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

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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. To date, 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 has increased in recent years. White-nose syndrome (WNS) has killed more than six million bats since 2007. WNS affects 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 10 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 WNS surveillance monitoring, gray bat population censusing, cave protection, habitat improvement, 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.

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Symbols, Acronyms, and Abbreviations

ARPA	Archaeological Resources Protection Agency
AST	Aboveground storage tank
ATV	All-terrain vehicle
BA	Biological Assessment
BMP	Best Management Practice
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

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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 nine million people in this seven-state region of the mid-south.

TVA's daily goals are to work safely, work more efficiently, deliver better service to its stakeholders, and strive for continuous improvement. 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 sodalist (*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). To date, TVA actions with the potential to affect federally listed bat species have been addressed on a project-specific basis, which is time-consuming, resource intensive, can result in uncertainties in schedule and cost, and may not provide significant conservation benefits.

Factors influencing TVA's programmatic approach:

- TVA actions routinely involve the need for the removal of trees.
- White-nose syndrome (WNS) has affected 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 10 years and has subsequently lead 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 virtually all of its revenues from sales of electricity. In addition to operating and investing its revenues in its electric system, TVA provides flood control, navigation and land management (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 2008 Environmental Policy (TVA 2008), 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 Integrated Resource Plan

TVA's 2015 Integrated Resource Plan (IRP) guides TVA's generation planning to meet long-term energy needs of the TVA region (TVA 2015). 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 clean energy and minimize environmental impacts from its operations.

- TVA's goal is to meet future power demand by identifying the need for generating capacity and determining the best mix of resources to meet the need on a least-cost, system-wide basis.
- 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.

1.2.4 TVA Natural Resource Plan

TVA's Natural Resource Plan (NRP) was developed in 2011 in 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. Updates to the NRP currently are underway; any necessary changes resulting from this consultation would be incorporated into the updated NRP. 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.

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.

1.2.5 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).

1.2.6 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.

1.2.7 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 and Virginia big-eared bat, and the federally listed as threatened northern long-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. Since then, TVA has met and communicated with the SE and Midwest Regional USFWS Offices, and Ecological Service (ES) Field Offices (FO) of TN, NC, KY, AL, MS, GA, and VA. 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 will prepare 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.
- 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.

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
June 16, 2017	Email, postal correspondence	TVA staff, staff in SE and NE Regional offices and ES FO	Submission of BA

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

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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 all of the 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.

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 9 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 154 individual LPCs, 52 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. 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 2011).

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 NRP (TVA 2011), 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.

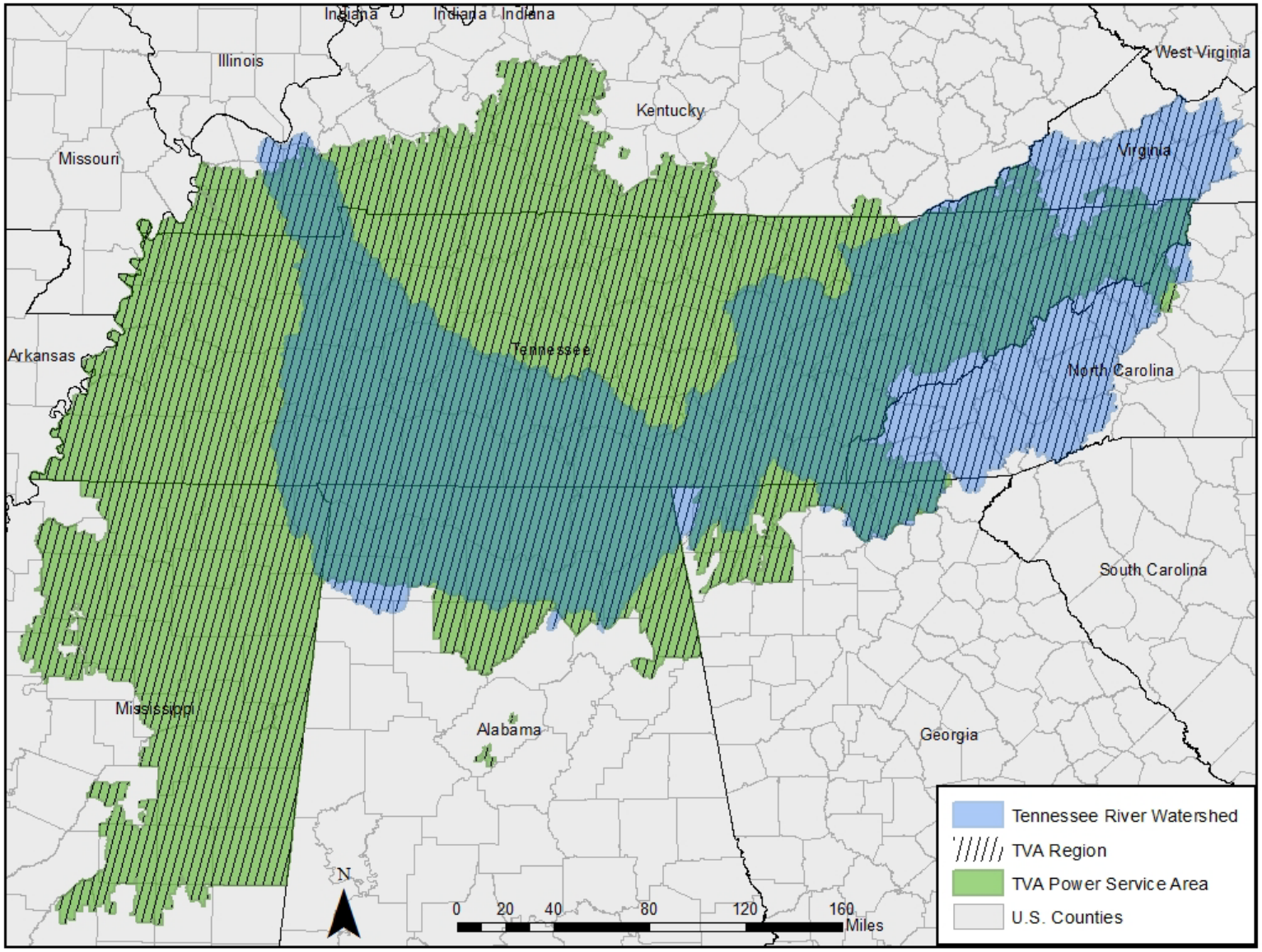

Figure 2-1. The Tennessee Valley Authority Region is Composed of the Tennessee River Watershed and Tennessee Valley Authority Power Service Area Combined

Table 2-1. 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 Resource Plan (TVA 2011).
[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). 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:

- Water use facilities, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space and non-potable water intakes,
- 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

TVA maintains 237,300 ac of existing TL ROW easements throughout its PSA. TVA estimates that 23,800 ac of new ROW will 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).

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 Renewable Program for Solar Projects

TVA currently 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 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 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. It is anticipated that most of the future solar development will be mid-scale projects (50-kilovolts [kV] and greater). Solar projects associated with TVA's Renewable Program have the potential to occur across the TVA region and likely will range from generating 50-kV to 2 MW.

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 2011).

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).

