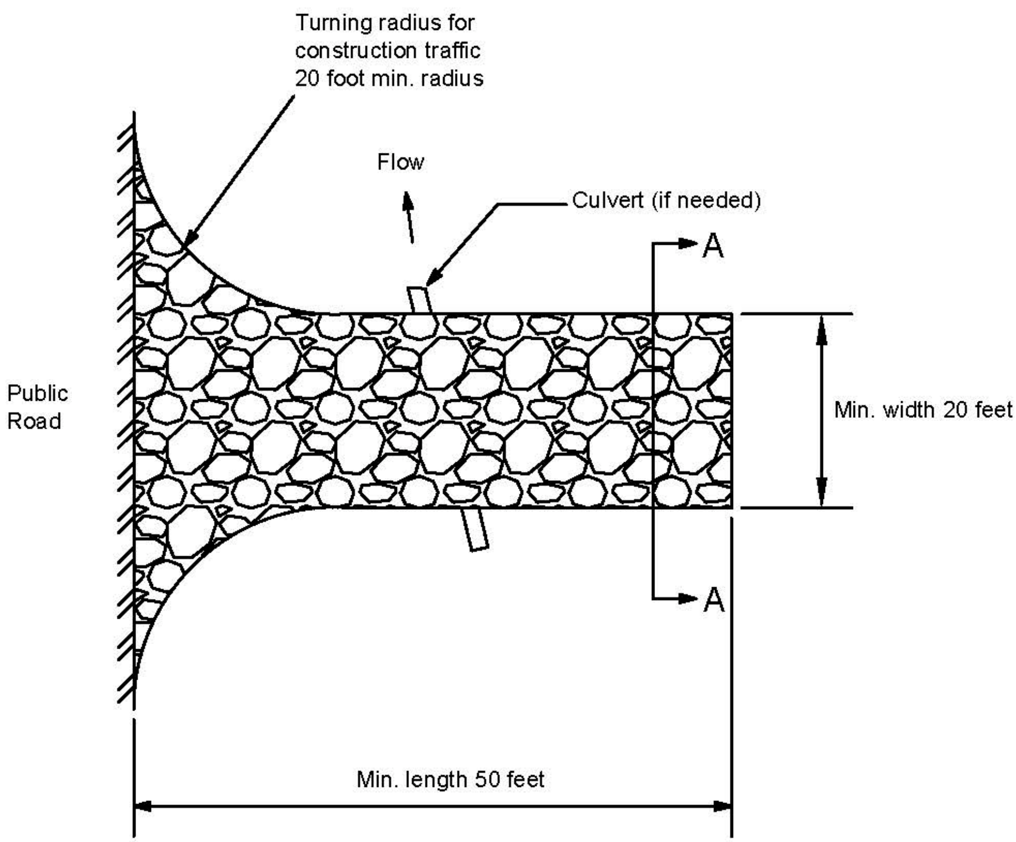
Construction entrances/exits should be inspected regularly, and maintenance should be expected as heavy vehicular traffic decreases its effectiveness.

The entrance/exit should be removed once all project areas have been fully stabilized.

Figure 16 - Construction Entrance/Exit.



Notes:
1. Not to scale.
2. Public road should be claened if any sediment from the construction site reaches the road.
3. Additional stone should be added to the exit as needed.
4.If construction exit slopes more than 2% towards the public road, a berm can be added to prevent runoff from leaving the site.
5. The stone pad is not required to be directly abutting the public road and can be setback as needed for safety reasons.



5- O. Sediment Basin & Temporary Sediment Trap

Definition

A sediment basin is a pond created by excavation and/or construction of an embankment designed to capture and hold construction stormwater runoff. It typically includes a principal spillway, emergency spillway, and other flow control devices such as baffles. The size of the sediment basin would depend on its location, size of the drainage area, local storm event data,etc.

A temporary sediment trap is a small temporary ponding area, formed by constructing an earthen embankment with a gravel outlet, across a drainage swale. Sediment traps are typically used below drainage areas of 5 acres or less and where the sediment trap would be used no longer than 18 months. If conditions warrant a longer time or larger drainage areas, then a permanent sediment basin should be considered (Figure 17).

Purpose

To sufficiently capture and detain construction stormwater runoff to allow sediment to settle to the bottom of the basin/trap while allowing the water to be slowly released.

To protect downstream areas from surges of construction stormwater runoff.

Conditions where practice applies

Sediment basins are often required by state and/or local construction stormwater permits. Referto any applicable permits for site specific requirements.

They could also be used in critical or sensitive areas where other erosion and sediment controlsare not sufficient in retaining sediment on-site.

Appropriate topography and space must be present for sediment basins to be effective.

Design Criteria

Given their ability to hold and release large volumes of water, sediment basins must be designed according to good engineering practices. Sediment Basin design and construction should complywith all local, state, and federal laws and regulations. Refer to state and/or local permits and/or BMP manuals for site specific requirements.

Sediment basins should never be placed in a live stream. They should be located to receive the largest amount of runoff possible from disturbed areas and for clean-out ease oftrapped sediment.

Designers should incorporate features to maximize detention time within the basin. Suggested methods include:

1. Length (distance between the inlet and outlet) to width ratio greater than 2:1
2. Use of baffles or diversions

The stormwater captured in the basin should be released at the water surface where the least turbid water is found. An emergency spillway should be designed and installed according to alarge storm event to prevent embankment failure.

An outlet should be provided to drain the collected stormwater in an erosion-free manner to an existing stabilized area.

Construction Specifications
Areas underneath the sediment basin should be cleared, grubbed, and stripped of topsoil.

The fill material used for embankments should be taken from an approved borrow area. It should be clean soil free of roots, vegetation, rocks, or other perishable or objectionable material.

