Natural Resource Plan

Environmental Impact Statement

Draft | March 2011

TVA

Document Type: EIS-Administrative Record
Index Field: Environmental Document Transmitted Public/Agencies
Project Name: Natural Resource Plan EIS
Project Number: 2009-60

DRAFT ENVIRONMENTAL IMPACT STATEMENT

NATURAL RESOURCE PLAN

Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

MARCH 2011

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Environmental Impact Statement **March 2011**

Proposed project: Natural Resource Plan
Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia

Lead agency: Tennessee Valley Authority

For further information, contact: Charles P. Nicholson, Manager
National Environmental Policy Act Compliance
Tennessee Valley Authority
400 West Summit Hill Drive, WT11D-K
Knoxville, Tennessee 37902
Phone: 865.632.3582
Fax: 865.632.3451
E-mail: NRP@tva.gov

Comments must be submitted by May 16, 2011

Abstract: The Tennessee Valley Authority (TVA) proposes to adopt a Natural Resource Plan (NRP) to determine how TVA will manage its natural resources over the next 20 years. On May 19, 2008, the TVA Board of Directors approved the TVA Environmental Policy. The Environmental Policy sets forth principles to guide TVA in reducing the environmental impacts of its activities while continuing to provide reliable and affordable power to the Valley. By establishing the Environmental Policy, TVA committed to a more systematic and integrated approach to managing stewardship. The NRP addresses the planning processes and Environmental Policy objectives related to Water Resource Protection and Improvement, Sustainable Land Use, and Natural Resource Management. This environmental impact statement examines potential impacts associated with implementing the NRP proposed for these resources and reasonable alternative management strategies, including a No Action Alternative. Under the No Action Alternative, TVA would continue its current management approach. Under three Action Alternatives (Alternatives B, C, and D), TVA would alter its management approach to reflect the implementation of varying levels of activities across numerous stewardship programs. TVA's Preferred Alternative is Alternative D.

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SUMMARY

PURPOSE OF AND NEED FOR ACTION

On May 19, 2008, the Tennessee Valley Authority (TVA or the Agency) Board of Directors (TVA Board) approved the TVA Environmental Policy. A biennial review of this policy occurred in August 2010 and did not result in an update or revision. The Environmental Policy sets forth principles to guide TVA in the reduction of the environmental impact of its activities while continuing to provide reliable and affordable power to the Tennessee Valley region. The Natural Resource Plan (NRP) addresses the planning processes and Environmental Policy objectives related to Water Resource Protection, Sustainable Land Use, and Natural Resource Management.

Historically, TVA has taken various approaches to managing biological, cultural, recreation, and water resources and to planning the use of reservoir lands. In its Environmental Policy, TVA committed to a more systematic and integrated approach to natural resource stewardship. The purpose of the NRP is to develop a plan to guide TVA's responsible management of natural resources over the next 20 years while upholding TVA's mission and renewed vision and balancing stewardship objectives with sound business practices. The following objectives and critical success factors in the Environmental Policy bear on this:

Water Resource Protection and Improvement Objective: TVA will improve reservoir and stream water quality, reduce the impact of its operations, and leverage alliances with local and regional stakeholders to promote water conservation.

Critical Success Factors

- *Integrate the impacts of water quality and quantity into the long-range planning and decision-making process.*
- *Promote the integration of energy efficiency and water conservation into community planning and building construction.*
- *Collaborate in community outreach and partnerships through voluntary demonstrations of the efficient use of water resources and protection of water quality.*

Sustainable Land Use Objective: TVA will strive to maintain the lands under its management in good environmental health, balancing their multiple uses, and will improve its land transaction processes to support sustainable development.

Critical Success Factors

- *Actively manage TVA lands to meet the desired conditions for their purpose as defined in the reservoir land management plans.*
- *Improve reservoir shoreline conditions through collaborative partnership initiatives and balance the multiple uses of the reservoirs in accordance with TVA's Land Policy and Shoreline Management Policy.*

- *Manage TVA lands, mineral rights, and shoreline access to better achieve environmental commitments while meeting the needs for recreation, residential access, and economic development.*

Natural Resource Management Objective: TVA will be a leader in natural resource management through the implementation of sustainable practices in dispersed recreation while balancing the protection of cultural, heritage, and ecological resources.

Critical Success Factors

- *Allow for properly managed, ecologically friendly dispersed recreation while balancing the protection of biological, cultural, and heritage resources.*
- *Promote ecological diversity and wildlife habitats on TVA lands through partnerships and voluntary initiatives.*
- *Increase the level of environmental quality and management consistency among TVA-managed and -leased recreation facilities.*

This EIS evaluates various approaches to management of biological and cultural resources, recreation, reservoir lands planning, and water resources. The general goal of the NRP is to integrate the objectives of these resource areas, provide for the optimum public benefit, and balance competing and sometimes conflicting resource uses. These competing interests and development pressures, coupled with today's environmental awareness, underscore the necessity for a consistent approach to the management of TVA's lands. The specific goals of the NRP include:

1. Aligning TVA's stewardship programs and plans with the Environmental Policy
2. Providing a strategic plan that
    - Guides TVA's resource management decisions and actions
    - Integrates stewardship objectives for optimum public benefits while developing efficiencies for natural resources
    - Strikes a balance between the competing and sometimes conflicting resource uses on TVA-managed lands
3. Increasing the efficiency of environmental reviews of TVA actions
4. Providing TVA staff with a "reference manual" to guide implementation activities
5. Providing clarity and transparency to the public

The geographical scope for biological and cultural resources management and recreation management components of the NRP is limited to the approximately 293,000 acres of reservoir lands, active and former fossil and nuclear properties, Raccoon Mountain Pumped Storage Plant, and Buffalo Mountain Wind Power Project site managed by TVA. The NRP would be implemented at TVA's fossil and nuclear properties and at Raccoon Mountain and Buffalo Mountain as interim and/or secondary management techniques, as appropriate.

These properties will remain power assets, and primary management will remain as power generation. It would be at TVA's discretion to determine the appropriate programs and activities within the NRP for implementation on these power properties.

Recreation management focuses on the recreation facilities and programs managed by TVA and stream access sites located near TVA-managed reservoirs.

The reservoir lands planning component of the NRP addresses the approximately 293,000 acres of TVA-managed reservoir lands. The geographical scope for the water resource management component of the NRP includes the entire Tennessee River watershed and focuses on those discretionary programs and activities implemented by TVA to improve reservoir and watershed water quality.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

TVA has evaluated four alternatives for the NRP. Alternatives were developed using information from multidisciplinary TVA technical and advisory teams and from the public comments obtained during the scoping process described in Chapter 1. Under each of the alternatives, the following conditions would apply:

> TVA would continue to conduct environmental reviews to address site-specific issues prior to the approval of any proposed activity on lands under TVA's control. Future activities and land uses would continue to be guided by the TVA Land Policy and other relevant policies. In its reservoir lands planning activities, the allocation of uses on TVA property is not intended to supersede deeded landrights that may be held by others.

Alternative A — No Action Alternative. Under the No Action Alternative, TVA would continue to implement the existing stewardship programs and tools, aligning with existing policies and strategies, and would continue to apply the existing methodology when planning lands along TVA reservoirs. This alternative emphasizes regulatory and technical requirements, assessments of TVA-managed resources and partnerships, and capital projects associated with TVA-managed recreational facilities. TVA would manage and support stewardship activities on its lands through existing prioritization methods that consider recreational needs and public safety while meeting applicable regulations and policies.

Alternative B — Custodial Management. Under Alternative B, specific programs that address safety and compliance with TVA's mission, applicable laws, regulations, and executive orders (EOs) and policies would be implemented. As laws, regulations, policies and EOs are created or amended; implementation activities would be revised to reflect this. In those areas in which TVA would discontinue programs or projects, existing contractual agreements relating to those programs or projects would be honored. In addition, TVA would focus on transitioning the management of certain recreational facilities through contractual agreements or would close the facilities. This alternative is consistent with custodial management, as described in the NRP.

Alternative C — Flagship Management. Under Alternative C, TVA would explore, pilot test, and implement new strategies for enhancing stewardship programs and developed recreational facilities while emphasizing sustainable technologies. Similarly, activities or projects that address safety and compliance with TVA's mission and applicable laws, regulations, policies, and EOs would be implemented. As these change, implementation activities would be revised accordingly.

Alternative D — Blended Management. Under Alternative D, TVA has identified key programs that are integral toward enhancing future implementation efforts while maintaining activities and projects that address safety and comply with TVA's mission and applicable laws, regulations, policies, and EOs. This alternative takes into account the interconnectivity of each resource area and their supporting programs, helping to establish a foundation by which TVA may implement greater levels of programs in the future.

Within this alternative, all program options have been placed into one of three priority level groupings as described in the NRP. The first grouping, custodial management, reflects those program options described under Alternative B. This level of effort represents the baseline at which TVA proposes to implement for its natural resource programs. The second grouping, blended management, identifies additional programs and activities that are integral to the successful implementation of the NRP and are considered to be a springboard to help TVA to effectively and efficiently implement additional activities as partnerships and/or funding allows. The third grouping, advanced management, reflects program options that could be considered for future execution depending upon available opportunities, partnership, and resources and on the condition that these programs do not undermine TVA's ability to conduct the programs in the custodial and blending management groupings. The programs in the advanced management grouping are higher levels of implementation effort that were not included in the blended management grouping.

AFFECTED ENVIRONMENT

The geographical scope will be referred to further as TVA-managed lands. Moreover, the Tennessee River watershed and TVA's power service area (PSA) will be collectively referred to as the TVA region, the primary study area. This area comprises 202 counties and approximately 59 million acres. In addition to the Tennessee River watershed, it covers parts of the Cumberland, Mississippi, Green, and Ohio rivers where TVA power plants are located. For some resources, such as air quality, and for the consideration of climate change issues, the assessment area extends beyond the TVA region. For some socioeconomic resources, the study area consists of the 170 counties where TVA is a major provider of electric power and Muhlenberg County, Kentucky, where the TVA Paradise Fossil Plant is located.

Recreation. Recreation demand is driven by population levels, recreation participation rates, and innovations in recreation equipment. Analysis of the current United States Census data provides estimates over the next 20 years of population increases of between 18 and 19 percent for the TVA region. Assuming that current participation rates remain relatively constant, recreation demand is anticipated to grow in direct proportion to the population. Public pressure would increase on TVA-managed lands, shoreline, and waterways in response to this demand.

Natural Areas. Natural areas occurring on TVA-managed lands include both TVA- and non-TVA-managed areas and ecologically significant sites. TVA managed natural areas include small wild areas, habitat protection areas, ecological study areas, and wildlife observation areas. These natural areas are further defined in Chapter 4. TVA manages 154 natural areas and conducts specific management activities that are suitable for a particular natural area designation. Examples of management activities are located in Chapter 2. There are 229 natural areas and ecologically significant sites occurring on or adjacent to TVA-managed lands that are managed by other agencies under contractual agreements.

Terrestrial Ecology. For the purpose of this EIS, the terrestrial ecology discussion focuses on the lands within the TVA region. The TVA region encompasses nine ecoregions. The terrain across the Valley is diverse from mountains to bottomland hardwoods and cypress swamps. This area, rich in biodiversity, is composed of numerous habitats and plant communities, which house approximately 4,000 species of herbs, shrubs, and trees. Much of the region is heavily forested, and three forest regions and two subregions are recognized.

Approximately 55 species of reptiles, 72 amphibians, 182 species of breeding birds, and 76 species of mammals occur in these ecoregions. Although some wildlife species have widespread distributions, others have restricted ranges unique to specific ecoregions. For example, forest habitats in the Blue Ridge Mountains provide globally significant habitat for many species, especially amphibians and land snails. The high elevations found in the Blue Ridge ecoregion also provide habitat for relict populations of animals typically found in more northern latitudes.

Wetlands. Wetland resources vary in their types and extents across these ecoregions due to the influence of geology, topography, and land use patterns. In the Blue Ridge, Ridge and Valley, and Central Appalachians ecoregions located in eastern portions of the TVA region, wetlands occupy a relatively small percent of the landscape relative to uplands. 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. Moving westward across the TVA region, 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.

Water Quality. Water quality is generally good in the TVA region. 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. Of the approximately 42,000 perennial stream miles in the Valley, 8,500 miles are not fully supporting their designated uses (compiled from seven Valley states' 2008 305(b) reports), and 113,000 acres of lakes and reservoirs (compiled from seven Valley states' 305(b) reports [2008 and 2010]) (out of approximately 660,000 total acres) are not supporting their uses.

Aquatic Ecology. Rivers located in the TVA region support a large variety of freshwater fishes and invertebrates (including freshwater mussels, snails, crayfish, and insects). Due to the number of major river systems found in this region, the Southeastern United States is recognized as a globally important area for freshwater biodiversity. The EIS discussion of affected aquatic environments focuses on two distinct categories of water bodies: the TVA reservoir system within the Tennessee River drainage and "free-flowing" streams that are unaffected (or relatively unaffected) by the presence of TVA's dams and reservoirs.

Endangered and Threatened Species. *Aquatic Species.* The Tennessee River and its tributaries contain many species that are federally listed as threatened or endangered. Many more species are listed by the states in the Tennessee River drainage. A summary of the number of state- and federally listed aquatic animal species known from the Tennessee River drainage is presented in Chapter 3. None of these species are known to occur on the TVA-managed lands that are a part of this plan. However, many of these species occur in streams and reservoirs adjacent to these lands. *Terrestrial Animal Species.* There are 33 federally listed, protected or candidate terrestrial animal species

occurring in the TVA region. Of these species, only five potentially occur on TVA-managed lands. These species include bald eagle, gray bat, interior least tern, piping plover, and Indiana bat, listed in decreasing prevalence of occurrence. A sixth species, red-cockaded woodpecker, historically occurred on or near TVA-managed lands. In recent decades, this species only occurs in isolated pockets in extreme southern portions of the region. *Plants.* There are 44 federally listed as endangered and threatened species, six federal candidate species, and 996 state-listed plant species are known to occur within the TVA region. Over 80 percent of the federally listed species occur within four of the nine ecoregions: Blue Ridge with 27 percent, Southwestern Appalachians with 25 percent, Interior Plateau with 18 percent, and Ridge and Valley with 17 percent. Of the federally listed plant species, 11 taxa have the potential to be impacted by TVA actions associated with the NRP.

Cultural Resources. The Tennessee Valley enjoys a rich cultural heritage. The temperate climate and abundant resources attracted nomadic hunters into the region as early as 10,000 years ago. Through centuries of continuity and conflict, a rich diversity of Native American cultures evolved. Archaeological evidence of these cultures is found throughout the region, scattered over the region's landscape and buried under layers of flood-borne silt. TVA is responsible for many historic properties that are located on TVA-managed lands or involved with the many different projects that take place in the TVA region. Various laws require TVA to manage, protect, and preserve these resources to the extent possible and mitigate impacts to these resources due to TVA-related projects. Archaeological survey of lands by TVA reservoirs varies across the Valley, and over 11,500 archaeological sites have been recorded to date. Approximately 5,320 historic structures have been recorded on or near TVA-managed public lands.

Land Use. The Tennessee River system has its headwaters in the mountains of western Virginia and North Carolina, eastern Tennessee, and northern Georgia. The Valley watershed includes approximately 40,913 square miles. This area lies mostly in the state of Tennessee, with portions in six other states—Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. TVA's PSA includes a total of 76,738 square miles, with 44,783 square miles extending outside the Valley. TVA-managed lands adjacent to reservoirs include approximately 293,000 acres or 458 square miles encompassing parts of the seven Valley states.

Prime Farmland. In the TVA region, approximately 17,360,515 acres are designated as prime farmland, farmland of statewide importance, or farmland of local importance. On average, this represents 33.2 percent of the total acreage farmed within the seven-state service area. On average, prime farmland surrounding most reservoirs (where soils data are available) is less than 12 percent of the acreage.

Visual Resources. TVA-managed lands include dam reservations, water bodies with floodrights, and tracts of land adjacent to the water bodies that range in size from tenths of an acre to several hundred acres. Since the scenic features of the landscape are not limited by land boundaries, landscape character extends across TVA-managed lands and other public and private lands alike. Large parts of the Tennessee Valley have the characteristics of a scenic, rural countryside.

Floodplains. As stated in the TVA Act, one of the primary reasons that TVA was established was to "control the destructive floodwater in the Tennessee River and the Mississippi River Basins." A series of dams and reservoirs was constructed to make flood control a reality. The operation of the integrated reservoir system substantially lowers the risk of flooding in the Valley and in the Ohio and Mississippi rivers basins.

Socioeconomics and Environmental Justice. The total population of the region is about 10.6 million, as of 2009. The larger population concentrations in the region tend to be located along the corridors of the Tennessee, French Broad, Cumberland, and Tennessee rivers. In 2008, the total employment for the study area was almost 6.1 million. In 2008, the per capita personal income for the study area was $32,949, about 82 percent of the national average of $40,166. However, the 2008 average income levels vary widely across the study area. Minorities constitute 21.2 percent of the population within the study area. However, the distribution within the region is very uneven. Minorities are a relatively large share of the total population in most counties located in the western portion of the study area. In 2008, the poverty level for the study area was estimated to be 15.9 percent, higher than the national average of 13.2 percent. County poverty levels are higher than the regional average more frequently in the western part of the region and in counties along or near the Tennessee-Kentucky border.

Navigation. Development of the Tennessee River navigation channel was essentially completed in 1945 with the construction of a series of 10 dams and navigation locks, extending commercial navigation from Knoxville, Tennessee, to Paducah, Kentucky, a distance of 652 miles. The Tennessee River waterway is an integral part of the interconnected, 12,000-mile National Inland Waterway System.

Air Quality. Air quality in the TVA region is generally good and has steadily improved over the last 30 years. There are currently no areas in the TVA region (nonattainment areas) that do not meet air quality standards for carbon monoxide, lead, nitrogen dioxide, sulfur dioxide (SO_2), ozone, and larger particulate matter (PM_{10}). A few counties in the eastern half of the region are designated as nonattainment for fine particulate matter ($PM_{2.5}$). Portions of the TVA region are expected to be designated as nonattainment for SO_2 and ozone standards, which were recently made more stringent.

Climate. The TVA region has a generally mild climate. Both annual average temperature and precipitation vary from year to year and neither shows significant long-term increasing or decreasing trends. Wind speeds are generally light with higher speeds in winter and spring and lower speeds in summer and autumn.

ENVIRONMENTAL CONSEQUENCES

Regardless of the alternative selected, some resources would not be directly affected either adversely or beneficially by the NRP, while other resources would likely be directly or indirectly affected in a minor way or to moderate degree across the range of alternatives. The relative impacts for each resource area are shown in figures presented in Chapter 5.

It is estimated that Alternative C would create the greatest potential beneficial impacts for the following resource areas: recreation, natural areas, wildlife, wetlands, water quality, listed aquatic species, listed terrestrial species, cultural resources, land use, prime farmland, and socioeconomics. Alternative D would create the greatest potential beneficial impacts for visual resources, listed plant species, and vegetation.

Alternative A would create the least potential beneficial impacts for the following resource areas: natural areas, vegetation, wildlife, wetlands, listed aquatic species, listed terrestrial species, listed plants, cultural resources, land use, prime farmland, and visual resources. Alternative B would create the least potential beneficial impacts for socioeconomics, water quality, and recreation. The potential impacts to floodplains, navigation, air quality, and climate would be relatively similar under all alternatives. Table S-1 provides a comparison

of resources and explains how each alternative could affect the resource. Relative benefical impacts to the resource are shown in figures in Chapter 5.

Table S-1. Summary of Potential Effects by Alternative

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
Developed Recreation	Beneficial impacts but insufficient to meet recreation demand	Growing gap in meeting recreation demand	Increase in the quality and quantity of recreation opportunites	Similar to Alternative A
Dispersed Recreation	Negative impact due to increased pressure on natural resouces	Beneficial impact in meeting recreation demand and managing impacts	Provides the most beneficial impact in meeting recreation demand and managing impacts	More beneficial than Alternative B but less than Alternative C
Natural Areas	Slightly adverse impacts due to lack of active management	Less adverse than Alternative A	Beneficial impacts due to proactive management	Less beneficial than Alternative C
Terrestrial Ecology — Plants	Negative Impacts anticipated due to spread of nonnative invasive plants (NNIPs)	Beneficial impact due to increase in NNIP management	Provides the greatest beneficial impact due to increase in NNIP management	Less beneficial than Alternative C
Terrestrial Ecology — Wildlife	No adverse impacts			
Wetlands	No significant impacts		Beneficial impacts due to identification, protection, and restoration efforts	Provides the greatest beneficial impacts
Water Quality	Beneficial impacts due to the Water Resource Management programs	Adverse impacts due to the reduction in Water Resource Management programs	Provides the greatest beneficial impacts	More beneficial than Alternative B but less than Alternative C
Aquatic Ecology	Beneficial impacts due to ongoing stewardship management	No significant impacts	More beneficial than Alternatives A and B	Provides the greatest beneficial impacts
Endangered and Threatened Species	No impacts to listed aquatic species and terrestrial animal species; impacts to listed plant species due to the spread of NNIPs			

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
Cultural Resources	Potential negative impacts to historic properties with the exception of programs associated with Archaeological Resources Protection Act	Less negative impacts than Alternative A	Greatest beneficial impacts due to proactively promoting protection and preservation of resources	More beneficial than Alternatives A and B but less than Alternative C
Land Use	Slightly adverse impacts due to lost opportunities for recreation and natural resource protection	Greatest potential for adverse impacts	Provides the least potential for adverse impacts	Similar to Alternative C
Prime Farmland	Beneficial impacts due to biological and cultural resources programs	Greater beneficial impacts than Alternative A	Greatest beneficial impacts	More beneficial than Alternatives A and B but less than Alternative C
Visual Resources	Reduction in the scenic attraction of TVA-managed lands	Increasingly beneficial impact in the scenic attraction of TVA-managed lands	Most beneficial impact in the scenic attraction of TVA-managed lands	Similar to Alternative C
Floodplains	Negligible loss of flood control and power storage			
Socioeconomics and Environmental Justice	No impacts	Small negative impacts to the economy and quality of life	Positive impacts to the economy and quality of life	Less beneficial than Alternative C
Navigation	Minimal impacts to commercial navigation			
Air Quality	No negative impacts			
Climate	No impacts			

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

§	Section
<	Less Than
≤	Less Than or Equal To
>	Greater Than
°C	Degree Celsius
°F	Degree Fahrenheit
ADAAG	Americans With Disabilities Act Accessibility Guidelines
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
BFN	Browns Ferry Nuclear Plant
BMPs	Best Management Practices
C&GCI	Clean and Green Campground Initiative
CFR	Code of Federal Regulations
CLCA	Comprehensive Land Conditions Assessment
CO_2	Carbon Dioxide
CWA	Clean Water Act
CWI	Clean Water Initiative
CVLP	Comprehensive Valleywide Land Plan
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
DU	Ducks Unlimited
EA(s)	Environmental Assessment(s)
EE	Environmental Education
e.g.	Latin term, *exempli gratia*, meaning “for example”
EIS	Environmental Impact Statement
Environmental Policy	TVA 2008 Environmental Policy
EO(s)	Executive Order(s)
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ETC	Endangered, Threatened, and Candidate
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
F&TF	Foundation and Trust Fund
GHG(s)	Greenhouse Gas(es)
GIS	Geographic Information System
HPA	Habitat Protection Area
HU	Hydrologic Unit
i.e.	Latin term, *id est*, meaning “that is”
IBI	Index of Biotic Integrity
IMBA	International Mountain Bicycling Association
IPCC	Intergovernmental Panel on Climate Change
IRM	Integrated Resource Management
IRP	Integrated Resource Plan
Land Policy	TVA 2006 Land Policy
LCA	Land Conditions Assessment
LNT	Leave No Trace
LSMNC	Land Stewardship Maintenance Needs Checklist
MOU(s)	Memorandum(s) of Understanding
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NAGPRA	Native American Graves Protection and Repatriation Act
n.d.	Indicates “no date,” or date which Web site was accessed is unknown
NEMO	Nonpoint Education for Municipal Officials

NEPA	National Environmental Policy Act
NGOs	Nongovernment Organizations
NHPA	National Historic Preservation Act
NNIP(s)	Nonnative Invasive Plant(s)
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRP	Natural Resource Plan
NSR	New Source Review
NWI	National Wetlands Inventory
NWS	National Weather Service
NWSG	Native Warm-Season Grasses
O&M	Operation and Maintenance
PA	Programmatic Agreement
PCBs	Polychlorinated Biphenyls
PIF	Partners in Flight
PSA	Power Service Area
PSD	Prevention of Significant Deterioration
QGP	Quality Growth Program
RLA	Rapid Lands Assessment
RLCA	Rapid Land Conditions Assessment
RLMP(s)	Reservoir Land Management Plan(s)
ROS	*Reservoir Operations Study*
RRSC	Regional Resource Stewardship Council
SE-EPPC	Southeast Exotic Pest Plant Council
SFI	Sport Fishing Index
SHPO(s)	State Historic Preservation Officer(s)
Sic	Latin word meaning “in such a manner”; it is used to indicate that an incorrect phrase or meaning in the quote has been reproduced verbatim from the original and is not a transcription error
SIP(s)	State Implementation Plan(s)
SMI	Shoreline Management Initiative
SMP	Shoreline Management Policy
SMZ(s)	Streamside Management Zone(s)
SQN	Sequoyah Nuclear Plant
STM	Stream and Tailwater Monitoring
SWA	Small Wild Area
TCPs	Traditional Cultural Properties
TDA	Tennessee Department of Agriculture
TDEC	Tennessee Department of Environment and Conservation
Trading	Water Pollutant Trading
TRI	Targeted Reservoir Initiative
TVA or the Agency	Tennessee Valley Authority
TVA Board	Tennessee Valley Authority Board of Directors
TVCMI	Tennessee Valley Clean Marina Initiative
TWI	Targeted Watershed Initiatives
TWRA	Tennessee Wildlife Resources Agency
Unit Plans	Resource Management Unit Plans
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Valley	Tennessee River Valley
VS	Vital Signs
WHC	Wildlife Habitat Council
WOA	Wildlife Observation Area
WS	Wildlife Services

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CHAPTER 1

1.0 PURPOSE OF AND NEED FOR ACTION

1.1. Introduction

For more than seven decades, Tennessee Valley Authority (TVA or the Agency) has been improving the quality of life in the Tennessee River Valley (Valley) through its threefold mission of providing affordable and reliable power, promoting sustainable economic development, and acting as a steward of the Valley's natural resources. The lands held by TVA as steward in the name of the United States of America are some of the most important resources of the region. They have provided the foundation for the dams and reservoirs that protect the region from flooding and provide the benefits of a navigable waterway and low-cost hydroelectricity. TVA-managed lands are also the sites for power generating systems and arteries for delivering power to those who need it. Many of the parks, recreation areas, and wildlife refuges that are so important for the region's quality of life are on lands owned or formerly owned by TVA. Use of TVA's public lands has often been the catalyst for public and private economic development.

In May 2008, the TVA Board of Directors (TVA Board) approved the TVA Environmental Policy. The Environmental Policy sets forth principles to guide TVA in the reduction of the environmental impacts of its activities while continuing to provide reliable and affordable power to the Valley. By establishing the Environmental Policy, TVA committed to a more systematic and integrated approach to managing stewardship. The proposed Natural Resource Plan (NRP) addresses TVA's activities involving Water Resource Protection, Sustainable Land Use, and Natural Resource Management. The proposed plan and alternatives to it are addressed in this environmental impact statement (EIS).

1.2. The Tennessee Valley Authority

President Franklin Roosevelt needed creative solutions to lift the nation out of the depths of the Great Depression, and TVA is considered one of his most innovative initiatives. Roosevelt envisioned TVA as an agency different from any other. He asked Congress to create "a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise." On May 18, 1933, Congress passed the Tennessee Valley Authority Act. A copy of the TVA Act is available at http://www.tva.com/abouttva/pdf/TVA_Act.pdf.

From the start, TVA established a unique problem-solving approach to fulfilling its mission, Integrated Resource Management. Each issue TVA faced—whether it was power production, navigation, flood control, malaria prevention, reforestation, or erosion control—was studied in its broadest context. TVA weighed each issue relative to the others. From this beginning, TVA has held fast to its strategy of integrated solutions, even as the issues changed over the years. A short TVA history is available at http://www.tva.com/abouttva/history.htm.

1.3. TVA's Stewardship Policies and Programs

1.3.1. Environmental Policy

As stated in TVA's 2007 Strategic Plan (http://www.tva.com/stratplan/tva_strategic_plan.pdf), "TVA will be proactive in addressing environmental concerns, including those related to global

climate change." About half of the identified strategic objectives and critical success factors relate directly to TVA's environmental activities and policy-making.

Following the release of the 2007 Strategic Plan, the TVA Board asked for the development of an integrated environmental policy to outline objectives and critical success factors across the multiple areas of TVA's activities. In 2008, the TVA Board approved the Environmental Policy, which provides board-level principles to guide TVA in reducing the environmental impacts of its activities while continuing to provide reliable and affordable power to the Valley. In 2010, a biennial review of the Environmental Policy occurred and did not result in an update or revision. TVA's overarching Environmental Policy objective is to provide cleaner, reliable, and affordable energy; support sustainable economic growth in the Valley; and engage in proactive environmental stewardship in a balanced and ecologically sound manner. A copy of the Environmental Policy is available at http://www.tva.gov/environment/pdf/environmental_policy.pdf.

1.3.2. Land Policy

TVA originally acquired approximately 1.3 million acres of land in the Valley. Creation of the TVA reservoir system inundated approximately 470,000 acres with water. TVA has already transferred or sold approximately 508,000 acres, the majority of which was transferred to other federal and state agencies for public uses. TVA currently controls (owns) approximately 293,000 acres of reservoir lands, which continue to be managed pursuant to the TVA Act (Figure 1-1).

In 2006, TVA adopted a Land Policy to guide retention, disposal, and planning of real property. Accordingly, it is TVA's policy to protect the integrated operation of the TVA reservoir and power systems, to provide for appropriate public use and enjoyment of the reservoir system, and to provide for continuing economic growth in the Valley. Recognizing that historical land transfers have contributed substantially to meeting multipurpose objectives, it is also TVA's policy to preserve reservoir lands remaining under its control in public ownership except in those rare instances where the benefits to the public will be sufficient to justify transferring lands to private ownership or another public entity. The Land Policy is available at http://www.tva.gov/river/landandshore/land_policy.htm.

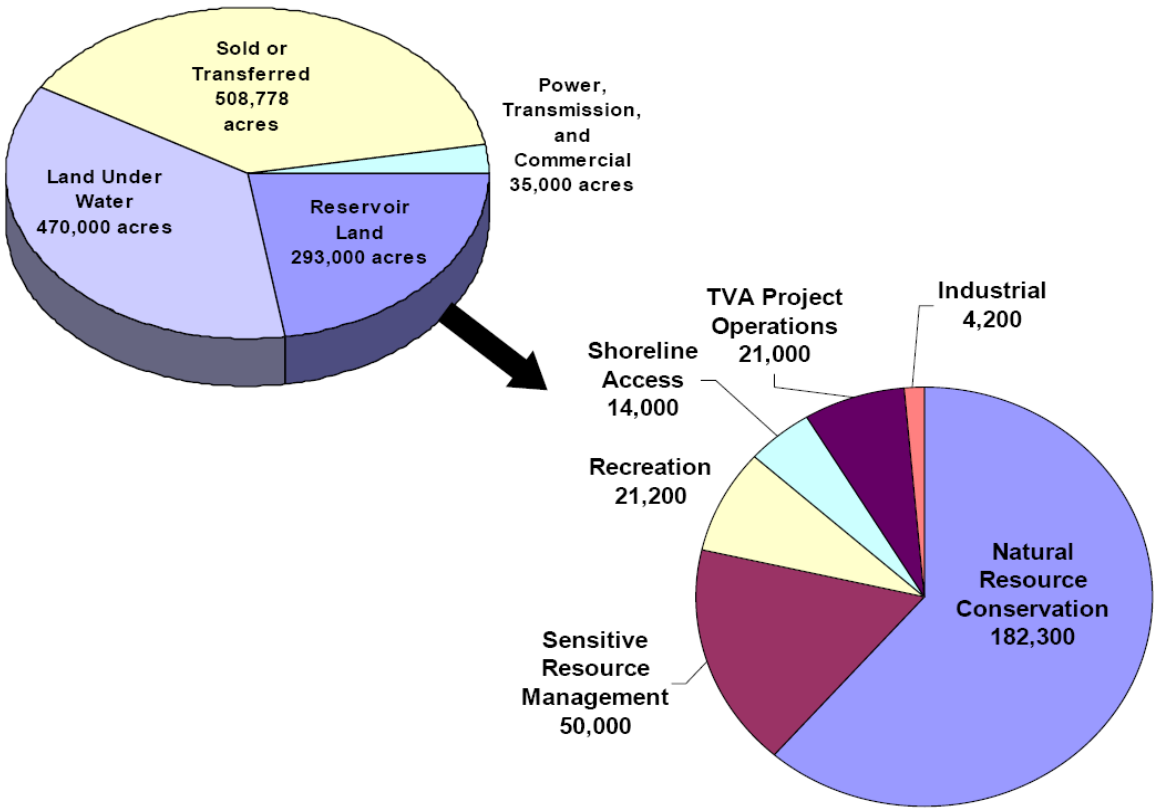

Figure 1-1. TVA-Managed Reservoir Land

1.3.3. Biological and Cultural Resources Management

TVA manages biological and cultural resources while providing for many types of recreational opportunities. The Agency has designated more than 180,000 acres of the lands under its control for natural resource conservation, which includes the enhancement of wildlife habitat and dispersed informal recreation. In addition, TVA has designated approximately 51,000 acres for sensitive resource management, where activities that might endanger significant cultural or natural features are restricted. Together, these 231,000 acres of public lands provide TVA with distinctive management opportunities in resource protection and enhancement and terrestrial greenhouse gas (GHG) sequestration management.

Biological Resources Management

TVA has a long and storied history in the biological resources management arena, especially in the areas of forestry, land reclamation, and wildlife management. The TVA Act recognized the role of forest management in the full development of the region's natural and human resources. The goals of the early forestry programs included optimum forest productivity, economic expansion, watershed protection, and environmental enhancement. Through the years, TVA worked with other agencies and stakeholders to encourage improved forest management, more efficient wood utilization, environmental protection, reforestation, and mine reclamation.

TVA developed the first forest tree nurseries in the Valley and assisted Valley states in developing their own tree production capabilities. Between the 1930s and 1960s, more than

600 million seedlings were produced at TVA's two forest nurseries for distribution across the Valley region. From the 1950s through the 1970s, TVA conducted a Valleywide program to inventory all forested tracts in the region. This program complemented the United States (U.S.) Forest Service's (USFS) national inventory system. Through the 1980s and 1990s, TVA initiated some of the first computerized forestry planning tools in the nation, which were used to complete a systematic inventory of its forested properties. This inventory was used to guide forestry management activities. During the 1990s and 2000s, private land development adjacent to TVA-managed land increased dramatically, putting more pressure on TVA's forests, and led TVA to balance these uses with traditional forest management goals.

Dating back to TVA's earliest days, there has been committed effort to protecting and improving wildlife populations and habitats. With a vast amount of impounded surface water, approximately 293,000 acres of land around the reservoirs, and 11,000 miles of shoreline, along with 42,000 miles of tributary streams and rivers, this land/water reservoir system represents a significant natural resource base offering numerous opportunities for productive wildlife management. Between the 1930s and 1950s, TVA provided more than 195,000 acres of land to federal and state agencies for the development of waterfowl and upland wildlife management areas and refuges. This effort provided significant benefits to resident and migratory wildlife species. In 1978, TVA initiated a wildlife restoration project aimed at restoring various animal populations. These introductions, conducted in partnership with other federal and state agencies and private organizations, resulted in establishing self-sustaining populations of several species, with reservoir habitat species such as osprey and bald eagles doing especially well. During the 1970s and 1980s, TVA was instrumental in developing techniques to restore productive wildlife habitat to previously disturbed lands. TVA was recognized nationally for its work in reclaiming surface mined lands and developed a wildlife-oriented model reclamation plan for southern Appalachia in cooperation with the U.S. Fish and Wildlife Service (USFWS).

In the 1970s, TVA created a regional Natural Heritage database to collect and store biological data to help guide effective conservation and land planning activities and to assist TVA when complying with the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), wetland regulations under the Clean Water Act (CWA), executive orders (EOs), and other applicable federal and state legislation. Today, TVA's Natural Heritage database is the largest in the Valley region. In addition to maintaining the database, TVA developed procedures and collected data to determine the health and status of endangered and threatened plant and animal species located at approximately 40 sites on TVA-managed lands.

Cultural Resources Management

The earliest TVA-related archaeological surveys began in 1933 with the first TVA dam at Norris, Tennessee. As TVA rapidly began constructing dams across the Valley, archaeological surveys were conducted of the Wheeler, Pickwick, Guntersville, Chickamauga, and Kentucky reservoir basins. Archaeological surveys conducted on TVA-managed lands from 1940 through 1960 were sporadic until the National Historic Preservation Act (NHPA) was passed in 1966. NHPA requires federal agencies to consider the potential effects of a proposed action on historic properties, which include archaeological resources and historic structures. NHPA also outlines an approach for agencies to consider preservation of cultural resources. Since 1966, TVA has conducted archaeological surveys on 30 reservoirs within the Valley.

Over the last few decades, archaeological survey techniques have improved due to scientific and technological advancements. Because some investigations were conducted prior to the development of modern survey methods, archaeological survey coverage and site documentation on TVA-managed lands vary across the Valley. Of the approximate 293,000 acres of TVA-managed lands along the reservoirs, about 30 percent (or approximately 88,000 acres) has been systematically surveyed for cultural resources.

To date, TVA has documented an estimated 11,000 archaeological sites on and adjacent to its reservoir and power properties across the Valley. While the number of resources is quite large, only about 25 percent of these sites have been assessed for eligibility for the National Register of Historic Places (NRHP). Authorized by the NHPA, the National Park Service's NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archaeological resources and the official list of the nation's historic places worthy of preservation.

TVA manages a number of significant archaeological sites that have made an important contribution to the understanding of prehistory in the Southeast U.S. These resources include the Seven Mile Island Archaeological District (listed in the NRHP) and Dust Cave in Alabama, Hiwassee Island and Ledbetter sites in Tennessee, the Jonathan Creek site in Kentucky, and Yellow Creek in Mississippi, as well as hundreds of other sites that have been studied since the inception of TVA.

Approximately 5,320 historic structures have been recorded on or near TVA-managed public lands. Approximately 233 of these structures are considered either eligible or potentially eligible for listing in the NRHP, 85 historic structures are listed in the NRHP, and nine NRHP historic districts exist on TVA-managed lands.

The majority of the historic structure data came from individual county surveys on file with the State Historic Preservation Officers (SHPOs) and from past TVA surveys, primarily associated with TVA's reservoir lands planning. Many of these surveys are incomplete or out of date. Comprehensive work at South Holston, Douglas, Chatuge, Normandy, and Tims Ford reservoirs and partial coverage at Boone, Fort Patrick Henry, and Norris reservoirs supplemented these surveys.

1.3.4. Recreation Management

From its beginning, TVA has encouraged development of a wide variety of outdoor recreational facilities and opportunities in the Valley, particularly on TVA reservoirs and shorelines. TVA has made approximately 485,300 acres of land available for recreational developments (see Table 1-1). In some instances, TVA transferred lands to various local, state, and federal agencies for recreational management purposes. For example, TVA has transferred public lands to the National Park Service and USFS for natural forestlands that simultaneously provide recreational use. In other instances, lands were sold for recreational purposes through auctions, easements, and/or other conveyances. TVA also has allowed third parties to manage its land for recreational purposes through land use agreements such as easements, leases, and licenses. Maps of TVA-managed recreation areas are located in Appendix A, and a detailed chronology of TVA's recreation history is provided in Appendix B.

Table 1-1. Land Conveyed by TVA for Recreation Development

Type of Recreation Area	Number of Areas	Acres*
Public Parks	**213**	**40,826**
State Parks	77	33,276
County	61	3,910
Municipal	74	3,451
Fair Association	1	189
Public Access Areas and Roadside Parks	**178**	**1,110**
Federal (USFS)	17	42
State	116	988
Local	45	80
Wildlife Refuges	**30**	**202,002**
National Wildlife Refuges	2	115,872
State Management Areas and Refuges	28	86,130
National Parks and Forests	**6**	**232,423**
National Forests	4	61,992
National Park	1	170,000
National Parkway	1	431
Other	**332**	**8,974**
Group Camps and Clubs	32	3,473
Commercial Recreation Areas	300	5,501
Total Recreation Areas	**759**	**485,335**

* All acreage figures are approximate.

As recreational demands continued to increase, TVA developed a recreational program to address the development and management of future recreation projects across the Valley. The goal of this program is to add value by working in partnership with other agencies to enhance recreational opportunities and address unmet recreational needs while managing resources on and along the Tennessee River system. The objectives of this program are to:

1. Support diverse recreational activities through management of river flows.
2. Provide recreational opportunities on TVA-managed lands.
3. Provide diverse recreational opportunities through collaborations and partnerships.
4. Plan, collect, and manage TVA recreational information.
5. Integrate operational activities and partnerships that support outdoor recreational opportunities to manage TVA's lands more effectively.

TVA continues to provide lands for recreational purposes through the reservoir lands planning process (see Section 2.3). During a reservoir lands planning effort, tracts of TVA-managed lands around reservoirs are categorized based upon a suitable use that is consistent with TVA policy and guidelines and applicable laws and regulations. As administrators of public land, TVA uses reservoir land management plans (RLMPs), along with TVA policies and guidelines, to manage resources and to respond to requests for the use of TVA-managed land. Throughout the years, TVA has allocated approximately 21,200 acres for developed recreational purposes. Approximately 90 percent of these lands are

currently committed under existing contractual agreements. TVA continues to entertain requests for the development of commercial or public recreation facilities on the remaining lands.

When the TVA Board approved the Land Policy, it also directed staff to review TVA-managed land designated for recreational development purposes to verify the suitability of the properties for this use. A review of land designated for recreational use was completed. The assessment evaluated needs for public boat access, commercial marinas, campgrounds, recreational visitor lodging, developed land-based day use facilities, and dispersed land-based opportunities. The report presenting the results and conclusions of this assessment is available at http://www.tva.gov/environment/land/assessment/recreation.htm.

1.3.5. Reservoir Lands Planning

Throughout its history, TVA has managed public lands to meet a wide range of regional and local resource development needs and to improve the quality of life, both within specific reservoir areas and throughout the Valley. Public lands adjacent to TVA reservoirs, together with adjoining private lands, have been used for public parks, industrial development, commercial recreation, residential development, tourism development, and forest and 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 began a massive dam and reservoir construction program that required the purchase of land for creation of 46 reservoirs (Table 1-2) within the Valley region. Today, TVA manages approximately 293,000 acres of land along these reservoirs for support of TVA operations and the benefit of the public. An increasing demand for and use of these remaining lands sometimes results in conflicting public opinions regarding the most appropriate use of a parcel of TVA-managed land. These competing interests and development pressures, coupled with today's environmental awareness, underscore the necessity for a planned approach to the management of TVA's reservoir lands and related resources.

TVA began comprehensive reservoir land management planning in 1979. Since that time, TVA has developed RLMPs for 34 of its reservoirs using various methodologies. In addition, a special study for the Muscle Shoals/Wilson Dam reservations and a recreation study for Fort Loudoun Reservoir have been completed. Finally, 12 of TVA’s reservoirs do not have RLMPs.

Table 1-2. TVA-Managed Reservoirs

Reservoirs			
Apalachia*	Dogwood**	Nickajack*	South Holston*
Beaver Creek*	Douglas*	Nolichucky*	Sycamore**
Beech River**	Fontana*	Normandy**	Tellico*
Big Bear Creek*	Fort Loudoun**	Norris*	Tims Ford*
Blue Ridge*	Fort Patrick Henry*	Nottely*	Upper Bear Creek*
Boone*	Great Falls**	Ocoee 1*	Watauga*
Chatuge*	Guntersville*	Ocoee 2*	Watts Bar*
Cherokee*	Hiwassee*	Ocoee 3*	Wheeler*
Chickamauga*	Kentucky*	Pickwick*	Wilbur*
Cedar**	Little Bear Creek*	Pin Oak**	Wilson**
Cedar Creek*	Lost Creek**	Pine**	
Clear Creek*	Melton Hill*	Red Bud**	

* TVA has developed an RLMP for this reservoir.
**TVA has not completed an RLMP for this reservoir.

1.3.6. Water Resources Management

TVA operates the Tennessee River and its tributaries as an integrated system for the purposes of navigation, flood control, and navigation and consistent with these purposes for other goals such as water quality, as set forth in the *Reservoir Operations Study* (ROS) EIS (TVA 2004). TVA has been involved with water resources and system integration since soon after the Agency was created in 1933. Programs to study and manage suspended sediment (TVA 1968); limnology; water quality in reservoirs, rivers, and tailwaters (Churchill 1957); reservoir fisheries (Eschmeyer and Jones 1941); stream biology (Charles Saylor, TVA, personal communication, April 15, 2010); and the hydrology and water quality impacts of different land uses (TVA 1951) all began before 1940. This work was associated with construction of new dams and reservoirs and the broader stewardship mission of TVA.

These programs evolved with the needs of TVA and the Valley, and TVA scientists were often leaders in advancing the state of the art of water resources and watershed management. Along the way, TVA assessed water quality throughout the Valley (Scott and Jones 1945; TVA 1952; TVA 1973) and completed a series of biological and river habitat studies (e.g., TVA 1970). Reservoir conditions were explored across the Valley (Placke 1983), and river-basin-specific (e.g., Brown and Meinert 1976) and reservoir-specific (e.g., Cox 1986) water resource studies were conducted. TVA used advances in computer technology to help develop the ability to model watersheds (Betson et al. 1980) and reservoirs (Bender et al. 1990). TVA biologists began developing biological water quality assessment tools for the Valley and exploring applications of this new tool (Saylor and Scott 1987). TVA combined remote sensing and computer capabilities to develop aerial-photography-based land use inventories (Carroll and Sagona 1993) to locate pollution sources and later incorporated geographic information systems (GIS) and watershed modeling into this process (TVA 2002a).

Several stewardship programs took shape in the 1990s. These programs can be grouped by the ultimate outcomes for which the programs are designed. The goal of the first group, referred to as public outreach programs, is to encourage and demonstrate good stewardship of water resources. Current programs in this group include the Quality Growth Program (QGP) and the Tennessee Valley Clean Marina Initiative (TVCMI).

The programs in the second group, water resources improvement group, are designed to create measurable water quality improvement in Valley watersheds. Targeted Watershed Initiatives (TWI) is the current program in this group.

The last group consists of programs that collect, maintain, and distribute information about water resource conditions. The Stream and Tailwater Monitoring (STM) Program started in 1986, with the first TVA application of the Index of Biotic Integrity (IBI) (Saylor and Scott 1987) to measure the condition of stream fish communities. STM grew into the primary data source for the TWI Program, providing data to target projects, track project progress, and define the outcome for watershed work. TWI also uses data from the Vital Signs Monitoring Program for targeting, tracking, and outcome measures.

Though TVA programs address water resource issues, TVA does not have the authority to regulate water pollution. The U.S. Environmental Protection Agency (USEPA) and each of the Valley states that share the river develop pollution regulations and grant permits for discharges to the Tennessee River and its tributaries. TVA facilities that have the potential to discharge pollutants into waters of the U.S., such as hydroelectric or steam electric generating plants, obtain the appropriate permits for routine facility discharges in accordance with these regulations.

1.4. Purpose and Need

Historically, TVA has taken various approaches to managing biological, cultural, recreation, and water resources and to planning the use of reservoir lands. In its Environmental Policy, TVA committed to a more systematic and integrated approach to natural resource stewardship. The purpose of the NRP is to develop a plan to guide TVA's responsible management of natural resources over the next 20 years while upholding TVA's mission and renewed vision and balancing stewardship objectives with sound business practices. The following objectives and critical success factors in the Environmental Policy bear on this:

> Water Resource Protection and Improvement Objective: TVA will improve reservoir and stream water quality, reduce the impact of its operations, and leverage alliances with local and regional stakeholders to promote water conservation.
>
> *Critical Success Factors*
>
> - *Integrate the impacts of water quality and quantity into the long-range planning and decision-making process.*
> - *Promote the integration of energy efficiency and water conservation into community planning and building construction.*
> - *Collaborate in community outreach and partnerships through voluntary demonstrations of the efficient use of water resources and protection of water quality.*
>
> Sustainable Land Use Objective: TVA will strive to maintain the lands under its management in good environmental health, balancing their multiple uses, and will improve its land transaction processes to support sustainable development.

Critical Success Factors

- *Actively manage TVA lands to meet the desired conditions for their purpose as defined in the RLMPs.*
- *Improve reservoir shoreline conditions through collaborative partnership initiatives and balance the multiple uses of the reservoirs in accordance with TVA's Land Policy and Shoreline Management Policy (SMP).*
- *Manage TVA lands, mineral rights, and shoreline access to better achieve environmental commitments while meeting the needs for recreation, residential access, and economic development.*

Natural Resource Management Objective: TVA will be a leader in natural resource management through the implementation of sustainable practices in dispersed recreation while balancing the protection of cultural, heritage, and ecological resources.

Critical Success Factors

- *Allow for properly managed, ecologically friendly dispersed recreation while balancing the protection of biological, cultural, and heritage resources.*
- *Promote ecological diversity and wildlife habitats on TVA lands through partnerships and voluntary initiatives.*
- *Increase the level of environmental quality and management consistency among TVA-managed and -leased recreation facilities.*

This EIS evaluates the alternative approaches to TVA's management of biological and cultural resources, recreation, reservoir lands planning, and water resources. The general goal of the NRP is to integrate the objectives of these resource areas, provide for the optimum public benefit, and balance competing and sometimes conflicting resource uses. These competing interests and development pressures, coupled with today's environmental awareness, underscore the necessity for a consistent approach to the management of TVA's lands. The specific goals of the NRP include:

1. Aligning TVA's stewardship programs and plans with the Environmental Policy
2. Providing a strategic plan that
    - Guides TVA's resource management decisions and actions
    - Integrates stewardship objectives for optimum public benefits while developing efficiencies for natural resources
    - Strikes a balance between the competing and sometimes conflicting resource uses on TVA-managed lands
3. Increasing the efficiency of environmental reviews of TVA actions
4. Providing TVA staff with a "reference manual" to guide implementation activities
5. Providing clarity and transparency to the public

1.5. Scope of the Natural Resource Plan

The content of the NRP addresses biological and cultural resources management, recreation management, reservoir lands planning, and water resource management. While TVA is engaged in its NRP planning process, it is continuing to implement activities consistent with its current resource management strategies and programs.

The geographical scope for biological and cultural resources management and recreation management components of the NRP focus on the approximately 293,000 acres of reservoir lands; active and former fossil and nuclear properties; Raccoon Mountain Pumped Storage Plant; and Buffalo Mountain Wind Power Project site managed by TVA (Figure 1-1 and http://www.tva.gov/sites/sites_ie.htm). The NRP would be implemented on TVA's fossil and nuclear properties and at Raccoon Mountain and Buffalo Mountain as interim and/or secondary management techniques, as appropriate; these properties will remain power assets, and primary management will remain as power generation. It would be at TVA's discretion to determine the appropriate programs and activities within the NRP for implementation on these power properties. For example, the NRP could be applied to the portion of the nuclear properties located outside the secured area of each site to ensure that plant security requirements and needs are not affected. This geographical area is referred to below as TVA-managed lands.

Recreation management focuses on those recreation facilities and programs managed by TVA and stream access sites located near TVA-managed reservoirs.

The reservoir lands planning component of the NRP addresses the approximately 293,000 acres of TVA-managed reservoir lands. The geographical scope for the water resource management component of the NRP includes the entire Tennessee River watershed (Figure 1-2) because of the programs associated with improving watershed water quality. The content of water resource management focuses on those discretionary programs and activities implemented by TVA to improve reservoir and watershed water quality proactively. The Tennessee River watershed and TVA's power service area (PSA) is collectively referred to below as the TVA region.

TVA's legal responsibilities extend to lands and landrights in the custody and control of TVA that are outside the scope of the NRP. If TVA were to propose conducting the programs or activities listed in the NRP on other lands or landrights managed by TVA outside the geographical scope of this EIS, an appropriate site-specific environmental review would be conducted.

Stewardship activities associated with TVA's Aquatic Plant Management, Mosquito Management, or Reservoir Releases Improvements Programs are not within the scope of the NRP. Similarly, this plan does not address reservoir operations or river flows, shoreline permitting activities, or the amount of shoreline open for residential development. These specific activities have been addressed in other comprehensive planning processes and their associated environmental reviews (see Section 1.8). It is TVA's intent to develop a mineral rights policy at a later date. Therefore, actions relating to TVA's mineral rights holdings or development of a mineral rights policy have been excluded from the scope of the NRP.

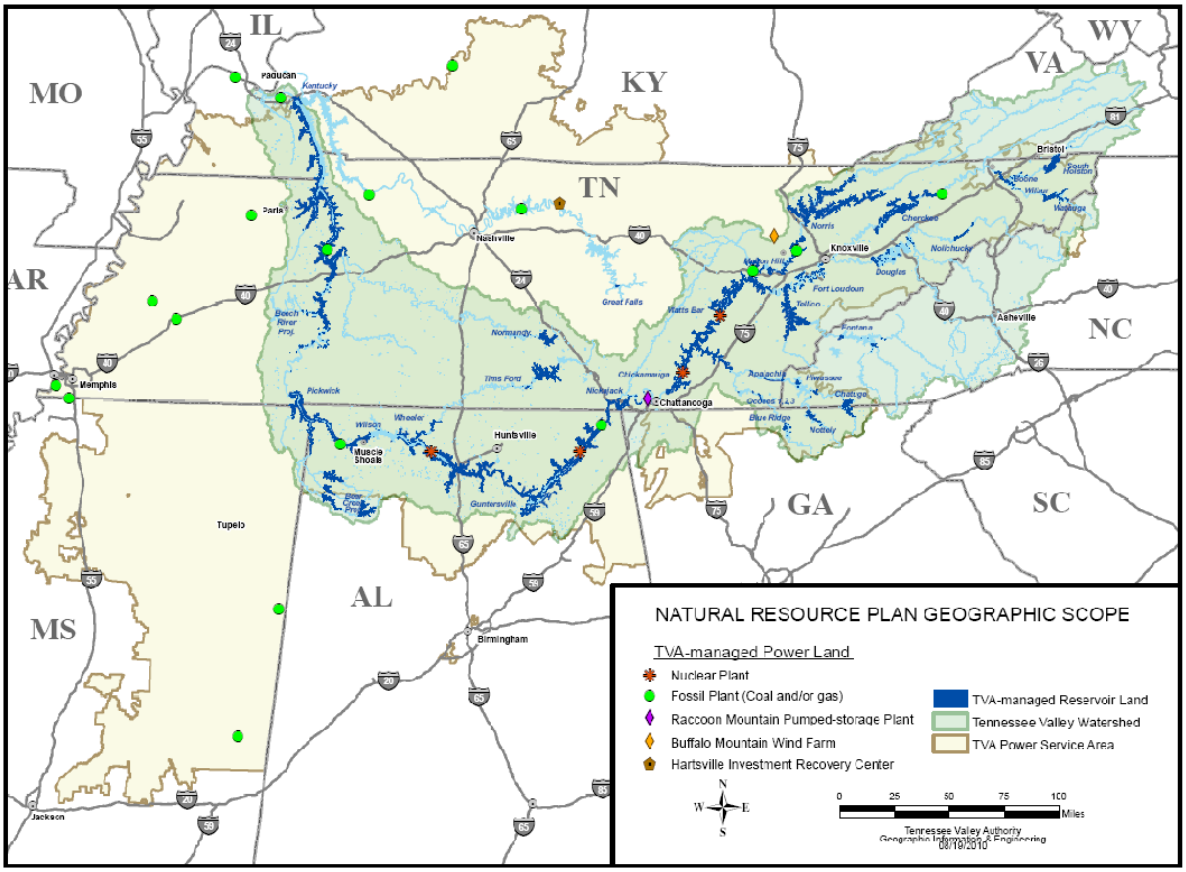

Figure 1-2. Natural Resource Plan Geographic Scope

1.6. The Decision

The TVA Board will decide whether to adopt the final NRP developed by TVA staff, to adopt one of the other alternatives analyzed in this EIS, or to take no action.

1.7. The Scoping Process

On June 15, 2009, TVA published a notice of intent (NOI) to prepare an EIS and to conduct a comprehensive study of its future energy and environmental stewardship needs, known as the Integrated Resource Plan (IRP). The IRP had two major objectives—to develop a plan for meeting the energy needs of the TVA region over the next 20 years and to develop implementation plans for achieving the objectives of the Environmental Policy. Subsequent to publishing the NOI, TVA decided it would be better to address NRP activities in a separate process.

Scoping, which is integral to the process for preparing EISs under NEPA, is a procedure that solicits public input to the NEPA process to ensure that: (1) issues are identified early and properly studied; (2) issues of little significance do not consume substantial time and effort; (3) the EIS is thorough and balanced; and (4) delays possibly caused by an inadequate review are avoided. TVA's NEPA procedures require that the scoping process commence soon after a decision has been reached to prepare an EIS in order to provide an early and open process for determining the scope and for identifying the significant issues related to a proposed action.

1.7.1. Regional Resource Stewardship Council

In 1999, TVA established the Regional Resource Stewardship Council (RRSC) to advise TVA on its stewardship activities and the priorities among competing objectives and values. In addition to these other responsibilities, the RRSC serves as a stakeholder review group and has been asked to provide input to the development of the NRP. The RRSC was established under the Federal Advisory Committee Act. Its meetings are open to the public, and its proceedings are published on TVA's Web site at http://www.tva.gov/rrsc/.

1.7.2. Summary of Public Participation

Public scoping for the NRP began as part of the IRP project on June 15, 2009, with the publication of the NOI (TVA 2009a). TVA issued press releases about the project and advertised it on its Web site (http://www.tva.gov/environment/reports/irp/index.htm). The IRP Web site materials included background information, a form for submitting scoping comments, a scoping questionnaire, addresses for submitting comments by mail, by e-mail, or by fax, and information on public scoping meetings. Letters requesting comments on the scope of the IRP were mailed to 80 federal and state agency offices and the representatives of 21 federally recognized Native American tribes.

TVA held seven public meetings between July 20 and August 6, 2009 (Table 1-3). The meetings were advertised in local newspapers, by press releases, and on the project Web site. About 180 people attended these meetings; attendees included members of the public and representatives from state agencies and local governments, TVA power distributors, nongovernmental organizations, and other special interest groups. Exhibits, fact sheets, and other materials were available at each public meeting to provide information about the study and the EIS.

At each of these meetings, attendees were invited to submit oral and written comments. In addition to the public meetings, TVA invited the public to submit comments through its Web site and by e-mail, letter, and fax. The IRP questionnaire included three questions pertaining to stewardship activities. The responses to those questions have been organized by issue categories and quantified in figures and tables in Appendix C. At the close of the IRP public scoping period on August 14, 2009, 609 total comments pertaining to stewardship had been submitted.

Table 1-3. Public Scoping Meeting Dates and Locations

Date (2009)	Location
Monday, July 20	Nashville, Tennessee
Tuesday, July 21	Chattanooga, Tennessee
Thursday, July 23	Knoxville, Tennessee
Tuesday, July 28	Huntsville, Alabama
Thursday, July 30	Hopkinsville, Kentucky
Tuesday, August 4	Starkville, Mississippi
Thursday, August 6	Memphis, Tennessee

Following the decision to separate the IRP and NRP, TVA announced an additional 30-day public comment period for the NRP beginning October 2, 2009. TVA staff mailed approximately 130 letters to federal, state, and regional agencies in the seven Valley states notifying them of the separation and requesting comments specifically on the NRP (Appendix C). During this comment period, information about the NRP, including an

interactive comment form, was available on the project Web site, http://www.tva.gov/environment/reports/nrp/index.htm.

During the NRP and IRP public comment periods, written comments were received from seven federal agencies, 16 state and regional agencies, and eight organizations or community groups. The scoping period concluded with 76 additional comments on the NRP for a total of 685 comments. Summaries of the public comments are located in Appendix C.

In addition to the general public participation opportunities, TVA directly solicited input from 11 federal and state agencies (Table 1-4). Members of the TVA NRP project team independently met with each agency and discussed the programs associated with biological and cultural resource management, recreation management, reservoir lands planning, and water resource management. Feedback from the agencies was taken into consideration in finalizing the alternatives as well as developing future partnership opportunities.

Table 1-4. Agency Meeting Dates and Locations

Agency	Date (2010)	Location
Various Virginia State Agencies	October 13	Richmond, Virginia
Various Kentucky State Agencies	October 13	Frankfort, Kentucky
Various North Carolina State Agencies	October 14	Raleigh, North Carolina
University of Tennessee	October 18	Knoxville, Tennessee
U.S. Army Corps of Engineers	October 20	Nashville, Tennessee
U.S. Forest Service	October 21	Cleveland, Tennessee
Georgia Department of Natural Resources	October 25	Social Circle, Georgia
National Park Service	October 26	Atlanta, Georgia
U.S. Fish and Wildlife Service	October 29	Cookeville, Tennessee
Mississippi Department of Wildlife, Fisheries, and Parks	November 4	Jackson, Mississippi
Alabama Department of Conservation and Natural Resources	November 4	Montgomery, Alabama
Tennessee Wildlife Resources Agency	November 16	Nashville, Tennessee

1.7.3. Scoping Response

The majority of public responses to the scoping notices focused on the use of public lands for recreational purposes. Many of the recreational comments addressed the accessibility and management of public lands for dispersed and water-based types of recreation. Many stakeholders commented that public lands should be managed for multipurpose benefits such as recreation, natural resources, and wildlife habitat conservation. Several stakeholders voiced opposition to development and referred to the amount of existing recreational boat traffic. Specifically, stakeholders commented about the amount of recreational boat traffic on Pickwick Reservoir. Additional comments were received expressing concerns about the fiscal impacts associated with implementing the NRP.

Tennessee Department of Agriculture, North Carolina Division of Inland Fisheries, and USFWS commented on the need to revise TVA's existing forest management strategies. Tennessee Citizens for Wilderness Protection and USFWS commented on the need to address invasive plants. Tennessee Environmental Coalition and USFWS commented on the need to develop water conservation activities and to continue water quality improvement efforts. The USFWS commented on the need to partner with private landowners for

enhanced habitat management, to increase programs for endangered species' protection and monitoring, and to begin plant and animal genetics studies. The comments received during the public scoping period are summarized in the *Summary of Public Participation* section attached to the scoping document issued in August 2010 (Appendix C or http://www.tva.gov/environment/reports/nrp/index.htm).

1.7.4. Issue and Resource Identification

Based on an analysis of the scoping activities, TVA has identified the following resources and issues that could be affected by implementing the activities associated with the NRP. The potential direct and indirect effects of each alternative are analyzed and disclosed for each resource. Other activities (existing and proposed) that may affect resources of concern for biological and cultural resources management, recreation, reservoir lands planning, and water resource management are also identified, and the potential effects of these activities on the NRP resources and trends in the resources are assessed. The major resource categories considered in the EIS are listed below.

Recreation – Current recreation facilities available to meet public recreation needs are identified, as well as those activities that are important for developed and dispersed recreation. The effects of adopting and implementing each alternative on recreation opportunities on TVA-managed lands and reservoirs are evaluated.

Managed Areas and Sensitive Ecological Sites – These are special and unique natural areas on or in the vicinity of reservoirs set aside for a particular management objective or lands that are known to contain sensitive biological, cultural, or scenic resources.

Terrestrial Ecology – This resource includes the plants and animals comprising the terrestrial ecosystems and natural community types found on TVA and adjacent lands. Issues include the identification and protection of significant natural features, rare species' habitat, important wildlife habitat, and locally uncommon natural community types. Consistent with EOs 13186 and 13112, TVA also has programs addressing migratory birds and invasive species.

Wetlands – Wetlands found on TVA-managed land and along the reservoir shoreline are reviewed with respect to the proposed activities under each alternative. TVA will comply with EO 11990 on wetlands and the CWA.

Water Quality – Water quality conditions affect the overall ecological conditions of the reservoir system. Water quality is influenced by activities that cause shoreline erosion. Additionally, pollution, litter, and debris control affect water quality.

Aquatic Ecology – Aquatic ecology includes the plants, animals, and fisheries found in the waters of the Tennessee River and its tributaries. Issues include the identification and protection of rare species' habitat, important aquatic habitat, and locally uncommon aquatic community types.

Endangered and Threatened Species – Federally or state-listed as threatened and endangered plant and animals and their habitats occurring on and near TVA-managed lands and in adjacent waters are identified. TVA will comply with the ESA and considers similar state laws.

Cultural and Historic Resources – Archaeological sites, historic structures, and cultural landscapes and properties on or near TVA-managed lands including sites eligible for or listed in the NRHP are reviewed with respect to the proposed activities under each alternative. TVA will comply with the NHPA and related laws.

Land Use – Existing land use patterns along the shoreline and back-lying land have been largely determined by TVA land acquisition, disposals, and land use agreements. Many TVA-managed lands are committed to existing land uses with little to no potential for change. Proposed activities on TVA-managed lands are evaluated using the goals of TVA policies and applicable laws and regulations.

Prime Farmland – Prime farmland is land with the best combination of characteristics to produce agricultural and silvicultural products. An important issue is the conversion of prime farmland to urban or industrial developments. TVA will comply with the Farmland Protection Policy Act (FPPA).

Visual Resources – The aesthetic setting of TVA-managed lands is characterized, and scenic and distinctive areas frequently seen by the public are identified. The effect of each alternative on the natural beauty of TVA-managed lands and adjacent areas is evaluated.

Floodplains – Floodplain management is important with respect to flood control and water quality issues, and these areas are productive natural areas. TVA will comply with EO 11988 on floodplains.

Socioeconomics – The current population, labor force, employment statistics, income, and property values of the region are reviewed in respect to proposed activities of each alternative. A subset of these issues is environmental justice, the potential for disproportionate impacts to minority and low-income communities.

Navigation – The navigation of commercial and recreational watercraft is an important resource on the Valley reservoirs. Potential issues include recreational boat traffic as well as commercial navigation.

Air Quality and Climate – Air quality relates to public health and welfare. Attaining and maintaining the National Ambient Air Quality Standards (NAAQS), established by USEPA to protect public health and welfare, is an important issue that is identified and discussed. This EIS also addresses climate change issues.

1.7.5. Alternatives Development

In order to establish a reasonable range of future options for the NRP, five project subteams were developed. These subteams focused on various aspects of biological and cultural resources management, terrestrial GHG management, recreation management, reservoir lands planning, and water resource management. The subteams were tasked to document existing and proposed programs, tools, and activities. Next, these subteams reviewed the comments submitted during public scoping and developed new programs or revised existing programs based on stakeholder input. Finally, the subteams grouped the programs to develop options for the future management of TVA's stewardship assets.

These program options were then grouped into potential management portfolios through a comparison of future "real world" scenarios against TVA's strategies to address stewardship needs. Program options developed from this comparison were then tested against specific valuation criteria. Those meeting the criteria were developed into Action Alternatives from which TVA prepared a draft NRP based on the preferred alternative.

1.8. Other Pertinent Environmental Reviews or Documentation

TVA's RLMPs and relevant EISs and environmental assessments (EAs) are briefly described in this section. A listing of TVA's EISs and EAs completed during the last decade is provided on TVA's Web site, http://www.tva.gov/environment/reports/index.htm.

Reservoir Operations Study Final Programmatic Environmental Impact Statement (TVA 2004)
This study and EIS evaluated alternative ways to operate the TVA reservoir system to produce greater overall public value. The recommended changes in the operation of the reservoirs were implemented in 2004.

Shoreline Management Initiative: An Assessment of Residential Shoreline Development Impacts in the Tennessee Valley Final Environmental Impact Statement (TVA 1998)
In November 1998, TVA completed an EIS analyzing possible alternatives for managing residential shoreline development throughout the Tennessee River Valley. The alternative selected determined TVA's current SMP, which incorporates a strategy of managing public shoreline through an integrated approach that conserves, protects, and enhances shoreline resources and public use opportunities while providing for reasonable and compatible use of the shoreline by adjacent residents. The SMP defines the standards for vegetation management, docks, shoreline stabilization, and other residential shoreline alterations. The Shoreline Management Initiative (SMI) EIS is available at http://www.tva.gov/river/landandshore/landuse_shore.htm. Key elements of the SMP are provided at http://www.tva.gov/river/landandshore/pdfs/shorelnk.pdf .

Clean Water Initiative Final Environmental Assessment (TVA 1997)
In May 1997, TVA issued a finding of no significant impact (FONSI) regarding its implementation activities associated with the Clean Water Initiative (CWI). The CWI activities included the implementation of agricultural best management practices (BMPs), stream bank and streambed restoration through bioengineering and structure placement; planting of native woody and herbaceous plants on stream banks and reservoir shorelines; and solid waste cleanup and disposal.

Lake Improvement Plan Final Environmental Impact Statement (TVA 1990)
This study includes an analysis of impacts of the Reservoir Releases Improvement Program.

Reservoir Land Management Plans

Since 2000, TVA has prepared the following RLMPs and associated EISs or EAs. These plans allocate TVA-managed reservoir lands into broad categories or "zones" that include Project Operations, Sensitive Resource Management, Natural Resource Conservation, Industrial, Developed Recreation, and Shoreline Access.

- *Northeastern Tributary Reservoirs Land Management Plan Final Environmental Impact Statement* (TVA 2010a) – This plan addresses 5,000 acres on Beaver Creek,

Clear Creek, Boone, Fort Patrick Henry, South Holston, Watauga, and Wilbur reservoirs in Tennessee and Virginia.

- *Douglas and Nolichucky Tributary Reservoirs Land Management Plan Final Environmental Impact Statement* (TVA 2010b) – This plan addresses 3,191 acres on Douglas and Nolichucky reservoirs in Tennessee.
- *Mountain Reservoirs Land Management Plan Final Environmental Impact Statement* (TVA 2009b) – This plan addresses 6,273 acres on Chatuge; Hiwassee; Blue Ridge; Nottely; Ocoees No. 1, No. 2, and No. 3; Apalachia; and Fontana reservoirs in Georgia, North Carolina, and Tennessee.
- *Watts Bar Reservoir Land Management Plan Final Environmental Impact Statement* (TVA 2009c) – This plan addresses 16,036 acres on Watts Bar Reservoir in Loudon, Meigs, Rhea, and Roane counties, Tennessee.
- *Boone Management Unit — Boone Reservoir Resource Management Plan and Environmental Assessment* (TVA 2002b) – This plan addresses 566 acres on Boone Reservoir in Sullivan and Washington counties, Tennessee.
- *Pickwick Reservoir Final Environmental Impact Statement and Land Management Plan* (TVA 2002c) – This plan addresses 19,238 acres on Pickwick Reservoir in Colbert and Lauderdale counties, Alabama; Tishomingo County, Mississippi; and Hardin County, Tennessee.
- *Bear Creek Reservoirs Land Management Plan Environmental Assessment* (TVA 2001a) – This plan addresses 9,178 acres on the Bear Creek Reservoirs in Franklin, Marion, and Winston counties, Alabama.
- *Cherokee Reservoir Environmental Assessment and Land Management Plan* (TVA 2001b) – This plan addresses 8,187 acres on Cherokee Reservoir in Grainger, Hamblen, Hawkins, and Jefferson counties, Tennessee.
- *Guntersville Reservoir Final Environmental Impact Statement and Land Management Plan* (TVA 2001c) – This plan addresses 40,236 acres on Guntersville Reservoir in Jackson and Marshall counties, Alabama, and Marion County, Tennessee.
- *Norris Reservoir Land Management Plan Environmental Assessment* (TVA 2001d) – This plan addresses 27,927 acres on Norris Reservoir in Anderson, Campbell, Claiborne, Grainger, and Union counties, Tennessee.
- *Tellico Reservoir Land Management Plan Final Environmental Impact Statement* (TVA 2000a) – This plan addresses 12,643 acres on Tellico Reservoir in Blount, Loudon, and Monroe counties, Tennessee.
- *Tims Ford Reservoir Land Management and Disposition Plan Final Environmental Impact Statement* (TVA 2000b) – This plan addresses 1,854 acres of TVA-managed lands and 4,599 acres owned and managed by the Tennessee Department of Environment and Conservation (TDEC) on Tims Ford Reservoir in Franklin and Moore counties, Tennessee.

1.9. Statutory Overview and Necessary Federal Permits or Licenses

1.9.1. Statutory Overview

A number of federal statutes and EOs are relevant to the formulation and evaluation of the NRP alternatives. Some of the programs and activities under consideration in the NRP are

required by laws such as ESA and NHPA. The implementation of other programs and activities can be influenced by requirements for compliance with these and other laws and regulations. Chapter 4, Affected Environment, and Chapter 5, Environmental Consequences, describe the regulatory setting for each resource and discuss applicable laws and their relevance to this analysis. The key laws and regulations that relate to this EIS are summarized below.

Tennessee Valley Authority Act
Congress charged TVA in 1933 with fostering the social and economic well being of the residents of the TVA region through the wise use and conservation of the region's natural resources. It was given broad authority to manage the Tennessee River system and to conduct activities to achieve this congressional mission.

National Environmental Policy Act
NEPA established a process by which federal agencies must study the effects of actions on the environment. Whenever a federal agency proposes an action, grants a permit, or agrees to fund or authorize an action that could affect the natural or human environment, the agency must consider the potential adverse and beneficial effects of the action. NEPA requires that an EIS be prepared for major federal actions, including the adoption of plans and policies, that have potential for significant impacts. This process must include public involvement and analysis of a reasonable range of alternatives. TVA prepared this draft EIS to comply with the requirements of NEPA.

Protection of Water Quality
The CWA was passed in 1972 to protect and improve the nation's water quality. The CWA is the primary law for regulating discharges of pollutants into the waters of the U.S. by enforcing water quality standards that are defined in Section 301 of the act. Two categories of pollutants enter streams, rivers, and lakes or reservoirs: nonpoint sources (runoff from the landscape) and point sources (direct discharge via a pipe or ditch into the water).

The issuance of federal permits for actions that affect waters of the U.S., including approvals under Section 26a of the TVA Act, is coordinated with the applicable states to receive water quality certification under Section 401 of the CWA. This certification is received by showing that the permitted activity will not adversely affect the water quality of the receiving stream, as defined by its designated uses. The designated use is determined by the primary uses of the water, such as recreation, water supply, and aquatic life. The states and USEPA have direct responsibility for protecting water quality, including that of the Tennessee River system.

Protection of Wetlands and Floodplains
Disturbance of wetlands or any other waters of the U.S. by the discharge of any dredge or fill material requires a permit from the U.S. Army Corps of Engineers (USACE) under Section 404 of the CWA. Under EO 11990 (Protection of Wetlands), federal agencies are required to avoid construction in wetlands to the extent practicable and to mitigate potential impacts as appropriate. State programs for protection of wetlands also exist. For example, the Tennessee Aquatic Resources Alteration Permit Program controls alteration of streams and wetlands for actions within the state of Tennessee.

Under EO 11988 (Floodplain Management), federal agency actions must, to the extent practicable, avoid siting projects in floodplain zones in order to reduce the risk of flood loss; minimize impacts of floods on human safety, health, and welfare; and restore and preserve

the natural and beneficial values of floodplains. The Federal Emergency Management Agency has identified where floodplains occur, and many local governments have adopted regulations to control the development of these defined floodplains.

Protection of Air Quality
Under the Clean Air Act, proposed new air pollutant sources must have permits and demonstrate that they will not violate the NAAQS. State implementation plans (SIPs) are developed by each state; these plans outline how the state will protect air quality. SIPs are based on the NAAQS, which are set by the USEPA for pollutants such as sulfur- and nitrogen-based air emissions, with margins of safety to protect human health and welfare. Sources of air emissions are controlled based on the quantity of the emission, its location, and the type of pollutant.

Protection of Endangered and Threatened Species
Under the ESA, federal agencies must conserve endangered and threatened species and ensure that their actions will not jeopardize the existence of these species or adversely affect their critical habitats. Under Section 7(a)(2) of the ESA, a federal agency that permits, licenses, funds, or otherwise authorizes activities must consult with the USFWS as appropriate to ensure that its actions will not jeopardize the continued existence of any listed species. In addition, Section 9 makes it unlawful to take or harm any listed species. The states within the Valley also have programs that protect state-listed species.

Protection of Cultural Resources
The NHPA and Archaeological Resources Protection Act (ARPA) were enacted to protect cultural and archaeological resources. NHPA requires agencies to consult the SHPO on undertakings that may affect historic properties. In some circumstances, the Federal Advisory Council on Historic Preservation must also be consulted. ARPA prohibits the removal, damage, defacement, or excavation of artifacts from archaeological sites on public land, including lands under TVA's control. The Valley states have additional requirements for protection of excavation of the remains of Native Americans on lands under state or local control. Some of these lands border TVA reservoirs, and TVA actively works with the states to protect these resources.

Protection of Farmland
Under FPPA, federal agencies are required to identify and consider the potential adverse effects of a proposed action on prime farmland. The FPPA ensures, to the maximum extent practicable, that federal programs are administered in a manner compatible with state and local government and private programs to protect farmland. In addition, the State of Tennessee has enacted the Agricultural District and Farmland Preservation Act, which provides limited protection of farmlands that have been specially designated under the act.

Environmental Justice
EO 12898 (Environmental Justice) requires federal agencies to identify and address the adverse human health or environmental effects of federal programs, policies, and activities that may be disproportionately greater for minority and low-income populations. Federal agencies must ensure that federal programs or activities do not directly or indirectly result in disparate impacts on minorities or low-income populations. Federal agencies must provide opportunities for input into the NEPA process by affected communities and must evaluate the potentially significant and adverse environmental effects of proposed actions on minority and low-income communities during preparation of environmental documents. TVA is not subject to this EO, but evaluates environmental justice impacts as a matter of policy.

Other Regulations and Executive Orders
Other statutes and EOs may be relevant, depending on the type of specific projects that occur as a consequence of this EIS, including:

- EO 13112 (Invasive Species)
- EO 13514 (Federal Leadership in Environmental, Energy, and Economic Performance)
- Section 10 of the Rivers and Harbors Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)
- The Safe Drinking Water Act and state drinking water regulations
- The Toxic Substances Control Act
- The Federal Insecticide, Fungicide, and Rodenticide Act
- The Resource Conservation and Recovery Act and other solid waste disposal regulations
- The Comprehensive Environmental Response, Compensation, and Liability Act

1.9.2. Necessary Federal Permits or Licenses

No federal permits are required to develop the NRP. Site-specific information on reservoir resources has been characterized in this EIS, and potential impacts on these resources were considered when making recommendations. However, TVA would conduct appropriate site-specific environmental reviews, including compliance with ESA and NHPA, when implementing the NRP. The preceding section generally describes permits or approvals that may be required for future projects.

1.10. Environmental Impact Statement Overview

This EIS has been developed to address the environmental impacts of implementing the NRP and alternatives to it. The EIS includes eight chapters as outlined below. The NRP includes the detailed descriptions of the programs, tools, and activities that were used to support the Preferred Alternative.

- Chapter 1 describes the purpose and need for the NRP EIS, scope of the NRP, decision to be made, history of TVA and its stewardship programs and policies, NRP scoping process, public review and agency consultation requirements, relationship to other NEPA reviews, and EIS overview.
- Chapter 2 provides an overview of TVA's existing and proposed stewardship programs, tools, and activities.
- Chapter 3 includes a description of the process of developing and evaluating the list of NRP alternatives, summary of the analyses of the alternatives, and summary of the environmental consequences of the alternatives considered. This chapter also identifies TVA's Preferred Alternative.

- Chapter 4 discusses the environmental resources and attributes potentially affected by the alternative actions.
- Chapter 5 describes the environmental consequences of each proposed alternative on the affected environment. This chapter also includes a discussion about cumulative impacts, irreversible and irretrievable commitments of resources, and a summary of TVA commitments and proposed mitigation measures.
- Chapters 6, 7, and 8 contain a list of preparers, a draft EIS distribution list, and other supporting information.

CHAPTER 2

2.0 RESOURCE MANAGEMENT PROGRAMS

When developing the NRP, TVA identified programs and associated activities, tools, or elements that could be used to support different options for future management of biological and cultural resources, recreation management, reservoir lands planning, and water resource management. All programs and activities, tools, or elements that are components of the No Action or any Action Alternative are discussed in this chapter. For purposes of the EIS, this chapter only includes an overview of the programs that pose potential impacts to the environment.

2.1. Biological and Cultural Resources Management

Biological Resources Management Overview

TVA manages biological resources in the Valley while providing for many types of recreational opportunities. The Agency has designated more than 180,000 acres of public land for natural resource conservation, which includes the enhancement of wildlife habitat and dispersed informal recreation. In addition, TVA has designated approximately 51,000 acres for sensitive resource management, where activities that might endanger significant cultural or natural features are restricted. Together, these approximate 231,000 acres of public lands provide TVA with distinctive management opportunities in resource protection and enhancement and terrestrial GHG management.

In its approach to biological resource management, TVA has demonstrated leadership through the ecologically sound management of natural resources and the protection of nonrenewable resources. TVA is committed to increasing the portion of TVA-managed resources that meet the desired environmental conditions of sustainable recreation, ecological diversity, and cultural resource protection.

This section summarizes the existing and proposed programs and supporting activities associated with TVA's biological resource management and improvement efforts. Tables 2-1 and 2-2 list TVA's biological resource management programs. These programs are components of the alternatives presented in Chapter 3.

Table 2-1. Summary of TVA's Biological Resources Management Programs

Biological Resources Management Programs		Current Program	Proposed Program
Dispersed Recreation Management	Dispersed Recreation Assessments	●	
	Dispersed Recreation Key Opportunities		●
	Dispersed Recreation Improvements	●	
	Dispersed Recreation Outdoor Clinics		●
	Leave No Trace	●	
	Trails Management	●	
Land Stewardship Assessment Tools	Boundary Maintenance	●	

Biological Resources Management Programs		Current Program	Proposed Program
Land Stewardship Assessment Tools	Land Condition Assessment	●	
	Land Stewardship Maintenance Checklist	●	
	Natural Resource Management Implementation Plans		●
	TVA Natural Heritage Database	●	
	TVA Wetlands Database	●	
Sensitive Biological Resources Management	Conservation Planning	●	
	Endangered and Threatened Species Program	●	
	Migratory Birds Management	●	
	Natural Areas Program	●	
	Wetlands Management	●	
Terrestrial Habitat Management	Agricultural and Open Lands Management	●	
	Dewatering Projects Management	●	
	Forest Resource Management	●	
	Nonnative Invasive Plant Management	●	
	Nuisance Animal Control	●	
	Terrestrial Greenhouse Gas Sequestration Management	●	
	Wildlife Habitat Council – Third-Party Certifications	●	
	Wildlife Habitat Enhancement Partnerships	●	

Table 2-2. Summary of Biological and Cultural Resources Management Public Outreach Programs

Public Outreach Program		Current Program	Proposed Program
Cultural Resource Management	Archaeological Outreach (Thousand Eyes Program)	●	
	Corporate History Program	●	
	Cultural Resources Partnerships		●
Biological Resource Management	Environmental Education Program		●
	Natural Resources Communication Program		●
	Resource Stewardship Campaigns		●
	Volunteer Program		●

Cultural Resources Management Overview
TVA is responsible for many historic properties that are located on its managed lands or potentially affected by TVA actions off its managed lands. These actions vary from the construction and management of power plants to approvals under Section 26a of the TVA Act. Historic properties include historic sites, historic structures, historic objects, and archaeological resources important to prehistory or history. Numerous laws require TVA to manage, protect, and preserve these resources to the extent possible and mitigate impacts to these resources resulting from TVA actions.

This section summarizes the existing and proposed programs and supporting activities associated with TVA's cultural resource management and improvement efforts (listed in Tables 2-2 and 2-3). These programs were used in developing the alternatives presented in Chapter 3.

Table 2-3. Summary of Cultural Resources Management Programs

Cultural Resources Management Programs		Current Program	Proposed Program
Cultural Resource Protection Programs	Archaeological Resources Protection Act Program	●	
	Archaeological Site Monitoring and Protection		●
	National Historic Preservation Act Section 106 Compliance	●	
	Native American Graves Protection and Repatriation Act Program	●	
	Preservation Program	●	
	Preserve America Program	●	
Consultation Efforts	Native American Tribal Consultation	●	

2.1.1. Cultural Resources Management

Archaeological Resources Protection Act Enforcement Program
ARPA was enacted to preserve and protect archaeological resources and sites on federal and Native American lands. The existing and proposed TVA-specific activities related to ARPA are shown in Table 2-4 and described below.

Table 2-4. Programs Proposed to Aid in TVA's Archaeological Resources Protection Act Enforcement Program

Programs
ARPA Investigations
ARPA Permitting Process
Archaeological Site Information Protection
Agency-Specific Code of Federal Regulations

ARPA Investigations — ARPA violations can result in both criminal and civil investigations. Criminal cases are tried through the federal court system when archaeological assessments include over $500 worth of damage, and cases can be tried as felonies with

penalties of up to $20,000 in fines and up to two years' imprisonment. Individuals who damage archaeological resources, regardless of intent, can be liable for civil penalties under ARPA. Under the different alternatives in this EIS, TVA would conduct a varying number of security checks on TVA-managed lands per year.

ARPA Permitting Process — Any archaeological survey or excavation that occurs on TVA-managed lands requires a permit issued by TVA under ARPA. TVA staff maintains and reviews all archaeological permit requests received by the Agency and approves or denies these requests, which typically come from universities, professional archaeologists, or other federal and state agencies.

Archaeological Site Information Protection — ARPA excludes from public disclosure any information concerning the nature and location of any archaeological resource unless such disclosure would further the purpose of ARPA.

Agency-Specific Code of Federal Regulations — TVA is proposing to develop regulations that would be published in the Code of Federal Regulations (CFR) to supplement investigative authority by prohibiting the removal of any artifacts or historic items from archaeological sites or historic sites on TVA-managed lands. The CFR is a codification of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the federal government.

Archaeological Site Monitoring and Protection Program
Pursuant to Section 110 of the NHPA and ARPA, TVA is obligated to protect the archaeological resources located on lands it manages. To meet these obligations, TVA proposes to establish a program for the monitoring and protection of archaeological sites potentially affected by TVA actions.

Archaeological Monitoring Program — TVA proposes to develop long-term management and monitoring plans with a goal of improved protection and management of archaeological resources.

Archaeological Site Protection Program — TVA would continue to stabilize critically impacted archaeological resources and protect other resources (such as caves) that are being impacted by looting, erosion, and other damaging activities. TVA is considering expansion of this program as described in this EIS.

Native American Graves Protection and Repatriation Act Compliance
The Native American Graves Protection and Repatriation Act (NAGPRA) provides for the protection of Native American cultural items and establishes a process for the authorized removal of human remains, funerary objects, sacred objects, and objects of cultural patrimony from sites located on lands owned or controlled by the federal government. NAGPRA also establishes a process for the transfer of ownership of cultural items to Native American individuals (e.g., direct lineal or cultural descendants), organizations, or tribes. It addresses the recovery, treatment, and repatriation of Native American cultural items by federal agencies and museums. The NAGPRA-related activities are shown in Table 2-5.

Table 2-5. Activities Proposed to Aid in TVA's Native American Graves Protection and Repatriation Act Compliance

Activities
Maintain NAGPRA Inventory
Complete Notices of Inventory
Dispose of Native American Human Remains, Associated Funerary Objects, and Objects of Cultural Patrimony Excavated or Discovered After 1990
Consult With Museums and Federally Recognized Tribes
Repatriate American Human Remains, Associated Funerary Objects, and Objects of Cultural Patrimony Curated Prior to 1990

Native American Tribal Consultation

TVA formally consults with federally recognized tribes to meet the objectives of NAGPRA, NHPA, the American Indian Religious Freedom Act (AIRFA), EO 13007 (Indian Sacred Sites), EO 13175 (Consultation and Coordination With Indian Tribal Governments), the April 29, 1994, executive memorandum regarding government-to-government relationships with tribal governments (http://www.justice.gov/archive/otj/Presidential_Statements_/presdoc1.htm), and the November 5, 2009, presidential memorandum regarding tribal consultation (http://edocket.access.gpo.gov/2009/E9-27142.htm). To facilitate such consultation, TVA has established a staff position designated as Native American liaison. TVA conducts a formal consultation workshop with federally recognized Native American tribes every five years. The NRP alternatives consider conducting these meetings more frequently.

National Historic Preservation Act Section 106 Compliance

Section 106 of the NHPA requires federal agencies to consider the effect of its actions on historic properties and to allow the Advisory Council on Historic Preservation an opportunity to comment on the action. Archaeological sites, historic sites, and historic structures are evaluated in terms of their ability to meet the criteria for eligibility for the NRHP. The existing and proposed Section 106-related activities are shown in Table 2-6 and described below.

Table 2-6. Activities Proposed to Aid in TVA's National Historic Preservation Act Section 106 Compliance

Activities
Conduct reviews under NHPA Section 106
Develop Emergency Procedures for NHPA Section 106 Compliance
Manage Existing Mitigation Obligations
Pursue Programmatic Agreements With Individual States Regarding Compliance for Repetitive Actions

Conduct Reviews Under NHPA Section 106 — TVA evaluates the potential effects of its actions on historic properties and consults with the SHPOs and federally recognized tribes when historic properties could be affected. Treatment and mitigation of adversely affected historic properties are determined through this consultation process.

Develop Emergency Procedures for NHPA Section 106 Compliance — Federal agencies are encouraged to develop procedures for considering historic properties during operations that respond to a disaster or emergency declared by the President, a tribal government, or the Governor of a state, or which respond to other immediate threats to life or property.

Manage Existing Mitigation Obligations — TVA is proposing to establish a program to monitor and manage ongoing mitigation measures to ensure compliance with Section 106 of the NHPA agreements and NEPA documents.

Pursue Programmatic Agreements With Individual States Regarding Compliance for Repetitive Actions — TVA is also proposing to execute agreements with each state to ensure compliance with Section 106 of the NHPA for requests for approvals under Section 26a of the TVA Act for certain types of actions.

Preservation Program

Section 110 of the NHPA requires federal agencies to establish a historic preservation program to manage historic properties under the Agency's purview. Federal agencies are responsible for identifying and protecting historic properties in a manner that benefits both the resource and the public. The existing and proposed activities associated with TVA's Preservation Program are shown in Table 2-7 and described below.

Table 2-7. Activities Proposed to Aid in TVA's Preservation Program

Activities
Develop Archaeological Identification Surveys
Maintain Historic Photo Collection
Maintain TVA's Historic Agency Information
Maintain Cemetery Database
Evaluate and Nominate Sites and Structures to the NRHP
Improve Preservation Program by Developing Implementation Procedure
Develop Comprehensive Database
Maintain Historic Artifact Collection
Identify and Nominate Historic Cemeteries on TVA-Managed Land
Develop Online Interactive Cemetery Database
Partner With Stakeholders to Identify Traditional Cultural Properties

Develop Archaeological Identification Surveys — TVA is proposing to develop management plans for surveying TVA-managed lands and protecting valuable sensitive resources under its management.

Maintain Historic Photo Collection — TVA currently maintains a collection of more than 17,000 photographic negatives documenting the Agency's history from its inception in 1933 to the mid-1980s. This collection also contains thousands of more recent original file copy prints and thousands of 35-millimeter negatives. This collection is currently being digitized to preserve the original negatives.

Maintain TVA's Historic Agency Information — TVA currently receives hundreds of requests for information about the Agency's history from people with a broad spectrum of general and professional interests. TVA is proposing to systematically catalog the Agency's historic information to aid in efficiently responding to public requests.

Maintain Cemetery Database — TVA maintains a database of cemeteries that were once located on TVA-managed lands and were investigated and moved prior to the construction of many of its reservoirs.

Evaluate and Nominate Sites to the NRHP — Pursuant to Section 110 of the NHPA, federal agencies are responsible for the identification, evaluation, and nomination of historic properties to the NRHP. While TVA currently has a small program in place for the identification of new historic properties each year, it has not been evaluating or nominating sites for inclusion in the NRHP. TVA is proposing to develop goals for the evaluation and nomination of significant historic properties under its management.

Improve Preservation Program by Developing Implementation Procedures — In order to improve the Preservation Program and facilitate a more efficient process for compliance with preservation laws, TVA is proposing to develop procedures for compliance processes required under these laws.

Develop Comprehensive Database — Pursuant to Section 112 of the NHPA, federal agencies shall ensure that records and other data are permanently maintained in appropriate databases. TVA maintains numerous data sources relating to historic properties under its management. However, because no comprehensive database has ever been developed, these sources are fragmentary. As a result, TVA does not have consolidated data on historic properties or survey data, site location information, and other historic data for the resources under its management. Development of a database would improve efficiency and the overall management of TVA's historic properties.

Maintain Historic Artifact Collection — TVA would maintain the unique collection of historic artifacts that the Agency has acquired throughout its history.

Identify and Nominate Historic Cemeteries on TVA-Managed Land — TVA is proposing to document cemeteries, identify unknown cemeteries, and nominate eligible cemeteries for listing in the NRHP.

Develop Online Interactive Cemetery Database — TVA is proposing to develop an interactive online database for the public to access cemetery information. This database would include maps showing locations of existing or relocated cemeteries.

Partner With Stakeholders to Identify Traditional Cultural Properties — TVA is proposing to partner with stakeholders and other groups to identify sites that may be considered traditional cultural properties.

Preserve America

EO 13287 directs federal agencies to improve their knowledge about, and management of, historic resources in their care. The existing and proposed activities associated with Preserve America are shown in Table 2-8 and described below.

Table 2-8. Activities Proposed to Aid in TVA's Initiative to Preserve America

Activities
Assess and Address Agency Section 110 of the NHPA Needs and Publish Reports
Conduct Adaptive Reuse Studies of TVA's Historic Buildings
Identify Historic Properties That May Be Suitable for Heritage Tourism
Seek Partners for Heritage Tourism

Assess and Address Agency Section 110 of the NHPA Needs and Publish Reports — TVA is required to prepare a report on these needs and submit it to the Secretary of the Interior and the Advisory Council on Historic Preservation.

Conduct Adaptive Reuse Studies of TVA's Historic Buildings — TVA historic buildings that have been determined surplus are evaluated for the feasibility of adaptive reuse.

Identify Historic Properties That May Be Suitable for Heritage Tourism — TVA is proposing to identify and maintain a list of those properties that might be suitable for supporting heritage tourism.