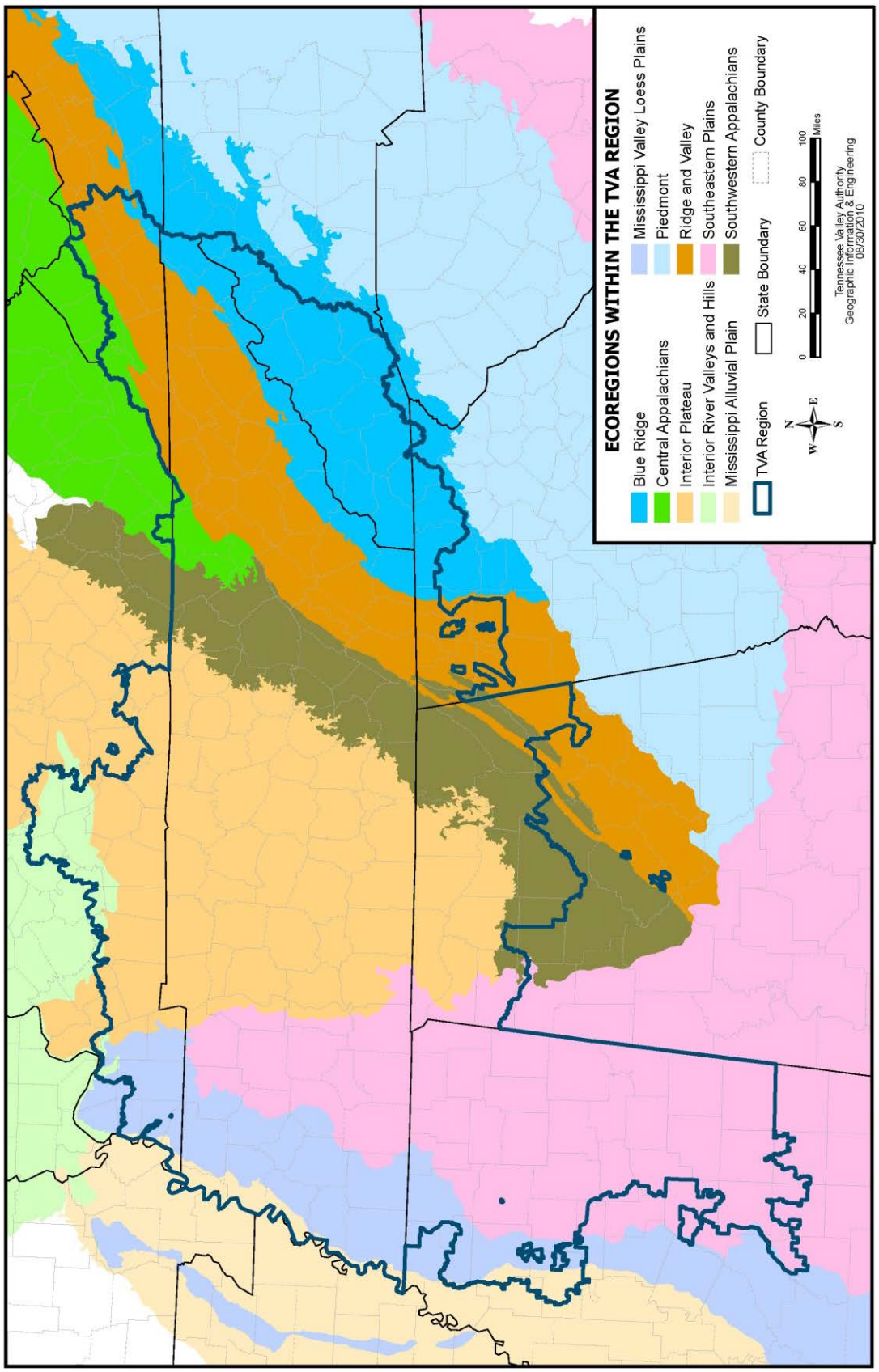

Figure 2-2. Ecoregions Within the TVA Region. Adapted from Omernik (1987)

Table 2-2. 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.

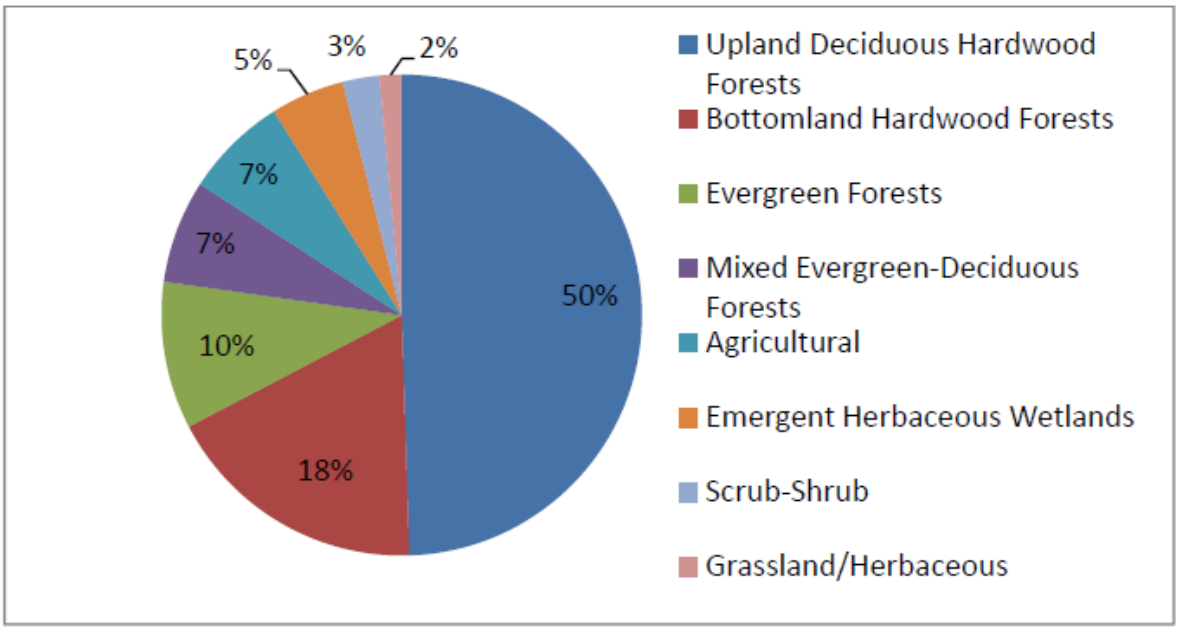

Figure 2-3. Vegetation Types on TVA Zone 3 and Zone 4 Reservoir Lands by Percent of Land Cover

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 2011).

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 2-3. 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 2-4. 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.

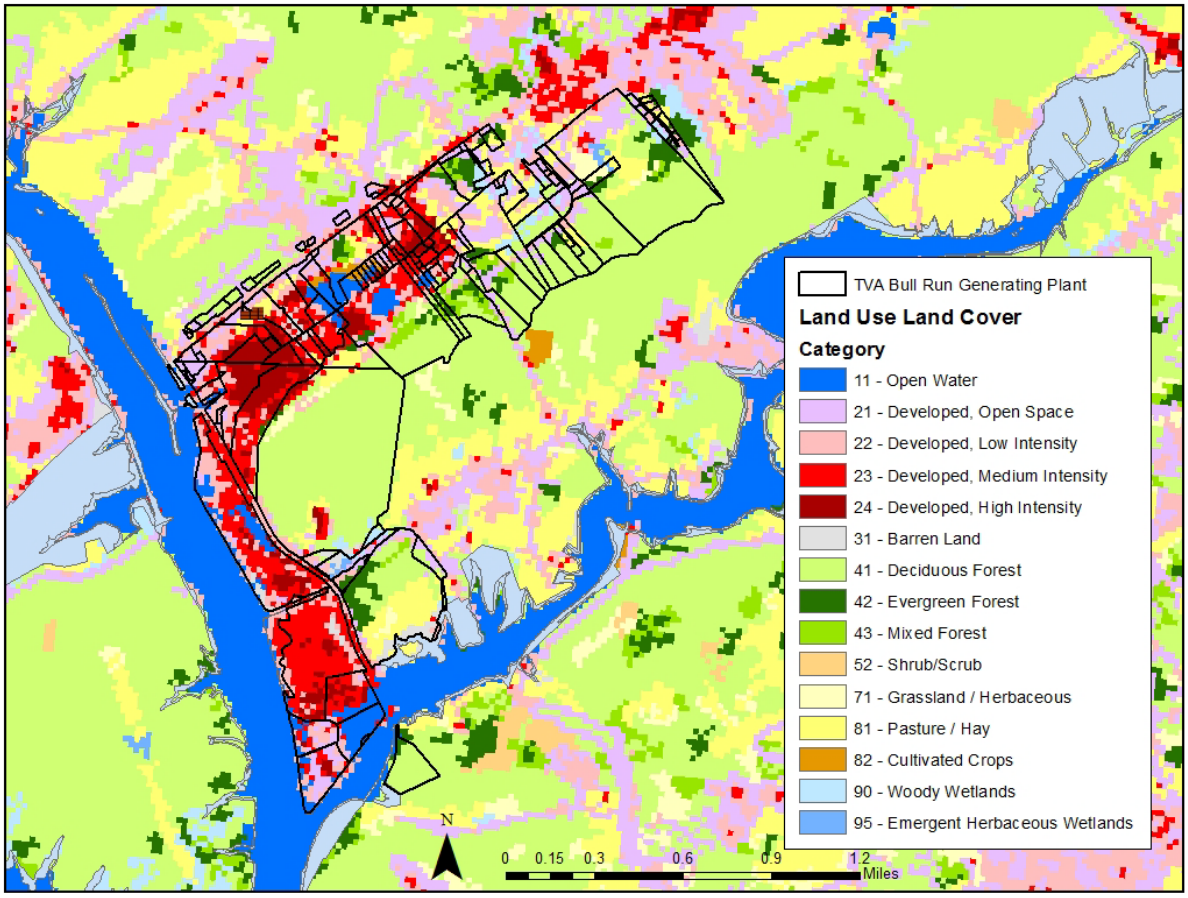

Figure 2-4. Example of a Land Use/Land Cover Characterization Surrounding a TVA Power Property

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 2-5. 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 2011).

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. In addition to the nine reservoirs on the mainstem of the Tennessee River, TVA operates 38 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 for TVA's NRP (TVA 2011b) 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). Gergia 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 3-1. 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 3-2. 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).

State	Swarming Season (bats present surrounding hibernacula)	Winter Season (bats not present on landscape)	Non-winter Season (bats present on landscape)	Pup Season (maternity period, juveniles unable to fly)
GA, KY, TN	Oct 15 - Nov 14	Nov 15 - Mar 31	Apr 1 - Oct 14	Jun 1 - Jul 31
VA	Sept 16- Nov 15	Nov 16 – Apr 14	Apr 15 - Sep 15	
AL	Oct 15 - Nov 14	Nov 15 - Mar 15	Mar 16 - Oct 14	
NC	Oct 15 - Nov 14	Nov 15 - Apr 15	Apr 16 - Oct 14	
MS	Oct 1 - Nov 14	Nov 15 - Apr 14	Apr 15 - Sep 30	

[3]First and second numbers reflect years 2017-2020 and 2021-2036, respectively.

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 3-3).