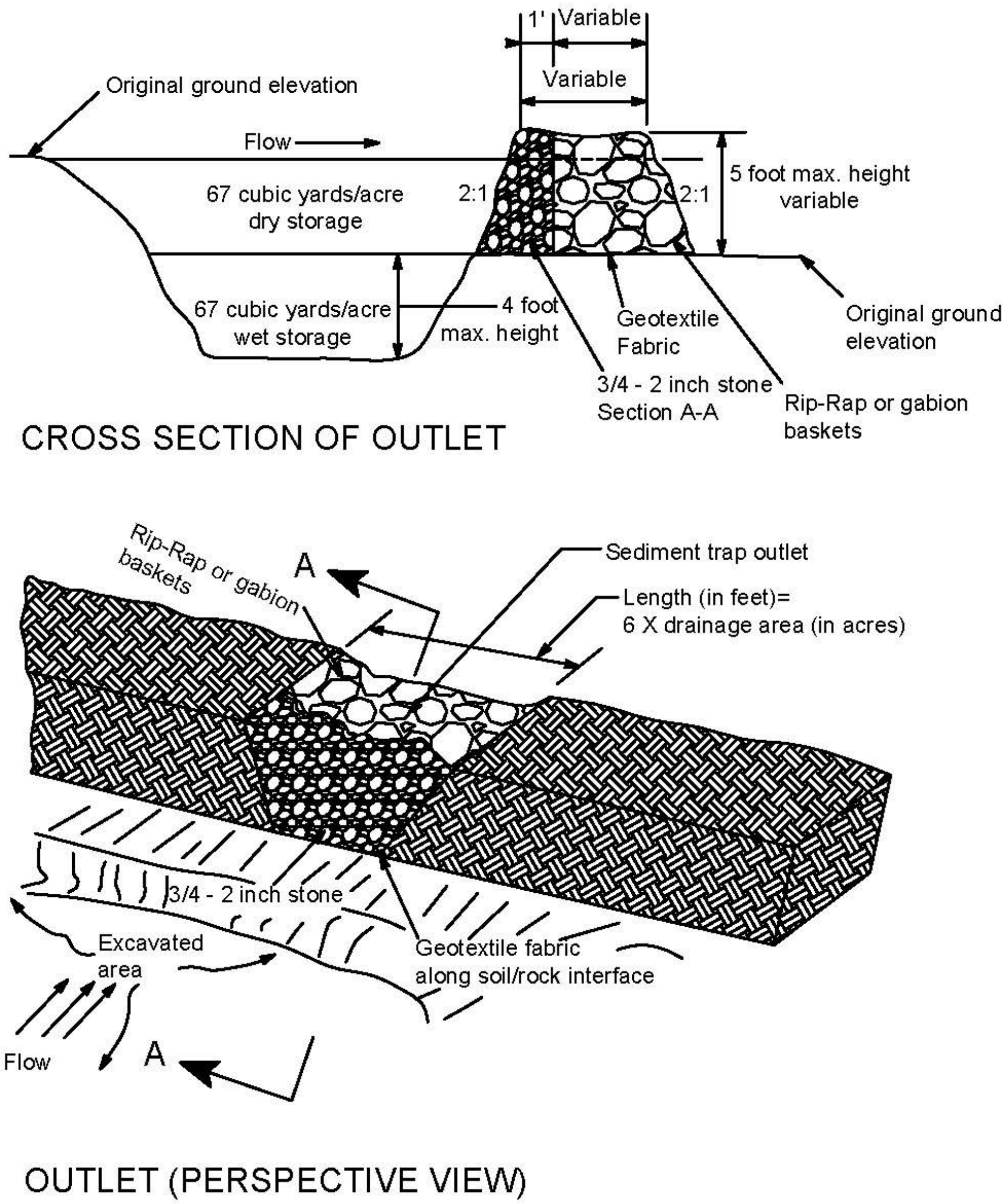
All areas of the sediment basin should be permanently stabilized with vegetation or suitable material (e.g., rock).

State and local requirements should be met concerning fencing, warning signs, and the presence of soft, saturated sediment and flood water.

Inspection and Maintenance
Sediment basins should be inspected to monitor sediment accumulation and to ensure correct operation. Sediment should be removed from the basin and stabilized in an upland area according to approved erosion and sediment control plan.

When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit should be treated according to the approved erosion and sediment control plan.

Figure 17 - Temporary Sediment Trap and Outlet.



Notes:

1. Not to scale
2. A check dams can be installed ahead of trap for velocity reduction as needed.
3. Sediment traps shall not be placed in streams or wetlands.

5 - P. Polyacrylamide (PAM)

Definition
The land application or stormwater application of products containing anionic polyacrylamide (PAM), a chemical agent that binds soil particles together, which reduces erosion in the field and promotes flocculation and sedimentation.

Purpose
Land application of PAM is performed to reduce soil surface erosion due to wind or water forces.PAM can also improve permanent vegetation establishment by acting as a tackifier and soil conditioner.

Stormwater applications of PAM promote settling of fine soil particles and reduce turbidity in sediment basins and enhanced sediment collection upstream of other BMPs (i.e., check dam).

Conditions where practice applies
This practice is not intended for application to surface waters of the state. It should only be usedat construction sites on bare soil areas, constructed stormwater ditches, and/or storm drains which feed into sediment basins or other BMPs.

Use of anionic PAM should comply with all local, state, and federal laws and regulations governing anionic PAM.

Only the anionic form of PAM should be used. Cationic PAM is toxic and should not be used. PAM and PAM mixtures should be environmentally benign, harmless to fish, wildlife, and plants.

Design Criteria
Formal design is not required; however, a qualified professional should design the location and application rates of PAM.

Application rates should follow manufacturer’s guidelines, MSDSs, etc. PAM is available in many forms including emulsions, powders, bars, or logs.

Other BMPs should be designed for use in conjunction with PAM, such as sediment basins, check dams, rock filter dams, etc. These BMPs would provide settling time and area needed tomaximize flocculation and sedimentation.

Construction Specifications
Never add water to PAM as clumping can occur which can clog dispensers, small storm drains,etc. Clumping indicates incomplete dissolving of the PAM which greatly reduces its effectiveness.

Add PAM slowly to water to ensure it dissolves correctly.

Inspection and Maintenance

Areas where PAM is applied should be inspected to ensure PAM is working properly bydissolving into stormwater.

PAM, used in the form of gel bars or logs, should be inspected per manufacturer's recommendations, and replaced when the gel bar or log has fulfilled its useful purpose.

Maintenance includes following the PAM application frequency in the site BMP plan.

Chapter 6 – Seeding and Stabilization Techniques

6 - A. Soil Sampling

Soil pH and fertility can significantly affect the success of re-vegetating disturbed areas. The need for soil sampling would be determined on a project-by-project basis, considering the size of the area of disturbance, and the expected benefit of the sampling.

Since the chemical properties of soil that limit plant establishment and growth vary greatly from site to site, specific recommendations from soil tests are useful for manipulating soil factors and optimizing plant growth.

For soil tests to yield accurate results, soil samples must be representative of the entire area to be revegetated. To accomplish this, a composite soil sample comprised of 15 to 20 sub-samples should be collected for a given site.

To collect a composite sample:

1. Use a spade, auger, or soil probe to obtain a sub-sample from the upper 6 inches of the soil profile.
2. Place the sub-sample in a clean plastic bag or bucket.
3. Discard rocks over ½ inch and large pieces of wood or vegetation.
4. After all sub-samples are collected, mix the contents thoroughly and place in a new plastic bag (Wet samples may be hard to mix adequately.).
5. Label the bag clearly and permanently to identify the collection site.
6. Ship each composite sample to the testing facility.

Composite samples should be collected for each distinct area found throughout a project area. Distinct areas are sections of a project area that “look” similar and can be included in broad categories like wetlands, well drained valley bottoms, steep slopes, rolling hills, and ridge tops. For example, soil fertility and pH may differ drastically between a bottomland field and an adjacent slope so these areas should be sampled separately. A particular transmission line segment can extend for many miles, so sampling everywhere is not feasible, but a few individual composite samples can be collected for each distinct area.

6- B. Seedbed Preparation and Soil Amendments

A suitable seedbed is required for successful seed germination and establishment. A suitable seedbed is comprised of a relatively loose, uncompacted soil with a rough surface that allows seeds to become embedded in approximately the top ½ to 1 inch of the soil profile. A favorable seedbed can be prepared using a variety of implements and techniques that would be chosen based on site conditions, equipment availability, and the discretion of the project supervisor.

Special care should be taken when working near water, all state and local requirements should be met.

To prepare a seed bed, it is essential that operators

1. Scarify, disk, or otherwise loosen heavily compacted soils prior to seeding.
2. Ensure the soil surface is adequately roughened to provide suitable environment for seedling germination and growth.

Soil amendments like lime and fertilizer should be applied at rates that are consistent with soil test results, but, since incorporating amendments into the top few inches of the soil is often advantageous, applications can be made during or immediately following seed bed preparation. On very steep slopes vulnerable to erosion, amendments can be applied to the soil surface only.For small, disturbed areas where soil test data was not obtained, the general recommendations below can be used (Table 10).

Table 10: Application rate for common soil amendments.