Seek Partners for Heritage Tourism — TVA is proposing to seek partnerships to promote economic development and heritage tourism by using historic properties in ways that benefit both the resource and the public.

2.1.2. Dispersed Recreation Management

Dispersed recreation includes passive and unconfined recreational opportunities occurring on TVA-managed lands and not associated with developed facilities. Examples of dispersed recreation include primitive camping, hiking, and bank fishing. Some improvements would be made to dispersed recreational areas to support access for the user, health and safety of the user, and/or mitigation of natural resource damage. In addition, dispersed recreational opportunities may occur on areas with highly concentrated or seasonally intensive use, as well as on noncontiguous lands. The dispersed recreation activities are shown in Table 2-9 and described below.

Table 2-9. Activities Proposed to Aid in Dispersed Recreation Management

Activities
Dispersed Recreation Assessments
Dispersed Recreation Key Opportunities
Dispersed Recreation Improvements
Dispersed Recreation Outdoor Clinics
Leave No Trace
Trails Management

Dispersed Recreation Assessments

TVA uses a methodology to quantitatively measure ecological and social impacts from dispersed recreational activities on TVA-managed lands. This methodology is rooted in the framework of the limits of acceptable change assessment, which essentially establishes a

threshold of impacts that is not acceptable and needs to be managed or mitigated (Guerry 2005). This process provides TVA the ability to assess the effects of dispersed recreation consistently and to guide resulting management or implementation activities. In addition, the types of recreational activities occurring on TVA-managed lands are identified. TVA capitalizes on this information when establishing priorities for future actions, identifying potential land uses during the reservoir lands planning process, and evaluating the impacts of its potential actions.

Dispersed Recreation Key Opportunities
TVA proposes to develop and implement key opportunities to support the need for dispersed recreation across the Valley. TVA would conduct a needs and gap analysis to identify these opportunities. This analysis would be conducted by projecting future demand, future population, and gaps in dispersed recreational needs. TVA would identify where needs are most pressing and take steps to provide the public with key dispersed recreational opportunities. Some examples of key dispersed recreational opportunities include, but are not limited to, stream access sites and bank fishing.

Dispersed Recreation Improvements
Types of dispersed recreation improvements are dependent on the impacts to a specific area. Improvement activities would concentrate on the variables contributing the most impacts to the area. Examples of impacts caused by dispersed recreation include litter, vegetation removal, and the expansion of the boundaries of the dispersed recreation area. Improvements to offset these impacts would include litter removal, planting native vegetation, installing barriers, and graveling or hardening specific areas. TVA would also consider rezoning dispersed recreational sites to developed recreational parcels, as appropriate, during the reservoir lands planning process or in accordance with other TVA policies.

The activities associated with dispersed recreation improvements are dependent on the surrounding resources, general land access, and land configuration. Table 2-10 outlines examples of activities that would be used to improve these areas. Appropriate BMPs are identified prior to and implemented during the construction activities associated with site management and improvement.

Table 2-10. Activities Associated With Dispersed Recreation Improvements

Activity Category	Improvement Activities		
Site Management	Provide improvements to the site (gravel or hardening of surfaces)		
	Plant native vegetation	Install physical barriers	Manage facilities
	Remove litter or other refuse		
Rationing / Allocation	Limit access to the area by using reservations, a first-come, first-served system, lotteries, and/or merit/eligibility criteria		
	Charge user fees		
Regulation	Create zones for specific types of activities	Limit the length of stays allowed	
	Restrict the use or type of behavior at facilities		
	Restrict or prohibit specific types of activities, equipment, and/or modes of travel		
	Limit the size of the groups and/or types of stocks or pets		
	Restrict or prohibit the type of use in an area to protect environmental conditions		

Activity Category	Improvement Activities	
Deterrence / Enforcement	Install signs and/or kiosks	Sanction visitors who engage in noncompliant behavior
	Provide enforcement personnel such as law enforcement	
Visitor Education	Educate visitors about appropriate behaviors and altering use patterns	

Dispersed Recreation Outdoor Clinics
One of the biggest barriers to participation in outdoor and dispersed recreation is skill development. TVA is proposing to host outdoor skill clinics to break these barriers. These outdoor clinics could lead to a higher proportion of Valley stakeholders enjoying a healthy outdoor recreation lifestyle. Some examples of outdoor clinics include kayaking, fly-fishing, and camping.

Leave No Trace
Leave No Trace (LNT) is a national and international program designed to assist outdoor enthusiasts with their decisions about how to reduce their impacts when they conduct dispersed recreation activities. The program strives to educate all those who enjoy the outdoors about the nature of their recreational impacts as well as techniques to prevent and minimize such impacts. LNT is best understood as an educational and ethical program, not as a set of rules and regulations (LNT 2008). LNT information is rooted in scientific studies and common sense. The information is framed under the LNT principles: Plan Ahead and Prepare, Travel and Camp on Durable Surfaces, Dispose of Waste Properly, Leave What You Find, Minimize Campfire Impacts, Respect Wildlife, and Be Considerate of Other Visitors. Additional information pertaining to the LNT Program can be found at www.lnt.org.

TVA joined other land management agencies by becoming an LNT partner in 2008. TVA provides educational materials to the public in all of its watershed field offices. In addition, TVA provides informational signage about LNT at some of its most intensively impacted dispersed recreation areas. TVA staff have completed the LNT trainer certification course to become better communicators of the LNT message to the recreating public.

Trails Management
Approximately 90 miles of marked trails are located on TVA-managed lands. Several of the trails or segments of the trails meet the Americans With Disabilities Act standards for accessible design. A small portion of the trails is paved. However, most are single-track trails intended for hiking, backpacking, mountain biking, and general access to TVA-managed lands. Activities associated with trails have recently become more popular across the U.S. For example, day hiking has risen from 23.8 percent of the population participating in 1995 to 33.3 percent in 2001 (Cordell et al. 2004). Nationally designated trails located on TVA-managed lands are listed below. A map showing these trails is presented as Figure A-1 in Appendix A.

- Appalachian National Scenic Trail
- Natchez Trace National Scenic Trail
- Overmountain Victory National Historic Trail
- Trail of Tears National Historic Trail
- Hemlock Bluff National Recreation Trail
- Lady's Bluff National Recreation Trail
- River Bluff National Recreation Trail
- Muscle Shoals Trail Complex National Recreation Trails

Trails occurring on TVA-managed lands allocated for natural resource conservation or sensitive resource management are typically narrow-path single-track trails. These trails are designed not to interfere with existing land uses or degrade sensitive resource areas. When constructing and maintaining trails, TVA or any associated partners would adhere to trail best management design and implementation practices as outlined in accepted trails manuals such as USFS 2007 and International Mountain Bicycling Association (IMBA) 2004.

2.1.3. Land Stewardship Assessment Tools

TVA currently utilizes a number of assessment tools to aid in the management of public lands. These assessment tools are shown in Table 2-11 and described below.

Table 2-11. Proposed Land Stewardship Assessment Tools

Tools
Boundary Maintenance
Land Condition Assessment
Land Stewardship Maintenance Needs Checklist
Natural Resource Management Implementation Plans
TVA Natural Heritage Database
TVA Wetlands Database

Boundary Maintenance

Establishing and maintaining TVA's property boundaries help to reduce encroachments and protect natural resources. Boundaries are maintained by completing a four-step process. First, TVA identifies priority areas to conduct boundary maintenance based on developmental pressures on adjacent properties, lack of existing boundary markings, elapsed time since the last boundary maintenance, and/or outcomes of other TVA processes. Second, a desktop review is conducted using aerial photos of the area, site-specific photos, and maps. This information, along with a data sheet, is taken to the boundary maintenance location. Next, the boundary line is located on the ground and denoted with the appropriate paint color. The following data are also collected during boundary maintenance: date of boundary maintenance, feet of boundary marked, TVA monument numbers and conditions, and type of additional maintenance needed (if any). Finally, the data collected during boundary maintenance are transferred to a GIS database.

Land Conditions Assessment

TVA conducts two types of Land Conditions Assessments (LCA): Comprehensive Land Conditions Assessment (CLCA) and Rapid Land Conditions Assessment (RLCA). This subsection describes TVA's methodologies for the two types of LCA.

<u>Comprehensive Land Conditions Assessment</u> — CLCA determines whether individual parcels of land meet desired conditions. The purpose of the CLCA is to identify stewardship needs for maintaining or improving the conditions of a parcel of land.

Teams consisting of natural resource professionals conduct field assessments by evaluating specific conditions that fall under four resource management categories (Table 2-12). After the field assessment is completed, an overall parcel rating is determined as "good," "fair," or "poor." These parcel ratings are internally reported and tracked in a GIS database.

Table 2-12. Parcel Conditions Reviewed During Comprehensive Land Conditions Assessment

Category	Attribute Assessed
Public Safety and Use	Access, Boundary, and Signage
	Dispersed Recreational Impacts
	Public Safety
	Unauthorized Use(s)
Resources Protection	Sensitive Resources
	Species Protection
Soil and Water	Access Road Best Management Practices
	Shoreline Conditions
	Watershed Protection Benefits
Vegetation and Wildlife	Invasive Exotic Plants
	Nuisance or Exotic Animals
	Vegetation Impacts
	Wildlife Habitat

Assessments are conducted when vegetation is dormant to minimize field assessment time. Lands are selected for CLCAs via a desktop exercise where parcels are systematically evaluated. This desktop exercise determines which lands have the greatest public use and support the most critical resources. Assessments require professional judgment by experienced specialists applying established protocols and criteria. Parcels of land are physically assessed by vehicle, boat, and/or foot. A complete review is conducted of the boundary lines, shorelines, hiking trails, all-terrain vehicle routes, roads, and other identified undeveloped public use areas. Stewardship needs are prioritized in multiyear plans for improving land conditions.

Rapid Land Conditions Assessment — Under the RLCA, TVA conducts a desktop review to identify and prioritize health, safety, and compliance needs relating to natural resource management activities. Additionally, TVA considers asset preservation needs for a small subset of TVA-managed lands such as dam reservations; resource management unit plans (Unit Plans); parcels allocated for sensitive resource management via the reservoir lands planning process; and parcels containing 50 acres or more receiving a single intensive recreational use, multiple recreational uses, or a prior stewardship investment within the last five years. Through the RLCA, TVA also identifies areas that require protection of prior investments including the creation of wildlife habitat, vegetative enhancements, or other on-the-ground management actions.

TVA collects the information obtained from RLCA and calculates needs for maintenance and improvement on specific parcels of land. The parcels of land are prioritized as having a low, medium, or high level of need. This expedited process provides a current “snapshot” of known and unknown parcel needs. This process directs prioritization of CLCA and provides a timely mechanism to address stewardship needs.

Land Stewardship Maintenance Needs Checklist

The Land Stewardship Maintenance Needs Checklist (LSMNC) is an assessment tool used to capture stewardship maintenance needs. The LSMNC addresses a parcel's specific or comprehensive needs as well as recommended action tasks, estimated costs, time

sensitivity per task, and/or other information. The LSMNC is used to document needs primarily on TVA-managed public lands allocated to sensitive resource management, natural resource conservation, TVA operations, and other public access areas. The LSMNC can be used for immediate needs and/or for documenting needs for development of multiyear plans.

When completing the LSMNC, the assessor does not have to assess all categories of potential needs to make a submittal. Sometimes, only a portion of the parcel of land can be assessed depending upon factors such as available time and skill level. Multiple parcels can be combined that have a common need. An example of a need is a forest road system on which BMPs need to be implemented and runs through several parcels of land. Potential resource stewardship maintenance needs are categorized as shown in Table 2-13.

Table 2-13. Potential Stewardship Maintenance Needs

Needs Category	
Abused and misused sites	Sensitive resources
Access roads and parking areas	Shoreline conditions
Agricultural fields	Signage and interpretive communication
Bank fishing sites	Species protection
Boundary	Trails
Dispersed recreational sites	Vegetation
Nuisance wildlife controls	Visual values
Public access sites	Watershed protection
Public health and safety	Wildlife habitat

Natural Resource Management Implementation Plans

Integrated Resource Management Plans — Integrated Resource Management (IRM) is a collaborative process that integrates stakeholder interests with coordinated management objectives to ensure viability of biological, cultural, visual, and recreation resources. TVA's IRM process ensures that resource stewardship issues and stakeholder interests are considered while optimizing benefits and minimizing conflicts. IRM is based on cooperation, communication, coordination, and consideration of stakeholders potentially affected by resource management. IRM recognizes that the management or use of one resource affects the management or use of others. Therefore, an integrated approach is more effective than considering resources individually. More specifically, the IRM process would:

- Identify data and technology needs
- Engage relevant stakeholders
- Focus on key management issues
- Merge disciplinary perspectives
- Resolve conflicting interests
- Make use of a wide range of available technologies
- Identify policy, technological, and management alternatives
- Foster adaptive management

Incorporation of the IRM process would allow TVA to manage public lands for an optimum level of multiple uses and benefits that protect and enhance natural, cultural, recreational, and visual resources in a cost-effective manner. TVA would develop IRM plans for prioritized Agency lands located adjacent to TVA-managed reservoirs.

Resource Management Unit Plan Implementation — Between 1998 and 2001, TVA developed 10 Unit Plans. Each Unit Plan addressed long-term land-based resource management activities on lands allocated for natural resource conservation and/or sensitive resource management.

The Unit Plans cover a total of 17,675 acres of land that were developed with substantial stakeholder input. Primary objectives of the Unit Plans were to provide sustainable amenities and benefits to the public through cost-effective management of unit-based resources including wildlife, forests, sensitive resources, and dispersed recreation opportunities. An example of a Unit Plan can be found at http://www.tva.gov/environment/reports/boone/.

TVA Natural Heritage Database

The TVA Natural Heritage database is a biological database that contains an ecological inventory of rare plants, animals, natural communities, natural areas, and other sensitive natural resource features. This extensive database also includes wetlands, champion trees, colonial bird nesting sites, and managed areas. The TVA Natural Heritage database is affiliated with and uses the same information storage system as the NatureServe (2009) network of heritage programs in North America. This ensures consistency of data among the seven Valley states in which TVA operates. The inventory records are added or updated throughout the year using the following:

- Data from museums and herbaria
- Results of field surveys by TVA and others
- Formal data exchanges with heritage programs in the seven Valley states
- Formal data exchanges with the USFWS
- Information from personal contacts in other agencies and academia
- Results from TVA's endangered species monitoring
- Unpublished and published scientific literature

Data users access the database for environmental reviews and planning purposes. All users are trained biologists, foresters, or ecologists that receive additional training on the use and proper interpretation of data contained in the database. They also receive supplemental training annually to improve interpretive skills and to be exposed to current conservation issues.

TVA Wetlands Database

In addition to the biological database, TVA also maintains a wetlands database. Several geospatial data layers have been developed to support the assessment of proposed projects on wetland resources. These data layers are used for a GIS-level resource assessment and preliminary reviews for ground surveys and wetlands' delineations. The wetland data available include more than 1,850 scanned National Wetlands Inventory (NWI) maps that have been georeferenced and combined to provide a seamless coverage of the TVA region. The NWI maps, covering approximately 70 percent of the TVA region, are in a digitized format for spatial analysis. TVA uses these data for environmental reviews.

2.1.4. Public Outreach Programs

TVA is proposing to utilize a number of public outreach programs to aid in the management of public lands from a biological and cultural resources perspective. These public outreach programs are shown in Table 2-14 and described below.

Table 2-14. Proposed Biological and Cultural Resources Public Outreach Programs

Programs
Archaeological Outreach (Thousand Eyes Program)
Corporate History Program
Cultural Resources Partnerships
Environmental Education Program
Natural Resources Communication Program
Resource Stewardship Campaigns
Volunteer Program

Archaeological Outreach (Thousand Eyes Program)
TVA is mandated by ARPA to establish a program to increase public awareness of the need to protect archaeological sites located on public lands. These public awareness activities would be incorporated into cultural and biological resource management programs where appropriate. TVA has established the Thousand Eyes Program specifically to meet the obligations under this portion of ARPA. This EIS considers various levels of implementation for this program.

Corporate History Program
TVA has a fascinating history, and as such, the Agency receives hundreds of questions each year about its past. The existing and proposed projects associated with TVA's Corporate History Program are described below.

Update the "TVA Timeline" — TVA currently has a history timeline; however, it has not been updated for many years. TVA is proposing to conduct the necessary research and annually update this timeline.

Establish an Oral History Program — TVA's oral history project would establish new and gather existing recordings or transcripts from planned oral interviews with individuals who were important in the shaping of TVA's history. These created and preserved interviews are intended for use by researchers and historians. This oral history project would serve to document the Agency's history. Oral history frequently complements the written record.

Establish TVA History Web Site and Outreach Program — TVA is proposing to develop a Web site on the Agency's history and historic programming showcasing the significant periods of TVA history.

Create a TVA History and Archaeology Museum — TVA would create a center to interpret the Agency's role in the history of the region, nation, and the world. TVA's historic and archaeological collections would be used to develop exhibits for the museum. TVA's digital and digitized historic photographs would be part of this facility. The museum would serve as the Agency's public outreach center regarding its significant legacy. It could also promote current TVA initiatives through the use of rotating exhibits. TVA would seek partnerships with nonprofit organizations for the development and implementation of this

facility. TVA would also consider a curation facility to house archaeological collections from previous and future excavations.

Cultural Resources Partnerships
TVA is evaluating the development of partnerships to support external stewardship activities such as the following:

Archaeological Field Schools – Historically, TVA has supported archaeological field schools on TVA-managed lands. These types of schools support the training of students by offering opportunities for the identification, testing, and excavation of archaeological sites. When beneficial to the Agency, TVA is proposing to continue to support this training by allowing access to TVA-managed lands and/or by seeking funding assistance to the field schools.

Publications – TVA is evaluating the development of a program to support publications pertaining to cultural resources in the Valley. These publications would target both academic and nonacademic audiences and include topics on archaeological, historic, and tribal research in the Valley. These publications would support TVA's public outreach programs in promoting the need for protection of sensitive resources.

Environmental Education Program
The Environmental Education (EE) Program would consist of public outreach efforts that teach selected audiences about the functions of biological and cultural resources and instruct people on managing human behaviors along with these resources to live in a sustainable manner. This is a learning process that seeks to increase people's knowledge of biological and cultural resources, as well as the challenges faced in preserving, enhancing, and/or managing these resources for sustainability. EE seeks to develop the necessary skills and expertise to address challenges and to foster motivations, attitudes, and commitments to make informed decisions and take responsible actions—all to deal effectively with biological and cultural resource issues.

Typically, EE would focus on efforts within the education system, from primary to postsecondary schools. However, an expanded EE program would include a variety of audiences such as civic and peer groups, elected officials, business leaders, and the general public. Efforts to educate these audiences included formal programs, print materials, museum displays and interpretation, Web sites, media campaigns, and information kiosks.

Natural Resources Communication Program
TVA engages in efforts across the Valley to improve and protect the Valley resources. The Natural Resources Communication Program would highlight many of the programs and projects to increase public awareness of TVA's work and provide useful information to stakeholders. Examples of Natural Resources Communication Program activities would include, at a minimum:

- Creating and maintaining an external TVA Web site to highlight natural resource protection and improvement efforts and innovations of current TVA projects.
- Presenting information to stakeholders about TVA's efforts to protect and manage natural resources in the region.

Resource Stewardship Campaigns
To increase effectiveness and serve a larger portion of the Valley, TVA proposes to combine technical support and communications to promote natural resource improvement and protection. These campaigns could include focused efforts to improve riparian and streamside management, develop and promote dispersed recreation, and raise public awareness of biological and cultural resource management issues or other issues. In addition, TVA could provide technical support for existing restoration or wildlife habitat enhancement projects. Resource Stewardship Campaigns are intended to be short-term projects with high likelihood of measurable success. A Resource Stewardship Campaign may include materials for stakeholders developed in conjuction with other programs and activities listed in this chapter.

Volunteer Program
TVA proposes to establish a Volunteer Program to better manage its lands by encouraging others to implement smart growth, low impact, and/or "green" projects on and adjacent to TVA-managed lands. TVA would manage such a program by engaging volunteers and leveraging dollars from other agencies and stakeholders to help fund management actions. Potential project focuses include targeted caretaking and installation and maintenance of "green practices" on TVA-managed lands. Implementation projects would include or would be similar to trail establishment or maintenance; tree planting; invasive species removal; shoreline biostabilization; green campground projects; habitat enhancement; data collection; visual surveys; and installation and maintenance of rain gardens, rain barrels, and native butterfly gardens.

TVA would actively seek volunteers by joining http://www.volunteer.gov, engaging corporate volunteers and local students, hosting a short-term intensive Student Conservation Association-type volunteer program, and/or seeking other types of service or volunteer organizations.

2.1.5. Sensitive Biological Resources Management

TVA is proposing to enhance sensitive biological resources management by establishing new programs and continuing and expanding existing programs. These programs and activities are shown in Table 2-15 and described in detail below.

Table 2-15. Proposed Sensitive Biological Resources Programs

Programs
Conservation Planning
Endangered and Threatened Species Program
Migratory Bird Management
Natural Areas Program
Wetlands Management

Conservation Planning
TVA has participated in and provided data to many regional conservation-planning efforts throughout the Southeast U.S. These conservation planning efforts include ecoregional planning efforts with nongovernment organizations (NGOs), development of recovery plans for federally listed species, development of state wildlife action plans and fisheries programs, as well as many other small- and large-scale conservation planning efforts.

Because TVA's influence crosses state lines, TVA has been able to bring a unique perspective to these plans.

Endangered and Threatened Species Program

Endangered Species Act Section 7 Consultation — TVA is required under Section 7(a)(2) of the ESA to consult with the USFWS concerning the potential for its proposed projects to affect endangered and threatened species. This is a nondiscretionary obligation of TVA, as a federal agency, and occurs under all of the alternatives. In addition, any resulting reasonable and prudent measures and their terms and conditions are implemented and tracked.

Endangered and Threatened Species Management —TVA has identified programs and activities to assist in the management of endangered species on TVA-managed lands and reservoirs. These programs are bald eagle monitoring, cave gating, and protection plan development.

In support of the Bald and Golden Eagle Protection Act and in conjunction with conservation partners, TVA monitors bald eagles in the vicinity of TVA-managed lands. In conjunction with partners, TVA has been able to identify population trends and assess the applicability of protective buffers outlined in the National Bald Eagle Management Guidelines developed by the USFWS (2007) to protect the species since its removal from the federal list of endangered species. TVA uses this monitoring information to assess the impacts of its actions on the bald eagle.

Cave habitats are home to endangered bats and other vulnerable cave-dwelling animal species. Caves used by rare species are protected and managed through the installation and maintenance of cave gates on TVA-managed lands and in areas along TVA reservoirs. Due to the significant cultural resources associated with many of these caves, gating often serves the dual purpose of protecting both biological and cultural resources. TVA also uses additional measures, such as signage, data loggers, routine monitoring, and law enforcement, to protect and manage sensitive resources in caves.

For those target species identified by monitoring/cataloging efforts, TVA proposes to develop management plans. Particular emphasis would be placed on the development of protection plans for those species occurring on TVA-managed lands. Then, TVA would implement these plans through partnerships with other federal and state agencies, NGOs, and/or universities. TVA would also establish a public outreach program that would seek to inform stakeholders about the important natural resources of the region and promote awareness and cooperative effort to protect these resources.

Endangered and Threatened Species Monitoring — To support a thriving river system across the Valley and to demonstrate environmental leadership, TVA determines the impacts on endangered species for its actions, land use approvals, or actions subject to TVA approval under Section 26a of the TVA Act. These efforts play a major role in TVA meeting its goals of conducting business operations in a manner that fulfills environmental responsibilities while forming alliances to solve environmental problems. Part of these efforts is the monitoring of some populations of federally and/or state-listed species that occur on TVA-managed lands or in areas affected by TVA operations. Monitoring data are used to assess past and present land management strategies and to guide future environmental policy for TVA.

Approximately 40 sites supporting populations of federally and/or state-listed animals and plants on TVA-managed or -influenced lands are monitored. The monitoring activities were designed in cooperation with the USFWS and, as appropriate, other federal and state agencies. The data obtained are reported to the appropriate resource agencies. They are used to protect these sensitive resources and to make informed land management and conservation planning decisions that would not result in adverse impacts to the species. The species presently being monitored are identified in Table 2-16.

Table 2-16. Listed Species Monitored by TVA and Partners on TVA-Managed Lands and Near TVA Operations

Scientific Name	Common Name (State or Federal Listing)	Long-Term Monitoring	Short-Term Monitoring
Animals			
Etheostoma wapiti	Boulder darter (state, federal)		X
Haliaeetus leucocephalus	Bald eagle (state, federally protected)	X	
Lampsilis abrupta	Pink mucket (state, federal)		X
Myotis grisescens	Gray bat (state, federal)	X	
Percina tanasi	Snail darter (state, federal)		X
Plants			
Aureolaria patula	False foxglove (state)		X
Pityopsis ruthii	Ruth's golden aster (state, federal)	X	
Scutellaria montana	Mountain skullcap (state, federal)	X	
Sarracenia oreophila	Green pitcher-plant (state, federal)		X

Migratory Bird Management

TVA's Migratory Bird Management Program is comprised of three components: Migratory Bird Management Plans, Partners in Flight, and Tennessee River Valley Shorebird Working Group.

Migratory Bird Management Plans — TVA proposes to develop management plans to inventory, monitor, and manage migratory birds on TVA-managed lands. A component of a management plan would include agency guidelines for compliance with EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). In addition, partnerships would be identified for inventorying and monitoring waterfowl and other water bird populations along TVA reservoirs. Conservation projects for migratory birds would be planned on TVA-managed lands in cooperation with other federal and state partners. TVA's management plans could be used in national and regional planning efforts to support the conservation of migratory birds.

Partners in Flight — TVA is a signatory to a Partners in Flight (PIF) joint memorandum of understanding (MOU) venture. PIF is a cooperative effort, among numerous agencies, to address the decline of land birds and their habitats. Historical PIF projects have occurred at Land Between The Lakes, a large area previously managed by TVA.

Tennessee River Valley Shorebird Working Group — In 2004, TVA altered the drawdown schedule on several reservoirs to maximize benefits to public recreation. Concern about the resulting impacts to shorebird populations led TVA to establish a five-year working group composed of federal and state agencies, NGOs, and volunteers to learn more about shorebird resources in the Valley.

In 2009, the working group was evaluated to determine the project's effectiveness and to identify improvements for similar future initiatives. Project accomplishments include more than 2,000 hours of shorebird monitoring (3,639 surveys at 127 sites), resulting in the largest shorebird monitoring effort ever undertaken in the Valley. TVA leveraged $94,000 in associated cost-sharing projects and $47,000 from in-kind and volunteer support. This effort funded three associated research projects through the University of Tennessee. In an online questionnaire, all working group members indicated they were satisfied with the results of this initiative, and all felt the group should continue beyond its original five-year mission.

Natural Areas Program

Natural areas include ecologically significant sites, lands set aside for a particular management objective, and/or lands that contain sensitive biological, cultural, or scenic resources. Natural areas are not limited to TVA-managed lands. In 1983, in recognition of the importance of unique natural resources, TVA established policy for the identification and protection of areas or features of natural and scenic significance. This policy provided for direct and cooperative actions by TVA in identifying significant natural and scenic areas of the region and in establishing protection for these resources. In order to implement this policy, a natural area identification and protection effort was established.

TVA natural areas are categorized as small wild areas (SWAs), ecological study areas, habitat protection areas (HPAs), and wildlife observation areas (WOAs). SWAs are sites with exceptional natural, scenic, or aesthetic qualities that are suitable for low-impact public use, such as foot trails and backcountry campsites. Ecological study areas are sites suitable for ecological research or EE. These study areas contain plant or animal populations of scientific interest and/or are located near an educational institution that would utilize and manage the area. HPAs are established to protect rare plants, animals, exemplary biological communities, or unique geological features. WOAs are sites that support concentrations of viewable wildlife such as shorebirds, songbirds, and waterfowl.

Natural Areas Management — TVA manages 154 natural areas throughout the TVA region. Activities included in natural areas management are similar to those conducted elsewhere on TVA-managed lands; however, they are tailored to accommodate the type of natural area designation. Prominent activities include on-site condition assessments; erection of gates or barriers; and development of interpretive signage, overlooks, and interpretive pamphlets. Cooperative management agreements with state agencies and NGOs are used to support monitoring, maintenance, trail development, and invasive plant control. Typically, natural areas management activities would be conducted through partnership and volunteer efforts via stakeholders with an interest in helping maintain these unique areas. Nonnative invasive plant (NNIP) control would be conducted as described later in this

chapter. Walking and hiking trails would be established and maintained with the use of both nonmechanized and mechanized equipment. See the dispersed recreation subsection for more information concerning the construction and maintenance of trails.

Natural Areas Protection — The environmental reviews associated with TVA projects, land use approvals, and approvals under Section 26a of the TVA Act, along with the use of TVA's Natural Heritage database, play an active role in the protection of natural areas. Information and boundaries of both TVA- and non-TVA-managed natural areas are maintained in the TVA Natural Heritage database. When conducting environmental reviews, both TVA and non-TVA managed natural areas and ecologically significant sites are identified and considered for impact analysis. The following are typical activities identified during environmental reviews for the protection of natural areas.

- On-site assessments, as needed, to determine potential impacts as related to the specific project
- Determination of property boundaries and status of contractual agreements for non-TVA-managed natural areas occurring on Agency-managed lands
- Coordination with other agencies, stakeholder groups, and academic institutions to ensure that newly designated natural areas are added to the TVA Natural Heritage database
- Maintenance of TVA- and non-TVA-managed areas and ecologically significant site records in the TVA Natural Heritage database to ensure that contacts, descriptions, and boundary information stored in the database and natural areas digitizing layer are current for use in environmental reviews

Wetlands Management

TVA proposes to develop and implement a wetlands management policy for TVA-managed lands. This policy would include a proactive program for wetlands identification and protection. TVA would then implement this policy through partnerships with other federal and state agencies, NGOs, and/or universities.

2.1.6. Terrestrial Habitat Management

Terrestrial habitat management programs and activities are shown in Table 2-17 and described below.

Table 2-17. Proposed Terrestrial Habitat Management Programs and Activities

Programs and Activities
Agricultural and Open Lands Management
Dewatering Projects Management
Forest Resource Management
Nonnative Invasive Plant Management
Nuisance Animal Control
Terrestrial Greenhouse Gas Sequestration Management
Wildlife Habitat Council — Third-Party Certifications
Wildlife Habitat Enhancement Partnerships

Agricultural and Open Lands Management
TVA agricultural licenses are considered to maintain ground cover; provide open, early successional wildlife habitat; enhance local agribusiness; demonstrate carbon management and energy crop production; and provide cost savings to TVA. Each agricultural tract is managed to ensure that acceptable land use and soil management practices are implemented while preventing shoreline erosion and water quality degradation. Acceptable land use includes implementation of agricultural BMPs, restoration of natural vegetative buffers, leaving portions of crops in the field for wildlife consumption, implementation of effective soil management practices, and conversion of some pasturelands to native warm-season grasses (NWSG). To offset habitat loss from row crop and "clean" pasture farming on nearby private land, special provisions are often included in agricultural licenses to enhance TVA-managed land for a wide variety of game and nongame wildlife.

Over the last 15 years, TVA has been converting license agreements for livestock grazing to hay forage management. Livestock are being removed from TVA-managed lands in an effort to protect water quality and riparian habitat. Private farmers utilizing conventional agricultural practices and mechanized equipment manage the license areas. Special provisions in these agreements address soil nutrient amendments and harvest timing. Agricultural licensed TVA-managed lands are available for public use, but public access can be restricted to protect crop investments.

Agricultural licenses can be canceled because of an unacceptable license violation, repeated instances of noncompliance, or conversion to other uses such as recreation or planting of wildlife food plots. Agricultural licenses are not intended as an encroachment resolution tool, nor are they intended as a general license to authorize mowing or reservoir access.

Dewatering Projects Management
TVA operates, either alone or in partnership, nine dewatering projects on Kentucky and Wheeler reservoirs (Figure A-2, Appendix A). These areas were developed as part of a long-term approach to mosquito control and were operated primarily for that purpose until the 1970s when TVA began reducing its mosquito-control efforts. Additional factors in the design, development, and operation of dewatering projects included providing food and habitat for wildlife, protecting bottomland hardwoods, making land available for farming, and avoiding expensive slope protection for relocated highways and railways. As TVA reduced its mosquito-control activities, these other benefits began to increase in value. Recreational activities, including fishing, waterfowl hunting, and bird watching, continued to contribute substantially to the local economies.

TVA has entered into agreements with the Alabama Department of Conservation and Natural Resources, Tennessee Wildlife Resources Agency (TWRA), and the USFWS for the management and cost sharing of operation and maintenance (O&M) of these areas.

Over time, TVA has reduced the resources allocated to the O&M of these dewatering projects. However, written agreements between TVA and agency partners dictate the level of resources expended on O&M of the dewatering projects. A dewatering project typically consists of levees, water control structures, and pump houses. TVA currently maintains the levees, water control structures, and pump house operations for several of these units. Specific activities associated with this maintenance include the mowing of earthen levees, repairing of levees, and operating pump house and water control gates. Levee repair consists of grading and rock surfacing. Pump house and water control gate O&M consist of

the replacement of pump parts as necessary. Appropriate BMPs are identified prior to and implemented during maintenance operations.

Overall, the current operations of the Kentucky and Wheeler dewatering projects provide numerous primary and supplementary benefits. These units provide protection for power transmission line structures, relocated highway and railroad embankments, and bottomland hardwood forests; reduce mosquito-breeding habitat; and allow for continued farming of tillable cropland.

The continued operation and maintenance of the dewatering areas have resulted in the creation of high-quality overwintering waterfowl and migratory bird habitat that is recognized at both the state and national levels. Waterfowl habitat provided in the dewatering projects on both Wheeler and Kentucky reservoirs helps meet the federally and state-established goals and objectives for the lower Mississippi flyway zone as defined in the jointly developed United States and Canadian *North American Waterfowl Management Plan* (USFWS 2009a). Additionally, most of the project acreage is classified as wetland habitat and is included in TVA's (2004) ROS EIS. TVA committed to implementing a 15-year plan to document the effects of reservoir operational changes on wetland resources.

Forest Resource Management

TVA's Forest Resource Management Program is comprised of four key components: forest access roads and parking areas, forest resource protection, forest vegetation management, and watershed protection and other public benefits.

Forest Access Roads and Parking Areas

Some TVA forestlands have preexisting unimproved roads with a limited number of improved roads that are used to gain vehicular access for management needs and to provide public access and parking (where appropriate). There are tracts of land where TVA has no deeded rights for vehicular access, and the only access may be by water. This impacts public access and use of these properties.

Forest roads are highly beneficial for often-overlooked management needs such as wildfire suppression resources. Forest roads are physically used for establishing wildfire control lines or fuel breaks. The existing improved roads and parking areas would be maintained through standard practices and installing BMPs to minimize any off-site water quality impacts. Unimproved roads would eventually need a higher level of improvement such as surface water drainage control, surfacing, and associated maintenance. Selective rerouting or reestablishment of roadbeds may be needed to reduce steep grades and for soil erosion control.

Certain tracts of land used by the public have limited or no vehicular parking areas. Parking areas for these tracts should be considered to minimize resource impacts, to offer public access, and to reduce conflicts with adjacent private property owners.

Forest Resource Protection

Forest resource protection activities address measures associated with watershed benefits, biodiversity, wildlife habitat, scenic quality, sensitive resources, wildfire control, unauthorized public uses, and other impacts.

Insect and Disease Control and Monitoring — TVA cooperates with other agencies, universities, forest industries, and private landowners to detect, monitor, and control impacts from forest insects and diseases.

Public Health and Safety — TVA takes proactive measures to respond to and mitigate potentially hazardous situations such as tree hazards.

Sensitive Resources — TVA implements appropriate BMPs to protect natural features that are rare, uncommon, or unique and are often easily damaged. Examples of these features include wetlands, geologic features (caves), rare plant communities, special animal habitats, and cultural resources.

Wildfire Control — TVA cooperates with wildfire control agencies, fire departments, and others in both prevention and suppression of wildfires. The prevention of wildfires may include educational campaigns or programs.

Unauthorized Uses — TVA would take proactive measures to prevent unauthorized uses of forestlands such as damage to vegetation, site abuse, vandalism, dumping, and littering.

Forest Vegetation Management

Forest Vegetation Management addresses actions to protect, maintain, improve, enhance, and manage both herbaceous and woody vegetation to meet land management goals and objectives. This generally involves manipulation of both planted and naturally occurring vegetation as well as damaged vegetation. Examples of vegetation manipulation activities are as follows: (1) salvaging commercially important trees from insects, diseases, storms, and wildfire damages; (2) removal of trees to help control insects and spread of diseases; (3) removal of trees that present hazards to public use areas, private residences, structures, and other improvements; (4) removal of vegetation from earth dam faces, levees, and other water control structures to ensure their structural integrity; (5) removal of trees to support higher land uses and to address safety considerations such as airport expansions; (6) removal of trees to support wildfire fuels reduction efforts; (7) removal of trees to support nonnative invasive exotic plant control efforts; (8) selective cuttings to enhance wildlife habitat and create more diverse plant communities; (9) selective cuttings to support sensitive resource needs; (10) selective cuttings to maintain or enhance public use vistas and viewsheds; (11) selective cuttings along established hiking trails to maintain accessibility; (12) selective cuttings or removal of undesirable vegetation to enhance growth of desirable vegetation to promote carbon sequestration; (13) selective cuttings or “day lighting” along secondary forest roads to allow better drying and protection as well as to create linear wildlife openings; (14) mechanical treatment of vegetation such as bush-hogging to control invading vegetation to maintain accessibility of public use forest access roads or to maintain forest wildlife openings in an early plant succession state; (15) chemical applications (see NNIP Management) to maintain or improve forest health; and (16) prescribed burns to meet resource objectives such as maintaining established native warm-season grass stands or for forest understory habitat enhancement.

Vegetation Management Planning — A written vegetation management action plan would be prepared prior to manipulation of resources on 1 acre or greater. Depending on the site and nature of the action, the plan would address any or all of the following: property boundaries, streams and drainages, soil restrictions, slopes, environmental concerns, access routes, stream and drainage crossings, drainage structure spacing, and streamside management zones (SMZs). Seasonal timing of action would be included. The objective of

the vegetative management plan is to determine which BMPs are necessary to protect water and site quality and how those BMPs would be implemented. These plans would be used to identify sites where BMP compliance may be difficult. In some areas, additional protective measures would be implemented.

Vegetation Management Actions — Before actions begin, resource managers would consider the potential impacts of vegetation manipulation such as access roads and equipment staging areas. Careful preplanning would minimize potential impacts on water quality and reduce costs.

Any needed staging areas would be located at least 150 feet from the SMZ to minimize the impacts on natural drainages. Water turnouts would be constructed around the uphill side of staging areas as needed to divert water onto the adjacent forest floor. Adequate drainage on approach roads and trails would be provided. All equipment fueling and servicing areas would be located away from SMZs. On-site equipment would be serviced so that oil and other waste products would be drained into containers and disposed of properly. All accidental fuel or oil spills would be contained and reported. Trash and all materials resulting from servicing would be removed from the site and disposed of properly. Organic debris piles would be located no less than 100 feet outside of wet-weather drainages. Land disturbances would be revegetated to prevent movement of soil from the site. Compacted areas may be ripped, subsoiled, or disked for preparation of a suitable seedbed and/or planting site.

Access routes would be located outside SMZs. Instream disturbances would be avoided, and stream crossings would be minimized.

Access routes would be restored by installing and repairing water bars, removing stream crossing structures, shaping and smoothing, and revegetating any exposed areas subject to erosion.

Streamside Management Zones — SMZs would be maintained along all streams, lakes, ponds, natural springs, and all springs and reservoirs serving as domestic water supplies. SMZs would protect stream channels and banks from disturbance and form the “last line of defense” to filter sediment from surface runoff. SMZs also provide shade for streams to minimize thermal pollution.

Streams may be classified as perennial, intermittent, or ephemeral. SMZs would be maintained for all stream classifications. The level of vegetation manipulation within an SMZ would reflect the degree of potential water quality impact. The greatest protection would be given to perennial streams, followed by intermittent and ephemeral streams.

Site Preparation — This would include techniques to improve the site to support desirable vegetation. Activities could include measures such as the following:

> *Mechanical Operations.* Bulldozing would be limited to slopes of 30 percent or less, and the distance between windrows should be minimized. When a sloping site is raked and windrowed, the windrows would be placed on the contour to act as an interceptor and filter of any surface runoff. Windrows would be located well away from drains to prevent materials from being washed into streams. Occasional breaks would be provided in the windrows to permit access by fire suppression and other vehicles and to prevent damming of water. Soil disturbance would be kept to

a minimum. The topsoil, including the root mat, would be protected as much as possible to preserve site quality and minimize water quality impact. Stumps would be left in place except where removal is required on earth dam faces and levees.

Prescribed Burning. Prescribed burning would be carried out under favorable conditions of wind, humidity, and temperature to achieve desired results while preventing removal of surface duff and root mat and maintaining control of the fire. A plan would be prepared defining objectives and conditions under which burning would be conducted. All appropriate state and/or local permits would be obtained prior to beginning a prescribed burn. When possible, hot burns on pure pine stands and erodible sites during drought periods would be avoided. Hot burns consume most of the protective litter on the forest floor and would increase the chance of raindrop erosion of bare mineral soil. Burns conducted in the early morning or after a rain are more likely to leave a portion of the surface duff in place. The greatest threat to water quality in prescribed burning is from the construction of fire lines by heavy equipment. Fire lines would only be plowed immediately prior to burning and should be kept to a minimum. Forest access roads would be utilized where feasible. SMZs would be avoided, where practical, during prescribed burns.

Revegetation of Land Disturbances — All land disturbance including road surfaces, cuts, fills, and ditches would be revegetated. Native plants or plant mixtures adapted to the site would be selected, and the recommended rate of application and optimum seeding dates would be used.

Road surfaces would be shaped and smoothed prior to seeding. Heavily compacted areas may require scarification or disking to promote infiltration of water and create suitable seedbed. However, loosening soil on steeper slopes would be avoided. When desirable, mulch would be used in revegetating disturbed areas to hold seed in place, maintain moisture, and prevent extreme temperatures on the soil surface.

Bush-hogging would be utilized to maintain roads that would be used in the future and/or to maintain open areas for wildlife. Seeded areas would be protected from livestock grazing and unrestricted vehicle traffic.

Reforestation — Hand and/or machine plantings would be established to meet management objectives such as reforestation of old agricultural fields, storm-damaged areas, and habitat enhancement, and unauthorized vegetative clearings. Planting stock could include cuttings, bare root seedlings, saplings, or balled and burlapped trees and shrubs. Natural regeneration methods could be used to help establish desirable species. This could include other methods such as direct seeding.

Damage Rehabilitation — Measures could be taken to restore or rehabilitate forestlands damaged by natural causes such as wildfire, storms, or unauthorized uses.

Forest Improvement — Mechanical or chemical practices (addressed under Nonnative Invasive Plant Section) could be used to maintain or improve forest health such as control of invasive exotic plants or other undesirable species. Such practices would support biodiversity, wildlife habitat, carbon sequestration, considerations for biofuels, and/or other benefits to forest stands.

Tree Improvement — TVA cooperates with other agencies and universities to provide historical research information as well as to assist with current tree improvement activities such as national efforts in restoration of the American chestnut.

Watershed Protection and Other Public Benefits

Best Management Practices — Continued effort would be placed on using state-of-the-art BMPs for vegetation management activities on TVA-managed lands to ensure watershed protection benefits. TVA has developed its own BMPs to address the growing awareness of environmental issues and TVA's commitment to protect water quality. Special environmental concerns from TVA resource managers not addressed by existing federal and state guidelines have been included. Multiagency cooperation would continue to monitor, research, and develop new innovations and methods that would continuously update these BMPs.

Additional Conservation Practices — Other conservation practices would be used to control soil erosion and to maintain healthy forest cover, associated understory, and riparian vegetation that provide high-quality watershed protection benefits. Some examples of these practices include stabilizing critically eroding reservoir shoreline and stream banks, establishing and maintaining livestock exclusion fencing, and riparian corridor management. Additional practices could address energy conservation, pollution abatement, storm water control, and residential and urban benefits. Other special practices could address visual considerations valued by lake users, adjacent landowners, and the public.

Nonnative Invasive Plant Management

NNIPs infest a variety of forested and nonforested habitats. NNIPs can reduce forest productivity, hinder forest use and management activities, and degrade diversity and wildlife habitat. NNIPs can include trees, shrubs, vines, grasses, ferns, and forbs. Some NNIPs have been introduced accidentally, but most NNIPs were brought here as ornamentals or for livestock forage. Many infestations on TVA-managed lands are the result of deliberate plantings in efforts to reduce erosion and improve wildlife habitat. Invasive species typically lack predators and diseases that inhibit their growth and reproduction and have increased to the point that widespread control and rehabilitation measures are necessary (Miller 2003).

Four plants in the TVA region are designated as noxious weeds according to the Federal Noxious Weed List of 2006 (U.S. Department of Agriculture [USDA] 2007a) and the Southeast Exotic Pest Plant Council (SE-EPPC) 2008: cogongrass, giant salvinia, hydrilla, and tropical soda apple. Several more species occurring in the TVA region are considered to pose potential threats to native ecosystems and human health (SE-EPCC 2008).

Georgia, Mississippi, and Tennessee have developed MOUs with federal and state agencies to create an Early Detection Rapid Response Program to assist public and private landowners with controlling invasive species, particularly cogongrass. Cogongrass disrupts ecosystem functions, reducing wildlife habitat, decreasing tree seedling establishment and growth, and altering fire regimes and intensities (Evans et al. 2008). Miller et al. (2008) estimated the acres covered by 33 nonnative invasive species within the southern states. Their 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 nonnative species.

Nonnative Invasive Plant Prevention — According to the Center for Invasive Plant Management (2009), the most effective, economical, and ecologically sound approach to managing invasive plants is to prevent them from invading. Infestations must be managed to limit the spread of invasive plants, but weed management that controls existing infestations while focusing on prevention and early detection of new invasions can be far more cost-effective.

NNIP prevention includes the following practices:

- Early detection and eradication of small patches of weeds
- Evaluating the effectiveness of prevention efforts and adapting plans for the following year
- Limiting the introduction of weed seeds
- Maintaining desired plant communities through good management
- Minimizing the disturbance of desirable plants along trails, roads, and waterways
- Monitoring high-risk areas such as transportation corridors and bare ground
- Revegetating disturbed sites with desired plants

Nonnative Invasive Plant Removal (Manual and Mechanical Methods) — Weed removal often includes mechanical removal of the plant and application of herbicides. Removal involves pulling and cutting the plants or using mechanized equipment. Often, herbicides that have been approved by the USEPA are applied to the plants. TVA's use of mechanical and chemical controls for NNIP would follow those used by the USFS (USDA 2009). Manual or mechanical methods would be the principal method for controlling small spot infestations. Examples of hand tools that might be used include shovels, saws, axes, loppers, hoes, or weed-wrenches. Mechanical methods could include cutting with a string trimmer, chainsaw, brush blade, or mower.

Nonnative Invasive Plant Removal (Chemical [Herbicide] Methods) — The objectives of herbicide use would be to control NNIP infestations where manual or mechanical means would be cost-prohibitive or would result in excessive soil disturbance or other resource damage. All herbicides would be used according to manufacturers' label directions for rates, concentrations, exposure times, and application methods. Herbicides would be directly applied to the target plants using selective treatment, which would consist of various techniques for applying herbicides to target plants with minimal impact to desirable vegetation and other nontarget organisms including humans. Herbicide drift would be greatly reduced with selective treatments (relative to broad-scale or aerial application). Techniques include spraying foliage using a hand-held wand or backpack sprayer, basal bark and stem treatments using spraying or painting (wiping) methods, cut surface treatments (spraying or wiping), and woody stem injections. Only formulations approved for aquatic use would be applied in or adjacent to wetlands, lakes, and streams in accordance with label direction.

A list of current specific herbicides that may be used on NNIP species on TVA-managed lands are below. Detailed descriptions of these chemicals, including comprehensive risk assessments for each, can be found on the USDA's Web site (USDA 2007a). The list below is subject to change based on relevant published data pertaining to each herbicide and recommendations from other federal and state agencies.

- **Glyphosate** is a nonselective, broad spectrum, systemic herbicide used to control many grasses, forbs, vines, shrubs, and trees. Specific formulations of glyphosate have been labeled for aquatic application, and these can be effective on both emergent aquatics and shoreline vegetation. This chemical is a growth inhibitor that can be applied through direct foliar application, stem injection, and cut surface application. It has been proven effective on a wide variety of NNIP species. Commercial brand names include Accord™ and Rodeo™.

- **Triclopyr** is a selective herbicide that controls invasive, broadleaf herbaceous and woody plants, but has little to no effect on grasses. This chemical acts as a growth regulator and can be applied as a direct foliar application, stem injection, or cut surface treatment. Specific formulations of triclopyr have been labeled for aquatic application and can be effective on both emergent aquatics and shoreline vegetation. It has been proven effective on a wide variety of NNIP species. Commercial brand names include Garlon 3A™, Garlon 4™, and Pathfinder II™.
- **Clopyralid** is a selective herbicide affecting broadleaf herbs, primarily legumes, composites, and smartweeds. This chemical acts as a growth regulator and is typically applied as a direct foliar application. With selectivity to legumes, this chemical is particularly useful in the control of kudzu, mimosa, and lespedeza. Commercial brand names include Transline™.
- **Imazapic** is a selective herbicide primarily used to control cool-season grasses. Warm-season grasses, many wildflower species, and legumes are resistant, while many cool-season grasses and broadleaf weeds are susceptible. Commercial brand names include Plateau™.
- **Metsulfuron methyl** is a systemic herbicide that is selective to woody species, broadleaf species, and many annual grasses. It has been proven effective in the control of lespedeza, Japanese honeysuckle, kudzu, and multiflora rose. Commercial brand names include Escort™.
- **Dicamba** is a somewhat selective herbicide that controls most annual and perennial broadleaf herbs and some woody species. Care must be taken, as it can damage or kill hardwood and pine seedlings, but has little to no effect on grasses. This chemical is known to be effective in the control of autumn olive. Commercial brand names include Vanquish™ and Overdrive™.

Nonnative Invasive Plant Management (Other Control Measures) — In addition to strict adherence to herbicide labels, standard project BMPs, and planned monitoring, the following additional measures would be implemented to reduce the spread of NNIPs and minimize the potential impacts associated with treatment methodologies.

- Equipment (including vehicles), boots, and clothing would be cleaned thoroughly before moving from treatment sites to ensure that seeds or other propagules are not transported to other sites.
- Fueling or oiling of mechanical equipment would occur away from aquatic habitats.
- Application staff would install barriers (silt fence) along stream edges and banks prior to any application of herbicides. If a silt fence cannot be easily secured on steep rocky banks, one member of an application team would maintain a mobile barrier between the herbicide application and the stream during the application.

- NNIP parts capable of starting new plants (seeds, rhizomes, etc.) would be properly disposed of. Plants would be piled and burned on site or bagged and moved off site. Bagged plants would either be incinerated or disposed of using standard garbage methods. For large woody bushes that are difficult to move, treatments would be scheduled prior to seed set, as practical.
- When work is conducted in areas containing rare or sensitive plant species, those plants would be flagged or marked to avoid spraying. A physical barrier would be used to protect nontarget species when they occur immediately adjacent to the treatment area. All NNIP species located within 10 feet of any federally listed species would be cut back to within 6 inches of the ground for woody stems or to expose the root crown for vines.
- Herbicide would be applied to cut stems with a small wick applicator, if possible, or with a small spray bottle to minimize herbicide drift onto nontarget vegetation.
- Use of mowing as an NNIP-control method would be timed to avoid spreading seeds. Native vegetation would be retained, and soil disturbance would be limited, to the extent practicable.
- Prior to any NNIP treatments, TVA would conduct the appropriate environmental review.
- Following NNIP treatments, exposed soils would be promptly revegetated to avoid recolonization.

Nuisance Animal Control

TVA has managed the effects of nuisance animals for many years. This process can involve the removal of problem individuals or populations or can involve altering the affected area to make it less hospitable to the nuisance animals. Some species of wildlife become habituated to man's presence or adapt to human changes in the environment, which can result in property damage, safety issues, and risk transfer of disease to humans, or can interrupt critical TVA operations. Common nuisance wildlife species for TVA include, but are not limited to, vultures, Canada geese, herons, pigeons, gulls, beavers, raccoons, squirrels, bats, groundhogs, and various other rodents.

TVA has entered into a contractual agreement for the management of nuisance animals with the Wildlife Services (WS) section of the USDA's Animal and Plant Health Inspection Service. USDA-WS holds all required federal and state permits that are required to conduct control activities with various wildlife species. USDA-WS has also reviewed and documented potential effects from nuisance animal control activities through various EAs. TVA either has adopted existing EAs or been considered a cooperating agency in the development of environmental documentation for specific animal damage control activities across the Valley.

The primary objective of TVA's animal damage control program is to reduce damage in a practical, humane, and environmentally acceptable manner. Wildlife managers and wildlife control specialists base control methods on the habits and biology of the animals causing damage. In turn, their efforts maximize safety to the environment, humans, and other animals.

Examples of impacts from nuisance animals include:

- Flooding of adjacent private property from active beaver dams on TVA-managed lands.
- Vultures roosting on TVA structures.
- Vultures damaging other structures including dam and lock walls and vehicles parked at boat launching ramps.
- Droppings from pigeons roosting, creating health and safety issues.
- Burrowing rodents creating dam safety integrity concerns.

TVA proposes to conduct proactive measures for nuisance animal damage prevention. Examples of proactive measures include:

- Design and placement of TVA structures not amenable to roosting behavior by vultures or nesting activity by raptors.
- Design and installation of barriers and/or exclusion devices to prevent certain bird and mammal species from creating health and safety issues.

Terrestrial Greenhouse Gas Sequestration Management
Carbon sequestration is the capture and storage of carbon dioxide (CO_2) that would otherwise be emitted to or remain in the atmosphere. Terrestrial carbon sequestration is carbon stored in the biomass created by perennial vegetations such as root systems and tree trunks. Transformation of atmospheric carbon into a fixed state largely occurs through forest management activities such as planting trees and perennial grasses. These projects result in sequestration of emissions that, if achieved by a specific protocol, could earn a CO_2 reduction credit applicable toward a future mandatory CO_2 cap-and-trade program (described below).

TVA anticipates that mandatory reductions of GHGs, mainly CO_2, will be required for the electricity sector. These reduction requirements may be in the form of a cap-and-trade program, which is a market-based approach of achieving emissions reductions. At the essence of the program are emissions caps and the distribution of allowances equal to the cap. An allowance authorizes the release of a specific amount of the regulated emission(s). CO_2 reduction credits, as discussed above, are expected to be equivalent to an allowance and would be applicable toward a compliance program. As such, TVA would review options to acquire CO_2 reduction credits by implementing emission-reduction projects either on TVA-managed land or through bilateral contracts on land owned by others. Another option would be to consider purchasing and/or renting credits from a market. The types of terrestrial carbon sequestration projects that TVA would consider are as follows:

- Forest creation/reforestation activities
- Forest type conversion
- Forest clearing/deforestation avoidance
- Conservation farming techniques

Wildlife Habitat Council – Third-Party Certifications
In 1998, TVA established a formal relationship with the Wildlife Habitat Council (WHC), a Maryland-based nonprofit organization that encourages corporations to enhance wildlife habitats on their properties. WHC biologists work with member companies to inventory wildlife populations, identify wildlife enhancement projects, and form teams of employees to

administer them. Wildlife projects vary from site to site, but typically include maintaining wildlife food plots and providing artificial nesting structures for bluebirds, tree swallows, wood ducks, and other species. Native grass and wildflower meadows have also been established at several locations. TVA projects currently certified by the WHC include Colbert Fossil Plant, Raccoon Mountain Pumped Storage Plant, and the Muscle Shoals Reservation. TVA's Reservoir Releases Improvements Program has also received WHC certification. This program is credited with improving more than 300 miles of aquatic habitat by increasing the amount of dissolved oxygen (DO) and keeping the riverbed wet at all times.

Certifying sustainably managed forests is another option for forest landowners. Other third-party programs include certification standards for environmental protection and for the conservation of biological values such as species diversity and wildlife habitat. Compliance with standards is determined through third-party verification by independent, accredited auditors. The largest such program in North America is the Sustainable Forestry Initiative. This initiative has enrolled more than 136 million acres of forestland. Certifications to the standards of the Forest Stewardship Council, another major program, have been attained on 20.9 million acres in North America. In recognizing wildlife needs in forest and other program management, third-party certification would ensure that TVA fully considers wildlife objectives and habitat relationships in all forest planning and management activities. Additionally, third-party certification ensures support for old-growth forest protection and vegetation management programs that provide for the full diversity of habitats and species.

Wildlife Habitat Enhancement Partnerhips

Habitat Partnerships — TVA has actively cooperated with various agencies along with stakeholder groups and NGOs (such as Quail Forever, Ducks Unlimited [DU], and the National Wild Turkey Federation) to improve habitat and increase wildlife-oriented recreational opportunities on TVA-managed lands. Partnerships are used for developing and implementing techniques to restore productive wildlife habitat. Examples of such projects include the establishment of NWSG and food plots by local Quail Forever chapters on Tellico, Watts Bar, and Melton Hill reservoirs. DU chapters have assisted TVA in the construction and erection of wood duck nesting boxes on TVA-managed lands across the Valley. In addition, DU has provided substantial resources to partner with TVA and TWRA on habitat restoration efforts on the Camden Dewatering Project and Wildlife Management Area. TVA also incorporates a wildlife enhancement provision into some of its agricultural licenses in partnership with the licensee. In recent years, TVA has partnered with local native plant nurseries and enthusiasts, and the University of Tennessee's Native Landscape Design Laboratory, to establish and manage native wildflower meadows on certain TVA-managed lands.

Habitat Enhancement and Management — Wildlife management is a general term for the process of keeping wild species at desirable levels determined by professional wildlife managers and others. Wildlife management has become an integrated science using disciplines such as mathematics, chemistry, biology, ecology, climatology, and geography to determine BMPs. Wildlife conservation has evolved from original wildlife management practices and aims to halt the loss in the earth's biodiversity by considering ecological principles. Such principles can include carrying capacity, disturbance, and succession and environmental conditions such as physical geography, soils, and hydrology with the aim of balancing the needs of wildlife with the needs of people.

There are two general types of wildlife management, often referred to as manipulative and custodial management. Manipulative management acts on a population, either changing its

numbers by direct means or influencing numbers by the indirect means of altering food supply, habitat, density of predators, or prevalence of disease. Manipulative management is generally conducted by federal and state wildlife agencies through specific habitat management actions and hunting season regulations. In general, other federal and state laws and regulations apply to all TVA-managed lands that are deemed open for legal hunting activities. On rare occasions, TVA may work with certain state and/or federal agencies to allow hunting on select areas in an effort to reduce populations of particular species.

Custodial management is largely preventive or protective. The aim of custodial management is to minimize external influences on a specific animal population and/or its habitat. Custodial management is appropriate in an area where one of the stated goals is to protect ecological processes and diversity. It is also appropriate for conservation of a threatened species where the threat is of external origin rather than being intrinsic to the system. TVA's wildlife management activities are largely considered custodial management. Wildlife habitat diversity is developed and managed through the establishment of native grassland and forbs, open land, periodic controlled burning, planting of native shrubs and trees in riparian zones, harvesting timber in 15- to 25-acre blocks to diversify age and structure, establishing food plots and linear openings (usually in partnership with select NGOs), and erecting and maintaining nesting boxes targeted at select species.

Wildlife habitat management is also accomplished through long-term agreements among TVA and other federal and state wildlife management agencies. This wildlife resource partnership began in the 1940s when TVA made land and water areas on many of its reservoirs available to these agencies for wildlife management and refuge designation purposes (Table 2-18).

These areas, which total over 200,000 acres Valleywide, have been critical to the management of both game and nongame wildlife species, in particular waterfowl. The juxtaposition of reservoir waters to adjacent bottomlands and other low-lying agricultural areas provides excellent habitat development opportunities for migratory waterfowl and other water birds. This habitat situation led to the creation of Wheeler and Tennessee National Wildlife Refuges. Both refuges are critical to waterfowl management in the Mississippi and Atlantic flyways. State wildlife management areas have provided similar enhanced habitats and opportunities for waterfowl hunting that have national significance. TVA has partnered with other federal and state entities to assist in the management of these areas by providing infrastructure maintenance and operation, materials and supplies, permit coordination, and technical advice on specific project initiatives. The long-term benefits of these lands agreements and management partnerships to the Valley's wildlife resources cannot be overstated.

Table 2-18. Previous TVA-Managed Land and Water Used for Federal and State Wildlife Management Programs

Agency	Reservoir	Acres
USFWS — Tennessee National Refuge	Kentucky	50,830
USFWS — Wheeler National Refuge	Wheeler	35,300
State of Alabama	Guntersville	25,000
State of Alabama	Pickwick	9,421
State of Alabama	Wheeler	9,484
State of Kentucky	Kentucky	3,274
State of Mississippi	Pickwick	1,597

Agency	Reservoir	Acres
State of Tennessee	Cherokee	224
State of Tennessee	Chickamauga	2,770
State of Tennessee	Douglas	1,230
State of Tennessee	Fort Loudoun	30
State of Tennessee	Kentucky	12,585
State of Tennessee	Nolichucky	733
State of Tennessee	Normandy	815
State of Tennessee	Norris	26,869
State of Tennessee	Tellico	5,900
State of Tennessee	Watts Bar	3,705
State of Tennessee	Columbia	12,800

2.2. Recreation Management

This section describes, in general terms, the existing and proposed facilities and programs associated with TVA's management of developed recreation. Activities associated with dispersed recreation are described in Section 2.1. Table 2-19 lists the supporting programs and tools for TVA's Recreation Management Program.

Table 2-19. Summary of TVA's Recreation Management Program

Recreation Management Programs		Current Program	Proposed Program
Campground Management	Campgrounds Located on Dam or Power Plant Reservations	●	
	Campgrounds Located on Other Reservoir Properties	●	
Day Use Areas Management	Blueways		●
	Day Use Areas	●	
	Greenways	●	
	Stream Access Sites	●	
Public Outreach Programs	Annual Tours		●
	Clean and Green Campground Initiative		●
	Foundation and Trust Fund		●
	Recreation Information Management	●	
	Recreation Management Regulations		●
	Resource Ranger Program		●
Recreation Assessments and Design Tools	Boating Capacity Studies	●	
	Boating Density Assessments	●	
	Developed Recreation Inventory and Surveys	●	
	Recreation Design Principles		●
	Recreation Planning, Assistance, and Technical Support	●	

2.2.1. Campground Management

TVA manages 12 campgrounds in Alabama and Tennessee with approximately 670 campsites available to the public (see Figure A-3, Appendix A). Campgrounds are operated seasonally from mid-March to mid-November. As each campground opens in the spring, TVA exercises an annual lottery system for the long-term or seasonal rentals of approximately 140 campsites or about 21 percent of TVA's total campsite inventory. The remaining campsites are available to the public on a first-come, first-served basis. Currently, TVA charges campers from $16 per night for a campsite without hookups to $24 per night for a campsite with water, electric, and sewer services. In addition, picnic pavilions can be reserved for a flat fee of $50. Over the last six years, TVA collected an annual average of $771,882 from campground and pavilion rentals. Table 2-20 shows the yearly revenue, expenses, and net profit for TVA-managed campgrounds and pavilions.

Table 2-20. TVA Campground and Pavilion Revenues

Year	Revenue	Expenses	Net Profit
2004	$672,864	$418,891	$253,973
2005	$715,286	$428,126	$287,160
2006	$725,847	$504,595	$221,252
2007	$803,495	$571,407	$232,088
2008	$820,694	$570,406	$250,288
2009	$893,105	$572,406	$320,699
Average	$771,882	$510,972	$260,910

TVA-Managed Campgrounds Located on Dam or Power Plant Reservations — TVA manages eight campgrounds on dam and power plant reservations. Six campgrounds are located in northeast Tennessee (Cherokee Dam, Douglas headwater and tailwater, John Sevier, Melton Hill, and Watauga), one campground located in southwest Tennessee (Pickwick Dam), and one campground located in northwest Alabama (Wilson Dam).

Cherokee Dam Campground is a self-service campground containing 42 campsites with water and electric hookups. The campground amenities also include restrooms with heated showers and flush toilets, dump station, children's play equipment, picnic tables and grills, group pavilion available by reservation, swimming beach, boat ramps above dam and below dam, lake and river fishing, paved walking trail, and bird watching. TVA employs a nonresident manager and volunteer campground hosts to oversee daily operations.

Douglas Dam Headwater Campground is a self-service campground containing 65 campsites, 61 with water and electric hookup and two handicapped-accessible sites. The campground amenities also include restrooms with heated showers and flush toilets, dump station, picnic tables, swimming beach, boat ramp, walking trail, wildlife viewing area, and bird watching. Trotter Bluff SWA is located nearby and features walking trails through 30 acres of mature hardwood forest, limestone sinkholes, spring wildflowers, and vistas of the dam and tailwaters. TVA employs a nonresident manager to oversee daily operations.

Douglas Dam Tailwater Campground is a self-service campground containing 62 campsites with water and electric hookup and two handicapped-accessible sites. The campground amenities also include restrooms with heated showers and flush toilets, dump station, children's play equipment, picnic tables and grills, group pavilion available by reservation,

boat ramp, river fishing with fishing pier, bait and tackle shop, wildlife viewing area, and bird watching. TVA employs a nonresident manager to oversee daily operations.

John Sevier Campground is located at John Sevier Fossil Plant on the Holston River. This is a self-service campground containing 74 campsites. The campground amenities include picnic tables, a bathhouse, and a boat ramp. TVA directly oversees daily operations at John Sevier Campground.

Melton Hill Dam Campground is a self-service campground containing 57 campsites, 33 with water and electric hookups; eight with water, electric, and sewer service; three handicapped-accessible sites with water, electric, and sewer service; and 13 without hookups, nine of which are tent sites. Campground amenities also include restrooms with heated showers and flush toilets, dump station, multipurpose court, picnic tables with grills, group pavilion available by reservation, swimming beach, boat ramp above and below the dam, lake fishing, and bird watching. TVA employs a nonresident manager and volunteer campground host to oversee daily operations.

Pickwick Dam Tailwater Campground is a self-service campground containing 95 campsites, of which 66 have water and electric hookups. The campground amenities include restrooms with heated showers and flush toilets, dump station, picnic tables and grills, boat ramp below dam, tailwater bank fishing, and bird watching. TVA manages the Pickwick Dam Campground on an honor system, with plans to employ a volunteer campground host to assist with daily operations.

Watauga Dam Tailwater Campground is a self-service campground containing 29 campsites with electric hookups. The campground amenities include restrooms with heated showers and flush toilets, dump station, public phone, picnic tables and grills, canoe access, boat ramps above and below the dam, lake and river fishing, hiking trail, walking trail, wildlife viewing area, and bird watching. In addition, the Appalachian Trail crosses Watauga Dam. TVA employs a volunteer campground host to assist with daily operations.

Wilson Dam – Lower Rockpile Campground contains 23 campsites. The campground amenities include restrooms with heated showers and flush toilets, picnic tables and grills, group pavilion available by reservation, boat ramps above and below the dam, lake and river fishing, 10 miles of hiking trail, walking trail, natural area, wildlife viewing area, bird watching, and bicycling. Old First Quarters SWA, comprising 25 acres and located nearby, is managed to preserve biological and cultural features, including a rich array of spring wildflowers, woodland birds, and structures built by the Civilian Conservation Corps. TVA manages this campground on an honor system.

<u>TVA-Managed Campgrounds Located on Other Reservoir Properties</u> — TVA manages four campgrounds located on other reservoir properties. Two campgrounds are located in central Tennessee (Barton Springs and Foster Falls), one campground in northeast Tennessee (Loyston Point Campground), and one campground in northwest Alabama (Mallard Creek Campground).

Barton Springs Campground is located adjacent to Normandy Reservoir. It contains 67 campsites, of which 40 campsites have water and electric hookups. The campground amenities also include restrooms with heated showers and flush toilets, dump station, picnic tables, group pavilion available by reservation, swimming beach, boat ramp above the dam, and a fishing pier. TVA employs a resident manager to oversee daily operations.

Foster Falls Campground is located about 40 minutes northwest of Chattanooga, Tennessee. It contains 26 campsites with one handicapped-accessible site. The campground amenities include restrooms with heated showers and flush toilets, picnic tables and grills, group pavilion available by reservation, hiking trail, natural area, and bird watching. Foster Falls SWA is located nearby and features a 60-foot waterfall, visible from sandstone overlooks, and 178 acres of forest including mountain laurel, azalea, and hemlock. A new handicapped-accessible trail to an overlook has been added. TVA employs a resident manager to oversee daily operations.

Loyston Point Campground is located adjacent to Norris Reservoir and contains 64 campsites, of which 39 campsites have electric hookups. The campground amenities include restrooms with heated showers and flush toilets, dump station, picnic tables, swimming beach, boat ramp, and a hiking trail. Hemlock Bluff National Recreation Trail, named for the prominence of hemlocks in the hardwood forest that the trail traverses, is a 7-mile loop along the steep ridges and bluffs of Norris Reservoir. TVA employs a resident manager to oversee daily operations.

Mallard Creek Campground is located adjacent to Wheeler Reservoir and contains 56 campsites with water and electric hookups. The campground amenities include restrooms with heated showers and flush toilets, dump station, children's play equipment, picnic tables, group pavilion available by reservation, swimming beach, boat ramp, lake fishing, and bird watching. TVA employs a resident manager to oversee daily operations.

2.2.2. Day Use Areas Management

Day Use Areas

Day use areas offer various types of recreational facilities available to the public from dawn to dusk and are typically free of charge. TVA manages 63 day use areas across the Valley (see Figure A-4, Appendix A). There are 30 day use areas located on TVA's dam reservations and 33 day use areas located on other types of TVA-managed lands. In addition, TVA manages nine visitors' centers and 22 overlooks at dams. Typical day use amenities include picnic sites, pavilions, fishing piers, restrooms, and trails. Play courts, children's play equipment, and open play fields are provided at some day use areas.

TVA manages 12 swimming beaches across the Valley. Swimming beaches are typically located within TVA campgrounds or day use areas and designated with a yellow floating line, "Swim at your own risk" and/or "No lifeguard on duty" signs. Unlike the day use areas, swimming beaches are seasonal and usually close around mid-September.

TVA also manages 49 boat access areas across the Valley. These areas provide the public with boating access to TVA reservoirs and nearby rivers and streams. The boat access areas vary from concrete launching ramps and large parking areas to primitive graveled or dirt launching ramps and minimal parking areas. Most often, TVA develops partnerships for the planning, construction, and maintenance of boat access areas. In addition, TVA has acquired 81 stream access sites, as discussed below.

Blueways

A blueway is a water path or trail developed with launch points, camping locations, and points of interest for canoeists and kayakers. Physical and geopositioned markers guide trail users through the waterways. An ideal blueway trail also includes an abundance of scenery and wildlife as well as easy canoe and kayak access. The benefits of a system of paddling trails are many, including the promotion of healthy, nonpolluting, family-friendly

outdoor recreation and the potential to contribute to our local economy. Many paddling trails traverse areas with unique ecological, geological, or historical features, providing excellent educational opportunities for outdoor enthusiasts. Paddling a stream or river increases appreciation for good stewardship practices and may result in more support for cleanups, habitat restoration, and improved water quality. TVA currently manages blueway partnership located on the Tellico River and within the upper portions of Tellico Reservoir.

Greenways
A greenway is a long, narrow piece of land, often used for recreation and pedestrian and bicycle traffic. TVA currently manages five greenways and has provided land for an additional 25 greenways across the Valley. Often, greenways provide natural settings in otherwise developed landscapes. Some greenways include native plant gardens as well as typical park-style landscaping of trees and shrubs. They also tend to have a mostly contiguous pathway, allowing urban commuting via bicycle or foot.

Stream Access Sites
TVA, along with various other partners, promotes the protection of streams while providing recreational opportunities. In 1978, TVA began to assist with acquisition of 147 stream access sites on 40 scenic streams throughout the Valley. TVA purchased small tracts of land or landrights adjacent to streams for public recreation purposes. TVA transferred 66 of the stream access sites to other agencies or groups. However, 81 stream access sites remain under TVA's ownership with 50 managed by partnerships and under contractual agreements and 31 managed by TVA (see Figure A-5, Appendix A). A typical stream access site consists of a parking area, picnic area, and access to the stream. The stream access typically varies from a primitive dirt path, boat ramp, or steps to a swimming hole and/or fishing area.

2.2.3. Public Outreach Programs

TVA is proposing to utilize a number of public outreach programs to aid in recreation management. The public outreach programs are shown in Table 2-21 and described below.

Table 2-21. Proposed Recreation Public Outreach Programs

Programs
Annual Tours
Clean and Green Campground Initiative
Foundation and Trust Fund
Recreation Information Management
Recreation Management Regulations
Resource Ranger Program

Annual Tours
TVA would host annual media and technology transfer tours of campgrounds and day use recreational areas where emerging technologies are featured and showcased. If a demonstration project were to be conducted during the tour, TVA would conduct the appropriate environmental review and seek applicable approvals prior to the tour.

Clean and Green Campground Initiative
The Clean and Green Campground Initiative (C&GCI) is a program that TVA would model after the TVCMI (see Subsection 2.4.1). C&GCI would be a voluntary program developed

and implemented by TVA and partners to promote environmentally responsible campgrounds and camping practices. This program would be established to support the LNT Program and to help campground operators protect the surrounding natural resources. The C&GCI effort would encourage camper education, coordination among state agencies, resource conservation/recycling, and better communication of existing laws, and would offer incentives, when possible, for creative and proactive campground operators. Campgrounds that operate in accordance to the goals and objectives of the C&GCI Program would be rewarded for those efforts.

Foundation and Trust Fund
A Foundation and Trust Fund (F&TF) type program would be established to leverage funding for stewardship, conservation, and/or recreation project(s) across the Valley. An F&TF would similar to a corporate partnership program in which a center or foundation would be established to oversee and managing a fundraising campaign, trust fund, and request proposals. Funding would be available for on-the-ground projects, contracted technical support services, plan development, and project implementation.

Grantees would be organizations capable of entering into cooperative agreements such as either local governments or nonprofit organizations. The F&TF would solicit requests for proposals on an annual basis. The F&TF Board of Directors would select grantees and/or conservation/stewardship projects based on the following criteria:

- Alignment with recreational unmet needs analysis
- Organizational capability to successfully complete the proposed projects
- Alignment with TVA goals and programs
- Total measurable benefits to recreation, natural resource management, water resources, and/or conservation

TVA would ensure consistency with the NRP when identifying the appropriate standards and criteria for the F&TF Program.

Recreation Information Management
TVA's recreation information is the foundation for many aspects of recreation. TVA uses this information to track recreation demand analysis and conduct impact analysis for projects or proposals requiring the use of TVA-managed lands. Furthermore, recreation information is also provided to partners and stakeholders. This information can be provided upon request or obtained from TVA's Web site.

Visitor Assessments — Visitor assessments are a tool that TVA uses to obtain additional recreation information and help the Agency understand recreation trends and needs. TVA would conduct studies to examine visitor use, demand, and preferences, and the results would be used to set priorities for future development and planning. Surveys would include a variety of techniques and media (i.e., site, phone, and Web surveys). Specific guidelines and methodologies for surveys would follow established and valid criteria as recognized by the social science research and academic community.

Recreation Management Regulations
TVA would use the federal rule-making process to develop and implement regulations to articulate expectations for visitors on TVA-managed lands. The rules would be codified in the CFR. TVA would ensure consistency with the NRP when developing these regulations.

Resource Ranger Program
A Resource Ranger Program would be used to supplement TVA Police efforts at TVA-managed recreational areas across the Valley. The rangers would receive instructions in being a good witness, radio procedures, recreational area rules and regulations, handling emergencies, and remaining safe while on duty as a ranger. These uniformed rangers would be available at various recreational sites looking for and immediately reporting violations of TVA rules, criminal mischief, and suspicious activity to TVA Police. They would also be available to assist those in need and answer questions visitors may have about TVA recreational areas or the community in general.

Resource rangers would also focus on undeveloped TVA-managed lands. The main objective of this program would be to provide the public an interface and TVA presence on undeveloped lands. Resource rangers would ensure users abide by the rules and regulations governing TVA-managed lands while providing education and outreach opportunities.

2.2.4. Recreation Assessment and Design Tools

Recreation assessments and design tools are shown in Table 2-22 and described below.

Table 2-22. Proposed Recreation Assessment and Design Tools

Activities
Boating Capacity Studies
Boating Density Studies
Developed Recreation Inventory and Surveys
Recreation Design Principles
Recreation Planning, Assistance, and Technical Support

Boating Capacity Studies
Boating capacity is the prescribed number of people/boats that a particular body of water can reasonably accommodate, given the desired biophysical/social/cultural resources, visitor experiences, and management program. Recreational boating capacity studies are aimed at describing existing conditions and evaluating whether proposed changes would impact current users. TVA completed a pilot boating capacity study on Tims Ford Reservoir in 2002 (TVA 2002d).

Boating Density Assessments
TVA's recreational boating density assessments are similar, in theory, to boating capacity studies. However, the boating density assessment methodology is specifically used for conducting impact analysis for TVA projects or proposals requiring TVA's approval. Collection and analysis of data provide useful tools for gaining a better understanding of future desired boating conditions and offer choices for altering management strategies. TVA uses data on the number of recreational watercraft stored in the vicinity of the reservoir to estimate on-water boat numbers during summer weekdays, weekend days, and holidays. These data assist planners and state boating law administrators in estimating impacts from current and proposed recreational watercraft storage/access projects along with the appropriate management regimes. TVA often coordinates the results of these studies with the appropriate boating law administration.

Developed Recreation Inventory and Surveys
The purpose of TVA's Developed Recreation Inventory Program is to create and maintain an up-to-date database on recreation facilities and services available on TVA-managed reservoirs. This information is made available within TVA for use in planning, managing, and public information initiatives. Decisions regarding data collection were based on the information needed to support future recreation and resource management planning efforts. These efforts include the preparation of integrated resources management plans and recreation capacity studies.

TVA's Developed Recreation Inventory includes public, private, and quasi-public recreational opportunities on or near TVA-managed lands and reservoirs. Public recreation includes opportunities provided by TVA or other federal, state, county, and municipal agencies. Private recreation includes opportunities provided by private commercial areas operated for profit along with noncommercial areas for members/residents only. Quasi-public recreation includes those opportunities for members of nonprofit organizations.

While the primary focus of the inventory is on areas directly bordering the reservoir shoreline, large dry boat storage facilities located off reservoir (within 1 to 2 miles) are included to gain a sense of total level of water-related development and use. Information collected includes basic attribute data, such as area type, contact, and location information and facilities listing, encompassing a wide range of accommodations typically offered at water-oriented outdoor recreational operations.

The scope of information collected varies with the type of recreational facility. The most detailed information would be gathered at TVA-managed recreational areas and would include information on ramp widths, elevations, and presence of a courtesy pier. Substantial details on facilities and services offered by other public agencies and commercial recreation areas would be collected. Because of limited availability to the public, various levels of details would be collected for quasi-public recreational areas. Similarly, information about members-only boating clubs and private residential community docks would be generally limited to attribute data and an approximate count of boat slips.

TVA's Developed Recreation Inventory only includes those recreation areas with development and evidence of maintenance. By these criteria, undeveloped lands managed by TVA or other public agencies are excluded. While many of these lands offer important opportunities for informal recreation, they are considered to be beyond the scope of this initiative. Similarly, developed areas in poor condition without routine maintenance efforts were not included in the inventory.

Recreation Design Principles
TVA implements standard construction designs and products that promote compliance with the Americans With Disabilities Act Accessibility Guidelines (ADAAG), principles of universal design, or other accredited design standards as appropriate. This process ensures that TVA recreation facilities and amenities are usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

In addition, TVA seeks to develop or adopt standards for interpretative and informative signage. These signs would be installed and maintained at TVA recreation areas. In addition, sign placement along highway systems using the International Highway sign symbols for TVA recreation areas is of interest to the Agency. Resource conservation designs would be developed and implemented to encourage a variety of methods and

technologies such as resource conservation and recycling. TVA would ensure consistency with the NRP when developing recreation designs.

Recreation Planning, Assistance, and Technical Support
Through planning and technical assistance on a fee or sponsored basis, TVA furnishes guidance to all types of parks, recreational programs, and the development of reservoir-oriented facilities. TVA also furnishes information about recreational use and development of the region's resources for analyzing and evaluating recreational opportunities and needs. In addition, existing site plans are available to agencies upon request.

2.3. Reservoir Lands Planning

2.3.1. Reservoir Lands Planning Methodologies

TVA has implemented four different land planning methodologies for classifying reservoir lands: Forecast System, Multiple Use Tract Allocations, Single Use Parcel Allocations, and Rapid Lands Assessment (RLA). These land planning methodologies have been utilized to guide land use decisions and, to varying degrees, have created systematic approaches to planning and managing multipurpose uses of TVA-managed reservoir lands across the Valley. This section provides an overview and timeline of the four methodologies. Table 2-23 categorizes TVA reservoirs by land planning methodology.

Table 2-23. Land Planning Methodology Applied to TVA Reservoirs

Reservoir Lands Planning Methodology	Time Frame Applied	Reservoirs		
Unplanned or Forecast System	1933-1979	Beech	Lost Creek	Pine
		Cedar	Normandy	Redbud
		Dogwood	Pin Oak	Sycamore
Multiple Use Tract Allocations	1979-1999	Chickamauga	Nickajack	Wheeler
		Kentucky		
Single Use Parcel Allocations	1999-2010	Apalachia	Fontana	Ocoees
		Beaver Creek	Fort Patrick Henry	Pickwick
		Big Bear Creek	Guntersville	South Holston
		Blue Ridge	Hiwassee	Tellico
		Boone	Little Bear Creek	Tims Ford
		Cedar Creek	Melton Hill	Upper Bear Creek
		Chatuge	Nolichucky	Watauga
		Cherokee	Norris	Watts Bar
		Clear Creek	Nottely	Wilbur
		Douglas		
Rapid Lands Assessment*	2007 and 2010	Beech	Kentucky	Pine
		Cedar	Lost Creek	Redbud
		Chickamauga	Nickajack	Sycamore
		Dogwood	Normandy	Wheeler
		Fort Loudoun	Pin Oak	Wilson
		Great Falls		

* RLA was conducted to communicate consistent Valleywide statistics to the public. Land use decisions are not being made from the RLA methodology.

Forecast System
Before 1979, when TVA began the comprehensive planning of its reservoir lands in a public forum, the Forecast System was used to guide land use decisions on most TVA reservoir

lands. The Forecast System was an in-house process created in the 1960s to document actual and prospective uses for certain TVA-managed land around a reservoir using a somewhat variable set of designations described in Appendix D. A forecast record book was prepared to serve as a general guide for use or potential development of each TVA reservoir. Decisions on the best use of the property were made based on internal agency expertise and incorporated local and regional needs for various land uses as determined by TVA specialists' professional judgment. Table 2-24 identifies those reservoirs that use the Forecast System or have no designations for land management decisions.

Table 2-24. Reservoirs Using the Forecast System or No Designations

Reservoirs		
Beech River	Great Falls	Pin Oak
Cedar	Lost Creek	Redbud
Dogwood	Normandy*	Sycamore
Fort Loudoun*	Pine	Wilson

*Reservoirs using the Forecast System

Multiple Use Tract Allocations

In 1979, TVA began using the Multiple Use Tract Allocations method, which was a systematic approach to planning reservoir lands for multiple uses. A planning team that included TVA staff representing various disciplines and areas of expertise was assembled to complete a detailed planning process for individual reservoirs. The planning team gathered existing reservoir data and regional trends, conducted field surveys of reservoir lands, conducted capability and suitability analyses, and sought input from local officials and the public. Next, the lands were subdivided into manageable tracts and assigned multiple use designations.

Narrow strips of TVA-managed land fronting property formerly owned by TVA that was previously sold or transferred, also known as marginal strips, were not planned using this planning methodology. For example, TVA shoreland fronting former TVA reservoir land that was sold for private development purposes with deeded rights to construct private shoreline improvements was not planned. Additionally, the Multiple Use Tract Allocation method often did not plan land that was committed to a long-term or permanent use, such as parcels encumbered by easements or parcels used for TVA dam reservations or power plants.

The RLMPs were approved by the TVA Board and adopted as Agency policy. The Multiple Use Tract Allocation approach of developing RLMPs was discontinued in 1999. A detailed description of the methodologies associated with this approach is presented in Appendix E. RLMPs based on Multiple Use Tract Allocations remain in effect for Chickamauga, Kentucky, Nickajack, and Wheeler reservoirs.

Single Use Parcel Allocations

The approach that TVA has used since 1999 is similar to the Multiple Use Tract Allocation approach in that the lands surrounding each reservoir are subdivided into small parcels. However, each parcel is designated for a single use or allocation. This technique is called Single Use Parcel Allocations.

A planning team that included various TVA staff would be assembled to complete a detailed planning process for individual reservoirs or groups of reservoirs. First, the lands (including

marginal strip and non-TVA managed lands) would be subdivided into manageable parcels. Next, the planning team would gather existing reservoir data and regional trends, conduct limited field surveys, conduct capability and suitability analyses, and assign single use allocations or zones to each parcel.

Public input would be sought for the initial parcel allocations. The planning team would analyze the public input and make any necessary changes to parcel allocations. The RLMP would be approved by the TVA Board or appropriate designee and adopted as Agency policy.

The land use zone definitions used in recent RLMP efforts are presented in Appendix F. These zone definitions have been modified slightly to provide additional clarity and consistency. However, there have been no substantive changes in comparison to those definitions used in recently approved RLMPs. A detailed description of the methodology associated with the Single Use Parcel Allocation approach is presented in Appendix G.

Currently, TVA applies the Single Use Parcel Allocation approach when planning reservoirs or groups of reservoirs. Table 2-25 lists the reservoirs that currently use the Single Use Parcel Allocation approach for land management decisions. In order to have a consistent reservoir lands planning methodology across the Valley, reservoirs that have Forecast System designations or Multiple Use Tract Allocations are slated for conversion to the Single Use Parcel Allocation.

Table 2-25. Reservoirs Using Single Use Parcel Allocations

Reservoirs			
Apalachia	Clear Creek	Nolichucky	South Holston
Beaver Creek	Douglas	Norris	Tellico
Big Bear Creek	Fontana	Nottely	Tims Ford
Blue Ridge	Fort Patrick Henry	Ocoee 1	Upper Bear Creek
Boone	Guntersville	Ocoee 2	Watauga
Cedar Creek	Hiwassee	Ocoee 3	Watts Bar
Chatuge	Little Bear Creek	Pickwick	Wilbur
Cherokee	Melton Hill		

Rapid Lands Assessment

With the varying methodologies and allocations, it was often difficult to calculate the acreage of TVA-managed lands that had been planned for sensitive resources, natural resource management, industrial development, and recreation. In 2006, the RLA methodology was developed to quickly convert the Forecast System designations and Multiple Use Tract Allocations to Single Use Parcel Allocations or zones. To date, the information obtained from RLA has only been used to estimate acreage of lands managed in the various allocations or zones. These estimates have not been approved by the TVA Board, but the estimates have been communicated to the public when consistent Valleywide statistics were needed.

A planning team that included various TVA staff was assembled to complete high-level planning for most of the reservoirs having Multiple Use Tract Allocations or Forecast System designations (Table 2-26). First, the planning team gathered and evaluated the existing reservoir data, information that had changed since the last RLMP (if applicable), regional trends, and existing land use agreements and deeds. Next, marginal strips and

other previously unplanned TVA-managed lands were divided into manageable parcels and assigned the single use allocation that best represented existing conditions or current needs. In 2010, this same methodology was applied to Great Falls and Wilson reservoirs. A detailed description of the methodology associated with the RLA approach is presented in Appendix G.

Table 2-26. Reservoirs With Rapid Lands Assessment Data

Reservoirs	
Beech River Project	Nickajack
Cedar	Normandy
Chickamauga	Pine
Dogwood	Pin Oak
Fort Loudoun	Redbud
Great Falls	Sycamore
Kentucky	Wheeler
Lost Creek	Wilson

2.3.2. Property Administration

As administrators of public land, TVA would use the NRP and RLMPs, along with TVA policies and guidelines, to manage resources and to respond to requests for the use of TVA-managed land. All inquiries about or requests for the use of TVA-managed land should be made to the TVA Environmental Information Center at 800-882-5263 between 8 a.m. and 6 p.m. Eastern time Monday through Friday.

Pursuant to the TVA Land Policy, TVA would consider changing a land use designation outside of the normal planning process only for the purpose of water access for industrial or commercial recreational operations on privately owned back-lying land or to implement TVA's SMP.

Additionally, there are a small number of TVA parcels in the Valley that have deeded access rights for shoreline access that are currently utilized for other uses such as commercial recreation, industrial, etc. Should the private back-lying land become residential, a request for a change of allocation of the parcel to Zone 7 (Shoreline Access) would be subject, with the appropriate environmental review, to action by the TVA Board or its designee or to board-approved policy.

Consistent with the TVA Land Policy, those parcels or portions of parcels that have become fragmented from the reservoir may be declared surplus and sold at public auction. Public works/utility projects, such as easements for pipelines, power or communication wires, roads, or other public infrastructure, proposed on any TVA-managed land that do not affect the zoned land use or sensitive resources would not require an allocation change as long as such projects would be compatible with the use of the allocated zone. Proposed public works/utility projects would be subject to a project-specific environmental review. Any other requests involving a departure from the planned uses would require the appropriate Agency approval.

Proposals consistent with TVA's policies and the allocated use, and otherwise acceptable to TVA, will be reviewed in accordance with NEPA and must conform to the requirements of other applicable environmental regulations and other legal authorities.

2.4. Water Resource Management

This subsection summarizes the existing and proposed programs associated with TVA's water resource management and improvement efforts. Table 2-27 lists the associated programs and tools used in developing the alternatives presented in Chapter 3.

Table 2-27. Summary of TVA's Water Resource Management Programs

Water Resource Management Programs		Current Program	Proposed Program
Aquatic Monitoring and Management	Aquatic Ecology Management	●	
	Stream and Tailwater Monitoring Program	●	
Partnership Programs	Case Studies and Research Initiatives		●
	Strategic Partnership Planning	●	
Public Outreach Programs	Quality Growth Program	●	
	Tennessee Valley Clean Marina Initiative	●	
	Water Efficiency Program	●	
	Water Resource Outreach Campaigns		●
Water Resource Improvement Programs	Reservoir Shoreline Stabilization		●
	Targeted Reservoir Initiatives		●
	Targeted Watershed Initiatives	●	
	Water Resource Grant Program		●
	Water Resource Improvement Campaigns		●
Water Resource Improvement Tools	Access Controls and Lands Protection	●	
	Agricultural Assistance	●	
	Construction and Maintenance of Access Roads and Parking Areas	●	
	Mine Land Reclamation	●	
	Urban Storm Water Assistance	●	
	Stream and Riparian Management and Restoration	●	
	Wetlands Restoration, Creation, and Enhancement	●	
	Water Pollutant Trading		●
	Water Resource Communications	●	
Water Resource Management Assistance	Technical Assistance	●	
	Water Resource Organizational Assistance	●	

2.4.1. Aquatic Monitoring and Management

Aquatic Ecology Management

TVA would partner and actively participate in restoring aquatic biological communities. This may include activities such as habitat protection and enhancement, biological monitoring, and pollution reduction. In addition, TVA would develop and evaluate public outreach opportunities to raise public awareness of exotic and invasive aquatic animal species

consistent with EO 13112. This may include activities such as developing presentations to deliver to communities, working with marinas to support proper boat hull cleaning, and providing information to stakeholders on steps they could take to reduce the spread of certain exotic and invasive species.

Stream and Tailwater Monitoring
The U.S. Geological Survey (USGS) assigns each watershed with a specific numerical hydrologic unit (HU) code. There are 611 HUs labeled with the 11-digit USGS code within the Tennessee River watershed. Typically, TVA refers to specific watersheds by the individual HU code.

In 1987, TVA began using biological monitoring to evaluate watershed condition (Saylor and Scott 1987). The main biological monitoring tool chosen was the IBI for fish communities (Karr 1981). Initially, this method was applied at major inflows to TVA reservoirs as part of the fixed station ambient monitoring program. Later, the IBI methodology was adapted for assessment of smaller streams and was used to evaluate the success of stream restoration projects.

In 2000, IBI scores became a key tool in identifying projects and measuring the success efforts of the TWI Program (see below). In order to provide a complete assessment of Valley water quality, IBI stations were located to characterize each of the Valley's HUs. Because of practical considerations, some HUs cannot be monitored, and there are 516 IBI stations for the 611 Valley HUs. Since 2000, IBIs have been performed on each HU station once every five years.

The STM Program also provides diagnostic and supporting data. Routine monitoring also includes an evaluation of the health of the benthic community and characterizes habitat quality at the monitoring station. In addition to the TWI Program, STM-generated data are used to measure certain aspects of TVA reservoir operations in tailwaters for tracking operational changes because of ROS and supporting the analysis needed for environmental reviews. These data are also shared with other agencies and partners, as appropriate.

2.4.2. Partnership Programs

Case Studies and Research Initiatives
TVA is proposing a new program that would increase partner abilities to improve overall stewardship awareness and generate increased participation in improvement activities. This program would demonstrate existing stewardship improvement tools and programs in settings where these tools would be valuable but are currently not being used. In addition, this program would seek to develop new applications for existing improvement tools and improve and document the effectiveness of existing tools. Lessons learned from these projects would be easily exported to other projects throughout the Valley and the nation.

Strategic Partnership Planning
Strategic partnership planning focuses on building strong partnerships with state, regional, and national organizations to address stewardship issues of mutual importance. Examples of projects may include facilitation of state working groups to develop collaborative projects, networking with current and prospective funders to enhance TVA's ability to secure external funding, providing technical assistance to expand programs into additional states, exploring "market"-based opportunities for improving water quality, and building relationships with key contacts at agencies and organizations throughout the TVA region.

2.4.3. Public Outreach Programs

TVA is proposing to utilize a number of public outreach programs to aid in water resource management. Public outreach programs are shown in Table 2-28 and described below.