Table 3-3. 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 by the International Society of Arboriculture (Appendix D) and TVA's checklist for hazard trees or downed trees (Appendix E). 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 2011).

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 F, 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 G, Land and Water Stewardship Reservoir Properties Land Conditions Assessment and Appendix H, 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 I, 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 J, 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.

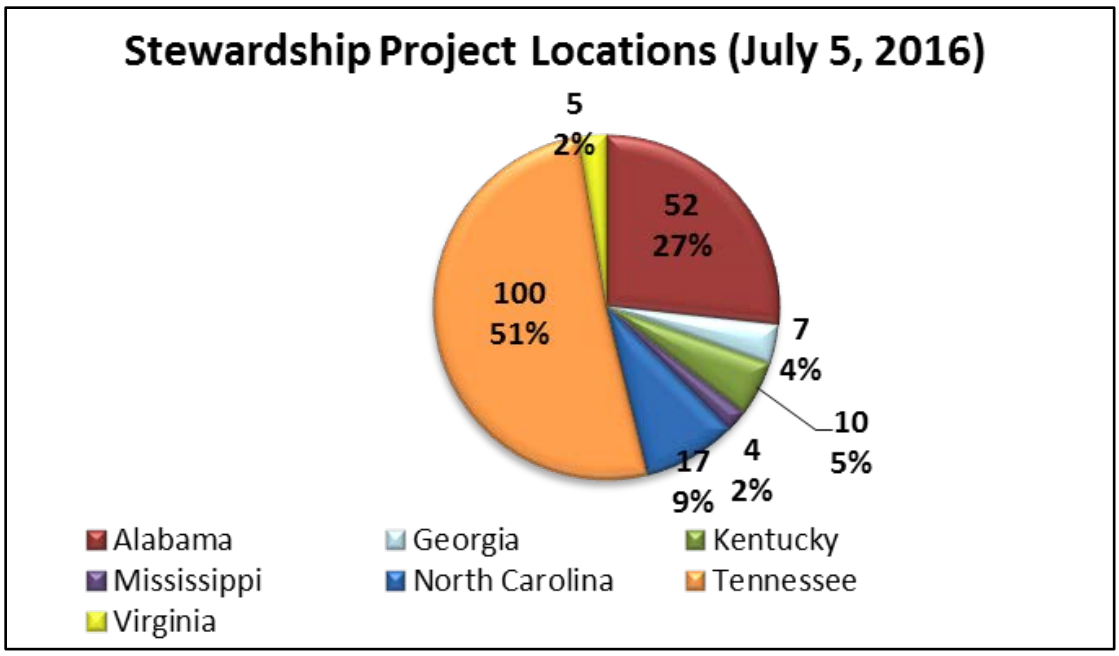

Figure 3-1. TVA Stewardship Projects grouped by Partnership Type during Fiscal Year 2016 (as of July 5, 2016)

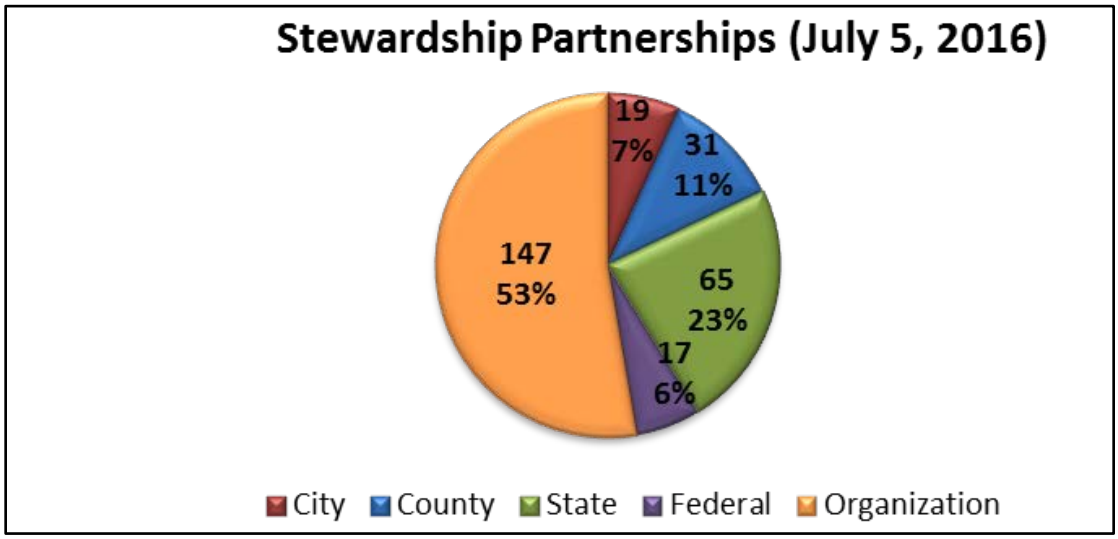

Figure 3-2. TVA Stewardship Projects grouped by Partnership Type during Fiscal Year 2016 (as of July 5, 2016)

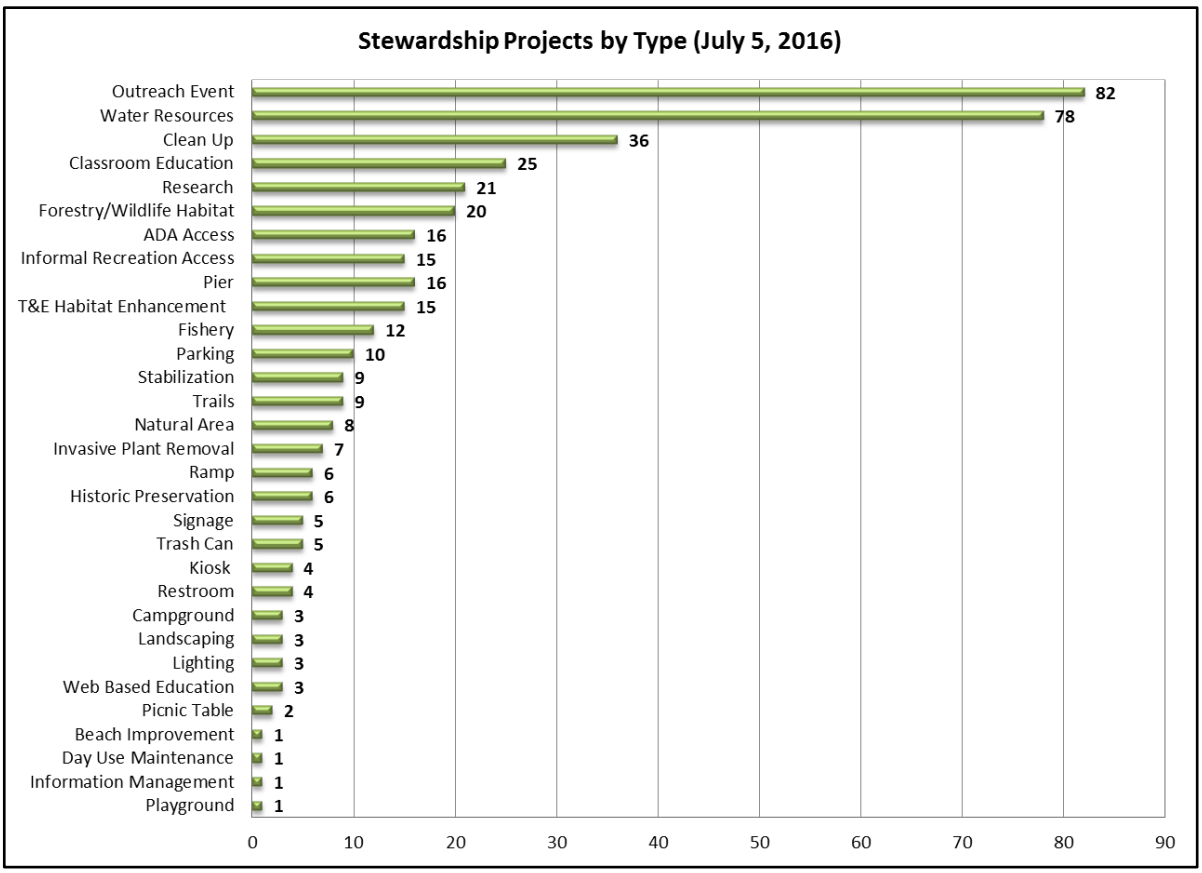

Figure 3-3. Stewardship Projects Organized by Type for Fiscal Year 2016

Example Stewardship Projects on TVA Natural Areas and elsewhere in the TVA Region (Fiscal Years 2014 -2017)

- *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:* Pilot study of use of unconventional summer roosts by Indiana bats (and possibly northern long-eared bats) on TVA-managed land that assesses success of installed unconventional roost structures based on one or more variables: habitat type, proximity to human infrastructure or disturbance (TL ROW, Dam Reservation, Natural Areas/contiguous forest). Some roosts are established in areas available for viewing by the general public. Locations include Cave Mountain (Guntersville Reservoir) and Hemlock Bluff Small Wild Area Norris, Tennessee) (FY 2016-2017).
- *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).
- *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).

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 3-4). 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.

Table 3-4. 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 3-5). 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 3-5. 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 3-6). 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.

Table 3-6. 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 3-7) 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 3-7. 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 3-8). 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.

Table 3-8. 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.