Amendment	Large areas of disturbance	Smaller areas of disturbance
Lime	Use soil test results	2-3 tons/ac OR 90 - 140 lbs./ 1000 $ft.^2$
15-15-15 (Temporary Cover)	Use soil test results	300 lbs./ac OR 7 lbs./1000 $ft.^2$
6-12-12 (Permanent Cover)	Use soil test results	1,000 lbs./ac OR 23 lbs./1000 $ft.^2$

6 - C. Mulching

Mulch can be applied to disturbed land to reduce erosion, maintain soil moisture, moderate soil temperature, and to promote seed germination. Mulching can be used in conjunction with seeding or as a standalone method to provide temporary cover. Mulch should be anchored witha tackifier, disk, or other mechanical implement.

Table 11: Application rate for straw mulch on disturbed lands.

Mulching Method	Surface Cover Requirements	Approximate Application Rate
Straw Mulch (with seed)	75%	1.5 - 2 tons/ac. OR 70- 90 lbs./1000 $ft.^2$
Straw Mulch (without seed)	95%	2.5 - 3 tons/ac. OR 115 - 160 lbs./1000 $ft.^2$

6 - D. Erosion Control Blankets and Netting

On steep slopes and areas with heavy surface water runoff conditions, erosion control blankets or mats are effective in providing temporary erosion control during the critical seedling establishment period. Several types and grades of blankets are available. Blankets are usually made with wood excelsior, straw, or coconut fibers. The mulch material is generally held togetherwith a plastic or nylon mesh netting and/or cotton thread and is manufactured in rolls. Consult state and local BMP manuals for specific application requirements in each state.

General Installation Practices
Roll blankets directly up or down the slope, not across, overlapping the seams at each joint. Install pins or anchors according to manufacturer's specifications

6 - E. Seeding Temporary Vegetation

Fast-growing, temporary vegetation can be seeded on a disturbed site to reduce erosion when it is not possible or appropriate to establish permanent vegetation. For instance, if additional work is planned for a disturbed site but the work would not occur for several months, seeding temporary vegetation may be a good option. Also, if work concludes on a disturbed site in a season unsuitable for establishing permanent vegetation, establishing a cover of annual vegetation can hold a site until perennial species can be planted. See seed listings in Appendices A and B.

Consider the season when the planting would occur as some species perform better than othersat different times of year.

Price and purchase quality seed sold on a pure live seed (PLS) basis.

Ensure good seed/soil contact by covering broadcast seed by raking or chain dragging if necessary.

Coordinate planting of the annual species with seeding of permanent vegetation. Inspect plantings to ensure sufficient cover is achieved. Replant if needed.

6 - F. Seeding Permanent Vegetation

Actively establishing permanent vegetation is necessary for sites where the soil profile has been extensively disturbed. Annual species grow quickly and prevent erosion in the short-term, but these species do not persist for more than one growing season. For this reason, seed mixtures comprised of fast-growing annual species and long-lived perennial species are used to permanently re-vegetate disturbed sites. See seed listings in Appendices A and B.

Consider the season when the planting would occur as some species perform better than others at different times of year.

Price and purchase quality seed sold on a pure live seed (PLS) basis.

Disk or mow before seeding if a dense stand of temporary vegetation was established separately from permanent seeding.

Inoculate legume seed according to product specification prior to planting.

Ensure good seed/soil contact by covering broadcast seed by raking or chain dragging if necessary.

Inspect planting to ensure sufficient cover is achieved. Replant if needed.

6 - G. Noxious Weeds and Non-native Invasive Species

EO 13112 as amended by 13751 serves to prevent the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that non-native invasive species cause. As a federal agency, it is TVA's responsibility to comply withEO 13751 and EO 13112.

TVA should, to the extent practicable

1. Prevent the introduction of invasive species.
2. Detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner.
3. Monitor invasive species populations accurately and reliably.
4. Provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

Practical application of this executive order would be determined on a case-by-case basis, takinginto consideration each projects parameters, the feasibility of success and practicality of implementation of the EO. Any BMP used to prevent the spread of an invasive species would be listed as a commitment in the NEPA review for the project.

Chapter 7 – Literature Cited

Muncy, J. A. 1992. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities*. Prepared for Tennessee Valley Authority. Norris: Tennessee Valley Authority, TechnicalNote TVA/LR/NRM 92/1.

Muncy, J. A. 1999. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (revised edition). Edited by Chris Austin, Chris Brewster, Alicia Lewis, Kenton Smithson, Tina Broyles, and Tom Wojtalik. Chattanooga: Tennessee Valley Authority.

Muncy, J. A. 2012. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (revised edition). Edited by A. Bowen, et al. Chattanooga: Tennessee Valley Authority.

Muncy, J. A. 2017. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (revised edition). Edited by R. Wilson, et al. Chattanooga: Tennessee Valley Authority.

Tennessee Valley Authority. 2016. Tennessee Valley Authority, Transmission, RelatedGuidelines and Specifications. Chattanooga, TN. Retrieved from:
<https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.)

Appendix A – Recommended Seeding Tables

* Seed selection can be altered due to site conditions or special property restrictions.

Standard Seed Table

	Temporary Cover (lbs./per acre)			Permanent Cover (lbs./per acre)				
	Pick two from below			Use two grasses, Clover, and Oats or Millet				
January	**Wheat**	**Rye Grass**	**Barley**	Do not attempt Permanent Cover				
	75	15	75					
February	**Wheat**	**Oats**	**Barley**	**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
	75	75	75	10	10	3	2	25
March	Use Permanent Cover unless re-grading is anticipated			**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
				10	10	3	2	25
April				**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
				10	10	3	2	25
May	**Buckwheat**	**Millet**	**Sudan Grass**	**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Millet**
	25	10	20	10	10	3	2	5
June	**Buckwheat**	**Millet**	**Sudan Grass**	Do not attempt Permanent Cover				
	25	10	20					
July	**Buckwheat**	**Millet**	**Sudan Grass**					
	25	10	20					
August	**Buckwheat**	**Millet**	**Sudan Grass**	**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Millet**
	25	10	20	10	10	3	2	5
September	Use Permanent Cover unless re-grading is anticipated			**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
				10	10	3	2	25
October				**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
				10	10	3	2	25
November	**Wheat**	**Oats**	**Barley**	**Orchard Grass**	**Tall Fescue**	**Red Top**	**White/Red Clover**	**Oats**
	75	75	75	10	10	3	2	25
December	**Wheat**	**Rye Grass**	**Barley**	Do not attempt Permanent Cover				
	75	15	75					

Native Seed Table

Common Name	Botanical Name	PLS lbs./ac
Native Warm Season Grasses		
Switchgrass	Panicum virgatum	5
Indian Grass	Sorghastrum nutans	1
Big Bluestem	Andropogon gerardii	1
Little Bluestem	Schizachyrium	2.25
Purple Top	Tridens flavus	0.75
Virginia Wild Rye	Elymus virginicus	2.25
Fall Panicum	Panicum anceps	0.75
Side Oats Grama	Bouteloua curtipendula	1
Native Forbs		
Partridge Pea	Cassia fasciculata	0.63
Blackeyed Susan	Rudbeckia hirta	0.31
Showy Tickseed	Bidens aristosa	0.38
Tall Goldenrod	Solidago altissima	0.125
Rigid Goldenrod	Solidago rigida	0.125
Ragweed	Ambrosia artemisiifolia	0.5
Illinois Bundleflower	Desmanthus illinoensis	0.25
Cool Season Annual Nurse Crops		
Spring Oats	Avena sativa	10
Annual Rye Grass	Lolium multiflorum	4
Warm Season Annual Nurse Crops		
Annual Rye Grass	Lolium multiflorum	4
Brown Top Millet	Panicum ramosum	5

Planting Notes

1. Cool season planting period: October 1 -November 30 and February 1- April 15
2. Warm season planting period: April 15 – July 1
3. DO NOT ATTEMPT NATIVE SEEDING BETWEEN JULY 1 – SEPTEMBER 30
4. Prior to broadcasting seed, scarify the soil surface.
5. After broadcast seeding, compact the soil surface.
6. Species selection and proportions are based on the following criteria:
    a. Suppression of woody growth.
    b. Establishment of permanent vegetation.
    c. Ecological benefits.