Table 2-28. Proposed Water Resource Public Outreach Programs

Programs
Quality Growth Program
Tennessee Valley Clean Marina Initiative
Water Efficiency Program
Water Resource Outreach Campaigns

Quality Growth Program

The concept for the QGP began when the Tennessee Department of Agriculture (TDA) recognized that local communities needed support to protect water resources as they grew. Through funding from the USEPA, TDA convened a leadership team to develop and deliver the QGP. This leadership team is led by TVA, and team partners include the Southeast Watershed Forum and the University of Tennessee Water Resources Research Center.

The QGP was based on a set of best practices developed by the University of Connecticut's Nonpoint Education for Municipal Officials (NEMO) Program, along with watershed protection processes developed at the Center for Watershed Protection. QGP is a founding member of the National NEMO Network. NEMO best practices emphasize reducing impervious land cover (roads, parking lots, sidewalks, and buildings), encouraging denser development, preserving open space, and treating storm water runoff close to its source.

The QGP helps communities make decisions that are more informed about managing growth and its impact to land, water, air, energy, and other resources. A presentation/training package has been developed that recognizes regional culture and constraints. The presentations are delivered in such a way that fits the scale and partnership structure of communities across the state and the larger Southeastern region. Through this training and other technical assistance, local government officials, planners, and engineers gain information and tools to support their review and change of local plans, ordinances, and codes. Local officials from more than 300 Valley communities have participated in program activities. Of these, 120 have changed their development practices. Sustainable community and economic growth are being achieved through changes brought about by the QGP. As a result of these and future changes, Valley communities will continue to prosper as they preserve the natural beauty that has attracted development to this region.

The QGP workshop series has been conducted numerous times in Tennessee and piloted in Georgia, Kentucky, Mississippi, and Virginia (see Figure A-6, Appendix A). These workshops have prompted 230 communities to review existing codes and ordinances, and 123 communities either have changed or plan to change existing codes and ordinances. In addition, communities have reported that 57 "green" projects have been implemented because of QGP workshops. These types of "green" projects have included installation of porous pavement, preserved open space, grassy swales, rain gardens, and cluster design subdivisions. The interest raised from the QGP has sparked such states as Kentucky, Virginia, North Carolina, and Georgia to develop similar training programs.

Tennessee Valley Clean Marina Initiative
TVCMI is a voluntary program developed and implemented by TVA and its watershed partners to promote environmentally responsible marina and boating practices. This program, established in support of the National Clean Boating Campaign, helps marina operators protect the very resource—clean water—that provides them with their livelihood. TVCMI is designed as an ongoing program to reduce water pollution and erosion in the Tennessee River watershed. The effort encourages boater education, coordination among state agencies, and better communication of existing laws, and offers incentives, when possible, for creative and proactive marina operators.

TVA developed and authored the *Tennessee Valley Clean Marina Guidebook* to support marina operators and owners who are voluntarily striving to protect the water resources of the Valley (TVA 2009d). This manual is intended as an educational tool and reference for reducing water pollution and erosion from marina and boating activities and is available at http://www.tva.gov/environment/pdf/cleanmarina.pdf.

Marinas that operate in accordance to the goals and objectives of the TVCMI, as stated in the guidebook, are rewarded for their efforts. The marinas receive a certificate, authorization to use the TVCMI logo, and the prestigious TVCMI flag. The certified marinas are also recognized in press releases and listed on TVA's Web site and in other TVCMI promotions and events. Table 2-29 shows the number of marinas that have been certified under the TVCMI Program, and Figure A-7 (see Appendix A) identifies the locations of those marinas.

Table 2-29. Number of Marinas Certified Under the Tennessee Valley Clean Marina Initiative Program

Year	Number of Certified Marinas
2002	7
2003	17
2004	15
2005	14
2006	19
2007	5
2008	4
2009	4
Total	**85**

Water Efficiency Program
The Water Efficiency Program promotes using water wisely across the Valley through various outreach efforts. Specifically, TVA has become a USEPA WaterSense promotional partner. WaterSense is a USEPA-sponsored voluntary partnership program with the goal of protecting the future of the nation's water supply. By promoting and enhancing the market for water efficient products and services, WaterSense "makes every drop count" by leveraging relationships with key utility, manufacturer, and retail partners across the U.S. The WaterSense Program produces effective communication products that (1) make it simple for consumers to differentiate among products that use less water, (2) reinforce that saving water is easy, and (3) state that saving water does not require a major lifestyle change. TVA has collaborated with USEPA and local wastewater utility districts to promote

the WaterSense Program and promote efficient water and energy use. Examples of WaterSense Program activities include:

- Hosting workshops for utility managers to learn about WaterSense and available water efficiency techniques and products.
- Promoting WaterSense to communities and counties that need to fulfill education needs, storm water reduction strategies, and/or state requirements for pollutant reductions on streams.
- Hosting workshops for irrigation professionals to learn about WaterSense and become USEPA certified.
- Encouraging stakeholders to become USEPA WaterSense promotional partners and/or adopt WaterSense practices.
- Promoting WaterSense concepts across TVA.

Water Resource Outreach Campaigns
To increase effectiveness and serve a larger portion of the Valley, TVA would develop communication products and delivery processes to promote water resource improvement and protection. Water Resource Outreach Campaigns could include focused efforts to raise public awareness of storm water management issues, develop and promote blueways (Section 2.2.2), and address TVA and/or stakeholder needs, emerging issues, or other resource concerns. These campaigns could demonstrate TVA's leadership in water resource stewardship and are intended to be flexible short-term projects with a high likelihood of measurable success. A Water Resource Outreach Campaign could include stakeholder products from various components of the QGP, Water Efficiency Program, shoreline stabilization, water resource improvement tools, technical assistance, and organizational support.

2.4.4. Water Resource Improvement Programs

Water Resource Improvement Programs and activities are shown in Table 2-30 and described below.

Table 2-30. Proposed Water Resource Improvement Programs

Programs
Reservoir Shoreline Stabilization
Targeted Reservoir Initiatives
Targeted Watershed Initiatives
Water Resource Grant Program
Water Resource Improvement Campaigns

Reservoir Shoreline Stabilization
TVA is charged with the management and stewardship of some 11,000 miles of reservoir shoreline. Therefore, TVA established criteria for determining the health of those shorelines by conducting reservoir shoreline assessments. Initial assessment results and the reservoir shoreline assessment methodologies are described in the SMI EIS (TVA 1998). During 2000 and 2001, assessments were completed on additional TVA reservoirs. TVA has subsequently continued to conduct assessments to update shoreline information.

Since 2001, TVA has used this information to prioritize stabilization efforts for critically eroded reservoir shoreline segments across the Valley. Stabilization plans are developed based on site-specific information including severity of shoreline erosion, location of nearby sensitive resources, appropriate BMPs, opportunities for innovative stabilization techniques, and installation methods. Typical reservoir shoreline stabilization techniques used by TVA include various forms of bioengineering, geotextiles, and rock riprap. TVA conducts the appropriate site-specific environmental reviews prior to stabilizing reservoir shoreline.

Targeted Reservoir Initiatives

The Targeted Reservoir Initiative (TRI) Program would be a new program for TVA and would focus on point source discharges to reservoirs. The TRI Program would set goals or targets to reduce nutrients and/or sediment in TVA-managed reservoirs. This program would adopt the targeting and implementation processes of the existing TWI Program while providing resources to meet specific reservoir-based goals. Under the TRI Program, TVA, in conjunction with partners and stakeholders, would develop improvement plans with a planning horizon of several years. In theory, the improvement plans would include, but would not be limited to, the numerous mechanisms described under Water Resource Management.

Targeted Watershed Initiatives

The TWI Program has been TVA's delivery mechanism for proactive water quality improvement work. The TWI Program implements water quality improvement efforts that protect and improve water resources for human health, fishing, swimming, boating, drinking water supply, agricultural use, aquatic habitat, and economic development.

The TWI process begins with project selection, which is based on analysis of information about the condition of watersheds and streams throughout the Valley. TVA uses biological monitoring, examining fish and other aquatic life, to assess the water quality of the watersheds and streams. The projects are prioritized based on the likelihood of measurable water quality improvement or protection from measurable degradation. After projects are selected, TVA develops project-specific teams to assist local citizens, organizations, and agencies in identification of water quality problems. Working groups or coalitions are often formed from these partnerships. These coalitions then work collaboratively to develop watershed action plans and implement improvement actions. TVA provides technical support to leverage funds, build local partnerships/coalitions, promote outreach efforts, and implement water quality improvement projects. The TWI Program allows TVA and stakeholders to develop effective partnerships, create a sustainable effort, and protect water quality for present and future generations.

The success of TWI is determined by the rating of project HUs based on TVA biological monitoring. An IBI is used to assess water quality by applying ecologically based metrics to resident aquatic communities. Each metric rates the condition of one aspect of the community. Metrics are scored against the expected condition of regional unimpacted stream communities. Potential scores are 1-poor, 3-fair, or 5-good. Table 2-31 shows the condition of and improvements with the HUs since 2000. Watershed improvement requires changes to infrastructure and behavior along with time for water quality recovery.

A TWI could include various components of shoreline stabilization, water resource improvement tools, technical assistance, and organizational support. The TWI process has catalyzed effective partnerships to gain support in environmental stewardship. These partnerships leverage additional funding to implement projects that focus on improving and protecting water resources. Table 2-32 shows the amount of TVA and leveraged funding

along with the stream performance since 2002. From 2002 to 2008, TVA funds decreased and leveraged dollars increased, while stream performance trended upward. During this period, TVA focused the TWI Program in a more effective targeting and implementation process. Figure A-8 (see Appendix A) identifies the locations of TVA's TWIs in 2010.

Table 2-31. Water Quality Improvements From Targeted Watershed Initiatives

Year	Number of HUs and IBI Conditions			Total Rating Value	Maximum Rating Available	Total Hydrologic Units	Stream Performance (Percent)
	Poor	Fair	Good				
2000	126	110	148	1196	1920	384	62.3
2001	162	147	223	1718	2660	532	64.6
2002	148	153	231	1762	2660	532	66.2
2003	138	155	239	1798	2660	532	67.6
2004	148	157	234	1789	2695	539	66.4
2005	143	165	239	1833	2735	547	67.0
2006	128	169	250	1885	2735	547	68.9
2007	131	162	254	1887	2735	547	69.0
2008	131	170	246	1871	2735	547	68.4

Table 2-32. Partnership Funding for Water Quality Improvements From Targeted Watershed Initiatives

Year	TVA Funding	Partnership Funding*	Total TWI Funding*	Stream Performance (Percent)
2002	$3,971,000	$2,000,000	$5,971,000	66.2
2003	$3,806,000	$2,000,000	$5,806,000	67.6
2004	$2,504,000	$2,000,000	$2,504,000	66.4
2005	$2,395,000	$2,000,000	$4,396,000	67.0
2006	$1,815,000	$2,800,000	$4,615,000	68.9
2007	$1,800,000	$3,800,000	$5,600,000	69.0
2008	$1,725,000	$2,200,000	$3,925,000	68.4

*The figures associated with Partnership Funding and Total TWI Program funding are approximate.

Water Resource Grant Program

By establishing a Water Resource Grant Program, TVA would be able to provide grant funding for the implementation of water quality improvement projects throughout the Valley. This program would target projects with documented water quality problems, would be connected to a state-approved watershed action plan, and would leverage outside funds and resources. The grant funds would be available for on-the-ground projects, for contracted technical support services, or for assisting stakeholders in grant writing, coalition building, plan development, and project implementation.

Grantees would be organizations capable of entering into cooperative agreements such as either local governments or nonprofit organizations. TVA would solicit requests for proposals on an annual basis. A review panel, consisting of representatives from TVA along with water resource stakeholders, would select grantees based on the following criteria:

- Alignment with a state-approved watershed action plan
- Organizational capability to successfully complete the proposed projects
- Alignment with TVA goals and programs
- Total measurable benefits to water resources

The grant program could be administered by TVA, and all projects funded by this grant program would be subject to a site-specific environmental review and all applicable local, state, and federal approvals.

Water Resource Improvement Campaigns
TVA would provide technical and organizational support to promote water resource improvement and protection. Water Resource Improvement Campaigns may include focused efforts to improve riparian and streamside management, reduce impacts of storm water runoff, improve the condition of water resources on TVA-managed land, or other issues. In addition, TVA would provide technical support or existing watershed restoration projects, organizational support to develop or sustain local partnerships and organizations, and grant writing assistance. A Water Resource Improvement Campaign may include various components of shoreline stabilization, water resource improvement tools, technical assistance, and organizational support, and would address TVA and/or stakeholder needs, emerging issues or other resource needs. These projects would demonstrate TVA's leadership in protecting and improving water quality and result in measurable water quality improvements. Process measures would include products delivered (such as plans, models, or designs) and decreased pollutant loading to the project water body. Water Resource Improvement Campaigns are intended to be flexible short-term projects with a high likelihood of measurable success.

2.4.5. Water Resource Improvement Tools

Table 2-33 lists the existing and proposed tools and supporting activities associated with TVA's water resource management and improvement efforts. These tools and activities were used in developing the programs chosen in the various alternatives. In addition, these tools and activities could be modified and applied to the programs listed under Biological and Cultural Resource Management and Recreation Management. A detailed discussion of these tools is located below.

Table 2-33. Proposed Water Resource Improvement Tools

Tools
Access Controls and Lands Protection
Agricultural Assistance
Construction and Maintenance of Access Roads and Parking Areas
Mine Land Reclamation
Urban Storm Water Assistance
Stream and Riparian Management and Restoration
Wetlands Restoration, Creation, and Enhancement
Water Pollutant Trading
Water Resource Communications
Water Resource Management Assistance
Technical Assistance
Water Resource Organizational Assistance

Access Controls and Lands Protection
In an effort to reduce the abuse of public lands, access control measures are utilized to protect natural and nonrenewable resources, minimize soil erosion, and prevent other environmental impacts. To facilitate the appropriate use of TVA-managed lands, signage and/or kiosks would be installed, and trash or litter would be removed. If TVA deems the abuse to be severe, gates or other physical barriers would be installed to deter the unwanted actions. Appropriate BMPs are indentified prior to installation of physical barriers and implemented during construction.

Agricultural Assistance
Agricultural BMPs are an effective and practical means of preventing or reducing agricultural pollutants from entering waterways. Some of the most commonly used conservation practices for nutrient management and erosion control are described within this subsection.

Critical Areas Management — The need to manage critical areas occurs both in the agricultural and urban settings. Critical areas include highly erodible locations that have been altered by landscaping, sloping, or that support inadequate vegetation. Erosion control in such areas may involve reshaping, terracing, fertilizing, liming, placement of erosion-control matting, and seeding or tree planting to establish vegetative cover. In larger areas, standard industrial practices (e.g., placement of silt fences and straw barriers) would be used to reduce surface runoff during grade work.

Exclusion Fencing — Exclusion fencing is used to restrict the access of livestock to streams. Livestock exclusion can reduce direct inputs of pollutants from livestock, lessen erosion and stream bank deterioration, and protect riparian vegetation. Minor excavation is required for installation of fence posts.

Heavy Use Area Protection — Heavy use area protection is used in highly trafficked areas such as livestock feeding areas, watering areas, and loafing areas. This practice usually includes grading the surface and applying geotextile fabric and suitable rock/gravel materials for stabilization. Heavy use area protection can reduce soil erosion, soil compaction, and pollutant runoff from entering a nearby water body.

Livestock Water Systems — Livestock water systems are installed along with other agricultural BMPs to supply adequate water while preventing contamination of water bodies. This is accomplished by reducing the need for livestock to enter the stream and reservoir. Such water systems may consist of wells, spring developments, troughs and tanks, ponds and reservoirs, and stream crossings. Depending on the site characteristics and available water sources, these systems may require excavation for spring development, ponds, and/or pipelines.

Planned Grazing Systems — Planned grazing systems, also known as rotational or intensive grazing, involve using multiple fields on a rotational basis. A field would be divided into two or more pastures by fencing. Livestock are then moved from pasture to pasture on a prearranged schedule based on forage availability. Such measures can decrease erosion and potential impacts to water quality by improving vegetation cover. Installation of planned grazing systems may include one or more of these practices: exclusion or cross fencing, stream crossing installation, livestock watering system installation, and heavy use area protection.

Roof Runoff Management — In certain situations, runoff from roofs can cause pollution. The need to manage roof runoff occurs both in the agricultural and urban settings. Roof runoff management includes use of facilities to collect, divert, or dispose of water from roofs in situations where this runoff can contact waste or cause erosion. Measures may include the installation of gutters, downspouts, curbing, erosion-resistant channels, and subsurface building foundation drains. Such measures can prevent runoff across waste areas or barnyards, thereby preventing pathogens and concentrated nutrients from being washed into streams. Most of these installations require minor excavation for channels or pipes.

Stream Crossing — Stream crossings allow livestock to cross a stream at a controlled location and restrict free access to the stream and stream banks. Crossings would be located perpendicular to the stream channel and would be permanently fenced to prevent livestock from entering the stream. Depending on the physical characteristics of the stream, these crossings would take the form of culverts, concrete structures, or gravel crossings laid on geotextile fabric. Installation of crossings can reduce streambed and stream bank erosion and can improve water quality by reducing the inputs of sediment, nutrients, and organic matter. Depending on site characteristics and the particular crossing design, installation would require excavation of banks and/or bed, placement of geotextile, and placement of soil and/or gravel fill.

Waste Management Systems — A waste management system is designed to manage solid and liquid waste, including wastewater and polluted water from feedlots, in a way that does not degrade air, soil, or water resources. Components of these systems typically include sediment basins, composting facilities, dikes, diversions, fencing, grassed waterways, irrigation systems, drains, waste storage ponds or structures, and treatment lagoons. Most systems covered by this EIS would be installed on existing livestock facilities that currently have inadequate waste management systems. Some grading and/or excavation would be required for installing these systems. However, the extent of soil disturbance would be dependent on the particular system chosen.

Construction and Maintenance of Access Roads and Parking Areas

In some cases, access roads are needed to allow vehicle access for approved construction activities, agricultural and timber activities, fire suppression and prevention, official TVA business, and to improve roads outside developed recreational areas unless barricaded or otherwise posted. Existing roads, some of which may need upgrading, would be used where possible. New access roads would be designed to avoid sensitive resources, severe slope conditions, and minimize stream crossings. New access roads and parking areas would be surfaced with dirt or gravel. Culverts and other drainage devices, fences, and gates would be installed as necessary. Appropriate BMPs are identified prior to road construction or maintenance and implemented during the construction operations. If the access road or parking area were no longer needed, the areas would be planted with native vegetation after closure.

Mine Land Reclamation

Mine land reclamation BMPs would be used to address pollution associated with runoff and storm water associated with abandoned mine lands. Some examples are cited below.

Remediation of Acid Mine Drainage — Acid mine drainage occurs when surface water is contaminated by contact with pyrite. When pyrite, an iron sulfide, is exposed to air, it reacts with oxygen in the air and with water to form sulfuric acid and dissolved iron. Some or all of this iron can precipitate to form the red, orange, or yellow sediments in the bottom of streams containing mine drainage. Various treatment options are used to restore streams

affected by acid mine drainage. Installation of settling basins to receive mine drainage and the reinforcement of existing ponds can provide adequate treatment of acidic wastewaters. Often, neutralizing agents can be introduced into settling basins or ponds to provide additional treatment of acidic waters. Additional treatment includes the creation of new stream channels to divert streamflow away from acid-forming materials. This technique minimizes water contact with acid-forming mine spoils. In addition, neutralizing agents are used in the new stream channel to reduce the acidity of flowing waters before the new channel reconnects with the original stream.

Revegetation of Abandoned Mine Lands — Abandoned mine lands are areas of land that have been impacted from previous mining activities. Resource concerns associated with these lands include exposed subsoil, mine spoil, lack of vegetation, acidic substrates, and compacted soils. The condition of the soil or lack of topsoil often creates an environment that is not suitable for plant growth, which increases the likelihood of soil erosion and storm water runoff. Treatments to improve such sites include:

- Grading of existing site materials to increase the stability of the site.
- Conditioning of soil by addition of neutralizing materials to reduce the occurrence of acidic wastewaters and increase plant viability.
- Adding topsoil to provide a medium for plant growth and reduce the exposure of acid materials.
- Planting native vegetation to stabilize soils and enhance habitat.

Urban Storm Water Assistance

Urban BMPs would be used to reduce the amount of storm water entering a stream and to address pollution associated with runoff and storm water facilities. Some examples are described below.

Critical Area Management — The need to manage critical areas occurs both in the agricultural and urban settings. Critical areas located in an urban setting often have the same characteristics as those located in a more rural or agricultural setting. Characteristics of critical areas include highly erodible locations that have been altered by landscaping or sloping or that contain inadequate vegetation. Erosion control in such areas may involve reshaping, terracing, fertilizing, liming, placement of erosion-control matting, and seeding or tree planting to establish vegetative cover. In larger areas, standard industrial practices (e.g., placement of silt fences and straw barriers) would be used to reduce surface runoff during grade work.

On-Site Wastewater Installation and Repair — On-site wastewater systems treat household wastes in areas that do not have access to public sewer systems. These systems could include conventional septic tank and drain field systems or alternative systems. Installing or repairing wastewater systems can effectively reduce or eliminate these pollutants from entering surface water or groundwater. Local, state, and federal regulations provide minimum standards for installation and maintenance of wastewater systems. Appropriate systems would be selected for the sites and installed according to pertinent regulations.

Roof Runoff Management — In certain situations, runoff from roofs can cause pollution. The need to manage roof runoff occurs both in the agricultural and urban settings. Roof runoff management includes installing facilities to collect, divert, or dispose of water from roofs in situations where this runoff can contact waste or cause erosion. Measures may

include the installation of gutters, downspouts, curbing, erosion-resistant channels, and subsurface building foundation drains. Such measures can prevent runoff across waste areas, thereby preventing pathogens and concentrated nutrients from being washed into streams. Most of these installations require minor excavation for channels or pipes.

Runoff Filtration — These practices are designed to increase filtration of surface runoff by various methods as described below.

Rain gardens (biofiltration/bioretention) – Bioretention areas are shallow depressions filled with loose soil with a high organic matter and sand content. Surface runoff is directed into these areas, and pollutants are removed by filtration and biological processes. Rain gardens are created by using an existing depression or strategic excavation of a new depression.

Catch basin inserts and separators – A catch basin is a part of a storm drain or sewer system that is designed to trap debris so that it cannot enter the drainage pipes. Catch basins are a large-scale version of the traps used in home drains to accomplish a similar function. Most municipal sewer and storm drainage systems use catch basins. Catch basin inserts consist of a frame that fits below the inlet grate of a catch basin. Inserts are fitted with various trays that target specific pollutants, and often, more than one tray is included in the design. The first tray would remove sediment, and subsequent trays typically would address a specific targeted pollutant. Separators remove sediment and trash with hydrodynamic action, such as centrifugal force from swirling action. These practices are typically installed in existing catch basins.

Vegetated filter strips – Grassed filter strips are vegetated areas that treat sheet flow from adjacent impervious areas. Filter strips function by slowing runoff velocities and filtering sediment and other pollutants. Filter strips also provide some infiltration into underlying soils. The initial installation of a vegetative filter strip includes minor grading, placement of sod or seeds, and installation of erosion-control matting.

Sand or organic filters – Sand filters are usually two-chambered storm water treatment features. The first chamber is for settling, and the second is a filter bed filled with sand or another filtering medium. As storm water flows into the first chamber, large particles settle out, and the finer particles and other pollutants are removed as storm water flows through filtering media.

Runoff Retention and Detention

Dry detention ponds/extended detention ponds – Dry extended detention ponds are basins with outlets designed to detain storm water runoff for a specified duration. This design allows sediment particles and associated pollutants to settle. In some cases, existing detention ponds designed only for water quantity control can be converted to extended detention ponds (with improved water quality treatment capability) with little or no excavation. After treatment, the outflowing water can be channeled to streams or other existing treatment facilities.

Underground or inline detention structures – Detention tanks and vaults are underground structures used to control peak runoff flows. They are usually constructed of concrete (vaults) or corrugated metal pipe (tanks). Underground detention can also be achieved by retrofitting the overcapacity storm drainpipes with baffles. The baffles allow water to be stored in the pipes so it can be released at a slower rate. Pretreatment structures such as water quality inlets and sand filters can be used to treat runoff and remove trash and debris.

After treatment, the outflowing water can be channeled to streams or other existing treatment facilities.

Storm water wetlands – Storm water wetlands (or "constructed wetlands") are structural features similar to wet ponds (described below) that incorporate wetland plants in a shallow pool. As storm water runoff flows through the wetland, pollutants are removed by settling and biological uptake within the wetland. Wetlands are among the most effective storm water features in terms of pollutant removal and offer aesthetic value.

Wet ponds – Wet ponds (also called "storm water ponds," "retention ponds," or "wet extended detention ponds") are constructed basins that contain a permanent pool of water throughout the year (or at least throughout the wet season). Wet ponds treat incoming storm water runoff by settling and algal uptake.

On-lot treatment practices – The term "on-lot treatment" refers to a series of features that are designed to treat runoff from individual residential lots. The primary purpose of most on-lot features is to manage rooftop runoff and, to a lesser extent, driveway and sidewalk runoff. The primary advantage of managing runoff from rooftops is to disconnect these impervious surfaces, reducing the effective impervious cover in a watershed. Many of the impacts of urbanization on the habitat and water quality of streams are related to the fundamental change in hydrologic cycle caused by the landscape's increase in impervious cover. Examples of on-lot treatment features include rain barrels, soil improvement, vegetation management, and runoff routing.

<u>Storm Water Infiltration</u> — In general, these practices are designed to impede surface runoff and facilitate the infiltration of water into the ground. Specific techniques and options are described below.

Grassed swale – The term "swale" (also known as a "grassed channel," "dry swale," "wet swale," or "biofilter") refers to a series of vegetated, open channel features that are designed specifically to treat and attenuate storm water runoff for a specified water quality volume. As storm water runoff flows through the channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swale construction requires excavation to shape an existing channel or construct a new one.

Infiltration basin – An infiltration basin is a shallow impoundment designed to infiltrate storm water into the soil. Infiltration basins are believed to have high pollutant removal efficiency, and they can help recharge the groundwater, thus restoring low flows to stream systems. Excavation is required to create or shape the basin.

Infiltration trench – An infiltration trench (also known as an "infiltration galley") is a rock-filled trench, with no outlet, that receives storm water runoff. Runoff is then stored in the voids of the stones and slowly infiltrated through the bottom and into the soil matrix over a few days. The primary pollutant removal mechanism of this practice is filtering through the soil.

Porous pavement – Porous pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before the runoff infiltrates into the subsoil. This porous surface replaces traditional pavement, allowing parking lot runoff to infiltrate directly into the soil and receive water quality treatment. There are several porous pavement options, including porous asphalt, pervious concrete, and grass pavers. Depending on site characteristics, some combination of excavation and grading would likely

be required to create a level area at the right elevation relative to adjacent land for installation of this feature.

Illegal Solid Waste Dump Cleanup and Disposal — Illegal dumps are often located near streams or reservoirs. Thus, such sites contribute to nonpoint source pollution. Such dumps frequently contain household garbage, automotive wastes, and larger items such as construction debris and old appliances. Heavy equipment would be used to gather and load the material. Collected waste would be transported to an approved landfill for disposal.

Solid Waste Litter Cleanup and Disposal — Litter cleanups would be organized at the local level. Local volunteers would be provided with necessary supplies. TVA would participate in the organization and logistical support of the cleanups. The collected litter would be taken to an approved landfill for disposal.

Stream and Riparian Management and Restoration

Stream bank and streambed restoration occurs when active bank erosion, bank failure, or excessive alteration of the streambed or riparian area is occurring. Available restoration techniques include vegetative bank protection, bank sloping, installation of flow deflectors, stabilization of the stream bank, and installation of structures in the stream. Stabilization plans are developed based on site-specific information including severity of shoreline erosion, location of nearby sensitive resources, appropriate BMPs, opportunities for innovative stabilization techniques, and installation methods.

Bank Stabilization — When the stream is likely to fail, or to allow for the installation of other stabilization features, the stream bank is shaped to a more stable slope. Sloping would likely be accomplished with heavy equipment. In some cases where there are sensitive resources that would be impacted by excavation, the desired slope may be reached by a combination of cut and fill or just fill. Bank toe stabilization and bank revetment are installed to protect newly planted vegetation and to prevent additional erosion. Depending on site characteristics, one or more of the following materials would typically be used for toe stabilization: whole cedar trees anchored with cables, coir (coconut fiber) rolls, permanent or biodegradable erosion-control mats, and/or rock. Flow deflectors are designed to deflect streamflow away from the stream bank in order to decrease bank erosion. They also provide habitat for fish and other aquatic life. These deflectors may be constructed of rock, logs, or logs with attached root wad. Additional structures are also constructed across the full width of the stream to stabilize the stream bottom elevation.

Riparian Vegetation Planting — In some instances, the establishment of native vegetation would be the only practice necessary to stabilize a stream bank site. Grasses and forbs may be established by planting seeds, sod, or sprigs. Woody vegetation may be established from plant cuttings, bare-root seedlings, or potted seedlings. An erosion-control mat may be used to protect soil and/or seed until the vegetation is established and/or to reinforce the vegetation after establishment.

In areas with beaver activity, wire mesh cylinders would be placed around the vegetation for protection. Where conditions warrant, stream bank protection measures using willow stakes along with posts and fascines made from several other tree and shrub species would be used. These enclosures are usually smaller than 500 square feet and would be removed once the plants are established.

Hydroseeding and hydrosprigging would be used on eroding shoreline and hillsides of varying steepness. This method uses a slurry mixture of water, seed or plant parts (e.g., rhizomes, stem nodes), fertilizer, fiber mulch, and a binding agent. The mixture is sprayed via a hose onto the target shoreline area. Disking or scarifying may be necessary in some areas to break up compacted soil.

Wetlands Restoration, Creation, and Enhancement
Restoration of a wetland refers to returning a degraded wetland or former wetland to a preexisting condition or as close to that condition as possible. There are two general approaches to wetland restoration: passive restoration and active restoration. Passive approaches are generally used when restoration can likely be accomplished by eliminating or reducing the cause or source of degradation. The active approach involves techniques that are more advanced, such as recontouring a site to the desired topography, changing the water flow with water control structures, intensive plantings and seeding, intensive control of nonnative species, and soil substrate conditioning. Wetland creation involves converting a nonwetland area (either dry land or an unvegetated water body) to a wetland. Wetland enhancement involves increasing one or more of the functions performed by an existing wetland beyond what currently or previously existed in that wetland. Depending on the site requirements and constraints, excavation, fill, and stream channel modification are potential tools for achieving these conditions.

Water Pollutant Trading
Water pollutant trading (Trading) is a market-based approach to improving water quality. Trading can take place between nonpoint sources (such as agriculture or urban runoff) and point sources (such as wastewater treatment plants or industrial facilities). Trading allows a pollution source to comply with a pollutant discharge limitation by purchasing credits generated by another pollution source that can control its pollutant discharge at a lower cost. The pollutant source buying the credit meets its pollution-reduction obligation at a lower cost than it would otherwise, while the source generating the credit further lowers its pollution-control cost.

The goal of Trading is to allow pollution sources to optimize the cost of meeting water quality goals across a watershed. Successful implementation of a Trading program requires identification of the critical pollutant or pollutants, knowledge of costs of control for all pertinent sources, and the creation of a bank or other institutional structure to administer and oversee the Trading process. Opportunities for Trading are created by regulatory processes, such as a total maximum daily load or a stringent water-quality-based requirement in a discharge permit for a particular source. In order to provide Trading opportunities, different sources within the watershed would have significantly different control costs, and there would be some space between the maximum possible pollution reduction and the required levels of pollution reduction. Regulatory processes that allow Trading would be present in the watershed, and stakeholders would be involved in developing the Trading mechanisms.

Water Resource Communications
TVA engages in efforts to improve and protect resources of the Valley. The Water Resources Communication Program would highlight programs and projects to increase public awareness of TVA's work and provide useful information to stakeholders. Examples of Water Resources Communication Program activities include:

- Creating and maintaining a Web site to highlight water resource protection and improvement efforts and innovations of current TVA projects.
- Presenting information to stakeholders about TVA's management of resources.
- Presenting information to stakeholders that describes TVA's local stake in protecting and enhancing environmental resources.
- Communicating water efficiency messages through TVA's Web site.

Water Resource Management Assistance
TVA provides support and expertise to help guide watershed improvement and protection efforts throughout the Valley. Water resource assessments and technical assistance are provided to external stakeholders in order to facilitate collaboration and coordination, resulting in improved water quality.

Technical Assistance
Best Management Practices Design — TVA would offer design and/or construction supervision services for practices described in the NRP. TVA's designs would be constructed by TVA, other agencies, or stakeholder groups. The implementation of TVA's designs would be subject to an environmental review, as appropriate. In addition, designs provided by other agencies and constructed under TVA supervision would be subject to an appropriate environmental review process.

Stream Assessments and Monitoring — Monitoring gathers data about conditions of water chemistry, temperature, microbiology, and biota of water bodies to assess stream conditions, target improvement efforts, and track improvements. All sampling procedures are conducted according to established methodologies, and activities are approved by the appropriate federal and state agencies.

Water Resource Modeling — TVA has used computer models of both reservoirs and watersheds in support of stewardship programs. Models are used to determine causes and sources of pollution and quantify the pollution loads generated by different sources. They are also used to explore the response of a watershed and/or reservoir to changes in management practices. This information is critical to developing optimal treatment strategies for the water resource planning process. TVA has used a variety of models, from relatively simple ones that require only readily available data to much more complex versions that use detailed data from the area being modeled. Model choice is based on project requirements and available resources.

Watershed Assessment and Watershed Restoration Planning — Watershed assessment includes analysis of monitoring and inventory data to determine sources of pollution, severity and amount of pollutant, and optimum methods to reduce the level of pollutants present. Strategies and planning for implementation are generated with participation of stakeholders. The desired outcome of this analysis is a restoration strategy that makes optimum use of resources.

Watershed Inventories — Land use data are required to determine pollutant sources within a watershed. Depending on project needs, land use data can be developed from existing data infrastructure including maps, satellite images, or published database, or from project-specific data including purchased proprietary satellite images or aerial photography. The TVA Integrated Pollution Source Investigation process commissions color infrared photography for each project and analyzes the photographic images manually.

Water Resource Organizational Assistance

Communication Plan Assistance — TVA assists partners in identifying tools and strategies for developing communication plans. Communication plans are considered a vital component of a water quality improvement project and are used to create awareness, provide implementations tools, and foster stakeholder involvement.

Grant Writing Assistance — TVA assists partners in identifying available funding and developing grant applications to implement water quality improvement projects. These grants may be from federal, state, or local organizations as well as corporations or foundations. TVA may provide additional grant support through partnership development, project scope, and project management.

Organizational Support — TVA works with stakeholders to create sustainable partnerships and organizations that can implement water resource improvement efforts. TVA helps these groups set goals and develop a mission statement to guide their efforts, enhance their skill levels through training and support, and build their capacity. TVA also collaborates with established partnerships and organizations to provide assistance as needed.

> *Financial support for watershed organization staff.* Knowledgeable staff increases the effectiveness of organizations and increases the probability that an organization would be self-sustaining. TVA support would be intended to help a new organization develop the skills and capacity to find further funding and be effective in implementing water quality improvement strategies. TVA's selection of organizations to provide financial support would complement other water resource improvement efforts.
>
> *Development of organizational and/or governance structure.* TVA would support watershed organizations by providing information and guidance for selection and development of appropriate leadership structures and processes. In addition, TVA would assist with leadership skill development for board members and staff and help the organizations become effective partners in implementing watershed strategies.
>
> *Consulting and support for effective communications and marketing.* TVA would support watershed organizations by providing services and training in effective communications and marketing. This opportunity would lead to increased recruiting for and participation in water quality improvement activities.
>
> *Leverage funding.* TVA would provide assistance in seeking and securing non-TVA funding.

2.4.6. Water Resource Standard Best Management Practices

This section describes the standard BMPs associated with the programs and tools identified for water resource management. These BMPs would be identified when developing project or watershed action plans and would be implemented during construction, as appropriate. Site-specific environmental reviews would be conducted to determine the appropriate BMPs on a project-by-project basis.

- When projects are located near streams or water bodies, temporary sediment barriers or traps would be installed, as appropriate, when implementing practices require grading or other soil disturbance.

- Native vegetative cover would be established as soon as possible following construction.
- Projects involving instream work or soil disturbance would be subject to the appropriate environmental review.
- Appropriate state and USDA requirements would be met, and standard practice guidelines would be followed, where applicable. Examples of USDA technical standards are presented at the Natural Resources Conservation Service's (NRCS) Web site, http://www.nrcs.usda.gov/technical/standards/nhcp.html.
- Projects would be scheduled to conduct work during dry weather conditions and to reduce soil exposure to erosion.
- Stream stabilization would be scheduled during periods of low flows, and disturbance by heavy equipment would be minimized.
- Tall-growing woody species would not be planted in front of navigation lights or markers.
- Appropriate vegetation would be planted under transmission lines.

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CHAPTER 3

3.0 ALTERNATIVES

The purpose of this EIS is to analyze, in a programmatic manner, the environmental impacts anticipated from the programs, tools, and activities associated with the NRP and alternatives to it. This chapter describes the four alternatives considered in detail in this EIS, as well as the process used to develop alternatives. The alternatives encompass a variety of approaches for managing biological and cultural resources, recreation, and water resources, and conducting reservoir lands planning. This chapter also addresses the alternatives and program options dismissed from detailed study.

3.1. Development of Alternatives

3.1.1. Development of Program Options

To establish a reasonable range of future options for the NRP, TVA documented existing and proposed programs and activities listed in Chapter 2. Next, TVA reviewed the comments submitted during public scoping and grouped the programs and activities accordingly to develop options for TVA's future management of natural resources.

TVA decided on four future program options each for biological and cultural resources management, recreation management, and water resource management, and three future options for reservoir lands planning. The four future options for biological and cultural resources management, recreation management, and water resource management are current management, custodial management, enhanced management, and flagship management. The three future options for reservoir lands planning are current management, programmatic management, and comprehensive Valleywide management. Tables 3-1 and 3-2 summarize the various future options.

Table 3-1. Biological and Cultural Resources Management, Recreation Management, and Water Resource Program Options

Program Option	Descriptions
Current Management	There would be no NRP for future guidance. TVA would continue to operate in much the same way it does currently with varying levels of resource programs that include those addressing legal and policy requirements.
Custodial Management	TVA would operate in compliance with legal and policy requirements. This program option includes the essential functions for biological and cultural resources management, recreation management, and water resource management as outlined in the Environmental Policy.
Enhanced Management	TVA would operate in compliance with legal and policy requirements. This program option recommends a limited number of projects that begin to elevate TVA's stewardship programs.
Flagship Management	TVA would operate in compliance with legal and policy requirements. This program option recommends Valleywide opportunities that elevate TVA's stewardship programs to the "gold standard."

Table 3-2. Reservoir Lands Planning Program Options

Program Option	Descriptions
Current Management	There would be no NRP for future guidance. TVA would continue to plan reservoir lands primilarly on a reservoir-by-reservoir basis.
Programmatic Planning	TVA would continue to plan reservoir lands in much the same way it does currently. However, TVA would apply slightly different land use zone definitions than those used in recent RLMPs. Future reservoir lands plans would tier from this EIS, and TVA would prepare reservoir-specific environmental reviews for the plans.
Comprehensive Valleywide Planning	TVA would create a Comprehensive Valleywide Land Plan (CVLP), which would set threshold ranges for each allocation zone to guide the creation of future RLMPs. As TVA continues to plan its reservoir lands, it would revise the baseline allocations created by existing RLMPs and the RLA methodology.

3.1.2. Natural Resource Plan Program Analysis Framework

The NRP analysis framework evaluates each program option based on a wide range of inputs and perspectives to provide an accurate comparison of potential implementation level of effort. Figure 3-1 shows the various inputs and perspectives used to assess each program option. The following sections describe each of these steps in more detail. Section 3.1.3 contains more information regarding the analysis framework and selection process used for reservoir lands planning.

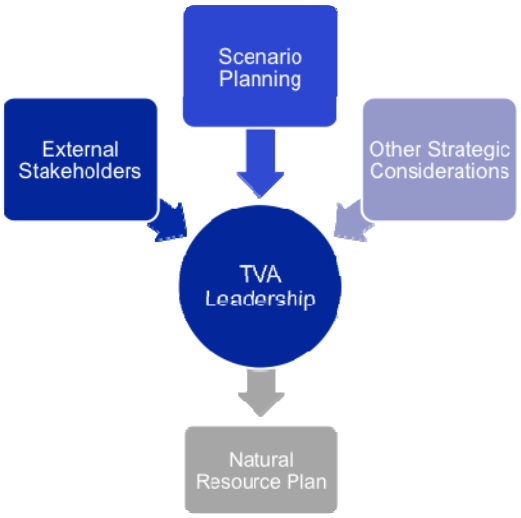

Figure 3-1. Key Inputs to the Natural Resource Plan Decision-Making Process

3.1.2.1. External Stakeholders

As the TVA region has developed and the population has grown, the stewardship of natural resources has become more complex and more important. TVA has always collaborated with stakeholders that have responsibilities for and interest in the use and conservation of natural resources, and this has become more important with population growth.

The RRSC was asked to provide input to the development of the NRP. The RRSC's advice is an integral piece of the overall NRP analysis and provides a necessary level of objectivity on TVA's proposed NRP. RRSC comments were taken into account when developing each program option. The RRSC also provides perspective on industry trends, challenges, and stakeholder needs.

As part of defining appropriate methods by which to develop and implement the NRP program options, TVA met with various state and other federal agencies throughout the Valley to understand better the challenges and trends they are facing. This type of peer discussion helped to advance the collaborative approach by which TVA intends to manage its natural resources in the future.

3.1.2.2. Scenario Planning Analysis

A scenario is a set of uncertainties that describes a plausible future "world" or condition. Scenario planning provides an understanding of how near- and long-term decisions are influenced and can respond to varying economic and regulatory conditions or circumstances that are outside of TVA's control. Comparing the performance of plans under a number of potential scenarios drove TVA to an NRP that is flexible and more easily adapted to changing future conditions. Scenario planning assesses the relevant risks, uncertainties, and challenges surrounding the NRP and alternatives to it. This framework integrates various inputs that are independently developed, ensuring objectivity while reducing bias from the results. Inputs to this process are shown in Figure 3-2. The various aspects of scenario planning are described in detail in Chapter 5 of the NRP.

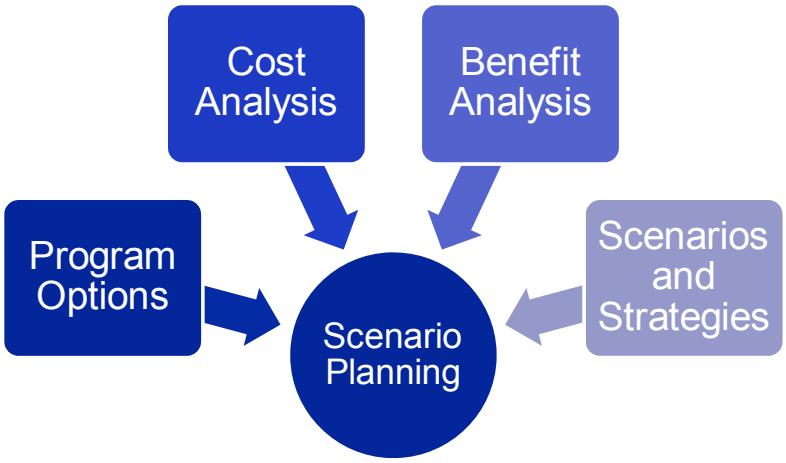

Figure 3-2. Various Scenario Planning Analysis Inputs

3.1.2.3. Other Strategic Considerations

Once the optimal NRP program mix was identified using the scenario planning process described above, TVA identified strategic or high-priority programs that are integral to the successful implementation of the NRP. These strategic considerations provided a third data point, along with scenario planning and advice from the RRSC, when identifying the final program mix for the NRP.

Any program identified as a strategic consideration aligns with TVA's commitment to manage lands under its control while meeting the desired land conditions. Prioritizing certain programs helps to focus implementation efforts as partnerships and other resources become available. Criteria for selecting these high-priority programs included (but were not limited to) economic development, partnership potential, public goodwill/perception, breadth of beneficial impact, and needs of nonrenewable resources.

3.1.3. Reservoir Lands Planning Analysis Framework

The Land Policy indicates that TVA will maintain a regular cycle and approach for RLMPs. Currently, TVA maintains a schedule for planning reservoirs. However, the time and resources required to plan reservoir lands and complete the associated reviews are significant and restrict TVA from revising land plans in a more timely fashion. In response, TVA seeks to streamline the reservoir lands planning process and update RLMPs in a more efficient manner. The expected result is for TVA to:

- Simplify the assessment process for future planning efforts
- Determine a consistent methodology for all future planning efforts
- Increase flexibility in future planning efforts

The analysis framework for reservoir lands planning is as follows:

- Complete a current state assessment of the RLMPs
- Review the past methodologies used in developing RLMPs
- Identify gaps in RLMPs and methodologies
- Present future recommendations
- Select an NRP approach toward reservoir lands planning efforts

3.2. Alternatives Evaluated in Detail

TVA evaluated the components of the No Action and Action Alternatives through the NRP analysis framework. The outcome of the analysis does not recommend one specific strategy going forward, but instead lays out an immediate course of action and a road map of options for TVA to use when evaluating future strategic decisions. The options resulting from the analysis are bounded by the No Action and Action Alternatives described below. For purposes of the EIS, the alternatives only include the programs and associated tools with potential impacts to the environment.

With respect to the various Action Alternatives, TVA would implement the specific programs that address safety, TVA's mission and relevant laws, regulations, and policies, including applicable EOs. As laws, regulations, and policies are created or amended, implementation activities would be revised to reflect the changes and ensure compliance. In those areas in which TVA could discontinue programs or projects, existing contractual agreements relating to those programs or projects would be honored. The tables located in Appendix H list the

existing programs and actions under the No Action Alternative and the proposed programs and actions under all of the Action Alternatives.

3.2.1. Alternative A – No Action

Under the No Action Alternative, TVA would continue its current natural resource management efforts by implementing the existing stewardship programs and tools aligning with existing policies and strategies and continuing to apply the existing methodology when planning lands along TVA reservoirs. This alternative emphasizes regulatory and technical requirements, assessments of TVA-managed resources and partnerships, and projects associated with TVA-managed recreational facilities. TVA would manage and support stewardship activities on its lands through existing prioritization methods that consider recreational and other resource needs, public safety, and public health while complying with all existing and future laws and regulations. The tables located in Appendix H list the existing programs and actions under the No Action Alternative and the proposed programs and actions under all of the Action Alternatives.

3.2.1.1. Biological and Cultural Resources Management

Under this alternative, TVA would continue all current activities in order to meet the requirements of laws, regulations, and policies, including applicable EOs relating to the management and protection of biological and cultural resources. The following paragraphs outline the basic programs and activities currently being conducted by TVA regarding biological and cultural resources management.

Cultural Resource Management

Archaeological Resources Protection Act Program — TVA Police has dedicated officers for the enforcement of ARPA criminal provisions. These officers typically conduct ARPA inspections with approximately 1,000 security checks per year. TVA would continue to protect archaeological site information and provide ARPA permits for approved archaeological excavations on TVA-managed lands.

Archaeological Site Monitoring and Protection — TVA has historically taken measures to protect approximately 0.2 mile of shoreline containing archaeological resources each year; however, the level of effort associated with this activity has decreased in recent years. TVA is required to protect archaeological resources under both Section 110 of NHPA and ARPA. TVA also monitors archaeological sites associated with mitigation projects.

Native American Graves Protection and Repatriation Act Compliance — TVA participates in a number of activities related to NAGPRA:

- Consultation with federally recognized tribes concerning those remains in TVA's custody that may be culturally affiliated and assists tribes in their repatriation
- Consultation with federally recognized tribes concerning disposition of remains in TVA's custody that are culturally unidentifiable
- Consultation with federally recognized tribes when NAGPRA items are inadvertently discovered or intentionally excavated
- Determination of disposition of NAGPRA items excavated or discovered after 1990
- Maintenance of NAGPRA inventory
- Preparation of NAGPRA notices of inventory completions

National Historic Preservation Act Section 106 Compliance — TVA evaluates approximately 1,500 undertakings each year to determine effects on historic properties and manages existing mitigation obligations.

Native American Tribal Consultation — TVA conducts formal consultation with federally recognized tribes to meet the objectives of NAGPRA, NHPA, AIRFA, EO 13007 (Indian Sacred Sites), EO 13175 (Consultation and Coordination With Indian Tribal Governments), the April 29, 1994, executive memorandum regarding government-to-government relationships with tribal governments (http://www.justice.gov/archive/otj/Presidential_Statements/presdoc1.htm), and the November 5, 2009, presidential memorandum regarding tribal consultation (http://edocket.access.gpo.gov/2009/E9-27142.htm). To facilitate such consultation, TVA conducts formal consultation workshops with federally recognized Native American tribes once every five years.

Preservation Program — Consistent with Section 110 of NHPA and ARPA, TVA currently surveys approximately 2,000 acres annually to identify archaeological sites within areas under its management.

TVA receives hundreds of questions each year about its past. The Agency maintains resource information through various means. TVA maintains a collection of historic photographs, which document the history of the Agency beginning in 1933. This collection has more than 17,000 photographic negatives, which are being scanned for preservation purposes. TVA also maintains a database on cemeteries that were relocated as a result of TVA projects and uses these data to respond to inquiries from the public. In addition, the Agency maintains a collection of historic artifacts.

Preserve America — Historic TVA buildings that have been determined surplus are evaluated for the feasibility of adaptive reuse. TVA is currently working on the adaptive reuse of historic buildings located on the Muscle Shoals Reservation.

Dispersed Recreation Management

Dispersed Recreation Management — TVA identifies and evaluates the condition of 70 dispersed recreational areas annually for potential impacts to TVA-managed lands using existing methodologies. TVA rehabilitates approximately one dispersed recreational area annually. TVA implements one key dispersed recreation opportunity annually as described in Section 2.1.2.

Leave No Trace — Currently, TVA participates in this program by making LNT information available at select recreational areas.

Trails Management — TVA has approximately 90 miles of existing trails located on TVA-managed lands. Currently, TVA does not have a systematic inventory or a maintenance plan for existing trails. Maintenance activities are restricted to reduction of safety hazards (e.g., removal of obstacles and surface enhancements). TVA also coordinates trail projects with potential partners to establish sustainable projects.

Land Stewardship Assessment Tools

Boundary Maintenance — TVA prioritizes and implements annual boundary maintenance as needed at the reservoir level.

Land Conditions Assessment and Land Stewardship Maintenance Needs Checklist — TVA currently assesses land conditions using established LCA and LSMNC methodologies on about 5,000 acres of TVA-managed lands per year. These assessment tools and methodologies drive the prioritization of stewardship maintenance and management activities on TVA's lands. Currently, no holistic implementation plan exists. However, TVA continues to refine the CLCA and RLCA.

Natural Resource Management Implementation Plans — TVA would continue partial implementation of 10 existing Unit Plans on more than approximately 18,000 acres along eight reservoirs.

TVA Natural Heritage Database — TVA would continue the management and use of the TVA Natural Heritage database. Currently, TVA has agreements with the seven state heritage programs in the region to share data. TVA also exchanges data with the USFWS Ecological Services offices located in these states.

TVA Wetlands Database — Under Alternative A, TVA would continue to manage and use the wetlands database.

Public Outreach Programs

Archaeological Outreach (Thousand Eyes Program) — TVA has established an outreach program to promote the protection of archaeological sites on TVA-managed lands. Approximately two to three outreach programs are sponsored annually. TVA has recently installed signs along its managed lands informing the public of penalties under ARPA.

Sensitive Biological Resources Management

Conservation Planning — TVA staff members currently act as advisers or participants in local and regional conservation planning efforts. TVA's involvement on these planning teams would continue under Alternative A.

Endangered and Threatened Species Program — TVA is required, under Section 7(a)(2) of the ESA, to consult with USFWS as appropriate concerning the potential for projects proposed by TVA or subject to approval by TVA (i.e., land use agreements and approvals under Section 26a of the TVA Act) to affect endangered species. This is a nondiscretionary obligation of TVA as a federal agency.

The majority of TVA's current endangered species management activities are conducted to comply with USFWS biological opinion requirements and commitments resulting from environmental reviews. TVA's primary active endangered species management program is its cave gate maintenance and signage activities, which would continue under this alternative.

Approximately 40 sites containing populations of federally listed animals and plants on TVA-managed or influenced public lands are monitored. These monitoring activities were designed in cooperation with the USFWS and, as appropriate, other federal and state agencies. The data obtained are reported to the appropriate resource agencies and are used to protect these sensitive resources and to make informed decisions about land management and conservation planning.

Migratory Bird Management — TVA is a signatory on the PIF joint MOU venture. However, TVA has not recently participated in this venture. TVA would continue to comply with

objectives outlined in EO 13186 on migratory birds. In addition, TVA provides limited monitoring information to support national and regional planning efforts for migratory birds and is a member of the Tennessee River Valley Shorebird Working Group.

Natural Areas Program — TVA would continue to conserve 154 ecologically and visually sensitive areas while monitoring approximately eight natural areas on an annual rotation. Natural areas would continue to be added or removed from the program via the reservoir lands planning process. Health and safety maintenance needs on natural areas would be implemented as they are opportunistically identified.

Wetlands Management — Under Alternative A, wetland resources are avoided where possible. Mitigation credits are often purchased to offset wetland impacts from projects.

Terrestrial Habitat Management

Agricultural and Open Lands Management — Under Alternative A, TVA would continue the management of 5,600 acres of agricultural/open lands through the existing licensing program. These lands are currently under revocable license agreements with area farmers, allowing for the production of hay/forage or row crop commodities. TVA has established a small-scale demonstration project with NWSG and seedling tree plantings to test the effectiveness of this approach to carbon offsets.

Dewatering Projects Management — Under Alternative A, TVA would continue the current management of dewatering projects on Kentucky and Wheeler reservoirs. TVA is currently conducting a detailed engineering-based assessment of these units, which have several miles of levee embankment and numerous electrically operated pump stations. These studies would assist in determining any necessary repairs and maintenance required for future operation scenarios. TVA would also continue to honor existing contractual agreements with other federal and state wildlife agencies, counties, and railroads affected by operations of these projects.

Forest Resource Management — Since discontinuation of the Forestry Prescription Process in the mid-1990s, TVA's forest management efforts have been limited in scope. These efforts have involved only small-scale salvage operations in response to storm or insect damages and planned harvests primarily for habitat enhancement. These actions have involved less than 1 percent of TVA's undeveloped lands. TVA's other forestry-related efforts have been limited to mitigating tree hazards and encroachments involving tree cutting or other vegetative disturbances. TVA has provided limited support to state forestry assessment plans.

Nonnative Invasive Plant Management — Under Alternative A, TVA would continue limited efforts to control NNIPs on approximately 600 acres of TVA-managed lands per year. TVA focuses on selected natural areas, high-profile habitat enhancement projects, and dam reservations primarily in response to stakeholder interest. TVA currently participates actively in the SE-EPPC and cooperates on an early detection initiative for cogongrass.

Nuisance Animal Control — Under this alternative, TVA would continue to resolve animal damage conflicts on TVA-managed lands and at TVA facilities through an existing contractual agreement.

Terrestrial Greenhouse Gas Sequestration Management — Under Alternative A, TVA would continue to pursue carbon offset projects on 41 acres of TVA-managed lands for research

purposes to build institutional knowledge of terrestrial carbon sequestration programs. TVA has also entered into two consortiums focusing on issues related to terrestrial GHG management. TVA would maintain the existing two demonstration projects while continuing to seek projects that meet the following objectives: gaining further understanding of establishing a baseline for inventory purposes; adapting forestry BMPs to increase carbon sequestration; and working with third-party contractors to ensure emissions reductions are real, permanent, additional, measurable, and verifiable in order to obtain fungible offsets. Demonstration projects typically focus on increased vegetation management, nutrient management, and selective harvesting while ensuring habitat preservation. These projects would be limited to areas allocated for natural resource conservation to ensure sensitive areas are not disturbed.

Wildlife Habitat Council — Third-Party Certifications — Under Alternative A, TVA would continue the management of four projects currently certified by the WHC on TVA-managed lands. These projects are focused on basic wildlife habitat enhancement activities.

Wildlife Habitat Enhancement Partnerships — Under Alternative A, TVA would continue partnerships to improve habitat on approximately 500 acres per year of TVA-managed lands.

3.2.1.2. Recreation Management

In addition to the programs and activities listed below, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process. Approximately 21,200 acres of land have been recommended for future consideration for recreational development. Of the total, approximately 19,100 acres are currently committed under existing contractual agreements, leaving approximately 2,100 acres currently available for development. TVA would continue to entertain proposal for the development of commercial or public recreation facilities on these remaining lands and manage existing contractual agreements.

Campground Management

TVA would continue to collaborate with community and commercial campground operators to assist with providing quality campground facilities on TVA-managed lands. Examples of this assistance include site plan development, assistance with environmental review coordination, and campground assessment methodologies that rate public health, safety, and environmental conditions.

TVA-Managed Campgrounds Located on Dam or Power Plant Reservations — TVA would continue to operate and manage eight campgrounds located on dam or power plant reservations. Annually, TVA proactively upgrades two campground facilities and amenities consistent with ADAAG standards, building codes, and emerging technologies. TVA has established the Melton Hill Dam Campground as a flagship campground.

TVA-Managed Campgrounds Located on Other Reservoir Properties — TVA would continue to operate and manage four campgrounds located on other reservoir properties. TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities.

Day Use Areas Management
TVA would continue to operate and manage 30 day use areas located on dam reservations and 33 day use areas located off dam reservation properties. These facilities are available to the public at no charge. Currently, TVA proactively upgrades one day use area consistent with ADAAG standards, building codes, and emerging technologies while implementing one sustainable initiative per year. TVA would continue to manage 13 picnic pavilions that can be reserved for a small fee. TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities.

Blueways — TVA has a target to develop one area per year to facilitate blueway miles contingent upon available partnerships.

Greenways — TVA would continue to assist partners and stakeholder groups with greenway development, as appropriate.

Stream Access Sites — TVA owns 81 stream access sites. TVA has entered into contractual agreements for the management of 50 stream access sites and manages the remaining 31 sites. The Agency would continue to entertain requests from stakeholders for the management of stream access sites not currently under contract. All stream access areas are available to the public at no charge.

Public Outreach Programs
Annual Tours — TVA would continue to host two annual media and technology transfer tours of campgrounds and day use areas where emerging technologies are featured and showcased.

Recreation Information Management — Under Alternative A, TVA would continue to provide educational presentations to the public while maintaining the existing Internet presence. TVA currently is engaged in on-site education programs and outreach efforts pertaining to those lands allocated for developed recreation through the reservoir lands planning process.

Recreation Assessment and Design Tools
Boating Capacity Studies — TVA has conducted a pilot boating capacity study on Tims Ford Reservoir (TVA 2002d). However, the Agency has not planned for additional boating capacity studies for other reservoirs.

Boating Density Assessments — When reviewing certain requests for new water-based recreational facilities, TVA completes boating density assessments as a planning tool in support of the associated environmental review.

Developed Recreation Inventory and Surveys — TVA would continue to maintain an up-to-date inventory of all public, private, and quasi-public recreational facilities on or near shoreline properties. The inventory is updated on a three-year cycle. The updates include basic and noncyclical visitor use and satisfaction surveys, assessments of recreational facilities/areas conditions, and campground evaluations. TVA also conducts field reconnaissance of nontargeted recreation facilities located on TVA-managed lands to ensure ongoing compliance with regulations. TVA shares recreational information and provides technical support to other agencies and stakeholders as requested.

Recreation Design Principles —TVA would continue to place signage at recreational facilities and stream access sites to support the implementation of recreational guidelines.

Recreation Planning, Assistance, and Technical Support — TVA would continue to utilize regional recreational data to guide potential expansion of new campgrounds on TVA-managed lands allocated for developed recreation via the reservoir lands planning process.

3.2.1.3. Reservoir Lands Planning

Under Alternative A, TVA would continue to apply the Single Use Parcel Allocation methodology and existing land use zone definitions (Appendix F) when planning lands along TVA reservoirs, and an appropriate level of environmental review would be completed for each reservoir or group of reservoirs. TVA manages 46 reservoirs and approximately 293,000 acres across seven Valley states. Since 1999, TVA has planned 30 reservoirs and approximately 147,500 acres using the current methodology. Table 3-3 shows the reservoirs that have been planned using the current methodology and existing land use zone definitions.

Table 3-3. Reservoirs Planned Using the Current Methodology and Land Use Zone Definitions

Reservoir	Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Apalachia	91	0	0	0	9	0
Beaver Creek	14	0	0	0	86	0
Big Bear Creek	7	82	0	0	10	0
Blue Ridge	62	3	6	0	3	26
Boone	24	17	51	0	9	<1
Cedar Creek	10	66	10	0	8	5
Chatuge	22	1	49	0	24	4
Cherokee	7	12	68	0	9	3
Clear Creek	100	0	0	0	0	0
Douglas	50	3	40	0	6	1
Fontana	43	0	5	0	47	4
Fort Patrick Henry	27	7	41	0	14	10
Guntersville	6	27	60	1	5	2
Hiwassee	36	11	44	0	4	4
Little Bear Creek	18	69	2	1	6	4
Melton Hill	11	49	24	1	8	6
Nolichucky	5	57	13	<1	25	0
Norris	3	18	67	0	7	5
Nottely	53	0	33	0	11	3
Ocoees	100	0	*	0	*	0
Pickwick	7	8	69	3	8	6
South Holston	28	<1	46	6	19	1
Tellico	5	17	56	2	15	4
Tims Ford**	9	15	58	1	6	10
Upper Bear Creek	6	81	8	0	3	2
Watauga	46	9	38	0	8	<1

Reservoir	Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Watts Bar	12	28	29	3	12	17
Wilbur	83	0	17	0	0	0
Average Percentage	10	23	53	1	9	5

Note: Zone 1 – Non-TVA Shoreland is not represented because the parcels are private land (on which TVA owns flowage rights) and will not change as a result of the land planning process. Figures in this table have been rounded to the nearest whole number.

* Includes narrow strip of TVA-retained land along shoreline; acreage not calculated.

** Includes TVA lands only. Tims Ford Reservoir contains an additional 67 acres allocated to Zone 8 or a conservation partnership. The allocation of public lands to Zone 8 has been discontinued. However, TVA would continue to manage lands allocated to Zone 8 per Agency policy.

Planning public lands is a large, complex task requiring many specific skills, resources, and capabilities for the duration of the project. Often, the effort to complete a single RLMP encompasses several years. Table 3-4 shows the extent of TVA-managed lands that surround each of the planned reservoirs and the duration of each planning effort. For those RLMPs with an EIS, the durations of the planning efforts were calculated from the dates that the NOI and the record of decision were published in the *Federal Register*. For those RLMPs with an EA, the durations of the planning efforts were calculated based on the beginning of evaluations and date of the FONSI. The duration of the development of Watts Bar RLMP is substantially longer than other RLMPs. During this time frame, TVA developed the Land Policy and Environmental Policy. The planning efforts for Watts Bar RLMP were suspended during the development of these policies. Table 3-5 shows the remaining reservoirs to be planned and the estimated duration of each planning effort under Alternative A.

Table 3-4. List of Reservoirs Planned With Single Allocations

Reservoir	Acres of TVA Lands	Duration of Planning Efforts
Apalachia	897	2007-2009
Beaver Creek	291	2008-2010
Big Bear Creek	2,295	1999-2001
Blue Ridge	470	2007-2009
Boone	880	2007-2009
Cedar Creek	2,747	1999-2001
Chatuge	1,765	2007-2009
Cherokee	8,187	1999-2001
Clear Creek	14	2008-2010
Douglas	2,055	2008-2010
Fontana	931	2007-2009
Fort Patrick Henry	283	2008-2010
Guntersville	37,796	2000-2002
Hiwassee	1,007	2007-2009
Little Bear Creek	1,181	1999-2001
Melton Hill	2,579	1997-1999
Nolichucky	1,136	2008-2010
Norris	27,425	1999-2001
Nottely	829	2007-2009

Reservoir	Acres of TVA Lands	Duration of Planning Efforts
Ocoee 1	77	2007-2009
Ocoee 2	80	2007-2009
Ocoee 3	218	2007-2009
Pickwick	17,573	2001-2002
South Holston	2,270	2008-2010
Tellico	12,814	1997-2000
Tims Ford	4,348	1998-2000
Upper Bear Creek	2,955	1999-2001
Watauga	1,137	2008-2010
Watts Bar	13,240	2004-2009
Wilbur	58	2008-2010

Table 3-5. List of Reservoirs to be Planned Under Alternative A

Reservoir	Acres of TVA Lands	Estimation of Planning Effort Duration
Beech River Project	5,217	3 years
Chickamauga	15,947	4 years
Fort Loudoun	1,574	2 years
Great Falls	362	1 year
Kentucky	75,217	6 years
Nickajack	3,574	3 years
Normandy	4,795	3 years
Wilson	117	1 year
Wheeler	36,177	5 years

3.2.1.4. Water Resource Management

Aquatic Monitoring and Management
Stream and Tailwater Monitoring —TVA would continue to conduct 110 stream assessments per year. In addition, stream and reservoir data would be shared with other agencies and stakeholders upon request.

Partnership Programs
Strategic Partnership Planning — Under this alternative, TVA would continue to maintain relationships, partnerships, and contractual agreements.

Public Outreach Programs
Quality Growth Program — The QGP would continue to promote the integration of energy efficiency and water conservation into community planning and building construction. This program has an annual goal of delivering to the Valley 25 communication products, including workshops, new training products, various awards, and/or conferences.

Tennessee Valley Clean Marina Initiative — TVA would also continue the TVCMI Program for collaboration in community outreach and partnerships through voluntary demonstrations of the efficient use of water resources and protection of water quality. The TVCMI has an annual goal of maintaining certification for 80 marinas.

Water Resource Improvement Programs
Targeted Watershed Initiatives — The goal of the TWI Program related to water resource improvement is to increase the rating of one HU across the Valley every five years. For the purposes of this EIS, annual HU improvement ratings have been translated into short-term goals for the TWI Program. These short-term goals assist in showing intermediate improvements to watershed water quality. The intermediate goals include reductions of the amount of pollutants reaching water bodies each year. Using sediment and phosphorus as representative pollutants, TVA has estimated that the TWI Program currently reduces loading to streams and reservoirs by 234 tons of suspended sediment and 350 pounds of phosphorus per year. TVA's methodology for measuring reductions in pollutant loads is described in Appendix I.

The goal of the TWI Program related to public outreach is to deliver 50 stakeholder products per year. These products include the establishment of watershed groups with TVA organizational support; completion of watershed action plans; implementation of marketing information or outreach campaigns; administrative follow-up; and pollution-reduction projects.

3.2.2. Alternative B – Custodial Management

Under Alternative B, TVA would implement projects to meet the intent of the Environmental Policy including maintaining the character of TVA-managed lands and recreational facilities and watershed water quality. TVA would develop and implement public outreach and improvement opportunities across the Valley and in associated communities. In addition, TVA would focus on transitioning the management of certain recreational facilities to other parties through contractual agreements or would close the facilities. Those specific programs that address safety, and compliance with TVA's mission and relevant laws, regulations, and other policies, including EOs, would be implemented. As laws, regulations, and policies are created or amended, implementation activities would be revised to reflect the changes and ensure compliance. In those areas in which TVA would discontinue programs or projects, existing contractual agreements relating to those programs or projects would be honored per the terms of the agreement(s). This alternative is consistent with custodial management as described in the NRP. The tables located in Appendix H list the existing programs and actions under the No Action Alternative and the proposed programs and actions under all of the Action Alternatives.

3.2.2.1. Biological and Cultural Resources Management

Under this alternative, TVA would continue all current activities (identified in the discussion of Alternative A) in order to meet the requirements of laws, regulations, and policies relating to the management and protection of biological and cultural resources.

Cultural Resources Management
Archaeological Resources Protection Act Program — Under this alternative, TVA would no longer employ ARPA investigators to help protect archaeological resources, but would instead rely on other methods to protect these resources including relying on others to monitor and investigate looting of resources. TVA would continue to conduct ARPA permitting and protect archaeological information.

Archaeological Site Monitoring and Protection — Under this alternative, TVA would establish goals for annual shoreline stabilization. In addition, a monitoring schedule would be developed to identify those sites that are subject to the greatest threat of shoreline erosion. Specifically, TVA would monitor approximately 150 miles of shoreline per year. In

addition, TVA would establish targets to protect between 0.3 and 0.4 tributary shoreline miles or between 0.4 and 0.6 main stem shoreline miles per year.

National Historic Preservation Act Section 106 Compliance — TVA would continue to review projects under Section 106 of the NHPA. In addition, TVA would establish a database to monitor and manage ongoing mitigation measures to better ensure compliance with Section 106 agreements and existing environmental review commitments.

Native American Graves Protection and Repatriation Act Compliance — TVA would continue to participate in the required activities as defined under Alternative A.

Native American Tribal Consultation — TVA would continue to participate in the required activities as defined under Alternative A.

Preservation Program — TVA would survey approximately 1,000 acres annually to identify archaeological sites within areas under its management. In addition to all other activities currently being conducted under the No Action Alternative, TVA would begin identifying historic structures that are present on TVA-managed lands to incorporate them into a database for improved project planning. TVA would initiate a plan for evaluating and nominating historic properties to the NRHP and strive to evaluate two sites per year. Curation of the historic collection would be upgraded to meet the standards consistent with 36 CFR 79 *Curation of Federally-Owned and Administered Archaeological Collections*. Other improvements to this program would be the development of implementation procedures.

A comprehensive GIS database would be developed to unify TVA's cultural resource data sources in one location for improved resource management. This database would ensure more efficient project reviews and improved management of the resources.

Preserve America — TVA would develop a plan for the potential use of historic properties suitable for heritage tourism. TVA would also submit a triennial Section 3 report notifying the Advisory Council on Historic Preservation and the Secretary of the Interior on its progress with the Section 110 Program under NHPA. Lastly, TVA historic buildings that have been determined surplus would be evaluated for the feasibility of adaptive reuse.

Dispersed Recreation Management

Dispersed Recreation Assessments — Under this alternative, TVA would collect data on those dispersed recreational sites identified during LCA. Independent dispersed recreational assessments would occur only as resource issues arise. TVA would target to improve five dispersed recreational sites annually and would implement five dispersed recreational key opportunities as described in Section 2.1.2. These opportunities would be chosen in accordance with the goals and intent of the objectives outlined in the Environmental Policy. Finally, TVA would implement an educational campaign to promote ecofriendly dispersed recreation.

Trails Management — TVA would continue to maintain the approximately 90 miles of existing trails. In addition, TVA would add 10 miles of trails annually or other appropriate mileage in accordance with the proposed dispersed recreation multiyear plans.

Land Stewardship Assessment Tools
Boundary Maintenance — In addition to those activities listed under Alternative A, TVA would develop a proactive program to prioritize and implement boundary maintenance at the reservoir level.

Land Conditions Assessment and Land Stewardship Maintenance Needs Checklist — Reservoir shoreline conditions and the character of TVA-managed public lands would continue to improve by implementing the activities as prescribed during the LCA and LSMNC. TVA would assess approximately 20,000 acres of its lands per year. These assessment tools and methodologies would drive the prioritization of stewardship maintenance activities. TVA would continue to refine the CLCA and RLCA processes to improve integration of cultural, ecological, and compliance components. TVA would implement the necessary stewardship activities to improve land conditions while meeting the objectives of the Environmental Policy.

Natural Resource Management Implementation Plans — Under this alternative, TVA would continue partial implementation of the existing Unit Plans on approximately 18,000 acres of TVA-managed lands. TVA would specifically focus implementation efforts on areas where current environmental commitments exist.

TVA Natural Heritage Database — TVA would conduct those activities described under Alternative A.

TVA Wetlands Database — TVA would conduct those activities described under Alternative A.

Public Outreach Programs
Archaeological Outreach (Thousand Eyes Program) — TVA would continue to conduct public outreach activities as defined under Alternative A. However, TVA would sponsor three to five outreach programs per year.

Volunteer Program — Under this alternative, TVA would establish and implement a formal volunteer program. This program would include those components described in Section 2.2.3 of Chapter 2.

Sensitive Biological Resources Management
Conservation Planning — TVA would limit involvement on conservation planning teams to those efforts required by regulatory compliance (e.g., ESA Section 7[a][2] consultation requirements). TVA's participation in conservation planning would be minimal under this alternative.

Endangered and Threatened Species Program — TVA is required under Section 7(a)(2) of ESA to consult with the USFWS as appropriate concerning the potential for projects proposed by TVA or subject to approval by TVA (i.e., land use agreements and approvals under Section 26a of the TVA Act) to affect endangered species. This is a nondiscretionary obligation of TVA as a federal agency.

Voluntary managed activities, as described under Alternative A, would be continued. In addition, TVA would implement those endangered species management activities prescribed following ESA Section 7(a)(2) consultation with the USFWS. Further, TVA

would continue to locate, survey, and protect sensitive resources in caves on TVA-managed lands.

Migratory Birds Management — In addition to those activities described under Alternative A, TVA would establish a leadership role in the Tennessee River Valley Shorebird Working Group and provide data to support while participating in national and regional planning efforts for migratory birds.

Natural Areas Program — TVA would continue to conserve 154 ecologically and visually sensitive areas while annually monitoring one-third of TVA's natural areas.

Wetlands Management — TVA would continue those activities described under Alternative A.

Terrestrial Habitat Management

Agricultural and Open Lands Management — TVA would continue the existing agricultural licensing program as described in Alternative A.

Dewatering Projects Management — Under this alternative, TVA would continue the current management of dewatering units on Kentucky and Wheeler reservoirs. TVA is conducting a detailed engineering-based assessment of these units, which includes miles of levee embankment and numerous electrically operated pump stations. These studies would help to determine the level of repairs and maintenance required for future operation scenarios and would define long-term programmatic responsibility. TVA would also continue to honor existing contractual agreements with other federal and state wildlife agencies, counties, and railroads affected by operations of these projects.

Forest Resource Management — TVA would cooperate with local, state, and federal agencies, universities, and other stakeholders to monitor emerging forestry trends and issues. TVA would conduct basic forest-protection activities including cooperating with state and local agencies. These activities include small-scale salvage operations, control of wildfires on TVA properties, appropriate actions to deal with significant outbreaks of native or invasive forest insects or diseases, and control of invasive plants. TVA's other forestry-related efforts would be limited to mitigating tree hazards and encroachments involving tree cutting or other vegetative disturbances.

Nonnative Invasive Plant Management — Under this alternative, TVA would continue limited efforts to control NNIPs on approximately 1,000 acres of TVA-managed lands per year. TVA would focus NNIP-control efforts on those areas with existing environmental commitments and/or sensitive resources. In addition, TVA would conduct the appropriate level of NNIP control consistent with EO 13112 and other applicable laws.

Nuisance Animal Control — Under this alternative, TVA would continue to resolve animal damage conflicts on TVA-managed lands through existing contractual agreements. TVA would develop strategies to manage feral animal habitation on TVA-managed lands.

Wildlife Habitat Council – Third-Party Certifications — TVA would continue those activities described under Alternative A.

Wildlife Habitat Enhancement Partnerships — TVA would seek opportunities to increase habitat diversity on those lands under existing contractual agreements with federal and

state agencies. In addition, TVA would continue to foster partnerships with NGOs. Furthermore, a goal would be established to improve habitat on approximately 750 acres per year of TVA-managed lands. Integration with other resource areas would occur to ensure compliance with laws and policies.

3.2.2.2. Recreation Management

In addition to the programs and activities listed below, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process. Approximately 21,200 acres of land have been recommended for future consideration for recreational development. Of the total, approximately 19,100 acres are currently committed under existing contractual agreements, leaving approximately 2,100 acres currently available for development. TVA would continue to entertain proposals for the development of commercial or public recreation facilities on these remaining lands and manage existing contractual agreements.

Campground Management

TVA would continue to collaborate with community and commercial campground operators to assist with providing quality campground facilities on TVA-managed lands. Examples of this assistance are described under Alternative A.

TVA-Managed Campgrounds Located on Dam or Power Plant Reservations — TVA would continue to operate and manage eight campgrounds. TVA would continue to proactively upgrade one campground facility and amenity per year consistent with the ADAAG standards, building codes, and emerging technologies.

TVA-Managed Campgrounds Located on Other Reservoir Properties — Under this alternative, TVA would transition the management of three campgrounds to contractual agreements. TVA would require campground operators to meet relevant health, safety, and environmental protection standards and make proactive upgrades consistent with ADAAG. However, in circumstances where contractual agreements could not be reached, TVA would close the campgrounds.

Day Use Areas Management

Under Alternative B, TVA would reduce its operation of day use areas. TVA would continue to operate and manage the 30 day use areas located on dam reservations. However, the remaining 33 day use areas located off dam reservation properties would be transferred to local, state, or federal agencies or would be closed. As such, some picnic areas, picnic pavilions, swimming beaches, boat ramps, and other day use amenities may no longer be available to the public. Other amenities may be available to the public for a fee charged by the new manager. TVA would require all operators to meet relevant health, safety, and environmental protection standards and make proactive upgrades consistent with ADAAG. In the circumstance where a contractual agreement could not be reached, TVA would close that particular day use area.

Stream Access Sites — Of the 81 stream access sites owned by TVA, approximately 50 sites are managed under contractual agreements. TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities. The remaining 31 sites would continue to be managed by TVA.

Public Outreach Programs
Recreation Information Management — TVA would continue those activities described under Alternative A.

Recreation Assessment and Design Tools
Other than the specific types of data collection mentioned in this subsection, TVA would not actively engage in recreational data management.

Boating Density Assessments — TVA would continue those activities described under Alternative A.

Developed Recreation Inventory and Surveys — TVA would continue to maintain the existing recreation inventory data by continuing field reconnaissance, inventories, and assessments to ensure ongoing compliance with regulations.

Recreation Design Principles — TVA would continue those activities described under Alternative A.

Recreation Planning, Assistance, and Technical Support — TVA would continue those activities described under Alternative A.

3.2.2.3. Reservoir Lands Planning

Under Alternative B, TVA would apply the Single Use Parcel Allocation methodology when planning reservoirs or groups of reservoirs. However, TVA would apply land use zone definitions (Appendix F) that vary only slightly in terminology from those used for Alternative A. For the purpose of this EIS, potential impacts associated with these programmatic approaches would be from a Valleywide perspective. Therefore, future environmental reviews for reservoir lands planning would tier from this EIS, and the level of NEPA review would be determined by each planning effort. All future planning efforts would be subject to TVA's NEPA procedures located at http://www.tva.gov/environment/reports/pdf/tvanepa_procedures.pdf.

TVA estimates that implementing Alternative B would reduce the duration of each planning effort. The 16 reservoirs that have not been planned using the Single Use Parcel Allocation methodology are Beech River, Cedar, Chickamauga, Dogwood, Fort Loudoun, Great Falls, Kentucky, Lost Creek, Nickajack, Normandy, Pin Oak, Pine, Redbud, Sycamore, Wilson, and Wheeler reservoirs. Beech River, Cedar, Dogwood, Lost Creek, Pin Oak, Pine, Redbud, and Sycamore reservoirs are considered by TVA to be the Beech River Project reservoirs and have been combined for comparison purposes. Table 3-6 shows the amount of TVA-managed land that surrounds each of the remaining reservoirs and an estimate of the duration of each planning effort under Alternative B.

Table 3-6. List of Reservoirs to be Planned Under Alternative B

Reservoir	Acres of TVA-Managed Lands	Estimation of Planning Effort Duration
Beech River Project	5,217	1 year
Chickamauga	15,947	2 years
Fort Loudoun	1,574	9 months
Great Falls	362	6 months

Reservoir	Acres of TVA-Managed Lands	Estimation of Planning Effort Duration
Kentucky	75,217	3 years
Nickajack	3,574	1 year
Normandy	4,795	1 year
Wilson	117	3 months
Wheeler	36,177	2-3 years

The land use zone definitions used for Alternative B are similar to those used for Alternative A. The few changes in the definitions have been captured under Zones 4, 5, and 6. In Zone 4, the proposed definition includes all islands without sensitive resources or existing development. In Zone 5, one type of development, "light industry," has been replaced with "industry." In addition, the definition associated with "industry" has been broadened. Finally, the Zone 6 definition has been revised to focus on the two types of recreation (public and commercial) described in the TVA Land Policy and to better categorize "water access" as a component of "public recreation."

As mentioned in Chapter 2, a step in the Single Use Parcel Allocation methodology includes gathering existing reservoir data. In future land planning efforts, the RLA methodology would be used as the existing reservoir data or as a baseline to compare regional trends. Table 3-7 shows the preliminary RLA allocations for those reservoirs to be planned using the Single Use Parcel Allocation methodology. Maps showing the RLA data can be found on TVA's Web site at http://www.tva.com/environment/land/assessment/index.htm.

Table 3-7. Rapid Lands Assessment Data for Reservoirs

Reservoir	Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Beech River Project	6	0	51	0	43	0
Chickamauga	9	34	40	1	7	10
Fort Loudoun	33	3	18	0	2	44
Great Falls	100	0	0	0	0	0
Kentucky	1	2	84	2	5	6
Nickajack	20	25	51	3	2	0
Normandy	13	15	67	0	4	<1
Wheeler	4	24	62	2	8	<1
Wilson	0	0	7	0	63	30
Average Percentage	4	12	70	2	7	5

Note: Zone 1 – Non-TVA Shoreland is not represented because the parcels are private land (on which TVA owns flowage rights) and will not change as a result of the land planning process. The figures in this table are an estimate based on the RLA and are subject to change pending additional verification.

3.2.2.4. Water Resource Management

TVA would measure the success of the programs implemented under this alternative by tracking products delivered to stakeholders and quantifying reductions in pollutant loads. The success of the Water Resource Improvement Campaigns would be measured by the

reduction in sediment and phosphorus reaching streams and reservoirs. TVA's methodology for measuring reductions in pollutant loads is presented in Appendix I.

Aquatic Monitoring and Management
Stream and Tailwater Monitoring — Under this alternative, TVA would reduce the number of stream assessments conducted to 50 per year. Stream and reservoir data would be shared with other agencies and stakeholder groups upon request.

Partnership Programs
Strategic Partnership Planning — TVA would continue those activities described under Alternative A.

Public Outreach Programs
Tennessee Valley Clean Marina Initiative — TVA would continue those activities described under Alternative A.

Water Resource Outreach Campaign — The Water Resource Outreach Campaign Program would combine technical support and communications to promote water resource improvement and protection. These campaigns would include such things as focused efforts to improve knowledge of riparian and streamside management, development of education/outreach materials associated with blueways, and/or raising public awareness of water resource management. The QGP and Water Efficiency Program would be incorporated under these efforts. TVA would deliver 20 stakeholder products per year via this program.

Water Resource Improvement Programs
Water Resource Improvement Campaign — The Water Resource Improvement Campaign Program would provide technical support and project implementation to promote water resource improvement and protection. These campaigns would include such things as focusing efforts to improve riparian and streamside management, developing and promoting blueways, improving water resources on TVA-managed lands, and/or raising public awareness of water resource management. The Water Resource Improvement Campaign Program would have an annual goal of implementing demonstration projects that would reduce pollutant loads reaching streams and reservoirs by 720 tons of sediment and 1,100 pounds of phosphorus.

3.2.3. Alternative C – Flagship Management

Under Alternative C, TVA would explore, pilot test, and implement new strategies for enhancing stewardship programs and developed recreational facilities while emphasizing sustainable technologies. Similarly, activities or projects that address safety, TVA's mission and other relevant laws, regulations, and policies would be implemented. As laws, regulations, and EOs are created or amended, implementation activities would be revised to reflect the changes and ensure compliance. The tables located in Appendix H list the existing programs and actions under the No Action Alternative and the proposed programs and actions under all of the Action Alternatives.

3.2.3.1. Biological and Cultural Resources Management

Under this alternative, TVA would develop a Biological and Cultural Resources Management Program that would be a model for protecting and managing resources.

Cultural Resource Management

Archaeological Resources Protection Act Program — TVA Police would continue their efforts with the ARPA investigators focusing on expanding the program to include additional officers and support for greater coverage of archaeological resources on TVA-managed lands. This coverage would allow officers to maintain wider surveillance projects without having to sacrifice a presence in other regions. With multiple officers working in each region, TVA Police could also devote more time to conducting undercover work through trade shows and other avenues, and having officers available for fieldwork and reporting. TVA would strive to conduct ARPA inspections with 5,000 security checks per year. TVA would continue ARPA permitting and protect archaeological information. Lastly, the Agency would develop codified regulations to supplement its investigative authority.

Archaeological Site Monitoring and Protection — Under this alternative, TVA would establish larger goals for the monitoring and protection of resources to have a more proactive effect on the management of these resources. Specifically, TVA would monitor approximately 500 shoreline miles per year. In addition, TVA would establish targets to protect between 1.1 and 1.3 tributary shoreline miles or between 1.9 and 2.1 main stem shoreline miles per year.

National Historic Preservation Act Section 106 Compliance — TVA would continue to review projects under Section 106 and to initiate those projects described in Alternative B. In addition, TVA would develop procedures for compliance with Section 106 while TVA operated under emergency situations. TVA would also pursue a programmatic agreement (PA) with individual states regarding compliance for repetitive actions such as routine requests for land use agreements and approvals under Section 26a of the TVA Act.

Native American Graves Protection and Repatriation Act Compliance — TVA would continue to participate in the required activities as defined under Alternative A.

Native American Tribal Consultation — TVA would continue to participate in the required activities as defined under Alternative B. However, TVA would support more frequent tribal consultation workshops (every two years) to improve relationships and partnerships on the management of archaeological resources on TVA-managed lands.

Preservation Program — In addition to those activities previously defined in Alternatives A and B, TVA would expand its archaeological identification surveys to cover 5,000 acres each year. TVA would also conduct surveys to identify historic properties on its managed lands and develop a Web-based interactive database for cemeteries that can be used by the public to support the frequent requests for this information.

TVA would initiate a plan for evaluating and nominating historic properties to the NRHP and strive for evaluating approximately six sites per year. TVA would also partner with stakeholders to identify traditional cultural properties (TCPs). TCPs are properties that are eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community.

Preserve America — TVA would continue those activities discussed under Alternative B. In addition, TVA would develop partnerships with communities, local governments, or other entities to promote heritage tourism and economic development incorporating TVA-managed historic properties in a manner that benefits both the resource and the

public. TVA would target to develop between three and five new partnerships per year to promote heritage tourism.

Dispersed Recreation Management
Under this alternative, TVA would adjust the current systematic method of data collection and collect information only on those areas identified from the LCA. Independent dispersed recreational assessments would occur only as needed. To aid in planning, needs, and program evaluation efforts, TVA would distribute user surveys to 600 recreationists annually.

TVA would implement 20 key dispersed recreational opportunities consistent with the Agency's intent of ecofriendly dispersed recreation. TVA would improve its on-line presence by the formation of a dispersed recreation educational campaign. This initiative would educate the public on the appropriate uses of TVA-managed lands and low-impact recreational techniques (e.g., LNT), would provide maps of TVA lands suitable for dispersed recreation, and would implement other components designed to enhance the experience of the user while lowering the impacts to public lands. In addition, TVA would highlight significant dispersed recreational opportunities (e.g., trails) and provide updated printed maps.

TVA would improve 25 priority dispersed recreational areas annually. TVA would develop and implement multiyear dispersed recreation plans to ensure Valleywide consistency and focus. These plans would incorporate unmet needs analysis and stakeholder input and be integrated across all resource areas with other TVA planning methodologies (such as IRM and lands planning). TVA would develop and adopt regulations to aid in the enforcement of unauthorized uses of TVA-managed lands.

In an effort to break skill barriers to the full enjoyment of TVA dispersed lands, TVA would conduct approximately 100 outdoor clinics to teach members of the public how to responsibly enjoy dispersed recreation.

Leave No Trace — TVA would emphasize its partnership and promotion of LNT Outdoor Ethics in educational material.

Trails Management — TVA would formally design and implement a trails program to inventory and assess the existing 90 miles of trails on TVA-managed lands. If any ongoing maintenance issues exist, TVA would conduct the necessary maintenance. In addition, TVA would add 20 miles of trails annually or other appropriate mileage in accordance with dispersed recreation multiyear plans.

Land Stewardship Assessment Tools
Boundary Maintenance — TVA would develop a program and process to consistently prioritize and implement boundary maintenance Valleywide. TVA-managed lands would be marked and signed so they are more easily identifiable to the public for the appropriate use. The program would address Valleywide boundary maintenance, incorporating future survey technologies on a minimum five-year cycle. However, boundary maintenance would still be conducted on an as-needed basis at the reservoir level.

Land Conditions Assessments and Land Stewardship Maintenance Needs Checklist — Reservoir shoreline conditions and character of TVA-managed lands would continue to be improved by addressing the resource needs identified during the LCA and LSMNC.

Approximately 50,000 acres would be assessed per year. These assessment tools and methodologies would drive the prioritization of stewardship maintenance activities. TVA would continue to refine the CLCA and RLCA processes to improve integration of cultural, ecological, and compliance components. Stewardship activities would be implemented to improve land conditions while meeting public health and safety and compliance needs. Under this alternative, TVA would maintain or improve 25 percent of its identified preservation needs annually.

Finally, TVA would participate with partners and peer agencies in development of assessment processes and benchmarking measures to ensure project outcomes are comparable with those of its peers.

Natural Resource Management Implementation Plans — TVA would develop natural resource management implementation plans for reservoir properties at a rate of five planned reservoirs annually. In addition, TVA would continue partial implementation and associated environmental compliance for the existing Unit Plans on approximately 18,000 acres of TVA-managed lands. TVA would solicit public input on the revisions and updates needed for individual Unit Plan areas.

TVA Natural Heritage Database — In addition to those activities described under Alternatives A and B, TVA would conduct additional activities in support of database development, maintenance, and use. TVA would expand information-gathering efforts for identification of sensitive resources to include the entire TVA region through federal, state, and academic partnerships. Sensitive resources identified during these surveys would be incorporated into the database. Data in the TVA Natural Heritage database would be used to develop predictive models for state- and federally listed plant and animal species. These models would be used in environmental review, project planning, and conservation planning activities by TVA and federal, state, academic, and NGO cooperators.

TVA Wetlands Database — TVA would conduct additional activities in support of database development, maintenance, and use. TVA would institute an information-gathering effort on TVA-managed lands for assessments of wetland resources and identification of opportunities to improve these resources. Wetlands identified during these surveys would be incorporated into the database.

Public Outreach Programs

Archaeological Outreach (Thousand Eyes Program) — TVA would continue to conduct public outreach activities as defined in Alternative B. However, TVA would sponsor 10 to 15 outreach programs per year. The Thousand Eyes Program would be expanded to include partnerships with other agencies, SHPOs, tribal governments, and other interested organizations to increase efforts in reaching those audiences with a need for greater public outreach. A goal would be to establish five to 10 partners to support this program.

Corporate History Program — This program would actively promote TVA's history and would continue ongoing efforts to document the Agency's past. Programmatic activities, such as an agency Oral History Project and the enhancement of the TVA History Web site, would be instituted as part of this program. TVA would also conduct between three and five outreach events with the public to share information about TVA's history.

TVA would establish a historic and archaeological museum to interpret the Agency's role in the history of the region, nation, and the world. The remnants of TVA's historic collection

and archaeological collections would be utilized in the development of exhibits for the museum. TVA's digital photographs would be part of this facility. It would serve as the Agency's public outreach center regarding its significant legacy. Such a facility could also serve to promote current TVA initiatives through the use of rotating exhibits. TVA would seek partnerships with nonprofit organizations for the development and implementation of this facility. TVA would also consider a curation facility to house archaeological collections from previous and future excavations.

Cultural Resources Partnerships — TVA would develop grant opportunities to support external stewardship activities such as the publication of archaeological and historic research for both academic and nonacademic audiences. A goal would be to provide one or two grants per year.

When beneficial to the Agency, TVA would also provide access and support to universities for the establishment of archaeological field schools at TVA sites. This support would be conducted under stipulated agreements with each university to establish the research design, schedule, necessary consultation requirements, research benefits, associated publication commitments, and restoration following completion of the project. A goal would be to provide support for one or two schools.

Environmental Education Program — TVA would develop an EE Program and would establish close partnerships and participation with various stakeholder groups and agencies. The TVA cultural and natural resource story would be "taken on the road" to inform audiences about TVA's efforts and actions toward preserving, managing, and conserving the Valley cultural and natural resources. Additionally, extensive interactive Web sites would be developed highlighting TVA's cultural and natural resource activities.

TVA would communicate to various audiences the successful techniques and methodologies for sound biological and cultural resource management. Examples of TVA's commitment to preserving, managing, and conserving the cultural and natural resources and dissemination of the success stories may include TVA's nationally recognized Natural Heritage Program, efforts to restore globally rare plant and animal communities, forestry and wildlife improvement practices, dispersed recreation evaluation methodology and mitigation, and archaeological site protection and preservation. Additionally, TVA staff would conduct 100 outdoor clinics per year to teach outdoor skills along with an expansion of interpretive programming such as nature walks and wildflower pilgrimages.

In addition, TVA would seek opportunities to create a museum that features the Valley's cultural history, legacy, and natural environment. The museum would contain displays of TVA's archaeological collections; the natural and human history of the Valley (including presettlement, settlement, and modern eras); the conceptual vision and implementation of TVA as an agency; TVA construction projects; TVA's contributions to national and international interests; and infrastructure, defense, and natural resource preservation and conservation.

Natural Resources Communication — TVA would develop and implement this new program as described in Chapter 2.

Resource Stewardship Campaigns — The Resource Stewardship Campaign Program would combine technical support and communications to promote natural resource

improvement and protection. Under this alternative, this program would have an annual goal to deliver 25 stakeholder products.

Volunteer Program — Under this alternative, TVA would implement this new program as described in Chapter 2.

Sensitive Biological Resources Management

Conservation Planning — Under this alternative, TVA would expand its role in large-scale planning efforts across the region via partnerships with other federal and state agencies, academics, and NGOs. Planning efforts could address individual species, communities, or larger regional or ecoregional scales (e.g., planning). TVA staff members would continue to be advisers and/or participants in planning organizations.

Endangered and Threatened Species Program — TVA is required under Section 7(a)(2) of the ESA to consult with the USFWS as appropriate concerning the potential for projects proposed by TVA or subject to approval by TVA (i.e., land use agreements and approvals under Section 26a of the TVA Act) to affect endangered species. This is a nondiscretionary obligation of TVA as a federal agency. TVA would also continue those activities as described under Alternatives A and B.