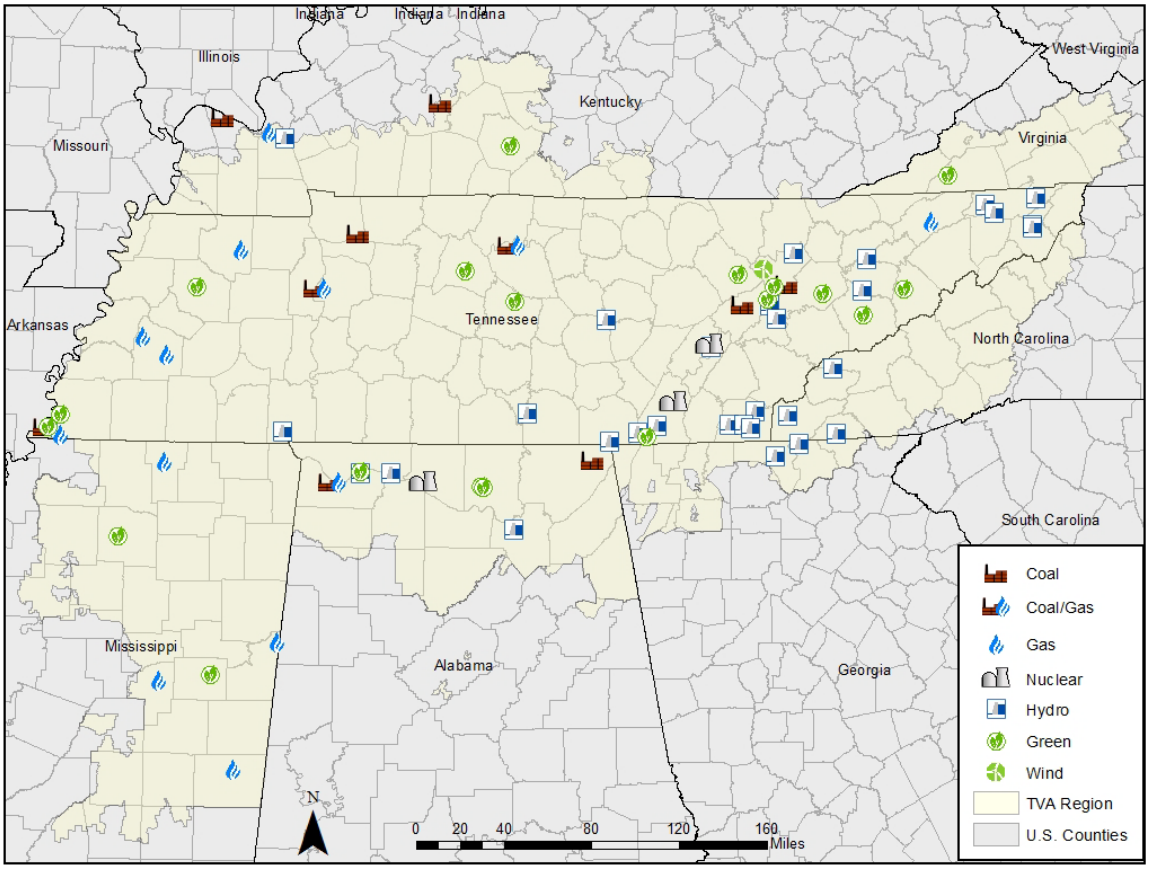

Figure 3-4. TVA Generation Facilities

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 3-9). 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.

Table 3-9. Estimated Acreage associated with Actions at Power Plants

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
Operate and Maintain Plants	1,089	35	10,888	700
Retire, Construct and Expand Plants		75		1,500
Total	**1,089**	**110**	**10,888**	**2,200**

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).

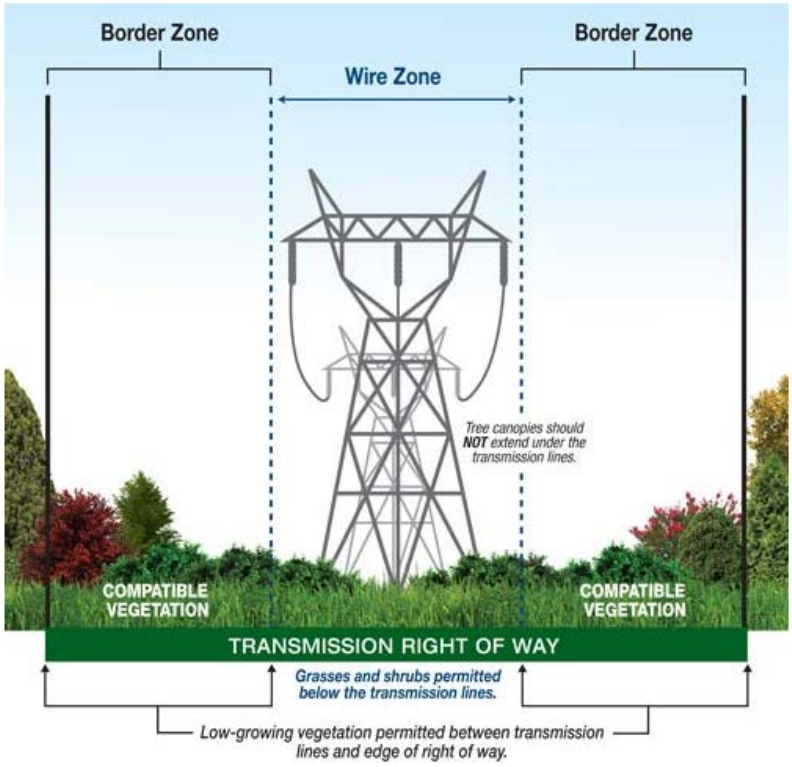

Figure 3-5. Compatible Vegetation for Transmission Line Rights-of-Way

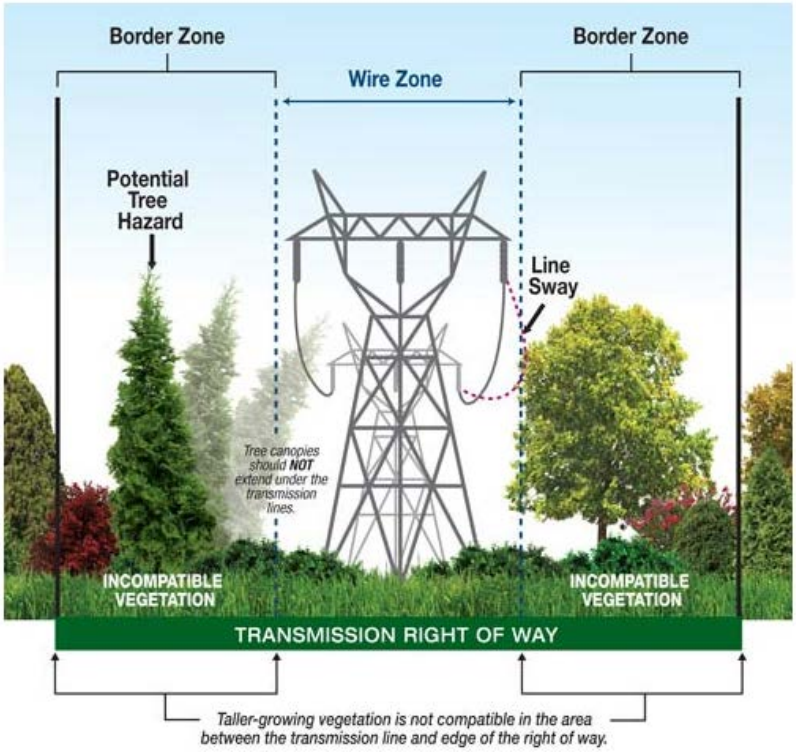

Figure 3-6. Incompatible Vegetation for Transmission Line Rights-of-Way

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 K). 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. 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

Currently, TVA has about 237,300 ac of TL ROW easement in its PSA. This constitutes 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 is estimated that a combined 1,834 ac of trees (i.e., primarily hazard trees, but also tree removal for equipment clearance) will need to be conducted on an annual basis across TVA's PSA for the first four years of the consultation term. This estimate includes 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 ((1,834*4) + (85*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 3-10).

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]).

Table 3-10. 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 L, M, and N), and Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (Appendix O) 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 O 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 L, M, N, and O. 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 L and M.

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 P). 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 L, M, and N), and A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities (Appendix O) 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 O. 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 Q), 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 R) 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 next 20 years 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 3-11).

Thus, over the next 20 years, 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.

Table 3-11. 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 are estimated to involve 75,220 ac over the course of 20 years (Tables 3-1 and Table 3-12). 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).

Table 3-12. 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 Mid-Scale Solar Generation

3.12.1 Objectives

TVA annually solicits purchase power plan proposals for combined total of 10 MW of solar capacity. This includes generation that ranges from 50 kw to no more than 2 MW of solar capacity at one site. The majority of 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.

3.12.2 Activities Associated with Promoting 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 mid-scale solar generation are estimated to involve 40,000 ac over the course of 20 years (Tables 3-1 and Table 3-13). 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).

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 3-13. Estimated Acreage associated with Promoting 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**

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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.