* Deviation from this seed mix may undermine one or more of these goals. Consult with TVA Project Environmental Planning staff prior to making field planting changes.

Appendix B. - Non-Native, Non-Invasive Species List

Species suitable for public use areas, erosion control/stabilization and wildlife habitat plantingsfor compliance with EO 13122 as amended by 13751 on Invasive Species

KY 31 AND OTHER FESCUES - for dam reservations, public use areas, and other facilities; transmission line construction stabilization where fescue is currently present as forage or lawngrasses, or when landowners request it. Not to be used in wildlife plantings or in agricultural license areas.

ZOYSIA VARIETIES - for dam reservations, public use areas, and other facilities.

BERMUDAGRASS - for dam reservations, public use areas, and other facilities.

ANNUAL RYEGRASS - suitable for all sites.

FOXTAIL, BROWNTOP AND JAPANESE MILLETS - suitable for all sites.

BUCKWHEAT - suitable for wildlife plantings.

WINTER WHEAT - suitable for wildlife plantings.

OATS - suitable for wildlife plantings.

ORCHARDGRASS - suitable for all sites.

PERENNIAL RYEGRASS - suitable for all sites.

REDTOP - suitable for all sites.

RYE - suitable for all sites.

TIMOTHY - suitable for all sites.

WEEPING LOVEGRASS - for erosion control use only.

CRIMSON, RED AND LADINO CLOVERS - suitable for all sites.

SOYBEANS - suitable for wildlife plantings.

SORGHUM-MILO - suitable for wildlife plantings.

Appendix C – Definitions

2-year, 24-hour storm event means the maximum 24-hour precipitation event with a probable recurrence interval of once in two years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed there from.

Agricultural Land means cropland, grassland, rangeland, pasture, and other agricultural land, on which agricultural and forest related products or livestock are produced, and resource concerns may be addressed. Agricultural lands include cropped woodlands, marshes, incidental areas included in the agricultural operations, and other types of agricultural land used for the product of livestock.

Best Management Practices (BMP) means implementation and continued maintenance of appropriate structural and non-structural practices and management strategies to prevent and minimize the introduction of pollutants to stormwater and to treat stormwater to remove pollutants prior to discharge.

Borrow Area "Pit" means the activity of removing material (soil, gravel, sand) from one area to use in another area. For the purposes of this manual, this activity is solely in conjunction with theproject requesting permit coverage and not to be sold for profit. The borrow area and associated activity will open and close with the project requesting permit coverage.

Construction means any land disturbance or discharges of pollutants associated with, or the result of building, excavation, land clearing, grubbing, placement of fill, grading, blasting, reclamation, areas in which construction materials are stored in association with a land disturbance or handled above ground, and other associated areas including, but not limited to, construction site vehicle parking, equipment or supply storage areas, material stockpiles, temporary office areas, and access roads. Construction also means significant pre-constructionland disturbance activities performed in support or in advance of construction activity including,but not limited to, land clearing, excavation, removal of existing buildings, dewatering, and geological testing.

Construction Activity means the disturbance of soils associated with clearing, grading, excavating, filling of land, or other similar activities which may result in soil erosion. Construction activity does not include agricultural and silvicultural practices.

Construction Site means any site regardless of size where construction or construction associated activity has commenced, or is continuing, and associated areas, including sites where active work is suspended or has ceased, until the activity is completed and effective reclamation and/or stormwater quality remediation has been achieved.

Construction Waste means construction and land disturbance generated materials, including but not limited to, waste chemicals, sediment, trash, debris, litter, garbage, construction demolition debris, land clearing and logging slash or other materials or pollutants located or buried at the site prior to disturbance activity or that is generated at a construction site.

Control Measure refers to any Best Management Practice or other method used to prevent or reduce the discharge of pollutants to waters of the State.

CWA means the Clean Water Act (formerly referred to as the Federal Water Pollution ControlAct or Federal Water Pollution Control Act Amendments of 1972).

Discharge means the addition, introduction, leaking, spilling, or emitting of any sewage, industrial waste, pollutant, or other waste into waters of the state.

DOT refers to Department of Transportation

EPA refers to the U.S. Environmental Protection Agency.

Ephemeral Stream means a stream or portion of a stream which typically flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is always above the groundwater reservoir. They are also known as wet weather conveyances or “WWCs”.

EMS refers to the TVA Environmental Management System.

FERC refers to the Federal Energy Regulatory Commission.

Final Stabilization means the application and establishment of the permanent ground cover (vegetative, pavements of erosion resistant hard or soft material or impervious structures) planned for the site to permanently eliminate soil erosion to the maximum extent practicable. Established vegetation will be considered final if 100% of the soil surface is uniformly covered inpermanent vegetation with a density of 70% (TN, MS, GA) or 85% (AL) or greater. Permanent vegetation shall consist of; planted trees, shrubs, perennial vines; an agricultural or a perennial crop of vegetation appropriate for the region.

Hydric Soils means soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor growth and regeneration of hydrophytic vegetation.

Hydrophytic Vegetation means the community of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to influence plant occurrence.

Intermittent Stream means a stream where portions flow continuously only at certain times of the year. At low flow there may be dry segments alternating with flowing segments.

Maximum extent practicable (MEP) means full implementation and regular maintenance of available industry standard technology and effective management practices designed to prevent and/or minimize discharges of pollutants and ensure protection of groundwater and surface water quality.

Minor Land Disturbing Activities means activities which will result in minor soil erosion such as home gardens or individual home landscaping, repairs, maintenance work, fences, routine maintenance, and other related activities.

MS4 refers to Municipal Separate Storm Sewer Systems.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking, and reissuing, terminating, monitoring, and enforcing permits for the discharge of pollutants into waters of the state.

Natural Buffer (Riparian buffer) means a strip of dense undisturbed perennial native vegetation, either original or re-established, that borders streams and rivers, ponds and lakes, and wetlands. Buffer zones are established for the purposes of slowing water runoff, enhancing water infiltration, and minimizing the risk of any potential nutrients or pollutants from leaving the upland area and reaching surface waters. Buffer zones are most effective when stormwater runoff is flowing into and through the buffer zone as shallow sheet flow, rather than in concentrated flow from areas such as in stream channels, gullies, ditches, or ephemeral streams.Buffer zones are established for the primary purpose of protecting water quality and maintaining a healthy aquatic ecosystem in receiving waters.

NEPA refers to the National Environmental Policy Act.

Nephelometric Turbidity Unit or NTU means a numerical unit of measure based upon photometric analytical techniques for measuring the light scattered by fine particles of asubstance in suspension.

Non-stormwater Discharges means discharges that do not originate from storm events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, sanitary wastes, concrete washout water, paint wash water, irrigation water, or pipe testing water.

NOI means Notice of Intent.

NRCS refers to the Natural Resource Conservation Service.

NWPL refers to the National Wetland Plant List.

Outfall means the location where stormwater in a discernible, confined, and discrete conveyance, leaves a facility or construction site or, if there is receiving water on site, becomes a point source discharging into that receiving water.

Perennial Stream means a stream or portion of a stream that flows year-round, is considered a permanent stream, and for which base flow is maintained by groundwater discharge to the streambed due to the groundwater elevation adjacent to the stream typically being higher than the elevation of the streambed.

Receiving Stream means the “waters” receiving a “discharge” from a “point source”.