TVA would develop a list of target state- and federally listed as endangered, threatened, and candidate (ETC) species where TVA has proactive species or ecosystem management opportunities on TVA-managed lands and in streams and rivers within the TVA region. TVA would develop management plans for these ETC species or other targeted species identified by monitoring/cataloging efforts. Particular emphasis would be placed on development of protection plans for those species occurring on TVA-managed lands. Management and/or protection plans would include proactive conservation actions based on ETC monitoring results throughout the TVA region. TVA would then implement these plans through partnerships with other federal and state agencies, NGOs, and/or universities. TVA would also establish a public outreach program that would seek to inform TVA stakeholders about the important natural resources of the region and would promote awareness and cooperative effort to protect these resources.

Under this alternative, TVA would establish long-term monitoring and population trend assessment for all federally listed species on TVA-managed lands. Monitoring plans for certain other target species would also be developed. Monitoring plans would most likely include an expansion of monitoring efforts within the Tennessee River watershed. Target species would be identified in consultation with the USFWS and state agencies. However, target species would likely be those subject to opportunities for TVA to enhance the survival of the species. The Agency would also catalog ETC species on TVA-managed lands and in TVA-affected waters for the development of management plans.

Migratory Birds Management — In addition to those activities described under Alternatives A and B, TVA would establish a leadership role in Tennessee River Valley Shorebird Working Group by coordinating an annual meeting of the partners and by implementing the charter of the group. Conservation projects for migratory birds would be implemented on TVA-managed lands in cooperation with federal and state partners. TVA would partner to inventory and monitor waterfowl and other water bird populations along TVA reservoirs. In addition, TVA would participate in national and regional planning efforts to support the conservation of migratory birds. Five demonstration projects would be implemented on

TVA-managed lands to benefit regional habitat objectives for migratory birds. Lastly, Agency-specific guidelines would be developed for EO 13186.

Natural Areas Program — TVA would continue to conserve the current 154 ecologically and visually sensitive areas while monitoring 33 percent of them annually. TVA would develop programmatic guidelines for the natural areas program. These guidelines would provide a road map for how TVA would implement the functional elements of a comprehensive program: inventory and designation, management, research, monitoring and data management, and education and communication. TVA would promote the natural areas program by actively participating in national natural areas conferences and regional natural areas advisory committees.

Evaluation criteria would be established for the designation of natural areas outside of the existing reservoir lands planning process, and 5,000 acres of high-priority areas would be evaluated annually for potential inclusion in the program. Management plans would be developed and implemented on 33 of the 154 natural areas annually until all areas are operating under an implementation plan. Stewardship needs would be implemented as identified through monitoring, management plans, and opportunistic observations. All TVA natural areas' records would be updated to include appropriate information (including spatial data) using national standards and methodologies.

Wetlands Management — In addition to the activities identified in Alternatives A and B, TVA would develop and implement a wetland management policy that includes a proactive program for wetland identification and protection on TVA-managed lands.

Terrestrial Habitat Management

Agricultural and Open Lands Management — TVA would develop an open land/early successional habitat program through agricultural licensing or cooperative agreements. Lands suitable for program inclusion to improved wildlife/forest habitats would be converted at a rate of 50 percent annually.

Dewatering Projects Management —Under this alternative, TVA would renovate levees and pump stations based on an individual unit review. TVA would manage and maintain the dewatering projects at the newly renovated conditions. TVA would continue to honor existing contractual agreements with federal and state wildlife agencies, counties, and railroads affected by operations of these projects.

TVA would seek additional partnership opportunities, especially with other federal and state wildlife agencies and select NGOs. In addition, TVA would work directly with existing partners to further develop habitat and recreational opportunities associated with migratory birds. TVA would document and showcase contributions to migratory bird resource management in the Valley. A goal would be to develop a direct linkage of habitat provided by TVA projects with the *North American Waterfowl Management Plan* (USFWS 2009a) and other state migratory bird conservation plans as described above for the Migratory Birds Management Program. TVA would work with local and regional nature-based tourism officials to explore opportunities to design and implement interpretive trails and establish WOAs. Such projects would bring attention to the nature study and wildlife viewing opportunities that the dewatering projects provide.

Forest Resource Management — Forest resource management activities include protection and management of resources to provide watershed protection benefits, biodiversity,

wildlife habitat, scenic quality, carbon sequestration, forest products, and opportunities for recreation. Some examples of activities include mitigation of tree hazards, damage rehabilitation (insect, disease, wildfire, weather, conservation practices, vegetation management, and invasive plant control), small-scale salvage operations, and associated land management activities (such as vegetative encroachments and unauthorized off-highway vehicle damages).

TVA would cooperate with local, state, and federal agencies, universities, and other stakeholders to monitor emerging forestry trends and issues. TVA would conduct basic forest protection activities, including cooperating with state and local agencies to address common management issues. TVA would implement selected vegetation management activities (such as creation of early successional habitat) primarily to improve wildlife habitat diversity in coordination with state wildlife action plans.

TVA would maintain a fully qualified fire management crew supporting prescribed fire needs on TVA-managed lands. In emergencies, qualified members would be released from their primary job functions to suppress wildfires on TVA-managed lands and support interagency efforts on fires, natural disasters, or other emergencies.

TVA would establish a forest management program to help meet TVA goals and support management decisions. TVA would inventory forest stands through the forest prescription process on 10 percent of TVA reservoir properties annually. An electronic database containing the parameters of forest stands on TVA-managed lands would be established and maintained. A prioritized list of implementation actions would be developed and reviewed by a multidisciplinary team. TVA would implement selected forestry activities with an emphasis on activities that promote terrestrial GHG sequestration, biofuels production, and wildlife habitat diversity, or that support or enhance other TVA functions. TVA would maintain and enhance forest health by monitoring invasive plants, insects, and diseases and applying controls in selected areas. TVA would establish targets with a goal of implementing actions on 10 percent of lands per year.

Nonnative Invasive Plant Management — TVA would target NNIP-control activities to locations where impacts to sensitive resources are occurring and environmental commitments exist. This alternative would also focus on TVA-managed lands where NNIP species are currently outcompeting native or sensitive plant species in high-profile HPAs and other natural areas settings. This alternative would allow for control measures on 40,000 acres of TVA-managed lands per year. In addition, TVA would participate in SE-EPPCs along with regional early detection and rapid response initiatives.

Nuisance Animal Control — TVA would continue to resolve animal damage conflicts on TVA-managed lands and at TVA facilities through the existing contractual agreement. TVA would develop proactive strategies to manage feral animal habitation on TVA-managed lands. In addition, TVA would develop programmatic guidelines for addressing nuisance animals on its lands. TVA would establish a memorandum of agreement with other federal and state agencies responsible for regulating wildlife. TVA would develop and share BMPs for nuisance wildlife control with other agencies.

Terrestrial Greenhouse Gas Sequestration Management — Under this alternative, TVA would pursue carbon offset projects on 500 acres of TVA-managed lands for research purposes to build institutional knowledge of terrestrial carbon sequestration programs. TVA would also have a goal of entering into eight consortiums focusing on issues related to

terrestrial GHG management. TVA would seek up to six demonstrations that meet the following objectives: gaining further understanding of establishing a baseline for inventory purposes; adapting forestry BMPs to increase carbon sequestration; and working with third-party contractors to ensure emissions reductions are real, permanent, additional, measurable, and verifiable in order to obtain fungible offsets. Demonstration projects typically focus on increased vegetation management, nutrient management, and selective harvesting while ensuring habitat preservation. These projects would be limited to areas allocated for natural resource conservation to ensure sensitive areas are not disturbed.

Wildlife Habitat Council/Third-Party Certifications — TVA would continue the management of the four projects currently certified by the WHC on TVA-managed lands. These projects are focused on basic wildlife habitat enhancement activities. TVA would also initiate new wildlife enhancement activities at five locations on TVA-managed lands while incorporating third-party project review and certification. In addition, TVA would establish a third-party review and certification process for wildlife management activities on 10 percent of appropriate TVA-managed lands annually. Sites would be selected based on interest, land base available, new methodologies (e.g., habitat banking for endangered species), and on-site habitat conditions amenable for enhancement activities. This would require the development of long-range habitat enhancement plans to assist with project implementation.

Wildlife Habitat Enhancement Partnerships — Through cooperative partnerships, TVA would improve wildlife habitat on 20,000 acres per year outside existing Unit Plan implementation commitments. TVA would engage other federal and state agencies who currently have lands licensed for wildlife habitat management to assess improvement activities designed to align with habitat diversity efforts as outlined in the Environmental Policy. Furthermore, a goal would be established to foster these efforts on approximately 20,000 acres per year of TVA-managed lands. In addition, TVA would further integrate other resource areas to ensure compliance with laws as they relate to habitat management areas under agreement to other agencies. Integration with other resource areas would occur to ensure compliance with laws and policies. Moreover, a Valleywide partnership agreement for use with resource management partners would be developed.

TVA would also establish an initiative with federal and state wildlife agencies to address landscape conservation needs around natural resources in the region. Objectives outlined in state wildlife action plans and federal initiatives would be incorporated into TVA wildlife management initiatives, where appropriate.

3.2.3.2. Recreation Management

In addition to the programs and activities listed below, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process. Approximately 21,200 acres of land have been recommended for future consideration for recreation development. Of the total, approximately 19,100 acres are currently committed under existing contractual agreements, leaving approximately 2,100 acres currently available for development. TVA would continue to entertain commercial or public recreation requests for development of these remaining lands and manage existing contractual agreements.

Campground Management

TVA would continue to collaborate with community and commercial campground operators to assist with providing quality campground facilities on TVA-managed lands. Examples of

this assistance are described under Alternative A. TVA would also develop and implement a C&GCI.

TVA-Managed Campgrounds Located on Dam or Power Plant Reservations — TVA would continue to operate and manage eight campgrounds. TVA would establish one of these eight campgrounds as flagship campgrounds. Additionally, the flagship campground would have program improvements including, but not limited to, a reservation system and on-site managers. TVA would enhance the natural resources of the campgrounds and sustainability designs, where appropriate. TVA would make proactive upgrades consistent with ADAAG at all eight campgrounds.

TVA-Managed Campgrounds Located on Other Reservoir Properties — Under this alternative, TVA would continue to operate and manage the four campgrounds located on other reservoir properties. TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities. TVA would make, or require a third-party operator to make, proactive upgrades consistent with ADAAG at all four campgrounds.

Day Use Areas Management
TVA would operate and manage the 63 day use areas located across the Valley. TVA would target to proactively upgrade four day use areas consistent with ADAAG per year. Additional initiatives to enhance day use areas would include innovative conservation and sustainability designs. Specifically, TVA would implement sustainable initiatives at four day use areas per year. The day use areas would be designed to complement the surrounding natural resources.

Blueways — Under this alternative, TVA would establish a goal of developing four access areas per year to facilitate blueway miles contingent upon available partnerships.

Greenways — TVA assists and collaborates with stakeholder groups in support of greenway development, as requested. Under this alternative, however, TVA would invest in greenway development, and this investment would be contingent on partnerships. TVA would dedicate cost-share funding on greenway projects and strive to add 20 greenway miles per year via established partners.

Stream Access Sites — Of the 81 stream access sites owned by TVA, approximately 50 sites are managed under contractual agreements. TVA would continue to operate and manage the remaining 31 stream access sites. TVA would implement initiatives to enhance sustainability of stream access areas. Specifically, TVA would implement improvements at 31 stream access sites. The stream access sites would be designed to complement the surrounding natural resources. Guided by regional recreational data or as appropriate, TVA would assist partners with acquisition and development of six additional stream access sites.

Public Outreach Programs
Annual Tours — TVA would host six annual media and technology transfer tours of campgrounds and day use recreational areas where emerging technologies would be featured and showcased.

Clean and Green Campground Initiative — TVA would develop and implement the C&GCI, a voluntary program developed and implemented by TVA and partners to promote environmentally responsible campgrounds and camping practices.

Foundation and Trust Fund — TVA would establish the F&TF to leverage funding for conservation and/or recreation projects across the Valley.

Recreation Information Management — TVA's Web site would be enhanced to provide self-service and automated support. All TVA recreational areas would have appropriate on-site signage and up-to-date maps available for download on the TVA Web site. Additionally, TVA would seek opportunities to publish materials about the recreational opportunities on and along the Tennessee River and its tributaries. Visitor assessments would be designed to enhance the visitor experience and explore options for upgrades and initiatives.

Recreation Management Regulations — TVA would develop and implement codified regulations to assist with enforcement and articulate expectations for visitors on TVA-managed lands.

Resource Rangers — To aid in enforcement and educational capability, TVA would develop a professional Resource Ranger Program to perform interpretive, enforcement, and key recreational management activities exclusively on undeveloped TVA-managed lands.

Recreational Assessment and Design Tools

Boating Capacity Studies — TVA would partner with state boating law administrators to complete two studies per year.

Boating Density Assessments — When reviewing certain requests for new water-based recreational facilities, TVA would continue to complete boating density assessments in support of the associated environmental review. TVA would continue to share recreational information and would make an effort to be a leader in collecting recreational data.

Developed Recreational Inventory and Surveys — TVA would maintain and annually update an inventory of all public, private, and quasi-public recreational facilities on or near shoreline properties. TVA would also perform basic and noncyclical visitor use and satisfaction surveys, assessments of recreational facility/area conditions, or campground evaluations. TVA would continue to maintain the existing recreation inventory data while continuing field reconnaissance, inventories, and assessments to ensure ongoing compliance with regulations.

Recreation Design Principles — TVA would continue to place signage at recreation facilities and stream access sites to support the implementation of recreation guidelines.

Recreation Planning, Assistance, and Technical Support — TVA utilizes regional recreational data to guide potential expansion of new campgrounds on TVA-managed lands allocated for developed recreation via the reservoir lands planning process. In addition, TVA would provide additional technical support to other agencies and stakeholders while sharing recreation information, as appropriate. Furthermore, TVA would foster partnerships to assist in identifying unmet recreational needs around TVA-managed reservoirs.

3.2.3.3. Reservoir Lands Planning

Under Alternative C, TVA's implementation of reservoir lands planning would shift from only RLMPs for a reservoir or groups of reservoirs to include a more comprehensive Valleywide perspective. Under this alternative, a Comprehensive Valleywide Land Plan (CVLP) is created as a component of the NRP to help guide future land use decisions across the Valley. A CVLP would be a holistic approach to balancing shoreline development, recreational use, sensitive and natural resource management, and other uses in a way that maintains the quality of life and other important values provided across the Valley. Furthermore, a CVLP identifies the range of allocated uses that TVA considers for the lands it manages on its reservoir system. This enables TVA and the public to consider the totality of those allocations across the reservoir system and whether too much or too little attention is being given to certain kinds of uses on a programmatic basis.

The CVLP identifies target ranges for allocations to each land use zone for the Valley as a whole (Appendix H). The target ranges were developed using the allocations assigned in existing RLMPs with Single Use Parcel Allocation methodology and previously approved by the TVA Board. For all other reservoirs, the RLA methodology was used to initially identify appropriate land use zone allocations using the land use zone definitions in Alternative B. Together, these existing RLMPs and information obtained during RLA create a baseline of land use zone allocations for the CVLP (Table 3-8). Maps of the existing RLMPs and RLA data are available on TVA's Web site at http://www.tva.com/environment/land/land_mgmt_plans.htm and http://www.tva.com/environment/land/assessment/index.htm.

TVA anticipates that some parcels of land may be better represented in different land use allocations from those initially identified. For example, field assessments may identify additional areas that warrant the sensitive resource management allocation. In addition, during the creation or update of each individual RLMP, TVA may determine, either for its own management purposes or as a result of a third-party request, that certain parcels of land should be used differently from how they have been used in the past. To plan accordingly for these changes and align with a future recreation focus or conservation focus when planning lands, TVA has established a reservoir-specific allocation range for each land use zone (Appendix J).

Based on TVA's years of planning uses on its reservoir properties, an understanding of the value of those properties in meeting public needs, and public input, TVA determined that natural resource conservation and recreation are the two uses that receive the most attention and pressure. TVA lands also support other uses. TVA's reservoir land base supports important operational activities, such as its dams and hydroelectric units, but less than 10 percent of TVA's total reservoir system land base is devoted to this use. TVA has not proposed to materially change the reservoir land base for its operations, and it is unlikely to do so in the future. Industrial uses are supported on TVA lands. This is an important use, but the amount of property dedicated to this also is relatively small, less than 2 percent. Other properties in the Tennessee Valley, including private property on TVA reservoirs, also support industrial uses and help meet this need. The other very important use to which TVA property is dedicated is protection and management of sensitive uses. On the average reservoir systemwide, 17 percent of TVA's lands are allocated to this use. There are a number of federal laws and policies that make it difficult to materially reduce the amount of lands TVA has dedicated to sensitive resource management.

Table 3-8. Comprehensive Valleywide Land Plan Allocation Baseline

Reservoir	Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Apalachia	91	0	*	0	9	0
Beaver Creek	14	0	0	0	86	0
Beech River Project	6	0	51	0	43	0
Big Bear Creek	7	82	0	0	10	0
Blue Ridge	62	3	6	0	3	26
Boone	24	17	51	0	9	<1
Cedar Creek	10	66	10	0	8	5
Chatuge	22	1	49	0	24	4
Cherokee	7	12	68	0	9	3
Chickamauga	9	34	40	1	7	10
Clear Creek	100	0	0	0	0	0
Douglas	50	3	40	0	6	1
Fontana	43	0	5	0	47	4
Fort Loudoun	33	3	18	0	2	44
Fort Patrick Henry	27	7	41	0	14	10
Great Falls	100	0	0	0	0	0
Guntersville	6	27	60	1	5	2
Hiwassee	36	11	44	0	4	4
Kentucky	1	2	84	2	5	6
Little Bear Creek	18	69	2	1	6	4
Melton Hill	11	49	24	1	8	6
Nickajack	20	25	51	3	2	0
Nolichucky	5	57	13	<1	25	0
Normandy	13	15	67	0	4	<1
Norris	3	18	67	0	7	5
Nottely	53	0	33	0	11	3
Ocoees	100	0	*	0	*	0
Pickwick	7	8	69	3	8	6
South Holston	28	<1	46	6	19	1
Tellico	5	17	56	2	15	4
Tims Ford**	9	15	58	1	6	10
Upper Bear Creek	6	81	8	0	3	2
Watauga	46	9	38	0	8	<1
Watts Bar	12	28	29	3	12	17
Wheeler	4	24	62	2	8	<1
Wilbur	83	0	17	0	0	0
Wilson	0	0	7	0	63	30
Average Percentage	7	17	61	2	8	5

Note: Zone 1 – Non-TVA Shoreland is not represented because the parcels are private land (on which TVA owns flowage rights) and will not change as a result of the land planning process. The figures in this table (1) have been rounded to the nearest whole number; (2) are an estimate based on the RLA; and (3) are subject to change pending additional verification.

* Includes narrow strip of TVA-retained land along shoreline; acreage not calculated.

** Includes TVA- and State of Tennessee-managed public lands. Tims Ford Reservoir contains an additional 33 acres allocated to Zone 8 or a conservation partnership. The allocation of public lands to Zone 8 has been discontinued. However, TVA would continue to manage lands allocated to Zone 8 per Agency policy.

Accordingly, for purposes of assessment, the ranges in land use allocation were grouped into two categories, one with a natural resource conservation focus and one with a recreation focus. While other land use zones were not used as focuses, TVA did vary the percentage of lands dedicated to those uses when it evaluated the impacts of these two focus areas.

To determine the potential impact of shifting more property to conservation or recreational uses, TVA chose to reallocate approximately 20 percent of the lands previously allocated to Zones 2, 3, 5, and 6 to conservation and recreation uses. Based on the results of TVA's planning activities to date, it is highly unlikely that percentage changes would exceed this level. This helped bound potential impacts, both adverse and beneficial.

Because this allocation shift would exceed the amount of TVA-managed land potentially needed to fully implement identified biological and cultural resource programs and recreation programs component of the NRP, TVA proposes to restrict reallocations that could result from its CVLP as follows. Lands previously allocated to Zone 2, Project Operations, would only be redesignated to Zone 4, Natural Resource Conservation, when their primary use is no longer needed to support project operations. Similarly, for recreation, Zone 2 lands would only be redesignated to a Zone 6, Developed Recreation, when their primary use is no longer needed to support project operations and existing recreational infrastructure is present. Lands previously allocated to a Zone 3 would only be designated to a Zone 4 or a Zone 6 when it is determined that the sensitive resource and/or its habitat is no longer present. Lands previously allocated to Zone 5 would only be redesignated when an industrial tract of land is no longer needed in the area.

When completing future RLMPs, the final land use zone allocations for each land planning effort would fall between the baseline, conservation focus, or recreation focus. The range in land use zone allocations for each reservoir was combined to create a Valleywide range (Table 3-9 and Appendix H).

Table 3-9. Allocation Ranges for a Comprehensive Valleywide Land Plan

Rapid Lands Assessment Ranges	Percentage of Land Area by Single Use Allocation Range					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	7	17	61	2	8	5
Recreation Focus	5	14	50	1	25	5
Conservation Focus	6	14	68	1	6	5

After completion of the NRP, TVA would continue to develop and update RLMPs for a portion of a reservoir, an entire reservoir, or a group of reservoirs using the Single Use Parcel Allocation methodology. A prioritized list of areas for planning would be developed upon completion of the NRP. The planning process will validate and revise, as appropriate, the baseline created by the existing RLMPs and the RLA methodology. At a minimum, the reservoir lands planning process would consist of the key components listed below.

- Collaboration would occur with other federal and state agencies to share information and data pertaining to developed recreation, natural resource management, and water resources.

- Existing conditions would be identified by assimilating existing resource data, conducting capability and suitability analysis (as appropriate), and predicting future public needs for specific allocations.
- Draft plans would be created either for a portion of a reservoir, entire reservoir, or a group of reservoirs. The draft plans would include an overview of the new lands planning process, detailed parcel descriptions, and a set of detailed maps.
- TVA would consider proposals for alternative uses of TVA-managed lands.
- TVA would seek and incorporate input from the public on the draft plans.
- TVA would issue a final plan, which would include an overview of the lands planning process, parcel allocations, and a set of detailed maps.
- The outcomes of each planning effort would be included in any periodic update for the NRP, and TVA would track allocation changes to assure that they continued to fall within the CVLP total allocation percentages.

In summary, Alternative C includes the key components of the new lands planning implementation strategy, a baseline for each reservoir (Table 3-8), estimated ranges for each land use zone (Table 3-9), and target ranges for Valleywide land use allocations (Appendix H). In addition, any specific development proposal on TVA-managed public land would be subject to a site-specific environmental review.

3.2.3.4. Water Resource Management

Under Alternative C, TVA would implement programs and activities to foster stakeholder awareness of water resource issues and participation in water resource management. The increased emphasis would focus efforts on improvement opportunities for watersheds and/or communities having identified water quality problems, stakeholder interest, and leveraged funding sources. An increased emphasis on shoreline stabilization and water resource improvements would be intended to enhance the characteristics of stewardship and improve the health of streams and reservoirs within the Valley.

TVA would measure the success of the programs implemented under this alternative by tracking products delivered to stakeholders, quantifying reductions in pollutant loads, and counting the miles of shoreline stabilized. The success of the Water Resource Improvement Campaign, TRI, TWI, and Water Resource Grant programs would be measured by short-term goals for the reduction in sediment and phosphorus reaching streams and reservoirs. The success of the TRI and TWI programs would be further measured by a combination of short-term goals for pollutant load reductions and long-term goals for HU improvements. TVA's methodology for measuring reductions in pollutant loads is described in Appendix I. The success of the Reservoir Shoreline Stabilization Program would be measured by miles of shoreline stabilized.

Aquatic Monitoring and Management

Aquatic Ecology Management — Under this alternative, TVA would partner and actively participate in restoring the aquatic biological communities. In addition, TVA would develop and evaluate public outreach opportunities to raise public awareness of exotic and invasive aquatic animal species consistent with EO 13112.

Stream and Tailwater Monitoring — Under this alternative, TVA would conduct 150 stream assessments per year. Stream and reservoir data would be shared with the public via interactive methods on TVA's Web site.

Partnership Programs
Case Studies and Research Initiatives — TVA would undertake three case studies or research projects annually.

Strategic Partnership Planning — Under this alternative, TVA would continue to maintain existing and aggressively develop new relationships, partnerships, and contractual agreements.

Public Outreach Programs
Tennessee Valley Clean Marina Initiative — The TVCMI would maintain certification for 80 marinas and seek certification for two new marinas per year.

Water Resource Outreach Campaign — The Water Resource Outreach Campaign Program would provide communication, outreach products, and technical support to promote water resource improvement and protection. These campaigns would include such things as focused efforts to improve knowledge of riparian and streamside management, development of education/outreach materials associated with blueways, and/or raising public awareness of water resource management. The QGP and Water Efficiency Program would be included under these efforts. TVA would deliver 70 stakeholder products per year via this program.

Water Resource Improvement Programs
Reservoir Shoreline Stabilization Program — The goal of this program would be to stabilize 8 miles of critically eroding shoreline per year. TVA would follow the existing methodologies to prioritize the critically eroded shoreline.

Targeted Reservoir Initiative — Under Alternative C, the TRI Program would be established by adopting the targeting and implementation processes of the existing TWI Program. While providing resources to meet specific reservoir-based goals, TVA envisions the TRI Program addressing nonpoint and point source pollution sources that contribute to reservoir water quality degradation. Under the TRI Program, improvement plans would be developed for a TVA-managed reservoir. Each improvement plan would include reservoir-specific goals and objects supported by the appropriate technical analysis. TVA anticipates that one short-term goal of the TRI Program would be to annually reduce phosphorous loading to a TVA-managed reservoir by 5,000 pounds. Likewise, an anticipated long-term goal would be to improve one HU located in the project area within four years.

Targeted Watershed Initiative — TVA would follow the existing processes to identify priority watersheds for inclusion in the TWI Program. Similar to Alternative A, the TWI Program would be applied to the Tennessee River watershed in its entirety. The short-term goals of the TWI Program related to water resource improvements would be to reduce pollutant loads to streams and reservoirs by an estimated 1,300 tons of suspended sediment and 2,000 pounds of phosphorus per year. The long-term goal of the TWI Program would be to improve one HU within three years. The goal of the TWI Program related to public outreach is to deliver 75 stakeholder products per year. The types of stakeholder products would be consistent with those described under Alternative A.

Water Resource Grant Program — Under Alternative C, TVA would establish a Water Resource Grant Program. This program would be used to subsidize water resource management efforts by stakeholders located within the Tennessee River watershed. Prior to implementing this program, TVA would develop a process that includes mechanisms to ensure the appropriate levels of project oversight.

Water Resource Improvement Campaign — The Water Resource Improvement Campaign Program would provide technical support and project implementation to promote water resource improvement and protection. These campaigns would include such things as focusing efforts to improve riparian and streamside management, developing and promoting blueways, improving water resources on TVA-managed lands, and/or raising public awareness of water resource management. The Water Resource Improvement Campaign Program would have an annual goal of implementing demonstration projects that would reduce pollutant loads reaching streams and reservoirs by 360 tons of sediment and 550 pounds of phosphorus.

3.2.4. Alternative D — Blended Management

Under Alternative D, TVA has identified key programs that are integral toward enhancing future implementation efforts while maintaining activities and projects that address safety, meet the intent of the Environmental Policy, and comply with TVA's mission and relevant laws, regulations, and other policies including EOs. This alternative takes into account the interconnectivity of the various programs described in Chapter 2, helping to establish a foundation by which TVA may implement greater levels of programs in the future.

Within this alternative, all program options have been placed into one of three priority level groupings as described in the NRP. The first grouping, custodial management, reflects those program options described under Alternative B, which represent the baseline of effort at which TVA proposes to implement its natural resource programs under this alternative. The second grouping, blended management, reflects several critical programs and activities that are integral to the successful implementation of the NRP and are considered to be a springboard to help TVA to effectively and efficiently implement additional activities as partnerships and/or funding allows. The third grouping, advanced management, reflects program options that may be considered for future execution depending upon available opportunities, partnership, and resources. The programs listed in the advanced management group are typically reflective of the enhanced or flagship program options (Section 3.1.1) that were not included in the blended management group. The NRP contains a detailed explanation of the three priority level groupings.

In this EIS, it is anticipated that, over the next 20 years, all of the programs within the custodial and blended management groupings would be implemented, although the programs in the blended management group would not necessarily be implemented all at once or all at the higher management level every year. However, in order to analyze the potential environmental consequences stemming from this alternative, this EIS assumes that those programs in the blended management group would be implemented at the higher level starting immediately and continuing throughout the duration of the NRP. The advanced management group consists of a "tool box" of options for the Agency to implement if opportunities, partnerships, or resources become available and as long as these programs do not undermine TVA's ability to conduct the activities in the custodial management or blended management groupings.

The subsections below have been organized by resource area. Within each resource area, the programs have been placed into two groups: (1) custodial and blended management and (2) advanced management. The tables located in Appendix H list the programs and actions under the No Action Alternative and all of the Action Alternatives. For comparison purposes, the programs and activities grouped within the custodial and blended management groupings are only represented in Appendix H.

Similar to Alternatives B and C, as laws, regulations, and policies, including EOs, are created or amended, implementation activities would be revised to reflect the changes and ensure compliance. In those areas in which TVA would discontinue programs or projects, existing contractual agreements relating to those programs or projects would be honored per the terms of the agreement(s).

3.2.4.1. Biological and Cultural Resources Management

Under this alternative, TVA would continue to meet the minimum requirements of laws, regulations, and EOs relating to the management and protection of biological and cultural resources.

Custodial and Blended Management Programs

Cultural Resources Management

Archaeological Resources Protection Act Program — TVA would conduct those activities as defined under Alternative A.

Archaeological Site Monitoring and Protection — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would establish goals for annual shoreline stabilization. A monitoring schedule would be developed to identify those sites that are subject to the greatest threat to better management and protection of these resources. Specifically, TVA would monitor approximately 250 miles of shoreline per year. In addition, TVA would establish targets to protect between 0.4 and 0.6 tributary shoreline miles or between 0.9 and 1.1 main stem shoreline miles per year.

National Historic Preservation Act Section 106 Compliance — TVA would conduct those activities as defined under Alternative B.

Native American Graves Protection and Repatriation Act Compliance — TVA would continue to participate in the required activities as defined under Alternative A.

Native American Tribal Consultation — TVA would continue to participate in the required activities as defined under Alternative A.

Preservation Program — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would conduct approximately 3,000 acres of surveys to identify archaeological sites within areas under its management. In addition to all other activities currently being conducted under the No Action Alternative, TVA would begin identifying historic structures that are present on TVA-managed lands to incorporate them into a database for improved project planning. TVA would initiate a plan for evaluating and nominating historic properties to the NRHP and strive for evaluating four sites per year. Curation of the historic collection would be upgraded to meet the standards required by 36 CFR 79 *Curation of Federally-Owned and Administered Archaeological Collections*. Other improvements to this program would be the development of procedures to guide the implementation of preservation activities.

A comprehensive GIS database would be developed to unify TVA's cultural resource data sources in one location for improved resource management. This database would ensure more efficient project reviews and improved management of the resources.

Preserve America — TVA would conduct those activities as defined under Alternative B.

Dispersed Recreation Management
This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would collect data on those dispersed recreational sites identified during LCA. Independent dispersed recreational assessments would occur only as resource issues arise.

TVA would improve 15 priority dispersed recreational areas annually. TVA would develop and implement multiyear dispersed recreation plans to ensure Valleywide consistency and focus. These plans would incorporate unmet needs analysis and stakeholder input and be integrated across all resource areas with other TVA planning methodologies (such as IRM and lands planning). TVA would develop and adopt a formal regulation to aid in the enforcement of unauthorized uses of TVA-managed lands.

TVA would implement 10 dispersed recreational key opportunities as described in Section 2.1.2 of Chapter 2. Finally, TVA would implement an educational campaign to promote ecofriendly dispersed recreation.

Trails Management — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would continue to maintain the approximately 90 miles of existing trails. In addition, TVA would add 10 miles of trails annually or other appropriate mileage in accordance with proposed dispersed recreation multiyear plans.

Land Stewardship Assessment Tools
Boundary Maintenance — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would develop a program and process to consistently prioritize and implement boundary maintenance Valleywide. TVA-managed lands would be marked and signed so they are easily identifiable to the public for the appropriate use. The program would address Valleywide boundary maintenance, incorporating future survey technologies on a minimum 10-year cycle. However, boundary maintenance would still be conducted on an as-needed basis at the reservoir level.

Land Conditions Assessment and Land Stewardship Maintenance Needs Checklist — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

Reservoir shoreline conditions and TVA-managed lands would continue to be improved by addressing the resource needs identified during the LCA and LSMNC. Approximately 35,000 acres would be assessed per year. These assessment tools and methodologies would drive the prioritization of stewardship maintenance activities. TVA would continue to refine the CLCA and RLCA processes to improve integration of cultural, ecological, and compliance components. Stewardship activities would be implemented to improve land conditions while meeting public health and safety and compliance needs. Under this alternative, TVA would maintain or improve 10 percent of its asset preservation needs annually.

Finally, TVA would participate with partners and peer agencies in development of assessment processes and benchmarking measures to ensure project outcomes are comparable with those of its peers.

Natural Resource Management Implementation Plans — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would develop IRM plans for reservoir properties at a rate of two planned reservoirs annually. In addition, TVA would continue partial implementation and associated environmental compliance for the existing Unit Plans on approximately 18,000 acres of TVA-managed lands. TVA would solicit public input on the revisions and updates needed for individual Unit Plan areas.

TVA Natural Heritage Database — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would conduct those activities described under Alternatives A and B and expand the number of data users for environmental review and planning purposes.

TVA Wetlands Database — TVA would continue to maintain its wetlands database.

Public Outreach Programs

Archaeological Outreach (Thousand Eyes Program) — This program has been identified under the blended managed grouping in the NRP. TVA would, at a minimum, conduct

those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would sponsor five to 10 outreach programs per year. The Thousand Eyes Program would be expanded to include partnerships with other agencies, SHPOs, tribal governments, and other interested organizations to increase efforts in reaching those audiences with a need for greater public outreach. A goal would be to establish between three and five partners to support this program.

Corporate History Program — This program has been identified under the blended management grouping in the NRP. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. This program would actively promote TVA's history and would continue ongoing efforts to document the Agency's past. Programmatic activities, such as an agency Oral History Project and the creation of a TVA History Web site, would be instituted as part of this program. In addition, regular updates to TVA's timeline would occur.

Environmental Education Program — This program has been identified under the blended management grouping in the NRP. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would develop an EE Program and would establish close partnerships and participation with various stakeholder groups and agencies. The TVA cultural and natural resource story would be "taken on the road" to inform audiences about TVA's efforts and actions toward preserving, managing, and conserving the Valley cultural and natural resources. Additionally, extensive interactive Web sites would be developed highlighting TVA's cultural and natural resource activities.

TVA would communicate to various audiences the successful techniques and methodologies for sound cultural and natural resource management. Examples of TVA's commitment to preserving, managing, and conserving the cultural and natural resources and dissemination of the success stories may include TVA's nationally recognized Natural Heritage Program, efforts to restore globally rare plant and animal communities, forestry and wildlife improvement practices, dispersed recreation evaluation methodology and mitigation, and archaeological site protection and preservation. Furthermore, TVA staff would conduct 100 outdoor clinics per year to teach outdoor skills along with an expansion of interpretive programming such as nature walks and wildflower pilgrimages.

In addition, TVA would seek opportunities to create a museum that features the Valley's cultural history, legacy, and natural environment. The museum would contain displays of TVA's archaeological collections; the natural and human history of the Valley (including presettlement, settlement, and modern eras); the conceptual vision and implementation of TVA as an agency; TVA construction projects; TVA's contributions to national and international interests; and infrastructure, defense, and natural resource preservation and conservation.

Natural Resources Communication — This program has been identified under the blended management grouping in the NRP. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would develop and implement this new program as described in Section 2.1.4.

Volunteer Program — Under this alternative, TVA would implement this new program as described in Section 2.1.4.

Sensitive Biological Resources Management
Conservation Planning — TVA would conduct those activities as defined under Alternative B.

Endangered and Threatened Species Program — TVA is required under Section 7(a)(2) of the ESA to consult with the USFWS concerning the potential for projects proposed by TVA or subject to approval by TVA (i.e., land use agreements and approvals under Section 26a of the TVA Act) to affect endangered species. This is a nondiscretionary obligation of TVA as a federal agency. TVA would also continue those activities as described under Alternatives A, B, and C.

Migratory Birds Management — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Natural Areas Program — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA would continue to conserve 154 ecologically and visually sensitive areas while monitoring 33 percent of TVA's natural areas annually. TVA would develop programmatic guidelines for the natural areas program. These guidelines would provide a road map for how TVA would implement the functional elements of a comprehensive program: inventory and designation, management, research, monitoring and data management, and education and communication. TVA would promote the natural areas program by actively participating in national natural areas conferences and regional natural areas advisory committees.

Evaluation criteria would be established for the designation of natural areas outside of the existing reservoir lands planning process, and 5,000 acres of high-priority areas would be evaluated annually for potential inclusion in the program. Management plans would be developed and implemented on 15 of the 154 natural areas annually until all areas are operating under an implementation plan. Stewardship needs would be implemented as identified through monitoring, management plans, and opportunistic observations. All TVA natural areas' records would be updated to include appropriate information (including spatial data) using national standards and methodologies.

Wetland Management — TVA would continue to comply with the CWA and EO 11990 (Protection of Wetlands) through its environmental review process.

Terrestrial Habitat Management
Agricultural and Open Lands Management — TVA would conduct those activities as defined under Alternative A.

Dewatering Projects Management — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be

implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Forest Resource Management — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

Forest resource management activities include protection and management of resources to provide watershed protection benefits, biodiversity, wildlife habitat, scenic quality, carbon sequestration, forest products, and opportunities for recreation. Some examples of activities include mitigation of tree hazards, damage rehabilitation (insect, disease, wildfire, weather, conservation practices, vegetation management, and invasive plant control), small-scale salvage operations, and associated land management activities (such as vegetative encroachments and unauthorized off-highway vehicle damages).

TVA would cooperate with local, state, and federal agencies, universities, and other stakeholders to monitor emerging forestry trends and issues. TVA would conduct basic forest protection activities, including cooperating with state and local agencies to address common management issues. TVA would implement selected vegetation management activities (such as creation of early successional habitat) primarily to improve wildlife habitat diversity in coordination with state wildlife action plans.

TVA would maintain a fully qualified fire management crew supporting prescribed fire needs on TVA-managed lands. In emergencies, qualified members would be released from their primary job functions to suppress wildfires on TVA-managed lands and support interagency efforts on fires, natural disasters, or other emergencies.

Nonnative Invasive Plant Management — TVA would conduct those activities as defined under Alternative B.

Nuisance Animal Control — TVA would conduct those activities as defined under Alternative B.

Wildlife Habitat Enhancement Partnerships — TVA would conduct those activities as defined under Alternative B.

Advanced Management Programs

Cultural Resources Management

Archaeological Resources Protection Act Program — TVA Police would continue their efforts with the ARPA investigators focusing on expanding the program to include additional officers and support for greater coverage of archaeological resources on TVA-managed lands. TVA would strive to conduct ARPA inspections with between 2,500 and 5,000 security checks per year. TVA would continue ARPA permitting and protect archaeological information. Lastly, the Agency would develop codified regulations to supplement its investigative authority.

Archaeological Site Monitoring and Protection — TVA would conduct those activities as defined under Alternative C.

National Historic Preservation Act Section 106 Compliance — TVA would conduct those activities as defined under Alternative C.

Native American Tribal Consultation — TVA would continue to participate in the required activities as defined under Alternative B. However, TVA would support more frequent tribal consultation workshops (every two to three years) to improve relationships and partnerships on the management of archaeological resources on TVA-managed lands.

Preservation Program — TVA would conduct those activities as defined under Alternative C.

Preserve America — TVA would continue those activities discussed under Alternative B. In addition, TVA would develop partnerships with communities, local governments, or other entities to promote heritage tourism and economic development incorporating TVA-managed historic properties in a manner that benefits both the resource and the public. TVA would target to develop between one and five new partnerships per year to promote heritage tourism.

Dispersed Recreation Management
TVA would conduct those activities as defined under Alternative C.

Leave No Trace — TVA would continue to participate in the program with the option of emphasizing its partnership and promotion of LNT Outdoor Ethics on educational material.

Trails Management — TVA would formally design and implement a trails program to inventory and assess approximately 90 miles of trails on TVA-managed lands. Any backlog of maintenance activities would be addressed. In addition, TVA would add between 10 and 20 miles of trails annually or other appropriate mileage in accordance with proposed dispersed recreation multiyear plans.

Land Stewardship Assessment Tools
Boundary Maintenance — TVA would conduct those activities as defined under Alternative C.

Land Conditions Assessment and Land Stewardship Maintenance Needs Checklist — TVA would conduct those activities as defined under Alternative C.

Natural Resource Management Implementation Plans — TVA would conduct those activities as defined under Alternative C.

TVA Natural Heritage Database — TVA would conduct those activities as defined under Alternative C.

TVA Wetlands Database — TVA would conduct those activities as defined under Alternative C.

Public Outreach Programs
Archaeological Outreach (Thousand Eyes Program) — TVA would continue to conduct public outreach activities as defined in Alternative C.

Corporate History Program — TVA would conduct those activities as defined under Alternative C.

Cultural Resources Partnerships — TVA would conduct those activities as defined under Alternative C.

Natural Resources Communication — TVA would develop and implement this new program as described in Chapter 2.

Resource Stewardship Campaigns — TVA would conduct those activities as defined under Alternative C.

Sensitive Biological Resources Management
Conservation Planning — TVA would conduct the activities or portions of the activities as defined under Alternative C.

Natural Areas Program — TVA would conduct those activities as defined under Alternative C.

Wetland Management — TVA would conduct the activities or portions of the activities as defined under Alternative C.

Terrestrial Habitat Management
Agricultural and Open Lands Management — TVA would conduct the activities or portions of the activities as defined under Alternative C.

Forest Resource Management — TVA would conduct those activities as defined under Alternative C.

Nonnative Invasive Plant Management — TVA would target NNIP-control activities to locations where impacts to sensitive resources are occurring and environmental commitments exist. This alternative would also focus on TVA-managed lands where NNIP species are currently outcompeting native or sensitive plant species in high-profile HPAs and other natural areas settings. This alternative would allow for control measures on between 20,000 and 40,000 acres of TVA-managed lands per year. In addition, TVA would participate in SE-EPPCs along with regional early detection and rapid response initiatives.

Nuisance Animal Control — TVA would conduct those activities as defined under Alternative C.

Terrestrial Greenhouse Gas Sequestration Management —TVA would pursue carbon offset projects on up to 500 acres of TVA-managed lands for research purposes to build institutional knowledge of terrestrial carbon sequestration programs. TVA would also have a goal of entering into up to eight consortiums focusing on issues related to terrestrial GHG management. TVA would seek up to six demonstrations that meet the following objectives: gaining further understanding of establishing a baseline for inventory purposes; adapting forestry BMPs to increase carbon sequestration; and working with third-party contractors to ensure emissions reductions are real, permanent, additional, measurable, and verifiable in order to obtain fungible offsets. Demonstration projects typically focus on increased vegetation management, nutrient management, and selective harvesting while ensuring

habitat preservation. These projects would be limited to areas allocated for natural resource conservation to ensure sensitive areas are not disturbed.

Wildlife Habitat Council/Third-Party Certifications — TVA would continue the management of the four projects currently certified by the WHC on TVA-managed lands. These projects are focused on basic wildlife habitat enhancement activities. TVA would also initiate new wildlife enhancement activities at between three and five locations on TVA-managed lands while incorporating third-party project review and certification. In addition, TVA would establish a third-party review and certification process for wildlife management activities on 10 percent of appropriate TVA-managed lands annually. Sites would be selected based on interest, land base availability, new methodologies (e.g., habitat banking for endangered species), and on-site habitat conditions amenable for enhancement activities. This would require the development of long-range habitat enhancement plans to assist with project implementation.

Wildlife Habitat Enhancement Partnerships — Through cooperative partnerships, TVA would improve wildlife habitat on between 1,000 and 20,000 acres per year outside existing Unit Plan implementation commitments. TVA would engage other federal and state agencies who currently have TVA-managed lands licensed for wildlife habitat management to assess improvement activities designed to align with habitat diversity efforts as outlined in the Environmental Policy. Furthermore, a goal would be established to foster these efforts on approximately 20,000 acres per year of TVA-managed lands. In addition, TVA would further integrate other resource areas to ensure compliance with laws as they relate to habitat management areas under agreement to other agencies. Integration with other resource areas would occur to ensure compliance with laws and policies. Moreover, a Valleywide partnership agreement for use with resource management partners would be developed.

TVA would also establish an initiative with federal and state wildlife agencies to address landscape conservation needs around natural resources in the region. Objectives outlined in state wildlife action plans and federal initiatives would be incorporated into TVA wildlife management initiatives, where appropriate.

3.2.4.2. Recreation Management

In addition to the programs and activities listed below, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process. Approximately 21,200 acres of land have been recommended for future consideration for recreational development. Of the total, approximately 19,100 acres are currently committed under existing contractual agreements, leaving approximately 2,100 acres currently available for development. TVA would continue to entertain proposals for the development of commercial or public recreation facilities on these remaining lands and manage existing contractual agreements.

Custodial and Blended Management Programs

Campground Management

TVA would continue to collaborate with community and commercial campground operators to assist with providing quality campground facilities on TVA-managed lands. Examples of this assistance are described under Alternative A.

This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort.

TVA-Managed Campgrounds Located on Dam or Power Plant Reservations — TVA would conduct those activities as defined under Alternative C.

TVA-Managed Campgrounds Located on Other Reservoir Properties — TVA would transition the management of three campgrounds to contractual agreements. TVA would require campground operators to meet relevant health, safety, and environmental protection standards and make proactive upgrades consistent with ADAAG. TVA would also have the option of conducting the upgrades on a portion of the campgrounds. However, in the circumstance where a contractual agreement could not be reached, TVA would close that particular campground or group of campgrounds.

Day Use Areas Management
TVA would operate and manage the 63 day use areas located across the Valley. TVA would target to proactively upgrade up to two day use areas consistent with ADAAG per year. Additional initiatives to enhance day use areas would include innovative conservation and sustainability designs. Specifically, TVA would implement sustainable initiatives at up to two day use areas per year. The day use areas would be designed to complement the surrounding natural resources. TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities.

Stream Access Sites — TVA would conduct those activities as defined under Alternative B.

Public Outreach Programs
Annual Tours — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would host up to four annual media and technology transfer tours of campgrounds and day use recreational areas where emerging technologies would be featured and showcased.

Foundation and Trust Fund — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would establish the F&TF to leverage funding for conservation and/or recreation projects across the Valley.

Recreation Information Management — TVA would continue those activities described under Alternative B.

Recreation Assessment and Design Tools
Other than the specific types of data collection mentioned in this subsection, TVA would not actively engage in recreational data management.

Boating Density Assessments — TVA would conduct those activities as defined under Alternative A.

Developed Recreation Inventory and Surveys — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would maintain an up-to-date inventory of all public, private, and quasi-public recreational facilities on or near shoreline properties. The inventory would be updated on a two-year rotating basis. The updates would include basic and noncyclical visitor use and satisfaction surveys, assessments of recreational facilities/areas conditions, and campground evaluations. TVA would also conduct field reconnaissance of nontargeted recreation facilities located on TVA-managed lands to ensure ongoing compliance with regulations. TVA shares recreational information and provides technical support to other agencies and stakeholders as requested.

Recreation Design Principles — TVA would conduct those activities as defined under Alternative B.

Recreation Planning, Assistance, and Technical Support — TVA would conduct those activities as defined under Alternative B.

Advanced Management Programs

Campground Management
TVA-Managed Campgrounds Located on Other Reservoir Properties — TVA would conduct those activities as defined under Alternative C.

Day Use Areas Management
TVA would operate and manage the 63 day use areas located across the Valley. TVA would target to proactively upgrade four day use areas consistent with ADAAG per year. Additional initiatives to enhance day use areas would include innovative conservation and sustainability designs. Specifically, TVA would implement sustainable initiatives at four day use areas per year. The day use areas would be designed to complement the surrounding natural resources.

Blueways —TVA would establish a goal of developing between two and four access areas per year to facilitate blueway miles contingent upon available partnerships.

Greenways — TVA assists and collaborates with stakeholder groups in support of greenway development, as requested. Under this alternative, however, TVA would invest in greenway development, and this investment would be contingent on partnerships. TVA would dedicate cost-share funding on greenway projects and strive to add between 10 and 20 greenway miles per year via established partners.

Stream Access Sites — Of the 81 stream access sites owned by TVA, approximately 50 sites are managed under contractual agreements. TVA would continue to operate and manage the remaining 31 stream access sites. However, TVA continually evaluates contractual agreements for the future management of these facilities along with the potential closure of these facilities.

TVA would implement initiatives to enhance sustainability of stream access areas. Specifically, TVA would implement improvements at between 15 and 31 stream access sites. The stream access sites would be designed to complement the surrounding natural

resources. Guided by regional recreational data or as appropriate, TVA would assist partners with acquisition and development of four to six additional stream access sites.

Public Outreach Programs
Annual Tours — TVA would host up to six annual media and technology transfer tours of campgrounds and day use recreational areas where emerging technologies would be featured and showcased.

Clean and Green Campground Initiative — TVA would develop and implement the C&GCI, a voluntary program developed and implemented by TVA and partners to promote environmentally responsible campgrounds and camping practices.

Recreation Information Management — TVA would conduct the activities or portions of the activities as defined under Alternative C.

Recreation Management Regulations — TVA would conduct the activities as defined under Alternative C.

Resource Rangers — TVA would conduct the activities as defined under Alternative C.

Recreation Assessment and Design Tools
Other than the specific types of data collection mentioned in this subsection, TVA would not actively engage in recreational data management.

Boating Capacity Studies — TVA would partner with state boating law administrators to complete one to two comprehensive boating capacity studies per year.

Developed Recreation Inventory and Surveys — TVA would maintain an up-to-date inventory of all public, private, and quasi-public recreational facilities on or near shoreline properties. The inventory would be updated on an annual basis. The updates would include basic and noncyclical visitor use and satisfaction surveys, assessments of recreational facilities/areas conditions, and campground evaluations. TVA would also conduct field reconnaissance of nontargeted recreation facilities located on TVA-managed lands to ensure ongoing compliance with regulations. TVA shares recreational information and provides technical support to other agencies and stakeholders as requested.

Recreation Planning, Assistance, and Technical Support — In addition to those activities defined under Alternative B, TVA would provide technical support to other agencies and stakeholders and share recreation information, as appropriate.

3.2.4.3. Reservoir Lands Planning

Under Alternative D, TVA's implementation of reservoir lands planning would reflect the same strategies, land use zone definitions, and ranges in allocations as described under Alternative C.

3.2.4.4. Water Resource Management

TVA would measure the success of the programs implemented under this alternative by tracking products delivered to stakeholders and quantifying reductions in pollutant loads. The success of the Water Resource Improvement Campaigns would be measured by the reduction in sediment and phosphorus reaching streams and reservoirs. TVA's methodology for measuring reductions in pollutant loads is presented in Appendix I.

Custodial and Blended Management Programs

Aquatic Monitoring and Management
Stream and Tailwater Monitoring — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Partnership Programs
Strategic Partnership Planning — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Public Outreach Programs
Tennessee Valley Clean Marina Initiative — TVA would conduct those activities as defined under Alternative B.

Water Resource Outreach Campaign — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Water Resource Improvement Programs
Reservoir Shoreline Stabilization Program — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Targeted Reservoir Initiative — This program has been identified under the blended management grouping in the NRP. TVA would, at a minimum, conduct those activities defined under Alternative B. As discussed in Section 3.2.4, this program could be implemented with a greater level of effort. TVA would conduct those activities as defined under Alternative C.

Water Resource Improvement Campaign — TVA would conduct those activities as defined under Alternative B.

Advanced Management Programs

Aquatic Monitoring and Management
Aquatic Ecology Management — TVA would conduct those activities as defined under Alternative C.

Partnership Programs
Case Studies and Research Initiatives — TVA would undertake two or three case studies or research projects annually.

Public Outreach Programs
Tennessee Valley Clean Marina Initiative — The TVCMI would maintain certification for 80 marinas and seek certification for one or two new marinas per year.

Water Resource Improvement Programs
Targeted Watershed Initiative — TVA would follow the existing processes to identify priority watersheds for inclusion in the TWI Program. Similar to Alternative A, the TWI Program would be applied to the Tennessee River watershed in its entirety. The short-term goals of the TWI Program related to water resource improvements would be to reduce pollutant loads to streams and reservoirs by up to 1,300 tons of suspended sediment and 2,000 pounds of phosphorus per year. The long-term goal of the TWI Program would be to improve one HU within three to five years. The goal of the TWI Program related to public outreach is to deliver between 50 and 75 stakeholder products per year. The types of stakeholder products would be consistent with those described under Alternative A.

Water Resource Grant Program — TVA would conduct those activities as defined under Alternative C.

Water Resource Improvement Campaign — The Water Resource Improvement Campaign Program would provide technical support and project implementation to promote water resource improvement and protection. These campaigns would include such things as focusing efforts to improve riparian and streamside management, developing and promoting blueways, improving water resources on TVA-managed lands, and/or raising public awareness of water resource management. The Water Resource Improvement Campaign Program would have an annual goal of implementing demonstration projects that would reduce pollutant loads reaching streams and reservoirs by up to 1,080 tons of sediment and up to 1,650 pounds of phosphorus.

3.3. Other Program Options Considered

3.3.1. Other Biological and Cultural Resources Program Options Considered

The following options were dismissed from detailed evaluation in this EIS because they do not align with the Environmental Policy nor substantially fulfill the project's purpose and need.

Forest and Terrestrial Greenhouse Gas Management Focus
TVA would only conduct those programs and activities associated with forestry management while seeking opportunities for terrestrial GHG sequestration. In addition, TVA would continue to implement those programs and activities to maintain or improve the health of TVA-managed lands. The TVA-managed lands allocated for natural resource management conservation and sensitive resource management via the reservoir lands planning process would be utilized to implement this option. TVA would only conduct the programs relating to biological and cultural resources management that are required by laws and regulations, and the programs associated with recreation and water resource management would not be implemented.

TVA Dispersed Recreation and Wildlife Habitat Management Focus
TVA would only implement those programs and activities associated with sustainable practices in dispersed recreation and promotion of ecological diversity and wildlife habitats on TVA-managed lands while balancing the protection of cultural, heritage, and ecological resources. In addition, TVA would continue to implement those programs and activities to

maintain or improve the health of TVA-managed lands. The TVA-managed lands allocated for natural resource management conservation and sensitive resource management via the reservoir lands planning process would be utilized to implement this option. TVA would only conduct the programs relating to biological and cultural resources management that are required by laws and regulations, and the programs associated with recreation and water resource management would not be implemented.

3.3.2. Other Recreation Program Options Considered

The following options were dismissed from detailed evaluation in this EIS because they do not align with the Environmental Policy nor substantially fulfill the project's purpose and need.

Sunset Management of Recreation Facilities
Under this program option, TVA would conclude all of the programs and activities described in Chapter 2. Those contractual agreements relating to recreation management would be honored per the terms of the agreement(s). The recreation facilities managed by TVA would be closed, and the programs would be terminated.

Transition TVA-Managed Recreational Facilities
Under this option, TVA would transfer or seek contractual agreements for all recreational facilities and programs as described in Chapter 2. In the circumstance where a transfer or contractual agreement could not be reached, TVA would close the facilities and/or conclude the program.

3.3.3. Other Water Resource Program Options Considered

The following option was dismissed from detailed evaluation in this EIS because it does not align with the Environmental Policy nor substantially fulfill the project's purpose and need. .

Sunset Water Resource Improvements
The scope of the Water Resource Management portion of this EIS has been limited to those discretionary programs or activities implemented by TVA to improve reservoir and watershed water quality proactively. Under this option, TVA would conclude all of the programs described in Chapter 2. Those contractual agreements relating to water resource improvements would be honored per the terms of the agreement(s).

3.4. Other Alternatives Considered

TVA created three alternatives based only on information from the scenario planning process. Each of these alternatives contained a similar blend of programs, and TVA anticipated that the potential impacts to the environment would be relatively similar among the alternatives. Furthermore, the alternatives did not reflect the Agency's desire to include additional programs that align with future priorities. Therefore, these alternatives were discarded from detailed analysis.

Conservation Management Focus
Under this alternative, TVA would focus on implementing the programs associated with biological and cultural resources management. Certain recreational facilities would be managed under contractual agreements or would close. TVA would only implement water resource management programs when a benefit to biological and cultural resources could be realized.

Recreation Management Focus
Under this alternative, TVA would focus on implementing the programs that result in improvements to recreation facilities and resources. The programs relating to biological and cultural resources management would only be conducted if they are required by laws and regulations, and water resource management programs would only be implemented when a benefit to recreational resources could be realized.

3.5. Comparison of Alternatives

Regardless of the alternative selected, some resources would not be directly adversely or beneficially affected by the NRP, while other resources would likely be directly or indirectly affected in a minor way or to some small to moderate degree across the range of alternatives. The relative impacts for each resource area are shown in figures throughout Chapter 5. The potential impacts to floodplains, navigation, air quality, and climate would be relatively similar under all alternatives.

It is estimated that Alternative C would create the greatest potential beneficial impacts for the following resource areas: recreation, natural areas, wildlife, wetlands, water quality, listed aquatic species, listed terrestrial species, cultural resources, land use, prime farmland, socioeconomics, and environmental justice. Alternative D would create the greatest potential beneficial impacts for visual resources, listed plant species, and vegetation. Alternative A would create the least potential beneficial impacts for the following resource areas: natural areas, vegetation, wildlife, wetlands, listed aquatic species, listed terrestrial species, listed plants, cultural resources, land use, prime farmland, and visual resources. Alternative B would create the least potential beneficial impacts for environmental justice, socioeconomics, water quality, and recreation. Table 3-10 provides a comparison of resources and explains how each alternative could affect the resource. Relative benefical impacts to the resource are shown in figures in Chapter 5.

Table 3-10. Summary of Potential Effects by Alternative

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
Developed Recreation	Beneficial impacts but insufficient effort meet recreation demand	Growing gap in meeting recreation demand	Increase in the quality and quantity of recreation opportunites	Similar to Alternative A
Dispersed Recreation	Negative impact due to increased pressure on natural resouces	Beneficial impact in meeting recreation demand and managing impacts	Provides the most beneficial impact in meeting recreation demand and managing impacts	More beneficial than Alternative B but less than Alternative C
Natural Areas	Slightly adverse impacts due to lack of active management	Less adverse than Alternative A	Beneficial impacts due to proactive management	Less beneficial than Alternative C

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
Terrestrial Ecology — Plants	Negative Impacts anticipated due to spread of nonnative invasive plants (NNIPs)	Beneficial impact due to increase in NNIP management	Provides the greatest beneficial impact due to increase in NNIP management	Less beneficial than Alternative C
Terrestrial Ecology — Wildlife	No adverse impacts			
Wetlands	No significant impacts		Beneficial impacts due to identification, protection, and restoration efforts	Provides the greatest beneficial impacts
Water Quality	Beneficial impacts due to the Water Resource Management programs	Adverse impacts due to the reduction in Water Resource Management programs	Provides the greatest beneficial impacts	More beneficial than Alternative B but less than Alternative C
Aquatic Ecology	Beneficial impacts due to ongoing stewardship management	No significant impacts	More beneficial than Alternatives A and B	Provides the greatest beneficial impacts
Endangered and Threatened Species	No impacts to listed aquatic species and terrestrial animal species; impacts to listed plant species due to the spread of NNIPs			
Cultural Resources	Potential negative impacts to historic properties with the exception of programs associated with Archaeological Resources Protection Act	Less negative impacts than Alternative A	Greatest beneficial impacts due to proactively promoting protection and preservation of resources	More beneficial than Alternatives A and B but less than Alternative C
Land Use	Slightly adverse impacts due to lost opportunities for recreation and natural resource protection	Greatest potential for adverse impacts	Provides the least potential for adverse impacts	Similar to Alternative C
Prime Farmland	Beneficial impacts due to biological and cultural resources programs	Greater beneficial impacts than Alternative A	Greatest beneficial impacts	More beneficial than Alternatives A and B but less than Alternative C

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
Visual Resources	Reduction in the scenic attraction of TVA-managed lands	Increasingly beneficial impact in the scenic attraction of TVA-managed lands	Most beneficial impact in the scenic attraction of TVA-managed lands	Similar to Alternative C
Floodplains	Negligible loss of flood control and power storage			
Socioeconomics and Environmental Justice	No impacts	Small negative impacts to the economy and quality of life	Positive impacts to the economy and quality of life	Less beneficial than Alternative C
Navigation	Minimal impacts to commercial navigation			
Air Quality	No negative impacts			
Climate	No impacts			

3.6. The Preferred Alternative

TVA's Preferred Alternative for the NRP is Alternative D. The programs described within tier one of Alternative D would result in overall beneficial impacts to the environment while providing TVA with a concise focus for implementing stewardship programs and activities over the next 20 years. Alternative D also provides TVA with the flexibility to increase the number of active stewardship programs and activities should opportunities and/or resources become available. If these opportunities and/or resources become available, the potential benefits and impacts to the environment would approach those of Alternative C.

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CHAPTER 4

4.0 AFFECTED ENVIRONMENT

The existing conditions of various environmental resources that could be affected by implementation of the proposed NRP are described in this chapter. Because of the nature of this project, TVA has determined that adoption of the No Action or any Action Alternative would not result in waste stream generation or alteration involving solid or special wastes. Likewise, TVA has determined there would be no impacts to noise or traffic.

4.1. Recreation

For the purpose of this EIS, the recreation resources discussion focuses on facility-based recreation on the lands within the TVA region and primarily on those recreation areas/facilities owned and operated by TVA. Various types of public, commercial, and TVA recreation areas and facilities are associated with TVA-managed lands and reservoirs in the region. TVA regionwide estimates for facility types are listed below in Table 4-1. The information in this table was taken from the seven Valley states' comprehensive outdoor recreation planning data. It is anticipated that the TVA region would also be impacted by the 20-year growth in population as discussed in Section 4-12 (Socioeconomics and Environmental Justice).

Table 4-1. Recreation Facilities Located Within the TVA Region

Facility Type	Number in TVA region	Number of TVA-Managed Facilities	Percent of Facilities Located in the Region and Managed by TVA
Picnic tables	4,000	400	10
Pavilions	400	16	4
Trail miles	1,100	90	8
Fish berms/piers	250	25	10
Swimming beach	150	12	8
Swimming/splash pools	150	0	0
Playgrounds	400	6	2
Play courts	400	6	2
Golf	50	0	0
Amusement parks	65	0	0
Visitor centers	40	9	23
Overlooks	75	22	29
Museums	40	0	0
Campsites with water and electric hookups	18,000	270	2
Campsites without water and electric hookups	5,000	400	8
Boat ramps	1,200	49	4
Boat ramp parking	24,000	1,200	5
Wet boat slips	35,000	0	0
Dry boat slips	5,000	0	0
Stream access sites	200	81	41

Recreation demand is driven by population levels, recreation participation rates, changing preferences for different types of recreation, and innovations in recreation equipment. Analysis of the current U.S. Census data provides estimates over the next 20 years of

population increases of between 18 and 19 percent for the TVA region. Assuming that current participation rates remain relatively constant, recreation demand is anticipated to grow in direct proportion to the population. In addition, public use of TVA-managed lands, shoreline, and waterways to fill the recreation demand would increase. TVA currently has around 19,600 acres committed to helping fill demand for facility-based recreation. If TVA chooses to assist in filling the projected increase in recreation demand over the next 20 years, it would require an additional commitment of around 3,500 to 3,600 acres and increased development of facilities and infrastructure by between 18 and 19 percent to complement the current ratio as listed in Table 4-1 and Section 4-12. TVA currently provides around 5 to 10 percent of the public recreation facilities in the region, and TVA could choose to operate in that range over the next 20 years.

Presently, TVA provides land use agreements in support of 164 campground and 135 marina operations on TVA-managed lands with a total of around 350 campgrounds and 190 marinas in the region. Assuming that most facilities are operating at or close to their capacity, there would need to be an overall increase of an additional 63 to 67 campgrounds and 34 to 36 marinas to provide for recreation needs over the next 20 years.

TVA would continue to provide land use agreements for public and commercial recreation facilities on TVA-managed lands. Currently, TVA provides land for 24 state parks. In order to meet demand over the next 20 years, TVA would need to provide land and funding assistance for up to four additional state parks as population increases push recreation demands in the region. Probable locations for these state parks would include lands adjacent to Douglas, Watts Bar, Fontana, and Kentucky reservoirs.

TVA's current recreation strategy includes a process to ensure access to TVA's technical staff in support of recreation needs throughout the region. This process is known as the "Power Service Protocol."

4.2. Natural Areas

Natural areas occurring on TVA-managed lands include both TVA and non-TVA-managed areas and ecologically significant sites. These areas are lands set aside for a particular management objective or lands that are known to contain sensitive features or resources (TVA 2002e). For example, TVA has set aside lands for protection and enhancement of sensitive resources and other features important to the area viewscape or natural environment (TVA 2010b). These lands are also managed for the enhancement of natural resources for human use and appreciation. Recreational activities, such as hunting, wildlife observation and camping on undeveloped sites, may occur in these areas. However, the overriding focus of the natural area is protecting and enhancing the sensitive resources. Natural areas may provide habitat for nationally or regionally rare species, contain exemplary biological communities and geological and important scenic features, and provide opportunities for ecological research, EE, or high-quality, nature-oriented recreation.

TVA-managed natural areas (Figure A-9, Appendix A) include SWAs, HPAs, ecological study areas, and WOAs and are defined in the following paragraphs. TVA manages these areas to restrict activities that might alter or destroy significant natural elements. TVA conducts specific management activities that are suitable for a particular natural area designation (TVA 2002e). Examples of management activities are listed in Section 2.1.5. There are 31 TVA SWAs located throughout the TVA region (Figure A-9, Appendix A). SWAs are locations with exceptional natural, scenic, or aesthetic qualities suitable for low

impact public use, where appropriate development is undertaken (e.g., foot trails, signs, parking areas, backcountry campsites), providing recreational opportunities for the public while also protecting and enhancing natural resources. SWAs require on-site assessments for determination of the natural areas' condition and maintenance needs to ensure that management objectives are met and the integrity of the SWA and sensitive resources protected are intact.

There are 111 TVA HPAs (Figure A-9, Appendix A). HPAs are natural areas established to protect populations of species that have been identified as threatened or endangered by the USFWS or that are rare in the state in which they occur. Unusual or exemplary biological communities or unique geological features also receive protection by placement in this category. HPAs require on-site assessments for determination of the natural areas' condition, status of plant and animal species' population and vitality, and maintenance needs to ensure that management objectives are met and the integrity of the HPA and sensitive resources protected there are intact.

There are five TVA ecological study areas (Figure A-9, Appendix A). The ecological study areas consist of locations suitable for ecological research or EE. These areas are usually large enough to allow establishment of both experimental and control research plots. These areas typically contain plant or animal populations of scientific interest or are usually located near an educational institution that will utilize and manage the area. Ecological study areas require on-site assessments for determination of the natural areas' condition, status of plant and animal species' population and vitality, and maintenance needs to ensure that management objectives are met and the integrity of the ecological study area and sensitive resources protected there are intact.

There are six TVA WOAs (Figure A-9, Appendix A). The WOAs have concentrations of watchable wildlife (e.g., shorebirds, songbirds, and waterfowl) and typically are found in drawdown zones, dam reservations, urban wetlands, and bluffs. They are typically established in cooperation with TWRA's Watchable Wildlife Program. WOAs require on-site assessments for determination of the natural areas' condition and maintenance needs to ensure that management objectives are met and the integrity of the WOA and resources located there are intact.

There are 229 natural areas and ecologically significant sites occurring on or adjacent to TVA-managed lands under contractual agreements with other agencies for management purposes (Figure A-10, Appendix A). The status of these non-TVA-managed natural areas may change periodically pending renewal of the contractual agreement. The map represents larger boundaries of entire natural areas or portions of natural areas located on or partially within TVA-managed lands, and therefore, these areas may appear to be located off TVA-managed lands. These non-TVA-managed areas consist of state parks, local city parks, county parks, state and national trails, state natural areas, potential and existing national natural landmarks, state wildlife management areas, national wildlife refuges, nationwide rivers inventory streams, research natural areas, camps, state and national forests, mussel sanctuaries, fish hatcheries, historical areas, cultural areas, greenways, and WOAs.

There are an additional 2,379 non-TVA-managed natural areas and ecologically significant sites throughout the TVA region not occurring on TVA-managed lands. These additional non-TVA natural areas are not within the scope of this project.

Ecologically significant sites are areas that have some ecological or scenic significance occurring on or immediately adjacent to TVA-managed lands. However, these areas are not necessarily managed by TVA. Several criteria constitute designation as an ecologically significant site. For example, significance is representative of locations containing the following:

- Species that are listed or proposed for listing as endangered or threatened by the USFWS
- Species listed as endangered, threatened, or otherwise sensitive by any of the seven Valley states
- Unique or exemplary geological or scenic features and biological communities

Most of these areas have approximate boundaries and include designated critical habitats, potential national natural landmarks, nonessential experimental population status areas, colonial bird nesting areas, champion trees, and other areas deemed ecologically significant. Some of these locations may have a steward responsible for active or passive management of the site.

4.3. Terrestrial Ecology

4.3.1. Vegetation

For the purpose of this EIS, the terrestrial ecology discussion has been based on the lands within the TVA region. The TVA region encompasses nine ecoregions as illustrated in Figure 4-1 and adapted from Omernik (1987). The terrain across the Valley is diverse 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, which house 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, and based on current data (Dyer 2006), three forest regions and two subregions are recognized (Figure A-11, Appendix A). These forest determinations were based on data obtained from more than 100,000 forest inventory and analysis plots on both private and public lands in the eastern U.S. and monitored by the USFS.

Ecoregions

The nine ecoregions 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 easternmost part of the TVA region is in the Blue Ridge ecoregion, an area composed of remnants of an ancient mountain chain. This region has a greater variation in terrain than other regions in the Valley. Terrain ranges from nearly level along floodplains to rugged mountains that reach elevations of more than 6,000 feet. The southern Blue Ridge ecoregion is one of the richest centers of biodiversity in the eastern U.S. and one of the most floristically diverse (Griffith et al. 1998). The land cover in this ecoregion is dominated (80 percent) by mesophytic forest, which includes the Appalachian oak forest, and 13.5 percent of the land cover is in the form of agriculture (Dyer 2006; USGS 2008). Within the forest regions are several significant plant communities such as the northern hardwood forests, and at the highest elevations in Tennessee and North Carolina, the southeastern spruce-fir forest. Shrub, grass, and heath balds, hemlock, cove hardwoods, and oak-pine communities are also significant. The 11 TVA reservoirs found within the Blue Ridge

ecoregion include Apalachia, Blue Ridge, Chatuge, Fontana, Hiwassee, Nottely, Ocoees 1, 2, and 3, Watauga, and Wilber.

The Ridge and Valley ecoregion is located east of the Southwestern Appalachians ecoregion and west of the Blue Ridge ecoregion. The Ridge and Valley ecoregion has complex folds and faults with alternating valleys and ridges trending northeast to southwest. Ridges have elevations of up to 3,000 feet and are generally capped by dolomites and resistant sandstones on the west sides, and valleys have developed in more soluble limestones and dolomites. The dominant soils in this province are residual clays and silts derived from in-situ weathering. Karst features such as sinkholes and springs are numerous in the Ridge and Valley ecoregion. Soils vary in their productivity, and 56 percent of the land cover is forested (USGS 2008). Mesophytic forest and Appalachian oak forest are the dominate forest regions; southern mixed forest and the oak-pine section occur in the southernmost area of the ecoregion (Dyer 2006). Land cover also includes pasture, intensive agriculture (30 percent), with 9 percent in urban and industrial areas (USGS 2008). Table 4-2 lists the TVA facilities and reservoirs located with the Ridge and Valley ecoregion.

Table 4-2. TVA Facilities and Reservoirs Located Within the Ridge and Valley Ecoregion

TVA Facilities and Reservoirs	
Beaver Creek Reservoir	Norris Reservoir
Boone Reservoir	South Holston Reservoir
Cherokee Reservoir	Tellico Reservoir
Chickamauga Reservoir	Watts Bar Reservoir
Clear Creek Reservoir	Bull Run Fossil Plant
Douglas Reservoir	Kingston Fossil Plant
Fort Loudoun Reservoir	John Sevier Fossil Plant
Fort Patrick Henry Reservoir	Buffalo Mountain Wind Farm
Melton Hill Reservoir	Watts Bar Nuclear Plant
Nickajack Reservoir	Sequoyah Nuclear Plant

The Central Appalachians ecoregion stretches from central Pennsylvania through West Virginia, Maryland, Virginia, and Kentucky, and into northern Tennessee (Omernik 1987). It is primarily a high, dissected, rugged plateau composed of sandstone, shale, conglomerate, and coal. The Cumberland Mountains of Tennessee and Kentucky are known for their rugged terrain, cool climate, and infertile soils. As a result, this limits agriculture, and most of the land cover is forested. According to USGS (2008), approximately 83 percent of the central Appalachians consist of mesophytic forests with areas of Appalachian oak forests covering the high hills and low mountains. The remaining land use is in the form of agriculture and urban or developed areas. No TVA reservoirs or power generating facilities occur within this ecoregion.

The Southwestern Appalachians ecoregion, subdivided into the Cumberland Plateau and Sequatchie River Valley, rises about 1,000 to 1,500 feet higher than the adjoining Ridge and Valley ecoregion to the east and Interior Plateau to the west. It extends about 175 miles, ranging northeast to southwest across central Tennessee. The bedrock is a sequence of near horizontal Pennsylvanian sandstones, shales, conglomerates, and coals, underlain by Mississippian and older shale and carbonates. The area underlain by the resistant Pennsylvanian sandstones has produced a “table-top” landscape. Groundwater

usually occurs in areas of shallow, sandy soils and in deeper cracks in the bedrock. At depth, the Mississippian carbonates possess mature Karst features. Sinkholes, large caves, sinking streams, and springs typify the landscape, resulting in a complex aquifer system. Rapid groundwater movement is typical. Approximately 75 percent of the land cover is mesophytic forest with 16 percent considered agricultural lands and almost 3 percent developed (USGS 2008). Guntersville Reservoir, Widows Creek Fossil Plant, Raccoon Mountain Pumped Storage Plant, and Bellefonte Nuclear Plant are in the Southwestern Appalachians ecoregion.

The Interior Plateau ecoregion is a series of grassland plateaus and forested uplands that are generally lower in elevation than the Appalachian Mountains to the east but higher than the plains to the south (USGS 2008). This ecoregion occupies much of central Tennessee and parts of Kentucky and northern Alabama. The Interior Plateau consists of the east and west Highland Rim and the Central Basin. The Highland Rim was formed from flat-lying Mississippian carbonates, and these formations constitute the most extensive aquifer in the Tennessee region. The Central Basin (Nashville Basin) is an oval area in middle Tennessee lying about 200 feet below the surrounding Highland Rim. The bedrock is carbonate rocks that are generally flat lying but are locally folded, and the soil cover is usually thin and home to a globally uncommon ecosystem, the Limestone cedar glades and barrens. The plant communities associated with the cedar glades and barrens within the Central Basin are home to 544 plant species, 448 of which are native, and of those, 21 are endemic to the glades/barrens (Baskin and Baskin 2003). The forested area of the Central Basin has closer affinities to the beech-maple-basswood forest of the Midwest than to the mesophytic forests of the other sections of the Interior Plateau. Fifty percent of the land use is in the form of agricultural practices, with 38 percent being forested and approximately 10 percent developed. Reservoirs found within the Interior Plateau include Great Falls, Normandy, Tims Ford, Wheeler, Wilson, and a portion of Kentucky. Cumberland and Gallatin Fossil Plants are found on the Cumberland River, and Colbert and Johnsonville Fossil Plants and Browns Ferry Nuclear Plant are on the banks of the Tennessee River.

Within the TVA region, a small portion of the Interior River Valley and Hills ecoregion can be found in northwest Kentucky where it is compromised of nearly level lowlands dominated by agriculture and forested hills. It is characteristically underlain by carboniferous sedimentary rock drainage conditions, and terrain strongly affects land use. Wetlands are common on lowlands and bottomlands. Bottomland deciduous forests and swamp forests were once extensive on poorly drained, nearly level lowland sites, but most have been replaced by cropland and pastureland. Hilly uplands remain mostly forested. This ecoregion includes Kentucky's western coalfields, and both underground and surface coal mining are now extensive. Siltation from mining and agriculture has increased flooding and prompted remedial channelization projects (Woods et al. 2002). Paradise Fossil Plant, located on the Green River in western Kentucky, and a portion of Shawnee Fossil Plant nearest the Ohio River occur within the Interior River Valley and Hills ecoregion.

The Southeastern Plains ecoregion, the largest ecoregion in the East, extends from near the Gulf of Mexico in the south to Maryland in the north and up to Tennessee in the west. In the TVA region, this ecoregion is found in parts of western Alabama, eastern Mississippi, and western Tennessee. The irregular, relatively flat plains of the region are covered by a mosaic of forests (51 percent), agricultural lands (22 percent), and wetlands (10 percent). Natural forests of pine, hickory, and oak once covered most of the ecoregion, but much of the natural forest cover has been replaced by heavily managed timberlands (USGS 2008). Three of TVA's combustion turbine facilities (Gleason, Caledonia, and Kemper) are found in

the Southeastern Plains ecoregion. Reservoirs include those found in the Beech River projects in west Tennessee, the Bear Creek projects in Alabama, Pickwick, and a portion of Kentucky Reservoir on the main stem of the Tennessee River.

Sandwiched between the Mississippi Valley Alluvial Plain to the west and the Southeastern Plains to the east, the Mississippi Valley Loess Plain ecoregion extends from western Kentucky south to Louisiana. The topography consists primarily of irregular plains. A highly erodible, thick layer of loess, a unique geologic deposit consisting almost entirely of wind-transported, silt-sized grains of quartz and other common minerals, is the distinguishing characteristic of this region (Omernik 1987). Forest, agriculture, and developed land account for more than 90 percent of the land cover in the ecoregion. The southern portion of the ecoregion is a mosaic of forest and cropland, and agriculture is the dominant land use in the northern portion. Trees, cotton, corn, soybeans, strawberries, and tobacco are common crops grown throughout the region (USGS 2008). The southern portion of the Shawnee Fossil Plant Reservation along with Brownsville, Lagoon Creek, and Marshall combustion turbine facilities occur within the Mississippi Valley Loess Plain ecoregion.

The Mississippi Alluvial Plain occurs along the Mississippi River floodplain on the very western edge of the TVA region. Bottomland hardwood forests and cypress swamps, also referred to as forested wetlands, are the dominant natural plant communities in this region. A key factor in the development and maintenance of these communities is their ability to survive extended periods of flooding. Much of land use within the region is agricultural, with some areas of deciduous forest. According to Griffith et al. (1998), soybeans, cotton, corn, sorghum, and vegetables are the main crops. The natural vegetation consists of southern floodplain forest (oak, tupelo, bald cypress). Allen Fossil Plant in Shelby County, Tennessee, and Southhaven Combined-Cycle Plant in Desoto County, Mississippi, both occur within the Mississippi Alluvial Plain.

Forest Regions

Based on Dyer (2006), much of the TVA region is dominated by the mesophytic forest, 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, the Appalachian oak section is a subsection, which is dominated by various species of oak: black oak, chestnut oak, northern red oak, scarlet oak, and white oak. Dyer (2006) also notes, as previously mentioned, that the area of the Nashville Central Basin has close affinities with the beech-maple-basswood forests that dominate the Midwestern U.S. Species associated with this region are American basswood, American beech, American elm, black cherry, northern red oak, sugar maple, white ash, and white oak. The oak-pine section 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. Figure 4-1 shows forest regions derived from contemporary forest data. The cross-hatching in the Nashville Basin (shown on the figure below) and the black belt region indicates inclusions within the larger forest regions—areas

with affinities to the noncontiguous region with the same color as the cross-hatching (Dyer 2006).

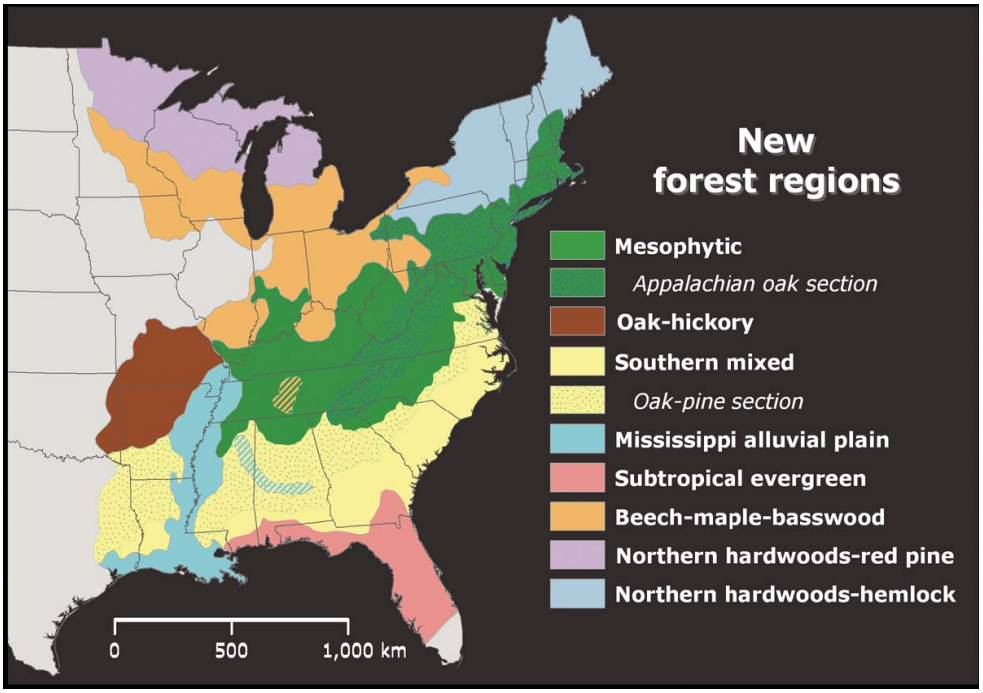


Figure 4-1. Forest Regions Derived From Contemporary Forest Data

Nonnative Invasive Plant Species

Most lands in and around the TVA region have been affected by introduced NNIP species. NNIPs are known to occur across southern Appalachian forests, accounting for 15-20 percent of the documented flora (USFS 2009). According to NatureServe (2009), NNIP species are the second-leading threat to imperiled native species. Not all nonnative species pose threats to our native ecosystems. Many species introduced by European settlers are naturalized additions to our flora and are considered nonnative noninvasive species. These “weeds” have very little negative impacts to native vegetation. Examples of these are Queen Anne’s lace and dandelion. However, other nonnative species are considered exotic invasive species and do pose threats to the natural environment. EO 13112 defines an NNIP species as any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem and whose introduction does or is likely to cause economic or environmental harm or harm to human health (USDA 2007a). Proposed changes to the regulations implementing the Noxious Weed Act were published in the *Federal Register* on June 10, 2009 (USDA 2009).

NNIPs 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. These robust plants arrived without their natural predators of insects and diseases that tend to keep native plants in natural balance. Now 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).

According to the Federal Noxious Weed List of 2006 (USDA 2007b), the supplemental list of 2009 (USDA 2009), and SE-EPPC 2008, there are five known federal noxious weeds reported from the TVA region. These species include cogongrass, giant salvinia, hydrilla, Japanese climbing fern, and tropical soda apple. In addition, SE-EPPC (2008) provides a list of nonnative invasive species that could pose potential threats to native ecosystems and human health for each southeastern state. Currently, Georgia, Mississippi, and Tennessee have developed MOUs with federal and state agencies to create Cooperative Weed Management Areas to implement an Early Detection Rapid Response Program to assist public and private landowners with controlling invasive species. All three states have developed these plans in hopes of controlling cogongrass. Cogongrass is an aggressive invader of natural and disturbed areas throughout the Southeast disrupting ecosystem functions, reducing wildlife habitat, decreasing tree seedling establishment and growth, and altering fire regimes and intensities (Evans et al. 2008). Miller et al. (2008) estimated the acres covered by 33 nonnative invasive species within the southern states. These 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 the following invasive species:

Invasive trees: tree-of-heaven (*Ailanthus altissima*), silktree or mimosa (*Albizia julbrissin*), princesstree or paulownia (*Paulownia tomentosa*), chinaberrytree (*Melia azedarach*), tallowtree or popcorntree (*Triadica sebifera*), and Russian olive (*Elaeagnus angustifolia*)

Invasive 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*), and nonnative roses (*Rosa multifora, R. bracteata,* and *R. laevigata*)

Invasive vines: oriental bittersweet (*Celastrus orbiculatus*), 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*)

Invasive grasses and canes: giant reed (*Arundo donax*), tall fescue (*Lolium arundinaceum*), cogongrass (*Imperata cylindrica*), Nepalese browntop or microstegium (*Microstegium vimineum*), Chinese silvergrass (*Miscanthus sinensis*), and nonnative bamboos (*Phyllostachys aurea,* other *Phyllostachys* spp., and *Bambusa* spp.)

Invasive fern and forbs (broadleaved plants): Japanese climbing fern (*Lygodium japonicum*), garlic mustard (*Alliaria petiolata*), shrubby lespedeza (*Lespedeza bicolor*), Chinese lespedeza (*Lespedeza cuneata*), and tropical soda apple (*Solanum viarium*)

According to the Center for Invasive Plant Management (2009), the most effective, economical, and ecologically sound approach to managing invasive plants is to prevent them from invading. Land managers often concentrate on fighting well-established infestations, at which point management is expensive, and eradication is unlikely.

Infestations must be managed to limit the spread of invasive plants, but weed management that controls existing infestations while focusing on prevention and early detection of new invasions can be far more cost-effective. Weed prevention depends on the following:

- Limiting the introduction of weed seeds
- Early detection and eradication of small patches of weeds
- Minimizing the disturbance of desirable plants along trails, roads, and waterways
- Maintaining desired plant communities through good management
- Monitoring high-risk areas such as transportation corridors and bare ground
- Revegetating disturbed sites with desired plants
- Evaluating the effectiveness of prevention efforts and adapting plans for the following year

4.3.2. Wildlife

The TVA region contains portions of nine ecoregions (see above section) providing a unique mixture of wildlife habitat. Ranging from bottomland hardwood swamps in the floodplains of the Mississippi Alluvial Plain to high elevation balds and spruce-fir/northern hardwood forests in the Blue Ridge Mountains, this diverse mixture of habitats supports a rich assemblage of wildlife communities.

Approximately 55 species of reptiles, 72 amphibians, 182 species of breeding birds, and 76 species of mammals occur in these regions throughout the TVA region (Ricketts et al. 1999, Stein 2002, Tennessee Ornithological Society 2009, TWRA 2005). Although some wildlife species have widespread distributions, others have restricted ranges unique to specific ecoregions (TWRA 2005). For example, forest habitats in the Blue Ridge Mountains provide globally significant habitat for many species, especially amphibians and land snails (Ricketts et al. 1999). The high elevations found in the Blue Ridge ecoregion also provide habitat for relict populations of animals typically found in more northern latitudes.

Wildlife Trends

Many wide-ranging species occur throughout the TVA region; most species that are tolerant to humans continue to thrive in the region. Wildlife populations have been greatly altered by loss and modification of habitats due to agriculture, mining practices, forestry practices, urbanization, and the construction of impoundments. While some species flourish under these changes, others have shown marked declines (USFWS 2008). For example, grassland and woodland-dependent birds have shown dramatic decreases in their numbers (Southern Appalachian Man and Biosphere 1996). Approximately, 48 percent of grassland breeding birds are of conservation concern, and 23 species are significantly declining in number (North American Bird Conservation Initiative [NABCI] 2009). Approximately, 22 percent of area-dependent woodland birds are of conservation concern. These numbers have declined by 10 percent through 1980 but have shown some increases in recent years (NABCI 2009). Habitats used by these species have been modified largely by urban development and agricultural practices.

In general, gulls, wading birds, waterfowl, raptors, game birds, game mammals, and nongame wildlife (reptiles, amphibians, and small mammals) exhibit stable or increasing numbers throughout the TVA region. Populations of white-tailed deer, wild turkey, coyote,

and beaver have shown significant population increases. Species associated with river corridors such as osprey, herons, and Canada geese have also shown notable recoveries, largely since the ban of dichlorodiphenyltrichloroethane (DDT). This trend is quite noticeable on the Tennessee River, as breeding populations of these species had been relatively scarce in portions of northwest Alabama or northeast Tennessee up to the late 1990s. However, in recent years, breeding populations of these species have expanded into these areas and have become more evenly distributed throughout the Valley. Recent surveys show that shorebirds and waterfowl communities are quite diverse in portions of the Valley, especially during autumn and spring migrations. However, numbers of several species of songbirds continue to decline in the region, especially those typically found in grassland or unfragmented forests.

Federal regulations and policies that apply to the terrestrial ecology in the TVA region include the Migratory Bird Treaty Act of 1918 and EO 13186—Responsibilities of Federal Agencies to Protect Migratory Birds. The Migratory Bird Treaty Act decreed that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected; however, conflicting decisions in various federal district courts indicate that this act may or may not apply to federal agencies. EO 13186 requires federal agencies implementing or planning actions that could affect migratory birds and their habitats to "support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions." The EO requires federal agencies whose actions may negatively affect migratory birds to develop MOUs with the USFWS to promote migratory bird conservation. Generally, these regulations provide for the conservation of all native birds of the U.S., except game species that are managed by states.

TVA-Managed Lands

While TVA manages lands across the region, most TVA-managed lands are concentrated around its reservoirs. Habitats on TVA-managed lands are just as complex as other lands found throughout the TVA region, supporting diverse communities of wildlife. Important habitats found in the Valley include riparian corridors, bluffs, swamps, grasslands, rivers, reservoirs, islands, large unfragmented forested landscapes, and karst habitats.

Riparian habitats associated with the Tennessee River and its tributaries provide important habitats for wildlife. Coupled with unique features such as vernal pools, oxbows, bluffs, and islands, these areas provide a diverse array of nesting and foraging habitats for wildlife.

Open lands are comprised of old-field, pasture, agricultural, and other early successional habitats. Most of these areas have been greatly modified by intensive row cropping and timber harvesting. Yet, these habitats also provide needed environment for species favoring early successional habitats.

Caves are abundant features throughout much of the Valley, 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.

Hunting, Fishing, and Wildlife-Associated Recreation

Wildlife-related recreation is prevalent on TVA-managed lands, especially on those properties surrounding TVA impoundments. The USFWS summarizes hunting, fishing, and wildlife-associated recreational trends at national and state levels. This comprehensive

study began in 1955 and is performed every five years (USFWS and U.S. Census Bureau 2007). Statistics are developed using a study group ages 16 years and older. In 2006, 87.5 million Americans spent more than $122 billion on wildlife-related recreation. Approximately 30 million people fished, 12.5 million people hunted, and 71.1 million people participated in wildlife watching (USFWS 2006). While there were slight declines in hunting and fishing between 2001 and 2006, there were marked increases in wildlife-related recreation. These national trends were also observed in states within the TVA region. The TVA-region states had high participation rates in fishing, hunting, and wildlife watching relative to much of the rest of the country (USFWS and U.S. Census Bureau 2007).

TVA-managed lands and reservoirs play an important role in supporting wildlife-related recreation. TVA works with a variety of federal and state agencies, universities, NGOs, and volunteers to support these activities. The various dewatering projects on Kentucky and Wheeler reservoirs provide excellent examples of resources that are collectively managed by TVA and its partners. These resources provide a host of benefits for the public and wildlife that use these areas.

TVA also partners with federal and state agencies to manage wildlife habitat on a number of wildlife management areas. In many cases, Agency lands are managed in conjunction with back-lying lands to form larger wildlife management units to provide a more diverse land base to attract wildlife for both consumptive and nonconsumptive uses. Key Cave National Wildlife Refuge, managed collectively by USFWS, TVA, and the Alabama Department of Conservation and Natural Resources is an excellent example. The entrance is located on TVA-managed lands, and much of the aquifer is protected by lands owned by the USFWS. This site is used by a large maternity colony of endangered gray bats and is the only known locality of the Alabama cavefish.

Although hunting is not allowed at most TVA power generation facilities (Gallatin and Shawnee Fossil Plants are exceptions), several, such as Raccoon Mountain Pumped Storage Plant, provide opportunities for wildlife viewing, bank fishing, or access to waterways. Several facilities also allow access to warm-water discharge areas to provide additional fishing opportunities during winter and spring.

TVA has several WOAs where the public can observe large aggregations of migratory birds or evening emergences of bats. Examples include WOAs at Kentucky Dam Reservation and Nickajack Cave TVA natural area, which is also a TWRA wildlife management area. Many of these sites are promoted by various state agencies and regional ornithological groups.

4.4. Wetlands

Wetlands are highly productive and biologically diverse ecosystems that provide multiple public benefits such as flood control, reservoir shoreline stabilization, improved water quality, and habitat for fish and wildlife resources.

EO 11990 (Protection of Wetlands) directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In addition, activities in wetlands are regulated under the authority of the federal CWA and state regulations. 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."

Wetlands are typically transitional ecosystems between terrestrial and aquatic communities. As described in Subsection 4.3, Terrestrial Ecology, the TVA region is located in portions of nine physiographic provinces (see Table 4-3) (Omernik 1987; Bailey 1995). Wetland resources vary in their types and extents across these ecoregions due to the influence of geology, topography, and land use patterns.

Table 4-3. Regional Variation of Wetland Abundance by Ecosystem — 2000

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

Source: U.S. Department of the Interior 2008

In the 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).

Moving westward across the TVA region, the topography levels out, and wetlands become more common, as shown in Table 4-3. Broad, flat floodplain areas are common features, and various types of wetland habitats, especially bottomland hardwood forested wetlands, are widespread.

Palustrine wetlands are the predominant wetlands in the TVA region. As described by Cowardin et al. (1979), these are nontidal wetlands dominated by trees, shrubs, persistent emergent vegetation, and emergent mosses or lichens. These wetlands include bottomland hardwood forests and upland swamps (forested wetlands), scrub-shrub wetlands, beaver ponds (aquatic-bed or emergent wetlands), wet meadows and marshes (emergent wetlands), and highland bogs (forested, scrub-shrub, or emergent wetlands that have organic soils). Lacustrine (i.e., related to a lake) and riverine (i.e., related to a river) systems are also wetland types found within the region. These wetlands consist of aquatic beds containing floating or submersed aquatic plants.