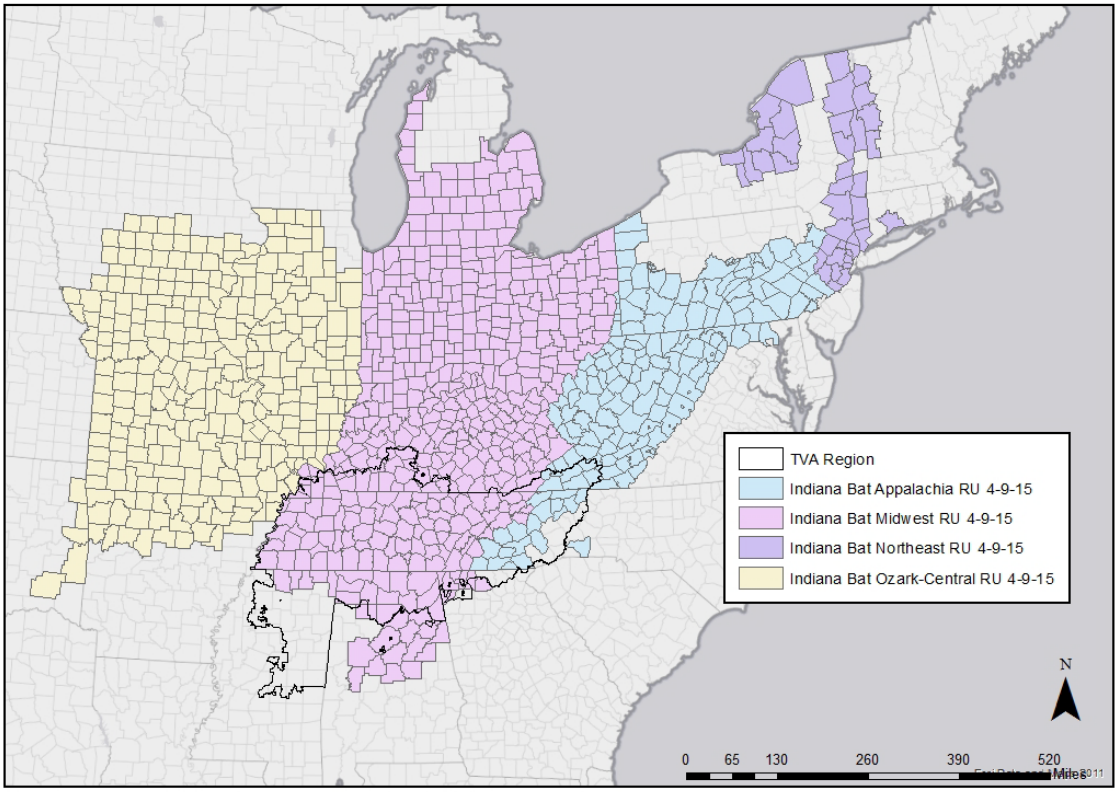

Figure 4-1. TVA Region in Relation to Range (subdivided into Recovery Units) of Indiana Bat

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 recent 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 10 years have been primarily attributed to WNS. WNS was first documented in the TVA region in 2009-2010 in Sullivan and Carter counties, Tennessee.

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 4-1. 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).

Based on 2015 population estimates, 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.

Table 4-2. 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

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 third 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.

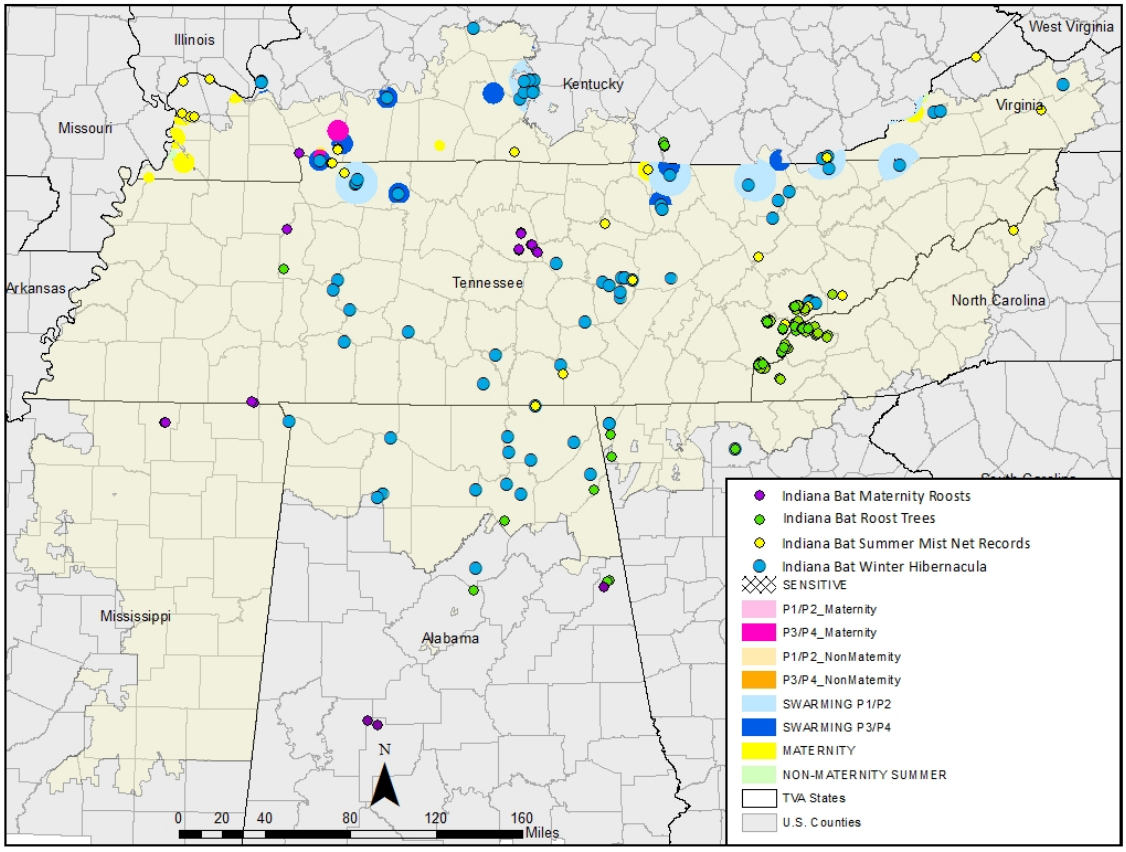

Figure 4-2. Documented occurrences of Indiana Bat in the TVA Region, Source: TVA Regional Natural Heritage Database

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 (spearheaded by Copperhead Environmental Consulting, Inc.) of Indiana bats during the spring migration season began in 2010. 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 approximately five caves within the TVA Region and these eight maternity roosting sites.

Artificial roosting structures are being erected throughout the TVA region in four locations on TVA lands as well as at one location on land managed by TWRA and one location on land managed by the Nature Conservancy (TNC). These locations include Loyston Point in Union County, Tennessee; Cave Mountain Cave Small Wild Area in Jackson County, Alabama; Marbut Bend in Limestone County, Alabama; Big Sandy Wildlife Management Area in Benton County, Tennessee; Bellamy Cave Preserve in Montgomery County, Tennessee (TNC-managed land); and a reclaimed strip mine in Van Buren County, Tennessee (TWRA-managed land).

TVA is partnering with TWRA to erect additional unconventional roosting structures at the Wilson County Maternity Site, to be managed and monitored by TWRA. TVA is also partnering with TNC to implement conservation actions to benefit Indiana bats. These may include installing gates at, or improving damaged gates fronting, Indiana bat hibernacula and/or erecting unconventional roosting structures in West Tennessee.

TVA recently 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 has participated in collaborative continent-wide surveys for five years with Dr. Winifred Frick), and to improve understanding of cave ecology (i.e., TVA is partnering with Dr. Donald Walker at Tennessee Technological University to monitor WNS and cave microbiomes).

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).