ROW refers to Right-of-Way.

SDS refers to Safety Data Sheets. Formerly Material Safety Data Sheets (MSDS).

Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

Site means the land or water area where any facility or activity for which coverage under this permit is required is physically located or conducted, including adjacent land use in connection with the facility or activity.

SMZ refers to Streamside Management Zone.

Stormwater means runoff, accumulated precipitation, process water, and other wastewater generated directly or indirectly because of construction activity, the operation of a construction management site, including but not limited to, precipitation, up gradient or offsite water that cannot be diverted away from the site, and wash down water associated with normal construction activities.

SPCC refers to Spill Prevention Control and Countermeasure Plan.

SWPPP refers to Stormwater Pollution Prevention Plan.

Steep Slope means a slope of 15% or greater.

Tackifier means a bonding or adhesive agent that is used for hydraulic seeding and keeping hay or straw mulch in place during restoration.

Temporary Stabilization means the application and establishment of temporary ground cover(vegetative, pavements of erosion resistant hard or soft materials or impervious structures) for the purpose of temporarily reducing raindrop impact and sheet erosion in areas where final stabilization cannot be established due to project phasing, seasonal limitations, or other project related restrictions.

TVA refers to the Tennessee Valley Authority.

Waters means all waters of any river, stream, watercourse, pond, lake, coastal, ground or surface water, wholly or partially within the State, natural or artificial. This does not include waters which are entirely confined and retained completely upon the property of a single individual, partnership, or corporation unless such waters are used in interstate commerce.

Wet weather conveyance (also sometimes identified as WWC) for the purpose of this document equates to an ephemeral stream.

USACE refers to the U.S. Army Corps of Engineers.

USFWS refers to the U.S. Fish and Wildlife Service.

Appendix O – Tennessee Valley Authority Site Clearing and Grading Specifications

Tennessee Valley Authority Site Clearing and Grading Specifications

1. **General** - The project manager with the clearing and/or grading contractor(s) shall review the environmental evaluation documents for the project or proposed activity (categorical exclusion checklist, environmental assessment, or environmental impact statement) along with all clearing and construction appendices, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, open burning or demolition notification requirements, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and storm water management practices as outlined in TVA's best management practices (BMPs) manual. The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible. BMPs shall be installed before general site clearing or grading, with progressive stabilization BMPs applied from the perimeter toward the interior work areas as grading is completed. Any stabilized area that must be disturbed in subsequent steps shall have temporary BMPs installed until work is completed and the area is restabilized.

   If the contractor fails to use BMPs or to follow environmental expectations discussed in the prebid, prework meeting or present in contract specifications, TVA will order corrective changes and additional work, as deemed necessary in TVA's judgment, to meet the intent of environmental laws and regulations or other guidelines. Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other remedial action is taken at the contractor's expense. Penalty clauses may be invoked as appropriate.

2. **Regulations** - The clearing contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances, including without limitation, all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances. He or she shall secure, or ensure that TVA has secured, all necessary permits and authorizations and made all appropriate notifications to conduct work on the acres shown on the drawings and plan and profile for the contract. The contractor's designated project manager will actively seek to prevent, control, monitor, and safely abate all commonly recognized forms of workplace and environmental pollution. Permits or authorizations and any necessary certifications of trained employees knowledgeable of environmental requirements shall be documented with copies submitted to TVA's project manager or project environmental person before work begins. The contractor and subcontractors will be responsible for meeting all conditions specified in permits. Permit conditions shall be reviewed in prework discussions.

3. **Land and Landscape Preservation** - The contractor shall exercise care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible in areas not to be developed for buildings, structures, or foundations. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material shall be placed to prevent erosion and sedimentation of water bodies or conveyances to surface water or groundwater. The

placement of erosion/sediment controls shall begin at the perimeter and work progressively to the interior of the site. Repeated work in an area will require establishment of a ground cover immediately after each disturbance is completed. In areas outside the clearing, borrow, fill, or use and access areas, the natural vegetation shall be protected from damage. The contractor and his or her employees and subcontractors must not deviate from delineated access routes or use areas and must enter the site(s) at designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones shall be observed by modifying the methods of clearing or reclearing, grading, borrow, or fill so that the buffer and sensitive area are protected. Some areas may require planting native low-growing plants or grasses to meet the criteria of regulatory agencies, executive orders, or commitments to special program interests.

4. **Streamside Management Zones** - The clearing and/or grading contractor(s) must leave as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. In such streamside management zones (SMZs), tall-growing tree species (trees that would interfere with TVA's National Electrical Safety Code clearances) shall be cut, and the stumps may be treated to prevent resprouting. Low-growing trees identified by TVA as marginal electrical clearance problems may be cut and then the stump treated with growth regulators to allow low, slow-growing canopy development and active root growth. Only approved herbicides shall be used, and herbicide application shall be conducted by certified applicators from the Transmission Operations and Maintenance (TOM) organization after initial clearing and construction. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment, such as a feller-buncher. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Disturbed soils in SMZs must be stabilized by appropriate methods immediately after the access or site is cleared. Stabilization must occur within the time frame specified in applicable storm water permits or regulations. Stumps within SMZs may be cut close to the ground but must not be removed or uprooted. Trees, limbs, and debris shall be prevented from falling into water bodies or immediately removed from streams, ditches, ponds, and wet areas using methods that will minimize dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at locations designated by TVA after the application of appropriate erosion-control BMPs and consistent with permit conditions or regulatory requirements.

5. **Wetlands** - In forested wetlands, tall trees will be cut near the ground, leaving stumps and roots in place. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision will be situationally made based on existing ground cover, wetland type, and tree species, since tall tree removal may "release" understory species and allow them to quickly grow to "electrical clearance problem" heights. In many circumstances, herbicides labeled for water and wetland use may

be used in reclearing. At substation, switching stations, and communications sites, wetlands are avoided unless there is no feasible alternative.

6. **Sensitive Area Preservation** - If prehistoric or historic artifacts or features that might be of archaeological or historical significance are discovered during clearing, grading, borrow, or fill operations, the activity shall immediately cease within a 100-foot radius, and a TVA project manager, a project environmental person, and the TVA Cultural Resources program manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program. Work may continue beyond the finding zone and the 100-foot radius beyond its perimeter.

7. **Water Quality Control** - The contractor's clearing, grading, borrow and fill, and/or disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainageways, surface waters, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body. Open burning debris shall be kept away from streams and ditches and shall be incorporated into the soil. Only materials allowed to be burned under an open burning permit may be incorporated into the soil.

   The clearing and grading contractor(s) and subcontractors will erect and (when TVA or contract construction personnel are unable) maintain BMPs, such as silt fences, on steep slopes and adjacent to any steam, wetland, or other water body. BMPs will be inspected by the environmental technician or other designated TVA, or contractor personnel routinely and at least as frequently as required by the permit or good management practices and during periods of high runoff; any necessary repairs will be made as soon as practicable. BMP runoff sampling will be conducted in accordance with permit requirements. Records of all inspections and sampling will be maintained on site, and copies of inspection forms and sampling results will be forwarded to the project environmental person.

8. **Turbidity and Blocking of Streams** - If temporary clearing, grading, borrow, or fill activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls shall be provided to avoid erosion and siltation of streams and other water bodies or water conveyances. In Tennessee, conditions of an Aquatic Resource Alteration Permit shall be met. Turbidity levels in receiving waters or at storm water discharge points shall be monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps shall be installed as soon as practicable after initial access, site, borrow, fill, or right-of-way disturbance and after sequential disturbance of stabilized areas due to stepwise construction requirement in accordance with applicable permit or regulatory requirements.