The type and extent of wetlands within the TVA region are estimated using aerial photography and remote sensing data. The primary data source is NWI maps produced by the USFWS. TVA maintains an in-house database of NWI maps for the TVA region.

Produced in the 1980s, the NWI data have somewhat limited value because of age. For this EIS, as well as most other TVA environmental reviews, these data are supplemented by aerial photography and land use/land cover analyses that are more recent (Table 4-4).

Table 4-4. Proportion of the TVA-Managed Lands With Wetlands — 2010

Location	Proportion (Percent) of Forested/Scrub-Shrub Wetlands in Study Area	Proportion (Percent) of Emergent Wetlands in Study Area
Near Reservoirs	16.0	<0.2
Near Power Plants	11.0	<0.4
Total	**15.0**	**0.8**

Source: TVA Data 2010

Approximately 90 percent of the wetlands on TVA-managed lands are located on the mainstream 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 mainstream reservoirs is flatter, lending itself to the establishment of wetlands. In addition, there is much less drawdown from summer pool elevation to winter pool elevation on mainstream reservoirs. In addition, there is about three times as much shoreline on mainstream reservoirs as there is on tributary reservoirs (Snoddy and Cooney 1999).

The above conclusions are supported by data prepared for the ROS, as well as land use/land cover data compiled for this study. NWI data were analyzed to determine the type and extent of wetlands associated with the TVA system of reservoirs; this analysis was not limited to TVA-managed lands and included land within groundwater influence of the reservoirs. The analysis showed approximately 197,000 acres of wetlands are found along the TVA reservoir system and within the groundwater influence area of the reservoirs (Figure 4-2). The data showed that vegetated wetlands occur with greater frequency and size along the mainstream reservoirs and tailwaters than along the tributary reservoirs and tailwaters. This is due in part to the larger-sized watersheds of mainstream reservoirs resulting in a greater volume of water; greater predictability of the annual hydrologic regime; shoreline and drawdown zone topography (wider and flatter floodplains, riparian zones, and drawdown zones and large areas of shallow water); and larger sections of relatively still, shallow-water areas. Wetlands tend to be smaller and do not occur as frequently on tributary reservoirs because of the relatively steep drawdown zones, the rolling to steep topography of adjacent lands, shoreline disturbance caused by wave action, and the lower predictability and shorter duration of summer pool levels.

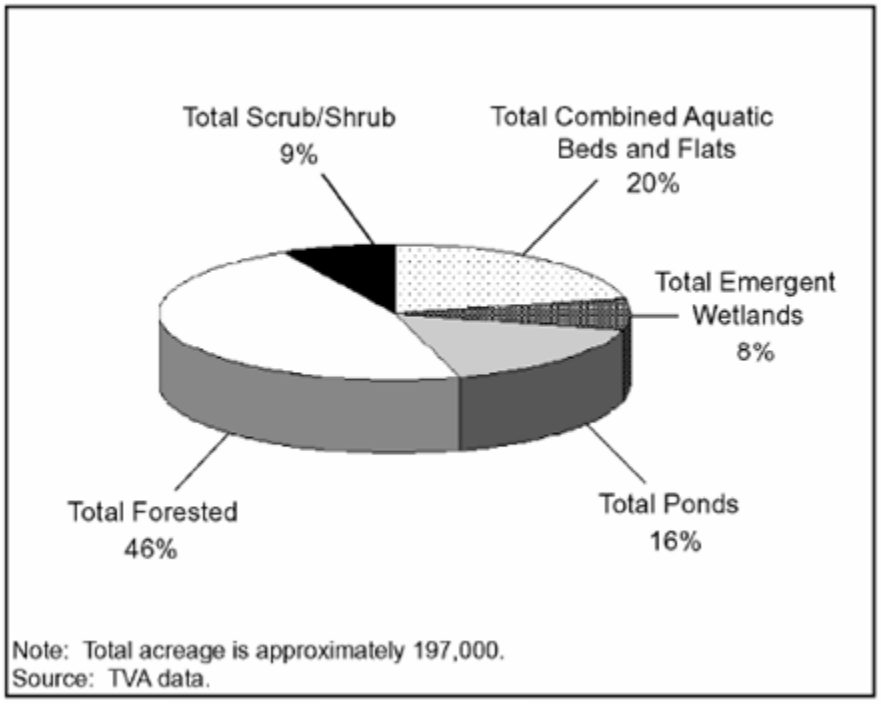
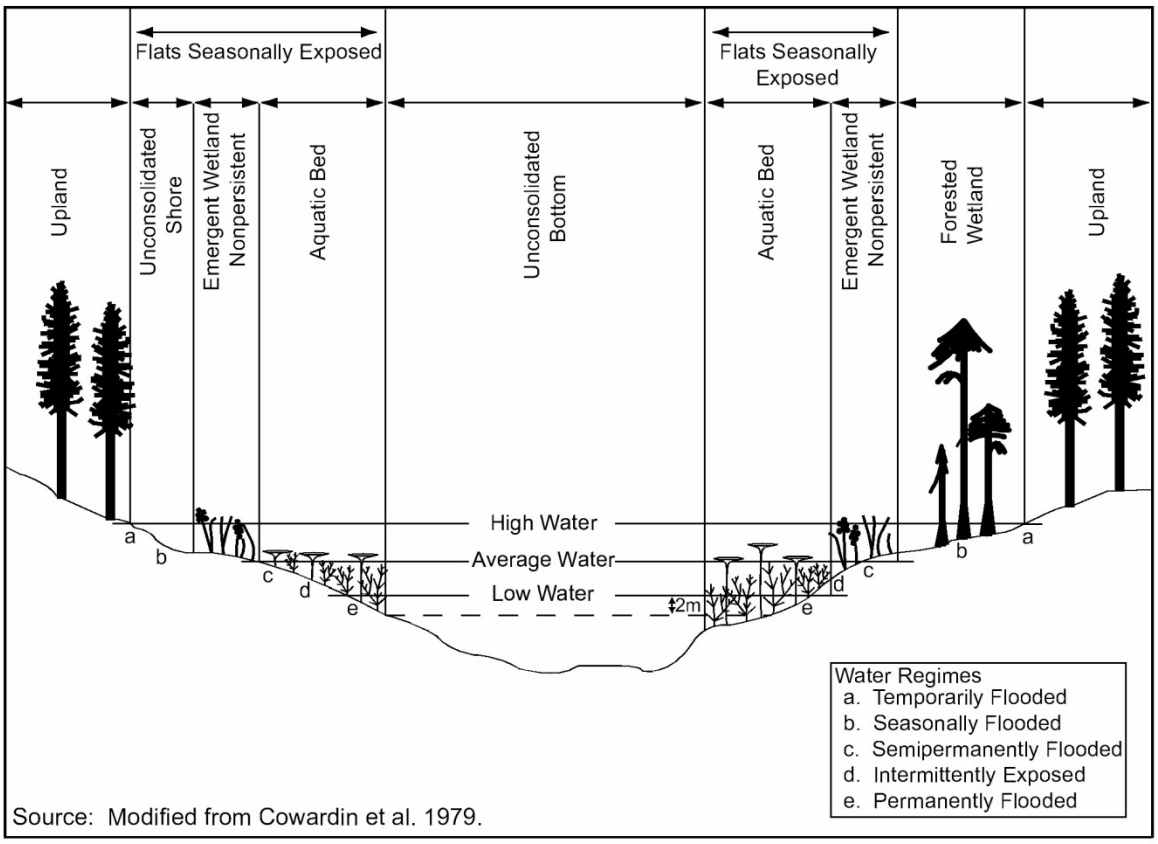


Figure 4-2. Wetlands of the TVA Reservoir System by Vegetation Class

Within mainstream 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 acre) areas along the shoreline.

As shown in Figure 4-2, forested wetlands are the most common wetland type found on TVA-managed land located adjacent to reservoirs and within the area of groundwater influence of the river system. Aquatic bed and pond wetlands are the next most common types of wetland, followed by scrub-shrub and emergent wetlands. Figure 4-3 shows the types and locations of wetlands along TVA reservoirs.

For the purposes of this EIS, an analysis was conducted of wetland types specific to TVA-managed lands adjacent to reservoirs. This analysis showed that wetlands are less common on TVA-managed lands than throughout the overall reservoir system. The percentage of forested and scrub-shrub wetlands is 16 percent of the overall land use/land cover. Emergent wetlands make up less than 0.2 percent as contrasted with 0.8 percent of the overall land use of the entire reservoir system.



Wetland Reservoir Types and Locations (Lacustrine Wetlands)

Figure 4-3. Wetland Reservoir Types and Locations

TVA also manages lands associated with power generation facilities and dam reservations. 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. Land use/land cover data indicated forested and scrub-shrub wetlands comprise approximately 11 percent of the total land use/land cover status of the power properties. Emergent wetlands are much less common, comprising less than 0.4 percent of total land use.

Status and Trends

Historically, the wetland acreage across the TVA region has declined over the past 30 years, but the rate of loss has slowed significantly over the past 10 years due to regulatory mechanisms for wetland protection. National wetlands trend studies (Dahl 2000) indicate that, between 1986 and 1997, freshwater forested wetlands declined 2.3 percent, and freshwater emergent wetlands declined 4.6 percent. Parts of these declines were due to conversion of forested and emergent wetlands to scrub-shrub wetlands and freshwater ponds during the study period. Timber harvesting, agriculture, natural succession, beaver activity, changes in land use (including urban and rural development, mining, and recreation such as golf courses), and conversion of bottomland forests to managed pine plantations played a role in these trends in wetland change. These trends are likely to continue to various degrees over the next 30 years. National trend data do not include analyses of flats and aquatic bed coverage; however, TVA data indicate an increase in coverage of aquatic beds between the 1960s and 2000s (TVA 2004).

National trends are mirrored by general trends in the Southeast. These data indicate that forested, emergent, and scrub-shrub wetlands have suffered a net loss in acreage. This is primarily due to transportation impacts, the continued growth of urban/suburban development associated with continued population growth, and to a lesser degree, agriculture and timber harvesting (Hefner et al. 1994; Dahl 2006; Keeland et al. 2004). These same data indicate a net increase in open water ponds created as agricultural impoundments, by urban and suburban development, and as the result of compensatory mitigation for the loss of emergent wetlands for regulatory purposes (Dahl 2006).

The area of emergent, scrub-shrub, and forested wetlands (located on and immediately adjacent to TVA reservoirs) has remained relatively stable as compared to the trend for these wetland types in the Southeast (Hefner et al. 1994). Forested wetlands have been the most heavily impacted on private land throughout the TVA region over the last 50 years. The presence of wetlands on or adjacent to TVA reservoirs appears related to the development status of the shoreline. Within the 0.25-mile shoreline area, the proportion of total wetlands acreage was greater along undeveloped shorelines than along developed shorelines. This is partially explained by the fact that many wetlands occur in low-lying or flood prone areas where development is often restricted (TVA 1998).

4.5. Water Quality

The quality of the region's water is critical to protection of human health and aquatic life. These water resources provide habitat for aquatic life, recreation opportunities, domestic and industrial water supplies, and other benefits. Water quality can be affected through point sources, such as wastewater treatment plants and industries, and through nonpoint sources, such as air emissions and deposition, construction and development, urban runoff, mining, agriculture, and silviculture.

The Tennessee River basin 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 to Knoxville. Virtually all the major tributaries have at least one dam. In addition to the 10 reservoirs on the main stem 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. This system of dams and their operation is the most significant factor affecting water quality and aquatic habitats in the Tennessee River and its major tributaries.

Water quality is generally good in the TVA region. 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. Of the approximately 42,000 perennial stream miles in the Valley (TVA 1971), 8,500 miles are not supporting their designated uses (compiled from seven Valley states 2008 and 2010 305(b) reports), and 113,000 acres of lakes and reservoirs (compiled from seven Valley states 2008 and 2010 305(b) reports) (out of approximately 660,000 total acres [compiled from 2000 U.S. census GIS coverage]) are not supporting their uses.

Ecological health in TVA reservoirs is monitored by the Vital Signs (VS) Monitoring Program. The VS Monitoring Program uses five metrics: chlorophyll concentration, fish community health, bottom life, sediment contamination, and DO. Values of good, fair, or poor are assigned to each metric. All TVA reservoirs have at least two monitoring locations, one in the deep area near the dam (forebay), and one in the upstream end of the reservoir (inflow). Larger reservoirs also have a midreservoir site, and some have sites in

major embayments. These scores are combined for a representative summary score for each reservoir. The principal water quality concerns in TVA reservoirs identified by VS, along with fish consumption advisories issued by the states, are summarized in Table 4-5.

Table 4-5. Ecological Health Ratings of TVA Reservoirs

Reservoir	Ecological Health Rating	Score	Latest Survey Date	Concerns	Fish Consumption Advisory
Apalachia	Good	84	2008		Hg North Carolina statewide
Bear Creek	Fair	64	2007	DO	Hg
Beech	Poor	51	2008	DO, chlorophyll	None
Blue Ridge	Good	83	2007	DO	Hg
Boone	Poor	50	2007	DO, chlorophyll, bottom life	PCBs, chlordane
Cedar Creek	Fair	69	2007	DO	None
Chatuge	Fair	59	2008	DO, bottom life, sediment quality	Hg
Cherokee	Fair	63	2008	DO, chlorophyll, bottom life	None
Chickamauga	Good	78	2009	Chlorophyll, bottom life	None
Douglas	Fair	59	2009	DO, chlorophyll	None
Fontana	Fair	69	2008	Bottom life	Hg North Carolina statewide
Fort Loudoun	Poor	50	2007	DO, chlorophyll, bottom life	PCBs
Fort Patrick Henry	Fair	60	2007	Chlorophyll, bottom life	None
Guntersville	Good	79	2009	Chlorophyll	None
Hiwassee	Fair	67	2008	DO, chlorophyll	None
Kentucky	Fair	70	2009	DO, chlorophyll	Hg Kentucky statewide
Little Bear Creek	Fair	70	2009	DO, bottom life	None
Melton Hill	Fair	65	2008	Bottom life	PCBs
Nickajack	Good	85	2009	Chlorophyll	PCBs
Normandy	Poor	52	2008	DO, chlorophyll	None
Norris	Fair	60	2007	DO, chlorophyll, bottom life	None
Nottely	Poor	50	2009	DO, chlorophyll, bottom life	Hg

Reservoir	Ecological Health Rating	Score	Latest Survey Date	Concerns	Fish Consumption Advisory
Parksville	Good	81	2009	Sediment quality	None
Pickwick	Good	78	2006	Chlorophyll	None
South Holston	Fair	60	2008	DO, chlorophyll, bottom life	None
Tellico	Poor	55	2009	DO, chlorophyll, bottom life	PCBs
Tims Ford	Poor	52	2008	DO, bottom life	None
Watauga	Good	75	2008	DO	None
Watts Bar	Fair	59	2008	DO, chlorophyll, bottom life	PCBs, Hg
Wheeler	Poor	57	2007	DO, chlorophyll, bottom life	DDT
Wilson	Poor	54	2008	DO, chlorophyll	None

Abbreviations: DDT = Dichlorodiphenyltrichloroethane; DO = Dissolved oxygen; Hg = Mercury; PCBs = Polychlorinated biphenyls

TVA also monitors ecological health in the streams of the Valley. The STM Program assesses the condition of the biological community at sites throughout the Valley. The primary tool in this assessment is a fish IBI that uses 12 metrics to arrive at an overall score for the health of the fish community at each site. This program also collects data on the health of the benthic community. These data complement state monitoring programs and are frequently used by them to aid in assessing use support.

Of the 869 active monitoring stations, 544 have been matched to 11-digit HUs to track and evaluate the overall water quality on an HU basis. These HU stations are typically monitored on a five-year cycle. A combination of VS reservoir data and stream monitoring data is used to rate a total of 598 HUs; the remaining seven Valley HUs have no suitable location for collecting data to characterize their condition (see Figure A-12, Appendix A).

Most of the state listings for impaired streams in the TVA region are ascribed to pollution from sediment or bacterial contamination. Sediment sources are mostly erosion from agriculture, silviculture, and construction activities. Bacteria are from contamination from fecal material from livestock, malfunctioning septic systems, leaking sewage collection systems, and urban runoff. Plant nutrients are also an important pollutant. These come from agriculture, wastewater treatment plants, and urban runoff. Nutrients stimulate the growth of algae and cause shifts in aquatic communities. In reservoirs, excessive algae growth consumes DO, which in turn limits available aquatic habitat in the reservoir and can influence the health of the aquatic community. Low DO levels in stream reaches downstream of TVA dams are associated with low DO within the reservoirs. Long stretches of river can be affected, especially in areas where pollution further depletes DO. In addition, flow in these sections of stream can be determined by the amount of water released from the upstream dams, and in the past, some of the tailwaters were subject to periods of little or no flow. Since the early 1990s, TVA has addressed these issues by

installing equipment to increase DO concentrations below 16 dams. At the same time, TVA made operational changes and installed additional equipment to ensure minimum water flows through its dams.

4.6. Aquatic Ecology

Rivers located in the TVA region support a large variety of freshwater fishes and invertebrates (including freshwater mussels, snails, crayfish, and insects). Due to the number of major river systems found in this region, the Southeastern U.S. is recognized as a globally important area for freshwater biodiversity (Stein et al. 2000). The discussion of affected aquatic environments focuses on two distinct categories of water bodies: the TVA reservoir system within the Tennessee River drainage and "free-flowing" streams that are unaffected (or relatively unaffected) by the presence of TVA's dams and reservoirs.

The TVA Reservoir System

The construction of the TVA dam and reservoir system fundamentally altered both the water quality and physical environment of the Tennessee River and many of its tributaries. While dams promote navigation, flood control, power benefits, and river-based recreation by moderating the flow effects of floods and droughts throughout the year, they also disrupt the daily, seasonal, and annual flow patterns that are characteristic of a river. Damming of the rivers was done at a time when there was little regard for aquatic resources (Voigtlander and Poppe 1989). ROS describes in great detail the aquatic communities and resources present in the TVA reservoir system.

Prior to construction of the TVA reservoir system, aquatic communities were structured by water quality and physical habitat condition, which were driven by physiographic region and climate. Streamflow was proportional to rainfall, and flow regime followed the same trends as the annual rainfall pattern. Flow established physical habitat conditions (depth, velocity) within a stream and maintained stream shape and other habitat conditions (substrate). Relatively infrequent high-flow events (flows that only occur every one to two years) were responsible for maintaining large-scale habitat patterns such as the number of riffles or pools (Rosgen 1996). High water flows clean substrate by flushing out fine sediments, which may suffocate fish eggs or mussels and fill in the spaces between rocks needed by aquatic insects. These "free-flowing" streams and rivers represent the natural condition of these waterways. Because historical flow was proportional to rainfall, over short-time intervals, such as days, flow was relatively predictable—meaning that yesterday's flow was likely to be similar to today's flow, and from hour to hour, there was little change except during storm events.

Floods were common during spring, and flows decreased throughout the year with the lowest typically occurring August through October, the warmest part of the year. Spring flooding was an important component in the life cycles of some fish species that use flooded overbank areas for spawning or nursery areas. The Tennessee River was shallow, with expansive areas of rocky or gravel shoals, which are critical features that contribute to the great diversity of aquatic life (Etnier and Starnes 1993).

<u>Tributary Reservoirs and Tailwaters</u> — Reservoirs located on the tributaries to the Tennessee River are typically of the deep storage type that retains water for long periods of time. Little flow and regular periods of thermal stratification result in oxygen depletion in the deeper water. These aquatic habitats are simplified relative to undammed streams, and fewer species are found. Lack of minimum flows and low DO in the first few miles below tributary dams may severely limit the habitat needed by native fish. This may restrict their

movement, migration, reproduction, and available food supply. Large seasonal fluctuations in reservoir levels also affect aquatic communities within the reservoir pool.

Dams located on tributary rivers affected the habitat of benthic invertebrates (benthos), which are a vital part of the food chain of aquatic ecosystems. Benthic life includes worms, snails, and crayfish, which spend all of their lives in or on the streambeds, and aquatic insects, mussels, and clams, which live there during all or part of their life cycle. Many benthic organisms have narrow habitat requirements that are not always met in reservoirs or tailwaters below dams. Further downstream from dams, the number of benthic species increases as natural reaeration occurs and DO and temperatures rise.

TVA has implemented several programs to improve the water quality of releases at tributary dams including establishment of minimum flows from all of its tributary dams and the addition of active and/or passive reoxygenation systems at many of its tributary dams. Improvements in habitat conditions and freshwater communities have occurred in over 300 miles of TVA's tailwater areas as a result of these actions.

Improved year-long cold-water discharges in seven TVA tailwaters in Tennessee has allowed development of highly valued put/grow/take trout fisheries and resulted in Tennessee's assigning these tailwaters a "Trout Stream" use designation, along with protective water quality criteria in its Water Quality Standards. This fishery resource has been developed and is managed by TWRA. TWRA has estimated the number of fishing trips in tailwaters on the Clinch, Duck, Elk, Hiwassee, and South Fork Holston rivers over comparable 26-week fishing seasons (2003 estimates) ranged from 2,722 on the Duck to 24,242 and 24,635 on the South Fork Holston and Clinch, respectively (Williams and Bettoli 2003). Total number of trips for the five rivers was 77,288, representing a "Travel Cost Method" total value of $4.5 million over a 26-week fishing season. Total 26-week expenditures for these five rivers were $2.2 million, ranging from $148,213 on the Elk to $1,513,043 on the Hiwassee. These tailwaters have unique value for supporting such fisheries, especially if natural trout habitats were to become impacted by climate change (higher temperatures and reduced flow).

Mainstream Reservoirs — The nine mainstream reservoirs on the Tennessee River differ from tributary reservoirs primarily in that they are shallower, have greater flows, and thus retain the water in the reservoir for a shorter period of time. They generally do not become as strongly stratified as tributary reservoirs. Although DO in the lower lake levels is often reduced, it is seldom depleted. Winter drawdowns on mainstream reservoirs are much less severe than tributaries, so bottom habitats generally remain wetted all year. This benefits benthic organisms but promotes the growth of aquatic plants in the extensive shallow overbank areas of some reservoirs.

Tennessee River mainstream reservoirs generally support healthy fish communities, ranging from about 50 to 90 species per reservoir. Good to excellent sport fisheries exist, primarily for black bass, crappie, sauger, white and striped bass, sunfish, and catfish. The primary commercial species are channel and blue catfish and buffalo. The benefit of the system minimum-flow mode of operation has already been seen during a recent (2006-2008) drought period in the Valley. TVA monitoring data indicated that while there was a decline in aquatic communities across the Valley, these declines were somewhat mitigated in the regulated portions of the Tennessee River drainage.

The TVA VS Monitoring Program rates environmental conditions in reservoirs using a fish and benthic IBI (Dycus and Meinert 1991). TVA also monitors sport fish populations using

the Sport Fishing Index (SFI), which incorporates the status of population quantity and quality along with available angler catch information. Within a reservoir, SFI scores monitor positive or negative trends in population status, relative to fishing experience (Hickman 2000). Beyond the SFI Monitoring Program, TVA operates certain hydropower operations in a manner that provides important flow levels for spring spawning grounds of certain fishes. For example, below Watts Bar Reservoir, prescribed spring flows are provided to enhance sauger spawning.

"Free-Flowing" Streams and Rivers in the Tennessee River Drainage
The "free-flowing" streams within the Valley hold a much higher diversity of aquatic life (including state- and federally listed species) than are found in the TVA reservoir system. The Clinch River and Duck River in Tennessee and Virginia are recognized as global "hotspots" for freshwater biodiversity.

While aquatic communities in these rivers and streams are much more diverse than within the reservoir system, it is recognized that these watersheds have their own water quality issues. Land practices including agriculture, industry, residential and recreational development, forestry, etc., have led to the degradation of water quality and habitat in many of the region's streams and rivers.

4.7. Endangered and Threatened Species

4.7.1. Aquatic Species

The Tennessee River and its tributaries contain many species that are federally listed as endangered or threatened. Many more species are listed by the states in the Tennessee River drainage. A summary of the number of state- and federally listed aquatic animal species known from the Tennessee River drainage is presented in Table 4-6. Detailed lists of the species reported from each state are presented in Appendix K. None of these species are known to occur on TVA-managed lands that are a part of this plan. However, many of these species occur in streams and reservoirs adjacent to these lands.

Table 4-6. State- and Federally Listed Aquatic Animal Species Present in the Tennessee River Drainage

State	Crustaceans		Insects		Mollusks		Fish		Total	
	State	Federal	State	Federal	State	Federal	State	Federal	State	Federal
Alabama	7	1	14	0	73	26	36	5	130	32
Georgia	0	0	0	0	0	0	18	2	18	2
Kentucky	0	0	0	0	16	6	11	0	27	6
Mississippi	0	0	0	0	7	0	13	0	20	0
North Carolina	5	0	1	0	31	4	22	2	59	6
Tennessee	4	0	6	1	74	37	43	13	127	51
Virginia	0	0	1	0	33	18	32	6	66	24

4.7.2. Terrestrial Animals

There are 33 federally listed, protected, or candidate terrestrial animal species occurring in the TVA region (Appendix K). Of these species, only five potentially occur on TVA-managed lands. These species include bald eagle, gray bat, interior least tern, piping plover, and Indiana bat, listed in decreasing prevalence of occurrence. A sixth species,

red-cockaded woodpecker, historically occurred on or near TVA-managed lands. In recent decades, this species only occurs in isolated pockets in extreme southern portions of the region. TVA's resource management activities on Agency-managed lands would not result in impacts to this species.

Bald eagles are largely distributed throughout the region with the largest aggregations noted in the central and western ecoregions. TVA reservoirs and surrounding lands provide ideal habitat for this species; breeding and wintering populations are routinely observed on TVA-managed lands (see Appendix K). The species is especially prevalent on lands surrounding Kentucky and Guntersville reservoirs.

Bald eagles nest in a variety of habitats throughout the region. Some pairs select large solitary trees, often a loblolly pine, in open fields, while others select more hidden sites in pines or hardwoods on forested hillsides. The species typically forage on fish, turtles, semiaquatic mammals, ducks, and herons. TVA biologists have observed remnants of these food items at eagles' nests throughout the Valley during routine monitoring activities.

Historically, the distribution of eagles was spotty throughout the Valley; however, recently, they have expanded their breeding range throughout much of the Valley. Population numbers have largely rebounded since DDT was banned from agricultural use. An intensive reintroduction program (hacking) initiated collectively by federal and state conservation agencies was also instrumental in increasing the number of bald eagles in the Valley. TVA provided bald eagle hacking localities during this program in north Alabama and other sites along the Tennessee River.

Gray bats are widely distributed throughout the region (see Appendix K); largest concentrations occur in central and eastern ecoregions. This species hibernates in cold caves (usually deep pits) and forms large maternity colonies in warmer caves during summer. Many significant maternity caves are found adjacent to TVA reservoirs. In the early 1990s, TVA partnered with the USACE and Auburn University to study gray bats on Guntersville Reservoir (Thomas and Best 2000; Best et al. 1995). This endangered species was found to routinely forage along TVA-managed lands and adjacent to power generation properties throughout north Alabama. TVA routinely monitors and protects all known gray bat populations on TVA-managed lands. Subsequent monitoring by the USFS, TVA, USFWS, state conservation agencies, and other universities has documented the species throughout the TVA region.

Interior least terns are largely associated with the Mississippi Alluvial Plains. The species nests in colonies on exposed sandbars in the Mississippi River during summer months. After breeding, least terns often disperse along adjacent tributaries. Postbreeding populations are occasionally observed on Kentucky Reservoir. Recently, the species nested along the Mississippi River.

Piping plovers are transient fall migrants in the interior Southeast during late July (females) and late September (males and juveniles). There are few reports of observations during spring migration. They use exposed mudflats on the Mississippi, Ohio, Cumberland, and Tennessee rivers as stopover sites during migration. The species is more prevalent along the Mississippi River than the Tennessee River. Solitary piping plovers are observed sporadically on Kentucky and Douglas reservoirs. Isolated observations have been reported on Chatuge and Nottely reservoirs in northern Georgia and Boone Reservoir in northeast Tennessee. Piping plovers have also been observed at Colbert and Kingston fossil plants.

Indiana bats are rare throughout the region; most recent records of this species are reported from areas in the Blue Ridge Province (i.e., Cherokee National Forest). The species hibernates in caves and forms summer roosts usually in dead trees that are largely covered with exfoliating bark. Indiana bats typically roost in multiple trees having varying exposure to sunlight (Miller et al. 2002). Historic records of this species are reported from caves on TVA-managed lands. TVA's Nickajack Cave is the type of locality for the species. The species has also been reported from TVA's Little Bayou Creek Ridge HPA at Shawnee Fossil Plant. A small maternity population occurs on USFS lands near a TVA-managed parcel of land adjacent to Tellico Reservoir. Small populations hibernate in Sauta Cave on Guntersville Reservoir. The species has also been found recently at sites near Fontana Reservoir lands and in the Cherokee and Bankhead national forests.

TVA has routinely surveyed for this species during resource stewardship activities, lands planning, and power-related projects. With one exception, no Indiana bats have been captured during these surveys. Recently, Indiana bats were captured along a transmission line corridor in middle Tennessee and Kentucky. Any forested habitat throughout the Valley with mature forest, a high density of snags, and open midstories could be suitable habitat for this species (Menzel et al. 2001; Romme et al. 1995). TVA surveys for Indiana bats when medium- or high-quality habitat is identified during field surveys.

Trends of Listed Terrestrial Animals

Populations of several listed species have improved since the creation of the ESA. Bald eagles and gray bats appear to have increasing and stable numbers. Bald eagles are considered recovered and have been removed from the endangered species list; however, the species is still protected by the Bald and Golden Eagle Protection Act. Some species, such as Indiana bats, continue to decline or remain low despite protective measures implemented by various federal and state agencies. Recent discovery of a disease (white-nose syndrome) impacting cave-dwelling bats could result in serious declines in numbers of gray and Indiana bats. Therefore, an initial move to downgrade gray bats from federally listed as endangered to threatened status has been dropped, and both species are being monitored closely to see how they cope with this new threat. Conservation efforts have stabilized or slowed the declines of the remaining listed species. However, little is known about the population trends of cave invertebrates in the region. If white-nose syndrome results in substantial reductions in populations of cave-dwelling bats, which cave invertebrates depend upon, subsequent reductions in cave invertebrates are likely.

Approximately 701 state-listed or state-ranked terrestrial animal species occur in the TVA region (Appendix K). The list is comprised of a diverse array of birds (28 percent), mammals (16 percent), reptiles (11 percent), and amphibians (14 percent). Over 31 percent of the list is comprised of invertebrates, mostly cave-dwelling species. Most species are found in the Blue Ridge, Southwestern Appalachians, and Interior Plateau ecoregions. Many species have widespread distributions; examples include osprey, southeastern shrew, or green treefrog. However, some species are endemic to specific ecoregions, states, or localities, especially cave-dwelling species. Although many of these species have no legal status, they are considered very rare and are often associated with very fragile habitats.

Many of the species listed in Appendix K occur on TVA-managed lands and are considered during the Agency's stewardship and reservoir lands planning processes. For example, during lands planning efforts on Guntersville and Upper Bear Creek reservoirs, biologists located extensive sandstone outcrops, which is habitat used by green salamanders. Although common on these reservoir lands, this habitat is very limited on a regional scale,

restricted largely to very narrow bands along portions of the Valley. TVA designated many sandstone outcrops at Upper Bear and Guntersville reservoirs as natural areas to protect populations of green salamanders and other species that occur in these areas.

4.7.3. Plants

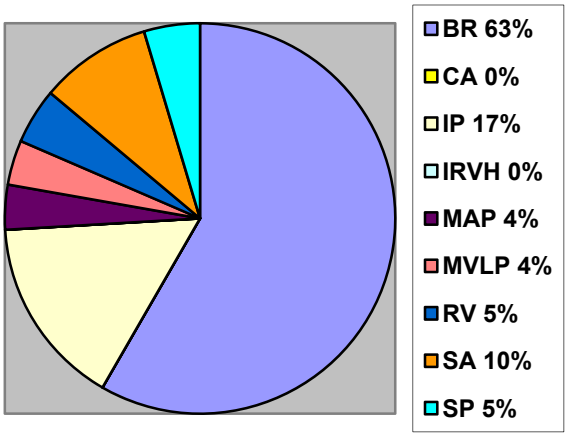
A review of the TVA Natural Heritage database indicated that 44 federally listed as endangered and threatened species, six federal candidate species, and 996 state-listed plant species are known to occur within the TVA region. A complete listing of the federally and state-listed plant species reported from each ecoregion within the TVA region can be found in Appendix K.

Globally Rare Communities and Sensitive or Threatened Ecosystems

NatureServe (Comer et al. 2003) has developed interrelated classifications of ecosystems and communities based on physiognomic vegetation classes of Grossman et al. (1998). This multifaceted approach to ecosystem management benefits conservationists and land managers seeking consistent ways to characterize the landscape (NatureServe 2009). Vegetation classes as defined by Grossman et al. (1998) are as follows: forests have tree crowns overlapping, generally forming 60 to 100 percent cover; woodlands are open stands of trees with crowns not usually touching, generally forming 25 to 60 percent cover; shrublands contain shrubs generally greater than 0.5 meter tall with individuals or clumps not touching or overlapping, generally forming greater than 25 percent cover with tree cover; herbaceous vegetation or “grasslands/herbaceous” of Comer et al. (2003) is dominated by graminoides, forbs, and ferns, generally forming at least 25 percent cover; other life forms with less than 25 percent cover; sparse vegetation sites are dominated by abiotic substrates such as rock or sand, and vegetation is scattered to nearly absent; total vegetation cover is typically less than 25 percent. These classes are further defined based on leaf type, where each class can be determined to be either evergreen (leaves stay green and persist all year), deciduous (leaves do not persist all year; they fall off usually in autumn, and new leaves are produced in the spring), or evergreen-deciduous (vegetation consists of a mixture of plants that are both evergreen and deciduous, often referred to as mixed deciduous).

NatureServe (2009) recognizes 83 community associations within the TVA region as having a global ranking of G1. The G1 ranking defines communities that are critically imperiled and at a high risk of extinction due to extreme rarity (often five or fewer occurrences worldwide). A list of the G1-ranked communities can be found in Appendix K. The G1 communities are classified based on their NatureServe vegetation classification, the state in which they are found, whether they occur in rare ecosystems (described below), and in what ecoregion(s) they occur. Often, rare communities harbor endangered and native plant and/or animal species, as well as species not found outside the TVA region. Therefore, knowledge of these globally imperiled communities is important for the future implementation of the NRP. Figure 4-4 depicts the percentage of G1 ranked communities per ecoregion.

Often these globally rare communities are found in sensitive or threatened ecosystems such as the southern Appalachian spruce-fir forest, cedar glades, grasslands, prairies and barrens, Appalachian bogs, fens, and seeps (including ponds), and bottomland hardwood forests (Appendix K). Most of these sensitive ecosystems are being threatened by anthropogenic-related causes such as urban development, agricultural practices, and the introduction of exotic species.

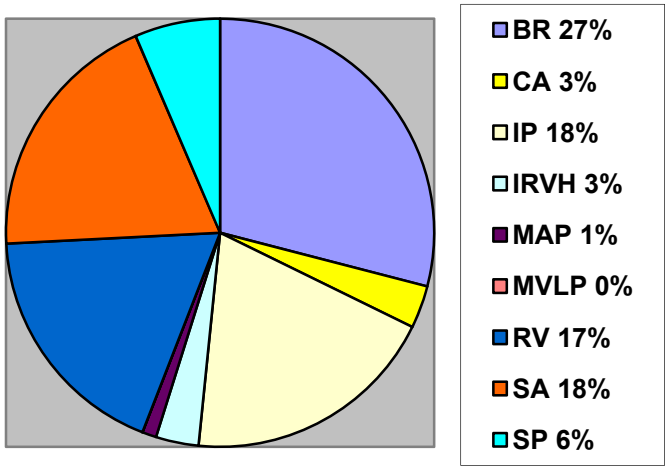


Ecoregion abbreviations are as follows: BR=Blue Ridge, CA=Central Appalachians, IP=Interior Plateau, IRVH=Interior River Valley and Hills, MAP=Mississippi Alluvial Plain, MVLP=Mississippi Valley Loess Plain, RV=Ridge and Valley, SA=Southwestern Appalachians and SP=Southeastern Plains

Figure 4-4. Percentage of G1 Plant Communities per Ecoregion

Federally Listed Plants

Over 80 percent of the federally listed species occur within four of the nine ecoregions: Blue Ridge with 27 percent, Southwestern Appalachians with 18 percent, Interior Plateau with 18 percent, and Ridge and Valley with 17 percent. Figure 4-5 depicts a graph representing the percentage of federally listed species found in each ecoregion. Of the 44 federally listed plant species, 11 taxa have the potential to be impacted by TVA actions associated with the NRP (Table 4-7). These taxa are discussed below.



Ecoregion abbreviations are as follows: BR=Blue Ridge, CA=Central Appalachians, IP=Interior Plateau, IRVH=Interior River Valley and Hills, MAP=Mississippi Alluvial Plain, MVLP=Mississippi Valley Loess Plain, RV=Ridge and Valley, SA=Southwestern Appalachians, and SP=Southeastern Plains

Figure 4-5. Percentage of Federally Listed Species per Ecoregion

Table 4-7. Federally Listed Species Potentially Impacted by the Natural Resource Plan

Scientific Name	Common Name	Federal Status
Conradina verticillata	Cumberland rosemary	LT
Leavenworthia crassa	Fleshy-fruit gladecress	C
Sarracenia oreophila	Green pitcher plant	LE
Scutellaria montana	Large-flowered skullcap	LT
Platanthera integrilabia	Monkey-face orchid	C
Clematis morefieldii	Morefield's leather-flower	LE
Apios priceana	Price's potato-bean	LT
Pityopsis ruthii	Ruth's golden aster	LE
Lesquerella globosa	Shorts bladderpod	C
Isotria medeoloides	Small whorled pogonia	LT
Spiraea virginiana	Virginia spiraea	LT

Federal status abbreviations: C=Candidate; LE=Endangered; LT=Threatened

Chatuge and Chickamauga reservoirs are the only TVA reservoirs with known populations of federally listed species along the shoreline. Green pitcher plant is managed on lands owned by the Georgia Nature Conservancy, and large-flowered skullcap occurs on private and public lands within the Tennessee River Gorge in Tennessee and Georgia. The Ocoee and Hiwassee rivers, where river flow is controlled by TVA (Ocoee 2 and Apalachia, respectively), both have populations of Ruth's golden aster growing on boulders in and adjacent to the rivers. Annually, TVA monitors populations of large-flowered skullcap in May and Ruth's golden aster in September.

Raccoon Mountain Pumped Storage Plant, in Hamilton and Marion counties, and Sequoyah Nuclear Plant in Hamilton County, Tennessee, are the only TVA power plants with known records of federally listed plant species occurring within or in the immediate vicinity of the reservation boundaries. Recent field surveys have reported more than 30 records of large-flowered skullcap growing on the Cumberland escarpment of Raccoon Mountain. Large-flowered skullcap, a federally listed as threatened species in the mint family, is commonly encountered on wooded slopes with rocky outcrops within the Tennessee River Gorge in southeast Tennessee and northwest Georgia. Plants are known to occur within the Raccoon Mountain Pumped Storage Plant Reservation and in close proximity to Sequoyah Nuclear Plant.

The green pitcher plant site on Chatuge Reservoir is monitored yearly by the Georgia Nature Conservancy and aided by TVA. The green pitcher plant, a federally listed as endangered species, is a carnivorous plant restricted to acidic seepage bogs and boggy stream edges in northeast Alabama, Georgia, and North Carolina.

Ruth's golden aster, a federally listed as endangered species, has a limited range and specific habitat. This rare member of the sunflower family can be found in cracks or crevices of phylite or greywacke boulders along the banks or within the Hiwassee and Ocoee rivers in Polk County (Kral 1983; USFWS 1990; NatureServe 2009). The construction of the dams on these rivers may have reduced the range of this species, and remaining populations are threatened by habitat changes resulting from postimpoundment river flows.

Cumberland rosemary, a member of the mint family, is a perennial evergreen shrub federally listed as threatened. Populations are restricted to boulder/cobble/gravel bars, sand bars and islands, sandy riverbanks, floodplains in river gorges, and similar sunny riparian areas where seasonal flooding minimizes competition and creates new gravel-bar habitats for colonization. Threats to this species include habitat destruction due to dam construction and water pollution from nearby coal mining. Intensive recreational use also poses a threat (NatureServe 2009).

Fleshy-fruit gladecress, a federal candidate member of the mustard family, is endemic to Lawrence and Morgan counties in Alabama. It is locally abundant, but only a few localities are known. Highway construction and residential development are major threats to this species, which NatureServe (2009) states is likely one of the most imperiled plant species in the Southeast and is in need of urgent protection.

The federal candidate species monkey-face orchid grows in swamp forests and sandy stream margins. Even though this species is known to occur in most southern states, these plants are not commonly encountered. Major threats to the species are a result of habitat loss from development, canopy closure, improper timber harvest techniques, and the encroachment of exotic invasive plants such as Chinese privet and Japanese stiltgrass. This species has been reported to occur on TVA-managed lands adjacent to Yellow Creek, but the population is now thought to have been listed as extirpated.

Morefield's leather-flower, a federally listed as endangered species in the buttercup family, is restricted to rocky limestone bluffs and boulder fields. Smoke tree is an indicator species. In several locations throughout the Valley, Morefield's vasevine and Price's potato bean have been found growing together. Threats to the species include development and encroachment of invasive species.

Price's potato bean, a federally listed as threatened member of the legume family, prefers disturbed portions of rocky limestone areas in forest openings, wood edges, and regions where bluffs descend to streams.

Short's bladderpod, a member of the mustard family is considered a federal candidate species. It is endemic to the Interior Low Plateau from middle Tennessee through north central Kentucky and into southern Indiana. According to NatureServe (2009), this species exhibits wide population changes from year to year due to variable germination and seedling survival levels in its arid microhabitat. Road construction and maintenance activities such as herbicide use, grading of road shoulders, mowing during the growing season, and encroachment of exotic species continue to threaten many of the populations. Some sites adjacent to rivers are threatened by water-level manipulation.

Small whorled pogonia occurs in a variety of habitats throughout its range. It is typically found on acidic soils, in dry to mesic second-growth, deciduous or deciduous-coniferous forests. In addition, the plants prefer habitats that have light to moderate leaf litter, an open herb layer (occasionally dense ferns), moderate to light shrub layer, and relatively open canopy (NatureServe 2009; USFWS 2008). The main threats to this species are habitat destruction and excessive collecting. It is known from the vicinity of five mountain reservoirs (Apalachia, Blue Ridge, Chatuge, Hiwassee, and Nottely).

Virginia spiraea is a shrub growing on rocky flood-scoured riverbanks and gravel bars in gorges or canyons in the central and southern Appalachian Mountains. Populations have been extirpated by impoundments, and other threats include riverbank development, habitat

changes resulting from altered river flows and the encroachment of exotic invasive species. Sexual reproduction is uncommon, and plants rely almost completely on vegetative reproduction, which could also account for the declining health of known populations.

State-Listed Plants

More than 10,000 element occurrence records for 996 state-listed plant species are found in the TVA Natural Heritage database (Appendix K). Thirty-two (4.1 percent) of these state-listed taxa are known to occur within a mile of TVA's facilities within the NRP geographical scope (Table 4-8). The Yellow Creek site, on Pickwick Reservoir in Mississippi, has the most state-listed species (13) occurring within or directly adjacent to the reservation, followed by Melton Hill Dam with six species. TVA-managed land surrounding the Raccoon Mountain Pumped Storage Plant not only is home to the federally listed as threatened large-flowered skullcap but also harbors five state-listed species.

Table 4-8. State-Listed Plant Species Found Within 1 Mile of TVA's Facilities Within the Natural Resource Plan Geographical Scope

Scientific Name	Common Name	State Rank	State Status	Location
Panax quinquefolius	American ginseng	S3S4	S-CE	Melton Hill Dam, Raccoon Mountain
Pilularia americana	American pillwort	S1S2	SPCO	Dogwood Reservation Dam
Cimicifuga rubifolia	Appalachian bugbane	S3	THR	Norris Dam
Carya laciniosa	Big shellbark hickory	S2S3 (MS)	SLNS (MS)	Yellow Creek
Juglans cinerea	Butternut	S3	THR	Melton Hill Dam
Lilium canadense	Canada lily	S3	THR	Bull Run Fossil Plant
Platanthera cristata	Crested fringed orchid	S3 (MS)	SLNS (MS)	Yellow Creek
Dicentra cucullaria	Dutchman's breeches	S2 (AL)	SLNS (AL)	Wilson Dam
Delphinium tricorne	Dwarf larkspur	S2 (MS)	SLNS (MS)	Yellow Creek
Talinum mengesii	Fame-flower	S2	THR	Raccoon Mountain
Leucothoe racemosa	Fetter-bush	S2	THR	Kingston Fossil Plant
Hybanthus concolor	Green violet	S2 (MS)	SLNS (MS)	Yellow Creek
Carex gravida	Heavy-fruited sedge	S1	SPCO	Melton Hill Dam; Tellico Dam
Symplocos tinctoria	Horsesugar	S2	SPCO	Ocoee 3 Dam
Meehania cordata	Meehania mint	S2	THR	Norris Dam
Diervilla sessilifolia var rivularis	Mountain bush-honeysuckle	S2	THR	Raccoon Mountain
Thuja occidentalis	Northern white cedar	S3	SPCO	Bull Run Fossil Plant
Pellaea atropurpurea	Purple cliff-brake fern	S1S2 (MS)	SLNS (MS)	Yellow Creek
Ruellia purshiana	Pursh's wild-petunia	S1S2	SPCO	Melton Hill Dam

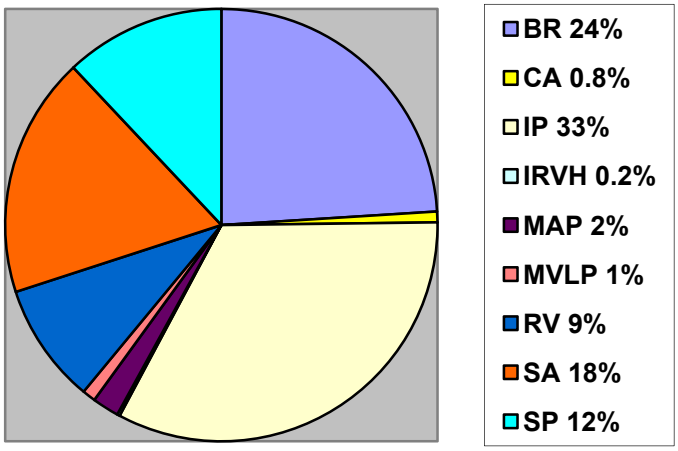
Scientific Name	Common Name	State Rank	State Status	Location
Amelanchier sanguinea	Round-leaf serviceberry	S2	THR	Raccoon Mountain
Carex stricta	Sedge	S2 (MS)	SLNS (MS)	Yellow Creek
Dodecantheon meadia	Shooting star	S2 (MS)	SLNS (MS)	Yellow Creek
Dentaria heterophylla	Slender toothwort	S2S3 (MS)	SLNS (MS)	Yellow Creek
Chimaphila maculata	Spotted wintergreen	S2 (MS)	SLNS (MS)	Yellow Creek
Aureolaria patula	Spreading false-foxglove	S3	SPCO	Kingston Fossil Plant, Bull Run Fossil Plant, Melton Hill Dam
Sedum ternatum	Stonecrop	S2 (MS)	SLNS (MS)	Yellow Creek
Sullivantia sullivantii	Sullivantia	S1	END	Norris Dam
Delphinium exaltatum	Tall larkspur	S2	END	Bull Run Fossil Plant
Viola tripartata	Three-parted violet	S2S3	SPCO	Raccoon Mountain, Melton Hill Dam
Pinus virginiana	Virginia pine	S2 (MS)	SLNS (MS)	Yellow Creek
Camassia scilloides	Wild hyacinth	S2S3 (MS)	SLNS (MS)	Yellow Creek
Erythronium rostratum	Yellow trout-lily	S2S3 (MS)	SLNS (MS)	Yellow Creek

Rank abbreviations: S1 = Critically imperiled with five or fewer occurrences; S2 = Imperiled with six to 20 occurrences; S3 = Rare or uncommon with 21 to 100 occurrences; S4 = Widespread, abundant, and apparently secure with more than 101 occurrences; S#S# = Occurrence numbers are uncertain.
Status abbreviations: END = Endangered; S-CE = Special concern, commercially exploited; SPCO = Special Concern; THR = Threatened; SLNS = State listed, no status
State abbreviations: AL = Alabama; MS = Mississippi

Within the TVA region, over 75 percent of the state-listed taxa are found in the Blue Ridge, the Interior Plateau, and Southwestern Appalachians ecoregions. Figure 4-6 depicts a graph representing the percentage of state-listed species found in each ecoregion.

Since both the Blue Ridge and Interior Plateau ecoregions contain the highest percentages of G1-ranked plant associations, these data suggest that rare plants tend to occur in rare-plant communities and that the Blue Ridge and the Interior Plateau are rich in rare species' diversity.

Information concerning threatened and endangered ecosystems, communities, and species can provide valuable assistance to land managers and educational opportunities for stakeholders in protecting these sensitive resources throughout the Valley.



Ecoregion abbreviations are as follows: BR=Blue Ridge, CA=Central Appalachians, IP=Interior Plateau, IRVH=Interior River Valley and Hills, MAP=Mississippi Alluvial Plain, MVLP=Mississippi Valley Loess Plain, RV=Ridge and Valley, SA=Southwestern Appalachians and SP=Southeastern Plains

Figure 4-6. Percentage of State-Listed Plant Species per Ecoregion

4.8. Cultural Resources

TVA is obligated to protect the many historic properties under its stewardship or affected by TVA projects pursuant to several federal laws and regulations. These projects range from the management and construction of power plants to the issuance of approval under Section 26a of the TVA Act. Historic properties include historic sites, buildings, structures, and objects, and archaeological resources important to prehistory or history. These resources are collectively referred to here as cultural resources. Congress has recognized that cultural resources are important to the nation's heritage and that the government should act as a facilitator to the preservation of these important resources.

4.8.1. Archaeology

Archaeological investigations in the TVA region began in the 19th century with the explorations of Cyrus Thomas, C. B. Moore, and the Smithsonian Institute (Guthe 1952). These early investigations focused on larger sites such as mound complexes and laid the foundation for the future role of archaeology in the U.S. The cultural history that was written as a result of these investigations along with other research that has been conducted in the Valley has been summarized elsewhere (TVA 1998; TVA 2004).

TVA's stewardship of archaeological resources began at its inception with the archaeological surveys conducted in the Norris, Wheeler, Pickwick, Guntersville, Hiwassee, Chickamauga, Gilbertsville (Kentucky), and Watts Bar basins through the efforts of local universities (Olinger and Howard 2009). Following World War II, archaeological surveys conducted on TVA-managed lands from 1940-1960 were sporadic until the NHPA was passed by Congress in 1966.

Following the passage of NHPA, numerous large-scale excavations were conducted as a result of agency undertakings that supported over 40 research volumes published by TVA and local universities. In 1983, TVA initiated an experimental archaeological stabilization program that explored various methodologies for the protection of archaeological sites eroding along the banks of its reservoirs. In addition, TVA conducted experiments on the

placement of protective signage near sensitive archaeological sites being exposed to illegal looting.

As large-scale undertakings and excavations have been reduced in the recent decades and with the growing awareness of the sensitive nature of these nonrenewable resources, the Agency has moved toward a preservation focus to protect those archaeological resources remaining under its management.

Pursuant to Section 110 of the NHPA, TVA is responsible for the identification, evaluation, and nomination of archaeological sites (in addition to other historic properties) to the NRHP. Toward that goal, TVA conducts identification surveys each year on its managed lands.

TVA manages approximately 293,000 acres surrounding TVA-managed reservoirs and 470,000 acres of inundated land totaling over 763,000 acres of public lands subject to the laws and regulations protecting archaeological resources. Archaeological survey of lands inundated by TVA reservoirs varies across the Valley, and over 4,144 archaeological sites have been recorded below normal summer pool elevation (Table 4-9). Because survey coverage below normal summer pool elevation is inconsistent and due to the lack of comprehensive data on survey coverage throughout TVA's history, it is not possible to estimate the percentage of TVA-managed lands that have been systematically surveyed within this 470,000-acre area. Many additional archaeological sites are likely present that have not been recorded as a result of the limited surveys conducted prior to construction of most TVA reservoirs. TVA often conducts identification surveys during temporary drawdown periods to identify those sites not normally exposed in regular reservoir operations.

In the last 30 years, over 40 large-scale archaeological surveys have been conducted by TVA using varying levels of intensity. Over the last few decades, archaeological survey techniques have improved due to scientific and technological advancements, and as a result, archaeological survey coverage and site documentation on TVA-managed lands varies across the Valley. To date, TVA has documented approximately 11,500 archaeological sites on its lands. While the number of resources is quite large, less than 25 percent of these sites have been assessed for eligibility for the NRHP. These data are approximate due to a lack of consolidated data across the Valley.

Table 4-9. Approximate Number of Archaeological Sites Identified on and Percent of TVA-Managed Lands Systematically Surveyed

Location	Percent of TVA-Managed Land Systematically Surveyed	Number of Inundated Sites	Number of Sites Above Normal Summer Pool	Total Number of Sites Recorded*
TVA-Managed Lands Adjacent to Reservoirs				
Apalachia	16	14	2	16
Bear Creek Project	75	152	454	606
Beaver Creek	2	0	1	1
Blue Ridge	51	111	7	118
Boone	0	36	20	56
Chatuge	40	185	158	343
Cherokee	16	599	164	763
Chickamauga	8	103	455	558
Clear Creek	0	0	0	0
Douglas	Unknown	103	12	115

Location	Percent of TVA-Managed Land Systematically Surveyed	Number of Inundated Sites	Number of Sites Above Normal Summer Pool	Total Number of Sites Recorded*
Fontana	Unknown	146	11	157
Fort Loudoun	0	65	31	96
Fort Patrick Henry	Unknown	35	37	72
Great Falls	0	0	0	0
Guntersville	<1	219	776	995
Hiwassee	40	248	16	264
Kentucky	1	500	1,335	1,835
Melton Hill	44	14	104	118
Nickajack	15	38	72	110
Nolichucky	0	0	0	0
Normandy	Unknown	0	43	43
Norris	Unknown	314	738	1,052
Nottely	12	168	56	224
Ocoee #1	10	20	1	21
Ocoee #2	0	0	0	0
Ocoee #3	0	0	0	0
Pickwick	29	222	596	818
South Holston	54	17	87	104
Tellico	7	285	368	653
Tims Ford	36	39	78	117
Watauga	Unknown	106	37	143
Watts Bar	41	151	477	628
Wheeler	8	254	1,077	1,331
Wilbur	0	0	0	0
Wilson	0	0	0	0
Fossil Plants				
Allen	0	N/A	0	0
Bull Run	<1	N/A	4	4
Colbert	10	N/A	11	11
Cumberland	8	N/A	4	4
Gallatin	37	N/A	1	1
John Sevier	18	N/A	3	3
Johnsonville	10	N/A	0	0
Kingston	27	N/A	0	0
Paradise	<1	N/A	0	0
Saltillo	0	N/A	15	15
Shawnee	17	N/A	17	17
Watts Bar	15	N/A	1	1
Widows Creek	0	N/A	2	2
Nuclear Plants				
Bellefonte	38	N/A	5	5
Browns Ferry	23	N/A	6	6
Sequoyah	100	N/A	1	1
Watts Bar	0	N/A	4	4
Other Properties				
Raccoon Mountain	27	N/A	8	8
Hartsville	27	N/A	14	14
Total	**--**	**4,144**	**7,309**	**11,453**

*Most of these totals are approximate due to lack of consolidated data across the Valley at the time of this publication.

TVA manages a number of significant archaeological sites that have had an important contribution to the understanding of prehistory in the Southeast. These resources include the Seven Mile Island Archaeological District (listed in the NRHP) and Dust Cave in Alabama, Hiwassee Island and Ledbetter sites in Tennessee, Jonathon Creek site in Kentucky, and Yellow Creek in Mississippi, as well as hundreds of other sites that have been included in academic research since the inception of TVA. TVA manages 22 historic properties listed in the NRHP. These include the pre-TVA dams (Ocoee #1 and #2, Blue Ridge, Wilson, Great Falls, and Wilbur), Seven Mile Island, numerous furnace sites across the Valley, and several archaeological sites excavated and inundated on Tellico Reservoir.

4.8.2. Historic Structures

Approximately 5,320 historic structures have been recorded on or near TVA-managed public lands (Table 4-10). Examples of these structures include gristmills, TVA dams, powerhouses associated with the dams, diversion flumes, homes, bridges, and cemeteries. Approximately 230 of the 5,320 historic structures are considered either eligible or potentially eligible for listing in the NRHP; 85 historic structures are listed in the NRHP; and there are nine NRHP historic districts. The historic districts include Little Bear, Normandy, Pickwick, Tims Ford, and Wheeler reservoirs, and four historic districts at Wilson Reservoir. In addition, Wilson Dam is listed as a national historic landmark. This is the only such designated TVA property, as well as the only such property within the study area. The study area is described in Section 1.5.

The majority of the historic structure data came from individual county surveys on file at State Historic Preservation Offices and from past TVA surveys, primarily associated with TVA's reservoir lands planning efforts. Many of these surveys are incomplete or out of date. Comprehensive work at South Holston, Douglas, Chatuge, Normandy, and Tims Ford reservoirs and partial coverage at Boone, Fort Patrick Henry, and Norris reservoirs supplemented these surveys.

The number of historic structures varies substantially among the reservoirs (Table 4-10). This reflects a wide variation in the availability of information about these structures. Some areas have been surveyed more than other areas, and NRHP eligibility has not been assessed for many structures. More comprehensive surveys and structure assessments would likely result in a more equal distribution of structures and NRHP-eligible structures at each reservoir. Consequently, the variation in the distribution in the existing data was not a major consideration in the impact analysis.

TVA's fossil plants are potentially eligible for listing in the NRHP like all other TVA power-generating facilities. However, with the exception of fossil plant property at the plant sites, TVA-managed lands along the river system near the fossil plants are associated with TVA mainstream and tributary projects. Historical resource surveys within the fossil plants and associated contiguous lands are conducted on a case-by-case basis as TVA proposed projects are undertaken.

Table 4-10. Numbers of Historic Structures Surveyed

Project and Location	Recorded Historic Structures	NRHP-Eligible or Potentially Eligible Historic Structures	NRHP-Listed Historic Structures/Districts
Main Stem Projects			
Kentucky, KY/TN	438	1	12
Pickwick, AL/MS/TN	151	2	1
Wilson, AL	21	1	4
Wheeler, AL	546	1	7
Guntersville, AL/TN	1,223	64	6
Nickajack, TN	50	1	0
Chickamauga, TN	138	1	10
Watts Bar, TN	91	1	10
Fort Loudoun, TN	139	1	2
Total Main Stem	**2,797**	**73**	**52**
Tributary Projects			
Norris, TN	421	22	0
Melton Hill, TN	19	1	5
Douglas, TN	413	47	4
South Holston, TN/VA	184	17	1
Boone, TN	89	4	5
Fort Patrick Henry, TN	73	1	0
Cherokee, TN	362	12	8
Watauga, TN	67	1	0
Wilbur, TN	0	1	0
Fontana, NC	28	1	3
Tellico, TN	269	6	3
Chatuge, NC	25	4	2
Nottely, GA	23	5	2
Hiwassee, NC	25	1	2
Apalachia, NC	1	1	0
Blue Ridge, GA	38	1	0
Ocoee #1, TN	1	2	0
Ocoee #2, TN	0	1	0
Ocoee #3, TN	1	1	0
Tims Ford, TN	158	3	1
Normandy, TN	93	1	4
Great Falls, TN	111	1	0
Upper Bear Creek, AL	63	2	0
Bear Creek, AL	2	2	1
Little Bear Creek, AL	14	1	1
Cedar Creek, AL	45	21	0
Total tributary	**2,525**	**160**	**42**
Total projects	**5,322**	**233**	**94**

State abbreviations: AL = Alabama; GA = Georgia; KY = Kentucky; MS = Mississippi; NC = North Carolina; TN = Tennessee; VA = Virginia

4.9. Land Use

The Tennessee River system has its headwaters in the mountains of western Virginia and North Carolina, eastern Tennessee, and northern Georgia. Two rivers, the Holston and the

French Broad, join at Knoxville to form the Tennessee River. Below this point, the river flows southwest through the state of Tennessee, gaining water from three other principal tributaries—Little Tennessee, Clinch, and Hiwassee rivers, in that order. The Tennessee continues flowing southwest into Alabama as far south as Guntersville and then westward, picking up water from the Paint Rock, Flint, and Elk rivers, in its course through the Muscle Shoals area in northern Alabama. At the northeast corner of Mississippi, the river turns north, recrosses the state of Tennessee, and continues to Paducah, Kentucky, where it enters the Ohio River. During the river's second passage through Tennessee, it is joined by another large tributary, the Duck River.

The Valley watershed includes approximately 40,913 square miles. This area lies mostly in the state of Tennessee, with portions in six other states—Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. TVA's PSA includes a total of 76,738 square miles, with 44,783 square miles extending outside the Valley watershed. TVA-managed lands adjacent to reservoirs include approximately 293,000 acres or 458 square miles encompassing parts of the seven Valley states.

TVA manages land around most of the reservoirs it operates. In all, approximately 293,000 acres of TVA-managed land is associated with 46 dams and reservoirs. This land is managed for project operations, sensitive resource management, natural resource conservation, industrial, developed recreation, and shoreline access. Nearly all of this land is in a band adjacent to the 11,000 miles of TVA-managed shoreline. In addition, TVA manages approximately 9,100 acres of land located adjacent to TVA's power facilities throughout the region.

In order to gain a better understanding of the development trends on TVA-managed lands and a 0.25-mile area of surrounding influence, TVA used 2008 and 2009 aerial photography from the USDA's National Agricultural Imagery Program and GIS mapping to estimate the land uses and land cover information of these lands. The current land cover among the TVA-managed lands is dominated by natural habitat. Specifically, 75 percent of TVA-managed lands are forested. Table 4-11 shows the other types of land cover on TVA-managed lands. Similarly, the 0.25-mile area of surrounding influence was also predominately natural habitat (Table 4-12). However, TVA-managed lands have 31 percent more forested lands than the surrounding areas. While the percentages of developed lands are similar for TVA-managed lands and the surrounding area, there is a significant difference in actual acreage between them. There are approximately 7,100 acres of development and an additional 13,373 acres of development with open spaces on TVA-managed lands. These figures are in significant contrast to the 30,241 acres of development and the additional 56,916 acres of development with open spaces on the surrounding areas.

Table 4-11. Land Use/Land Cover of TVA-Managed Lands

Land Use/Land Cover Class	Percentage of TVA-Managed Lands
Barren Lands	1
Developed Lands	2
Developed Lands With Open Space	4
Forested Lands	75
Pastureland or Cropland	11
Water	7

Developed lands = Low-, medium-, and high-intensity developments; Forested lands = Deciduous forest, evergreen forest, mixed forest, scrub-shrub, woody wetlands, and emergent herbaceous wetlands; Pastureland or cropland = Grassland/herbaceous, pasture/hayland and cultivated crops

Table 4-12. Land Use/Land Cover of 0.25-Mile Area Surrounding TVA-Managed Lands

Land Use/Land Cover Class	Percentage of 0.25-Mile Area of Influence
Barren Lands	1
Developed Lands	3
Developed Lands With Open Space	5
Forested Lands	44
Pastureland or Cropland	17
Water	31

Developed lands = Low-, medium-, and high-intensity developments; Forested lands = Deciduous forest, evergreen forest, mixed forest, scrub-shrub, woody wetlands, and emergent herbaceous wetlands; Pastureland or cropland = Grassland/herbaceous, pasture/hayland and cultivated crops

Across the TVA reservoir system, TVA estimates that up to 38 percent of the total shoreline is available for residential development, and a third of that shoreline had been developed by the mid-1990s (TVA 1998). SMI identified three times as many miles of residentially developed shoreline as all other developed uses combined (TVA 1998). Shoreline residential development is ongoing and would continue at some rate until complete buildout (the point at which the available shoreline property has been consumed by residential development). SMI anticipated that buildout would occur by 2023.

4.10. Prime Farmland

The FPPA requires that all federal agencies evaluate impacts to farmland prior to converting such land permanently to nonagricultural land use. Prime farmland is defined by the USDA as land that has the best combination of chemical and physical soil characteristics for meeting the nation's short- and long-range needs for food and fiber. Prime farmland can consist of cultivated land, pastureland, or forestland, but it is not urban land, built-up land, or land covered by water.

The States of Georgia, Kentucky, North Carolina, and Tennessee and the Commonwealth of Virginia have designated additional land as farmland of statewide and/or local importance. Generally, state agencies have identified these additional farmlands as those areas that economically produce high yields of crops when treated and managed according to acceptable farming practices. Some may produce as high a yield as prime farmland if

conditions are favorable. In some states, additional farmlands of statewide or local importance may include tracts of land that have been designated for agriculture by state law. Consideration for protection under the FPPA extends to farmland of statewide and local importance.

To evaluate any possible effects to prime farmland, farmland of statewide and local importance, TVA identifies soil classifications using the USDA NRCS *Web Soil Survey* (NRCS 2010). The FPPA encourages federal agencies, with assistance from the NRCS, to complete Form AD 1006 (*Farmland Conservation Impact Rating*) before an action is taken.

In the TVA region, approximately 17,360,515 acres are designated as prime farmland, farmland of statewide importance, or farmland of local importance. On average, this represents 33.2 percent of the total acreage farmed within the seven-state service area (Table 4-13).

Table 4-13 Acreage of Prime/Unique Farmland and Farming Trends in the Seven States Comprising the TVA Service Area

State	Percent of Total Area in Farms	Acres Protected by FPPA	Percent of Farmland Protected by FPPA	Percent Change From 1987 to 2007*		
				Number of Farms	Land in Farms (Acres)	Average Size of Farms (Acres)
Alabama	39.9	2,105,732	33	25.6	8.5	-12.7
Georgia	18.8	864,307	30	17.4	-6.2	-20
Kentucky	64.9	2,389,406	50	6.9	13.3	6.6
Mississippi	41.7	4,470,380	49	24.7	15.2	-6.8
North Carolina	12.2	852,691	28	-3.5	-17.8	-12.3
Tennessee	42.0	6,050,627	22	2	-6.2	-5.6
Virginia	39.4	627,372	21	4.8	9.5	5.9

*USDA, Agriculture Census, http://agcensus.mannlib.cornell.edu/

Agricultural census data show that during the 20 years between 1987 and 2007, the number of farms in six of the seven states that make up the TVA service area have increased between 2 to 25 percent. During the same period, the average size of farms within these same states has decreased. These data suggest that larger family-owned and -operated farms are being sold or subdivided into smaller farms, possibly through inheritance. This practice may place added pressure on prime farmlands by reducing the "connectivity" of adjoining farmland and promoting the expansion of utilities, which may lead to further nonfarm uses. North Carolina appears to be the state within the service area that is experiencing the greatest decline in the number and size of farms, as well as the acres of land committed to farming (Table 4-13).

Public lands surrounding TVA reservoirs and managed by TVA total approximately 293,000 acres, ranging from the 58 acres surrounding Wilbur Reservoir to the 75,216 acres associated with Kentucky Reservoir. On average, farmland protected by the FPPA surrounding most reservoirs (where soils data are available) is less than 12 percent of the acreage (Table 4-14).

Table 4-14. Acreage of Prime/Unique Farmland Surrounding TVA Reservoirs

Reservoir	Total Acres in Parcels	Percent of Farmland Protected by FPPA	Prime Farmland (acres)	Statewide Importance (acres)	Local Importance (acres)
Apalachia	897	12.0	107.3	0	0
Beaver Creek	290	47.6	18.2	120	0
Beech River Project	5,218	*			
Big Bear Creek	2,295	*			
Blue Ridge	470	2.2	10.7	0	0
Boone	880	6.6	58.5	0	0
Cedar Creek	2,747	*			
Chatuge	1,765	7.4	132.1	0	0
Cherokee	8,187	3.1	254.1	0	0
Chickamauga	15,947	*			
Clear Creek	14	17.8	0	2.5	0
Douglas	2,055	11.9	244.5	0	0
Fontana	931	0.0	0	0	0
Fort Loudoun	1,574	*			
Fort Patrick Henry	283	17.5	49.6	0	0
Great Falls	362	*			
Guntersville	37,282	6.7	2,498.5	0	0
Hiwassee	1,007	10.4	105.6	0	0
Kentucky	75,216	11.4	8,297.0	276.2	0
Little Bear Creek	1,181	*			
Melton Hill	2,579	*			
Nickajack	3,573	26.6	952.4	0	0
Nolichucky	1,132	17.0	193	0	0
Normandy	4,795	*			
Norris	27,928	1.5	433.5	0	0
Nottely	829	0.0	0	0	0
Ocoees	375	5.2	19.6	0	0
Pickwick	19,238	*		0	
South Holston	2,270	14.8	291.6	44.6	0
Tellico	12,644	16.6	2,102.1	0	0
Tims Ford	4,414**	11.7	518	0	0
Upper Bear Creek	2,955	*			
Watauga	1,137	1.0	12.4	0	0
Watts Bar	13,240	21.6	2871	0	0
Wheeler	36,178	8.3	2,994.4	0	0
Wilbur	58	0.0	0	0	0
Wilson	119	*			

* Data unavailable; ** Includes TVA-managed lands allocated for conservation partnerships

In addition to public lands surrounding its mainstream and tributary reservoirs, TVA is responsible for the management of lands associated with its fleet of power plants. Many of these sites, which were established 40 to 50 years ago, have experienced considerable changes to the soil and the surface hydrology during construction and operation. If prime farmland were present, these disturbances and the absence of active farming during this extended period would negate any negative impacts that conversion to nonagricultural land use might have on the farm service sector and surrounding farmland. Any land conversion activities within the existing boundaries of these sites would fall under the FPPA's exclusionary clause dealing with land already under (urban) development.

4.11. Visual Resources

Overview
The physical, biological, and man-made features seen in the landscape provide any selected geographic area with particular visual qualities and aesthetic character. The varied combinations of natural features and human alterations that shape landscape character also help define their scenic importance. The presence or absence of these features along with aesthetic attributes such as uniqueness, mystery, variety, pattern, vividness, contrast, and harmony make the visual resources of an area identifiable and distinct. The scenic value of these resources is based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures, and visual composition seen in each landscape.

Consistent with its objectives for environmental leadership, TVA ensures that, to the extent practicable, land use and natural resource management activities proposed for lands under its control would not significantly degrade or destroy outstanding visual resources. In those limited situations where no practicable alternatives are identified and substantial visual impacts would definitely occur, TVA may take reasonable and prudent measures to accomplish mitigation of the anticipated impacts.

A visual analysis includes evaluating the extent and magnitude of potential changes in the visual environment that could result from the proposed actions. The objectives are to identify:

- The scenic and aesthetic character of the existing landscape.
- The degree of discernible contrast between the proposed action and the existing landscape.
- The location and sensitivity levels of viewpoints available to the public.
- The visibility of the proposed action from the public's viewpoint.
- Any potential cumulative changes to the visual landscape.

The visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed action are reviewed and classified in the visual analysis process. The classification criteria are adapted from a scenic management system developed by the USFS, and integrated with planning methods used by TVA. The classifications are based on methodology and descriptions from USFS 1995.

Four categories of visual attributes are evaluated individually as described below, and the results help determine an overall scenic value.

- Scenic attractiveness is the measure of outstanding natural features, scenic variety, seasonal change, and strategic location. It is based on the intrinsic beauty of landforms, rock outcrops, water bodies, and vegetation. Attractiveness is ranked in one of three classifications from distinctive to minimal.
- Scenic integrity is the measure of visual unity and wholeness of the natural landscape character. It is based on the degree of disturbance in natural patterns, the presence of disruptive or discordant elements, and the relative harmony of human alterations. Integrity is ranked in one of four classifications from high to very low.

- Human sensitivity is the expressed concern of people for the scenic qualities of the project area. Sensitivity includes considerations such as the type and number of viewers, frequency, and duration of views, and viewer context of adjacent scenery. Concerns are also derived or confirmed by public input. Sensitivity is ranked in one of three classifications from high to low.
- Viewing distance is the measure of how far an area can be seen by observers and the degree of visible detail. It is ranked in one of three classifications from foreground to background.
    - Foreground is 0 to 0.5 mile from the observer where details of objects are clearly seen. Details are most distinct in the immediate foreground of 0 to 300 feet.
    - Middleground is 0.5 to 4 miles where single objects or groups tend to merge into larger patterns with less distinguishable details. When viewed in this broader context, alterations may contrast strongly with larger natural patterns and make some middleground views more sensitive than the foreground.
    - Background is 4 miles to the horizon where objects are seen as broad outline patterns and forms. Details and colors are not normally discernible unless they are quite large, standing alone, or provide strong contrast.

The term "scenic visibility" is sometimes used in visual analyses. Scenic visibility is composed of *human sensitivity* and *viewing distance*, which are interrelated, but evaluated and classified separately.

Visual absorption capacity is also considered when determining scenic value of a landscape. Absorption capacity indicates the relative ability of a landscape to accept human alteration with the least loss of scenic quality. It is based on characteristics of the natural features seen in the project area. As an example, alterations on a steep woodland slope with dense evergreen cover would create much greater visual contrast than similar actions on a gentle slope with a cover of mixed woodlands and pastures. Areas of greatest scenic value frequently have the least capacity to absorb visual change without substantial devaluation.

Overall, scenic value is determined by evaluating the combined levels of the four attributes, along with absorption capacity. It is ranked in one of four classes ranging from excellent to poor.

Affected Environment

TVA-managed lands and areas of jurisdiction include power plants, dam reservations, water bodies with floodrights, and tracts of land adjacent to the water bodies that range in size from tenths of an acre to several hundred acres. Since the scenic features of the landscape are not limited by land boundaries, the attractive landscape character extends across TVA-managed lands and other public and private lands alike. The natural elements together with the communities and other cultural development provide a scenic, rural countryside.

Land uses adjacent to the reservoirs include residential development, public parks, and sporadic industrial features. The reservoirs offer abundant water-recreation opportunities along with a variety of scenery. Most creek embayments are broadly open at the mouth, and some wind over a mile to their headwaters.

Among the scenic resources of each of the reservoirs, the water body itself is the most distinct and outstanding aesthetic feature. The horizontal surface provides visual balance and contrast to the islands and wooded hillsides. The reservoirs weave around ridges and bends, changing views periodically seen from the water. It also links the other landscape features together. Views across the water are satisfying and peaceful to most observers.

As noted in the ROS, lower winter pool levels often result in the exposure of reservoir bottoms and flats. This visual change in reservoir character is created in shallower portions of the reservoir and becomes most evident in the tailwater and embayment areas. Tailwater areas often revert to characteristics common of the original river environment, including wide, barren shorelines, and may create discoloration of rock bluffs along the river channel. Exposure of reservoir bottom areas is common to both tributary and main stem reservoirs but occurs more frequently in the main stem reservoirs.

The visual effect for main stem reservoirs from lower winter pool levels can range from the occurrence of sandbars and small islands to extensive flat areas that are dry with exposed ground. Many of these large, exposed flat areas are associated with wildlife management areas or other natural areas that exhibit wetland characteristics. Consequently, their appearance tends to blend in an acceptable degree with the surrounding landscape. In other cases, the flats are a notable part of residential viewsheds, where the change in landscape character is not as acceptable and was interpreted as creating a lower level of scenic integrity.

Each reservoir exhibits its own combination and degree of visual effects with respect to its operating plan. Its existing character and level of scenic attractiveness is maintained throughout the year. The same can be said for reservoirs classified as run-of-river projects. Reservoirs with similar landscape characteristics display a combination of effects related to both shoreline rings and exposed reservoir bottoms. These combinations create lower levels of scenic integrity.

Exposed shorelines or reservoir bottoms alone do not create the lowest level of scenic integrity, but rather exposure of other visible elements from lower water levels. Woody debris, trash, riprap, underwater structures, such as rubber tires used for fish habitat, and floating structures sitting on the bottom add unattractive visual contrast to the area viewed.

It is also important to note that, for some of the mainstream reservoirs, flood conditions create shoreline conditions that do not appear natural. For example, vegetated areas, normally above water, are covered; shoreline structures float higher than their moorings; and parking lots or other recreational facilities are submerged in water.

Various combinations of development and land use patterns that are present in the viewed landscapes along the shorelines contribute to the overall visual character of the project area. These can range from the more urban and industrial developments often associated with the mainstream reservoirs to residential developments that are common to both mainstream and tributary reservoirs. Urban and industrial developments generally create a lower level of scenic integrity. Residential areas and water-related facilities that include docks, boathouses, stairways, and shoreline protection structures are becoming more common. The presence of these facilities in the landscape reduces scenic integrity.

Islands are another significant feature. The islands provide scenic accents and visual reference points throughout the reservoirs and serve as visual buffers for less desirable

views. They also provide a pleasing foreground frame for the distant shoreline or background.

Other important scenic features include the secluded coves and steep, wooded ridges that occur around the reservoirs. The isolated coves with wooded shoreline provide relatively private locations for dispersed recreation activities. Significant elevation changes along some stretches of shoreline provide a dramatic contrast to the surrounding reservoir and gently sloping countryside, particularly when they are viewed from background distances. Most shorelines upstream of the dams appear natural. Slopes and ridgelines seen from the reservoirs are generally heavily vegetated with mature hardwood and evergreen trees and provide positive visual contrast to the reservoirs. There is usually little development in the foreground distances.

TVA's dam reservations contrast visually with the lands that border them. The dam reservations appear predominately industrial near the dams and switchyards. Most buildings are broadly horizontal and can be seen in the foreground. Transmission structures, including towers and lines, and fossil and nuclear plant structures generally can be seen up to middleground distances depending upon topography and viewer position. The most significant focal point in the landscape is generally the smokestacks and cooling towers, which can be up to 800 feet in height. Farther away, closer to the borders on all sides, the landscape becomes natural appearing with slight human alterations. Residents and motorists along local roads would have views up to middleground distances of the dam reservation depending upon seasonal variations of vegetation and atmospheric conditions.

4.12. Floodplains

As stated in the TVA Act, one of the primary reasons that TVA was established was to "control the destructive floodwater in the Tennessee River and the Mississippi River Basins." A series of dams and reservoirs was constructed to make flood control a reality. The operation of the integrated reservoir system provides substantial protection against flooding in the Valley and in the Ohio River and Mississippi River basins.

A common misconception about dams is that they prevent flooding. Floods cannot be prevented, but the operation of the TVA reservoir system can reduce damages. Efforts are made to reduce the peak flood elevations that would occur naturally without the dams. This is done by holding backwater upstream in the storage tributary reservoirs until the rains have subsided and then gradually releasing water until normal reservoir operations can be resumed. These actions substantially reduce the peak water elevations that would occur without the reservoir system.

Even with the system of dams, there is a floodplain adjacent to the reservoir. A floodplain is that relatively level land area along a stream or river that is subjected to periodic flooding. The 100-year floodplain is defined as that area inundated by the 100-year flood. The 100-year flood is the level of flooding that has a 1 percent chance of being equaled or exceeded in any given year and does not indicate a time period of 100 years between floods of this magnitude. Floodplain areas along reservoir shorelines normally encompass TVA-managed lands or TVA's flowage easements.

Floodplains provide and support many natural resources and functions of considerable economic, social, and environmental value. These values and benefits include natural wetlands and wildlife habitat, improved water quality, storm water management, recreational opportunities, and aesthetics.

As a federal agency, TVA is subject to the requirements of EO 11988 (Floodplain Management). The objective of EO 11988 is "to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (43 *Federal Register* 6030 [10 February 1978]). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

4.13. Socioeconomics and Environmental Justice

The NRP has the potential for social and economic impacts to virtually any area within the TVA region. Therefore, this analysis includes the 201 counties within these areas, plus Muhlenberg County, Kentucky, site of Paradise Fossil Plant, and DeSoto County, Mississippi, site of Southaven Combined-Cycle Plant. The 203-county area is further noted as the study area.

Population

The total population of the TVA region is about 10.6 million, as of 2009 (U.S. Bureau of the Census, http://www.census.gov/popest/estimates.html). Appendix L includes a table showing historical and projected population for the counties in the region. Population data from the 2010 Census of Population are not yet available for counties. However, total population is available for states (Table 4-15). These data are reasonably consistent with the state estimates for 2009, with the exception of Georgia, of which only a small area is in the TVA Region.

Table 4-15. Resident Population, Tennessee Valley States

State	Population, 2000 Census	Population, 2009 Estimate	Population, 2010 Census
Alabama	4,447,100	4,708,708	4,779,736
Georgia	8,186,453	9,829,211	9,687,653
Kentucky	4,041,769	4,314,113	4,339,367
Mississippi	2,844,658	2,951,996	2,967,297
North Carolina	8,049,313	9,380,884	9,535,483
Tennessee	5,689,283	6,296,254	6,346,105
Virginia	7,078,515	7,882,590	8,001,024

Sources: http://factfinder.census.gov/home/saff/main.html?_lang=en

The larger population concentrations in the region tend to be located along the corridors of the Tennessee, French Broad, Cumberland, and Tennessee rivers (Figure A-13, Appendix A). The areas of upper east Tennessee through Knoxville and Chattanooga, Tennessee, and North Alabama are situated along the Tennessee River and its tributaries. The Asheville, North Carolina, area is located along the French Broad River. The Nashville and Memphis, Tennessee, areas are located along the Cumberland and Mississippi rivers, respectively.

There are 16 metropolitan areas located within the study area (see Figure A-13, Appendix A). About 6.7 million regional residents live within the study area (see Figure A-14, Appendix A; and Table 4-16). Notable clusters of counties containing smaller populations are located along the Cumberland Plateau in Tennessee, along the Tennessee River in west Tennessee, and in Mississippi and western North Carolina.

Table 4-16. Metropolitan Area Population, 2009

Metropolitan Area	Total Population	Population Within Study Area	Population Outside Study Area
Memphis, Tennessee	1,304,926	1,241,468	63,458
Jackson, Tennessee	113,629	113,629	-
Florence-Muscle Shoals, Alabama	144,238	144,238	-
Decatur, Alabama	151,399	151,399	-
Huntsville, Alabama	406,316	406,316	-
Chattanooga, Tennessee-Georgia	524,303	524,303	-
Dalton, Georgia	134,319	134,319	-
Cleveland, Tennessee	113,358	113,358	-
Knoxville, Tennessee	699,247	699,247	-
Morristown, Tennessee	137,612	137,612	-
Kingsport-Bristol-Bristol, Tennessee-Virginia	305,629	305,629	-
Johnson City, Tennessee	197,381	197,381	-
Bowling Green, Kentucky	120,595	120,595	-
Clarksville, Tennessee-Kentucky	268,546	268,546	-
Nashville-Davidson-Murfreesboro, Tennessee	1,582,264	1,582,264	-
Asheville, North Carolina	412,672	412,672	-
Total	**6,616,434**	**6,552,976**	**63,458**

Source: U.S. Bureau of the Census, http://www.census.gov/popest/metro/metro.html

Employment

In 2008, the total employment for the study area was almost 6.1 million (http://www.bea.gov/regional/reis/). Regionally, manufacturing accounted for approximately 11.4 percent of all employment, somewhat higher than the national average of 7.8 percent. Manufacturing accounts for a substantial share of employment in many rural areas of the region (see Figure A-15, Appendix A) and often exceeds 20 percent of all employment.

However, the level of employment in manufacturing has been declining, both regionally and nationally, for a number of years. As of 2008, the estimated manufacturing employment in the region was about 631,000. This figure is a sharp decrease from 10 years ago with an employment level of almost 852,000. This decline is a national phenomenon, with a similar decline at the national level. The mix of manufacturing in the region has been gradually shifting to relatively more durable goods, including items such as automobiles. The durable goods share of total employment in manufacturing has increased from about 48 percent of the total to more than 55 percent. This trend is expected to continue. Manufacturing is an important source of employment, and its importance is expected to continue, although its share of total employment is likely to continue to decline.

Farming accounted for 2.7 percent of total employment in the study area, also higher than the national average of approximately 1.5 percent (see Figure A-16, Appendix A). Much farming in the study area is part time and not a primary income source. Earnings from farming account for less than 1 percent of all earnings in the study area. In 2007, the average farm in Tennessee was 138 acres, and half of all farms were 58 acres or less. Average reported sales per farm in Tennessee were $33,015, and the average net cash farm income was reported to be $3,075 per farm (USDA 2007c). In comparison, the national average farm was 418 acres, and the net cash farm income per farm nationwide was $33,827, more than 10 times the Tennessee average.

Income
In 2008, the per capita personal income for the study area was $32,949, about 82 percent of the national average of $40,166 (http://www.bea.gov/regional/reis/). However, the 2008 average income levels vary widely across the study area. For example, the average income for Williamson County, Tennessee, was 139 percent of the national average at $55,717, and Hancock County, Tennessee, was 46 percent of the national average at $18,365 (see Figure A-17, Appendix A).

Most counties with relatively high per capita income levels are in metropolitan or metropolitan areas.[1] Economic and social ties with urban centers often provide greater opportunities and easier access to many goods and services. However, these areas also are likely to result in somewhat higher costs of living, especially for housing.

Minority Populations
Minorities constitute 21.2 percent of the population within the study area. However, the distribution within the region is very uneven (see Figure A-18, Appendix A). Minorities are a relatively large share of the total population in most counties located in the western portion of the study area. In the rest of the region, with some exceptions, minority shares are low except in or around metropolitan areas. In particular, the Mississippi portion and most of Tennessee west of the Tennessee River as it flows north to Kentucky has a larger share of minorities than the regional average. Most other counties with large minority shares are located in metropolitan areas.

Poverty
In 2008, the poverty level for the study area is estimated to be 15.9 percent, higher than the national average of 13.2 percent (Figure A-19, Appendix A) (http://www.census.gov/did/www/saipe/). County poverty levels are higher than the regional average more frequently in the western part of the region and in counties along or near the Tennessee-Kentucky border. Relatively low poverty levels occur most often in metropolitan areas.

4.14. Navigation

The TVA Act authorized the construction and operation of dams and reservoirs in the Tennessee River and its tributaries to promote navigation and provide flood control. Development of the Tennessee River navigation channel was essentially completed in 1945 with the construction of a series of 10 dams and navigation locks, extending commercial navigation from Knoxville, Tennessee, to Paducah, Kentucky, a distance of 652 miles (see Table 4-17). The Tennessee River waterway is an integral part of the interconnected, 12,000-mile National Inland Waterway System.

[1] Metropolitan and Micropolitan Statistical Areas are defined by the U.S. Office of Management and Budget. Such areas have a high degree of social and economic integration with an urban core (http://www.whitehouse.gov/sites/default/files/omb/assets/omb/bulletins/fy2009/09-01.pdf).

Table 4-17. Navigation Locks Located on the Tennessee River Waterway

Lock	River Mile
Kentucky	Tennessee River Mile 22.4
Pickwick (Main and Auxiliary)	Tennessee River Mile 206.7
Wilson (Main and Auxiliary)	Tennessee River Mile 259.4
Wheeler (Main and Auxiliary)	Tennessee River Mile 274.9
Guntersville (Main and Auxiliary)	Tennessee River Mile 349.0
Nickajack	Tennessee River Mile 424.7
Chickamauga	Tennessee River Mile 471.0
Watts Bar	Tennessee River Mile 529.9
Fort Loudoun	Tennessee River Mile 602.3
Melton Hill	Clinch River Mile 23.1

The Tennessee River provides a year-round minimum depth of 11 feet, sufficient for 9-foot-draft vessels while allowing for 2 feet of overdepth. The minimum channel width in the dredged cuts is 300 feet with some widening on bends.

There are about 374 miles of secondary navigation channels in the Tennessee River system. On average, secondary channels provide at least 3 feet of depth at minimum pool levels and have a minimum width of approximately 50 feet.

Commercial Navigation

There are 187 commercial waterfront terminals located on the Tennessee River waterway. In 2007, the most recent year for which detailed data are available, waterborne commerce on the Tennessee River system totaled 49.6 million tons. Coal comprised 38 percent of all traffic, 18.9 million tons, much of which was delivered to TVA fossil plants. According to USACE 2007, other commodities moved on the system in 2007 included aggregates (12.5 million tons); grains (3.4 million tons); chemicals (3.4 million tons); iron and steel (3.3 million tons); ores and minerals (2.4 million tons); petroleum fuels (1.7 million tons); and all others (4.0 million tons).

It is estimated that shippers save about $461 million per year by using the waterway over other modes of transportation. In addition, shippers benefit from a competitive advantage provided by the availability of the waterway as a transportation option. This advantage is known as the water-compelled rate effect and provides an additional savings of about $486 million. For 2008, total navigation benefits for the Valley were estimated to be about $950 million.

Navigation Aids

On the Tennessee River system, the United States Coast Guard (USCG) is responsible for installing and maintaining navigation aids marking the commercial navigation channel, including channel buoys and daymarkers. TVA is responsible for those navigation aids marking secondary or recreational navigation channels. Responsibilities for navigation aids on the Tennessee River and its tributaries are described in a 1982 memorandum of agreement between the USCG and TVA.

TVA maintains approximately 2,500 navigation aids, marking 374 miles of secondary navigation channels on mainstream reservoirs. Secondary channel navigation aids help boaters avoid underwater obstructions, while accessing marinas, waterfront recreational areas, public launching ramps, and residential property. The majority of the secondary

channels lead off the commercial channel into large creeks and embayments. Secondary navigation aids include buoys, dayboards, pipes, hazard buoys, direct-read elevation gages, directional signs, and overhead power line buoys.

On TVA's tributary reservoirs, where there can be a large fluctuation between summer and winter pool levels, it would be impossible to install channel buoys that would be functional year-round. Instead, TVA installs and maintains hazard (danger) buoys to warn boaters of most isolated underwater hazards on the "main channel," as well as numbered dayboards placed at various locations around the reservoir. Tributary reservoirs with navigation aids include Apalachia, Bear Creek, Blue Ridge, Boone, Chatuge, Cherokee, Douglas, Fontana, Fort Patrick Henry, Hiwassee, Normandy, Norris, Nottely, Ocoee No. 1, South Holston, Tims Ford, and Watauga.

Safety Harbors and Safety Landings

On the Tennessee River, there are designated shoreline areas called safety harbors and safety landings where commercial traffic can tie off during fog and other inclement weather, equipment malfunctions, and emergencies. These safety harbors greatly minimize the risk of damage to private property. Over 160 safety harbors and landings are maintained along the mainstream reservoirs and two tributary reservoirs (Tellico and Melton Hill).

4.15. Air Quality

Air quality is a valuable environmental resource. Poor air quality can affect our health, ecosystem health, forest and crop productivity, economic development, as well as our enjoyment of scenic views. Through its passage of the Clean Air Act, Congress has mandated the protection and enhancement of our nation's air quality resources. NAAQS establish concentration limits in the ambient air for the following criteria pollutants to protect the public health and welfare:

- Sulfur dioxide
- Ozone
- Nitrogen dioxide
- Particulate matter whose particles are $\leq$ 10 micrometers
- Particulate matter whose particles are $\leq$ 2.5 micrometers
- Carbon monoxide
- Lead

The primary NAAQS were promulgated to protect the public health, and the secondary NAAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Ambient air monitors measure concentrations of these pollutants to determine attainment with these standards. Areas in violation of the NAAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to air permitting requirements that are more stringent. Figure A-20 (Appendix A) shows the current nonattainment areas for particles less than 2.5 microns. Figure A-21 (Appendix A) shows the areas that are currently nonattainment for ozone, as well as the areas that are expected to be designated nonattainment for the revised ozone standard. The USEPA promulgated new, more restrictive standards for particulate matter in 2006 and for ozone in 2008. There are currently no nonattainment areas for carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, and particles less than 10 microns in the TVA region. However, USEPA adopted a more stringent lead standard in 2008, and nonattainment areas have not yet been designated for this standard. Consequently, there may be nonattainment areas for lead in

the TVA region in the future. In 2009, the USEPA proposed new air quality standards for GHGs such as carbon dioxide. These regulations for GHGs have not yet been implemented. In 2010, USEPA adopted a 1-hour nitrogen dioxide standard. A listing of the NAAQS is presented in Table 4-18. National standards, other than annual standards, are not to be exceeded more than once per year (except where noted).

The feasibility of new management in the proposed area may be affected by several air quality considerations. One of the factors is regulatory status or attainment of air quality standards. Sources locating in clean air areas are subject to the Prevention of Significant Deterioration (PSD) New Source Review (NSR) rules, whereas those locating in or affecting areas failing to attain air quality standards must comply with nonattainment NSR. An overriding constraint in either NSR program is that no source may cause or significantly contribute to a violation of an ambient air quality standard.

PSD regulations restrict the increment by which ambient pollutant levels may increase due to emissions from major new sources, or the modification of existing sources, and require the use of best available control technology on such sources. A memorandum listing pollutants currently subject to PSD review was published in the *Federal Register* (USEPA 1992).

PSD regulations include protection of national parks and wilderness areas that are designated as PSD Class I air quality areas. A new or expanding major air pollutant source is required to estimate the potential impact of its emissions on the air quality of any nearby Class I area, as specified by the state or local air regulatory agency, with input from the federal land manager(s) having jurisdiction over the given Class I area(s). There are eight PSD Class I areas in the vicinity of the TVA region: the Great Smoky Mountains and Mammoth Cave national parks and the Joyce Kilmer, Shining Rock, Linville Gorge, Cohutta, Sipsey, and Upper Buffalo wilderness areas. The location of these Class I areas are shown in Figure A-22, Appendix A. Generally, dispersion modeling is required to demonstrate that pollution levels do not increase beyond the allowable increments. Ambient air quality data necessary for PSD analysis purposes are available for the region.

In 1999, USEPA established the Regional Haze Rule to improve visibility in Class I areas. This regulation requires states to develop long-term strategies to improve visibility with the ultimate goal of restoring natural background visibility conditions by 2064.

The air quality in the Valley and across the country has greatly improved. Some clean air standards, by which we judge progress, are much tougher now. The regulatory “bar” has been raised. Recent record low emission levels are due in part to manageable operations, as well as uncontrollable variables. TVA is undertaking one of the largest emission-reduction programs in the nation. Sulfur dioxide emissions have been reduced by 91 percent since the peak in 1977. Annual nitrogen oxide emissions have been reduced by 89 percent, and ozone season nitrogen oxide emissions have been reduced by 90 percent from the peak in 1995.