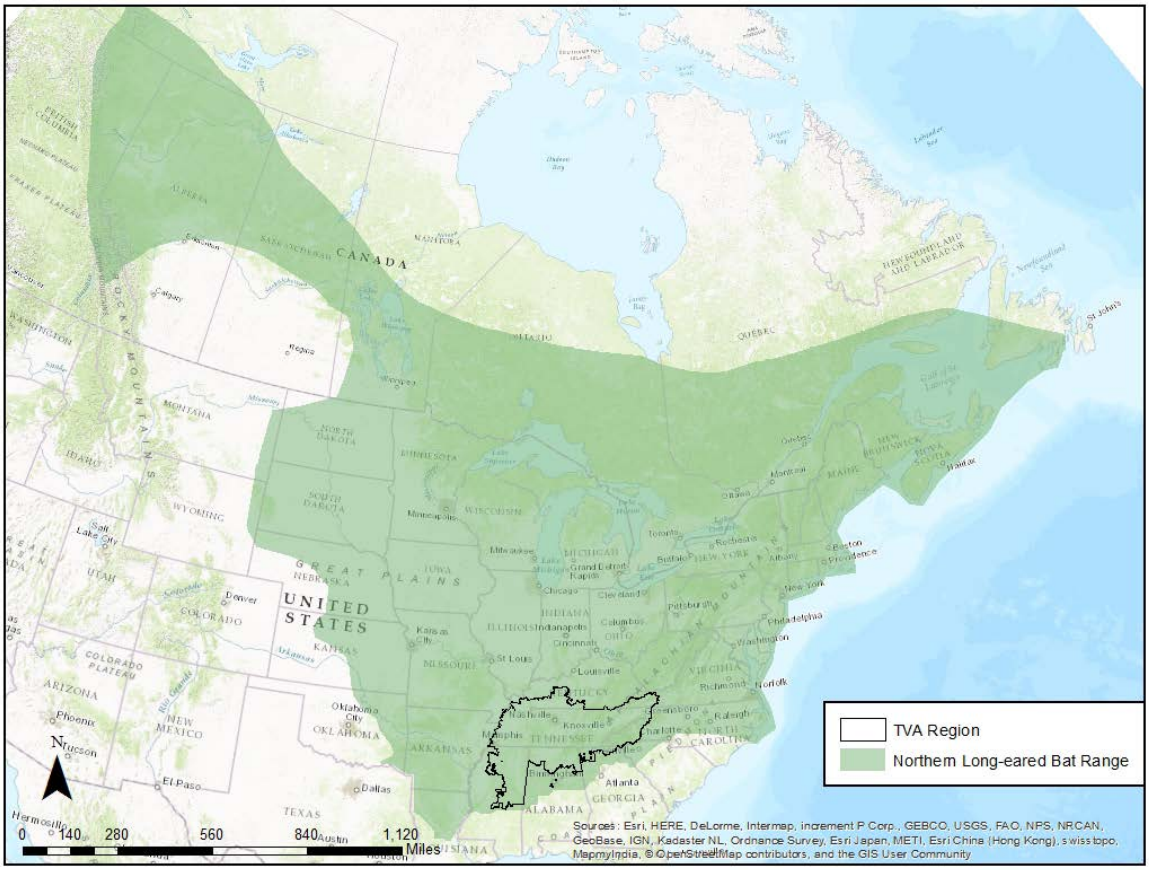

Figure 4-3. TVA Region in Relation to Range of Northern Long-eared Bat

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 provides measures tailored to the current understanding of the conservation needs of northern long-eared bat. This species-specific 4(d) rule prohibits 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 is 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 include 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 results from activities other than tree removal is not prohibited. Incidental take resulting from tree removal is prohibited if it: (1) Occurs within a 0.25 mile (0.4 kilometer) radius of known northern long-eared bat hibernacula; or (2) cuts or destroys 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 is 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).

4.2.3 Current Population Estimate

The number of distinct northern long-eared bat occurrences has not been determined using standardized criteria. More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals. Due to its roosting behavior in caves (deep within cracks and crevices) this species is notoriously hard to count in caves. Missouri, Pennsylvania, and West Virginia each have greater than 100 known hibernacula. The species is now absent from or very scarce in some of the historical hibernacula due to impacts from WNS. This species also is represented by a large number of maternity roost sites (Nature Serve 2017).

The total adult population size of northern long-eared bat is unknown but presumably it is at least 10,000 and perhaps greater than 100,000. Although there are hundreds of hibernating colonies range wide, these colonies rarely comprise as many as 50 individuals (very exceptionally 300), suggesting that the overall population (even before the incidence of WNS) was relatively small. Prior to the incidence of WNS, this species was regarded as 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, recent 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).

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) 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). Northern long-eared bats rarely have been documented in TVA caves despite decades of surveys. At present only four known TVA managed caves have had recorded occurrences of northern long-eared bat. Seventy-four caves are or were known to be inhabited by northern long-eared bat during the winter in the TVA region.

Figure 4.4 depicts known occurrences of northern long-eared bat within the TVA region and Action Area (Note: although maps on the GA ES FO website indicate occurrence data for northern long-eared bat, this data was not accessible at the time Figure 4.4 was developed and therefore is not reflected. As well, occurrence data for maternity roost trees is not available for anywhere in the TVA region.

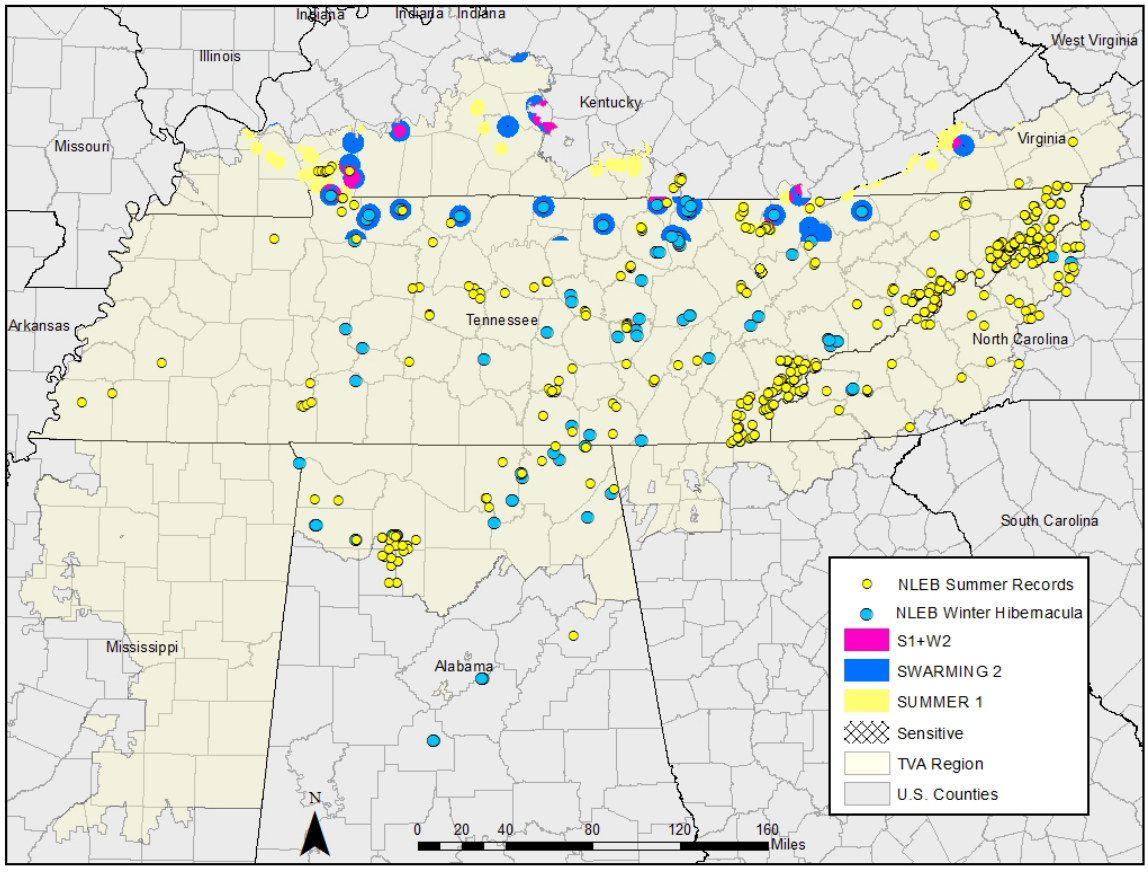

Figure 4-4. Documented occurrences of Northern Long-eared Bat in the TVA Region. Source: TVA Regional Natural Heritage Database

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).