   On rights-of-way, mechanized equipment shall not be operated in flowing water except when approved and then only to construct necessary stream crossings under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA design or construction access road standards. At any construction site, material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies shall be removed immediately. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained for stream or wetland crossings.

9. **Air Quality Control** - The clearing or grading contractor shall take appropriate actions to limit the amount of air emissions created by clearing and disposal operations to be well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land, crops, dwellings, highways, or people. If building renovation or demolition is involved, the required air quality organization shall be notified the minimum 10 days in advance, and if the start date is delayed, re-notified to start the clock again.

10. **Dust and Mud Control** - Clearing, grading, borrow, fill, or transport activities shall be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

11. **Burning** - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be temporarily stopped by TVA's ROW forester or project environmental person. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

12. **Smoke and Odors** - The contractor will properly store and handle combustible and volatile materials that could create objectionable smoke, odor, or fumes. The contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

13. **Vehicle Exhaust Emissions** - The contractor shall maintain and operate equipment in a manner that limits vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturer's recommended limits and tolerances. Excessive exhaust gases will be eliminated, and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

14. **Vehicle Servicing** - Routine maintenance of vehicles will not be performed on the site, right-of-way, or access route. However, if emergency or “have to” situations arise, minimal/temporary maintenance to vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Some heavy equipment may have to be serviced on the right-of-way,

site, or access route, except in designated sensitive areas. The clearing, grading, borrow, or fill contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the project environmental person or project manager will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

15. **Noise Control** - The contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the site and adjacent property owners. Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

16. **Noise Suppression** - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

17. **Sanitation** - A designated representative of TVA or the clearing, grading, borrow, fill, or construction contractor shall contract a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party and at each construction step. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

18. **Refuse Disposal** - The clearing, grading, borrow, fill, or construction contractor and subcontractor(s) shall be responsible for daily cleanup and proper labeling, storage, and disposal of all refuse and debris on the site produced by his or her operations and employees. Facilities that meet applicable regulations and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used. Records of waste generation shall be maintained for a site and shall be provided to the project environmental person assigned to the project.

19. **Brush and Timber Disposal (Initial Clearing)** - For initial clearing, trees are commonly part of the contractor's contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood, or they may be chipped or stacked and burned. All such activities must be coordinated with the TVA ROW forester or project environmental person and the open burning permits; notifications and regulatory requirements must be met. On rights-of-way, trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way, site, or access. Trees that have been cut may not be left on a substation, switching station, or communications site.

20. **Restoration of Site** - All disturbed areas, except for farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's ROW forester or project environmental person specify a different method:

   A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

   B. If needed, appropriate soil amendments will be added.

   C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line, site, or communications facilities construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor with emphasis on using landscaping materials provided in guidelines for low maintenance native vegetation use.

   D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

   E. Vegetation designated by the Federal Invasive Species Council must be eliminated at the work site, and equipment being transported from location to location must be inspected to ensure removal and destruction of live material.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

This page intentionally left blank

Appendix P – Tennessee Valley Authority Substation Lighting Guidelines

Tennessee Valley Authority
Substation Lighting Guidelines

For Greenfield Sites

Permanent substation lighting should be a two-stage design. Stage 1 is operated dusk to dawn for fixtures at higher mounting heights, more than 12 feet above the ground, and Stage 2 is switch-controlled for low mounting heights at 12 feet and below.

Stage 1 will be continuous nighttime lighting turned on with a photocell and designed to meet minimum requirements for safety and security. The general purpose of Stage 1 lighting is to light the ground and general area to the fence. Designing Stage 1 continuous lighting should follow Illuminating Engineering Society of North America (IESNA) RP-33-99 recommended practices for maximum lighting at the fence and past the fence, except where National Electrical Safety Code (NESC) requirements supersede these guidelines for safety reasons or *Federal Register* requirements supersede these guidelines for spill-containment facilities. Stage 1 lighting fixtures mounted at an elevation above 12 feet should be the cutoff or full-cutoff type to reduce off-site glare.

The Stage 2 lighting will be provided for temporary operational needs and will only be turned on when required. Stage 2 lighting is intended to provide visibility of substation structures and devices, to operate switches, and to perform tasks. Design of Stage 2 lighting should follow NESC and IESNA RP-7-01 recommended practices for task lighting.

Substation structures should be utilized for mounting Stage 1 and Stage 2 lighting fixtures wherever feasible. Lighting fixtures should be mounted at the minimum elevation required to provide coverage dictated by the required vertical and horizontal light levels and uniformity. Lights may be mounted above an elevation of 40 feet when required for security reasons, such as cameras, or lighting of objects taller than 40 feet.

For Minor Modifications to Existing Facilities

Additional lighting required for substation modifications will follow the basic existing lighting design. To the degree possible, substation structures should be utilized to mount light fixtures. Lighting fixtures may be mounted at an elevation above 40 feet when required for site coverage, security reasons, such as cameras, or lighting of objects taller than 40 feet. All substation lights mounted at an elevation above 12 feet should be cutoff or full-cutoff type, such that no light is emitted from the fixture at lateral angles above 90 degrees (above the horizontal plane) to reduce off-site glare, unless the light is required for operational needs, such as the operation of a disconnect switch mounted at a higher elevation. To the extent possible, lighting additions should follow *Federal Register*, NESC, IESNA RP-7-01, and IESNA RP-33-99 recommended practices for lighting.

The Stage 1 and Stage 2 lighting approach will not be considered for minor modifications because of the difficulty in rearranging wiring circuits for lighting power supply and control. These changes are more appropriately addressed when major modifications are made.

(For major modifications to existing substations, consideration should be given to implement lighting policies for greenfield sites. This can be determined during site visits and project scoping.)

General Design Issues and Design Principle Definitions

- A Good Neighbor. Most of the design constraints are summed up by this principle. Thoughtful consideration of the neighbors is critical to the success of the design.

- Luminaire Optical Properties. Four designations are used for the light control of outdoor lighting fixtures: Full Cutoff (0 percent, <10 percent), Cutoff (<2.5 percent, <10 percent), Semicutoff (<5 percent, < 20 percent), and Noncutoff. These are in terms of a percentage of the lamp's intensity lateral to the fixture and at an angle 10 degrees below the horizontal plane.

- Light Levels. Light levels are determined for both horizontal and vertical surfaces by the appropriate standards. Principally American National Standards Institute (ANSI)/IESNA RP-7-01, IESNA RP-33-99, IESNA *Lighting Handbook,* 9th Edition, 2000, blue pages Safety/Security-1, IESNA G-1-03, and the NESC, Section 111.A, should be considered.

- Neighboring Property Uses. The lighting design shall consider ways to reduce light trespass in directions where neighbors are known to exist through light fixture placement and control of the fixture light output.

- Design Standards. Design standards are general engineering guides to proper application of lighting equipment to achieve lighting levels consistent with their recommended standards. Primary design standards are listed under the "Light Levels" definition.

- Physical Security Survey. If warranted, specific lighting needs can be determined through the process outlined in IESNA G-1-03, Annex B, with measurements according to Annex C.

- Television Surveillance. If required, television surveillance provides lighting compatible with the needs of camera visibility, which may or may not enhance human visibility.

- Mounting Heights. Mounting height is a key factor in determining the uniformity or evenness of the light level. For substations, mounting heights are defined as Stage 1 or Stage 2 for high and low under "Mounting Locations." Generally, mounting heights provide good uniformity on the ground or structure when lights are spaced a distance two times the mounting height or lateral distance. Aboveground structures will have decreased uniformity by the same ratio unless this design geometry is considered. For example, lights at a 12-foot mounting height typically provide uniform coverage on the ground 24 feet wide. Spacing between fixtures of 48 feet would provide good uniformity on the ground. When lighting vertical structures, the distance to the light affects the uniformity in the same way.