Table 4-18. National Ambient Air Quality Standards

Pollutant	Primary Standards[a]		Secondary Standards[b]	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10,000 µg/m^3)	8-hour (1)	None	
	35 ppm (40,000 µg/m^3)	1-hour (1)		
Lead	0.15 µg/m^3 (2)	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
	100 ppb	1-hour(3)	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour (4)	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (5) (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour (6)	Same as Primary	
Ozone	0.075 ppm (2008 standard)	8-hour (7)	Same as Primary	
	0.08 ppm (1997 standard)	8-hour (8)	Same as Primary	
	0.12 ppm	1-hour (9) (Applies only in limited areas)	Same as Primary	
Sulfur Dioxide	0.03 ppm (80 µg/m^3)	Annual (Arithmetic Mean)	0.5 ppm (1300 µg/m^3)	3-hour (1)
	0.14 ppm (365 µg/m^3)	24-hour (1)		
	75 ppb (10)	1-hour	None	

Source: 40 CFR 50 (USEPA 2008a)

Abbreviations: ppb = parts per billion µg/m^3 = micrograms per cubic meter
ppm = parts per million

(a) Standards set to protect public health
(b) Standards set to protect public welfare
(1) Not to be exceeded more than once per year
(2) Final rule signed October 15, 2008
(3) To attain this standard, the three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010)
(4) Not to be exceeded more than once per year on average over three years
(5) To attain this standard, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m
(6) To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006)
(7) To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008)
(8) (a) To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm (b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as USEPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard
(9) (a) USEPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$1.
(10) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

4.16. Climate

The TVA region spans the transition between a humid continental climate to the north and a humid subtropical climate to the south. This provides the region with generally mild temperatures (i.e., a limited number of days with temperature extremes), ample rainfall for agriculture and water resources, vegetation-killing freezes from midautumn through early spring, occasional severe thunderstorms, infrequent snow, and infrequent impacts—primarily in the form of heavy rainfall—from tropical storms. The seasonal climate variation induces a dual peak in annual power demand, one for winter heating and a second for summer cooling. Rainfall does not fall evenly throughout the year, but tends to peak in late winter/early spring and again in midsummer. Winds over the region are generally strongest during winter and early spring and lightest in late summer and early autumn. Solar radiation (insolation) varies seasonally with the maximum sun elevation above the horizon and longest-day length in summer. However, insolation is moderated by frequent periods of cloud cover typical of a humid climate.

Prediction of the future trends in climate change is not an exact science. Global climate change and its relationship to GHGs are items of intense study and are important to TVA. In common usage, "global warming" often refers to the warming of the earth that may occur as a result of emissions of GHG in the atmosphere. Global warming may occur from a variety of both natural and anthropogenic causes. "Climate change" refers to any substantive change in measures of climate, such as temperature, precipitation, or wind. The two terms are often used interchangeably, but the climate change is broader as it conveys that there are other changes in addition to rising atmospheric temperature.

It is believed that certain substances present in the atmosphere act like the glass in a greenhouse to retain a portion of the heat that is radiated from the surface of the earth. The common term for this phenomenon is the "greenhouse effect," and it is essential for sustaining life on earth. Water vapor and, to a lesser extent, water droplets in the atmosphere are responsible for 90 to 95 percent of the greenhouse effect. The most abundant long-lived GHGs are CO_2, methane, and nitrous oxide. Both man-made and natural processes produce GHG. According to some sources, increases in the earth's average surface temperatures are linked in part to increasing concentrations of GHG, particularly CO_2, in the atmosphere. This has been a cause for concern among scientists and policymakers. This phenomenon has been studied internationally since 1992 by the United Nations Framework Convention on Climate Change, Intergovernmental Panel on Climate Change (IPCC).

The global carbon cycle is made up of large carbon sources and sinks. Billions of tons of carbon in the form of CO_2 are absorbed by oceans and living biomass (i.e., sinks) and are emitted to the atmosphere annually through natural and man-made processes (i.e., sources). When in equilibrium, carbon fluxes among these various reservoirs are roughly balanced. According to the IPCC (2007), since the Industrial Revolution (i.e., about 1750), global CO_2 atmospheric concentrations have risen about 36 percent, principally due to fossil fuel use.

The remainder of this section describes the current climate and recent climate trends of the TVA region in more detail. Identifying recent trends in regional climate parameters such as temperature and precipitation is a complex problem because year-to-year variation may be larger than the multidecadal change in a climate variable. Climate is frequently described in terms of the climate "normal," the 30-year average for a climate parameter (National

Climatic Data Center 2008). The climate normals described in the following sections are for the 1971-2000 period. Earlier and more recent data are also presented, where available. The primary sources of these data are National Weather Service (NWS) records and records from the rain gauge network maintained by TVA in support of its reservoir operations. NWS records, unless stated otherwise, are for Memphis, Nashville, Chattanooga, Knoxville, and Tri-Cities, Tennessee, and Huntsville, Alabama.

Temperature

1971-2000 Climate Normals — Average monthly temperatures for the TVA region during 1971-2000 ranged from 38.4°F in January to 79.1°F in July (Table 4-19).

Table 4-19. Monthly, Seasonal, and Annual Temperature Averages for Six National Weather Service Stations in the TVA Region for 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
°F	38.4	42.6	50.9	59.2	67.5	75.3	79.1	78.0	71.7	60.3	50.1	41.7
°C	3.5	5.9	10.5	15.1	19.7	24.1	26.2	25.6	22.1	15.7	10.0	53.9

	Winter	Spring	Summer	Autumn	Annual
°F	40.9	59.2	77.5	60.7	59.6
°C	5.0	15.1	25.3	16.0	15.3

Recent Trends — There is significant year-to-year variability in temperature. As suggested by the plot in Figure 4-7, annual temperature in the TVA region appears to have increased approximately 1°F (0.56°C) over the 30-year period between 1970 and 2000 (this is equivalent to a change of about 0.19°C per decade). This increase is most prominent in the winter and summer seasons. Spring and autumn experienced little change in temperatures. However, the overall annual change in temperature for the longer 1958-2008 period was not statistically significant (runs test [Bendat and Piersol 1986], $r^2 = 0.0994$, $p>0.05$). This implies that average temperature during the 50-year period was within the expected range of variability, and the long-term trend could not be distinguished from random variation.

There are some inconsistencies with these observations. For example, the number of days during the year with temperatures at or above 90°F increased by about 12 days during 1971-2000. However, the number of days experiencing 90+°F decreased during both 1958-2004 (by six days) and 1979-2004 (by 10 days). For 1958-2009, the number of days essentially remained unchanged.

The U.S. Climate Change Science Program (Lanzante et al. 2006) reports that global surface temperature through 2004 has increased at a rate of about 0.12°C per decade since 1958 and about 0.16°C per decade since 1979. Regional differences from the global trends are expected. In the tropics, for example, the observed surface temperature trends have increased about 0.11°C per decade since 1958 and about 0.13°C per decade since 1979. These rates represent an acceleration of temperature changes that during the entire 20th century were estimated by the IPCC as being in the range of 0.06 to 0.09°C per decade (Trenberth et al. 2007).

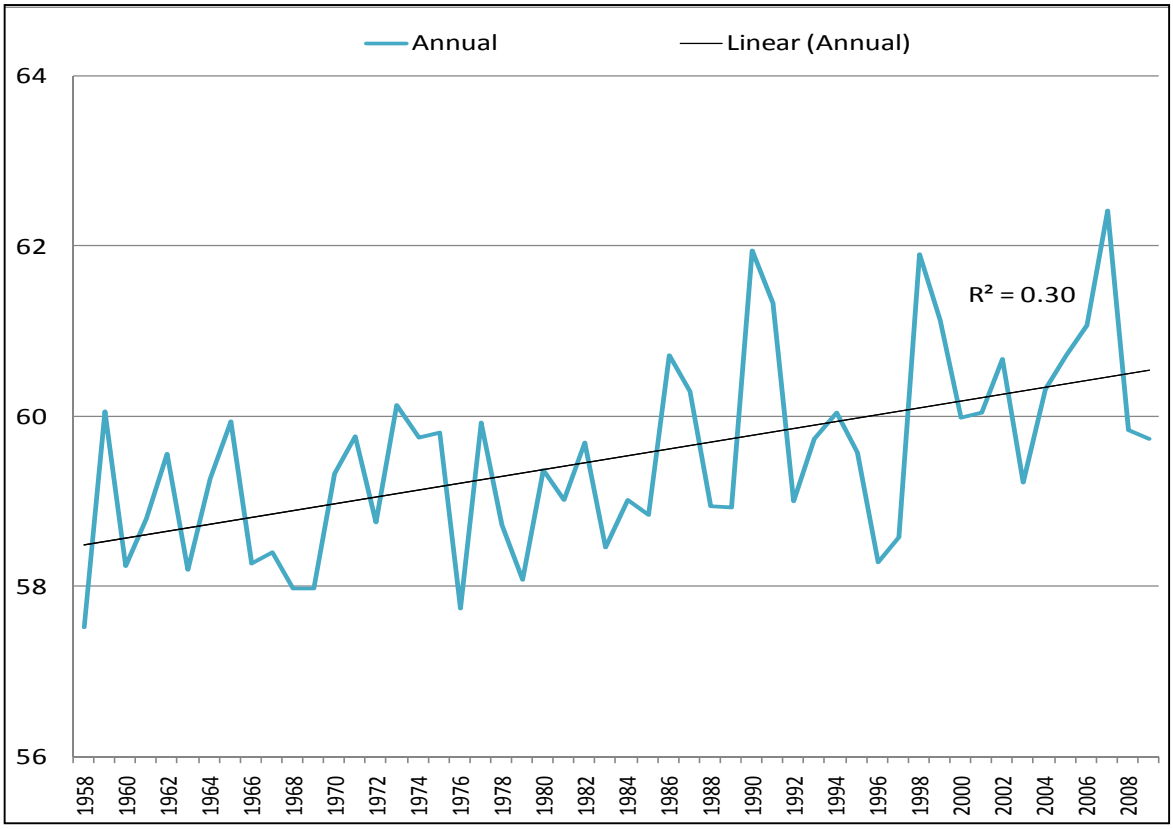


Figure 4-7. 1971-2000 TVA Region Annual Average Temperature (°F) Based on Data From Six National Weather Service Stations

For the southeastern U.S., Trenberth et al. (2007) indicate that temperature change during the 20th century (through 2005) was slightly negative with a mean cooling rate of about 0.2-0.3°C per decade in the vicinity of the TVA region. Their data indicate a warming rate of 0.3-0.4°C per decade for 1979-2005 for the TVA region, greater than the global average trend. The lack of significant temperature change (i.e., +0.19°C per decade) during 1958-2008 for the TVA region is consistent with these published findings.

Precipitation

1971-2000 Climate Normals — The average annual precipitation in the Tennessee River watershed during 1971-2000 was 49.92 inches; monthly averages ranged from 3.04 inches in October to 5.42 inches in March (Table 4-20).

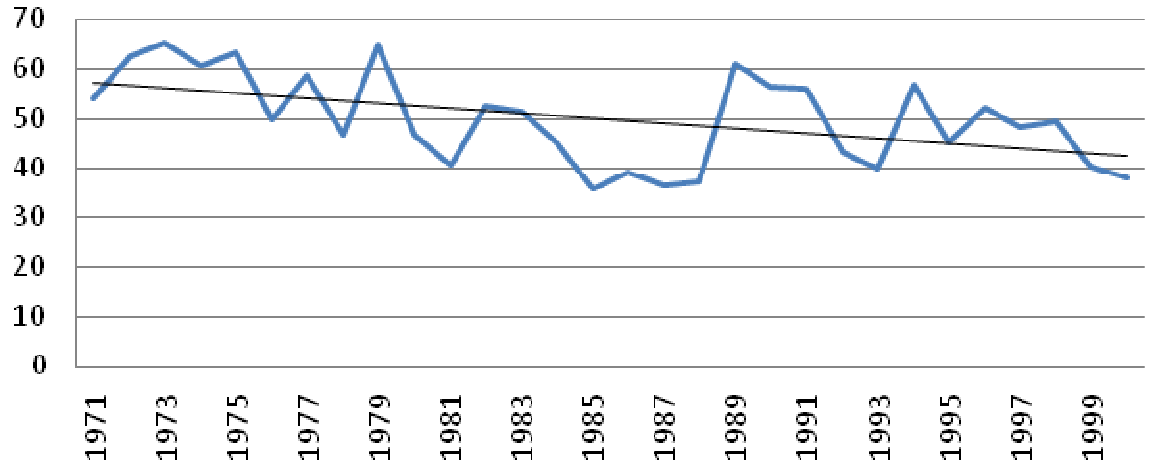
Table 4-20. Monthly, Seasonal, and Annual Precipitation Averages in the Tennessee River Watershed for 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inches	4.87	4.31	5.42	3.97	4.52	3.84	3.97	3.24	3.59	3.04	4.32	4.85
Centimeters	12.4	10.9	13.8	10.1	11.5	9.8	10.1	8.2	9.1	7.7	11.0	12.3

	Winter	Spring	Summer	Autumn	Annual
Inches	14.03	13.91	11.04	10.95	49.92
Centimeters	35.6	35.3	28.0	27.8	126.8

Source: TVA rain gage network data

Recent Trends — Although there is significant year-to-year variability, there appears to be a decrease in precipitation during the approximately 30-year period (Figure 4-8). The overall annual change in precipitation was deemed not statistically significant (with 95 percent confidence) based on results from a standard statistical test (Bendat and Piersol 1986) applied to the annual mean precipitation over the period of 1958-2008. This implies that average precipitation during the 50-year period was within the expected range of variability, and the long-term change could not be assumed anything other than random variation in the data. Note that precipitation information is highly variable and contradictory. Data for 1958-2004 indicate that annual precipitation is decreasing. However, data for 1979-2004 indicate that precipitation is increasing.



Source: TVA rain gauge network data
Note: Straight line represents the mean change in annual precipitation for the period.

Figure 4-8. Annual Average Precipitation (Inches) for the Tennessee River Basin

Recent changes in precipitation around the world are more variable than changes in temperature. Such behavior is expected as changes in atmospheric circulation (wind patterns) and temperature combine differently in different regions to influence the basic physical processes that control precipitation. The IPCC 2007 climate assessment reported that a few regions in North America, southern South America, Eurasia, and Australia experienced precipitation increases during the 1901-2005 period (Trenberth et al. 2007). However, changes since 1979 have been less pronounced except in Australia. Over the southeastern U.S., precipitation since 1901 has shown a small increase of generally less than 10 percent overall, and since 1979 the changes have been near zero. These results are consistent with a U.S. Global Change Research Program summary of recent and projected climate change in the Southeast (Karl et al. 2009), which shows small precipitation increases across Tennessee during the 20th century offset by decreases over Alabama, Georgia, and North Carolina. Hoerling et al. (2008), in describing the 1951-2006 interval, state "The spatial variations and seasonal differences in precipitation change are *unlikely* [sic] to be the result of anthropogenic greenhouse forcings alone." On a related issue, they further state "It is *unlikely* [sic] that a systematic change has occurred in either the frequency or area coverage of severe drought over the contiguous United States from the mid-twentieth century to the present." This does not mean that anthropogenic warming of the climate has not exacerbated the effects of drought. To the contrary, Hoerling et al.

(2008) concluded that an anthropogenic link to worsening drought effects (through the enhanced drying effects of warming) is likely.

Wind

1971-2000 Climate Normals — Wind speed and direction are important indicators of weather patterns and dispersion of air pollutants. Wind speed is also a factor in determining the potential of an area for wind energy development. Average surface wind speeds (measured 33 feet [10 meters] above the ground) for nine NWS stations in the TVA region for 1973-2000[2] are relatively light with higher speeds in winter and spring and lower speeds in summer and autumn (Table 4-21). In general, wind speeds at higher elevations are greater than those shown in the table. Average wind speeds in winter, spring, and autumn were slightly less than the 1961-1990 seasonal norms. A similar decrease is also shown in the maximum, minimum, and annual average wind speeds. The months of occurrence for the maximum and minimum wind speed remain unchanged, with highest wind recorded in March and lowest wind in August.

Table 4-21. Monthly, Seasonal, and Annual Wind Speed Averages for Nine Sites in the TVA Region for 1973-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Miles/Hour	8.3	8.4	8.9	8.4	7.1	6.3	5.8	5.4	5.8	6.2	7.3	7.9
Meters/Second	3.7	3.7	3.9	3.7	3.1	2.8	2.6	2.4	2.6	2.8	3.2	3.5

	Winter	Spring	Summer	Autumn	Annual
Miles/Hour	8.2	8.1	5.8	6.4	7.1
Meters/Second	3.6	3.6	2.6	2.7	3.2

Surface wind directions in the TVA region for the same period are shown in the wind rose diagram (Figure 4-9). A wind rose is a diagram with spokes representing directions (e.g., north, north-northeast, northeast). The frequency with which the measured wind blows from a given direction is illustrated by the distance between the point where a heavy line crosses a spoke and the center of the diagram. The most frequent wind directions are from the south and north sectors. This occurs at Memphis, Tennessee; Tupelo, Mississippi; Paducah, Kentucky; Nashville, Tennessee; Chattanooga, Tennessee; and Asheville, North Carolina. Prevailing wind directions at Knoxville, Tennessee, and Tri-Cities, Tennessee, are from northeast and/or southwest sectors, which reflect the down-valley and up-valley flow pattern seen in the area. Wind directions at Huntsville, Alabama, are more variable than at other sites. Overall, the prevailing wind directions in the TVA region during 1973-2000 are nearly identical to those during 1961-1990.

[2] Data for 1971 and 1972 are not available from the National Climatic Data Center.

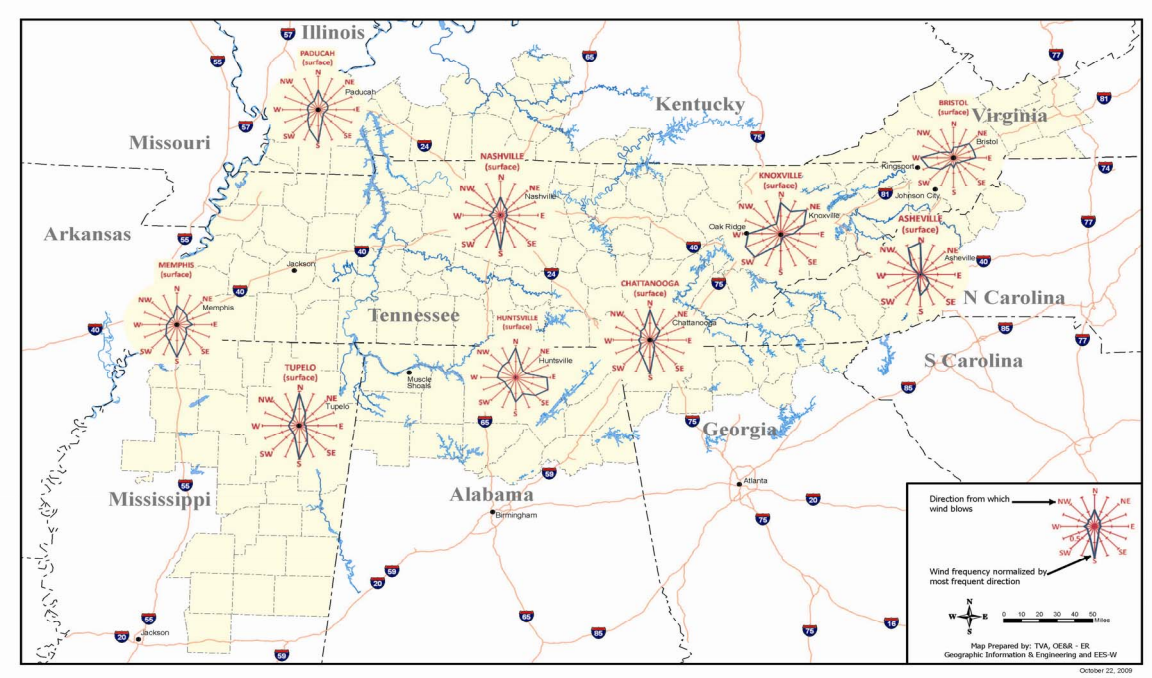


Figure 4-9. Prevailing Wind Direction for Surface Winds at Nine Regional Airports, 1973-2000

Solar Radiation

1971-2000 Climate Normals — Solar radiation (insolation) received at the earth's surface is a function of two factors—cloud cover and atmospheric particles (aerosols). Clouds generally decrease insolation by scattering and reflecting incoming solar radiation back into space. Aerosols scatter and absorb solar radiation. Absorbed radiation tends to be reradiated by aerosols in longer wavelengths with some of the energy reaching the earth surface, some warming the atmosphere, and some going back into space.

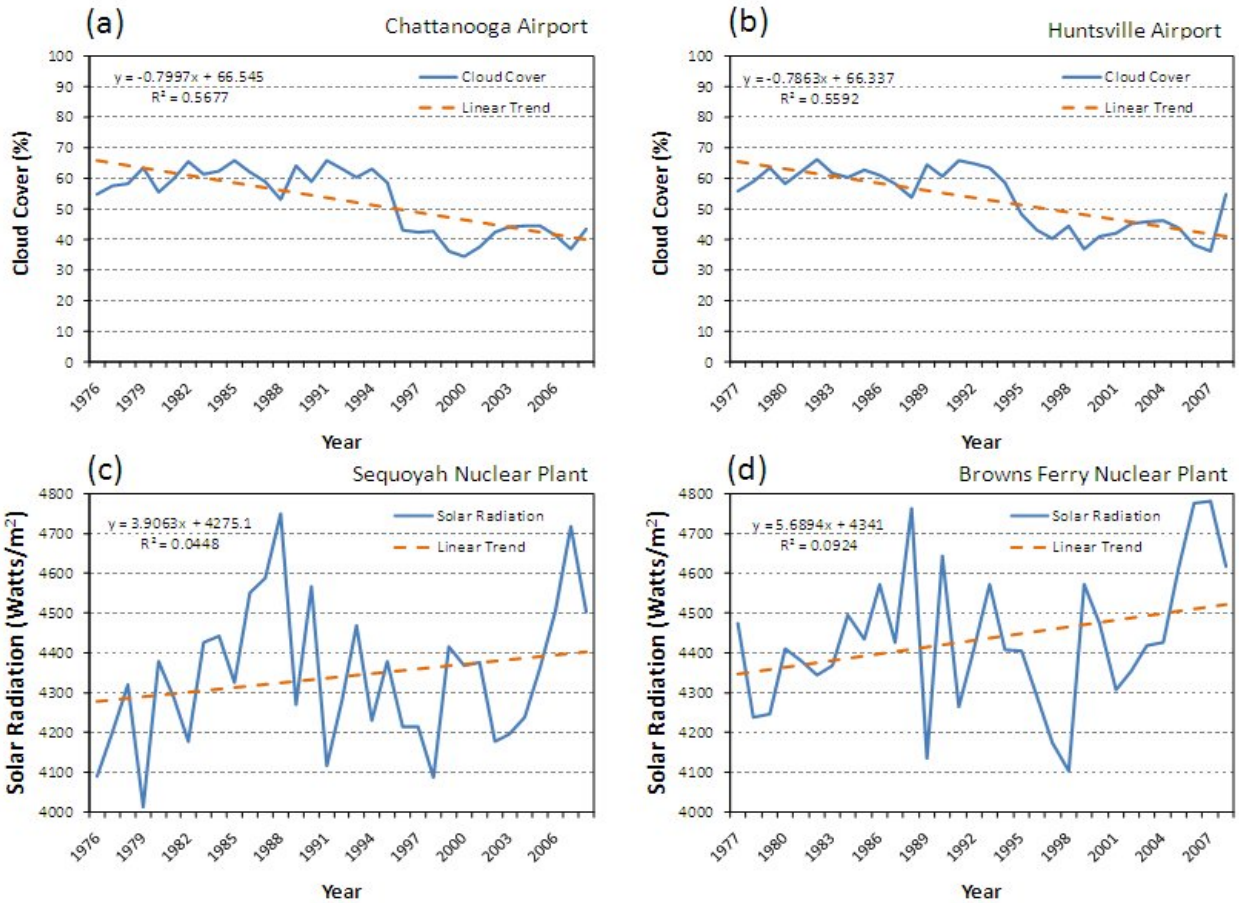
Solar radiation is measured at few NWS weather stations, and most of the data in the National Solar Radiation database produced by the National Renewable Energy Laboratory are based on modeling rather than original measurements. Cloud cover, however, is measured at all NWS weather stations and ranges from zero (totally clear sky) to 100 percent (completely covered by clouds). Table 4-22 shows mean cloud cover for nine sites in the TVA region during 1973-2000. The nine sites are Asheville, North Carolina; Tri-Cities, Knoxville, Chattanooga, Nashville, and Memphis, Tennessee; Huntsville, Alabama; Tupelo, Mississippi; and Paducah, Kentucky.

Table 4-22. Monthly, Seasonal, and Annual Cloud Cover Averages for Nine Sites in the TVA Region for 1973-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Percent (%)	66	64	63	57	59	56	53	51	53	49	59	63

	Winter	Spring	Summer	Autumn	Annual
Percent (%)	65	60	53	53	58

TVA has monitored solar radiation at Sequoyah Nuclear Plant (SQN) and Browns Ferry Nuclear Plant (BFN) since the 1970s. Figure 4-10 shows these monitoring results as well as cloud cover measurements at the Chattanooga airport (about 15 miles from SQN) and at the Huntsville airport (about 21 miles from BFN). Cloud cover at the Chattanooga airport was negatively correlated (correlation coefficient of -0.35) with solar radiation at SQN, and cloud cover at Huntsville airport was negatively correlated (correlation coefficient of -0.38) with solar radiation at BFN. The decreasing trends in cloud cover at both Chattanooga and Huntsville are significantly different ($p \leq 0.05$) from random variability. However, no trend is detected in solar radiation at SQN and BFN at the same level of significance. Due to this weak relationship between measured solar radiation and cloud cover, cloud cover is, at best, a weak proxy for solar radiation at specific sites in the TVA region.



(a) Cloud cover at the Chattanooga Airport
(b) Cloud cover at the Huntsville Airport
(c) Solar Radiation at SQN
(d) Solar Radiation at the BFN

Figure 4-10. Annual Observations and Fitted Trend Lines for Cloud Cover at Selected Airports and Solar Radiation at Selected Nuclear Plants for 1976/1977-2008

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CHAPTER 5

5.0 ENVIRONMENTAL CONSEQUENCES

This chapter addresses the potential direct, indirect, and cumulative effects of adopting and implementing Alternatives A, B, C, and D. A direct impact is an effect caused by the action and occurring at the same time and place. An indirect impact is an effect caused by the action but removed in time or distance. A cumulative impact results from the incremental or collective effect of the action when combined with other past, present, and reasonably foreseeable future actions. Cumulative effects were examined within the TVA region over the next 20 years in the context of gradually increasing population and land development in that area. When determining the potential direct, indirect, and cumulative impacts to the environment, all programs and activities described under the alternatives were taken into consideration. However, only those programs having the potential to impact the environment are discussed within this chapter.

The remainder of this section addresses cumulative impacts of implementing the NRP programs when added to regional trends and anticipated future conditions. Consistent with the broad geographic scope of the NRP, cumulative effects were examined throughout the TVA region (Figure 1-2). Within the TVA region, in addition to TVA-managed land, land is owned and managed by private individuals, NGOs (for example, The Nature Conservancy), and state and federal agencies. Similar to TVA, the USFS and National Park Service manage land in the region with goals for conservation, public access, and recreational opportunities. Because of the 20-year time frame and the geographic scope of the evaluation, predicting future resource conditions involves substantial uncertainty. Future cumulative impacts can result not only from possible actions of TVA, but also from those of other agencies and the public.

Past and present activities in the TVA region have resulted in a region shaped, in part, by TVA's successful achievement of the purpose and goals set by Congress to improve navigation, control floods, provide for the proper use of marginal lands, support industrial development, and provide affordable power, all for the general purpose of fostering the physical, economic, and social development of the region.

Existing conditions of the TVA region are described in Section 1.3 and throughout Chapter 4. The TVA region covers a total of 76,738 square miles with 44,783 square miles extending outside the Valley watershed. TVA-managed lands adjacent to reservoirs include approximately 293,000 acres or 458 square miles encompassing parts of the seven Valley states. In addition, TVA manages approximately 9,100 acres of land located adjacent to TVA's power facilities throughout the region. Historically, TVA has made approximately 485,300 acres of land available for recreational developments (Table 1-1). Today, there are approximately 95,520 public and private recreational facilities available on these lands and throughout the TVA region (Table 4-1). Only 2,586 of these facilities are managed by TVA. As described in Section 4.9, there are approximately 7,100 acres of general development and an additional 13,373 acres of development with open spaces on TVA-managed lands. These figures are in significant contrast to the 30,241 acres of general development and the additional 56,916 acres of development with open spaces on the surrounding 0.25-mile area of influence. Also shown in Tables 4-11 and 4-12, approximately 75 percent of TVA-managed lands are forested versus only 44 percent of the immediately surrounding 0.25-mile-influence area. In comparison, SMI reported that this

same area of influence was approximately 67 percent forested, and forest covered 55 percent of the area of the counties adjoining TVA reservoirs.

The NRP is designed for implementation over 20 years. Over this period, existing conditions in the TVA region are expected to change. TVA's IRP forecasts changes in social and economic conditions in the TVA region. The following general trends are anticipated over the next two decades:

- Increasing human population
- Increasing proportion of residents in metropolitan areas
- Increasing demand for public recreation opportunities associated with population growth
- Increasing development of natural habitat in rural and suburban areas

Foreseeable future actions in the TVA region have been described in long-range and regional planning documents such as TVA's IRP. Other future activities generally include:

- Continued development of shoreline properties in private ownership.
- State agency efforts to conserve natural resources and provide dispersed and developed recreation opportunities in state parks, gamelands, and state forests.
- State agency efforts to reduce regional impacts to water quality through the total maximum daily load, water quality certifications, and other programs.
- Federal agency conservation and recreation efforts with a trend toward improving biodiversity, recreation, and less timber harvest.
- Regional coalitions producing conservation plans geared toward reducing impacts to water and forest resources. An example of this type of effort is the Cumberland Habitat Conservation Plan (http://www.cumberlandhcp.org/default.html).
- Local efforts generated by various levels of governmental and nongovernmental agencies. For example, the Southeast Watershed Forum is working with local city-county leaders, resource organizations, and TWRA staff to integrate comprehensive plans with preserving priority habitat and shaping growth away from natural. Other local efforts can be found at http://wcs.conservationregistry.org/.

These past, present, and projected conditions provide the context for determining potential cumulative impacts of TVA's proposed natural resource management programs.

The management programs proposed in the NRP are designed to improve and benefit natural resources and recreation opportunities. At minimum, TVA would maintain compliance with applicable laws, regulations, guidance, and policies designed to reduce impacts to sensitive biological and cultural resources. Under the Flagship Management or Blended Management alternatives, TVA would implement additional projects designed to benefit biological and cultural resources and improve recreational opportunities. Some temporary and minor impacts of management projects could occur, as described in Section

5.1 below. However, those minor impacts are expected to be outweighed by overall benefits to natural resources (see Table 3-10).

Reservoir lands planning provides a basis for allocating lands available to various management and recreation projects. Lands planning, by itself, does not result in environmental impacts. Impacts are the result of projects or activities implemented according to the allocated land uses. The impacts of TVA projects are described in Sections 5.2 through 5.17 below. However, two aspects of the lands planning program influence the natural environment. The program: (1) establishes conservation of parcels where sensitive resources exist and (2) determines the proportion of TVA lands available for various uses. In many cases, the allocation is determined by an existing use, easement, or agreement of the land, and the use allocation generally is fixed. In recent RLMPs, land use allocations changed very little. Using RLMP and RLA data and projecting maximum changes to allocations (Table 3-9), TVA estimated that percentages of land in Zones 2, 3, 5, and 7 would change very little. The potential for variation is demonstrated primarily in Zones 4 and 6. Therefore, on a regional basis, future reservoir land planning efforts would primarily affect the amount of land allocated to natural resource conservation (Zone 4) or developed recreation (Zone 6). Because TVA manages a finite body of land, an increase in Zone 4 allocations normally results in a decrease in Zone 6 allocations and vice versa.

Under all alternatives, TVA would continue to allocate parcels containing sensitive resources (archaeological and historic properties, wetlands, rare species, and natural areas) to the most protective zone. Other federal and state agencies in the region would, minimally, be expected to conserve sensitive resources on their lands, pursuant to federal and state regulations. Additionally, regional conservation programs such as the Cumberland Habitat Conservation Plan support identification and conservation of sensitive resources on private lands in the region. These conservation efforts would combine to beneficially offset impacts to sensitive resources on private lands subject to development. Overall, the systematic protection of sensitive resources under the land planning process would contribute beneficially to regional conservation of wetlands, rare species, and cultural resources.

As described above, maximum projected changes in land uses would either emphasize developed recreation uses or natural resource conservation. Should a trend of increasing recreation uses occur, natural habitat lacking sensitive resources could be converted to developed recreation facilities. This would contribute to the regional trend of diminishing natural shoreline. On a Valleywide basis, because much of the land is forest (Section 4.9), a decrease of Zone 4 lands would result in minor regional changes in natural lands. Similarly, should a trend of increasing conservation resources occur, the sum total of natural habitat on TVA-managed lands could slightly increase. While such an increase would support regional efforts to conserve natural habitat, changes on TVA-managed lands would not result in regionally significant cumulative effects. However, on an individual reservoir, depending upon existing shoreline development, conversion of natural parcels to developed recreation facilities could be noticeable. Furthermore, conversion of habitat may have important local impacts for habitat types limited to aquatic and riparian zones, which may not be abundant regionally.

TVA's proposed recreation management strategies range from slightly reduced recreation opportunities (Alternative B) to expanded programs at existing facilities and additional land allocated to recreation during lands planning (Alternatives C and D). Currently, TVA provides between 5 and 10 percent of the public recreation facilities in the region (Section 4.1). However, the reservoir- and shoreline-associated recreation opportunities on

TVA-managed lands are somewhat unique in the region. As regional population increases, the need for recreational facilities is expected to increase. TVA, together with other federal, state, and local bodies, would strive to meet that demand to avoid excessive use pressure on existing facilities.

Expansion of recreation programs and facilities would beneficially contribute to the cumulative total opportunities in the TVA region. Likewise, reduction of TVA programs would negatively affect the cumulative total of opportunities in the TVA region. However, given that other entities provide between 90 and 95 percent of those opportunities, changes in recreation opportunities on TVA-managed lands would not result in significant cumulative impacts.

As stated in Section 5.6, regional water quality is influenced by the aggregate actions of all landowners in the Tennessee River watershed. Because TVA lands account for a small portion of the watershed, actions on TVA-managed land influence water quality on a local basis. TVA's proposed efforts to improve water quality under Alternatives A-D may result in important local improvements, but would not result in significant cumulative benefits. In the Tennessee River watershed, the efforts of federal and state water quality regulators, municipal/local programs, and others including TVA combine in an effort to offset threats to water quality from increased economic growth and development. TVA's contribution to beneficial cumulative impacts is greatest under Alternatives C and D, due to the increased participation in water quality outreach and programs.

5.1. Overview of Potential Environmental Impacts by Resource Management Programs

Prior to implementing the activities associated with the resource management programs described in Chapter 2, TVA would conduct an appropriate level of site-specific environmental review to determine the potential environmental effects of the proposed action. However, the typical impacts associated with these programs are described below.

5.1.1. Biological and Cultural Resources

The biological and cultural resource management programs would typically be implemented on the approximate 231,000 acres of TVA-managed lands allocated for natural resource conservation and sensitive resource management. The typical impacts to avoid or mitigate the impacts of the with biological and cultural resource program activities described in Section 2.1 include the removal of existing nonnative vegetation and replanting of native plants; avoidance or mitigation of any wetland areas; installation of construction related BMPs to minimize any potential impacts to aquatic life and water quality; avoidance or mitigation of impacts to endangered and threatened species in accordance with ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based obstructions consistent with applicable floodplain regulations; and implementation of projects consistent with the visual integrity of the surrounding landscape. The remainder of this sub-section describes the typical impacts resulting from implementation associated with the specific program categories.

<u>Cultural Resources Management</u> — The typical impacts associated with managing cultural resources include the protection of eroding archaeological sites and rehabilitation/reuse of historic buildings. When protecting eroding archaeological sites, TVA may install riprap along the shoreline. The impacts associated with shoreline stabilization result in a short-term and localized increase in sedimentation and alteration of stream bank and lake-bottom

aquatic habitat and visual effects. When rehabilitating historic buildings, there could be generation of solid waste with the potential for asbestos and lead paint waste streams needing special handling and disposal.

Dispersed Recreation — The types of dispersed recreation activities seen most often on TVA-managed lands are potential increases in human use within a defined area, primitive camping, hiking, bank fishing, and kayaking/canoeing. The impacts associated with these activities include increased litter, vegetation removal, and an increase in disturbed land areas. Section 2.1.2 discusses options for TVA to increase dispersed recreation management efforts and to offset these impacts. Actions to rehabilitate the areas would result in some minor, short-term impacts such as sedimentation from soil disturbances associated with site grading and revegetation. Solid waste resulting from removal of debris and litter would be disposed of in approved landfills.

Land Stewardship Assessment Tools — The use of land stewardship assessment tools aids in the management of public lands and results in implementing actions that benefit the environment long-term. The implementing actions associated with boundary maintenance, LCA, and LSMNC, may result in short-term minor impacts such as clearing of nonnative vegetation; increased sedimentation from improving access roads, installing shoreline stabilization, and creating wildlife habitat areas; and minor fugitive air emissions from the mechanical equipment needed to complete the project. By using the TVA Natural Heritage Database and the TVA Wetlands Database, the resulting actions can be modified to avoid or mitigate potential impacts to sensitive resources.

Public Outreach — The implementation of public outreach programs, themselves, would not directly impact the environment. However, there may be projects resulting from outreach programs that indirectly benefit the environment. Examples of these projects are described in Section 2.1.4. The indirect beneficial impacts may include localized improvement in water quality due to installation of vegetative buffers and biostabilization; increase in native vegetation from tree planting efforts and invasive plant removal; and promotion of water conservation by installing rain gardens and rain barrels.

Sensitive Resources Management — The impacts associated with the management of sensitive resources are intended to be solely beneficial. By monitoring endangered and threatened species, the overall knowledge base surrounding the species is increased. This increased knowledge leads to better land management and conservation planning decisions. Projects would also be implemented to reduce invasive plant species from natural areas with sensitive plant and animal species; conversion to native plant and wildlife habitat; and enhancement of user access for education and enjoyment purposes. The potential for adverse impacts is small; these impacts could include sedimentation from grading and revegetation activities, localized reductions of nontarget species, and localized closure of areas to public access.

Terrestrial Habitat Management — The impacts from terrestrial habitat management range from increases in dispersed recreation in a defined area to changes in overall forest structure. Maintaining agricultural and open lands; improving dewatering areas; implementing wildlife habitat management and WHC projects may result in an increase in dispersed recreation within those improved areas. Some short-term minor impacts associated with terrestrial habitat management include clearing of nonnative vegetation; increased sedimentation from improving access roads, installing shoreline stabilization, and creating wildlife habitat areas and riparian buffers; and minor fugitive air emissions from the mechanical equipment needed to complete a specific project and from controlled burning.

Dependent upon the types of forest management projects implemented, the resulting impacts may lead to changes in the overall forest structure and benefits to the type of herbaceous and woody vegetation present.

5.1.2. Recreation Management

The recreation management programs would be implemented at those recreation facilities managed by TVA and stream access sites located near TVA-managed reservoirs. The typical impacts associated with developed recreation projects include the removal of existing vegetation, hardening of surfaces and replanting of native plants; avoidance or mitigation of any wetland areas; installation of construction related BMPs and compliance with TVCMI to minimize any potential impacts to aquatic life and water quality; potential increase in recreational boating traffic within a defined area; impacts to endangered and threatened species in accordance with the ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based structures consistent with applicable floodplain regulations; construction of water use facilities to avoid impacts to navigation; and overall development consistent with the visual integrity of the surrounding landscape. The remainder of this sub-section describes the typical impacts resulting from implementation associated with the specific program categories.

Campground Management — The types of impacts associated with campground management result from the use of and improvements to campgrounds. Increases in litter, vegetation removal, and disturbed land areas are some expected impacts associated with the general use of a campground. Actions to rehabilitate the areas would result in minor, short-term adverse impacts such as sedimentation from soil disturbances associated with site grading and revegetation. Solid waste resulting from removal of debris and litter and from replacement of equipment and materials would be recycled or disposed of in approved landfills. Improvements to campgrounds, as depicted in the NRP, relate to upgrades consistent with ADAAG, incorporation of innovative designs, and installation of measures to increase efficiency. These upgrades and installations may require minor excavation, removal of existing vegetation, and minor fugitive air emissions from the mechanical equipment needed to complete a specific project. The installation of construction related BMPs would offset any potential short-term impacts. Overall, campground improvements, as described in the NRP, would result in long-term beneficial impacts to the environment.

Day Use Areas Management — Similar to campgrounds, the types of impacts associated with day use area management result from the use of and improvements to day use areas. Increases in litter, vegetation removal, and disturbed land areas, along with the potential increase in recreational boating traffic within a defined area are some expected impacts associated with the general use of a day use area. Actions to rehabilitate the land-based areas would result in minor, short-term adverse impacts such as sedimentation from soil disturbances associated with site grading and revegetation. Solid waste resulting from removal of debris and litter and from equipment and materials replacement would be recycled or disposed of in approved landfills. Improvements to day use areas, as depicted in the NRP, include upgrades consistent with ADAAG, implementation of sustainable initiatives, and the development of additional greenway, blue way, and stream access sites. The typical impacts associated with improvements to day use areas are typical to those of a developed recreation project. In addition, there would be minor fugitive air emissions from the mechanical equipment needed to complete the project.

Public Outreach Programs — The implementation of public outreach programs, themselves, would not directly impact the environment. However, there could be projects resulting from outreach programs that indirectly benefit the environment. Examples of these projects are described in Section 2.2.3. The indirect beneficial impacts may include localized improvements in water quality due to the installation of clean and green campground projects; and a decrease in litter and abuse of public lands due to recreation management regulations. There may also be benefits to biological, cultural, and water resources dependent upon the types of conservation projects implemented through the F&TF.

Recreation Assessment and Design Tools — The use of recreation assessments and design tools aids in the management of recreation areas and results in implementing actions that benefit the environment long-term. The implementing actions associated with recreation designs for conservation and efficiency may result in short-term minor impacts such as clearing of nonnative vegetation; hardening of land areas; increased sedimentation from improving access, and installing projects that promote conservation and recycling; and minor fugitive air emissions from the mechanical equipment needed to complete the project. By incorporating boating capacity studies, boating density assessments, or developed recreation inventories and assessments in its environmental review process, TVA can make more informed decisions relating to a project's potential impact on recreational resources.

5.1.3. Reservoir Lands Planning

The methodology which drives reservoir lands planning would not directly impact the environment. Under Alternatives C and D, reservoir lands planning would result in a CVLP with a range in land use zone allocations (Table 3-9 and Appendix H). This sub-section describes the typical impacts resulting from the ranges in allocations associated with the specific land use zones. The types of development that can occur on TVA-managed lands for each land use zone is defined in Appendix F. Prior to approving any proposal to use TVA-managed land, TVA would conduct an appropriate level of site-specific environmental review to determine the potential environmental effects of the proposed use.

Zone 2 (Project Operations) — Between five and seven percent of TVA-managed lands would be allocated for project operations. The largest potential change would result in a 29 percent reduction in the land available for project operations. The typical impacts associated with implementing projects within Zone 2 lands include the removal of existing vegetation; avoidance or mitigation of any wetland areas; installation of construction related BMPs to minimize any potential impacts to aquatic life and water quality; avoidance or mitigation of impacts to endangered and threatened species in accordance with the ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based structures consistent with applicable floodplain regulations; construction of water use facilities to avoid impacts to navigation; and overall development consistent with the visual integrity of the surrounding landscape. Some TVA-managed lands allocated for project operations also contain day use areas. The impacts associated with day use areas have been described above.

Zone 3 (Sensitive Resource Management) — Between 14 and 17 percent of TVA-managed lands would be allocated for sensitive resource management. This range in allocation would potentially result in a 22 percent reduction in the land available for sensitive resource management. The typical types of projects implemented within Zone 3 lands result from

biological and cultural resource management programs. The impacts associated with implementing these types of programs have been described above.

Zone 4 (Natural Resource Conservation) — Between 50 and 68 percent of TVA-managed lands would be allocated for natural resource conservation. The potential change would vary from an 18 percent reduction in land allocation for natural resource conservation to an 11 percent allocation. The typical types of projects implemented within Zone 4 lands result from biological and cultural resource management programs. The impacts associated with implementing these types of programs have been described above.

Zone 5 (Industrial) — Between one and two percent of TVA-managed lands would be allocated for industrial use. Therefore, the land allocated for industrial use could be reduced by half, with a corresponding reduction in many of the impacts associated with industrial development. The typical impacts associated with industrial development include the removal of existing vegetation; avoidance or mitigation of any wetland areas; installation of construction related BMPs and compliance with state water quality certification and/or standards to minimize any potential impacts to aquatic life and water quality; potential increase in commercial navigation/barge traffic within a defined area; avoidance or mitigation of impacts to endangered and threatened species in accordance with the ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based structures consistent with applicable floodplain regulations; construction of water use facilities and/or barge terminals to avoid impacts to navigation; and overall development consistent with the visual integrity of the surrounding landscape.

Zone 6 (Developed Recreation) — Between 6 and 25 percent of TVA-managed lands would be allocated for developed recreation purposes. Their potential change would vary from a 225 percent increase in land available for developed recreation to a 14 percent reduction. The typical impacts associated with developed recreation requests include the removal of existing vegetation and replanting of native plants; avoidance or mitigation of any wetland areas; installation of construction related BMPs and compliance with TVCMI to minimize any potential impacts to aquatic life and water quality; potential increase in recreational boating traffic within a defined area; avoidance or mitigation of impacts to endangered and threatened species in accordance with the ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based structures consistent with applicable floodplain regulations; construction of water use facilities to avoid impacts to navigation; and overall development consistent with the visual integrity of the surrounding landscape.

Zone 7 (Shoreline Access) — Approximately 5 percent of TVA-managed lands would be allocated for shoreline access purposes. The direct, indirect, and cumulative impacts associated with residential shoreline development have been evaluated in the SMI EIS (TVA 1998). According to SMI, this 5 percent of TVA-managed lands is equal to approximately 1,847 miles of shoreline. In these areas, the adjoining private property owner has legal rights across TVA–managed land. The future allocations for shoreline access are guided by TVA's Land Policy.

5.1.4. Water Resource Management

The water resource management programs have been limited to those discretionary programs and activities implemented by TVA to improve reservoir and watershed water

quality proactively. These programs would be implemented across the entire Tennessee River watershed. The typical impacts associated with water resource management projects include the removal of existing vegetation and replanting of native plants and riparian buffer areas; creation or mitigation of wetlands; installation of construction related BMPs to minimize any potential short-term impacts to aquatic life; impacts to endangered and threatened species in accordance with the ESA Section 7 consultation process; avoidance or mitigation of adverse effects to cultural resources in accordance with the NHPA Section 106 consultation process; construction of any land-based structures consistent with applicable floodplain regulations; construction of shoreline stabilization projects to avoid impacts to navigation; and overall development consistent with the visual integrity of the surrounding landscape. BMPs specific to water resource management projects (Section 2.4.6) would be implemented during construction, as appropriate. The remainder of this sub-section describes the typical impacts resulting from implementation associated with the specific program categories.

Aquatic Monitoring and Management — The impacts associated with aquatic ecology management would most likely result from habitat protection and enhancement projects along with efforts to reduce the spread of certain invasive species. Sedimentation from the installation of aquatic habitat enhancements such as fish attractors would short-term and minor. These same types of impacts would also occur when installing temporary barriers to protect specific aquatic habitats. Construction related BMPs and timing of project implementation during low flow conditions would occur to further reduce potential impacts.

Partnership Programs — The implementation of partnership programs, themselves, would not directly impact the environment. However, demonstration projects resulting from case studies and research initiatives could be later implemented on a larger scale, and at that time, provide direct benefits to the environment.

Public Outreach Programs — Projects resulting from the TCVMI and water resource outreach campaigns directly benefit the environment. The implementation of the QGP and water efficiency program would not directly impact the environment. TVCMI requires proper BMPs to address potential impacts for shoreline erosion, fuel spills, on-site septic systems and marina sewage disposal. Water resource outreach campaigns could include demonstration projects from any aspect of water resource management. Therefore, the potential impacts have been described above. The indirect beneficial impacts may include localized improvements in water quality due to the implementation of NEMO best practices and promotion of water conservation.

Water Resource Improvement Programs — The impacts from water resource improvement programs range from sediment reductions in tributary streams to nutrient reductions in TVA-managed reservoirs. Some short-term minor impacts associated with water resource improvement programs include clearing of nonnative vegetation; increased sedimentation from installing shoreline stabilization and creating riparian buffers; and minor fugitive air emissions from the mechanical equipment needed to complete a specific project. Most water resource improvement programs include implementing a variety of water resource improvement tools. The additional impacts associated with these tools are discussed below.

Water Resource Improvement Tools — Some short-term minor impacts associated with water resource improvement tools include clearing of nonnative vegetation; increased sedimentation from improving access roads and agricultural areas, installing shoreline

stabilization, riparian buffers and stream crossings, and creation of wetlands; and minor fugitive air emissions from the mechanical equipment needed to complete a specific project.

5.2. Recreation

5.2.1. Developed Recreation

Alternative A — No Action Alternative

Under this alternative, TVA would continue recreation management activities at current levels. While this would provide continued "status quo" operation of TVA recreation facilities and maintain existing partnerships and outreach programs, this level would not be sufficient to keep pace with projected increases in populations and recreation needs over the next 20 years as outlined in Section 4.1. TVA would continue to renegotiate new agreements as appropriate. In general, this alternative would generate a higher level of public recreation benefits and opportunities than Alternative B, would be fewer than what would be achieved under Alternative C, and would be equal to Alternative D.

TVA would continue to manage eight campgrounds on dam or power plant reservations and four campgrounds on TVA reservoir lands thus ensuring these areas continue to provide public recreation benefits.

TVA would operate 30 day use areas on dam reservations and 33 areas located off dam reservations. Facility upgrades and modifications needed to meet ADAAG standards and increase resource sustainability would be undertaken as capital funds become available, resulting in these areas being more accessible to the physically disabled and addressing some of the continued environmental deterioration at high use sites. However, there would continue to be some delay in meeting both sustainability objectives and accessibility standards compared to Alternatives C and D. TVA would continue to provide limited assistance to partners and stakeholder groups in trail, greenway, watertrail, and blueway development. However, TVA would not proactively participate in the development of additional watertrail, blueway, trail, and greenway corridors, which could result in inadequate trails, greenways, watertrails, and blueways to meet anticipated future needs within the region. TVA would provide for basic management of all of its 31 stream access sites plus a portion of the 50 TVA-owned sites no longer under viable third-party agreements. However, improvement of selected sites to enhance sustainability would not be initiated, resulting in continued environmental degradation at some sites.

This alternative would maintain public outreach projects at current levels. Initiatives aimed at increasing public awareness of environmentally responsible camping and other outdoor recreation practices, and development of an F&TF to leverage funding for conservation and recreation projects would not be undertaken, thus reducing TVA's capability to positively influence the level of environmental impacts associated with expected future increases in recreational development and use of TVA-managed lands.

TVA would continue to update its reservoir recreation facility inventory data on a three-year rotation. However, inability to track changes in recreation services and facilities on a biannual or annual basis as proposed under Alternatives D and C, respectively, reduces the accuracy of the inventory data available.

Cumulative impacts would include a growing gap in water-based recreation facilities/services needs (as outlined in Section 4.1) relative to available supply, increased use pressure on existing public or commercial recreation areas, and increased use of

undeveloped TVA-managed lands leading to sanitary and safety concerns. The extent of these cumulative impacts would likely be small.

Alternative B — Custodial Management Alternative
Under this alternative, TVA would continue to renegotiate new agreements as appropriate. TVA would discontinue and/or scale back selected programs and focus on meeting minimum regulatory and policy requirements. This alternative would significantly reduce TVA's ability to respond proactively to existing as well as future outdoor recreation needs within the TVA region and could also result in the closure of some campgrounds, day use areas, boat launching ramps, and other facilities at a time when demand for these facilities are expected to increase as outlined in Section 4.1 In addition, environmental conditions at unmaintained and closed facilities could increasingly deteriorate over time.

Under this alternative, three of the four campgrounds located off dam or power plant reservations would be transitioned to other operators or would be closed. The resulting impacts would depend on the level of success achieved in transition efforts. Areas successfully transitioned to other operators would continue to provide camping and related facilities and services at those areas. However, modification of management policies by outside operators could have some impact on future use of these areas. For example, changes in length of stay policies could reduce campsite availability to transient campers. Implementation of fees for use of swimming areas, trails, boat ramps, and picnic facilities associated with these campgrounds, traditionally available free of charge under TVA management, could cause public discontent and complaints and may disproportionally impact lower-income users. However, the overall negative impact of transitioning these areas to other operators would likely be small. The closure of Mallard Creek (Wheeler Reservoir), Loyston Point (Norris Reservoir), or Barton Springs (Normandy Reservoir) would significantly reduce opportunities for camping and related day use activities on these reservoirs. Closure of Loyston Point could also result in restricting access to the existing trail at Hemlock Bluff Small Wild Area. The closure of Foster Falls Recreation Area would virtually eliminate the existing access to the Foster Falls Natural Area.

Under this alternative, the 33 day use areas located off dam or power plant reservations would be transitioned to others or closed. The level of negative impacts associated with these actions would depend on the number of areas successfully transitioned. Areas transitioned to others could lead to changes in management policy such as establishment of user fees for facilities that are currently made available free of charge under TVA management. Such changes could lead to some public complaint and/or cause some users to shift to other recreation areas or to undeveloped TVA land. However, the overall impact of transitioning management of these areas to other operators should be small, but there would be an increase in TVA's need for agreement oversight and compliance monitoring. Depending on the number of areas closed, negative impacts could range from small (only a few relatively remote and lightly used areas closed) to significant (large number of areas closed). Negative impacts resulting from area closings include:

- Loss of existing accommodations for water-based recreation activities including: boat launching, picnicking, and swimming on TVA-managed lands.
- Disproportional impact on lower-income users.
- Continued informal use of closed areas resulting in garbage accumulation, misuse or vandalism, and environmental degradation.

Some of the 50 stream access sites currently managed under cooperative agreements would be closed to the public if existing cooperative agreements expire or are canceled. In general, closure of any of these existing areas would adversely impact public use of the affected stream. In many cases, these sites represent the only means of safe, legal public access to these waterways, and closure would significantly restrict public use opportunities.

Under this alternative, potential impacts associated with public outreach and recreation assessments and design tools to the environment would be similar to the No Action Alternative.

This alternative would result in the closure of some recreation areas and stream access sites, and would reduce TVA's outreach programs. Therefore, it is more likely to be a growing gap between recreation needs and supply under this alternative. Cumulative impacts would likely include reduced public access to the region's reservoirs and streams, adverse impacts to local economies in part dependent on tourism and outdoor recreation, increased use of undeveloped lands and continued use of some closed areas resulting in environmental degradation and safety concerns, increased pressure on other public and/or commercial recreation operations, and some shift in recreation users to areas outside the region. The extent of these cumulative impacts would be moderate.

Alternative C — Flagship Management Alternative

Under this alternative, TVA would establish new recreation initiatives and intensify selected existing programs to keep pace with cutting edge trends in outdoor recreation resource management and to maintain a strong TVA role in meeting regional recreation needs over the next 20 years. TVA would continue to renegotiate new agreements as appropriate. Implementation of this alternative would result in TVA displaying a stronger presence in recreation management compared to Alternatives A, B, and D. Overall, this alternative would result in an increase in the quality and quantity of recreation opportunities available in the TVA region. These programs would keep pace with anticipated increases in outdoor recreation needs, result in greener and more environmentally sensitive development and management of recreation areas on TVA-managed lands and reservoirs, and increase public awareness and adoption of more responsible and sustainable recreation use practices.

Under this alternative, TVA would accelerate upgrades at eight dam or power plant campgrounds and four campgrounds located on other reservoir properties to meet ADAAG standards. These upgrades ensure the campground facilities are available and accessible to a wide range of existing and potential users including the disabled.

Under this alternative, TVA would upgrade four areas annually to meet ADAAG standards. In addition, TVA would undertake additional resource conservation and sustainability measures to reduce the environmental impacts of the Agency's recreation areas. Initiatives to work within partnership agreements to develop additional trails, greenways, watertrails, blueways, and stream access facilities would also be undertaken. In combination, these initiatives would contribute significantly to meeting natural resource-based outdoor recreation needs within the TVA region over the next 20 years and increase recreation opportunities for a wide range of users including the disabled.

In general, the public outreach initiatives undertaken under this alternative would result in cleaner, more sustainable, and higher-quality recreation services and facilities leading to higher levels of recreation-user satisfaction as well as an increased understanding and appreciation of sustainable recreation use practices.

Under this alternative, TVA would increase current outreach efforts including the LNT Program and would also establish new outreach initiatives to promote sustainable, responsible recreation development and use of TVA-managed land. Expansion of the LNT Program would result in further decreases in garbage and trash, soil compaction, and loss of vegetation and erosion on both developed and undeveloped reservoir recreation areas.

New outreach initiatives that would be implemented include Annual Tours, C&GCI, F&TF, and a Resource Ranger Program. The Annual Tours Program would result in greater media and public awareness of TVA efforts and would increase the potential for similar technologies to be applied elsewhere in the TVA region and nation. The C&GCI would result in a reduction in the environmental footprint of developed commercial and public campgrounds on the Tennessee River system. The establishment of an F&TF would encourage and leverage funding for projects aligning with sound stewardship and conservation and recreation needs and would result in expansion of recreation opportunities needed to meet future needs while preserving and/or improving natural resources. The establishment of the Resource Ranger Program would result in significant reductions in violations of TVA recreation use regulations and/or guidelines, potential criminal activity, and would substantially improve public security and safety at developed and undeveloped recreation areas.

Additional actions under recreation assessments and design tools would include implementation of two reservoir boating assessments annually, update of TVA's recreation inventory on an annual schedule, increased emphasis on recreation area signage and interpretation upgrades, and implementation of recreation area visitor surveys.

The completion of boating assessments would enable TVA, in partnership with state agencies and other stakeholders, to proactively develop and apply strategies and policies to address boating capacity limits and boating safety. An annual update of TVA's recreation inventory data would ensure that recreation supply data would be based on accurate, up-to-date data. Improved signage, on-site interpretation, and map products would increase public awareness of recreation opportunities on TVA projects. An enhanced visitor survey program would result in a better understanding of customer needs and expectations and would provide a firmer foundation for identifying emerging trends and preparing development and/or management options for addressing trends and expectations.

Alternative D — Blended Management Alternative

This alternative includes elements of Alternatives A, B, and C. Overall, the implementation of this alternative would provide greater public recreation benefits than Alternative B, the same level of benefits as Alternative A, and fewer benefits than Alternative C.

The campgrounds located on dam or power plant reservations would be upgraded to meet ADAAG standards, resulting in the same benefits as those outlined under Alternative C. The potential impacts related to the remaining campgrounds would be the same as those described under Alternative B.

Annual implementation of two sustainable initiatives and two upgrades to meet ADAAG standards at day use areas, while less aggressive than Alternative C, would result in improved environmental conditions at selected areas and increased water-oriented recreation opportunities for the disabled. The impacts associated with potential closure of stream access sites currently managed under cooperative agreements would be the same as Alternative B.

Compared to Alternatives A and B, this alternative would emphasize public outreach efforts by increasing annual public tours and establishing an F&TF. These initiatives would foster projects focusing on meeting existing and future outdoor recreation needs consistent with sound stewardship and environmental sustainability. However, this alternative would be less effective than the broader range of outreach initiatives implemented under Alternative C.

Updating recreation inventory data on a two-year cycle would result in more accurate and up-to-date information on existing reservoir recreation areas. Therefore, this information would assist in supporting the planning efforts of TVA, other agencies, and stakeholders.

Cumulative Impacts — Under this alternative, the cumulative impacts would be similar to Alternative A.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to developed recreation under the four alternatives are shown in Figure 5-1. The impact bars shown in Figure 5-1 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-1. Relative Beneficial Impacts of the Alternatives on Developed Recreation

5.2.2. Dispersed Recreation

Alternative A — No Action Alternative
Under this alternative, TVA would continue dispersed recreation management. It is anticipated that this level of management would not keep up with the increase in use and impacts associated with dispersed recreation activities in the Valley. TVA would continue to collect data associated with dispersed use/impacts and implement management efforts on these areas on a limited basis. This level of management would result in a direct negative impact to dispersed recreation as public use increases to pressure limited natural resources.

Data collection would be conducted on 70 dispersed recreation areas annually. While this process is robust from the dispersed recreation perspective, it fails to make vital linkages between dispersed recreation and other pressures that could potentially impact the management and user experience of an area. A holistic management approach is preferred to maximize the existing and potential benefits dispersed recreation areas are able to sustain and offer. Data collection in conjunction with the existing LCA process is a more holistic approach, which would benefit the overall management objectives for TVA-managed land as it takes into account multiple dimensions of impacts.

TVA would implement one key opportunity associated with dispersed recreation annually. This effort is specifically designed to meet current and latent demand for dispersed

recreation opportunities. This level of effort would not keep pace with the existing or future demand for dispersed recreation on TVA-managed lands.

One heavily impacted dispersed recreation area would be mitigated annually. Based on past data collection, there are over 800 existing dispersed recreation areas on TVA-managed lands. An estimated 108 areas are known to have significant impacts from use. Improving one area would result in management action on less than 1 percent of known areas. This level of effort would not be suitable for TVA to achieve management of dispersed recreation impacts in an ecofriendly manner.

TVA would continue to manage its existing 90 miles of trails. Improvements or management efforts would be restricted to known needs identified through the LCA processes with focus on current prioritization of public health and safety. This strategy captures some existing needs but fails to take into consideration specific strategies for trails management or development.

Potential cumulative effects to dispersed recreation may result in management objectives for dispersed recreation not being met as well as management levels below that intended by the Environmental Policy.

Alternative B — Custodial Management Alternative
Under Alternative B, TVA would engage in active management and outreach at a minimal level to meet the objectives of the Environmental Policy. This alternative would be an increase in effort from Alternative A. However, this alternative would focus only on existing impacts and issues as currently known and give little flexibility to adapt to unknown issues for the life of the NRP.

The process of collecting data on dispersed recreation areas would be modified to be in alignment with the LCA methodology. That is, only areas that receive a score of “poor” (for the metric of dispersed recreation) under the LCA would be further evaluated with the Dispersed Recreation Analysis methodology. This would streamline the data collection process and ensure further data are only collected on those areas needing management attention. This change would result in less robust data being collected on dispersed recreation, but the data would be more in line with the future overall stewardship objectives and needs.

TVA would implement five key opportunities associated with dispersed recreation annually. This minimal level of effort is specifically designed to meet current and latent demand for dispersed recreation opportunities. This level of effort would give TVA the ability to implement the minimal amount of projects Valleywide benefiting a moderate variety of stakeholders needs. In addition, this effort would allow TVA to have a Valleywide presence on a limited basis of key projects on an annual basis.

Implementation of a dispersed recreation educational campaign would be present under this alternative. TVA-managed lands are generally spatially noncontiguous in nature. This phenomenon presents a challenge to people seeking dispersed opportunities as no central information port exists to educate people on where TVA-managed lands are located and what recreation opportunities they provide. In addition, TVA currently does not educate the public on preferred practices that would reduce the amount of ecological damage in established dispersed areas. The need for an educational campaign grows as more people move to the Valley who are not familiar with TVA-managed lands or the appropriate use of these areas. The implementation of this campaign would help TVA meet its management

objectives by empowering users with information to be better stewards of TVA-managed lands.

Five heavily impacted dispersed recreation areas would be improved annually. Based on past data collection, there are over 800 existing dispersed recreation areas on TVA-managed lands. Improving five areas annually would allow TVA to actively improve 5 percent of its known heavily impacted areas yearly or all known areas within the next 20 years. This level of effort would be the minimum for TVA to achieve management of dispersed recreation impacts in an ecofriendly manner.

TVA would continue to manage its existing 90 miles of trails and would correct potential safety hazards to the public. Trails facilitate many ecofriendly dispersed recreation activities (i.e., hiking, bird watching, nature observation, etc.). The minimal management of existing dispersed recreation trails is correction of safety hazards to safeguard the public from harm. Trails are an important conduit which allows the public to increase outdoor activity, and realize a healthier lifestyle, and which promotes awareness of natural resources and its conservation. One of the most popular and widely recognized activities associated with all trails is day hiking. Nationally, day hiking has risen in popularity 51.8 percent from 1995 to 2001 (Cordell et al. 2004). The addition of 10 miles of trails per year would roughly increase TVA's trails system by 10 percent a year, which is approximately the same rate of increase for day hiking. These additions are only taking into account the most popular of trail activities and are believed to be the minimum amount TVA should consider to meet the commitments of expanding ecologically friendly recreation trail activities.

Potential cumulative effects to dispersed recreation would be positive compared to Alternative A due to increased efforts of management and the implementation of an educational campaign designed to help the public assist TVA with meeting its management objectives. This alternative would allow TVA to meet the minimum objectives for managing dispersed recreation impacts and meet future needs of the recreating public.

Alternative C — Flagship Management Alternative
Under this alternative, activities currently associated with dispersed recreation management would be enhanced as described under Alternative B. In addition, many new activities designed to enhance the management of dispersed recreation would be added.

The process of collecting data on dispersed recreation areas would be modified to be in alignment with the LCA methodology. That is, only areas that receive a score of "poor" (for the metric of dispersed recreation) under the LCA would be further evaluated with the Dispersed Recreation Analysis methodology. This would streamline the data collection process and ensure further data are only collected on those areas that would need management attention. This change would result in less robust data being collected on dispersed recreation, but these data would be more in line with the future overall stewardship objectives and needs.

Under this alternative, TVA would develop and implement multiyear dispersed recreation plans. These plans would be a holistic view of all the dispersed recreation needs and the associated availability of opportunities on a Valleywide basis. This would allow TVA to best meet current dispersed recreation needs and plan activities well into the future as demands and activities change with time and technology. In addition, these plans would result in an interdisciplinary approach to the management of public use on TVA-managed lands. To aid in this effort, TVA would distribute and analyze 600 dispersed recreation surveys annually

to fully understand the types of uses and relative demands that are occurring on TVA-managed lands.

TVA would implement 20 key opportunities associated with dispersed recreation annually. This effort is specifically designed to meet current, latent and projected future demand for dispersed recreation opportunities. This expanded level of effort would give TVA the ability to fully meet the present and future needs of a wide variety of stakeholders annually and realize maximum benefit. In addition, this effort would allow TVA to have an expanded Valleywide presence of key projects on an annual basis as compared to Alternative B.

Implementation of a dispersed recreation educational campaign would be present under this alternative. The need for an educational campaign grows as more people move to the Valley who are not familiar with TVA-managed lands or the appropriate use of these areas. The implementation of this campaign would help TVA meet its management objectives by empowering users with information to be better stewards of TVA-managed lands. The level of effort for this educational campaign would be expanded as compared to Alternative B. In addition to basic information on TVA-managed lands and opportunities, the results of the dispersed recreation survey data as well as the information associated with multiyear plans would be added. Future information additions would be made to this effort as more is learned about the users of TVA-managed lands and their associated needs.

Twenty-five heavily impacted dispersed recreation areas would be improved annually. Based on past data collection, there are over 800 existing dispersed recreation areas on TVA-managed lands. An estimated 108 areas are known to have significant impacts from use. Improving 25 areas annually would allow TVA to actively improve approximately 25 percent of its known heavily impacted areas yearly or all known areas within five years. This level of effort would go above and beyond the minimum stewardship effort and would meet management objectives sooner than outlined in Alternative B.

This alternative also includes the development and implementation of formal regulations. The enforcement of these regulations would be a vital component of regulating use and abuse by providing a meaningful deterrent to actions that degrade the integrity of TVA-managed lands. In addition, this deterrent would aid in management efforts of bringing undeveloped lands into desirable conditions.

TVA would conduct 100 outdoor skills clinics. These clinics would be provided to members of the general public and designed to remove skills barriers from participation in outdoor recreation. These clinics would allow a greater participation in outdoor activities as well as incorporate low-impact practices specific to the activity.

TVA would continue to manage its existing 90 miles of trails. These trails would be incorporated into a holistic trails establishment and maintenance program. This program would establish annual monitoring plans to ensure maintenance needs are met in a timely fashion. In addition, this program would formally inventory existing trails resources and monitor population/demand to ensure that existing and future trails are effectively meeting the needs of trail users in the Valley. The addition of 20 miles of trails per year would roughly increase TVA trails system by 20 percent a year. These additions are taking into account the most popular of trail activities as well as tangential activities (bird watching, nature observation, etc.) for which they are enjoyed. This expansion from Alternative B would allow the full utilization of all dispersed activities that are facilitated by trails maintenance and development.

Potential cumulative impacts of Alternative C are the most positive off all the alternatives. Alternative C results in holistic management and proactive stewardship of all dispersed recreation resources. Under the Flagship Alternative, TVA would devote significant resources to the management of dispersed resources and would actively participate in activities to engage the public in outdoor recreation.

Alternative D — Blended Management Alternative
Impacts to dispersed recreation under Alternative D would be less positive than Alternative C and more positive than Alternatives A and B. Many programs outlined under Alternative C would be implemented on a more limited basis; however, some actions would be omitted. Activities outlined under Alternative C would meet current and future demand for dispersed recreation activities at a higher-than-minimal level.

The process of collecting data on dispersed recreation areas would be modified to be in alignment with the LCA methodology. The level of effort and associated impacts for this activity is similar across Alternatives B, C, and D.

TVA would implement 10 key opportunities associated with dispersed recreation annually. This effort is specifically designed to meet current and latent demand for dispersed recreation opportunities. This level of effort would give TVA the ability to implement enough projects Valleywide to benefit a wide variety of stakeholders needs annually. The impacts of this alternative are less positive than Alternative C and more positive than Alternatives A or B.

Implementation of a dispersed recreation educational campaign would be present under this alternative. The implementation of this campaign would help TVA to meet its management objectives by empowering users with information to be better stewards of TVA-managed lands. The level of effort for this educational campaign would be expanded as compared to Alternative B, although slightly less than outlined in Alternative C because survey data would be unavailable. In addition to basic information on TVA-managed lands and opportunities, the results of the information associated with multiyear plans would be added. Future information additions would be made to this effort as more is learned through the implementation of the dispersed recreation management plans.

Fifteen heavily impacted dispersed recreation areas would be mitigated annually. Based on past data collection, there are over 800 existing dispersed recreation areas on TVA-managed lands. An estimated 108 areas are known to have significant impacts from use. Improving 15 areas annually would allow TVA to actively improve approximately 15 percent of its known heavily impacted areas yearly or all known areas within seven years. This level of effort would be suitable to achieve management of dispersed recreation impacts in an ecofriendly manner and respond to stakeholder needs.

Under this alternative TVA would develop and implement multiyear dispersed recreation plans. The impacts associated with this activity would be similar to those in Alternative C.

This alternative also includes the development and implementation of formal regulations. The impacts associated with this activity would be similar to those in Alternative C.

TVA would continue to manage its existing 90 miles of trails and correct potential safety hazards to the public. The addition of 10 miles of trails per year would roughly increase TVA trails system by 10 percent a year, which is approximately the same rate of increase for day hiking participants. These additions are only taking into account the most popular of

trail activities and are believed to be the minimum amount TVA should consider to meet the commitments of expanding ecologically friendly recreation trail activities. The impacts of this alternative would be similar to those in Alternative B but slightly less positive than those outlined in Alternative C.

Potential cumulative impacts of Alternative D would be more positive than those outlined in Alternatives A and B by meeting a wide array of stakeholder needs as well as allowing for multiyear planning efforts, which approach dispersed recreation management from an interdisciplinary approach. However, the opportunity of engaging stakeholders through user surveys and skills clinics would be greater in Alternative C than Alternative D.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to dispersed recreation under the four alternatives are shown in Figure 5-2. The impact bars shown in Figure 5-2 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-2. Relative Beneficial Impacts of the Alternatives on Dispersed Recreation

5.3. Natural Areas

Alternative A — No Action Alternative
Under the No Action Alternative, TVA-managed natural areas preservation and management would be directly impacted. Currently, all TVA-managed natural areas are not actively managed. A majority of these natural areas do not have a management plan serving as a guideline for specific management needs of the natural areas. Alternative A would result in slightly adverse impacts to TVA-managed natural areas due to inadequate management. This alternative has the greatest potential to result in loss of natural areas due to negative effects from lack of active management. This level of management results in deterioration of some or all natural areas to the extent that these areas are no longer suitable to be characterized for the scenic, aesthetic, and exemplary biological values that define them. Specific TVA natural areas set aside for low-impact recreational use may no longer meet safety standards for public use resulting in the potential to adversely affect natural areas, which would cause closure of these areas. Active management of TVA natural areas based on developed management plans specific to each natural area and implementation of maintenance needs in an effective and efficient manner would minimize negative effects to natural areas.

Annual monitoring of eight TVA-managed natural areas allows for selected natural areas to be inventoried for plant and animal communities and for the condition of the natural areas to be assessed. Because only selected HPAs benefit from the annual monitoring, the remaining TVA-managed natural areas would be potentially impacted due to lack of surveys to assess the condition and to determine maintenance needs.

The process of designating new natural areas or removal of current natural areas from the program via the reservoir lands planning process would continue. Biologists survey TVA-

managed lands as part of routine land use reviews and an ongoing reservoir lands planning process. Data derived from these activities would serve as the basis for recommendations on additional natural areas. No potential impacts to existing TVA-managed natural areas are anticipated as a result of designation and removal through the reservoir lands planning process. However, opportunities to designate new natural areas may be limited due to the frequency in which the RLMPs are updated.

Implementing maintenance needs on natural areas as opportunistically identified would ensure that natural areas identified through limited monitoring or during the environmental review process would be assessed. Only a small number of natural areas are assessed on a limited basis and in a random manner with this opportunistic method. Other natural areas may be directly impacted due to limited, inadequate, or nonexistent assessments.

The TVA Natural Heritage database would continue to be utilized to add new information to, update, and maintain natural areas records in support of environmental reviews and planning purposes. Data sharing through formal exchanges with other federal and state resource agencies would continue under this alternative. The management of natural areas would continue to benefit from the use of the database.

Potential cumulative effects to natural areas may result in management objectives for these natural areas not being met resulting in the loss of the values and qualities that characterize these natural areas. Specifically, these cumulative impacts would be due to the minimal assessments of natural areas, other than HPAs, and an opportunistic approach to implementing maintenance needs.

Alternative B — Custodial Management Alternative

Under Alternative B, TVA-managed natural areas preservation and management would be directly impacted due to lack of active management and the need for management plans specific to each TVA-managed natural area. Alternative B would result in slightly less adverse effects to TVA-managed natural areas than compared to Alternative A due to increased monitoring and assessment of management needs. The more progressive active management approach under Alternative B would help identify and implement management needs more effectively resulting in less potential for loss of natural areas compared to Alternative A. However, the lack of management plans to provide guidelines for maintenance needs specific to each natural area would result in similar effects described under Alternative A. Active management of TVA natural areas based on developed management plans specific to each natural area and implementation of maintenance needs in an effective and efficient manner that ensures the integrity and protection of the natural area and sensitive resources present would minimize negative effects to natural areas.

Monitoring of TVA-managed natural areas would continue under Alternative B. However, 44 additional TVA-managed natural areas would be monitored on an annual rotation. This alternative would have effects that were more positive compared to Alternative A because several natural areas would be assessed annually to monitor listed plant and animal populations, to determine maintenance needs, and to ensure that management objectives of all TVA-managed natural areas are being met.

The process of designating new TVA-managed natural areas or removal of current natural areas from the program via the reservoir lands planning process would continue, and the effects would be similar to those described under Alternative A. However, under Alternative B, the duration of each planning effort would be reduced. This would benefit natural areas because this alternative would result in RLMPs being completed in a shorter amount of time

compared to Alternative A. Therefore, opportunities for designation of new natural areas would potentially occur more frequently and over a shorter time span.

Implementing maintenance needs on natural areas as opportunistically identified would ensure that natural areas identified through monitoring or during the environmental review process would be assessed. Natural areas assessed through these opportunistic activities benefit from implementation of maintenance needs to meet management objectives. Because a larger number of natural areas would be assessed due to the increased monitoring, there would be more opportunities to identify issues and implement maintenance needs to ensure management objectives are met.

The TVA Natural Heritage database would continue to be utilized to add new information, update, and maintain natural areas records in support of environmental reviews and planning purposes. Data sharing through formal exchanges with other federal and state resource agencies would continue under this alternative. Natural areas would continue to benefit from the use of the database.

Potential cumulative effects to natural areas would be positive compared to Alternative A due to implementation of maintenance needs for natural areas with an opportunistic approach paired with increased monitoring of a larger majority of TVA-managed natural areas. This combination would help to promote more effective management, supporting the goal of preserving the values and qualities that characterize these natural areas.

Alternative C — Flagship Management Alternative

Under Action Alternative C, TVA-managed natural areas would be directly impacted. In addition, under this alternative, activities currently associated with natural areas management and protection would continue as described under Alternatives A and B. However, a programmatic guideline for natural areas and the establishment of management plans specific to each natural area are additional measures under Alternative C. These additional measures would result in beneficial impacts to natural areas. Monitoring of TVA natural areas would continue under Alternative C comparable to Alternative B; however, monitoring programs would be established based on management plans under Alternative C. TVA would also establish a site-monitoring program specific to each natural area. Therefore, this alternative would benefit natural areas and have the least potential to result in loss of natural areas by ensuring management objectives are met so that the values and qualities that characterize a natural area are retained over time.

The process of designating new natural areas or removal of current natural areas from the program via the reservoir lands planning process would continue. However, the option for designating natural areas outside of the reservoir lands planning process based on the establishment of evaluation criteria would also be available. The opportunities for designation of new natural areas would occur frequently due to the evaluation of 5,000 acres of high-priority areas annually for potential inclusion in the program. This would have a positive impact on the natural areas program by allowing ecologically significant areas meeting the evaluation criteria to be potentially designated as a TVA-managed natural area within a quicker time frame. Non-TVA-managed natural areas occurring on TVA-managed lands would be affected similar to Alternative A.

Implementing stewardship needs on natural areas as identified under this Flagship Management Alternative would ensure that natural areas identified through monitoring, management plans, and opportunistic observations would be assessed. Natural areas assessed through these activities benefit from implementation of maintenance needs to

meet management objectives. Because a larger number of natural areas would be assessed due to increased monitoring, the establishment of management plans would identify specific needs and opportunistic observations. There would be more opportunities to identify issues and implement maintenance needs to ensure management objectives are met on a larger majority of natural areas. These actions would have a positive effect on the natural areas program.

The TVA Natural Heritage database would continue to be utilized to add new information, update, and maintain natural areas records in support of environmental reviews and planning purposes. Data sharing through formal exchanges with other federal and state resource agencies would continue under this alternative. The opportunity to gather information utilizing partnerships would help to promote TVA-managed natural areas and allow for information retrieval from other sources. Natural areas would continue to benefit from the use of the database. Updates to records of natural areas including spatial data for 52 records a year would ensure that the most up-to-date information is being utilized for the environmental review process.

Establishment of a public outreach and volunteer program paired with the promotion of the natural areas program locally, regionally, and nationally would be beneficial to the natural areas program. There would be several opportunities to interact with and inform the public about the importance of preserving all TVA-managed natural areas; to encourage and support research; to conduct EE activities; and to promote the appropriate use of TVA SWAs. The TVA natural areas program would potentially provide an effective platform to promote environmental stewardship and actively involve the public.

Promotion of the SWAs is intended to encourage interaction with and education of the public about the importance of resource conservation and preserving these areas and provide appropriate public access and recreation opportunities while minimizing potential impacts. While promotion of the SWAs may potentially increase the frequency of use by visitors and lead to increased usage of trails and campsites and even inappropriate uses by some (e.g., vandalism and all-terrain vehicle use), the benefits associated with stewardship opportunities from promotion of these SWAs (e.g., cooperative management partnerships, volunteer and EE programs) would outweigh any negative impacts.

Any negative impacts would be addressed by the proposed increased monitoring of these areas to assess any management needs and given the existing levels of dispersed recreation use (both authorized and unauthorized activities), the overall impacts would be negligible and insignificant.

The key to the preservation of TVA natural areas is effective management, and the components outlined in the Flagship Management Alternative would support that.

Potential cumulative effects to natural areas would be positive and more beneficial compared to Alternatives A and B due to the combined approach that would help to promote more effective management and support the goal of preserving the values and qualities that characterize these natural areas.

Alternative D — Blended Management Alternative

TVA-managed natural areas would be similarly impacted under Alternative D to that of Alternative C. Under Alternative D, activities currently associated with natural areas management and protection would continue as described under Alternatives A and B, but a programmatic guideline for natural areas and the establishment of management plans,

specific to each natural area similar to Alternative C would also be implemented. These measures would result in beneficial impacts to natural areas compared to Alternative A and B that do not support development of and implementation of management plans. However, compared to Alternative C, Alternative D would implement fewer management plans.

The process of designating new natural areas under Alternative D would be supported by establishment of evaluation criteria and the evaluation of 5,000 acres of high-priority areas annually for potential inclusion in the program. The benefits to natural areas under Alternative D are comparable to Alternative C. Implementing stewardship needs on natural areas as identified under this alternative would ensure that natural areas identified through monitoring, management plans, and opportunistic observations would be assessed and beneficial similar to Alternative C. However, with fewer natural areas receiving developed management plans under Alternative D, compared to Alternative C, management objectives may not be met for all natural areas. While these actions would have a positive effect in implementing stewardship needs compared to Alternatives A and B, the benefits are greater from more natural areas supported by management plans under Alternative C.

The TVA Natural Heritage database would continue to be utilized under Alternative D similarly to Alternatives A and B. Data sharing through formal exchanges with other agencies would continue under this alternative. However, the opportunity to gather information for identification of sensitive resources through utilizing partnerships available under Alternative C would not be available under Alternative D. While data exchanges between TVA and other agencies would occur under Alternative D, partnering with other organizations to identify sensitive resources in field studies would potentially allow for assessments of TVA lands not fully inventoried and strengthen relationships with other entities over time as proposed by Alternative C. Updates to records of natural areas including spatial data for 52 records a year would ensure that the most up-to-date information is being utilized for the environmental reviews process.

The establishment of a public outreach and volunteer program paired with the promotion of the natural areas program locally, regionally, and nationally would be beneficial to the natural areas program under Alternative D, similar to that of Alternative C.

Potential cumulative effects to natural areas would be more positive under Alternative D compared to Alternatives A and B due to the combined approach that would help to promote more effective management and support the goal of preserving the values and qualities that characterize these natural areas. However, the opportunity for additional management plans specific to each natural area to be developed and implemented under Alternative C that would provide guidelines for effectively managing natural areas would be more beneficial than Alternative D.

Relative Beneficial Impacts of the Alternatives

The relative beneficial impacts to natural areas under the four alternatives are shown in Figure 5-3. The impact bars shown in Figure 5-3 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-3. Relative Beneficial Impacts of the Alternatives on Natural Areas

5.4. Terrestrial Ecology

5.4.1. Vegetation

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue with current land management strategies. TVA would continue to address issues of invasive species encroachment into natural areas in an effort to follow EO 13112 and actively participate in the Cooperative Weed Management Areas established in Mississippi, Georgia, and Tennessee. Globally rare plant communities identified on reservoir lands would remain allocated in areas of sensitive resource management and natural resource conservation in RLMPs. Direct impacts would be anticipated to rare plant communities that have yet to be discovered on unplanned parcels on TVA-managed lands. Direct and indirect impacts would be also anticipated to plant communities from the introduction and spread of NNIP species.

Cumulative impacts are expected to the terrestrial communities and biodiversity of the TVA region as a result of deforestation. Deforestation is due to development activities and population growth causing a loss in habitat. Habitat loss, in turn, causes a reduction in biodiversity.

Alternative B — Custodial Management Alternative
Under the Custodial Management Alternative, TVA would continue with a portion of the current land management strategies. Globally rare plant communities identified on reservoir lands would remain allocated in areas of sensitive resource management and natural resource conservation in RLMPs.

Where practical, TVA would continue to address issues of NNIP encroachments into those areas with existing environmental commitments and/or sensitive resources while following EO 13112. TVA would develop the appropriate plans to ensure compliance with EO 13112. These plans would aid in preventing the inadvertent movement of NNIPs within the aquatic and terrestrial environment that can occur during routine operations.

Direct, indirect, and cumulative impacts to plant communities would be similar to those described under Alternative A. The plans associated with EO 13112 compliance would have a direct positive impact to prevent the introduction and spread of NNIP species within the TVA region.

Alternative C — Flagship Management Alternative
Under the Flagship Management Alternative, TVA would create and implement new reservoir lands planning strategies and a CVLP. Globally rare plant communities identified on reservoir lands would remain allocated in areas of sensitive resource management and natural resource conservation in RLMPs. In addition, TVA would work cooperatively with other federal and state agencies to develop a more comprehensive LCA.

TVA would expand control measures to address NNIP issues while ensuring compliance with EO 13112. These measures would aid in preventing the inadvertent movement of invasive species with the aquatic and terrestrial environment that can occur during routine operations.

Direct, indirect, and cumulative impacts to plant communities would be similar to those described under Alternative A. The plans associated with EO 13112 compliance would have a direct positive impact to prevent the introduction and spread of NNIP species within the TVA region.

Alternative D — Blended Management Alternative
Globally rare plant communities identified on TVA-managed lands located adjacent to reservoirs would remain allocated in areas of sensitive resource management and natural resource conservation. The programs associated with globally rare plant communities and NNIP would continue as described in Alternative B. Direct, indirect, and cumulative impacts to plant communities would be similar to those described under Alternative A. The plans associated with EO 13112 compliance would have a direct positive impact to prevent the introduction and spread of NNIP species within the TVA region.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to vegetation under the four alternatives are shown in Figure 5-4. The impact bars shown in Figure 5-4 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-4. Relative Beneficial Impacts of the Alternatives on Vegetation

5.4.2. Wildlife

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue to manage resources using existing stewardship practices that benefit wildlife resources while providing opportunities for dispersed recreation. TVA would incorporate stewardship actions as described in unit plans at specific sites throughout the TVA region.

TVA would also address wildlife resource issues on a case-by-case basis as they arise. For instance, TVA would continue to entertain partnerships to address collective resource needs in the future. Likewise, TVA would manage nuisance wildlife in cooperation with other regulatory agencies on a project basis. Under this alternative, TVA would continue its involvement with regional conservation initiatives.

Under Alternative A, TVA's stewardship activities would lack a holistic management approach, which may result in overlooking immediate threats to wildlife, including those from encroachments or invasive species. Any potential threats would ultimately be identified during LCAs or during routine maintenance. Appropriate resource management

responses to these threats would be developed at that time. Adoption of this alternative would not result in adverse direct, indirect, or cumulative impacts to wildlife or their habitats.

Alternative B — Custodial Management Alternative
Under the Custodial Management Alternative, TVA would focus on meeting regulatory requirements and maintenance needs of existing assets and would address public safety issues. Stewardship activities would benefit wildlife and their habitats. Continued management of dewatering projects and habitat enhancement partnerships would benefit wildlife, especially waterfowl and nongame species found at dewatering projects and habitat enhancement sites. TVA would develop an MOU with the USFWS to define TVA's approach to implementing EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). This would result in a programmatic approach to managing migratory bird populations on TVA-managed lands. The increased role in forestry, although minimal under this alternative, and GHG demonstration projects would also benefit wildlife.

A reduction in nondiscretionary conservation planning would reduce TVA's involvement in regional conservation plans. Currently, this involvement benefits TVA, other agencies, and biological resources throughout the TVA region. Renewal of WHC third-party certifications would maintain the benefits to wildlife that these arrangements provide.

The closure of day use areas located off dam reservations and stream access sites not currently managed under contractual agreements could result in decreased opportunity for wildlife-associated recreation, but these closures would likely result in less disturbance to wildlife in these areas.

Under Alternative B, TVA would develop a more comprehensive strategy for nuisance animal control. This strategy would result in a more systematic application of control measures and potentially result in increased use of nonlethal measures. Adoption of the Custodial Management Alternative would result overall in fewer wildlife-oriented stewardship projects compared to the No Action Alternative. However, adoption of this alternative would not result in adverse direct, indirect, or cumulative impacts to wildlife or their habitats.

Alternative C — Flagship Management Alternative
Under Flagship Management, several high-profile projects would be selected in addition to current stewardship activities. Improved assessment tools and methodologies driving the prioritization of stewardship activities would greatly benefit wildlife resources. Increased emphasis on demonstration projects would benefit migratory birds. Improved management of dewatering projects would benefit multiple species of wildlife and would provide better recreational opportunities. Incorporating goals and objectives in the *North American Waterfowl Management Plan* (USFWS 2009a) and state wildlife action plans would also benefit migratory species on a regional scale.

An improved trails program would have minimal impact to wildlife, other than potential increased disturbance to some species located near the trails. Outdoor educational clinics would promote outdoor ethics, perhaps minimizing increased disturbance to wildlife. A holistic approach to land protection and boundary marking would better protect wildlife and other sensitive resources.

The adoption of the Flagship Management Alternative would result in improved communication between TVA and conservation partners. Programs under this alternative would facilitate further collaboration with the public and would result in benefits to natural

resources on TVA-managed lands and the region. Cumulative impacts would also be beneficial at a regional scale.

Alternative D — Blended Management Alternative
The Blended Management Alternative meets TVA's regulatory obligations while allowing flexibility to implement additional programs. This alternative includes actions described in Alternative B, including management of dewatering units, an increased role in forestry, and habitat enhancement partnerships in addition to other activities that benefit wildlife. TVA's increased surveillance of its natural areas would also benefit the resources that these areas protect.

This alternative includes an increased focus on wildlife habitat enhancement partnerships, regional landscape conservation initiatives, and NNIP-control activities, and WHC certification would also benefit these resources. These cooperative partnerships would benefit wildlife on and adjacent to TVA lands and provide opportunities for TVA to collaborate with other agencies to address regional conservation issues in an efficient manner.

TVA's increase in dispersed recreation activities, developed recreation improvements, and increased shoreline stabilization could result in impacts to wildlife. Despite the potential for some level of disturbance to wildlife from these activities, potential impacts are considered minor as any impacts could be greatly reduced by proposed public outreach initiatives and through mitigation measures incorporated during development of specific projects.

The Blended Management Alternative would provide a more holistic and collaborative approach to managing wildlife resources on TVA properties, and provide flexibility regarding the implementation of management options as resource needs are identified. Benefits of this alternative would range between those described in Custodial and Flagship Management alternatives. Furthermore, adoption of the Blended Management Alternative would not result in adverse direct, indirect, or cumulative impacts to wildlife or their habitats.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to wildlife under the four alternatives are shown in Figure 5-5. The impact bars shown in Figure 5-5 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-5. Relative Beneficial Impacts of the Alternatives on Wildlife

5.5. Wetlands

This section analyzes impacts to wetlands that are associated with the four alternatives, including direct, indirect, and cumulative impacts.

Direct impacts result from disturbances that occur within the wetland. Common direct impacts to wetlands include filling, grading, removal of vegetation, building construction,

and changes in water levels and drainage patterns. Most disturbances that result in direct impacts to wetlands are controlled by federal and state wetland regulatory programs.

Indirect impacts result from disturbances that occur in areas outside of the wetland, such as uplands, other wetlands, or waterways. Common indirect impacts include influx of surface water and sediments, fragmentation of a wetland from a contiguous wetland complex, loss of recharge area, or changes in local drainage patterns. Most indirect impacts are beyond the authority of federal and state wetland regulatory programs.

Cumulative impacts reflect a net loss of wetland area and functions as the result of the incremental direct and indirect impacts of human activities.

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue to implement the existing stewardship programs and tools for wetland identification and protection. Under this alternative, wetlands are typically identified using the TVA wetlands database. The wetlands database also uses SMI data, and for project-specific analysis, field surveys are used to identify and map wetlands. No process exists for adding wetlands identified in the field for current projects to the existing wetlands database.

This alternative would continue to apply the existing methodology when planning lands along TVA reservoirs. Parcels of TVA-managed lands that include wetlands are typically designated as either sensitive resource management or natural resource management. In cases where high-quality or unique wetland habitats are identified on TVA-managed lands, these parcels may be designated as natural areas and managed appropriately.

Under the No Action Alternative, there would be no significant direct wetland impacts. TVA would continue to comply with CWA, state wetland protection regulations, and EO 11990 (Protection of Wetlands) through its environmental review process. Where direct wetland impacts are unavoidable, impacts would be assessed and mitigated via existing regulatory mechanisms.

Indirect wetland impacts associated with the No Action Alternative are due to activities or disturbances that occur outside the wetland. Regionally, indirect and cumulative adverse effects on wetlands would be related to the indirect effect of increased demand for shoreline access and regional growth.

Alternative B — Custodial Management Alternative
Under this alternative, wetland impacts would be similar to the No Action Alternative.

Alternative C — Flagship Management Alternative
Under this alternative, TVA would explore, pilot/test, and implement new strategies for enhancing wetland stewardship. This would include development and implementation of a wetland management policy that includes a proactive program for wetland identification, management, and protection on TVA-managed lands.

TVA would conduct additional activities in support of database development, maintenance, and use. Activities would consist of an information-gathering effort on TVA-managed lands for assessment of wetland resources. TVA would modify its existing wetland impact analysis tool, used in siting TVA projects, to support planning on TVA-managed lands. This process utilizes soils data, NWI mapping data, and aerial photography. Wetlands indentified during these surveys would be incorporated into the database. This would also

include the identification and mapping of globally rare wetland communities as indicated by NatureServe. These communities would also be added to the TVA Natural Heritage database.

Field surveys, mapping, and assessment of wetland resources would allow the identification of opportunities to improve these resources, where appropriate. Improvement activities would include invasive species removal, restoration of hydrologic functions, and restoration of native wetland species.

Under this option, TVA would expand its role in large-scale wetland conservation efforts across the region via partnerships with other federal and state agencies, academics, and NGOs. Planning efforts would address individual species associated with wetlands and communities of species or could operate on a larger scale (e.g., regional or ecoregional planning and landscape conservation cooperatives).