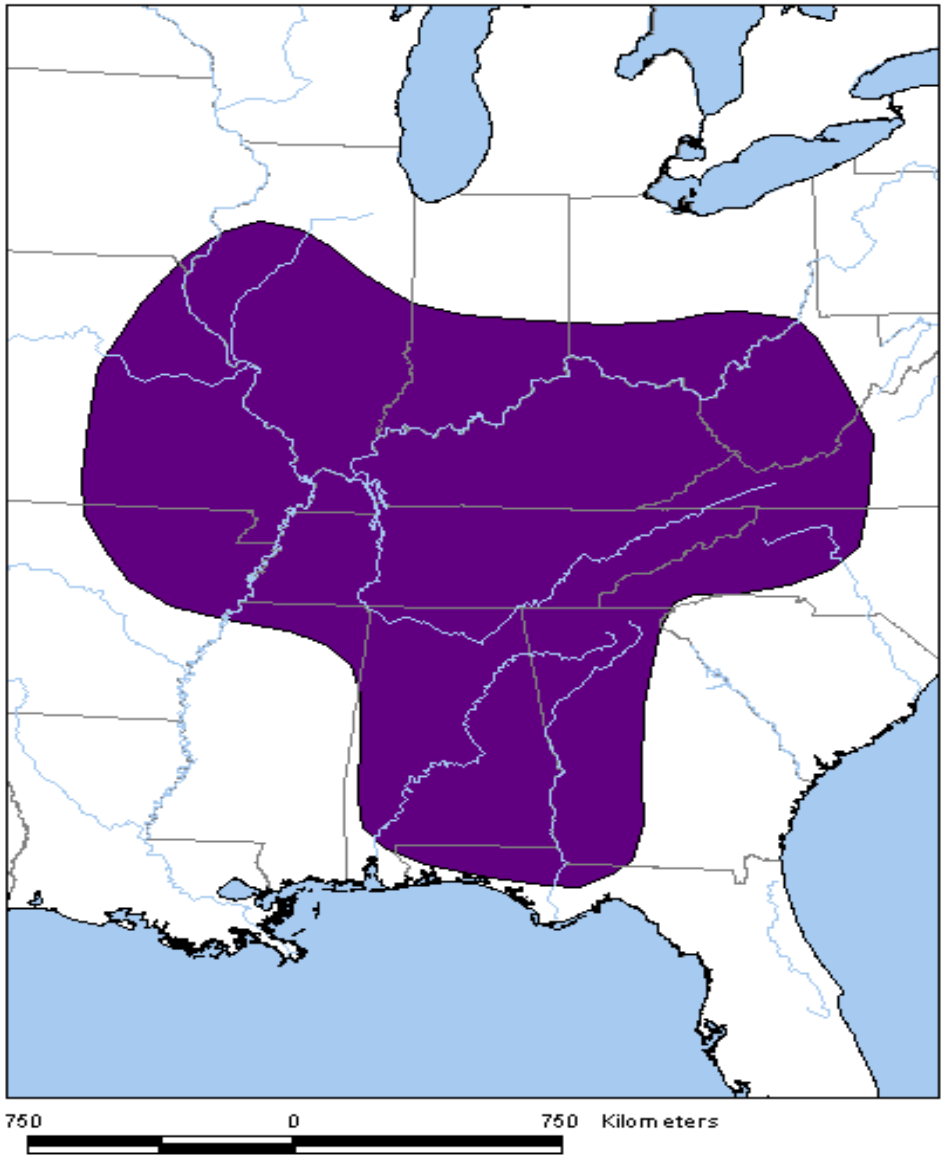

Figure 4-5. Range of Gray Bat

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 late as November or December, females preceding males. Females depart wintering caves in late March and early April, males in late April and May. Evidence suggests that bats migrate in small flocks. 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 (although no significant impact to populations is known as of early 2017). 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 seven known maternity roosting sites (Norris Dam Cave, Nickajack Cave, and Featherfoot Cave in Tennessee; Quarry Cave, Hambricks Cave, and Key Cave in Alabama. Additional efforts are currently underway to gate additional caves (Collier Cave, Alabama).

Based on long-term monitoring efforts, gray bat populations within the Action Area appear to be relatively stable. 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). 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 2017 winter survey efforts at Fern Cave in Jackson County, Alabama, where over 1 million gray bats were counted.

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 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. 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 11 maternity gray bat roosts each year. 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.

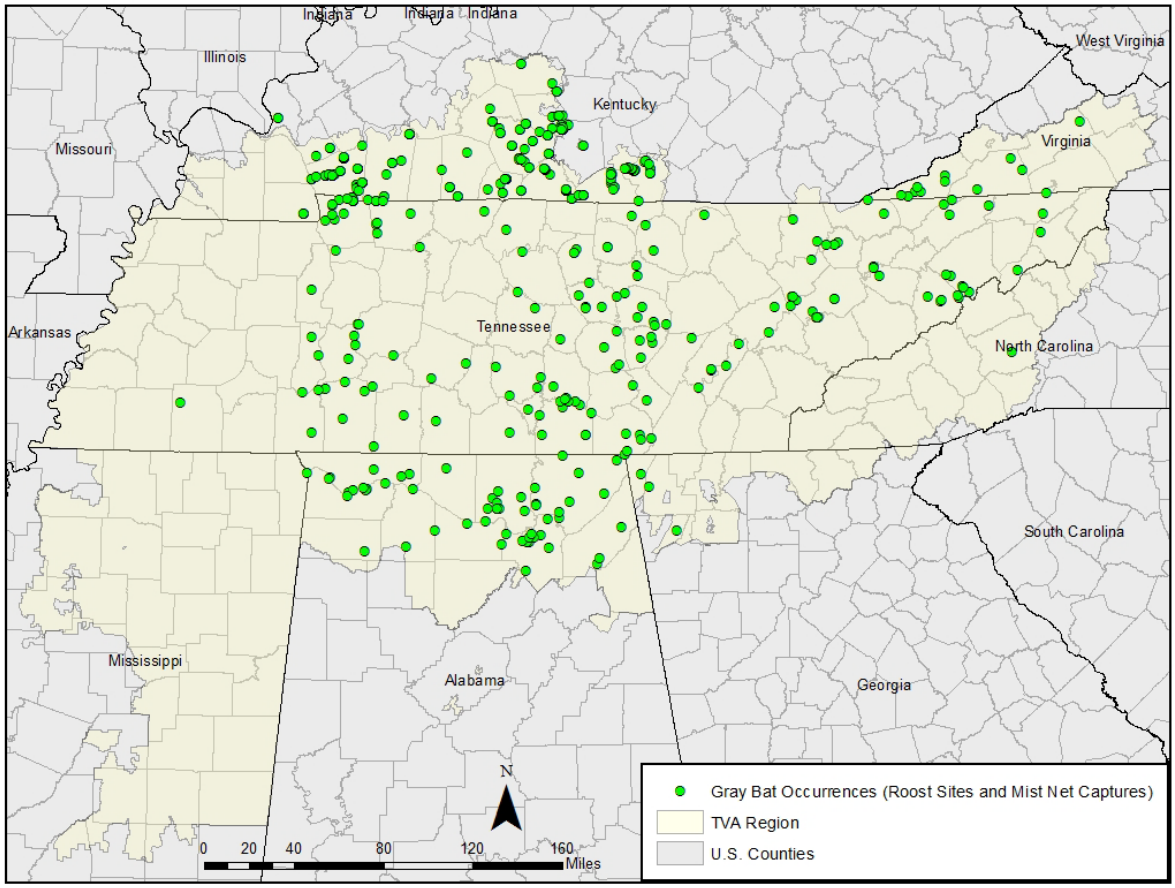

Figure 4-6. Occurrence Records for Gray Bat. Source: TVA Regional Natural Heritage Database

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).

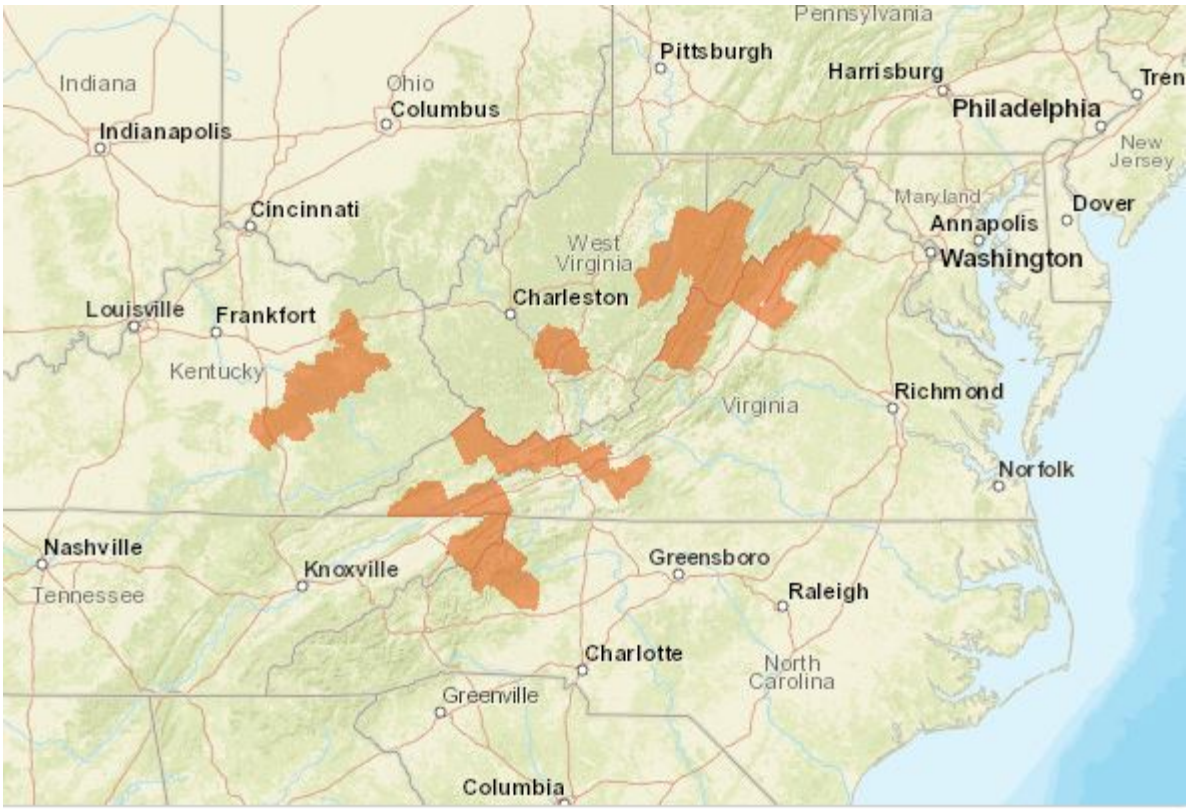

Figure 4-7. Range of Virginia Big-eared Bat (orange polygons). Source: Environmental Conservation Online System/Species Profile for Virginia Big-Eared bat

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, well-ventilated 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 $\geq$ 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 $\geq$ 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).

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. Occurrence records for Virginia big-eared bats within the TVA region and Action Area are shown in Figure 4.8.