- Mounting Locations. Low mounting heights are defined as 12 feet and below and high mounting heights are above 12 feet.

- Terrain. Nuisance glare and light trespass are also a function of the substation height above or below the average local terrain, including land contours and vegetation height. Terrain can shield fixtures and reduce lighting control requirements.

- Temporary Lighting Systems. Systems designed for outages and limited to portable systems should have no restrictions due to their temporary nature.

- Permanent Lighting Systems. These systems require the most care due to their persistent effect on the neighbors.

- New Construction Greenfield Sites. These sites have a higher level of care due to the clean slate available to accommodate good lighting design.

- Minor Substation Modifications. Small modifications include substation component replacement and expansions of less than 50 percent of the substation capacity. Following the existing lighting design pattern in these cases is acceptable practice to expand the lighting system coverage.

- Extensive Substation Modifications. Extensive modifications involve site voltages or expansions of more than 50 percent capacity. Lighting should be evaluated by design engineers to determine feasibility of using the design approaches of new construction greenfield sites.

- Safety. Wherever unsafe conditions are present, in the judgment of design engineers, additional lighting is warranted.

References

IESNA G-1-03, *Guideline on Security Lighting for People, Property, and Public Spaces*

IESNA *Lighting Handbook,* 9th Edition, 2000, blue pages Safety/Security-1

IESNA RP-7-01, *Recommended Practice for Lighting Industrial Facilities*

IESNA RP-33-99, *Recommended Practice for Lighting for Exterior Environments*

NESC, Institute of Electrical and Electronic Engineers (IEEE), *ANSI/IEEE C2-2007*, 2007 Edition

May 2008 Revision

This page intentionally left blank

Appendix Q – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Substation or Communications Construction

Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Substation or Communications Construction

1. **General** – Tennessee Valley Authority (TVA) and/or the assigned contractor and subcontractors shall plan, coordinate, and conduct his or her operations in a manner that protects the quality of the environment and complies with TVA's environmental expectations discussed in the preconstruction meeting (including clearing and grading or reclearing and removal or dismantling). This specification contains provisions that shall be considered in all TVA and contract construction, dismantling, or forensic operations. If the contractor and his or her subcontractors fail to operate within the intent of these requirements, TVA will direct changes to operating procedures. Continued violation will result in a work suspension until correction or remedial action is taken by the contractor. Penalties and contract termination will be used as appropriate. The costs of complying with the Environmental Quality Protection Specifications are incidental to the contract work, and no additional compensation will be allowed. At all site perimeters, structure, foundation, conduit, grounding, fence, drainage ways, etc., appropriate protective measures to prevent erosion or release of contaminants will be taken immediately upon the end of each step in a construction, dismantling, or forensic sequence, and those protective measures will be inspected and maintained throughout the construction and site stabilization and rehabilitation period.

2. **Regulations** - TVA and/or the assigned contractor and subcontractor(s) shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances related to environmental protection and prevention, control, and abatement of all forms of pollution.

3. **Use Areas** - TVA and/or the assigned contractor and/or subcontractor(s) use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas. The construction contractor and subcontractor(s) shall submit plans and drawings for their location and development to the TVA engineer and project manager for approval. Secondary containment will be provided for fuel and petroleum product storage pursuant to 29CFR1910.106(D)(6)(iii) (OSHA).

4. **Equipment** - All major equipment and proposed methods of operation shall be subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way, access routes, site, or structure, pole, or tower sites will not be permitted without permission of the TVA environmental technician or ROW forester. Heavy equipment use on steep slopes (greater than 20 percent) and in wet areas will be held to the minimum necessary to construct the transmission or communication facility. Steps will be taken to limit ground disturbance caused by heavy equipment usage, and erosion and sediment controls will be instituted on disturbed areas in accordance with state requirements and best management practices (BMPs).

   No subsurface ground-disturbing equipment or stump-removal equipment will be used by construction forces except on access roads or at the actual site, structure, pole, or tower sites, where only footing locations and controlled runoff diversions shall be created that disturb the

soil. All other areas of ground cover or in-place stumps and roots shall remain in place. (Note: Tracked vehicles disturb surface layer of the ground due to size and function.) Some disking of the right-of-way, access, and site(s) may occur for proper seedbed preparation.
Unless ponding previously occurred (i.e., existing low-lying areas), water should not be allowed to pond on the site or around structures except around foundation holes; the water must be directed away from the site in as dispersed a manner as possible. At tower or structure sites, some means of upslope interruption of potential overland flow and diversion around the footings should be provided as the first step in construction-site preparation. If leveling is necessary, it must be implemented by means that provide for continuous gentle, controlled, overland flow or percolation. A good grass cover, straw, gravel, or other protection of the surface must be maintained. Steps taken to prevent increases in the moisture content of the in-situ soils will be beneficial both during construction and over the service life of any anchor, foundation, or its structure.

5. **Sanitation** - A designated TVA or contractor and/or subcontractor(s) representative shall contract a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

6. **Refuse Disposal** - Designated TVA and/or contractor and subcontractor(s) personnel shall be responsible for daily inspection, cleanup, and proper labeling, storage, and disposal of all refuse and debris produced by his or her operations and by his or her employees. Suitable refuse collecting facilities will be required. Only state-approved disposal areas shall be used. Disposal containers such as dumpsters or roll-off containers shall be obtained from a proper waste disposal contractor. Solid, special, construction/demolition, and hazardous wastes as well as scrap are part of the potential refuse generated and must be properly managed with emphasis on reuse, recycle, or possible give away, as appropriate, before they are handled as wastes. Records of the amounts generated shall be provided to the sites or project's designated environmental person. Contractor(s) and subcontractor(s) must meet similar provisions on any project contracted by TVA. Final debris, refuse, product, and material removal is the responsibility of the contractor unless special written agreement is made with the ultimate TVA owner of the site.

7. **Landscape Preservation** - TVA and its contractor(s) and subcontractor(s) shall exercise care to preserve the natural landscape in the entire construction, dismantling, or forensic area as well as use areas, in or outside the right-of-way, and on or adjacent to access roads. Construction operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural vegetation and surroundings in the vicinity of the work.

8. **Sensitive Areas Preservation** - Certain areas on site and along the access and/or right-of-way may be designated by the specifications or TVA personnel as environmentally sensitive. These areas include but are not limited to areas classified as erodible, geologically sensitive, scenic, historical and archaeological, fish and wildlife refuges, endangered species' habitat, water supply watersheds, and public recreational areas such as parks and monuments. Contractors, their subcontractor(s), and TVA construction crews shall take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include suspension of work or change of operations during periods of rain or heavy public use; hours may be restricted, or concentrations of noisy equipment may have to be dispersed. If prehistoric or historic artifacts or features are encountered during clearing, grading, borrow, fill, construction, dismantling, or forensic operations, the operations shall immediately cease for at least 100 feet in each direction, and TVA's construction superintendent, project manager, project environmental person, and TVA Cultural Resources Program shall be notified. The site shall be left as found until a significance determination is made. Work may continue elsewhere beyond the 100-foot perimeter.

9. **Water Quality Control** - TVA and contractor construction, dismantling, or forensic activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing caves, sinkholes, streams, dry watercourses, lakes, ponds, and underground water sources.