Implementation of the proposed action would result in a positive effect on wetlands on TVA-managed lands, and no direct or indirect adverse wetland impacts would result from this alternative. TVA would continue to comply with CWA and EO 11990 (Protection of Wetlands) through its environmental review process. Where wetland impacts are unavoidable due to operational-associated projects, impacts would be assessed and mitigated via existing regulatory mechanisms.

Cumulative actions would have a long-term, moderate, beneficial cumulative effect on wetlands within the Valley due to wetland identification, protection, and restoration efforts. These benefits would provide moderate increases in wetland function (wildlife habitat, increased ability to trap sediment and pollutants, invasive species removal, and increased species diversity) as the result of wetland restoration, rehabilitation, and ecosystem management efforts. Regionally, cumulative adverse effects on wetlands would be related to the indirect effect of increased demand for shoreline access and regional growth.

Alternative D — Blended Management Alternative
Under this alternative, TVA mixes portions of the programs and activities as described under Alternatives B and C. The direct, indirect, and cumulative impacts on wetlands would be similar to those described under the Flagship Management Alternative. As strategic partnerships and resources become available, TVA would enhance management of both the in-house wetland database and wetlands on its lands.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to wetlands under the four alternatives are shown in Figure 5-6. The impact bars shown in Figure 5-6 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-6. Relative Beneficial Impacts of the Alternatives on Wetlands

5.6. Water Quality

Alternative A — No Action Alternative
TVA-managed lands are mostly a narrow band around reservoirs. Because these lands account for only a small portion of the watershed of a given reservoir or perennial stream and because none of the biological and cultural resources management activities generate substantial amounts of pollutants, activities on these lands are unlikely to have any measurable effect on water quality other than locally.

Water quality is not a current focus of the biological and cultural programs, but the practices are generally adequate to comply with regulations and to control pollutants in runoff from TVA-managed land. Shoreline erosion contributes some sediment and associated pollutants in many areas and is an ongoing slight adverse impact. Small amounts of sediment and slight adverse impacts may be generated by heavily used informal recreation areas and trails.

Access controls, land protection, and road and parking area maintenance generally control runoff and erosion from these facilities. Inadequate maintenance or access controls may occasionally allow accelerated erosion, generate pollutant loading, and cause slight adverse impacts to water quality. Illegal exploration for artifacts on TVA land can generate similar slight impacts. Shoreline erosion generates much larger amounts of sediment, but this is still a slight impact compared to other background sources. Active protection of archaeological sites and enforcement of laws that protect cultural resources decrease these impacts.

TVA-managed land under contractual agreements for agriculture, especially areas that allow grazing or row crops, can generate pollutants such as sediment, nutrients, bacteria, and pesticides. Because of the limited extent of these licensed areas, measurable impacts are unlikely.

Management of sensitive biological resources and terrestrial habitat generally improves vegetative cover of soil and thereby provides slightly beneficial water quality impacts in the long term. During the process of improving habitat, bare soil and herbicide use may generate pollutants, but any impacts would be minor and short term.

Dewatering areas support agriculture during the summer and are flooded during the winter to provide winter habitat for large populations of waterfowl. Water discharged from dewatering areas can contain nutrients and sediment. These pollutants come from the seasonally flooded agricultural areas within the dewatering areas, waste from waterfowl, and other pollutants from the watersheds upstream of the dewatering areas. The quantity of pollution discharged is usually small, resulting in slight adverse water quality impacts. However, adverse impacts are associated with the West Sandy dewatering area, where Tennessee lists the downstream West Sandy embayment as not supporting designated uses due to nutrients and low DO.

The scope of recreation actions is limited to developed recreation facilities; therefore, these activities are less likely to have any measurable effect on water quality than the biological and cultural resources management activities. However, management of Agency land creates opportunities for leadership by example, and recreation areas are among the TVA facilities that are most visible to the public. Management practices used by TVA can influence attitudes and expectations among visitors.

Promotion of water-based recreation (stream access sites, greenways) can make the public more aware of water resource issues and the value of clean water. TVA currently maintains 63 day-use areas and 81 stream access sites (including 50 stream access sites managed by contractual agreement).

Water quality is not a current focus of the recreation programs but the practices are generally adequate to comply with regulations and control potential runoff pollutants from TVA-managed lands allocated for recreation, although some pollutants reach adjacent water bodies in storm water runoff. The establishment of one flagship campground per year and one sustainable day use area initiative per year could reduce pollutant delivery to adjacent water bodies at these sites if water pollution treatment or reduction practices are included in the project. Construction activities associated with upgrades consistent with ADAAG and establishment of flagship campgrounds would generate additional pollutants. However, good design, construction, and maintenance practices would make any impacts very slight. Waste treatment facilities are operated in compliance with local and state regulations.

If policies are followed consistently, reservoir lands planning would have no impact on water quality.

Water resource management programs are intended to improve water quality and create public support for water quality and water resources improvement.

The QGP targets segments of the public to make them more aware of water resource issues and the value of clean water while encouraging them to act to protect and improve water quality. The TVCMI Program provides education material to the public and certifies those marinas that take efforts to improve and protect water quality.

The Stream and Tailwater Monitoring Program assesses water quality and ecological condition of streams throughout the Valley. The information generated by this program is used to target and track TWI projects and is used by other water quality agencies in the Valley to support their assessment and water quality improvement efforts. The quality and accessibility of data influences the accuracy of needs assessment and thereby the effectiveness of management actions.

The TWI Program has measurable beneficial impacts to water quality. During construction, there can be minor and temporary slight adverse impacts, but these would be minimized by appropriate BMPs. The TWI produces long-term decreases in pollutant quantities and improvement of water quality in targeted water bodies and makes the public more aware of water resource issues and the value of clean water while enabling them to act to protect and improve water quality.

TVA-managed lands are mostly a narrow band around reservoirs. Because these lands account for only a small portion of the watershed of a given reservoir or perennial stream and none of the uses that TVA-managed lands are used to generate substantial amounts of pollutants, activities on these lands are unlikely to have any measurable effect on water quality other than locally. Management practices are generally adequate to comply with regulations and to control pollutants in runoff from TVA-managed lands. However, some pollutants do reach water bodies from sources such as runoff from developed areas, eroding reservoir shoreline, land leased for agricultural uses, and dewatering areas. Overall impacts are slightly adverse compared to pristine conditions.

Water Resource Management programs have a direct connection to water quality and a greater geographic scope than programs that are focused on management of TVA land, and therefore, potentially have a much greater impact. The TWI program is intended to reduce pollutant loadings to water bodies and target these reductions in a manner that creates improvements measureable by biological monitoring and/or state use-support status. Stream and Tailwater Monitoring directly supports this effort. The QGP and TVCMI programs have slight beneficial impacts, and enhance the TWI program. Overall, the benefits of the Water Resource Management programs outweigh the slightly adverse impacts of the land management programs and this alternative is beneficial.

Alternative B — Custodial Management Alternative
Under this alternative, changes to biological and cultural resources management and recreation management programs that affect water quality are small and short-term. Overall, impacts of this alternative would be nearly zero. Long-term impacts would be slight for most of these program changes, and the benefits and adverse impacts would be nearly equal. Water resource management programs have a direct connection to water quality. Under this alternative, the creation of the Water Quality Improvement Campaign program would not completely compensate for the reduction in availability of current resource condition information, reduction of outreach programs, and elimination of the TWI program. The long-term impacts of this alternative would be that water resource improvements would be less than under the No Action Alternative, and therefore this alternative would have an adverse impact on water quality.

Monitoring and enforcement of archaeological resources can decrease soil disturbance from illegal exploration for artifacts and thereby decrease sediment pollution. Some of the monitoring and enforcement activities are reduced under this alternative compared to the No Action Alternative (such as ARPA inspections) while others are increased (shoreline archaeological site monitoring). Because this is such a minor pollutant source, the net impact would be nearly zero.

Active protection of cultural resource sites would decrease shoreline erosion after minor construction impacts, but a smaller amount of this work would take place under this alternative than the No Action Alternative. There would be a slight long-term adverse impact from this change.

An increased number of dispersed recreation areas improved would likely decrease erosion and other pollutant sources from these areas, while increased outreach activities that promote responsible use of these lands could create a slight long-term improvement in condition. A goal of 10 miles of trails would be constructed per year under this alternative. The construction and use of unsurfaced trails have the potential to create slight water quality impacts from erosion. However, good design, construction, and maintenance practices would make these impacts very slight.

Habitat improvements and terrestrial GHG projects would increase slightly under this alternative and would promote better vegetative cover. Minor temporary impacts would be possible during improvement and planting activities due to erosion from bare soil or herbicide use, but the long-term impact of these projects would be slightly positive.

Dewatering area management is unchanged under this alternative, so the impacts would be the same as under the No Action Alternative. Resource condition assessment has no direct impact on water quality, but the quality and accessibility of data influences the accuracy of needs assessment and thereby the effectiveness of management actions. Assessment and

data management activities would increase under this alternative, probably providing a slight long-term benefit.

Promotion of water-based recreation can make the public more aware of water resource issues and the value of clean water. The potential reduction in the number of stream access sites would reduce public use of water for recreation and opportunities to raise public awareness.

Under this Alternative, TVA would contract out or close campgrounds and day use areas located off dam reservations. This would most likely have no impact on water quality, but aggressive conservation management by the contractor or reversion to forest if the facilities were closed may have a slight beneficial impact; poor management by the contractor or continued heavy recreation use after closing would have a slight adverse impact.

Construction activities associated with upgrades consistent with ADAAG could generate slight water quality impacts from erosion. However, good design, construction, and maintenance practices would make any impacts very slight.

No flagship campgrounds would be established under this alternative, so there would be no construction impacts, nor would there be any potential for water quality improvements at appropriate sites.

If policies were followed consistently, reservoir lands planning would have no impact on water quality.

Under this alternative, the scale of the public outreach programs associated with water resource management would be reduced, and this would decrease the potential for beneficial impacts accordingly.

TVCMI would be maintained at its current level, so there would be no change in this program from the No Action Alternative. Stream assessments would be reduced from 110 to 50 per year, which would reduce the availability of current stream-condition data for decision-making.

The TWI Program would be eliminated. This program is intended to create significant water quality improvement within the watershed-level project areas. Any water quality improvements generated by this program would also be eliminated.

The Water Resource Improvement Campaign Program would be initiated. This program would reduce the pollutant loading to water bodies by a greater amount than the TWI Program it would replace. However, because the benefits are spread across the Valley, it is unlikely to produce significant water quality improvement at any location, and the overall benefit would be slight.

There are numerous federal, state, local, and NGO efforts to improve water quality throughout the Valley. TVA's activities are consistent with these efforts, but cumulative impacts on water quality are limited to the potential that TVA activities would encourage others to participate in similar projects.

TVA water resource management programs seek to partner directly with some existing efforts, generate new initiatives, provide resource condition data, and encourage those efforts that TVA cannot directly participate; these programs would result in positive

cumulative impacts. The cumulative impacts are implicit in the water resource management activities and would be approximately proportional to TVA's activity level. The creation of the Water Quality Improvement Campaign program would not completely compensate for the reduction in availability of current resource condition information, reduction of outreach programs, and elimination of the TWI program. The cumulative impact of this alternative would be that water resource improvements would be less than under the No Action Alternative.

Alternative C — Flagship Management Alternative
Under this alternative, biological and cultural resources and recreation management programs are expanded to more actively manage TVA's land resources. In nearly all cases, this would generate slight benefits to water quality. Because these improvements would still be small compared to background levels, the net impact would still be slightly beneficial.

Water resource management programs have a direct connection to water quality. The TRI and TWI programs both are intended to create measurable water quality improvement and therefore beneficial impacts. Public outreach programs, Water Resource Improvement Campaigns, and the grant program would have dispersed slight benefits, and in combination with increased partnership development, these programs would enhance the effectiveness of TWI and TRI projects. Overall, this alternative has a beneficial impact compared to the No Action and Custodial Management alternatives.

Under this alternative, the scale of all enforcement, active protection, enhancement, and maintenance programs associated with biological and cultural resources management would be increased. Minor temporary impacts would be possible during construction of protection and enhancement work due to erosion from bare soil or herbicide use, but these impacts would be minimized by use of BMPs. The increase in scale of these programs would improve the conditions on TVA land and reduce erosion of archaeological sites, which would tend to reduce pollutants to water bodies compared to the No Action and Custodial Management alternatives.

Increased outreach and the new EE Program and Resource Stewardship Campaign Program would raise public expectations for land stewardship and could thereby increase water quality slightly across the Valley.

A goal of 20 miles of trails would be constructed per year under this alternative. The construction and use of unsurfaced trails have the potential to create slight water quality impacts from erosion. However, good design, construction, and maintenance practices would make these impacts very slight.

The open land/early successional habitat program and conversion of appropriate agricultural land to forest would likely improve water quality slightly compared to the No Action Alternative and more rapidly than allowing expired agricultural licensed land to revert to forest without active management.

Rebuilding dewatering facilities may cause some short-term water quality impacts during construction, but good design and management during construction would make these impacts slight and short term. There would be no change in operations after these facilities, so there would be no long-term impacts.

An expansion of monitoring, data gathering, and planning programs would likely help make these programs more effective in identifying and responding to resource needs and increase the water quality benefits of management activities.

Recreation Management Construction activities associated with upgrades consistent with ADAAG and day use area sustainability initiatives could generate water quality impacts from erosion. However, good design, construction, and maintenance practices would make any impacts very slight. Appropriate practices installed as part of the day use area sustainability initiative could have a slight beneficial impact. Impacts from construction and any long-term water quality improvements associated with flagship campgrounds would be the same as in the No Action Alternative.

Blueway development, promotion and development of water-based recreation, and outreach programs would likely raise public expectations for water quality and appreciation of the value of clean water.

Greenway development can cause slight short-term water quality impacts during construction, but BMPs and good design would be used to minimize impacts. Greenways can also raise public expectations for water quality and appreciation of the value of clean water when they are developed adjacent to water bodies.

If policies were followed consistently, reservoir lands planning and the associated ranges in land use zone allocations would have no impact on water quality.

Under this alternative, water resource management partnership programs would be scaled up and a new case study program would be initiated. These efforts could improve the effectiveness of water quality improvement efforts throughout the Valley, and there would be slight beneficial impacts.

Public outreach programs would also be scaled up compared to the No Action Alternative. In addition, the TVCMI Program would expand and seek the certification of two additional marinas per year. It is difficult to evaluate the water quality impacts of outreach programs, but it is likely that a slight positive impact to water quality would be realized.

Reservoir shoreline stabilization would curtail erosion at targeted locations. During construction, there can be minor and temporary slight adverse impacts, but these would be minimized by appropriate management practices. There would be a net improvement to water quality from shoreline stabilization, but because the shoreline is a small part of the total watershed, measurable water quality improvement would be unlikely. Therefore, impacts would be slightly beneficial.

Stream assessments would be increased above the level in the No Action Alternative, so there would be more recent data available to support decision-making by TVA and other Valley agencies. In particular, the TWI Program would have better data available for targeting and tracking. This would not directly cause any water quality improvements, but it would make other efforts more effective.

The TRI Program would be initiated. This program would generate measurable beneficial water quality impacts in a manner similar to TWI but would be targeted to improve water quality in TVA reservoirs and their watersheds.

The TWI Program would be expanded. During construction, there can be minor and temporary slight adverse impacts, but these would be minimized by appropriate management practices. In the long term, the program would generate greater pollutant load reductions, and more measurable benefits to water quality would be realized. This would be a significant beneficial impact.

Water Resource Improvement Campaigns would be initiated. This program would reduce the pollutant loading to water bodies. The benefits of this program would be spread across the Valley, so it is unlikely to produce significant water quality improvement at any location. The program would likely generate slight beneficial impacts, depending on the particular project.

A new grant program would be initiated to support water quality projects managed by other entities. Impacts would depend on selection criteria and the effectiveness of the organizations receiving the grants. The benefits of this program would be spread across the Valley, so it is unlikely to produce significant water quality improvement at any location. The program would likely generate slight beneficial impacts, depending on the particular project.

There are numerous federal, state, local, and NGO efforts to improve water quality throughout the Valley. TVA's activities are consistent with these efforts, but cumulative impacts on water quality are limited to the potential that TVA activities would encourage others to participate in similar projects.

TVA water resource management programs seek to partner directly with some existing efforts, generate new initiatives, provide resource condition data, and encourage those efforts that TVA cannot directly participate in; these programs would result in positive cumulative impacts. The cumulative impacts are implicit in the water resource management activities and would be approximately proportional to TVA's activity level. Public outreach programs, Water Resource Improvement Campaigns, and the new grant program, in combination with increased partnership development, would enhance the effectiveness of TWI and TRI, and all of these efforts would complement and enhance other projects throughout the Valley. Overall, this alternative would have a greater beneficial cumulative impact compared to the No Action and Custodial Management alternatives.

Alternative D — Blended Management Alternative

Under this alternative, most biological and cultural resources and recreation Management programs would be larger in scale than in the No Action and Custodial Management alternatives but would be smaller in scale than in the Flagship Management Alternative. Overall impacts would be similar, with slight beneficial impacts, as compared to No Action and Custodial Management alternatives, and slight adverse impacts compared to the Flagship Management Alternative.

Water resources programs potentially influence water quality throughout the Valley and have a greater and more direct impact on water quality than programs that are chiefly concerned with TVA-managed lands. Including the Water Resource Improvement Campaign program, this alternative would generate a greater decrease in pollutant loadings than either the No Action or Custodial Management alternatives, but less than the Flagship Management Alternative. Overall impacts from this alternative are beneficial compared to the No Action and Custodial Management alternatives and adverse (less beneficial) compared to the Flagship Alternative.

Cultural resources monitoring, enforcement, and resource protection would be similar to the Custodial Management Alternative, and benefits would also be similar, with most of the water quality benefit derived from protection of shoreline archaeological sites. Dispersed recreation area improvements could reduce pollutant generation in amounts proportional to the number of sites improved, so this alternative would have less water quality benefit than the Flagship Alternative but more than the other two alternatives. Condition assessment and implementation of stewardship and asset preservation activities would allow better protection of water from pollutants generated on TVA-managed land compared to the No Action and Custodial Management alternatives but would be less protective than the Flagship Alternative. Outreach activities would raise public expectations for land stewardship and thereby increase water quality slightly across the Valley; the scale of these activities under this alternative are also generally greater than under the No Action and Custodial Management alternatives and less than under the Flagship Alternative. Agricultural and open-lands management would change little compared to the No Action Alternative, so these land areas would continue to generate small amounts of water pollutants with no change from current conditions.

As in the Custodial Alternative, 10 miles of trails would be constructed per year under this alternative. The construction and use of unsurfaced trails have the potential to create slight water quality impacts from erosion. However, good design, construction, and maintenance practices would make these impacts very slight.

Rebuilding dewatering facilities may cause some short-term water quality impacts during construction, but good design and management during construction would make these impacts slight and short term. There would be no change in operations after these facilities, so there would be no long-term impacts.

Recreation Management construction activities associated with upgrades consistent with ADAAG and for flagship campgrounds could generate slight short-term water quality impacts from erosion. However, good design, construction, and maintenance practices would make these impacts very slight. Other impacts within this alternative are similar to the No Action Alternative. With appropriate practices at the flagship campgrounds and at the day use areas subject to sustainability modifications, this option would generate slightly beneficial water quality impacts compared to the No Action and Custodial alternatives, but slightly less beneficial than the Flagship Alternative.

If policies were followed consistently, reservoir lands planning and the associated ranges in land use zone allocations would have no impact on water quality.

This alternative would retain the expansion of scale of Water Outreach Campaigns and stream assessments from the Flagship Management Alternative and would also retain the new Reservoir Shoreline Stabilization and TRI programs. TWI would be eliminated and Water Resource Improvement Campaigns would be increased in scale to the level of the Custodial Management Alternative. This alternative would accelerate the rate of measureable water quality improvement as measured by HUs improved per year compared to the No Action and Custodial Management alternatives. As compared to the Flagship Management Alternative, the rate of measureable water quality improvement as measured by HUs improved per year would be reduced. In addition to HU improvement, the TRI program is intended to make measurable improvements to reservoir water quality.

There are numerous federal, state, local, and NGO efforts to improve water quality throughout the Valley. TVA's activities are consistent with these efforts, but cumulative

impacts on water quality are limited to the potential that TVA activities would encourage others to participate in similar projects.

Water resource management programs seek to partner directly with some existing efforts, generate new initiatives, provide resource condition data, and encourage those efforts that TVA cannot directly participate in, resulting in positive cumulative impacts. These cumulative impacts are implicit in the water resource management activities and would be approximately proportional to TVA's activity level. Because of the relative activity levels, the cumulative beneficial impact of this alternative would be greater than the No Action or Custodial Management alternatives, but less than the Flagship Alternative.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to water quality under the four alternatives are shown in Figure 5-7. The impact bars shown in Figure 5-7 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-7. Relative Beneficial Impacts of the Alternatives on Water Quality

5.7. Aquatic Ecology

This section analyzes impacts to aquatic life that are associated with the four alternatives, including direct, indirect, and cumulative impacts.

Direct impacts result from disturbances that occur within aquatic environments. Common direct impacts to aquatic habitats include dredging, placement of fill in streams or other water features (including placement of riprap and other stabilization structures) and changes in water levels and drainage patterns. They may also include the introduction of pollutants (other than sediment) into streams. Most disturbances that result in direct impacts to aquatic life are controlled by federal and state regulatory programs including approvals under Section 26 of the TVA Act.

Indirect impacts result from disturbances that occur in areas outside of the water body in upland areas. Common indirect impacts include influx of surface water and sediments, loss of wetland function in areas along the water body, loss of recharge area, or changes in local drainage patterns. Most disturbances that result in indirect impacts to aquatic life are controlled by federal and state regulatory programs often including approvals under Section 26a of the TVA Act.

Cumulative impacts are those impacts resulting from combined direct and indirect impacts to the stream, water quality, or instream habitats over time.

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue to implement the existing stewardship programs and tools. Because the majority of the actions discussed as part of biological and cultural resources management, recreation management, and reservoir lands planning occur on TVA-managed lands and not in aquatic environments, these activities rarely result

in direct impacts to aquatic resources. This is in part because very few of the state- or federally listed aquatic species in the TVA region occur on or immediately adjacent to TVA-managed lands.

Water resource management programs are designed to improve riparian areas, water quality and instream habitat throughout the Valley. Because of the large geographic scope of water resource management programs, these programs have a much higher potential to affect aquatic resources. Activities performed as a part of water resource improvement programs occur within or immediately adjacent to streams, wetlands, ponds, and other aquatic environments. Disturbance associated with water resource improvement programs may have a short-term, direct adverse effect on instream water quality and habitats. However, the goal of these programs is to benefit aquatic and riparian conditions in the watersheds where they are applied. There is potential for some activities (particularly bank stabilization activities associated with both cultural and water resource management) to affect listed aquatic species directly. All of TVA's programs and third-party programs (e.g., local watershed initiatives) funded by TVA undergo an environmental review. Any adverse direct, indirect, or cumulative impacts to aquatic resources are identified and minimized or avoided during project planning. The intent of water resource improvement programs is to provide long-term benefits to aquatic habitats and communities.

This alternative would continue to apply the existing methodology when planning lands along TVA reservoirs. Parcels that include important aquatic resources (primarily caves and springs) are typically designated as either sensitive resource management or natural resource conservation. In cases where high-quality or unique habitats are identified on TVA-managed land, the specific parcel of land may be designated as a natural area and managed appropriately.

Under the No Action Alternative, it is not anticipated that there would be large, unavoidable impacts to aquatic resources. TVA would continue to comply with the CWA, state regulations, ESA, and EO 13112 (Invasive Species) through its environmental review process. Where direct or indirect impacts to aquatic resources are unavoidable, impacts would be assessed, avoided, and/or minimized via existing regulatory mechanisms (particularly the ESA). Long-term effects on aquatic resources (including listed species) from TVA's resource management activities are expected to be beneficial to aquatic habitat conditions and aquatic communities.

Alternative B — Custodial Management Alternative

Under this alternative, aquatic impacts would be essentially similar to the No Action Alternative. Scaling back some activities under the Custodial Management Alternative would result in fewer recreation development, biological and cultural resources management, or water resource improvement programs. The reduction of some beneficial programs (particularly water resource improvement programs) may reduce some of the short-term impacts of implementing these programs. However, there would be fewer beneficial projects for natural resources realized under this option, and some adverse cumulative impacts to water quality and aquatic communities could result.

No significant adverse direct, indirect, or cumulative impacts to aquatic communities are expected to occur from implementation of the Custodial Management Alternative. However, some beneficial effects on water quality and aquatic communities that would be accomplished under the Flagship Management Alternative would not be realized by the Custodial Management Alternative.

Alternative C — Flagship Management Alternative
Under this alternative, TVA would explore, pilot/test, and implement new strategies for enhancing environmentally sustainable recreation, resource stewardship, water resource improvements, and reservoir lands planning on TVA-managed lands. The potential impacts associated with reservoir lands planning and the associated ranges in land use zone allocations would be the same as those described under Alternative A. Direct, positive, beneficial changes in aquatic ecology due to the implementation of water resource improvement programs would be realized across the Valley. An inventory of resources on TVA-managed lands would help inform TVA (and partners) of opportunities to protect or enhance aquatic resources found on or adjacent to those lands. Field surveys, mapping, and assessment of resources would allow identification of opportunities to improve these resources where appropriate.

Under this alternative, TVA would expand its role in large-scale conservation efforts across the region via partnerships with other federal and state agencies, academics, and NGOs. Planning efforts would address individual species that are state- or federally listed and communities of rare and common species or would operate on a larger scale (e.g., regional or ecoregional planning; landscape conservation cooperatives). These conservation efforts should have measurable benefits to aquatic resources across the region.

Implementation of water resource improvement programs under the Flagship Management Alternative would likely provide direct, beneficial effects on aquatic life within the Valley. These benefits would result from direct improvements in water quality and aquatic habitat conditions in watersheds targeted under water resource improvement programs.

Under the Flagship Management Alternative, indirect, beneficial impacts to water quality and aquatic habitats are likely to be realized as upland conditions improve (i.e., better practices would be implemented during upland development, resulting in the increased ability of riparian areas to trap sediment and pollutants).

Implementation of the proposed Flagship Management Alternative is expected to result in a positive effect on aquatic life in the TVA region. No long-term direct or indirect adverse impacts to aquatic habitats or communities are expected to result from this option. TVA would continue to comply with the CWA, state regulations, ESA, EO 13112 (Invasive Species), and other applicable federal and state regulations through its environmental review process.

While short-term direct and indirect impacts could occur as a result of the implementation of specific projects under this alternative, any direct, indirect, or cumulative impacts to aquatic resources would be assessed, avoided, and/or minimized via existing regulatory mechanisms (particularly NEPA and ESA). It is anticipated that only beneficial long-term changes to aquatic resources (including water quality, aquatic habitat conditions, and aquatic communities) from TVA's resource management activities would occur.

Alternative D — Blended Management Alternative
Implementation of the proposed Blended Management Alternative is expected to result in a positive effect on aquatic life in the TVA region. No long-term direct or indirect adverse impacts to aquatic habitats or communities are expected to result from this option. TVA would continue to comply with the CWA, state regulations, the ESA, EO 13112 (Invasive Species), and other applicable federal and state regulations through its environmental review process. Several of the programs associated with water quality improvements would be implemented at a higher level of effort than identified in the Custodial

Management Alternative. Additional water quality and wildlife habitat improvements would be realized under this alternative when compared to the Custodial Management Alternative. These improvements would have a net benefit to aquatic communities in the TVA region.

While short-term direct and indirect impacts could occur as a result of the implementation of specific projects under this alternative, any direct, indirect, or cumulative impacts to aquatic resources would be assessed, avoided, and/or minimized via existing regulatory mechanisms (particularly NEPA and ESA). It is anticipated that only beneficial long-term changes to aquatic resources would result from TVA's resource management activities under the Blended Management Alternative.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to aquatic ecology under the four alternatives are shown in Figure 5-8. The impact bars shown in Figure 5-8 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-8. Relative Beneficial Impacts of the Alternatives on Aquatic Ecology

5.8. Endangered and Threatened Species

The ESA requires TVA to ensure that its actions do not harm any species listed as threatened or endangered or to adversely modify critical habitat. It applies to all actions authorized, funded, or carried out by TVA. If an action has the potential to affect listed species or their habitats, TVA must consult with the USFWS. TVA has established a process for consultation with USFWS and will follow these procedures when implementing the NRP.

5.8.1. Aquatic Species

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue the current stewardship activities designed to protect and enhance populations of protected, listed, or rare species and their habitats while providing recreational opportunities. As described in Section 4.7.1, no listed aquatic species are known to occur on lands that would be directly managed by TVA as part of the NRP. However, federally and state-listed species do occur throughout the TVA region.

Currently, TVA's natural resource management programs incorporate a variety of stewardship programs benefiting rare species and meeting regulatory responsibilities for protecting listed species and their habitats on the lands and waters within the TVA region. TVA would continue to comply with the CWA, state regulations, ESA, EO 13112, and other applicable federal and state regulations through its environmental review process.

While short-term direct and indirect impacts may occur as a result of the implementation of specific projects under this alternative, any direct, indirect, or cumulative impacts to aquatic resources (including listed species) would be assessed, avoided, and/or minimized via

existing regulatory mechanisms (particularly ESA and NEPA). It is anticipated that only beneficial long-term changes to aquatic resources including listed aquatic species from TVA's resource management activities would occur.

Adoption of this alternative would not result in direct, indirect, or cumulative adverse impacts to federally or state-listed aquatic species or their habitats.

Alternative B — Custodial Management Alternative
Stewardship activities described under the Custodial Management Alternative would benefit listed species and their habitats. Impacts to listed species differ little from those described in the No Action Alternative.

The transfer of day use areas located off dam reservations and stream access sites not currently managed under contractual agreements could potentially result in impacts to listed species near these resources if operation of these sites is transferred to external operators. TVA would inform future operators of potential conflicts with listed species and provide information on how to avoid impacts to these resources.

Adoption of the Custodial Management Alternative would have similar levels of regulatory compliance as the No Action Alternative. Adoption of this alternative would have no direct, indirect, or cumulative impacts to federally or state-listed aquatic species or their habitats.

Alternative C — Flagship Management Alternative
Implementation of the proposed Flagship Management Alternative is expected to result in net positive improvements to water quality and aquatic life in the TVA region (including listed aquatic species). No long-term direct or indirect adverse impacts to aquatic habitats or communities are expected to result from this alternative. TVA would continue to comply with the CWA, state regulations, ESA, EO 13112, and other applicable federal and state regulations through its environmental review process. Implementation of endangered and threatened species monitoring and management activities and water quality improvement programs at the highest proposed level of effort is expected to result in measurable improvements to water quality and aquatic habitats in the TVA region.

While short-term direct and indirect impacts may occur as a result of the implementation of specific projects under this alternative, any direct, indirect, or cumulative impacts to aquatic resources would be assessed, avoided, and/or minimized via existing regulatory mechanisms (particularly NEPA and ESA). It is anticipated that only beneficial long-term changes to aquatic resources including listed aquatic species from TVA's resource management activities would occur as a result of implementation of this alternative

Alternative D — Blended Management Alternative
Implementation of the Blended Management Alternative is expected to result in a positive effect on aquatic life in the TVA region (including listed aquatic species). No long-term direct or indirect adverse impacts to aquatic habitats or communities are expected to result from this alternative. TVA would continue to comply with the CWA, state regulations, ESA, EO 13112, and other applicable federal and state regulations through its environmental review process. Several of the programs associated with endangered and threatened species monitoring, and water quality improvements would be implemented at a higher level of effort than identified in the Custodial Management Alternative. Additional water quality and wildlife habitat improvements would be realized under this alternative when compared to the Custodial Management Alternative. These improvements would have a net benefit to aquatic listed species in the TVA region.

While short-term direct and indirect impacts may occur as a result of the implementation of specific projects under this alternative, any direct, indirect, or cumulative impacts to aquatic resources would be assessed, avoided, and/or minimized via existing regulatory mechanisms (particularly NEPA and ESA). It is anticipated that only beneficial long-term changes to aquatic resources including aquatic listed species from TVA's resource management activities would occur.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to listed aquatic species under the four alternatives are shown in Figure 5-9. The impact bars shown in Figure 5-9 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-9. Relative Beneficial Impacts of the Alternatives on Listed Aquatic Species

5.8.2. Terrestrial Species

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue current stewardship activities designed to protect and enhance populations of protected, listed, or rare species and their habitats while providing recreational opportunities. TVA currently incorporates a variety of stewardship programs benefiting rare species and meeting regulatory responsibilities for protecting listed species and their habitats. TVA would continue to work with the USFWS to develop a more programmatic approach to managing migratory bird issues. Adoption of this alternative would not result in direct, indirect, or cumulative impacts to listed species or their habitats.

Alternative B — Custodial Management Alternative
Stewardship activities described under the Custodial Management Alternative would benefit listed species and their habitats. Impacts to listed species differ little from those described in the No Action Alternative.

The transfer of day use areas located off dam reservations and stream access sites not currently managed under contractual agreements would potentially result in impacts to listed species near these resources if operation of these sites is transferred to external operators. TVA would inform future operators of potential conflicts with listed species and provide information on how to avoid impacts to these resources.

Adoption of the Custodial Management Alternative would have similar levels of regulatory compliance as the No Action Alternative. Adoption of this alternative would have no direct, indirect, or cumulative impacts to protected species or their habitats.

Alternative C — Flagship Management Alternative
Adoption of the Flagship Management Alternative would result in general improvements described under Section 5.3.2. Given TVA's current level of involvement with listed species, adoption of this alternative would differ little from the No Action or Custodial Management alternatives.

Alternative D — Blended Management Alternative
Adoption of the Blended Management Alternative would result in beneficial impacts ranging from those described in the Custodial Management and Flagship Management alternatives. TVA's regulatory obligations would be met under this alternative, but this alternative would also include coordinated enhanced and flagship-level projects that expand current protective measures to larger landscape levels. Adoption of the Blended Management Alternative would not result in adverse direct, indirect, or cumulative impacts to listed species or their habitats.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to listed terrestrial species under the four alternatives are shown in Figure 5-10. The impact bars shown in Figure 5-10 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-10. Relative Beneficial Impacts of the Alternatives on Listed Terrestrial Species

5.8.3. Plants

Under the No Action and all Action Alternatives, TVA would continue to comply with the ESA and manage the TVA Natural Heritage database. Currently, two reservoirs (Chatuge and Chickamauga) harbor federally listed species along the shoreline. TVA would continue to assist the Nature Conservancy of Georgia and the Nature Conservancy of North Carolina with annual monitoring of green pitcher plant populations on Chatuge Reservoir and would continue to conduct yearly monitoring of large-flowered skullcap within the Tennessee River Gorge and Chickamauga Reservoir. TVA would also continue to monitor populations of Ruth's golden aster on the Ocoee River and Hiwassee River systems in areas where TVA controls water flow.

There are more than 30 records of large-flowered skullcap reported from the Raccoon Mountain Pumped Storage Plant. However, the current land management practices and partnerships ensure the proposed activities are not likely to adversely affect this federally listed species.

Direct and indirect impacts would be anticipated to listed plant communities from the introduction and spread of NNIP species. Indirect impacts to the federally listed as endangered Ruth's golden aster are expected from the spread of NNIPs as well as woody vegetation on the Hiwassee and Ocoee rivers. Cumulative impacts to listed species may be expected from rare plant habitat destruction as a result of increased commercial and

residential development in the TVA region. These activities may result in the extirpation of rare plant populations and habitats. In addition, these changes may alter the genetic diversity of the affected species.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to listed plants under the four alternatives are shown in Figure 5-11. The impact bars shown in Figure 5-11 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-11. Relative Beneficial Impacts of the Alternatives on Listed Plants

5.9. Cultural Resources

The alternatives under consideration propose several programs designed to protect, preserve, enhance, and minimize adverse effects to historic properties. The level at which these programs would be implemented varies among the different alternatives. It is important to note that under each alternative except the No Action Alternative, planning for the management of cultural resources would be integrated with planning for other natural resource programs so that a balance may be achieved among potentially competing goals.

Consultation under Section 106 of the NHPA with the Advisory Council on Historic Preservation, the seven Valley SHPOs, 18 federally recognized Indian tribes, and other consulting parties on the effects that the NRP actions may have on historic properties is and would be ongoing. A PA is being developed that would address potential adverse effects and stipulate a process for phased compliance under Section 106 of the NHPA to identify and evaluate historic properties that may be impacted as a result of the alternatives proposed in this undertaking.

Alternative A — No Action Alternative
Under the No Action Alternative**,** TVA would continue to manage its historic properties as it currently functions. Management is conducted pursuant to the relative laws and regulations discussed in Chapter 2. Resource management is conducted to meet the basic requirements of these laws and regulations with most stewardship conducted around responsibilities and mitigation related to NHPA Section 106 compliance for TVA-related projects. A notable exception is the employment of dedicated ARPA investigators to provide greater protection of archaeological resources from looting and vandalism as discussed below.

Overall, this alternative would have the greatest negative impact on historic properties with the exception of the ARPA Program. TVA would continue to meet the minimum requirements of the relevant laws and regulations and would take measures to ensure compliance with those requirements not currently being met.

TVA's ARPA Program includes two police investigators who solely focus on ARPA violation enforcement. While not a requirement under ARPA or its associated regulations, the Agency took a proactive approach to its extensive looting and vandalism problem. By

having these investigators on staff, TVA has been able to protect numerous sites and deter vandals and looters. As a result, the United South and Eastern Tribes Incorporated passed a resolution commending TVA for its ARPA enforcement and the protection of valued historic properties of significance to Indian tribes under its jurisdiction. TVA manages approximately 11,500 known archaeological sites, and many sites are vulnerable to both looting and erosion due to their proximity along TVA's reservoirs. As a result, many archaeological sites on TVA-managed lands have experienced an extensive damage. The investigators have been invaluable to deterring looting and vandalism of historic properties on TVA reservoirs and while the program is still developing, several convictions have already been obtained. Continuation of this program would be very beneficial to archaeological sites on TVA-managed lands.

The looting problem must be combated with public outreach and education as well as with violation enforcement. While the investigators have succeeded in bringing forth numerous successful convictions, TVA has followed stakeholders' suggestions to improve its public outreach efforts to complement the enforcement of the law. TVA is currently posting ARPA signs at launching ramps and other access areas to inform the public of the need for protecting these resources. In addition, TVA participates in one or two public outreach events per year on a "by invitation" basis. Continuation of this format would not likely result in a significant increase in public appreciation and knowledge of the need for archaeological site protection.

TVA's current Preservation Program (pursuant to Section 110 of the NHPA) includes the identification of archaeological sites on a small portion (approximately 2,000 acres) of Agency-managed lands annually. This focus has been limited to archaeological sites and does not include historic structures located on or within the viewshed of TVA-managed lands. Evaluation of historic properties has been conducted through NHPA Section 106 for TVA-related undertakings; however, nominations to the NRHP have been limited to external efforts by universities or community groups.

Records of historic properties managed by TVA are maintained through various data sources and the Agency lacks a centralized database. This lack of consolidated data creates a challenge in developing a comprehensive NHPA Section 110 plan to complete the identification, evaluation, and nomination of historic properties owned by the Agency. Continuation of this form of data management would result in errors in the management of historic properties and may lead to inadvertent adverse effects to historic properties.

TVA currently conducts its monitoring and archaeological site protection, typically through shoreline stabilization and other means such as gating, under Section 106 mitigation agreements on TVA-related projects rather than through needs systematic assessments. Under the current archaeological site protection program, the five-year average has been approximately 0.2 miles of stabilization per year. Therefore, many sites in need of stabilization have not been protected.

TVA has recently begun evaluating historic buildings associated with the Muscle Shoals Reservation for potential adaptive reuse. This type of study is required by EO 13287 (Preserve America). As an asset manager of historic properties owned by the federal government, TVA is responsible for recognizing and managing historic properties in its ownership as assets that can support the Agency mission while contributing to the vitality and economic well-being of the public. However, other buildings that are potentially eligible for the NRHP and not needed for the Agency's mission have been neglected resulting in an adverse effect.

Pursuant to the stipulations of EO 13287, TVA submitted the required initial report on its NHPA Section 110 Program in 2004. Progress reports on its NHPA Section 110 improvements were not submitted in 2005 and 2008. TVA would meet the EO's requirement in the future regardless of which NRP alternative is chosen.

TVA would continue to review all projects and activities with a potential to affect historic properties. This review would be conducted pursuant to Section 106 of the NHPA and other relevant laws and regulations as well as through the stipulations defined in the PA for this undertaking. Activities defined in the Action Alternatives include a process for greater integration with the management of other resources and their associated activities. Selection of the No Action Alternative would mean this integrative approach would not likely occur.

Alternative B — Custodial Management Alternative
Under the Custodial Management Alternative, TVA would establish programs to meet the basic stewardship requirements of all historic preservation laws, regulations, and EOs. Existing programs that would be improved include the NHPA Section 106 compliance and the Preservation Program. Additional programs would be established to ensure that each requirement is met. Proposed programs include public outreach, archaeological site monitoring and protection, and the Preserve America Program.

Overall, the effects under the Custodial Management Alternative would be fewer than under the No Action Alternative. With the exception of the reduced acreage surveyed annually for archaeological sites, the Preservation Program would improve under this alternative. With additional programs for the identification of historic structures and buildings as well as a plan for the evaluation and nomination of historic properties to the NRHP, TVA would be in line with the goals and responsibilities of Section 110 of the NHPA. With the development of a comprehensive database, TVA would improve its overall management of historic properties through improved efficiency and knowledge base.

TVA Police are charged with a number of different responsibilities that include safety at TVA's facilities and reservations as a priority. ARPA enforcement would be conducted by reported incident with very little active monitoring or surveillance of illegal activity at TVA's archaeological sites. Public knowledge that TVA has no ARPA investigators would likely lead to an increase in site looting. This portion of the alternative would have the greatest adverse effect on archaeological sites managed by TVA as well as with its consultative relationships with federally recognized Native American tribes.

Although TVA nominally has a program to promote the need for archaeological site protection (Thousand Eyes), this program has been limited in its efforts and has mainly functioned by invitation or has been opportunistically approached through appropriate NHPA Section 106 undertakings where archaeological resources are at risk of damage from looting.

By establishing a formal program, TVA would proactively plan activities each year to meet the needs of the resource. Public outreach would be focused in areas of greatest need, and programs would include public presentations, academic speakers, school programs, grants, and partnerships with universities and other interested groups to promote archaeological site protection awareness. In addition, TVA would partner in report publications and add interpretive signs at local historic sites through cooperative efforts with community groups.

Site looting is a significant problem on TVA-managed lands, and this alternative would ensure that TVA is taking appropriate steps to share archaeological information with the public to build a greater appreciation for the need to protect these sensitive resources. In order to make a difference in public outreach, TVA would be proactive in these efforts and reach out to those communities with the greatest need. This alternative would support these efforts.

Under the Custodial Management Alternative, TVA would enhance its Preservation Program by including additional activities. Those activities that would be included under this alternative are:

- Identification of Archaeological Sites – Under this alternative, there would be a reduction in the focus for the identification of archaeological sites. This reduced focus would delay TVA from systematically completing surveys regarding NHPA Section 110 inventory. However, as the focus for archaeological identification is decreased, increased opportunities are available for other activities within the Preservation Program.
- Identification and Management of Historic Buildings and Structures – TVA would develop a plan for the identification, evaluation, and nomination of historic buildings and structures on TVA-managed lands to the NRHP. Under this alternative, historic structures on TVA-managed lands would be enhanced through preservation and protection. This alternative would be responsive to the public's expressed concern for TVA's cultural and historic resources. It would directly address preferences for more protection, maintenance, and greater access of these resources for public use and enjoyment.
- Evaluate and Nominate Sites to the NRHP – Pursuant to Section 110 of the NHPA, federal agencies are responsible for the identification, evaluation, and nomination to the NRHP. TVA identifies additional historic properties each year; however, evaluation and nomination of significant sites have not occurred. TVA proposes to develop goals for the evaluation and nomination of significant historic properties under its management which would reduce the rsik of adverse effects to these properties as well as improve stakeholder realations with those groups concerned with the preservation of historic properties.
- Develop an Implementation Procedure – In order to improve the Preservation Program and facilitate a more efficient process for compliance with preservation laws, TVA would develop procedures for compliance processes required under these laws. By having a defined set of procedures, TVA would improve consistency in its management and compliance procedures.
- Comprehensive Database – Pursuant to Section 112 of the NHPA, federal agencies shall ensure that records and other data are permanently maintained in appropriate databases. TVA maintains numerous data sources relating to historic properties under its management. However, because no comprehensive database has ever been developed, these sources are fragmentary. As a result, TVA does not have consolidated data on the locations of its previous surveys, site location information, and other important data for the resources under its management. Development of a database would improve efficiency and the overall management of TVA's historic properties. A consolidated database would also provide long-term savings of time and money.

The inclusion of these activities in the Preservation Program would be beneficial in the long term as they would improve TVA's information base of historic properties. By doing so, it would improve the incorporation of cultural resources management in early project planning and reduce potential future mitigation costs.

this alternative, TVA would establish a database to monitor and manage ongoing mitigation measures to ensure compliance with NHPA Section 106 agreements and NEPA documents. This database would be very beneficial with the number of compliance agreement documents that are executed by the Agency each year. By establishing a database system that would track these commitments and stipulations, TVA would ensure adherence to these agreements.

TVA would establish a program for archaeological site monitoring and protection. TVA would focus efforts on those areas with the greatest need (i.e., areas where our most significant archaeological sites are located and where threat of damage to these resources is the greatest). A plan would be developed to monitor a specific number of shoreline miles each year and protect a specific number of sites from erosion and looting. A plan would be a great benefit to the resource, and it would demonstrate TVA's intent to protect archaeological resources.

Under this alternative, TVA would complete an assessment of its NHPA Section 110 needs and prepare a report every three years on its improvement progress. This assessment is beneficial to the Agency because it meets the requirements under EO 13287 and allows the Agency to set long-term goals on its NHPA Section 110 responsibilities.

Under this alternative, the ARPA Program would not include the dedicated investigators TVA currently has in place. Compliance with ARPA would occur by reported incident with reliance on TVA Police. Effects of this change would likely mean a decrease in the number of criminal convictions and an increase in looting activity with investigators generally not able to devote the time necessary to develop these types of cases. This would have a negative impact on archaeological sites on TVA-managed lands. In addition, reduced efforts under ARPA may result in an increased risk to consultation relationships with Indian tribes. Federally recognized Indian tribes identified these resources as having religious and cultural significance.

Many new natural resource programs proposed for the Custodial Management Alternative have a potential to adversely affect historic properties. Specifically, any activity which causes ground disturbance or alters the viewshed or other ambiance of a historic property has the potential to have an adverse effect. Those activities are described in Appendix B of the PA. TVA would continue to review all projects and activities with a potential to affect historic properties. This review would be conducted pursuant to Section 106 of the NHPA and other relevant laws and regulations as well as through the stipulations defined in the PA for this undertaking.

Numerous programs are proposed that would encourage proactive management of TVA-managed lands. Included in these activities is a more integrated approach to resource management where cultural resources would be considered in initial NRP project planning. Integration of these programs would be beneficial for cultural resources as well.

Alternative C — Flagship Management Alternative

Under the Flagship Management Alternative, TVA would initiate numerous programs that would focus on an increased effort toward stewardship of its resources. Of the different

alternatives, this option would have the most beneficial effect to cultural resources. Some of the enhanced programs would include ARPA, public outreach, NHPA Section 106 compliance, historic preservation, archaeological site monitoring and protection, corporate history, tribal consultation, and Preserve America.

Overall, the Flagship Management Alternative would be the most beneficial for cultural resources managed by TVA. Cultural resources would be managed proactively to reduce adverse effects and promote the protection and preservation of resources in a manner that benefits the public.

Under the Flagship Management Alternative, TVA would expand its ARPA Program to include more resources for greater coverage across the Valley. Given TVA's high density of archaeological sites that are vulnerable to looting, ARPA enforcement is key to reducing this significant adverse effect to archaeological resources. This would be a great benefit to the archaeological resources and would improve our relationships with stakeholders, such as federally recognized Indian tribes, SHPOs, and other preservation groups that have an identified interest in these resources. This program would have a long-term beneficial effect on archaeological resources, as it would help reduce looting on TVA-managed lands.

TVA would initiate a very progressive public outreach program that would include outreach events, and numerous partnerships, interactive Web sites, assistance in programs for school systems in the Valley, and the establishment of a formal site monitoring program. Coupled with an aggressive ARPA investigation program, the outreach program would ensure that TVA is reaching the largest audience possible on the need for archaeological site protection. The need for such outreach is great in the Valley, and expansion of this program would be highly beneficial. Of all the management activities conducted by the Agency for archaeological resources, public outreach has the greatest long-term effects to making sure these resources are protected for future generations.

In addition, TVA would establish an EE Program to include all biological and cultural resources managed by the Agency. This would allow for an integrated approach to sharing resources with the public while promoting the protection of those sensitive resources that are being affected on TVA-managed lands. The outreach program would be expanded beyond archaeological resources and include public awareness of all historic properties (such as historic structures) and the need to protect and preserve them. This integrated approach would be highly beneficial to the historic properties under TVA's management.

In combination with the Preserve America Program, TVA would identify properties that are important to its heritage and provide public access to these areas. This would include providing information kiosks, self- or TVA-guided tours, or other methods to provide relevant information of the historic property. If the public were able to participate more in the protection and preservation of these resources, there would be a greater appreciation of the resources as well as the heritage associated with them.

TVA's NHPA Section 106 compliance would be detailed through the development of emergency procedures. Federal agencies are encouraged to develop procedures for taking historic properties into account during operations that respond to a disaster or emergency declared by the President, a tribal government, or the governor of a state or during situations that respond to other immediate threats to life or property. In addition, the program would benefit from the development and execution of PAs for compliance on requests for routine or repetitive actions. These agreements would streamline small

projects that have no effects to historic properties and potentially reduce the number of recurring reviews conducted by TVA.

The Flagship Management Alternative includes a number of activities that would further expand TVA's Preservation Program. Additional resources would be available to increase the amount of surveys conducted each year to identify historic properties on TVA-managed lands, as well as to evaluate and nominate sites to the NRHP and seek partners to identify traditional cultural places. By having a better knowledge base of the historic properties located on its lands, TVA would be able to more effectively manage these resources for the benefit of both the resource and the public.

A plan would be developed to identify historic cemeteries on TVA-managed lands, as well as to provide a Web-based interactive cemetery database. These tools would be very beneficial because TVA receives numerous requests each year for this information.

The long-term effects of this program in the Flagship Management Alternative would be the increased efficiency and knowledge base of the resources under TVA's management. TVA would complete its Section 110 obligations under NHPA more quickly and be able to have more historic property information to incorporate into early project planning. This could reduce future compliance costs associated with NHPA Section 106 and result in fewer adverse effects on historic properties.

Under this alternative, TVA would expand its program to monitor and protect sensitive archaeological sites. With a larger program in place to assess these sites and identify those that are in critical need for protection, fewer sites would be adversely affected each year due to erosion and looting. This would be highly beneficial to the archaeological resources under TVA's management. Since this activity has the greatest immediate effect on archaeological sites being adversely affected, the long-term effects of this program would be highly beneficial. Archaeological sites are being threatened on a daily basis from erosion and looting; the greater effort to save these resources each year would ensure that a greater number of them would be preserved for future generations.

TVA would establish a TVA History and Archaeology Museum showcasing TVA's significance on a regional, national, and international level. This museum would provide a location for improved curation and interpretation of TVA's historic collection. The creation of a museum would also be an excellent opportunity to develop partnerships with retirees, local communities, universities, federally recognized tribes, and with other stakeholders.

Consultation with federally recognized Indian tribes would be improved by having workshops more frequently with tribal representatives to talk about ways to improve management of those resources considered of religious or cultural importance. More frequent workshops would improve TVA's consultative relationship with Indian tribes and consequently would improve the Section 106 compliance process.

In addition to improving the Agency's NHPA Section 110 Program, TVA would seek partners to promote heritage tourism with communities and local governments. By seeking partners for heritage tourism, TVA would be supporting its mission to promote economic development by using historic properties in ways that benefit both the resource and the public. In general, this would assure that such properties are attended rather than neglected and would enhance the public's appreciation of such resources.

TVA proposes to develop a program to support publications pertaining to cultural resources in the Valley. Specifically, these publications would address both academic and nonacademic audiences and include topics on historic properties in the Valley. These publications would support TVA's public outreach programs in promoting the need for protection of sensitive resources. TVA participated in the publication of scientific reports many decades ago. These publications continue to be valued by the professional archaeological community today. Preservation laws were passed because Congress recognized these resources as being important to the American people. As such, TVA would share the importance of these resources with the public.

TVA would also participate in partnerships for the training of future archaeologists by providing locations or funding for archaeological field schools. These would be conducted when beneficial to TVA and would help enhance relationships with regional professional archaeologists and expand TVA's knowledge base of its own resources. Whereas field schools in the past have primarily focused on data recovery, new technology has made nondestructive data gathering possible through techniques such as geophysical testing (i.e., ground-penetrating radar, proton magnetometers, etc.). Data recovery field schools may be considered when sites are being adversely affected and other methods of protection or mitigation are not feasible. These partnership efforts would improve relationships with academic archaeologists and federally recognized tribes as well as with the public.

Under this alternative, other biological resource, recreation, and water resource management activities would be enhanced above other alternatives, and reservoir lands planning would create a CVLP. However, these activities have a potential to adversely affect historic properties as described under the Custodial Management Alternative. TVA would continue to review all projects and activities with a potential to affect historic properties. This review would be conducted pursuant to Section 106 of the NHPA and other relevant laws and regulations as well as through the stipulations defined in the PA for this undertaking.

The Flagship Management Alternative includes a number of integrated land management activities that would be highly beneficial to biological and cultural resources on TVA-managed land. In particular, a larger human presence on TVA-managed lands would support improved land conditions. Annual monitoring would allow TVA to develop long-term goals and identify problems before they arise rather than later.

Alternative D — Blended Management Alternative

Under this alternative, TVA would establish programs to meet the basic stewardship requirements of all historic preservation laws, regulations, and EOs. All cultural resource programs established in the custodial option would be included in this alternative. In addition, those programs that are considered essential stewardship functions for cultural resource management would be enhanced. Each of these programs is intended to avoid or reduce adverse effects on historic properties, whether by Agency action, neglect, or natural forces.

Overall, the Blended Management Alternative would result in fewer adverse effects than the No Action and Custodial Management alternatives and would provide greater benefit to those resources that are at greatest risk. This alternative would include the ARPA investigation program outlined in the No Action Alternative. ARPA investigations curb adverse effects to archaeological sites resulting from illegal acts on TVA-managed lands. Programs that would be enhanced under this alternative are the Archaeological Site

Monitoring and Protection Program, Preservation Program, Corporate History Program, and the Archaeological Outreach Program. Other programs would be considered if resources become available.

As in the Custodial Management Alternative, TVA would have a formal Archaeological Outreach Program focusing on those geographic areas with the greatest need. More outreach activities including public presentations, school programs, and grants are beneficial to historic resources by raising the public's awareness of their importance.

Because of the significant looting problem on TVA-managed lands, implementing this alternative would be more beneficial than the No Action and Custodial Management alternatives. More events and partnerships enhance the public's appreciation for the need to protect these sensitive resources more rapidly.

Under this alternative, TVA would enhance its Preservation Program from the activities outlined in the Custodial Management Alternative. Those activities that would be enhanced in this alternative beyond the custodial level include the following:

- Identification of Archaeological Sites – The more rapidly TVA-managed lands are inventoried for archaeological resources, the lower the risk of adverse effect. Under this alternative, the inventory would be completed three times as fast as under the Custodial Management Alternative.
- Evaluate and Nominate Sites to the NRHP –TVA would evaluate and nominate up to twice as many sites under this alternative as under the Custodial Management Alternative. TVA would evaluate and nominate twice as many sites under this alternative as under the Custodial Management Alternative. The greater the effort to evaluate the significance of resources, the greater the benefit is to those significant resources because protection and preservation efforts can be more focused on those significant resources.

In regards to NHPA Section 106 Compliance, the effects of this alternative would be the same as the Custodial Management Alternative.

The activities under the archaeological site monitoring and protection program provide the most immediate benefit toward the goal of preserving these significant resources. This alternative would include an enhanced archaeological site monitoring and protection program. In addition, the number of archaeological sites monitored and protected each year would double. By focusing efforts on those locations and resources with the greatest need, the benefits to those resources would be accomplished most efficiently.

With the establishment of a formal Corporate History Program, TVA would be able to actively promote awareness of its unique history through development of a Web site and public outreach programs on TVA history. Providing such information to the public raises the appreciation of TVA's role in the historical development of the Valley and of those historic resources associated with that development.

These efforts to promote TVA's history could provide an educational opportunity for the public and lead to a better understanding of TVA's past accomplishments and its future role in the history of the region and the nation. The oral history program would ensure that information is collected and retained that could otherwise be lost as older generations pass.

In regards to the preserve America program, the effects of this alternative would be the same as the Custodial Management Alternative.

In regards to the ARPA Enforcement Program, the effects of this alternative would be the same as the No Action Alternative.

Under this alternative, other biological resource, recreation, and water resource management activities would be enhanced above the Custodial Management Alternative, and reservoir lands planning would create a CVLP. However, these activities have a potential to adversely affect historic properties as described under the Custodial Management Alternative. TVA would continue to review all projects and activities with a potential to affect historic properties. This review would be conducted pursuant to Section 106 of the NHPA and other relevant laws and regulations as well as through the stipulations defined in the PA for this undertaking.

As with the Custodial Management Alternative, this alternative proposes a more integrated approach to resource management. By interdisciplinary planning of resource management, it is anticipated that adverse effects on all types of resources would be minimized.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to cultural resources under the four alternatives are shown in Figure 5-12. The impact bars shown in Figure 5-12 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-12. Relative Beneficial Impacts of the Alternatives on Cultural Resources

5.10. Land Use

Alternative A — No Action Alternative
Under the No Action Alternative, the NRP would not be developed, and activities currently associated with the management of Agency land would not change. TVA would continue to plan its reservoir properties on an individual basis, and they would be reviewed in accordance with TVA guidelines and policies. Under this alternative, there would be no new environmental impacts pertaining to land use.

However, this alternative would have the greatest potential for fluctuations and inconsistency in programs, goals, and monitoring. These future fluctuations in goals and emphasis could result in programs either improving land use and land conditions, such as new greenways, restored habitat, and improved riparian conditions, or they could potentially result in slightly adverse impacts because of lost opportunities for recreation and enhancement or protection of natural resources.

Alternative B — Custodial Management Alternative
Under this alternative, TVA would continue to operate in compliance with legal, regulatory, and TVA policy requirements. This alternative may result in the greatest long-term impact

to the use and condition of TVA-managed lands. Under this alternative, there would be the greatest potential for adverse impacts on land use such as increased shoreline development resulting in vegetation clearing, increased runoff, and soil erosion.

Regarding reservoir lands planning, slight adverse impacts would result from expanding the types of industries permitted on lands allocated to Zone 5. Expanding the industrial development opportunities may result in more discharges into reservoir or mainstream rivers. On back-lying lands, soil-disturbing activities from construction associated with infrastructure, residential development, and industrial development may result in vegetation clearing and would substantially increase the potential for shoreline and soil erosion. As lawns and paved surfaces are established, the potential for adverse impacts from runoff and erosion would slightly decrease.

TVA-managed lands allocated for developed recreation and those transferred to other agencies to be managed for recreation opportunities would potentially receive the greatest shoreline development pressure. In addition, dispersed recreation activities would potentially have a greater impact on lands allocated for sensitive resource management and natural resource conservation. However, TVA's management of recreation activities could decrease or eliminate impacts to TVA-managed shoreline and lands through routine monitoring, improvements, and installation of BMPs and by defining management requirements in agreements with other organizations or agencies.

Alternative C — Flagship Management Alternative
This alternative would have less potential for adverse impacts from modifying the Zone 5 land use definition from "Light Industry" to "Industry" due to limiting the types of industrial uses. The Flagship Management Alternative would have the greatest potential beneficial impacts for recreation and the enhancement or protection of natural resources due to the expansion of programs. The public would benefit from the opportunity to utilize TVA-managed land for recreation, agriculture, and other benefits to socioeconomics and the environment. In addition, TVA management of recreation activities may decrease or eliminate impacts to TVA-managed shoreline and lands through routine monitoring, improvements, and installation of BMPs and by defining management requirements in agreements with other organizations or agencies. TVA's ability to decrease or eliminate impacts through management procedures and policies would be greatest under this alternative.

Under the Flagship Management Alternative, TVA's management practices for the agricultural license program would have the least potential to adversely impact land use on TVA-managed lands. This alternative would support the development of partnerships to manage lands under agricultural licenses for enhanced wildlife habitat and proper land maintenance activities such as shoreline stabilization, vegetation planting, and eradication of NNIPs. As compared to the No Action and Custodial Management alternatives, this alternative has the greatest potential to reduce erosion and improve the condition of some TVA-managed lands.

Alternative D — Blended Management Alternative
This alternative would have the same potential impacts as Alternative C in respect to modifying the Zone 5 land use definition from "Light Industry" to "Industry." The Blended Management Alternative would also have potential beneficial impacts for recreation and the enhancement or protection of natural resources due to the expansion of programs. However, these potential benefits would be fewer than expected under the Flagship Management Alterative.

Similarly, this alternative would also support the development of partnerships to manage lands under agricultural licenses for enhanced wildlife habitat and proper land maintenance activities such as shoreline stabilization, vegetation planting, and eradication of NNIPs. As compared to the No Action and Custodial Management alternatives, this alternative has greater potential to reduce erosion and improve the condition of some TVA-managed lands. However, this alternative has less potential than the Flagship Management Alternative.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to land use under the four alternatives are shown in Figure 5-13. The impact bars shown in Figure 5-13 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-13. Relative Beneficial Impacts of the Alternatives on Land Use

5.11. Prime Farmland

Effects to prime and unique farmlands can occur when actual or designated land uses are changed to other uses or designations, such as industrial or recreational development, which preclude the property from being used for agricultural purposes. Generally, prime farmland on properties located in zones for sensitive resource management and natural resource conservation are not subject to adverse impacts because those properties would be retained in a relatively “natural” state and not be converted to other land uses, preserving any prime farmland. However, prime farmland on parcels allocated to other zoning designations is subject to potential adverse effects because land in these zones would be devoted to nonagricultural uses, such as industrial development, developed recreation, and water access.

Under any of the alternatives, proposed actions involving the transfer of land for development that contains any acreage of soil with prime farmland could require completion of Form AD 1006, *Farmland Conversion Impact Rating*. This impact rating is based on soil characteristics as well as site assessment criteria, such as agriculture and urban infrastructure, support services, farm size, compatibility factors, on-farm investments, and potential farm production loss to the local community and county. Site assessment scores tend to be higher for the more rural locations. Sites receiving scores greater than 160 points (out of a possible 260) are given greater consideration of protection so that agricultural use can be preserved.

Alternative A — No Action Alternative
Under Alternative A, no specific negative impacts to prime farmland exist. Under this alternative, TVA would continue all current activities in order to meet the minimum requirements of the laws, regulations, and EOs related to the management and protection of resources, including FPPA. As future requests for land uses on these parcels are submitted to TVA, project-specific environmental reviews are expected to identify and reduce negative impacts to prime farmland. Minor adverse impacts are expected as parcels are converted to uses incompatible with agriculture.

Positive impacts to prime and unique farmlands under this alternative are related primarily to the biological and cultural resources management program. Shoreline stabilization activities not only protect archaeological and historic sites but indirectly may include prime farmland in some areas. More importantly, TVA manages approximately 5,600 acres of agricultural/open lands through the existing licensing program. These revocable licenses, which allow for the production of hay/forage or row crops, directly enhance soil quality and contribute to the success of local farm services. Included in these 5,600 acres are prime farmlands within TVA's dewatering projects on Kentucky and Wheeler reservoirs. These dewatered lands are some of the most productive agricultural lands in their respective regions. Enhancements to the soil quality of prime farmlands would also be expected through newly established programs that focus on long-term terrestrial carbon sequestration.

Alternative B — Custodial Management Alternative
Under Alternative B, TVA would continue all current activities in order to meet the minimum requirements of the laws, regulations, and EOs related to the management and protection of resources. Potential negative impacts to prime farmland would develop through the broader redefinition of Zone 5 (Light Industry to Industry) and could possibility lead to more prime farmland being converted to nonagricultural use.

Positive impacts to prime and unique farmlands under this alternative are related primarily to enhance dewatering activities, continued forest management, long-term carbon management, NNIP control, and increased public awareness of the importance of environmental stewardship.

Alternative C — Flagship Management Alternative
Under Alternative C, little or no negative impacts to prime farmland exist. TVA would not only continue all current activities in order to meet the minimum requirements of the laws, regulations, and EOs related to the management and protection of resources but would implement new strategies for enhancing stewardship programs. With an additional focus on enhancing recreational facilities (trails, etc.), some minor adverse impacts are expected as parcels are converted to uses incompatible with agriculture. Potential negative impacts to prime farmland would develop through the broader redefinition of Zone 5 (Light Industry to Industry) and could possibility lead to more prime farmland being converted to nonagricultural use. As future requests for land uses on these parcels are submitted to TVA, project-specific environmental reviews are expected to identify and reduce negative impacts to prime farmland.

Positive impacts to prime and unique farmlands under this alternative would be related to both existing programs and new directives:

- The continuation of TVA's agricultural/open lands licensing program would protect and enhance prime farmland, as well as supply support to existing local agricultural services.
- Since prime farmland can be covered by forest, the proposed focus on forest management under this alternative can be beneficial to soil resources through protection and vegetation management (i.e., NNIP).
- The terrestrial carbon sequestration initiative would promote long-term commitment to soil improvement and prime farmland preservation. Since lands would be

prioritized according to their sequestration potential, prime farmland would receive added attention and protection.

- Indirect support to prime farmland may be provided by an increased focus on stewardship assets through the use of the land stewardship assessment tool and habitat enhancement partnerships.
- Under the EE Program, TVA would communicate to various audiences the successful techniques and methodologies for sound natural resource management. Protection of soil resources (whether on public or private land) has been a focus of TVA since its establishment.

Cumulative impacts under this alternative would likely be long term and beneficial. This would include evaluation and monitoring of visual resources on TVA-managed land. Evaluation and monitoring would result in proactive implementation of preservation and protection for scenic resources that are currently evaluated on a case-by-case basis. Impacts would result in landscapes that are aesthetically pleasing, intact, and beneficial for long-term public use.

Alternative D — Blended Management Alternative
Under Alternative D, TVA would continue to meet the minimum requirements of laws, regulations, and EOs relating to the management and protection of prime farmland resources. TVA's agricultural/open lands licensing program not only protects and enhances prime farmland, but it supports local and regional agricultural services. TVA's licensed property may also serve as corridors to adjacent farmland (under private ownership), and any discontinuances may result in fragmentation of existing farm units.

Positive impacts to prime and unique farmlands under this alternative would be related to existing programs and new directives:

- Indirect support to prime farmland may be provided by an increased focus on stewardship assets through the use of the land stewardship assessment tool and enhancement partnerships.

- Under the EE Program, TVA would communicate to various audiences the successful techniques and methodologies for sound natural resource management. Protection of soil resources (whether on public or private lands) has been a focus of TVA since its establishment.

- Since prime farmland can include forests, the proposed focus on forest management under this alternative can be beneficial to soil resources through protection and vegetation management.

- To a limited degree, the terrestrial GHG initiative would promote long-term commitment to soil improvement and prime farmland preservation. Since lands would be prioritized according to their sequestration potential, prime farmland would receive added attention and protection.

Under this alternative, cumulative impacts would be similar to those described under Alternative C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to prime farmlands under the four alternatives are shown in Figure 5-14. The impact bars shown in Figure 5-14 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-14. Relative Beneficial Impacts of the Alternatives on Prime Farmlands

5.12. Visual Resources

Alternative A — No Action Alternative
Under this alternative, TVA would continue to evaluate visual resources on a case-by-case basis. This would include TVA-managed lands possibly being subjected to various forms of development. A slow, but noticeable, decline in scenic resources, aesthetic quality, and visual landscape character would be expected as development demands continue to increase.

This alternative would likely result in relatively little preservation of specific scenic areas. A gradual loss of natural undisturbed areas may also continue, along with the alteration of land having the least capacity to absorb visual change. The cumulative effects of this alternative could reduce the scenic attractiveness of TVA lands over time, resulting in a negative impact on the visual landscape character and aesthetic sense of place.

Alternative B — Custodial Management Alternative
Under this alternative, visual/aesthetic resources on TVA-managed land would be enhanced through preservation and protection. This alternative would provide protection for areas of greatest scenic value. This option would be responsive to the public's expressed concern for visual resources. It would directly address preferences for more protection of scenic resources and natural, undeveloped lands. These lands would be protected and maintained for public use and enjoyment.

Under this alternative, TVA would manage its lands under one or more of the following objectives to address the public's concerns for scenic quality. These objectives are keyed to the values set forth for scenic value class and sensitivity levels. Except for preservation, each describes a different degree of acceptable alteration of the landscape based upon the importance of aesthetics. The degree of alteration is measured in terms of visual contrast with the surrounding natural landscape.

- Preservation – This objective allows low visual-impact activities. Low-impact recreational activities are generally prohibited. This objective applies to areas that have not been disturbed by human alteration.
- Retention – Under this objective, activities may only repeat form, line, color, and texture. This would include some low-impact forest activities such as select tree removal or reforestation.

- Partial Retention – Management activities under this objective would be visually subordinate to the characteristic landscape. Activities must repeat form, line, color, and texture, but changes of size, amount, intensity, etc., would remain subordinate.
- Modification – Under this objective, proposed activities may visually dominate the original landscape character. Activities that would alter the landscape would borrow from naturally established form, line, color, or texture at a scale that would complement the surrounding area.
- Maximum Modification – Management activities of vegetative and landform alterations may dominate the landscape under this objective. However, when viewed from background distances, the visual characteristics would be similar to those that are naturally occurring in the area. When viewed in the middleground and foreground distances, they may not appear to borrow completely from existing form, line, color, or texture. Alterations may also be out of scale or not consistent with natural occurrences.

Two additional short-term management goals may be required. The first is used to upgrade landscapes containing visual impacts that do not meet the quality objectives set for a given area. The second is for landscapes that are more natural appearing. These are:

- Rehabilitation – A short-term management objective used to restore landscapes that have undesirable characteristics. This may include a number of measures: alterations to terrain, vegetation, or removal or concealment of structures.
- Enhancement – A management alternative used to achieve visual variety where little now exists. This option could be achieved through addition, subtraction, or alteration to vegetation or other physical features such as variety, form, color, texture, or patterns.

Overall, this alternative would have an increasingly beneficial impact on visual resources over time. Scenic values and visual integrity would remain high. Substantial preservation of the scenic qualities, aesthetic sense of place, and attractive visual character of these lands would be expected.

Alternative C — Flagship Management Alternative
Under this alternative, effects to visual resources would be similar to those discussed in the Custodial Management Alternative. However, it is expected that under this option, there would be an increase in visual resource monitoring on TVA-managed lands. This monitoring would:

- Detect magnitude and duration of changes in conditions including scenic integrity and landscape character.
- Help to better understand changes in landscape character and predict impacts.

There are three types of monitoring: implementation, effectiveness, and validation.

Implementation monitoring determines whether visual resource standards and guidelines were followed.

Effectiveness monitoring determines if the application of a management plan achieved its intended results.

Validation monitoring determines if new information exists that alters the validity of the assumptions upon which the plan was based. Such considerations might include changes in resource conditions, changes in constituent values, and expectations or changes in legal requirements.

Alternative D — Blended Management Alternative
Under this alternative, potential impacts to visual resources would be similar to those discussed in the Flagship Management Alternative. In addition, it is expected that under this alternative, there would be similar visual resource monitoring as outlined in the Flagship Management Alternative.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to visual resources under the four alternatives are shown in Figure 5-15. The impact bars shown in Figure 5-15 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-15. Relative Beneficial Impacts of the Alternatives on Visual Resources

5.13. Floodplains

Under any of the alternatives, TVA would apply criteria contained in EO 11988 (Floodplain Management) during its review of all projects. EO 11988 directs federal agencies to use their authority to avoid (to the extent possible).

- Long-term and short-term adverse impacts associated with the occupancy and modification of floodplains.
- Direct and/or indirect support of floodplain development wherever there is a practicable alternative.

For activities involving TVA-managed lands, a floodplain review is conducted to ensure that the proposed activity is consistent with EO 11988 and TVA's flood damage reduction objectives. Regardless of the alternative implemented, compliance with EO 11988 should prevent an increase in flood damage associated with new development and ensure that the reservoir system can be operated for flood-control benefits. Under EO 11988, actions with no practicable alternative can proceed provided adverse impacts are minimized. Adverse impacts to facilities would be minimized by designing and constructing these facilities to withstand flooding with minimum damage and by using the least amount of fill possible to complete the project. However, some types of shoreland development would negatively impact natural and beneficial floodplain values (i.e., water quality, wildlife and plant resources, cultural resources, etc.). The amount of shoreland made available for development would directly relate to the amount of potential impacts to natural and beneficial floodplain values. The use of development standards would help to minimize these impacts.

Without the implementation of appropriate BMPs, some shoreline/shoreland development could also result in increased sedimentation in the reservoirs, resulting in a loss of reservoir flood control and/or power storage capacity. One source of sediment would be from erosion occurring during construction. In many instances, however, sedimentation would be deposited in the reservoir below the lower limits of flood control and power storage. Therefore, the potential loss of flood control and power storage should be negligible under any of the alternatives.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to floodplains under the four alternatives are shown in Figure 5-16. The impact bars shown in Figure 5-16 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-16. Relative Beneficial Impacts of the Alternatives on Floodplains

5.14. Socioeconomics and Environmental Justice

5.14.1. Socioeconomics

Alternative A — No Action Alternative
Under the No Action Alternative, current programs would continue to be implemented, and therefore, there would be no new impacts. However, there likely would be missed opportunities to improve quality and availability of recreation opportunities, to improve the stewardship of natural and water resources, and to increase overall benefits of the reservoir lands. Access to, and quality of, recreational experiences would suffer due to failure to keep pace with increases in population and recreational needs and expectations. Over time, these negative impacts would be noticeable.

Alternative B — Custodial Management Alternative
Under this alternative, legal requirements and essential functions, as outlined in the Environmental Policy, would be met. However, some existing programs would be discontinued, and there would be no additional projects to elevate TVA's stewardship programs. Reservoir lands planning would continue similar to current practice. There would be slight differences in land use zone definitions, and any resulting impacts would be small. However, continuation of planning on a reservoir-by-reservoir basis could lead to missed opportunities to improve overall benefits of the reservoir lands. Loss of accommodations for water-based recreation and loss of public access to streams with significant recreation use potential could result in a noticeable increase in cost for some users to access alternatives. Generally, this alternative is likely to have small negative socioeconomic and quality of life impacts. Lost opportunities and, therefore, cumulative impacts likely would be similar to those of the No Action Alternative, although somewhat greater.

Alternative C — Flagship Management Alternative
This alternative includes positive changes to a variety of programs, including cultural resources, historic preservation, trails and dispersed recreation, land and natural heritage

stewardship, wetlands, wildlife, and water resources. TVA would develop one CVLP. New lands planning strategies and ranges in land use zone allocations would be created, which could lead to significant changes that generate greater total benefits from TVA-managed lands. Some negative impacts to specific types of users would occur as a result of overall optimization. For example, as the system taken as a whole is optimized, some users could see a reduction in convenience of access for particular uses. However, these users likely would have access at sites slightly farther away. While some users may incur small negative impacts, Valleywide planning and allocation would result in greater positive benefits for most or all uses and greater overall benefits for visitors and for residents of the Valley. This alternative would provide positive impacts to the economy and to quality of life.

Lost opportunities likely would be somewhat fewer than those of the No Action and Custodial Management alternatives since some programs would undergo positive changes. On the other hand, reduction in convenience of access, in conjunction with increased pressure on available resources as population grows, could result in some cumulative impacts. However, cumulative impacts would be least under this alternative.

Alternative D — Blended Management Alternative
At a minimum, this alternative would maintain the programs of the Custodial Management Alternative and would increase the emphasis on some programs. Therefore, some of the impacts would be similar to those of that alternative but likely would be somewhat better overall. Therefore, the socioeconomic impacts would be positive and similar to or slightly better than those of the Custodial Management Alternative but smaller than those of the Flagship Management Alternative. Over the longer term, if other programs are implemented, positive impacts would be greater but likely would still be smaller than those of the Flagship Management Alternative.

Relative Beneficial Impacts of the Alternatives
Overall, the Flagship Management Alternative would have the greatest positive impacts on the social and economic environment of the TVA region. Positive impacts would be next greatest under Alternative D. The Custodial Management Alternative would likely have the smallest positive impacts, at least somewhat smaller than those of the No Action Alternative.

The relative beneficial impacts to socioeconomics under the four alternatives are shown in Figure 5-17. The impact bars shown in Figure 5-17 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-17. Relative Beneficial Impacts of the Alternatives on Socioeconomics

5.14.2. Environmental Justice

Alternative A — No Action Alternative
As discussed above in 5.13.1, access to and quality of recreational experiences on TVA sites would suffer over time. These negative impacts are likely to be greater for low-income

populations because their ability to access and utilize alternatives would be less than for other users (see Section 5.1). In addition, no actions would be taken that would adjust to changes in the level or types of demand for recreational activities due to population increases or to demographic changes, such as age, race, and ethnic distribution of the population. Cumulative impacts would result as opportunities to better serve the public overall are lost. Alternative recreational opportunities likely would be located at greater distances and be more expensive. Any such negative cumulative impacts would be proportionately greater with respect to low-income populations.

Alternative B — Custodial Management Alternative
The potential loss of accommodations for water-based recreation and loss of public access to streams with significant recreation use potential would result in disproportionate negative impacts to low-income populations due to the increased cost to access alternatives. This alternative likely would result in disproportionate negative impacts to low-income populations. Lost opportunities, and therefore, cumulative impacts likely would be similar to those of the No Action Alternative, although somewhat greater.

Alternative C — Flagship Management Alternative
Under this alternative, reservoir lands planning would be regional rather than by reservoir. The result would be an increase in overall benefits, although benefits specific to the disadvantaged population could be reduced at specific reservoirs due to the ranges in land use zone allocations. This overall increase in access would be expected to result in overall positive benefits to disadvantaged populations as well as to the total population. However, it is possible that some specific disadvantaged populations could see a reduction in benefits at nearby locations. As a result, some low-income users (as well as other users in that area) would utilize locations somewhat farther removed. It is likely, however, that any such impact would be small and would noticeably affect relatively few users. Overall, the impact on disadvantaged population would be positive. Cumulative impacts would be least under this alternative. Such cumulative impacts would be disproportionate impacts to lower-income and other disadvantaged populations but less likely than under the other alternatives.

Alternative D — Blended Management Alternative
Under Alternative D, the programs and actions of TVA would be at least as beneficial to disadvantaged populations as those of the Custodial Management Alternative but fewer than under the Flagship Management Alternative. Therefore, the positive impacts to environmental justice would be fewer than under the Flagship Management Alternative. Cumulative impacts would be similar to those of the Flagship Management Alternative and may be somewhat less beneficial. However, they likely would be fewer than under the No Action and Custodial Management alternatives.

Relative Beneficial Impacts of the Alternatives
The Flagship Management Alternative would have the smallest disproportionate impacts to disadvantaged populations, and the Blended Management Alternative would have the next smallest. The Custodial Management Alternative would have the greatest disproportionate impacts, somewhat more than the No Action Alternative.

The beneficial relative impacts to socioeconomics under the four alternatives are shown in Figure 5-18. The impact bars shown in Figure 5-18 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-18. Relative Beneficial Impacts of the Alternatives on Environmental Justice

5.15. Navigation

For biological and cultural resources management, recreation management, and water resource management, protection of the waterway is provided for under Section 26a of the TVA Act. TVA conducts Section 26a reviews to ensure that construction of water use facilities does not encroach upon the commercial navigation channel or marked recreational channels. Consequently, there would be no direct impact on commercial navigation under any of the proposed alternatives.

For reservoir lands planning, revisions in land use zone definitions and ranges in land use zone allocations have the potential to affect navigation interests. It is essential that navigation assets, uses, and interests on the Tennessee River and its tributaries are considered and protected during the land planning process. Historically, TVA has taken steps to ensure that impacts to the navigation industry are minimized to the extent possible. Under any of the proposed alternatives, the reservoir lands planning process would remain a systematic method of identifying and evaluating the most suitable use of lands along TVA reservoirs. In addition, any specific proposal on TVA-managed land would be subject to a site-specific environmental review. Therefore, with future input from a navigation perspective, impacts to commercial navigation would be minimal under any alternative.

Relative Beneficial Impacts of the Alternatives

The relative beneficial impacts to navigation under the four alternatives are shown in Figure 5-19. The impact bars shown in Figure 5-19 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-19. Relative Beneficial Impacts of the Alternatives on Navigation

5.16. Air Quality

Alternative A — No Action Alternative

Under the No Action Alternative, TVA would continue to implement the existing stewardship programs and tools aligning with existing policies and strategies and would continue to apply the existing methodology when planning lands along TVA reservoirs. The No Action Alternative would have no negative effects on air quality. TVA would continue to follow state and local agency regulatory permitting and authorization processes for new recreation projects, which are set to protect and enhance the public health and welfare through the

development and implementation of coordinated statewide programs for the prevention, abatement, and control of air pollution.

Alternative B — Custodial Management Alternative
Under Alternative B, TVA would implement projects to meet the intent of the Environmental Policy while maintaining the character of TVA-managed lands and recreation facilities, watershed water quality, and water resource management. The focus of an NRP is to conserve and protect natural resources with a particular focus on how management affects the quality of life for both present and future generations. Alternative B would have no negative effects on air quality. Air emissions identified from proposed development associated with this alternative would be reviewed to determine whether they could be mitigated by control technology, emission-reduction strategies, or avoidance. For any air quality impacts that cannot be mitigated, a full air quality analysis would be required. The emissions from sources associated with any alternative would be controlled to meet current applicable regulatory requirements.

Alternative C — Flagship Management Alternative
Alternative C would also have no negative effects on air quality. Any air emissions identified from proposed development associated with this alternative as well as mitigation of air emissions sources would be the same as described under Alternative B.

Alternative D — Blended Management Alternative
Alternative D would also have no negative effects on air quality. Any air emissions identified from proposed development associated with this alternative as well as mitigation of air emissions sources would be the same as described under Alternatives B and C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to air quality under the four alternatives are shown in Figure 5-20. The impact bars shown in Figure 5-20 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-20. Relative Beneficial Impacts of the Alternatives on Air Quality

5.17. Climate

In order to understand future climate scenarios in the TVA region better, TVA contracted with the Electric Power Research Institute (EPRI) to prepare a report on the impacts of global climate change on various resources throughout the Valley, including water resources, agriculture, forestlands, ecological resources, air quality, and recreation, which could be reasonably anticipated to occur over the 21st century (EPRI 2009). Emphasis was placed on the near future (through 2050), as high uncertainty exists for longer-range predictions. The basis for this report is the *United Nations Intergovernmental Panel on Climate Change's Fourth Assessment Report*, published in 2007. The report assumes a medium GHG emissions projection, which does not reflect additional efforts to reduce GHG emissions. In addition to this report, TVA received and reviewed comments (Christy 2009) on the 2009 EPRI report, which forecasts temperatures to increase as much as +0.8°C

between 1990 and 2020 and +4°C by the end of the 21st century in the TVA region. Christy presented two arguments regarding these estimates. First, based on historical climate records, a change of +0.8°C in 30 years is within the natural climate variations of the region. Second, the +4°C estimate is an "up to" result that is the least likely to occur. Precipitation forecasts are more uncertain and vary depending on location in the Valley and time of year. According to the EPRI (2009) report, precipitation is forecast to increase in the winter across the Valley as a whole, while in the western portion of the Valley, summers may be drier, and in the eastern portion of the Valley, summers may remain unchanged.

No impacts on climate are anticipated as a result of the adoption of the No Action or any Action Alternative. It is possible that under current management, climate change itself could impact natural resources that TVA manages (Appendix M). The adoption of any alternative may provide some indication of change over time and serve as a basis for options that mitigate detrimental impacts of climate change and positively manage the beneficial impacts. Current and proposed NRP programs enact conservation and enhancement, which serve to restore lands and water quality thus enhancing carbon storage.

Relative Beneficial Impacts of the Alternatives

The relative beneficial impacts to climate under the four alternatives are shown in Figure 5-21. The impact bars shown in Figure 5-21 are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Figure 5-21. Relative Beneficial Impacts of the Alternatives on Climate

5.18. Unavoidable Adverse Effects

Continuing regional development trends, such as residential development on non-TVA lands, would likely continue to result in degradation of aquatic and terrestrial habitat regardless of the alternative selected. Because the NRP has been designed to improve the management of natural resources located on TVA-managed lands, few, if any, unavoidable potential environmental effects would result under any of the four alternatives. Furthermore, implementation of any of the four alternatives is not expected to result in significant adverse cumulative effects to any resources.

5.19. Relationship of Short-Term Uses and Long-Term Productivity

NEPA requires consideration of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR §1502.16). For the NRP, short-term uses generally are those that occur within the project's span of 20 years, and long-term refers to later decades. Productivity is the capability of the land to provide market and amenity outputs and values for future generations. The capability of the land to maintain productivity is one factor that influences the quality of life for future generations.

Generally, the NRP would result in very few actions that adversely affect long-term productivity. As described in this document, TVA manages public lands for multiple uses,

including recreation, natural resources, and protection of sensitive resources, for the goal of protecting these values for the public.

5.20. Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources generally occur through the use of nonrenewable resources that have few or no alternative uses at the termination of the proposed action. Irretrievable commitments of resources result in the lost production or elimination of renewable resources such as timber, agricultural land, or wildlife habitat.

The construction of recreational facilities/structures, project operations, and industrial uses on TVA-managed lands allocated during the reservoir lands planning processes would involve irreversible commitment of fuel, energy, and building material resources. Use of these resources would occur under all four alternatives, but have the greatest potential under Alternatives C and D. Under these alternatives, the ranges in land use zone allocations provided for in the CVLP facilitate the potential construction mentioned above by allocating more TVA-managed lands to Developed Recreation than Alternatives A and B.

As shoreline is converted to residential, commercial, industrial, and some types of recreational use, the land is essentially permanently changed and is no longer available for agriculture, forestry, wildlife habitat, natural areas, or certain dispersed recreational activities for the foreseeable future. This is an irretrievable commitment of land that would occur under all alternatives. Over the long term, this type of irretrievable commitment would be greatest under Alternatives C and D due to the target ranges provided for in the CVLP described above. .

5.21. Energy Resources and Conservation Potential

Developing and implementing the NRP does not involve substantive use of energy resources, but there could be a small use of energy resources. Energy is used to fuel machines needed to maintain wildlife habitat areas, fields around recreation facilities, installation of shoreline stabilization, prevention of NNIPs and other activities described in Chapter 2. Implementation of Alternatives C and D would result in a slightly greater requirement for this type of energy use because of the target ranges provided for in the CVLP. These ranges facilitate the potential use of energy sources by allocating more TVA-managed lands to Developed Recreation and Natural Resource Management than Alternatives A and B.

Energy may be consumed by campers, boaters, and other recreation users. TVA is encouraging campers who utilize developed recreation areas to reduce energy consumption and to conserve water resources. Under certain NRP programs, TVA would encourage energy conservation measures to be utilized at recreation areas that may be developed in the future. These practices could potentially reduce energy usage under all alternatives.

Finally, because each alternative contains TVA-managed lands allocated for Industrial use, potential energy use associated with industrial activities would occur under each alternative. TVA actively promotes public education and outreach to encourage energy efficiency and green-energy offerings and promotes the integration of energy efficiency and water conservation into community planning and building construction. TVA would work with potential users of TVA-managed lands to achieve energy savings and to implement conservation practices.

5.22. Summary of TVA Commitments and Proposed Mitigation Measures

Mitigation measures are actions that could be taken to avoid, minimize, rectify, offset, reduce, or compensate for adverse impacts to the environment. The following mitigation measure would be entered into TVA's electronic database and tracking system used to record NEPA reviews. This database tracks commitments and mitigation measures identified in EAs and EISs.

Under any of the alternatives, TVA would comply with all applicable federal, state, and local regulations. Likewise, prior to approving any proposal to use TVA land, TVA would conduct an appropriate level of site-specific environmental review to determine the potential environmental effects of the proposed use. In addition to the use of construction-related BMPs, the following nonroutine measure would reduce the potential for adverse environmental effects.

- TVA is consulting with the Valley SHPOs and federally recognized Indian tribes on a PA for the identification, evaluation, and treatment of all cultural resources adversely affected by future proposed uses of TVA-managed lands subject to the NRP. All activities would be conducted in accordance with the stipulations defined in this PA.

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CHAPTER 6

6.0 LIST OF PREPARERS

6.1. TVA NEPA Project Management

Heather L. Montgomery

Position:	NEPA Specialist
Education:	B.S., Environmental Biology
Experience:	10 years in Planning and Managing Land and Environmental Impact Assessment
Involvement:	Lead NEPA Compliance and Document Preparation

Charles P. Nicholson

Position:	NEPA Compliance Manager, Knoxville, Tennessee
Education:	Ph.D., Ecology and Evolutionary Biology; M.S., Wildlife Management; B.S., Wildlife and Fisheries Science
Experience:	32 years in Zoology, Endangered Species Studies, and NEPA Compliance
Involvement:	NEPA Compliance

6.2. ScottMadden Inc. Project Management

Michael Anckner

Position:	Contract Project Manager
Education:	B.B.A, International Business; M.B.A., Corporate Finance
Experience:	5 years as a Management Consultant in the Electric Utility Industry; 3 years in the Aerospace Industry
Involvement:	Project Management

Randy McAdams

Position:	Lead Contract Project Manager
Education:	B.S., Management Science; M.B.A.
Experience:	28 years as a Management Consultant including 23 years in the electric utility industry with consulting to over 50 utilities
Involvement:	Project Management

6.3. Other TVA Contributors

John (Bo) T. Baxter

Position:	Specialist, Aquatic Endangered Species Act Permitting and Compliance
Education:	M.S. and B.S., Zoology
Experience:	21 years in Protected Aquatic Species Monitoring, Habitat Assessment, and Recovery; 13 years in Environmental Review
Involvement:	Aquatic Ecology/Threatened and Endangered Species

Chellye L. Campbell

Position:	Project Manager
Education:	B.S., Biology
Experience:	10 years in Planning and Managing Land
Involvement:	Reservoir Lands Planning

Stephen C. Cole

Position:	Contract Archaeologist
Education:	Ph.D., Anthropology
Experience:	9 years in Cultural Resource Management, 4 years Teaching Anthropology
Involvement:	Cultural Resources

Patricia B. Cox

Position:	Botanist, Specialist
Education:	Ph.D., Botany (Plant Taxonomy and Anatomy); M.S. and B.S., Biology
Experience:	31 years in Plant Taxonomy at the Academic Level; 7 years in Environmental Assessment and NEPA Compliance
Involvement:	Terrestrial Ecology, Invasive Plant Species, and Threatened and Endangered Species

Evan R. Crews

Position:	Senior Manager, Central and Western Regional Watersheds
Education:	M.S., Environmental Science; B.S., Environmental Science and Geology
Experience:	10 years in Natural Resource Management and Lands Planning
Involvement:	Reservoir Lands Planning

James H. Eblen

Position:	Contract Economist
Education:	Ph.D., Economics; B.S., Business Administration
Experience:	44 years in Economic Analysis and Research
Involvement:	Socioeconomics and Environmental Justice

Frank B. “Bucky” Edmondson

Position:	Senior Adviser, Land and Shoreline Management
Education:	B.S., Biology
Experience:	30 years in Land Natural Resource Management and Lands Planning
Involvement:	Reservoir Lands Planning

Patricia Bernard Ezzell

Position:	Native American Liaison and Historian
Education:	M.A., History with an emphasis in Historic Preservation; B.A., Honors History
Experience:	24 years in History, Historic Preservation, and Cultural Resource Management; 8 years in tribal relations
Involvement:	Cultural Resources

L. Suzanne Fisher

Position:	Environmental Scientist
Education:	M.S., Environmental Health; B.S., Ecology and Evolutionary Biology
Experience:	11 years in Assessments of Environmental Health and Ecological Trends
Involvement:	Climate Change

Tiffany L. Foster

Position:	Water Resource Specialist
Education:	M.S., Soil Science; B.S., Biology
Experience:	8 years in Watershed Management
Involvement:	Water Resource Management

Jerry G. Fouse

Position:	Recreation Manager
Education:	M.B.A.; B.S., Forestry and Wildlife
Experience:	35 years in Natural Resources – Recreation Planning and Economic Development
Involvement:	Recreation

S. Clay Guerry

Position:	Recreation Representative
Education:	M.S., Zoology, Masters of Parks, Recreation, and Tourism Management; B.S., Biology
Experience:	11 years in Biology and Resource Management; 5 years in Recreation Planning
Involvement:	Dispersed Recreation Management

Ella Christina Guinn

Position:	Project Control Specialist
Education:	M.S. and B.A., Geography
Experience:	15 years in Land Use Analysis; 9 years in Environmental Services
Involvement:	Technical Staff Coordinator

James R. Hagerman, P.E.

Position:	Environmental Engineer
Education:	M.S. and B.S., Agricultural Engineering
Experience:	21 years in Nonpoint Source Pollution and Water Quality
Involvement:	Surface Water Resources, Erosion, and Sedimentation; Water Resource Management

Patricia A. Hamlett

Position:	Senior Photo Interpretation Analyst
Education:	B.S. and M.A., Geography
Experience:	18 years in remote sensing and GIS technologies
Involvement:	Land Use and Geographic Information System Maps

Kelie H. Hammond, P.E.