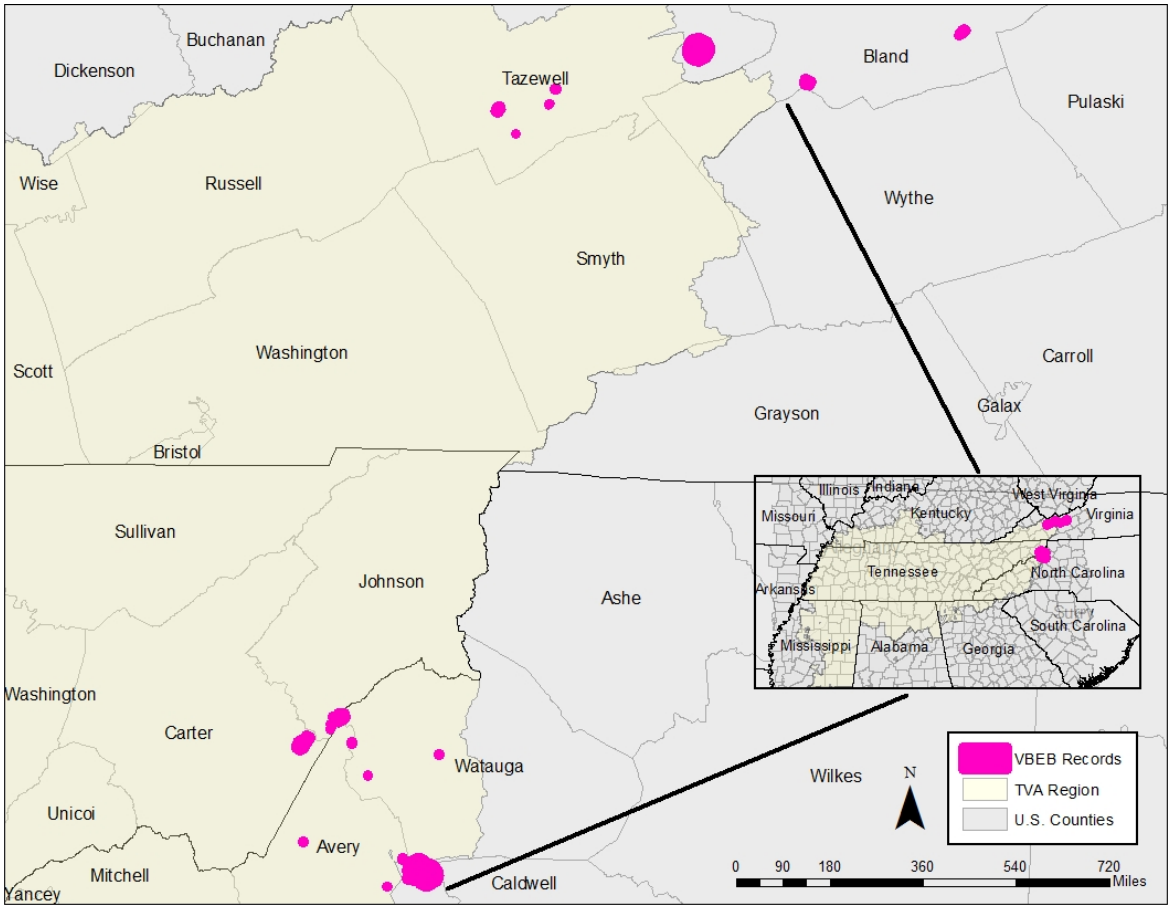

Figure 4-8. Occurrence Records for Virginia Big-eared Bat. Source: TVA Regional Natural Heritage Database

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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 one mile 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 minimize 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 minimize 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.

  - Where accessible and health and safety considerations allow, a survey of roof space for evidence of bats (e.g., droppings, scratch marks, staining, sightings), noting relevant characteristics of internal features that provide potential access points and roosting opportunities. Suitable characteristic may include: gaps between tiles and roof lining, access points via eaves, gaps between timbers or around mortise joints, gaps around top and gable end walls, gaps within roof walling or around tops of chimney breasts, and clean ridge beams.
  - Features with high-medium likelihood of harboring bats but cannot be checked visually include soffits, cavity walls, space between roof covering and roof lining.
  - Applies to box culverts that are at least 5 feet (1.5 meters) tall and with one or more of the following characteristics. Suitable culverts for bat day roosts have the following characteristics:
    - Location in relatively warm areas
    - Between 5 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
  - Bridge survey protocols will be adapted from the Programmatic Biological Opinion for the Federal Highway Administration (Appendix D of USFWS 2016c, which includes a Bridge Structure Assessment Guidance and a Bridge Structure Assessment Form).
  - Bat surveys usually are NOT needed in the following circumstances:
    - Domestic garages 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 O). 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 O). 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 5-1. Monitoring Schedule for Gray Bat Caves on TVA-Managed Lands

Cave	State	Monitoring Frequency			
		Annual	Every Two Years	Every Three Years	To Be Determined
Hambrick's	AL	X			
Nickajack	TN	X			
Featherfoot	TN	X			
Norris Dam	TN	X			
Collier	AL	X			
Quarry	AL		X		
Gross-Skelton	AL			X	
Marble Bluff	TN			X	
Blythe Ferry	TN		X		
Crompton Creek	TN				X[1]
Pennington Cave	TN				X[1]

[1]Establishment of monitoring frequency is pending determination of roost type (i.e., maternity vs bachelor).

- 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:*NLAA *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:*NLAA *VB:*NLAA
Maintenance and Modifications to Ground and Vegetation (Land, Shoreline or Below Water)						

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
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:*NLAA *VB:*NLAA
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:*NLAA *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

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
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 availability and quality of drinking water.	2. SSPC1, SSPC2, SSPC3, SSPC5, SSPC6, SSPC7	*IB:* NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA
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. Sediment 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:*NLAA *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. Sediment 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:*NLAA *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:*NLAA *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:*NLAA *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. Sediment 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:*NLAA *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. Sediment 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:*NLAA *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 combine	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. Sediment 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:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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 and	1. NV1 2.SSPC1, SSPC2, SSPC3 3. L1, L2	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				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:*NLAA *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
43	Replacement or	Replace or remove individual	Occurs during daytime	None	None	*IB:* NE

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
	removal of TL poles	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).	over days to weeks.			*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 removal. (#27 and #34) at new sites.	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]
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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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 driving	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 availability, resulting in reduced	1. NV1 2. SPCC5 3. L1, L2	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		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.		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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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 washout areas, seeding and	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:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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:*NLAA *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 expenditures and reduced	1. NV1, NV2 2. SSPC2, SSPC3 3. L1, L2	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
				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:*NLAA *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:*NLAA *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 - #24,	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	1. NV1 3.SSPC2, SSPC3	*IB:*NLAA *NB:*NLAA *GB:*NLAA *VB:*NLAA

#	ACTIVITY[1]	EXPLANATION[1]	EXPOSURE	STRESSOR AND RESPONSE[2]	CONSERVATION MEASURES[3]	EFFECT[4]
		vegetation removal - #27, #34).		drinking water and reduces 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 availability, resulting in reduced	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.	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:*NLAA *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:*NLAA *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:*NLAA *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

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
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

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
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
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

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
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

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 (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
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

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
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
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

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
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

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

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
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
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

SPECIES	ACTIVITY	EFFECTS DETERMINATION[1]
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
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

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
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

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
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
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

SPECIES[1]	ACTIVITY	EFFECTS DETERMINATION[2]
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 will begin implementing its programmatic bat strategy upon completion of consultation. 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, TVA will notify the appropriate USFWS FO (via email or letter) of proposed project, alignment with BPC, and project-specific determination. This notification will serve as documentation in the 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. TVA will notify the appropriate USFWS FO (via email or letter) of the proposed project, alignment with BPC, survey outcome, and determination. This notification will serve as 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. 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. This notification will serve as documentation in TVA's administrative record. All projects with effects determinations of these types will be summarized in annual reporting associated with the BPC. ***END***

As new bat species occurrence data is acquired over time, 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 TVA biological staff and other state, federal and non-governmental partners facilitates regularly communicates regarding newly discovered or newly available species data. 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.

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Appendix A – Photo Log of Associated Activities

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Appendix B – Job Safety Analysis Worksheet: Prescribed Fire Use on TVA Natural Resource Management Reservoir Lands

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Appendix C –Best Management Practices for Silviculture Activities on TVA Lands

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Appendix D – International Society of Arboriculture Tree Hazard Evaluation Form

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Appendix E – TVA Hazard Tree / Downed Tree Checklist

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Appendix F – TVA Land Conditions Assessment Protocol

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Appendix G – TVA Land and Water Stewardship Reservoir Properties Land Conditions Assessment

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Appendix H – TVA Land and Water Stewardship Reservoir Properties Maintenance Needs

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Appendix I – TVA Land Asset Tiering for Natural Resource Management

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Appendix J – Tennessee Valley Authority Natural Areas Procedures Manual

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Appendix K – TVA Transmission Environmental Protection Procedures Right-of-Way Vegetation Management Guidelines

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Appendix L – TVA Right-of-Way Clearing Specifications

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Appendix M – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Line Construction

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Appendix N – Tennessee Valley Authority Transmission Construction Guidelines Near Streams

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Appendix O – A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities

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Appendix P – Tennessee Valley Authority Site Clearing and Grading Specifications

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Appendix Q – Tennessee Valley Authority Substation Lighting Guidelines

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Appendix R – Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Substation or Communications Construction

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