   The clearing contractor erected erosion and/or sedimentation control shall be maintained and (when TVA or contract construction personnel are unable) the construction crew(s) shall maintain BMPs such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. Additional BMPs may be required for areas of disturbance created by construction activities and at sequential steps of construction at the same location on site. BMPs will be inspected by the TVA ROW forester or other designated TVA or contractor and/or subcontractor(s) personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections and any required sampling will be conducted in accordance with permit requirements. Records of all inspections and sampling results will be maintained on site, and copies of inspection forms and sampling results will be forwarded to the TVA project manager or project environmental person.

   Acceptable measures for disposal of waste oil from vehicles and equipment shall be followed. No waste oil shall be disposed of within the site, access, or right-of-way, on a related construction site or its access roads.

10. **Turbidity and Blocking of Streams** - Construction, dismantling, or forensic activities in or near streamside management zones or other bodies of water shall be controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. **All conditions** of a general storm water permit, aquatic resource alteration permit, or a site-specific permit **shall be met** including monitoring of turbidity in receiving streams and/or storm water discharges and implementation of appropriate erosion and sediment control measures.

Appropriate drainage facilities for temporary construction, dismantling, or forensic activities interrupting natural site drainage shall be provided to avoid erosion. Watercourses shall not be blocked or diverted unless required by the specifications or the TVA engineer. Diversions shall be made in accordance with TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022).

On rights-of-way, mechanized equipment shall not be operated in flowing or standing water bodies except when approved and then, only to construct crossings or to perform required construction under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses, their adjacent wetlands, or within stream bank areas where it could be washed away by high stream flows. Appropriate U.S. Army Corps of Engineers' and state permits shall be obtained.

Mechanized equipment shall not be operated in flowing or standing water on substation, switching station, or telecommunication sites.

Wastewater from construction, dismantling, or dewatering operations shall be controlled to prevent excessive erosion or turbidity in a stream, wetland, lake, pond or conveyed to a sinkhole. Any work or placing of equipment within a flowing or dry watercourse requires the prior approval of TVA.

11. **Floodplain Evaluation** - During the planning and design phase of the substation or communications facility, floodplain information should be obtained to avoid locating flood-damageable facilities in the 100-year floodplain. If the preferred site is located within a floodplain area, alternative sites must be evaluated, and documentation prepared to support a determination of "no practicable alternative" to siting in the floodplain. In addition, steps taken to minimize adverse floodplain impacts should also be documented.

12. **Clearing** - No construction, dismantling, or forensic activities may clear additional site or right-of-way vegetation or disturb remaining retained vegetation, stumps, or regrowth at locations other than the structure, substation, or communication site or access thereto. TVA and the construction, dismantling, or forensic contractor(s) must provide appropriate erosion or sediment controls for areas they have disturbed after each disturbance that have previously been restabilized after clearing operations. Control measures shall be implemented as soon as practicable after disturbance in accordance with applicable federal, state, and/or local storm water regulations.

13. **Restoration of Site** - All construction, dismantling, or forensic-related disturbed areas except for farmland under cultivation and any other areas as may be designated by TVA's specifications shall be stabilized in the following manner unless the property owner and permit preparer specify a different method:

A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

B. If needed, appropriate soil amendments will be added.

C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (TVA, 2022). Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

D. Rehabilitation species shall use species designated by federal guidance that are low–maintenance, native species appropriate for the site conditions that prevail at that location.

E. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

F. The site must be protected from species designated by the federal Invasive Species Council and must not be the source of species that can be transported to other locations via equipment contaminated with viable materials; thus, the equipment must be inspected, and any such species' material found must be removed and destroyed prior to transport to another location.

14. **Air Quality Control** - Construction, dismantling, and/or forensic crews shall take appropriate actions to minimize the amount of air pollution created by their operations. All operations must be conducted in a manner that avoids creating a nuisance and prevents damage to lands, crops, dwellings, or persons.

15. **Burning** - Before conducting any open burning operations, the contractor and subcontractor(s) shall obtain permits or provide notifications as required to state forestry offices and/or local fire departments. Burning operations must comply with the requirements of state and local air pollution control and fire authorities and will only be allowed in approved locations and during appropriate hours and weather conditions. If weather conditions such as wind direction or speed change rapidly, the contractor's burning operations may be temporarily stopped by the

TVA ROW forester. The debris for burning shall be piled and shall be kept as clean and as dry as possible, then burned in such a manner as to reduce smoke. No materials other than dry wood shall be open burned. The ash and debris shall be buried away from streams or other water sources and shall be in areas coordinated with the property owner on rights-of-way or project manager for TVA sites.

16. **RENOVATION OR DEMOLITION DEBRIS MAY NOT BE BURNED.**

17. **Dust and Mud Control** - Construction, dismantling, or forensic activities shall be conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used subject to TVA's approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

18. **Vehicle Exhaust Emissions** - TVA and/or the contractor(s) and subcontractor(s) shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles that show excessive emissions of exhaust gasses and particulates due to poor engine adjustments or other inefficient operating conditions shall not be operated until corrective repairs or adjustments are made.

19. **Vehicle Servicing** - Routine maintenance of personal vehicles will not be performed on the right-of-way or access route to the site. However, if emergency or “have to” situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the site except adjacent to or in designated sensitive areas. The Heavy Equipment Department within TVA or the construction, dismantling, or forensic contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the project environmental person will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Records of amounts generated shall be provided to TVA. Equipment shall not be temporarily stored in stream floodplains whether overnight or on weekends or holidays.

20. **Smoke and Odors** - TVA and/or the contractor(s) and subcontractor(s) shall properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The contractor and subcontractor(s) shall not burn refuse such as trash, rags, tires, plastics, or other debris.

21. **Noise Control** - TVA and/or the contractor and subcontractor(s) shall take measures to avoid the creation of noise levels that are considered nuisances, safety, or health hazards. Critical areas including but not limited to residential areas, parks, public use areas, and some ranching operations will require special considerations. TVA's criteria for determining corrective measures shall be determined by comparing the noise level of the construction, dismantling, or forensic operation to the background noise levels. In addition, especially noisy equipment such

as helicopters, pile drivers, air hammers, chippers, chain saws, or areas for machine shops, staging, assembly, or blasting may require corrective actions when required by TVA.

22. **Noise Suppression** - All internal combustion engines shall be properly equipped with mufflers as required by the Department of Labor's Safety and Health Regulations for Construction. TVA may require spark arresters in addition to mufflers on some engines. Air compressors and other noisy equipment may require sound-reducing enclosures in some circumstances.

23. **Damages** - The movement of construction, dismantling, or forensic crews and equipment shall be conducted in a manner that causes as little intrusion and damage as possible to crops, orchards, woods, wetlands, and other property features and vegetation. The contractor and subcontractor(s) will be responsible for erosion damage caused by his or her actions and employees and, especially, for creating conditions that would threaten the stability of the right-of-way or site soil, the structures, or access to either. When property owners prefer the correction of ground cover condition or soil and subsoil problems themselves, the section of the project to be handled shall be documented with an implementation schedule and a property owner signature obtained.

24. **Final Site Cleanup and Inspection** - The contractor's designated person shall ensure that all construction, dismantling, or forensic-related debris, products, materials, and wastes are properly handled, labeled as required, and removed from the site. Upon completion of those activities, that person and a TVA-designated person shall walk down the site and complete an approval inspection.

References

Tennessee Valley Authority. 2022. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities, Revision 4*. Edited by S.T. Benefield, R.L. Brannon, J.C. Buttram, B.V. Dalton, G.D. Dalton, C.A. Henley, W.G. Martin, A.E. Masters, C.L. Phillips, C.A. Suttles, and R.C Wilson. Chattanooga, TN. Retrieved from <https://www.tva.com/Energy/Transmission-System/Transmission-System-Projects> (n.d.).

Revised August 2022

This page intentionally left blank