Position:	Program Manager, Navigation
Education:	M.S., Environmental Engineering, Specializing in Water Resources; B.S., Civil Engineering
Experience:	10 years in Navigation
Involvement:	Navigation

David A. Hankins

Position:	Geographic Analyst
Education:	B.S., Fish and Wildlife Management
Experience:	30 years in Geographic Information and Engineering
Involvement:	Geographic Information System Maps

Barry D. Hart

Position:	Watershed Representative
Education:	B.S., Biology and Music; M.S., Ecology and Evolutionary Biology
Experience:	20 years in Terrestrial and Aquatic Ecosystem Monitoring and Management
Involvement:	Biological and Cultural Resources Management

Heather M. Hart

Position:	Contract Natural Areas Biologist
Education:	M.S., Environmental Science and Soils; B.S., Plant and Soil Science
Experience:	8 years in Surface Water Quality and Soil and Groundwater Investigations; 6 years in Environmental Reviews
Involvement:	Managed Areas

Amy Burke Henry

Position:	Project Manager, NEPA Contracts
Education:	M.S., Zoology and Wildlife; B.S., Biology
Experience:	14 years in Biological Surveys, Natural Resources Management Planning, and Environmental Reviews
Involvement:	Cumulative Impacts

Travis Hill Henry

Position:	Terrestrial Zoologist Specialist
Education:	M.S., Zoology; B.S., Wildlife Biology
Experience:	22 years in Zoology and Endangered Species; 15 years in NEPA Compliance
Involvement:	Terrestrial Ecology, Threatened and Endangered Species

John M. Higgins, P.E.

Position:	Water Quality Specialist
Education:	Ph.D., Environmental Engineering; B.S. and M.S., Civil Engineering
Experience:	40 years in Environmental Engineering and Water Resources Management
Involvement:	Surface Water and Wastewater

Mary E. Jacobs

Position:	Atmospheric Analyst
Education:	B.S., Mathematics
Experience:	20 years in Air Quality Analysis
Involvement:	Air Resources

Wesley K. James

Position:	Wildlife Biologist
Education:	B.S., Wildlife and Fisheries Science
Experience:	34 years in Terrestrial and Wildlife Management and Environmental Impacts Evaluation
Involvement:	Biological and Cultural Resources Management

Gary D. Jenkins

Position:	Biologist
Education:	B.S., Wildlife and Fisheries Science
Experience:	33 years in Aquatic and Terrestrial Habitat Assessments and Management
Involvement:	Biological and Cultural Resources Management

Clinton E. Jones

Position:	Senior Aquatic Community Ecologist
Education:	B.S., Wildlife and Fisheries Science
Experience:	18 years in Environmental Consultation and Fisheries Management
Involvement:	Aquatic Ecology and Aquatic Threatened and Endangered Species

Holly G. Le Grand

Position:	Biologist/Zoologist
Education:	M.S., Wildlife; B.S., Biology
Experience:	7 years in Biological Surveys, Natural Resource Management, and Environmental Reviews
Involvement:	Terrestrial Ecology and Threatened and Endangered Species

P. Alan Mays

Position:	Environmental Scientist
Education:	B.S., Plant and Soil Science
Experience:	33 years in Soil-Plant-Atmospheric Studies
Involvement:	Prime Farmland

Mark McCreedy

Position:	Forester
Education:	B.S., Forestry
Experience:	37 years in Forest, Land, and Natural Resource Management
Involvement:	Biological and Cultural Resources Management

Mark S. McNeely

Position:	Program Administrator
Education:	M.S., Education; B.S., Biological Sciences
Experience:	17 years in Resource Stewardship; 6 years in Environmental Education
Involvement:	Document Layout and Publishing Coordinator

Roger A. Milstead, P.E.

Position:	Program Manager, Flood Risk
Education:	B.S., Civil Engineering
Experience:	34 years in Floodplain and Environmental Evaluations
Involvement:	Floodplains

Aurora D. Moldovanyi

Position:	Recreation Specialist
Education:	M.S., Nature-Based Recreation and Park Planning; B.S., Wildlife and Fisheries Biology and Management
Experience:	5 years with TVA Recreation Program; 11 years in Natural Resource Recreation Management and Environmental Planning; 5 years in Environmental Review
Involvement:	Recreation Management

Mark Odom

Position:	Watershed Representative
Education:	M.S., Biology; B.S., Agriculture/Animal Science
Experience:	16 years in Watershed and Aquatic Ecosystems Management
Involvement:	Water Resource Management

Danny E. Olinger

Position:	Contract Archaeologist
Education:	M.A., Anthropology
Experience:	34 years in Archaeology and Cultural Resource Management
Involvement:	Cultural Resources

T. Shannon O'Quinn

Position:	Watershed Improvement Process Specialist
Education:	M.S., Geosciences; B.S., Environmental Studies
Experience:	10 years in Watershed Management
Involvement:	Water Resource Management

W. Chett Peebles, RLA; ASLA

Position:	Specialist, Landscape Architect
Education:	Bachelor of Landscape Architecture
Experience:	22 years in Site Planning, Design, and Scenic Resource Management; 5 years in Architectural History and Historic Preservation
Involvement:	Visual Resources and Historic Architectural Resources

Kim Pilarski

Position:	Senior Wetlands Biologist
Education:	M.S., Geography, Minor Ecology
Experience:	15 years in Wetlands Assessment and Delineation
Involvement:	Wetlands

Erin E. Pritchard

Position:	Archaeological Specialist
Education:	M.A., Anthropology
Experience:	13 years in Archaeology and Cultural Resource Management
Involvement:	Cultural Resources and Biological and Cultural Resources Management

Laura D. Smith

Position:	Client Services, Communications
Education:	B.A.
Experience:	Production and Project Management, Advisory
Involvement:	Project Team and Communications Liaison

Dana M. Vaughn

Position:	Watershed Representative
Education:	B.A., Biology
Experience:	3 years in Land and Shoreline Management
Involvement:	Reservoir Lands Planning

Donald C. Wade

Position:	Contract Water Regulatory Specialist
Education:	M.S. and B.S., Biology
Experience:	38 years in Aquatic Biology, Aquatic Toxicology, Water Permitting, and Water Regulatory Issues
Involvement:	Water Resource Management and Water Quality

6.4. Cardno ENTRIX Economics

John Cary

Position:	Contract Natural Resource Economist
Education:	M.A., Applied Economics
Involvement:	Natural Resource Economics

Rush Childs

Position:	Contract Natural Resource Economist
Education:	M.E.M., Environmental Economics and Policy
Involvement:	Natural Resource Economics

Doug McNair

Position:	Contract Natural Resource Economist
Education:	Ph.D., Economics
Involvement:	Natural Resource Economics

Barbara Wyse

Position:	Contract Natural Resource Economist
Education:	M.S., Environmental and Resource Economics
Involvement:	Natural Resource Economics

CHAPTER 7

7.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES ARE SENT

Federal Agencies

Chattahoochee-Oconee National Forests
Federal Highway Administration — North Carolina Division
George Washington and Jefferson National Forests
Great Smoky Mountains National Park
Mammoth Cave National Park
National Center for Environmental Health Centers for Disease Control and Prevention
National Forests in North Carolina
National Park Service — Appalachian National Scenic Trail
U.S. Environmental Protection Agency, Region IV
U.S. Army Corps of Engineers — Abingdon, Virginia; Asheville, North Carolina; Christiansburg, Virginia; Nashville, Tennessee; Norfolk, Virginia; Savannah, Georgia; Wytheville, Virginia
U.S. Department of Agriculture Natural Resource Conservation Service — Atlanta, Georgia; Auburn, Alabama; Jackson, Mississippi; Memphis, Tennessee; Nashville, Tennessee; Raleigh, North Carolina; Richmond, Virginia; Washington, D.C.
U.S. Fish and Wildlife Service — Abingdon, Virginia; Asheville, North Carolina; Athens, Georgia; Cookeville, Tennessee; Daphne, Alabama; Decatur, Alabama; Frankfort, Kentucky; Gloucester, Virginia

State Agencies

Alabama Department of Agriculture and Industries
Alabama Department of Conservation and Natural Resources — Boating Law Administrator; State Parks Division
Alabama Department of Economic and Community Affairs
Alabama Department of Environmental Management
Alabama Department of Transportation
Alabama Forestry Commission
Alabama Historical Commission
Alabama Tourism Department
Georgia Department of Economic Development
Georgia Department of Natural Resources — Fisheries Section; Historic Preservation Division; Northeast Region 2; State Parks and Historic Sites Division; Wildlife Resources Division, Northwest Region I
Georgia State Clearinghouse
Kentucky Department of Parks
Kentucky Energy and Environment Cabinet — Department of Environmental Protection
Kentucky Heritage Council
Kentucky Natural Resource Conservation Service
Kentucky Tourism — Arts and Heritage Cabinet
Mississippi Department of Archives and History
Mississippi Department of Environmental Quality

Mississippi Department of Finance and Administration
Mississippi Department of Wildlife, Fisheries, and Parks
Mississippi Development Authority — Division of Tourism Development
North Carolina Department of Commerce
North Carolina Division of Archives and History
North Carolina Division of Parks and Recreation — Basinwide Unit, Planning Section
North Carolina Division of Water Quality — Asheville Regional Office; Basinwide Planner for the French Broad Basin
North Carolina State Environmental Review Clearinghouse
North Carolina Wildlife Resource Commission — Aquatic Wildlife Diversity, Western Region
Tennessee Department of Agriculture
Tennessee Department of Economic and Community Development
Tennessee Department of Environment and Conservation — Division of Air Pollution Control; Division of Archaeology; Division of Water Pollution Control; Division of Recreation Educational Services; Division of Natural Heritage; Historical Commission; Parks and Conservation Operations
Tennessee Department of Transportation — Environmental Planning and Permits Division
Tennessee Department of Tourism Development
Tennessee Wildlife Resources Agency — Environmental Services Division
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality — Division of Environmental Enhancement
Virginia Department of Game and Inland Fisheries
Virginia Department of Historic Resources
Virginia Department of Transportation

Regional and Local Agencies and Private Organizations

Alabama Elk River Development Agency
Bear Creek Development Authority
Beech River Watershed Development Authority
Blue Ridge Parkway
East Tennessee Development District
Environmental Integrity Project
First Tennessee Development District
The Friends of Norris Lake
Greater Nashville Regional Council
Memphis Area Association of Governments
Mount Rogers Planning District Commission
North Central Alabama Regional Council of Governments
Northeast Mississippi Planning and Development District
Northwest Alabama Council of Local Governments
Northwest Tennessee Development District
South Central Tennessee Development District
Southeast Tennessee Development District
Southwest Tennessee Development District
Solar Valley Coalition
Tellico Reservoir Development Agency
Tennessee Duck River Development Agency

Tombigbee River Valley Water Management District
Top of Alabama Regional Council of Governments
Upper Cumberland Development District
Virginia Tourism Corporation

Individuals

Wendy Askins
Cookeville, Tennessee

Ben Bean
Arab, Alabama

William Bennett
Dandridge, Tennessee

Bill Black
Dandridge, Tennessee

Ralph Chambers
Hixson, Tennessee

Layton W. Davis
Jackson, Mississippi

David Dunlap
Cumberland, Tennessee

Timothy Gilbert
Guntersville, Alabama

Louise Gorenflo
Crossville, Tennessee

Sandra K. Goss
Knoxville, Tennessee

Gloria Griffith
Mountain City, Tennessee

Russ Harrison
Bluff City, Tennessee

Josh Hammond
Memphis, Tennessee

Paul Hargrove
Athens, Alabama

Mary Ben Heflin
Memphis, Tennessee

Martina Hines
Frankfort, Kentucky

Earl Hodges
Langston, Alabama

M. H. Huie
Memphis, Tennessee

Jim Hutchins
Dandridge, Tennessee

Richard and Andrea Jameson
Holly Springs, Mississippi

Tommy Johnson
Florence, Alabama

Cindy Kendrick
Knoxville, Tennessee

Judy Kennamer
Guntersville, Alabama

Todd Kesterson
Dandridge, Tennessee

Jeff and Heather King
Lithia, Florida

Sara Kuebbing
Knoxville, Tennessee

Jared LaDuke
Cleveland, Tennessee

Robert Lewis
Dayton, Tennessee

John Lichterman
Memphis, Tennessee

Ruth Maddigan
Knoxville, Tennessee

Vincent and Marsha Marascuilo
Cordova, Tennessee

Clyde Martin
Athens, Alabama

Jerry McArtor
Benton, Kentucky

Allen Miller
Hixson, Tennessee

Marc Miller
Atlanta, Georgia

Jake Mitchell
Collegedale, Tennessee

Ryan O'Keefe
Dayton, Tennessee

Martin Pleasant
Knoxville, Tennessee

David Poehler
Dandridge, Tennessee

Sarah Ramberg
Greenville, South Carolina

Michael and Melissa Reddock
Memphis, Tennessee

Howard Ricks
Soddy Daisy, Tennessee

Grace Robertson
Memphis, Tennessee

Sue Robertson
Chickamauga, Georgia

Allen Stokes
Clinton, Tennessee

Freda P. Taylor
Guntersville, Alabama

Liz Upchurch
Knoxville, Tennessee

John Wells
Burnsville, Mississippi

CHAPTER 8

8.0 LITERATURE CITED

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Appendix A – Maps

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Appendix B – TVA's Recreation Chronology

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TVA'S RECREATION CHRONOLOGY

1934-37
Demonstration parks and a boat dock built in cooperation with National Park Service and Civilian Conservation Corps.

1937
First lease of reservoir land to a public agency for recreation development: State of Tennessee, Cove Lake State Park.

1938
Publication of *The Scenic Resources of the Tennessee Valley*, a descriptive and pictorial inventory. Focused attention on the wealth of scenic resources in the Tennessee Valley and the need to conserve and develop them.

1940
Pickwick Village licensed to the Pickwick Company, first of six former TVA construction villages to be converted to public or commercial recreation use.

Recreation Development of the Tennessee River System Report transmitted by President Roosevelt to Congress (H. Doc. 565, 76th Congress).

1942-43
Memorandums of agreement with conservation departments of Alabama, Kentucky, North Carolina, and Tennessee recording common objectives in field of recreation and cooperation in achieving them in the public interest.

1945
First transfer of reservoir land to a state for public recreation development: State of Tennessee, Paris Landing State Park.

1961
Began publication of recreation maps for individual TVA reservoirs.

1966
Recreation was recognized for the first time as a significant benefit (56 percent) in the economic justification of a TVA project: Tims Ford.

1967
Recreation Resources Program established by TVA.

1972
Apalachia powerhouse operated on special experimental schedule during summer to provide streamflows to benefit trout fishing and canoeing or floating on Hiwassee River.

1973
TVA Board of Directors approved policy for the identification and protection of areas of natural, scenic, and cultural significance.

TVA entered into an agreement with the State of Tennessee and three counties to develop the recreation resources of a 1,000-square-mile area in the Cumberland Plateau of southeast Tennessee on land owned by federal, state, and local agencies.

Program of trail development on TVA-owned land initiated. New trails will be tied in with existing state and national ones where feasible.

Began publication of navigation-recreation maps for TVA tributary reservoirs.

1973
First community recreation appraisal completed, offering assistance to municipal/county recreation departments and public agencies in developing comprehensive recreation programs.

1974
Eighteen sites on TVA-managed land identified as SWAs to be preserved in natural state.

1975
A scenic riverway program developed as part of the Tennessee Valley Outdoor Recreation Plan.

1977
Conducted first community recreation demonstration.

1978
Community recreation was approved as a major component of TVA's socioeconomic mitigation program in areas affected by major TVA construction projects.

1979
TVA began providing organized summer recreation programs at selected reservoir recreation areas to serve special population day-camping groups, day users, and weekend users.

1981
TVA and the Tennessee Special Olympics Inc. cosponsored a Special Olympics outdoor recreation camp at Nickajack Dam Reservation. This was the first nonmilitary federal sponsorship of a sanctioned Special Olympics event.

Cooperative maintenance arrangements with local and private agencies sought to help maintain TVA recreation areas.

1982
A license agreement was developed for commercial river outfitters to operate on TVA-owned river access areas.

The Nature Conservancy, with financial assistance from TVA, established the Powell River Preserve in Claiborne County, Tennessee, to protect the only known population of the showy lady slipper orchid in the State of Tennessee or Tennessee Valley.

1983
TVA produced two Valleywide brochures showing available opportunities on TVA trails and scenic/recreational river resources.

Four TVA trails were designated as National Recreation Trails by the U.S. Department of the Interior bringing the total to nine trails with such designations.

TVA's emphasis on cooperative efforts to protect dispersed recreational and natural areas was exemplified through contracts with local, state, and federal agencies and private organizations. The agency entered into 11 agreements for stream access maintenance encompassing 35 sites; nine agreements for data exchange, management, protection, and/or identification of natural areas; and three maintenance agreements encompassing 17 trails.

1984
Fifteen local parks were developed on TVA-managed lands with financial assistance through the Jobs Bill Program.

TVA published *The Tennessee Valley Outdoor Recreation Plan, Volume VII: Natural Areas,* which describes natural area identification and evaluation process, management, and site descriptions.

1985
TVA initiated public-private partnerships to provide commercial concession agreements to operate TVA developed campgrounds and day use areas, bringing the total number of areas operated under cooperative agreements to 12.

1989-90
Recession led to realignment of TVA's Recreation Program and resulted in reduced staff for inventory and data collection. Reimbursement was initiated for certain technical assistance activities.

1994-96
TVA-managed land on the Ocoee River was used for Olympic Whitewater Center with initial events in 1996.

1996-98
Thirty-three TVA-developed campgrounds and day use areas were licensed and leased for concession operations, maintenance, and expansion (12 with public agencies and 21 with the private sector).

2002
TVA initiated the *Reservoir Operations Study* with a recreational component to determine increases or decreases in recreation values derived under certain operating conditions retaining various reservoir water levels.

TVA initiated inventory of reservoir recreation facilities.

2005
TVA developed a new *Recreation Strategy, Implementation Process and Guidelines* as a guide to TVA's future efforts in recreation. The plan was revised to incorporate advice from the Regional Resource Stewardship Council.

Initiated assessment of TVA's developed and dispersed recreation areas. Developed recreation site plans were updated to accommodate revisions of national standards for accessibility. "Limits of acceptable change" methodology was used to manage "high use" dispersed recreation areas.

2006
Ten-year workplan was completed for recreation demand analysis, participation rates, needs review, areas assessments, compliance inspections, inventory updates, and information sharing.

2007
Reservoir Recreation Inventory Matrix first published on external Web site for public use.

Appendix C – Summary of Public Participation

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SUMMARY OF PUBLIC PARTICIPATION

Part I – Integrated Resource Plan Questionnaire: Questions 2, 4, and 11

During the IRP scoping period, TVA solicited input from the public in the form of a questionnaire, in which three questions pertained to stewardship activities. All comments received during the IRP public comment period pertaining to stewardship have been included in the NRP project scoping. The responses have been organized by issue categories and quantified in the figures and tables below.

Question 2 asked the public to rank the public benefits (environmental protection, providing recreation, electricity production, economic development, research and technology development, protection of archaeological and historic sites, and management of natural resources) provided by TVA in terms of their importance to the responder on a scale of 1 (least important) to 5 (most important). Electricity production, environmental protection, and natural resource management were chosen as the most important by the commenters (Figure C-1). The public could also write in responses, and 13 write-in comments were received for Question 2 (Figure C-2).

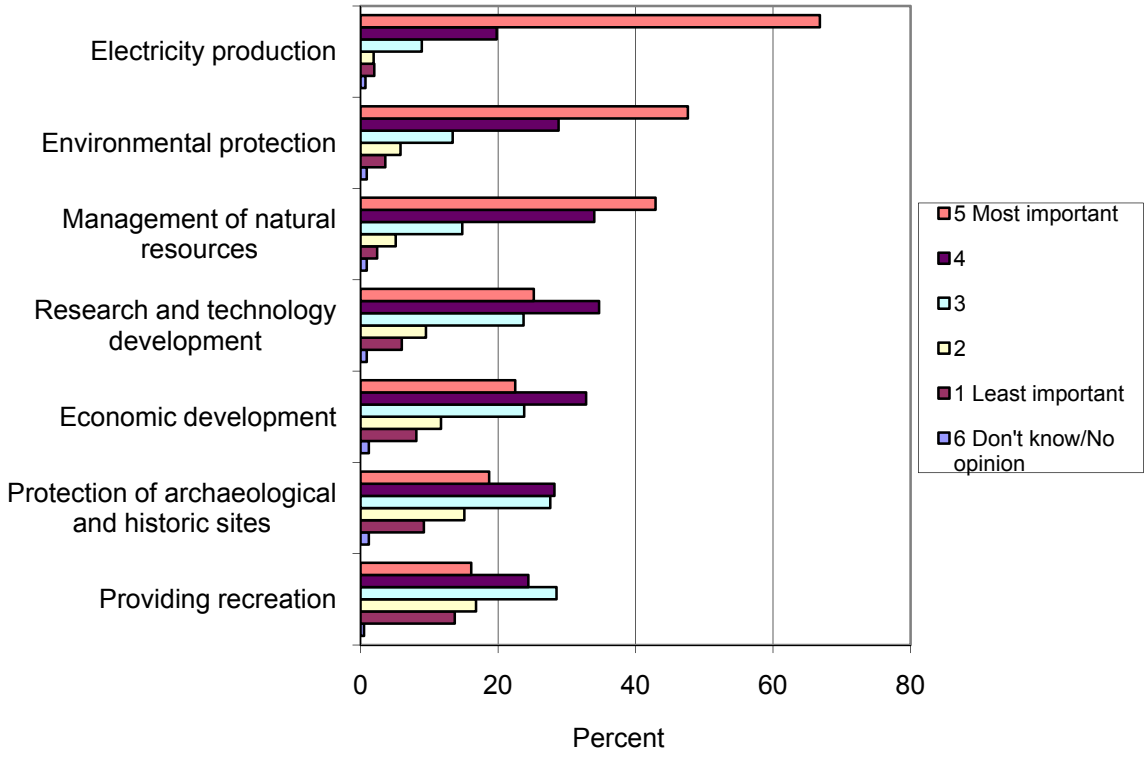

Figure C-1. Integrated Resource Plan Question 2 — Ranking of Public Benefits Provided by TVA

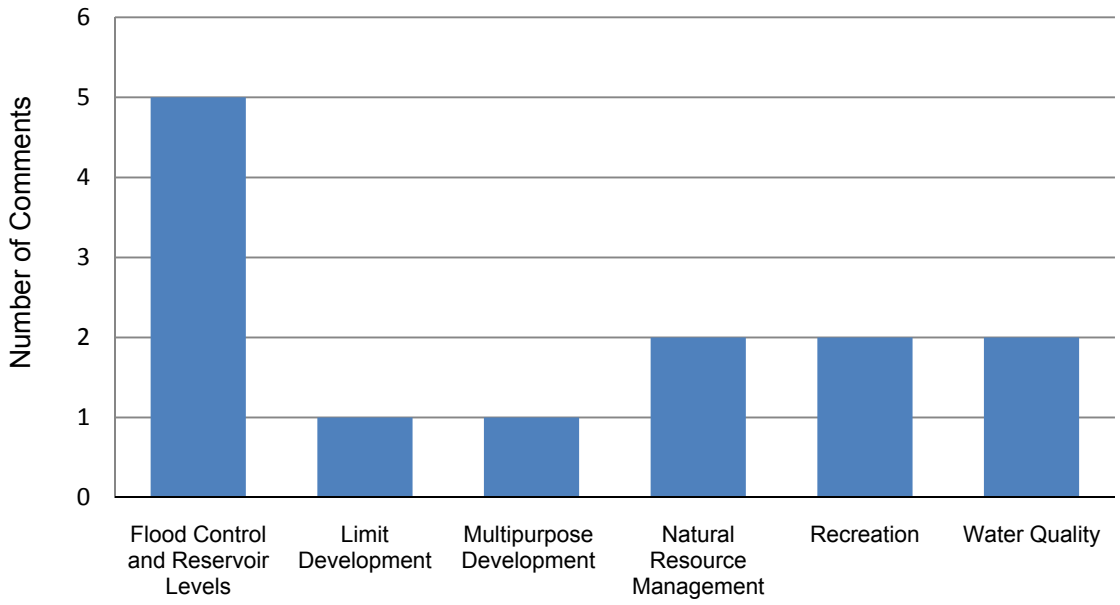

Figure C-2. Overview of Write-In Answers for Integrated Resource Plan Question 2 Organized by Issue Categories

Question 4 asked the public to rank the importance of the following activities: informal recreation, developed recreation, habitat management, and cultural resource management. Habitat management was chosen as the most important by the commenters (Figure B-3). The public could also write in responses, and 39 write-in comments were received for Question 4 (Figure C-4).

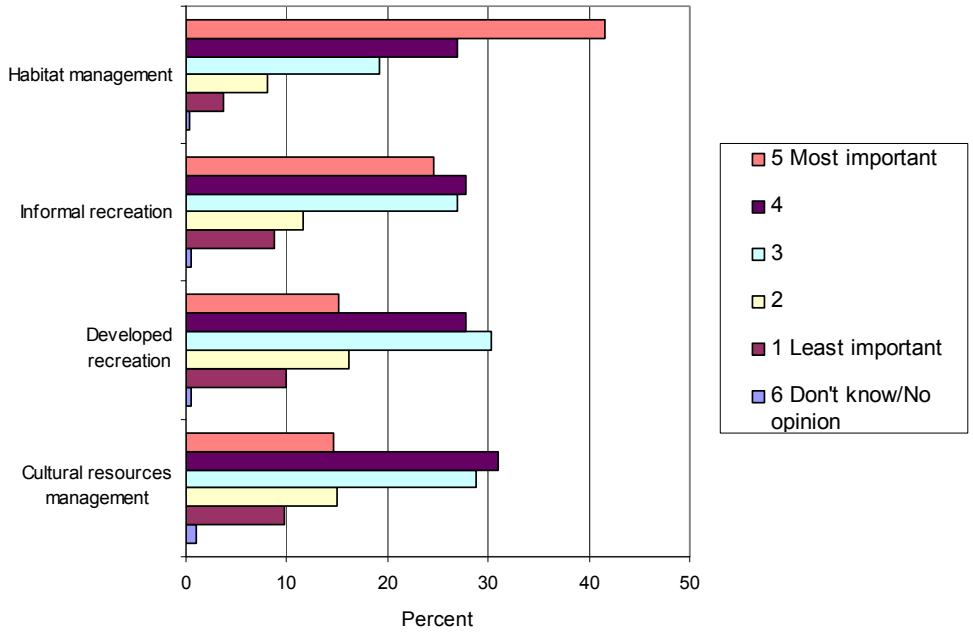

Figure C-3. Integrated Resource Plan Question 4 — Ranking of Natural Resource Management Activities

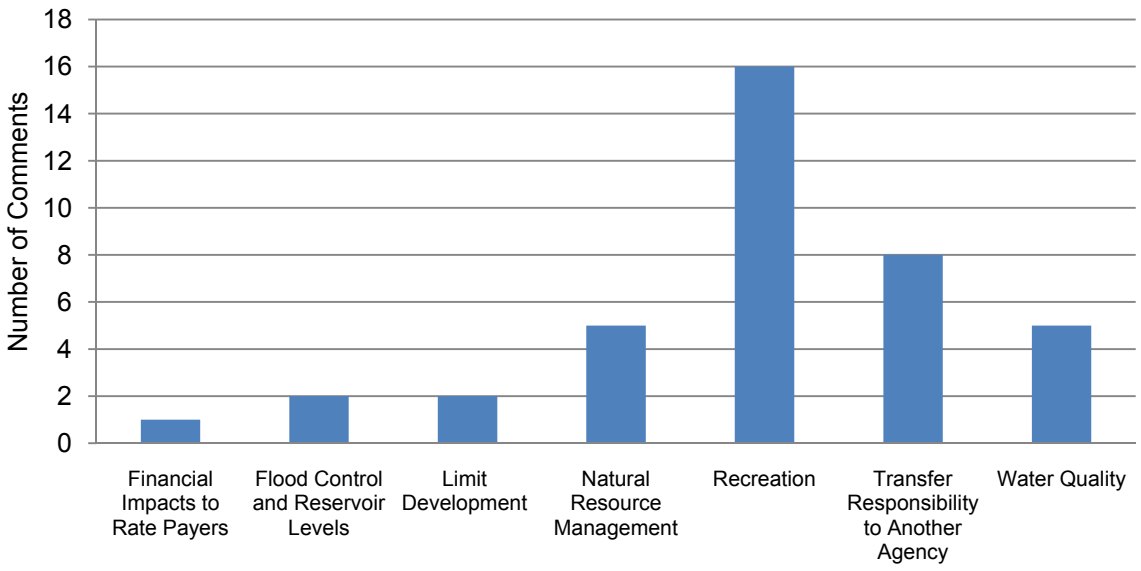

Figure C-4. Overview of Write-In Answers for Integrated Resource Plan Question 4 Organized by Issue Categories

Question 11 was a write-in question that asked the public "What do you value most about TVA-managed lands and reservoirs?" Of the 542 responses, the four most frequently mentioned concerns were recreation, multipurpose development, natural resource management, and limiting development (Table C-1).

Table C-1. Overview of Write-In Answers for Integrated Resource Plan Question 11 Organized by Issue Categories

Issue Category	Number of Comments
Accessibility of Public Lands	16
Fiscal Impacts	23
Flood Control and Reservoir Levels	20
Land Policy	1
Limiting Development	41
Multipurpose Development	95
Natural Resource and Wildlife Management	75
No Opinion of the use of TVA-managed lands	31
Recreation	199
Quality of Life	5
Visual Resources	22
Water Quality	14
Total comments received for Question 11	**542**

Part II – Integrated Resource Plan: Additional Comments from Agencies and Stakeholder Groups

Table C-2. Integrated Resource Plan – Additional Comments Submitted by Agencies and Stakeholder Groups and Organized by Issue Categories

Issue Category	Comment
Natural Resource Management	
Forestry Management	We respect the roles and responsibilities of the Tennessee Valley Authority to safely and efficiently provide the needed energy, recreation, water, and jobs to the citizens and businesses of our state. The added responsibility of TVA being a landowner places your agency squarely in public view to demonstrate sound land management practices. Although TVA has divested itself of a large majority of the forested properties it once held, TVA continues to own and control a sizeable acreage of land. We believe these forests can and should supply a similar suite of benefits and services that the privately owned lands in Tennessee now provide. These include timber, recreation, wildlife, hunting, clean water, and aesthetics.
	Forested areas should be managed to maximize the potential for carbon sequestration. TVA should consider the role that forests can play in carbon sequestration and carbon markets. Renewable energy production should be pursued if it is economical and environmentally sound to do so. Wood and fiber sources can certainly play a role in the production of renewable energy.
	Educate the general public and stakeholders, regarding sustainable logging practices, and implement sustainable logging practices on TVA lands to prevent tree over-harvest and associated greenhouse gas emissions and to reduce threats to listed species.
Habitat Management	Enhance and increase habitat to boost production of rapidly diminishing native pollinators by establishing a diversity of native flowering plants across the spring, summer, and fall seasons within TVA rights-of-way areas and resource lands. Pollinator habitat increases will also provide additional habitat for wildlife and birds and assist in offsetting carbon dioxide emissions.
Management of Listed Species	Management plans for ecological resources, particularly aquatic and terrestrial wildlife should be designed to monitor the status of populations and to determine the impacts of TVA operations including the effects of waste generation and water quality and quantity on these populations. Priority should be given to species that are federally listed as threatened and endangered.
Native Plants	Manage new and existing TVA resource lands and rights-of-way for recovery and protection of native vegetation with special emphasis placed upon threatened and endangered plant species.
Recreation	
Nonmotorized Recreation	TVA should consider the public value of natural resources for more than energy production, in a manner that offers high levels of protection and restoration of natural ecosystems and the public recreation that such ecosystems support. Encouraging citizens and children in particular to engage in nonmotorized outdoor recreation is a major priority for all public land management agencies.
Recreation-Water Based	Recreational resources are important for the citizens of the Valley; TVA fortunately has many of these assets. They should continue to be an important part of the mission going forward. Continued cooperation with the boating community should be a priority in the future.

Issue Category	Comment
Reservoir Lands Planning	
Land Policy	TVA's land use policy has been a bright spot and those measures that have been effective need to be continued. TVA should not allow mountaintop removal of mined coal to be used in its boilers. TVA needs to develop a biofuels extraction policy that is sustainable.
Water Resources	
Water Quality	Water quality needs to be included in all scenarios at the highest priority. We can no longer accept the degradation of our waters as an acceptable by-product of human activities. A healthy aquatic biota in all of our tributaries, streams, rivers, and lakes is a crucial part of our Tennessee way of life and should be a baseline assumption of the IRP. Best management forestry and land practices are essential for the maintenance of those biologic systems. These allow for the fullest use of our water resources.
Water Conservation	Research and implement water-saving measures at existing and new facilities, through public education, such as when reviewing and commenting on 26a permit applications and promoting financial incentives to homeowners who purchase and install water-saving appliances. As the region's water demands have increased, permit applications to withdraw water from streams and rivers are continuing to increase at an unprecedented rate. These uses, combined with anticipated aquifer and surface water losses attributed to climate change, will negatively impact future water resources available to the human population, fish and aquatic organisms, and terrestrial plants and animals.
Organization of Document	
Separation from IRP	We do not agree that any "integrated' plan should be developed separate from natural resource stewardship. We encourage you to develop this IRP to include natural resource stewardship on TVA land, water, and areas affected by the energy portfolio as integral to the way TVA meets the energy needs of the Tennessee Valley.
Issues Outside the Scope of The NRP	
Aquatic Plant Management	TVA should continue to provide aquatic vegetation management along residential shorelines and public access facilities and provide boat lanes to access channel areas.

Part III – Natural Resource Plan: Comments from Agencies, Stakeholder Groups, and Individuals

Table C-3. Overview of Comments Submitted for the Natural Resource Plan and Organized by Issue Categories

Issue Category	Number of Comments
Air Quality and Noise	2
Appreciation of NRP	5
Cultural and Visual Resources	2
Economy and Transportation	6
Fiscal Impacts	6
Forest and Land Management	6
Land Planning and Land Policy	3
Maintain Natural Areas and Sensitive Species Management	8
Mineral Rights	2
Navigation and Recreational Boating Traffic	9
NEPA and Alternatives	25
Oppose Development	3
Other	4
Outside Scope of the Natural Resource Plan	11
Public Involvement	21
Public Lands and Stewardship	5
Recreation	27
Vegetation	4
Water Quality and Shoreline Conditions	5
Wetlands, Wildlife, and Conservation	3

Table C-4. Natural Resource Plan – Summary of Comments Submitted by Agencies and Stakeholder Groups and Organized by Issue Categories

Issue Category	Summary of Comments
Air Quality and Noise	
Air Quality	Environmental stewardship applies not only to TVA's management of its lands and waters, but also to what TVA emits into the atmosphere, which has a huge potential of affecting the environment of this region and, indeed, of the world. As the largest public power producer in a nation that has until now contributed disproportionably to the atmospheric gases that are causing the Earth to warm dangerously (and with potentially catastrophic effects), TVA must now take a leadership position in reversing this trend. TVA must be a leader in promoting energy efficiency and the clean production of energy.
Noise	The growing number of nonmuffled boats operating on our lake is causing several problems. The noise pollution is very disturbing for lake residents, especially when experienced late at night or early in the morning. This noise is also disturbing to nearby wildlife. The growing number of water sport enthusiasts is creating a serious conflict on our lake. Nonmotorized boating enthusiasts (paddle boating, kayaking, canoeing, and sailing) and persons wanting to swim in the lake are being placed in a dangerous situation due to the many jet skis, power boats and speed boats operating on the lake.
Appreciation of Developing a Natural Resource Plan	
Appreciation	Thank you for the opportunity to provide scoping comments for the NRP. We look forward to the next opportunity for public involvement in the plan's development.
Cultural Resources	
Cultural Resources	We look forward to receiving Section 106 compliance documentation from you when it becomes available.
Economy	
Economy	The economic health of the region is not sustainable without proactive protection of our natural resources. Outdoor recreational opportunities and natural beauty support sustainable economic growth and increase the attractiveness of our region to employers and residents.
Forest and Land Management	
Forest Management	TVA should get back into active timber management and allowing things such as timber salvage after storms. TVA should also look for more cooperative agreements with other land management agencies such as state conservation agencies. Sharing resources and looking at management of public lands in a more cooperative manner will create a win-win situation for TVA and the residents of the Tennessee Valley.
Land Management	At TVA's beginning and throughout much of its history TVA lands and developments were examples to the locals, to the nation, and to the world of the best possible design. This was a deliberate programmatic effort managed by skillful architects and landscape architects with the same kind of seriousness that is applied within our national parks. It didn't happen by chance or just by the collective efforts of well-meaning engineers or nondesign professionals. As TVA manages and develops its public land going forward it should be with unapologetic high standards for excellence in the design arts. That will provide the public a rich return on its land investments through TVA.

Issue Category	Summary of Comments
Land Planning and Land Policy	
Land Planning	Land planning should look at land as contiguous tracts of land for natural resource protection instead of thinking of the land as divided by use. This will help with prevention of habitat fragmentation. Any past contracts or agreements should be reviewed to bring them into compliance, and efforts should be made to create shorter-term agreements so that management of the land is flexible.
Land Policy	TVA's current land policy has a tremendously positive impact on the quality of life in the Tennessee Valley.
Maintain Natural Areas	
Maintenance	Maintain necessary controls to assure natural resources are maintained and improved.
Protection	It is especially critical that TVA continue to provide ample protection of natural lands, such as small wild areas, through correct classification and management.
Navigation and Recreational Boating Traffic	
Recreational Boating Traffic	TVA must conduct boat capacity and boat traffic studies whenever a new or additional commercial marina or public boat ramp is being considered. Boat traffic should be studied around the specific location of the new or additional marina/boat ramp, not in a large area of the reservoir. Studies should be conducted during the peak traffic times (summer weekends), not during the week and in the off-season. TVA knows the boat count during the week and off-season is low and should not design studies during those times to "prove" there is boat capacity in a particular area. The busiest times should be studied so as to see the true impact on safety and the boating public.
NEPA and Alternatives	
NEPA	TVA should solicit feedback from every agency and individual who responds during a public comment period and/or attends a public meeting whenever any modification is being made to an environmental assessment (EA) or environmental impact statement (EIS). Modifications should not be made in secret with only TVA employees reviewing and approving changes to mitigation measures, which the public and outside agencies have previously been assured will be in enforced.
	Commercial development should not be allowed when the majority of the existing property owners object. Just because TVA can declare a FONSI does not mean that a commercial development should be allowed. Alternatives to a development including moving a development to a less congested site and reducing the size of the project should be considered and suggested by TVA.
	The language TVA uses in its EAs and EISs must be clear, absolute, enforceable, and easily understood by the public.
	The NRP should indicate whether the plan will be strictly adhered to or whether the plan can be adjusted.
Oppose Development	
Leave Areas Natural	My request for the NRP is to leave as many of the lands that TVA controls unspoiled, and available for use by the public. I recognize the need for environmental stewardship and planning via logging, agriculture, etc., but TVA provides opportunities to many hikers, hunters, fishermen, and outdoorsmen in general that would not otherwise be possible. Public access to recreation land is slowly dwindling, but the use of public land for hunting is rapidly diminishing.

Issue Category	Summary of Comments
Other – Fiscal Impacts	
Fiscal Impacts to Ratepayers	Please conduct a full economic analysis for impacts associated with TVA decisions and/or restrictions for use of publicly held lands. The current Land Policy adopted by TVA did not account for economic impacts. Additionally the NRP should clearly specify the actions being proposed by TVA and their associated costs/benefits to power customers resulting from the NRP and its implementation.
Project-Specific Financial Reviews	TVA must ensure that all developers have the financial means to complete a proposed project before it is approved and will not leave a project site in a disturbed and/or unfinished state. More thorough and in-depth financial reviews of developers must be conducted by TVA.
TVA Funding	All programs that protect and restore our waterways should be enhanced and funded.
Public Involvement	
Education Efforts	I would like to see more education efforts for protection of natural resources, more signs posted, more effort for closing abused areas, more TVA Police patrol (hiring of 'resource officers').
Public Involvement	Our experience, unfortunately, has been that TVA uses it power unilaterally and discounts the input and voice of the public, affected property owners, and wildlife agencies/organizations.
Public Involvement	Solicit feedback from property owners within a 5-mile radius, and local, state, and federal wildlife agencies whenever a commercial or industrial development is being proposed and whenever a change in land use is being considered. Publication in a local paper of limited circulation (many times rural) is an inadequate form of communication. TVA should prominently publish notices in regional newspapers, post notices on the affected site(s), and actively encourage public comment rather than treat public input as an obstacle to overcome.
Public Lands and Stewardship	
Long-Term Management	TVA's policies and actions related to its land and waters have tremendous impact on the quality of life in our region. While balancing the needs of many sectors, TVA must manage these natural resources in a way that protects their value in perpetuity. Long-term values must not be sacrificed for short-term solutions.
Proactive Management	Finally, we urge adoption of a more prudent policy toward environmental costs. Policies and actions should incorporate a “fix it now” attitude that marks TVA and the valley as a leader in taking proactive steps to protect our natural resources.
Stewardship	TVA must keep public lands in public ownership and provide careful stewardship of both lands and waters to meet the needs of current and future generations.
Recreation	
Campgrounds	TVA campgrounds should be upgraded to handle both small and large recreational vehicles. The campgrounds need upgrades, i.e., sewer, 50-ampere boxes, and clearances to accommodate large rigs and slides. A good example is De Soto Falls State Park Campground in Alabama. They have done a great job in bringing the facility up to date.
Commercial Recreation	Marinas should not be built on shorelines that are popular fishing areas and/or locations already popular with the boating public. Replacing fishing and boating areas with a marina is not offering new recreational opportunities.

Issue Category	Summary of Comments
Commercial Recreation	TVA should not allow popular fishing areas and boating areas to be eliminated by marinas and other shoreline development if opposed by the public. Replacing existing recreation with a marina should not be justified by saying it is providing new recreational opportunities. TVA should not approve commercial marinas in areas already served by large marinas regardless of the demand. If additional commercial marinas are needed, then TVA should identify appropriate locations spread out from one another.
Partnerships	TVA should actively work with the public and wildlife agencies to identify locations for environmentally friendly and low-impact recreational opportunities such as hiking, bank fishing, picnicking, and bird watching.
Recreation	TVA lands and waters are vitally important to support and protect water quantity and quality, and to support outdoor recreation, including water sports, hunting, fishing, hiking, and birding, camping, and picnicking.
Sensitive Species Management	
Sensitive Species Management	TVA should enhance sensitive species monitoring, habitat enhancement, and begin research in listed species genetics.
Transportation	
Transportation	Address how the outcome of this evaluation will interact with and facilitate the delivery of federal, local, and state transportation plans and projects.
Vegetation	
Exotic Invasive Plant Species	Effective natural resource management in today's environment must also include removal and control of exotic, invasive species and protection of native species.
Native Vegetation	Natural shoreline conditions should be preserved and trees and vegetation should be left on the shoreline to the maximum extent possible.
Visual Resources	
Project-Specific Impacts	Marinas are normally well lit at night and significantly change an area visually at night. The effect of light should be studied when marinas are proposed to ensure it will not negatively impact wildlife and the quality of life of nearby property owners and the value of their property.
Water Quality and Shoreline Conditions	
Water Quality	In managing its land and waters, TVA must protect water quality and quantity. Both are important for recreation, drinking water, agriculture, ecosystems, wildlife, and our economy.
	TVA's Water Resources Program appears to have made great strides in improving water quality by working within watershed communities to educate and motivate residents and provide the needed programs and tools for assessments and effective actions. Expansion of this program to more watersheds would be beneficial.
Wetlands	
Wetlands	Wetlands delineations are similarly important for areas that may be developed.
Wildlife and Conservation	
Wildlife Habitat Management	The amount of TVA land available for wildlife habitat improvement is limited, but timber harvest, prescribed burning, and other habitat manipulations should be considered where there are suitable tracts. Wildlife habitat management could be conducted in tandem with other recreational-like park trail systems and public fishing amenities. In addition, opportunities to enhance or create wetland habitats for waterfowl and other wildlife should be evaluated in some small, isolated areas.
Issues Outside the Scope of the NRP	
Aquatic Plant Management	Please reconsider the present policy of weed control in TVA lakes.
Contract	TVA should tighten its contract-writing specification enough so that both TVA

Issue Category	Summary of Comments
Management	and the contractor can be held responsible for actions under the contracts.
Fossil Power Operations	Several comments were submitted concerning the Kingston coal ash spill, future management of coal ash, and transitions to alternative fuel sources.
Mineral Rights Policy	TVA needs to demonstrate stewardship for the life-cycle costs of the resources it uses within its power supply program. TVA only uses a small percentage of mountain top removal coal. TVA should make a policy that it will not purchase mountain top removal coal. Such a TVA policy would have a large influence in the efforts to preserve our natural resources.
Muscle Shoals Reservation Redevelopment	Please don't allow Muscle Shoals Reservation to be released for commercial or residential development.
Procurement	TVA should demonstrate extended product responsibility through its purchases.
Section 26a Permitting	26a permit hearings should be held when requested by a member of the public. Currently TVA can approve 26a permits at its discretion without a 26a permit hearing no matter how many people request a hearing. When TVA approves a 26a permit without a hearing, the public is denied an opportunity to become a party of record and cannot file an appeal. This practice leads to an abuse of power whenever TVA does not want additional scrutiny of a project the public opposes.

AGENCIES SENT A COPY OF THE SCOPING NOTICE

Table C-5. Federal Agencies Sent a Copy of the Public Scoping Notice

Federal Agencies
Appalachian National Scenic Trail
Blue Ridge Parkway
Center for Disease Control
Chattahoochee-Oconee National Forests
Federal Highway Administration
George Washington and Jefferson National Forests
Great Smoky Mountains National Park
Mammoth Cave National Park
National Center for Environmental Health
Natural Resources Conservation Service: Chief, Eastern Region State Conservationists in: Alabama Georgia Kentucky Mississippi North Carolina Tennessee Virginia
U.S. Army Corps of Engineers: Asheville, North Carolina, District Nashville, Tennessee, District Norfolk, Virginia, District Raleigh, North Carolina, District Savannah, Georgia, District
U.S. Environmental Protection Agency – Region 4
U.S. Fish and Wildlife Service: Asheville, North Carolina Athens, Georgia Cookeville, Tennessee Daphne and Decatur, Alabama Frankfort, Kentucky Gloucester, Virginia Southwest Virginia Field Office

Table C-6. Agencies in Georgia Sent a Copy of the Public Scoping Notice

Georgia State Agencies
Department of Economic Development – Tourism and Marketing
Department of Natural Resources Fisheries State Historic Preservation Officer State Parks and Historic Sites Division Wildlife Resources
Georgia State Clearinghouse

Table C-7. Agencies in Alabama Sent a Copy of the Public Scoping Notice

Alabama State and Regional Agencies
Alabama Elk River Development Agency
Bear Creek Development Authority
Boating Law Administrator
Department of Agriculture and Industries
Department of Conservation and Natural Resources Division of State Parks
Department of Economic and Community Affairs
Department of Environmental Management
Department of Transportation
Forestry Commission
Historical Commission
North-Central Alabama Regional Council of Governments
Northwest Alabama Council of Local Governments
Top of Alabama Regional Council of Governments
Tourism Department

Table C-8. Agencies in Kentucky Sent a Copy of the Public Scoping Notice

Kentucky State Agencies
Arts and Heritage Cabinet Tourism
Department of Parks
Energy and Environment Cabinet Department for Environmental Protection Division of Water Quality Division of Air Quality
Heritage Council State Historic Preservation Officer

Table C-9. Agencies in Mississippi Sent a Copy of the Public Scoping Notice

Mississippi State and Regional Agencies
Department of Archives and History
Department of Environmental Quality
Department of Finance and Administration
Department of Wildlife, Fisheries, and Parks
Division of Tourism Development
Northeast Mississippi Planning and Development District
Tombigbee River Valley Water Management District

Table C-10. Agencies in North Carolina Sent a Copy of the Public Scoping Notice

North Carolina State Agencies
Department of Commerce Tourism, Marketing, and Global Branding
Division of Archives and History
Division of Parks and Recreation
National Forests in North Carolina
North Carolina State Clearinghouse

Table C-11. Agencies in Tennessee Sent a Copy of the Public Scoping Notice

Tennessee State and Regional Agencies
Beech River Development Authority
Department of Agriculture
Department of Economic and Community Development
Department of Environment and Conservation Division of Air Pollution Control Division of Archaeology Division of Natural Heritage Division of Recreation Educational Services Division of Water Pollution Control Historical Commission Parks and Conservation Operations
Department of Tourism Development
Department of Transportation Environmental Planning and Permits Division
East Tennessee Development District
First Tennessee Development District
Greater Nashville Regional Council
Memphis Area Association of Governments
Northwest Tennessee Development District
South Central Tennessee Development District
Southeast Tennessee Development District
Southwest Tennessee Development District
Tellico Reservoir Development Agency
Tennessee Duck River Development Agency
Tennessee Wildlife Resources Agency
Upper Cumberland Development District

Table C-12. Agencies in Virginia Sent a Copy of the Public Scoping Notice

Virginia State and Regional Agencies
Department of Conservation and Recreation
Department of Environmental Quality Division of Environmental Enhancement
Department of Game and Inland Fisheries
Department of Historic Resources
Department of Transportation Policy, Planning, and Environment
Mount Rogers Planning District Commission
Virginia Tourism Corporation

Table C-13. Agencies That Commented on the Public Scoping Notice

Federal Agencies
Natural Resources Conservation Service Georgia (State Conservationist) North Carolina
U.S. Fish and Wildlife Service Asheville, North Carolina Cookeville, Tennessee Daphne, Alabama Frankfort, Kentucky
State and Regional Agencies
Alabama Department of Conservation and Natural Resources
Georgia Clearinghouse
Georgia Department of Natural Resources Historic Preservation Division
Greater Nashville Regional Council
Kentucky Energy and Environment Cabinet Division of Water
Mississippi Clearinghouse
North Carolina Clearinghouse
North Carolina Wildlife Resources Commission Division of Inland Fisheries
Tennessee Department of Agriculture
Tennessee Department of Transportation
Tennessee Department of Water Supply
Upper Cumberland Development District
Virginia Department of Environmental Quality Office of Environmental Impact Review
Virginia Department of Game and Inland Fisheries
Virginia Department of Health Office of Drinking Water
Virginia Department of Transportation Natural Resources Program
Organizations or Community Groups
American Whitewater
Environmental Integrity Project
Scottsboro Forest Products
Solar Valley Coalition
Tennessee Citizens for Wilderness Planning
Tennessee Environmental Coalition
The Friends of Norris Lake
World Wildlife Fund

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Appendix D – Forecast System Designations

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FORECAST SYSTEM DESIGNATIONS

Forecast Designation	Definition
Dam Reservation	*Land managed to protect the integrity of the dam and associated switchyards and power lines*. Most TVA dam reservations provide a visitor reception building that overlooks the facilities. Day use recreational activities such as picnicking, fishing, hiking, and bird watching are encouraged. Campgrounds and boat-launching facilities are often available. Generally speaking, maintenance levels and care of the facilities are higher on dam reservation land than on other areas of the reservoir. Hunting and unregulated camping are generally prohibited on the reservations.
Public Recreation	*Land set aside for use by the public for recreational activities*. This includes informal, dispersed activities such as hunting, hiking, fishing, and primitive camping, as well as more formal activities in developed areas such as parks, boat-launching areas, and campgrounds.
Reservoir Operations (Islands)	*Islands in the mainstream or tributaries used for informal, dispersed recreation and natural resource management projects.*
Reservoir Operations (Mainland)	*Generally narrow bands of shoreland retained by TVA for flood control and other reservoir operations purposes*. Although there are no outstanding rights to construct water use facilities, TVA allowed back-lying residential property owners to construct facilities on these lands until 1992. Since 1992, facilities have only been allowed on reservoir operations land in those areas where existing facilities have been permitted.
Power Transmission and Power Needs	*Land reserved for future power development or to maintain the integrity of existing power lines*. Interim wildlife enhancement projects are often implemented on these lands.
Commercial Recreation	*Land that TVA has reserved primarily for commercial use.* This use includes, but is not limited to, marinas, commercial boat docks, and campgrounds. Informal, dispersed recreational activities often occur on this land as an interim use.
Minor Commercial Landings	*Tracts allocated for minor commercial landings available for public or private development of small-scale barge facilities*. These are sites that can be used for transferring pulpwood, sand, gravel, and other natural resource commodities between barges and trucks. Since this use is intermittent and usually not a major activity, there would generally be no significant impact on adjacent land uses.
Industrial	*Land that TVA identified as having potential for future industrial development*. Informal, dispersed recreational activities often occur on this land as an interim use.
Navigation Safety Harbors Landings	*Sites used for tying off commercial barge tows and recreational boats during adverse weather conditions*. Safety landings are straight stretches of shoreline fronting the commercial channel, and safety harbors are shoreline areas recessed into coves or creeks off the commercial channel.
Forestry Research	*Tracts used as ongoing sites for monitoring tree growth and stress*. In addition, trees are used in these areas to produce reliable seed sources.

Forecast Designation	Definition
Steam Plant Study	*Tracts set aside to potentially serve as a future steam plant location*. The actual construction of a steam plant would depend on energy demands and cost-benefit considerations.
Wildlife Management	*Land managed for the enhancement of natural resources for human use and appreciation*. Management of resources is the primary focus of this designation. Management strategies include planting food plots, selective timber harvesting, and other forms of manipulating habitat to attract certain wildlife species. Appropriate activities in this zone include hunting, wildlife observation, and camping on undeveloped sites.
Small Wild Areas	*These TVA natural areas are areas managed by TVA or in cooperation with other public agencies or private conservation organizations to protect exceptional natural or aesthetic qualities that can also support dispersed, low-impact types of outdoor recreation.* Where appropriate, development could include foot trails, signs, parking areas, and primitive camping, and efforts can be undertaken to encourage the public and interpretation for visitors.

Appendix E – Multiple Use Tract Allocation Methodology

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METHODOLOGY APPLIED DURING MULTIPLE USE TRACT ALLOCATION

Overview

The multiple use tract allocations reservoir lands planning process was based on active participation by various TVA staffs, other government agencies, nongovernment organizations, and the public. Comments from these groups were used to identify regional and local land management needs and to develop reservoir-specific objectives for realizing TVA's reservoir land management goals, which include:

- Protecting the visual and environmental quality of reservoirs and adjoining lands.
- Providing a diversity of quality recreation opportunities on TVA reservoirs and adjoining land.
- Planning for and promoting responsible economic development and growth.
- Protecting and enhancing the forestry, fisheries, and wildlife resources, as well as preserving the cultural and agricultural resources around the reservoir area for future generations.

Specific objectives or steps for reaching these goals were developed from the advice and technical expertise of TVA staff and from public input about local values and priorities related to land use. Because the public's interests and the available resource base are different on each reservoir, the management objectives were tailored to fit the specific reservoir.

The reservoir land management plans (RLMPs) guided TVA resource management and property administration decisions on the reservoir lands that are under TVA stewardship and control. It identified the most suitable uses for all the tracts of TVA-managed land, providing sites for recreation, industry, navigation, wildlife and forest management, cultural and environmental preservation, and agriculture.

The planned acreage was TVA-retained (fee-owned) land. The remaining portions of shoreline not addressed in the RLMPs fell into the following two categories:

- Shoreline fronting land formerly owned by TVA that has been sold or transferred for commercial, industrial, or public recreation purposes, or that has been transferred to other government agencies for uses other than public recreation, or that has been committed by TVA for dam reservations or power plants.
- Shoreline fronting former TVA reservoir land commonly referred to as "marginal strip" that was sold for private development purposes with deeded rights to request approval for construction of private shoreline improvements (boat docks, ramps, seawalls, etc.); this category also includes TVA-retained rights on sold land and the acquired rights to flood private land that was never owned by TVA.

In relation to TVA property administration, the RLMPs provided information that allowed a faster response to requests for the use of TVA-managed land. All requests for changes to the RLMP or requests for use of TVA-managed land were subject to TVA review through the reservoir land use review process. When requests are received, TVA staff would compare the request with the use allocated in the RLMP. If the request is not congruent

with the RLMP, the RLMP would be used to identify alternative tracts that are more suitable for the proposal, or the applicant may be given the opportunity to provide information that warrants a modification to the RLMP in the public's interest.

The RLMP established general guidelines for use of each tract, but "on-the-ground" management activities would be more clearly defined by TVA's resource management staffs. TVA land resource staffs comply with state-approved best management practices (BMPs) when implementing land management activities. The agency performs appropriate levels of environmental review on all proposed actions, including requests from the public for use of TVA-managed lands (e.g., recreational and industrial easements or permits under Section 26a of the TVA Act). Most actions are classified as categorical exclusions (i.e., actions which by their very nature have no significant environmental impacts) and are subjected to environmental review in the form of a categorical exclusion checklist. However, actions or proposals that do not qualify as categorical exclusions may require an environmental assessment or environmental impact statement as stipulated under TVA's procedures for compliance with NEPA.

Most RLMPs encompassed a 10-year planning horizon. During this time, TVA would monitor growth pressures, economic trends, and environmental conditions around the reservoir. The supporting database would be updated on a regular basis. Revisions to an RLMP would be considered as changing circumstances warrant. After 10 years, TVA would review the data, solicit public input, and update the RLMP, as appropriate.

Planning Team Mission
A planning team, representing various staffs within TVA, undertook a detailed planning process that resulted in the land use allocations presented in RLMPs. Site visits, public input, and information from TVA's resource specialists were carefully analyzed in making land use allocations.

Reservoir Resource Data
TVA's resource specialists provided information that was used to develop an extensive computerized database about physical resource characteristics of the land; existing uses of TVA-managed land and adjoining property; economic conditions in the area; and such environmental constraints as wetlands, floodplains, threatened and endangered species, and water and air quality. Other resource data, often more detailed, were collected on site-specific archaeological concentrations, historic structures, forest resources, prime farmland, and wildlife habitats. Some data were gathered from a designated study area that extended about 0.5 mile from TVA's property line.

Public Information Process
In addition to documented resource data, local residents and lake users were important in determining suitable uses for TVA-managed lands adjacent to the reservoir. TVA made a concerted effort to inform and encourage the public to participate in the development of the RLMP.

Key contacts were made by the planning staff with local community cooperators, such as county commissions. The goal was to encourage local officials and community leaders to attend the informational meetings held in local areas. The purpose was to inform and encourage government officials; service and civic organizations; congressional field staffs; chambers of commerce; industrial, tourism, and commercial development groups;

environmental groups; and other citizens to participate in the planning process for the reservoir.

Informational meetings were held in numerous locations throughout the local areas. At each meeting, TVA staff briefly described the upcoming planning effort as it related to future use of TVA-managed lands around the reservoir(s). TVA staff attempted to explain the planning process and the importance of public involvement in development of a quality RLMP to the participants. By taking this approach, TVA believed the public would be better informed at an early stage and would want to participate in future public workshops.

Media contacts and news releases were made available to local TV stations, radio stations, and area newspapers. In addition, TVA's planning staff initiated an extensive mailing campaign to invite by personal letter, individuals, government officials, area special interest groups, and organizations to attend the scheduled public workshops. The focus was to provide information packages about the planning process and about what each participant could expect at the workshops. By using these processes plus a mix of written invitations, public service announcements, media feature stories, letters about the project taken home by schoolchildren, and local constituent networks, TVA hoped for the maximum attendance and productivity at each workshop.

Public Workshops
Public workshops were held to ask participants specific questions about the reservoir(s). The planning team attended each public workshop and used the compiled agency and public comments, along with technical advice from TVA staffs, to develop the reservoir goals and management objectives of the RLMPs. These objectives provided guidelines for the planning team's analysis of available information and their subsequent identification of appropriate land uses for the TVA-managed land.

Capability Analysis
In the first phase of a two-phase analysis, the planning team analyzed the ability of the reservoir lands to support various uses. TVA staffs provided the planning team with capability ratings of excellent, good, fair, or poor for every possible use on each tract of TVA-managed land. The ratings were based on an analysis of specific criteria that indicated whether a tract was physically capable of supporting a given use.

Suitability Analysis and Tract Allocation
The second phase, a land use suitability analysis, is based on the capability ratings as well as other factors such as previous investments, interest by other agencies, TVA's objectives, and local or regional needs. TVA staff provided the planning team with maps exhibiting proposed uses for the TVA-managed land. Along with the map, each staff provided a written narrative and land needs justification for every tract of TVA-managed land requested by that staff. The planning team then compared a map of all the proposed uses with other maps and written justifications that identified existing resource data, such as wetlands, floodplain locations, threatened or endangered species, prime farmland, and historic or archaeological resource sites. In some cases, the data showed obvious constraints or conflicts with proposed uses, and such obvious unsuitable uses were eliminated. The planning team then analyzed the suitability of remaining potential uses by reviewing other information, such as the economic conditions of the reservoir area, the reservoir management objectives, public comment, and TVA land management goals and policies. Through debate and discussion, the planning team arrived at a consensus agreement and identified the most suitable use or uses for each tract of TVA-managed land.

Review Process

After allocating each tract of land for one or more compatible uses, the planning team looked at the entire RLMP in terms of how it met the reservoir management goals and planning objectives. In areas where the planning team felt the objectives were not met, adjustments were made to the RLMP. On tracts where uncertainty existed or there was specific conflict about appropriate use, the planning team made additional field inspections to ensure proper allocations. The RLMP was then reviewed within TVA and revised. The revised RLMP was mailed to individuals, agencies, and organizations for their review. A compilation of all the comments received, along with the TVA staff responses, was prepared. The responses included recommendations for changes to the RLMP based on the public input, review of the database, and consideration of the reservoir management goals and objectives.

Appendix F – Land Use Zone Definitions

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ALTERNATIVE A (EXISTING) LAND USE ZONE DEFINITIONS

Zone		Definition
1	**Non-TVA Shoreland**	Shoreland that TVA does not own in fee. This land may be privately owned or owned by a governmental entity other than TVA. Uses of this non-TVA land may include residential, industrial, commercial, and/or agricultural. In many instances, TVA may have purchased the right to flood and/or limit structures on this non-TVA land (i.e., flowage easement). TVA's permitting authority under Section 26a of the TVA Act applies to construction of structures on non-TVA shoreland. Non-TVA Shoreland allocations are based on deeded rights and, therefore, will not change as a result of the land planning process. This category is provided to assist in comprehensive evaluation of potential environmental impacts of TVA's allocation decision.
2	**Project Operations**	Land currently used, or planned for future use, for TVA operations and public works projects, including: • ***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 rights-of-way. • ***Dam reservation land***—Areas acquired and managed for the primary purpose of supporting the operation and maintenance of TVA dams and associated infrastructure; secondary uses may also include 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. • ***Navigation dayboards and beacons***—Areas with structures placed on the shoreline to facilitate navigation. • ***Public works projects***—Includes public utility infrastructure, such as substations and rights-of-way for sewer lines, water lines, transmission lines, and major highway projects.
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 and other land features/natural resources TVA considers important to the area viewscape or natural environment. Recreational natural resource 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. Areas included are: • TVA-designated sites with potentially ***significant archaeological resources***. • TVA public land with ***sites/structures listed in or eligible for listing in the National Register of Historic Places***. • ***Wetlands***—Aquatic bed, emergent, forested, and scrub-shrub wetlands as defined by TVA. • ***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/individuals*** for resource protection purposes.

Zone		Definition
		• ***Habitat protection areas***—These TVA natural areas are managed to protect populations of species identified as threatened or endangered by the U.S. Fish and Wildlife Service, state-listed species, and any unusual or exemplary biological communities/geological features. • ***Ecological study areas***—These TVA natural areas are designated as suitable for ecological research and environmental education by a recognized authority or agency. They typically contain plant or animal populations of scientific interest or are of interest to an educational institution that would utilize the area. • ***Small wild areas***—These TVA natural areas are managed by TVA 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 present***—A river corridor is a segment of a river and the adjacent land along the banks. River corridors often consist of a linear green space of TVA land serving as a buffer to tributary rivers entering a reservoir. These areas will be included in Zone 3 when identified sensitive resources are present. • ***Significant scenic areas***—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.
4	**Natural Resource Conservation**	Land managed for the enhancement of natural resources for human use and appreciation. Management of resources is the primary focus of this zone. Appropriate activities in this zone include hunting, timber management to promote forest health, wildlife observation, and camping on undeveloped sites. Areas included are: • ***TVA public land*** managed for wildlife or forest management projects. • ***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. • ***Dispersed 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. River corridors will be included in Zone 4 unless sensitive resources are present (see Zone 3). • ***Islands of 10 acres or less.***

Zone		Definition
5	Industrial	Land currently used, or planned for future use, for economic development, including businesses in distribution/processing/assembly and light manufacturing. Preference will be given for businesses requiring water access. There are two primary types of uses for TVA land allocated for Industrial: **(1) access for water supply or structures associated with navigation such as barge terminals, mooring cells, etc., or (2) land-based development potential.** Areas included are: • ***TVA public land under easement, lease, or license to other agencies/ individuals/entities*** for industrial purposes. • ***TVA public land fronting land owned by other agencies/individuals/entities*** for industrial purposes. In some cases, TVA land allocated to industrial use would be declared surplus and sold at public auction. Types of development that can occur on this land are: • **Light industrial**—TVA waterfront land that would support light manufacturing activities. Light industry does not include retail or service-based 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 terminals are associated with industrial access corridors. • **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.
6	Developed Recreation	Land currently used, or planned for future use, for concentrated, active recreational activities that require capital improvement and maintenance of developed infrastructure, including: • ***TVA public land*** developed for recreational purposes, such as campgrounds, day use areas, etc. • ***TVA public land under easement, lease, or license to other agencies/individuals/entities*** for developed recreational purposes. • ***TVA public land fronting land owned by other agencies/individuals/ entities*** for developed recreational purposes. Residential use, long-term accommodations, and/or individually owned units are not permitted on land allocated for Developed Recreation. Types of development that can occur on this land are: • ***Water access***—Recreation, generally on small shoreline areas, involving primarily limited levels of development that may include a launching ramp, courtesy piers, canoe access, picnic areas, trails, associated parking areas, etc. These areas are typically operated by federal, state, or local governmental entities for public access. • ***Public recreation***—Recreation with facilities or uses developed and owned by a public agency that are open to the public. Facilities at public

Zone		Definition
		recreation areas could include playgrounds/play structures, picnic facilities, tennis courts, horseshoe areas, play courts, recreation centers, athletic fields, trails, greenways, 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 campgrounds. Cabins or other overnight accommodations (other than campgrounds) are only permitted if the public recreation area is operated by a state or state agency as a component of a state park system. Public recreation areas and facilities are typically owned and operated by the federal, state, county, or local government. However, private entities may operate recreation facilities on public recreation land as concessionaires under agreement with the public entity controlling the property. The use of the facilities may be offered free or for a fee. Time-forward, public-private partnerships where facilities are owned by private investors will not be approved on public recreation land. All structures and facilities should be owned by the public entity. • ***Commercial recreation***—Recreation amenities that are provided for a fee to the public intending to produce a profit for the private owner/operator. These primarily water-based facilities typically include marinas and affiliated support facilities such as stores, restaurants, campgrounds, and cabins and lodges. Where applicable, TVA will require appropriate compensation for the commercial use of the property.
7	**Shoreline Access**	TVA-owned land where Section 26a applications and other land use approvals for residential shoreline alterations are considered. Requests for residential 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 public. Types of development/management that may be permitted on this land are: • ***Residential water use facilities***, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space, and nonpotable water intakes. • ***Shoreline access corridors***, e.g., pathways, wooden steps, walkways, or mulched paths that can include portable picnic tables and utility lines. • ***Shoreline stabilization***, e.g., bioengineering, riprap, gabions, and retaining walls. • ***Shoreline vegetation management.***

ALTERNATIVES B, C, AND D LAND USE ZONE DEFINITIONS

Zone		Definition
1	**Non-TVA Shoreland**	Shoreland that TVA does not own in fee. This land may be privately owned or owned by a governmental entity other than TVA. Uses of this non-TVA land may include residential, industrial, commercial, and/or agricultural. In many instances, TVA may have purchased the right to flood and/or limit structures on this non-TVA land (i.e., flowage easement). TVA's permitting authority under Section 26a of the TVA Act applies to construction of structures on non-TVA shoreland. Non-TVA Shoreland allocations are based on deeded rights and, therefore, will not change as a result of the land planning process. This category is provided to assist in comprehensive evaluation of potential environmental impacts of TVA's allocation decision.
2	**Project Operations**	Land currently used, or planned for future use, for TVA operations and public works projects, including: • ***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 rights-of-way. • ***Dam reservation land***—Areas acquired and managed for the primary purpose of supporting the operation and maintenance of TVA dams and associated infrastructure; secondary uses may also include developed and dispersed recreation, maintenance facilities, miscellaneous TVA field 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. • ***Navigation dayboards and beacons***—Areas with structures placed on the shoreline to facilitate navigation. • ***Public works projects***—Includes rights-of-way for public utility infrastructure, such as sewer lines, water lines, transmission lines, and major highway projects.
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 and other land features/natural resources TVA considers important to the area viewscape or natural environment. Recreational natural resource 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. Areas included are: • TVA-designated sites with potentially ***significant archaeological resources***. • TVA public land with ***sites/structures listed in or eligible for listing in the National Register of Historic Places***. • ***Wetlands***—Aquatic bed, emergent, forested, and scrub-shrub wetlands as defined by TVA. • ***TVA public land under easement, lease, or license to other agencies/individuals*** for resource protection purposes.

Zone		Definition
		• ***TVA public land fronting land owned by other agencies/individuals*** for resource protection purposes. • ***Habitat protection areas***—These TVA natural areas are managed to protect populations of species identified as threatened or endangered by the U.S. Fish and Wildlife Service, state-listed species, and any unusual or exemplary biological communities/geological features. • ***Ecological study areas***—These TVA natural areas are designated as suitable for ecological research and environmental education by a recognized authority or agency. They typically contain plant or animal populations of scientific interest or are of interest to an educational institution that would utilize the area. • ***Small wild areas***—These TVA natural areas are managed by TVA 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 present***—A river corridor is a segment of a river and the adjacent land along the banks. River corridors often consist of a linear green space of TVA land serving as a buffer to tributary rivers entering a reservoir. These areas will be included in Zone 3 when identified sensitive resources are present. • ***Significant scenic areas***—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.
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Zone		Definition
		and interpretive activities. River corridors will be included in Zone 4 unless sensitive resources are present (see Zone 3). • ***Islands*** without sensitive resources or existing development.
5	**Industrial**	Land currently used, or planned for future use, for economic development, including businesses in distribution/processing/assembly and manufacturing. Preference will be given for businesses requiring water access. There are two primary types of uses for TVA land allocated for Industrial: **(1) access for water supply or structures associated with navigation such as barge terminals, mooring cells, etc., or (2) land-based development potential.** Areas included are: • ***TVA public land under easement, lease, or license to other agencies/ individuals/entities*** for industrial purposes. • ***TVA public land fronting land owned by other agencies/individuals/ entities*** for industrial purposes. In some cases, TVA land allocated to industrial use would be declared surplus and sold at public auction. Types of development that can occur on this land are: • **Industry**—Manufacturing, fabrication, and distribution/processing/assembly involving chemical, electronics, metalworking, plastics, telecommunications, transportation, and other industries. Industry does not include retail or service-based 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 terminals are associated with industrial access corridors. • **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.
6	**Developed Recreation**	Land currently used, or planned for future use, for concentrated, active recreational activities that require capital improvement and maintenance of developed infrastructure, including: • ***TVA public land*** developed for recreational purposes, such as campgrounds, day use areas, etc. • ***TVA public land under easement, lease, or license to other agencies/individuals/entities*** for developed recreational purposes. • ***TVA public land fronting land owned by other agencies/individuals/ entities*** for developed recreational purposes. Residential use, long-term accommodations, and/or individually owned units are not permitted on land allocated for Developed Recreation. Types of development that can occur on this land are: • ***Public recreation***—Recreation amenities developed and owned by a public agency that are open to the public. Public recreation areas may

Zone		Definition
		have varying levels of development, ranging from a water access site (e.g., launching ramp) to a marina facility. Facilities at public recreation areas could include playgrounds/play structures, picnic facilities, tennis courts, horseshoe areas, play courts, recreation centers, trails, greenways, natural areas, amphitheaters, food concessions (vending, snack bar), access to water for fishing and boating, swimming areas and swimming pools, launching ramps, courtesy piers, canoe access, marina facilities owned by the public entity, parking, and campgrounds. Cabins or other overnight accommodations (other than campgrounds) are only permitted if the public recreation area is operated by a state or state agency as a component of a state park system. Public recreation areas and facilities are typically owned and operated by the federal, state, county, or local government. However, private entities may operate recreation facilities on public recreation land as concessionaires under agreement with the public entity controlling the property. The use of the facilities may be offered free or for a fee. Time-forward, public-private partnerships where facilities are owned by private investors will not be approved on public recreation land. All structures and facilities should be owned by the public entity. • ***Commercial recreation***—Recreation amenities that are provided for a fee to the public intending to produce a profit for the private owner/operator. These primarily water-based facilities typically include marinas and affiliated support facilities such as stores, restaurants, campgrounds, and cabins and lodges. Where applicable, TVA will require appropriate compensation for the commercial use of the property.
7	**Shoreline Access**	TVA-owned land where Section 26a applications and other land use approvals for residential shoreline alterations are considered in accordance with TVA's Shoreline Management Policy. Types of development/management that may be permitted on this land are: • ***Residential water use facilities***, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space, and nonpotable water intakes. • ***Shoreline access corridors***, e.g., pathways, wooden steps, walkways, or mulched paths that can include portable picnic tables and utility lines. • ***Shoreline stabilization***, e.g., bioengineering, riprap, gabions, and retaining walls. • ***Shoreline vegetation management.***

Appendix G – Single Use Parcel Allocation and Rapid Land Assessment Methodologies

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METHODOLOGY APPLIED DURING SINGLE USE PARCEL ALLOCATION

Overview

In order to systematically manage lands around its reservoirs, TVA develops reservoir land management plans (RLMPs). RLMPs seek to integrate land and water program goals, provide for the optimum public benefit, and balance competing and sometimes conflicting resource uses. By providing a clear statement of how TVA intends to manage land and by identifying each parcel for specific purposes, TVA hopes to facilitate decision-making for the use of the public land in its care. Land planning guides TVA in the management of resources and property administration decisions on land under its control. Plans are adopted as Agency policy, providing for long-term land stewardship and accomplishment of TVA responsibilities under the 1933 TVA Act.

TVA's integrated resource management approach focuses on balancing flood control, navigation, power generation, water quality, recreation, and land use needs to obtain the optimum benefit for the whole system. Land planning supports TVA's vision of generating prosperity in the Valley by addressing the goals of supporting a thriving river system and stimulating economic growth. To that end, RLMP provides a framework for deciding the optimum use of TVA-managed land and promotes the efficient operation of the TVA reservoir system.

Preplanning

Planning is preceded by preplanning, a set of specific activities that must occur before planning can start. Specifically, TVA would determine the readiness to plan. An RLMP is a complex task requiring many specific skills, resources, and capabilities. A planning team would be organized. Planning is a large task that requires sustained attention from a mixed skills team for the duration of the project. Preplanning provides time to select team leadership and team members and to develop budgets and schedules. Reservoir-specific planning goals are developed by the planning team early in the planning process to guide the allocation of TVA-managed land. The goals should reflect TVA's management objectives for the reservoir, the results of public scoping and intergovernmental coordination, and TVA staff preferences.

An Interdisciplinary Team (IDT) would be assembled to help conduct the environmental review. A communication plan is developed to lay out a strategy for interfacing with TVA management and project stakeholders for the duration of the planning process. A reservoir base map is prepared. This map is used as a base to overlay all resource data coverages, parcel allocations, and other map information for all RLMP project maps.

Preallocation

The planning team maps all existing data for endangered or threatened species, wetlands, natural areas, aquatic habitat, and cultural resources. Next, the committed and uncommitted lands would be identified and mapped. Planning focuses on the uncommitted land, although land use changes can be proposed for committed land. The existing land use is documented in a conversion matrix, and the parcels are numbered. Most TVA reservoirs have either an existing RLMP or a designation from the Forecast System.

During preallocation, the planning team, IDT, and other TVA staff members would weigh the land capability and suitability against public and programmatic needs and existing land conditions. Because the RLMP process assumes the protection of all sensitive resources, all parcels with known sensitive resources should be allocated to Zone 3. TVA staff would

assess and document the suitability and capability attributes of sought-after parcels to be preallocated to Zones 2, 4, 5, and 6. The assessment is based on an established set of capability/suitability criteria for Economic Development, Navigation, Developed Recreation, Visual Resources, and Natural Resource Stewardship. A preallocation map would be used to solicit comments from the public.

At the conclusion of preallocation, the following objectives would be met:

- Resolution of any remaining conflicting zone designations on tracts/parcels with multiple allocated uses
- Alignment of zone allocations with planning goals
- Notation of parcels identified by the public or TVA for development for future data collection and IDT review

New Data Collection
Public input is essential for identifying land for specific uses, gaining insight into stakeholders needs, and defining project issues and concerns. After a public input period has ended, the planning team would compile data from stakeholder consultations and modifiy any preallocation designations, if appropriate.

Allocation and Draft RLMLP
During allocation, preallocated land uses are adjusted, as needed, to reflect public input and new data. The zone and parcel boundary decisions are recorded in a final allocation map for each alternative under consideration. Adjustments to the Shoreline Categorization Map (see TVA's *Shoreline Management Initiative*, 1998) may be needed to reflect corrections to landrights data and sensitive resource data from field collection.

Final RLMP
Potential changes to the draft RLMP are based on public and agency comments and TVA directives. Once all revisions have been completed, the planning team produces a final RLMP for approval by the TVA Board of Directors or the appropriate designee.

NEPA
Throughout the processes mentioned above, the necessary steps to complete the appropriate environmental review would be finalized as dictated in TVA's NEPA procedures located at http://www.tva.gov/environment/reports/pdf/tvanepa_procedures.pdf.

METHODOLOGY APPLIED DURING RAPID LANDS ASSESSMENT

Overview
With the varying methodologies and allocations, it was often difficult to calculate the acreage of public lands that had been planned for sensitive resources, natural resource management, industrial development, and recreation. In 2006, the Rapid Lands Assessment (RLA) methodology was developed to quickly convert the Multiple Use Tract Allocations and Forecast System designations to Single Use Parcel Allocations or zones.

Planning
A planning team was organized that included biologists, foresters, geographic information systems (GIS) specialists, lands planners, land use specialists, recreation planners, and water quality specialists. The goal of the planning team was to document existing land use conditions into a single allocation designation for Beech River, Chickamauga, Kentucky, Nickajack, Normandy, and Wheeler reservoirs. The current land use zones and definitions are consistent with those mentioned in the Single Use Parcel Allocation methodology.

Allocation
The planning team mapped all existing data for endangered or threatened species, wetlands, natural areas, aquatic habitat, and cultural resources. Since RLA methodology assumes the protection of all sensitive resources, all parcels with known sensitive resources were allocated to Zone 3. However, no additional field assessments were conducted during RLA. The planning team also gathered and evaluated information that had changed since the last reservoir land management plan (if applicable), regional trends, and existing land use agreements. Planning focused on the uncommitted land, and the planning team documented the types of land use agreements for committed lands. The existing land uses were documented using GIS. Next, the lands including marginal strips and other previously unplanned lands were aggregated or subdivided into logical parcels and assigned the single use allocation that best represented existing conditions or current needs. Allocation maps were created to communicate the single use allocations to the public.

At the conclusion of RLA, the following objectives were met:

- Resolution of any remaining conflicting zone designations on tracts/parcels with multiple allocated uses
- Alignment of zone allocations with the Land Policy
- Consistency in allocating land use across all TVA-managed lands

National Environmental Policy Act (NEPA)
Since RLA was originally intended as a communication tool, NEPA was not conducted on the RLA methodology or outcomes.

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Appendix H – Comparison of Programs and Goals Across Alternatives

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BIOLOGICAL AND CULTURAL RESOURCES MANAGEMENT

This table is only intended to be a summary of the programs, goals, and activities described under the four alternatives in Chapter 3. This table does not supersede the descriptions of alternatives within Chapter 3 or any similar tables displayed in the NRP. Furthermore, the NRP may reflect slightly different groupings of programs within each program category.

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
Cultural Resources Management	ARPA Program	Conduct ARPA inspections with __ security checks per year	1,000	by reported incident	5,000	by reported incident or 1,000
		Develop codified regulations to supplement investigative authority			●	
	Archaeological Monitoring and Protection	Protect archaeological site of __ tributary shoreline miles (TSM) or __ main stem shoreline miles (MSM) per year	0.2 TSM and MSM	0.3 - 0.4 TSM	1.1 - 1.3 TSM	0.3 - 0.6 TSM
				0.4 - 0.6 MSM	1.9 - 2.1 MSM	0.4 - 1.1 MSM
		Monitor archaeological sites along __ miles of shoreline per year	mitigation projects only	150 miles	500 miles	150 - 250 miles
	NAGPRA	Ensure NAGPRA compliance	●	●	●	●
	NHPA Section 106 Compliance	Conduct reviews under Section 106 of NHPA	●	●	●	●
		Manage existing mitigation obligations	●			
		Establish a database for managing mitigation obligations		●	●	●
		Pursue a programmatic agreement with individual states regarding compliance for repetitive actions			●	
		Develop emergency procedures for requirements under NHPA Section 106			●	
	Native American Tribal Consultation	Coordinate consultation with federally recognized Indian tribes	●	●	●	●
		Conduct formal consultation workshops with federally recognized tribes every __ years	5 years	5 years	2 years	5 years
	Preservation Program	Conduct archaeological surveys of __ acres of TVA-managed lands per year	2,000 acres	1,000 acres	5,000 acres	1,000 - 3,000 acres

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Maintain historic photo collection, cemetery database, and TVA's historic agency information	●	●	●	●
		Maintain resource data through various data sources	●			
		Develop a comprehensive database and implementation procedures		●	●	●
		Improve curation and management of historic artifact collection		●	●	●
		Develop an online interactive cemetery database for public use			●	
		Annually evaluate and nominate __ sites to the National Register of Historic Places		2 sites	6 sites	2 - 4 sites
		Conduct identification surveys of historic properties located on TVA-managed lands		●	●	●
		Partner with stakeholders to identify traditional cultural properties			●	
	Preserve America	Conduct adaptive reuse studies of TVA historic buildings	●	●	●	●
		Submit NHPA Section 3 reports and Section 110 progress every three years		●	●	●
		Develop a plan for TVA-owned historic properties suitable for heritage tourism		●	●	●
		Target to develop __ new partnerships per year to promote heritage tourism			3 - 5 partners	
Dispersed Recreation Management	Dispersed Recreation Management	Evaluate 70 dispersed recreation areas annually	●			
		Collect data on dispersed recreation sites identified during LCA	●	●	●	●
		Distribute __ dispersed recreation user surveys annually			600	
		Implement __ key opportunities annually	1	5	20	5 - 10
		Implement an educational campaign(s) to promote ecofriendly dispersed recreation		●	●	●
		Improve __ dispersed recreation area(s) annually	1	5	25	5 - 15
		Develop and implement multiyear dispersed recreation plans			●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Develop and adopt formal regulations			●	●
		Conduct __ outdoor clinics annually			100	
	Leave No Trace	Continue to participate in this program	●		●	
		Emphasize partnership and promotion of Leave No Trace			●	
	Trails Management	Manage existing 90 miles of trail system with maintenance restricted to improving safety hazards	●	●		●
		Formally design and implement a Valleywide trails establishment and maintenance program			●	
		Add __ trail miles per year in accordance with Dispersed Recreation multiyear plans		10	20	10
Land Stewardship Assessment Tools	Boundary Maintenance	Conduct boundary maintenance on an as-needed basis at the reservoir level	●	●	●	●
		Develop Valleywide prioritization process for boundary maintenance to be implemented at the reservoir level		●	●	●
		Address Valleywide boundary maintenance incorporating future survey technologies on a __ -year cycle			5-year cycle	up to a 10-year cycle
	Land Condition Assessment, and Land Stewardship Maintenance Checklist	Assess __ acres of TVA-managed lands annually while continuing to refine the Comprehensive and Rapid LCA processes	5,000 acres	20,000 acres	50,000 acres	20,000 - 35,000 acres
		Implement prioritized stewardship activities addressing all public health and safety needs		●	●	●
		Implement prioritized stewardship activities and __ percent of asset preservation needs per year			25 percent	up to 10 percent
		Benchmark others for process improvements			●	●
	Natural Resource Management Implementation Plans	Develop IRM plans for TVA-managed lands at a rate of __ planned reservoirs annually			5	up to 2
		Continue implementation of 10 existing Unit Plans with updated stakeholder input on 18,000 acres of TVA-managed land	●	●	●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Focus implementation efforts on areas with environmental commitments	●	●	●	●
	TVA Natural Heritage Database	Continue current management	●	●	●	●
		Honor data sharing agreements among TVA and other federal and state resource agencies	●	●	●	●
		Expand information-gathering efforts for identification of sensitive resources through partnerships			●	
		Develop predictive models for federally and state-listed species			●	
	TVA Wetlands Database	Continue current management	●	●	●	●
		Conduct additional activities in support of database development, maintenance, and use			●	
		Institute an information-gathering effort on TVA-managed lands for assessments and improvements; incorporate wetlands identified during these surveys into the database			●	
Public Outreach Programs	Archaeological Outreach (Thousand Eyes)	Conduct __ events each year	2 - 3 events	3 - 5 events	10 - 15 events 5 - 10 partners	3 - 10 events up to 3 - 5 partners
	Corporate History Program	Develop a formal TVA corporate history program and conduct regular updates to the TVA timeline			●	●
		Develop an oral history program			●	●
		Develop an annual history public outreach component with __ events per year and develop a Web site			3 - 5 events	Web site only
		Develop a history and archaeology museum			●	
	Cultural Resource Partnerships	Provide __ grant opportunities for archaeological and/or historical research for both academic and nonacademic publications			1 - 2 grants	

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Provide support for __ archaeological field schools			1 - 2 schools	
	Environmental Education Program	Develop and implement this new program			●	●
	Natural Resources Communication	Develop and implement this new program			●	●
	Resource Stewardship Campaigns	Develop and implement this new program to promote natural resources improvements and protection; deliver 25 stakeholder products annually			●	
	Volunteer Program	Establish and implement a formal volunteer program		●	●	●
Sensitive Biological Resources Management	Conservation Planning	Continue to be advisers/participants in planning organizations	●		●	
		Limit TVA's involvement to those efforts required by regulatory compliance		●		●
		Expand role in large-scale planning efforts across the region via partnerships			●	
	Endangered and Threatened Species Program	Continue the requirements under Section 7(a)(2) of ESA and implementation of biological opinion requirements	●	●	●	●
		Continue cave gate maintenance and signage	●	●	●	●
		Continue voluntary monitoring of select species populations	●	●	●	●
		Develop a list of target species, monitoring and management plans, and seek partnerships			●	●
		Establish long-term monitoring and population-trend assessments for all listed species on TVA-managed lands			●	●
	Migratory Birds Management	Continue to meet EO 13186	●	●	●	●
		Develop agency guidelines for EO 13186			●	●
		Continue leadership role in Tennessee River Valley Shorebird Working Group	●	●	●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Provide data to support and participate in national and regional planning efforts for migratory birds		●	●	●
		Cooperate with partners to implement conservation projects for migratory birds on TVA-managed lands			●	●
		Participate in national and regional planning efforts		●	●	●
		Implement __ demonstration projects to benefit regional habitat objectives for migratory birds per year			5	5
		Partner with stakeholders to inventory and monitor waterfowl and other water bird populations along TVA reservoirs			●	●
	Natural Areas Program	Monitor __ percent of TVA's natural areas annually	5	33	33	33
		Develop and implement management plans on __ natural areas annually			33	up to 15
		Implement maintenance needs on natural areas as identified by observations, monitoring, and management plans			●	●
		Designate or remove natural areas via the reservoir lands planning process	●			
		Establish criteria and annually evaluate __ acres of TVA-managed land for potential designation as natural areas outside reservoir lands planning processes			●	●
		Update records to include appropriate information using national standards and methodologies			●	●
		Develop programmatic guidelines for the natural areas program			●	●
	Wetlands Management	Continue implementation of current wetland management practices on TVA-managed lands	●	●	●	●
		Develop a proactive program for wetland identification and protection on TVA-managed lands			●	

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
Terrestrial Habitat Management	Agricultural and Open Lands Management	Manage license agreements on 5,600 acres of TVA-managed lands	●	●		●
		Develop an open land/early successional habitat program through agricultural licensing or cooperative partnerships			●	
		Convert lands unsuitable for program inclusion to improved wildlife/forest habitats at a rate of 50 percent annually			●	
	Dewatering Projects Management	Continue current projects management	●	●		
		Manage existing contractual agreements	●	●	●	●
		Rebuild dewatering units based on per unit review			●	●
		Operate, manage and maintain dewatering unit projects at reestablished conditions			●	●
		Work with local and regional partners to incorporate nature-based tourism into management of dewatering areas projects; includes highlighting dewatering area contributions to migratory bird resource management within the region with linkage to *North American Waterfowl Management Plan* and other migratory bird conservation plans			●	●
	Forest Resource Management	Manage tree hazards and tree cutting/vegetation damage encroachments	●	●	●	●
		Continue small-scale vegetation salvage (tree removal) operations	●	●	●	●
		Monitor broad forestry trends on TVA-managed lands and conduct basic forest protection activities		●	●	●
		Provide support to state forestry assessment plans	●		●	●
		Develop and maintain a qualified fire management crew			●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Develop forest resource program with the intent to inventory, through forest prescription process, 10 percent of TVA reservoir properties annually			●	
	Nonnative Invasive Plant Management	Control NNIP on __ acres of TVA-managed lands per year	600	1,000	40,000	1,000
		Focus NNIP control efforts to areas with environmental commitments and/or sensitive resources		●	●	●
		Actively participate in State Exotic Pest Plant Councils along with regional early detection and rapid response initiatives	●		●	
	Nuisance Animal Control	Resolve animal damage conflicts via existing contractual agreements	●	●	●	●
		Develop and implement proactive strategies to manage feral animal habitation on TVA-managed lands		●	●	●
		Develop programmatic guidelines for addressing nuisance animals			●	
		Establish memorandum of agreement with agencies responsible for regulating wildlife			●	
		Develop and share BMPs with partners to proactively address nuisance animal control			●	
	Terrestrial Greenhouse Gas Sequestration Management	Conduct research projects on __ acres of TVA-managed land focusing on issues related to terrestrial GHG management practices	41		500	
		Conduct __ demonstration projects focusing on issues related to terrestrial GHG management practices	2		6	
		Enter into ___ third-party consortiums focusing on issues related to terrestrial GHG management	2		8	
		Develop and implement a terrestrial GHG management plan			●	
	Wildlife Habitat Council – Third-Party Certifications	Continue management of four current certified projects	●		●	●
		Initiate __ wildlife enhancement projects at new locations on TVA-managed lands			5 projects	

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Establish a third-party review and certification process for wildlife management activities on 10 percent of appropriate TVA–managed lands annually			●	
	Wildlife Habitat Enhancement Partnerships	Integrate with other resource areas to ensure compliance with laws and policies		●	●	●
		Improve habitat on __ acres of TVA-managed lands and outside existing Unit Plan implementation	500	750	20,000	750
		Seek opportunities to increase habitat diversity on those lands under existing contractual agreements with other agencies		●		
		Engage existing partners in the management of licensed lands (target of __ acres per year)			20,000 acres	
		Develop cooperative agreements for use with resource management partners			●	

RECREATION MANAGEMENT

This table is only intended to be a summary of the programs, goals, and activities described under the four alternatives in Chapter 3. This table does not supersede the descriptions of alternatives within Chapter 3 or any similar tables displayed in the NRP. Furthermore, the NRP may reflect slightly different groupings of programs within each program category.

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
Campground Management	Located on Dam or Power Plant Reservations	Manage eight campgrounds	●	●	●	●
		Make __ proactive upgrades consistent with ADAAG	2	1	8	1 - 8
		Establish __ flagship campgrounds with innovative design and efficiency measures	1		1	1
	Located on Other Reservoir Properties	Manage __ campgrounds	4	3	4	3 - 4
		Seek contractual agreements (CA) for campgrounds or potentially close campgrounds	●	●	●	●
		Make __ proactive upgrades consistent with ADAAG			4	up to 3
Day Use Areas Management	Blueways	Develop __ access sites per year to facilitate blueway miles contingent upon available partnerships	1 site		4 sites	
	Day Use Areas	Continue to operate and manage 30 day use areas located on dam reservations	●	●	●	●
		Continue to operate and manage 33 day use areas located off dam reservations	●	●	●	●
		Seek CAs to manage day use areas	●	●	●	●
		Proactively upgrade __ day use areas per year consistent with ADAAG	1		4	up to 2
		Implement __ sustainable initiatives per year for day use areas located on dam reservations	1		4	up to 2
	Greenways	Continue to assist with development, as appropriate	●		●	
		Assist with development of __greenway miles per year			20 miles	
	Stream Access Sites	Manage 81 stream access sites: __ managed by TVA and __ managed via CAs	31 by TVA	31 by TVA	31 by TVA	31 by TVA

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
			50 by CA	50 by CA or close area	50 by CA	50 by CA or close area
		Develop and implement improvements at __ stream access sites			31	
		Assist partners with acquisition and development of additional stream access sites, as appropriate			6 areas	
Public Outreach Programs	Annual Tours	Conduct __ annual tours that feature emerging technologies on recreation areas	2		6	up to 4
	Clean and Green Campground Initiative	Develop and implement this new program			●	
	Foundation and Trust Fund	Establish funding formal trust fund to solicit donations for conservation, environmental, and/or recreation project(s) across the Valley			●	●
	Recreation Information Management	Maintain and enhance existing Internet presence	●	●		●
		Enhance current management to provide self-service and automated support			●	
		Develop interactive dispersed recreation land maps			●	
		Utilize visitor assessments designed to enhance the visitor experience and explore options for upgrades and initiatives			●	
	Recreation Management Regulations	Develop formal regulations to articulate expectations for visitors on TVA-managed lands and to assist with enforcement of use restrictions			●	
		Develop and implement a Resource Ranger Program			●	
Recreation Assessment and Design Tools	Boating Capacity Studies	Partner with state boating law administrators to complete __ studies per year			2	
	Boating Density Assessments	Continue to complete these assessments in support of the associated environmental reviews	●	●	●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
	Developed Recreation Inventory and Surveys	Update recreation inventory for __ TVA-managed reservoirs per year	15		46	up to 23
		Continue field reconnaissance and assessments of recreation areas/sites	●	●	●	●
	Recreation Design Principles	Implement standard construction designs and products that promote compliance with ADAAG, principles of universal design, or other accredited design standards	●	●	●	●
	Recreation Planning, Assistance, and Technical Support	Provide technical support to other agencies and stakeholders and share recreation information, as appropriate	●		●	
		Utilize regional recreation data to guide potential expansion of new campgrounds on TVA-managed lands allocated for developed recreation use	●	●	●	●
		Foster partnerships to assist in identifying unmet recreation needs around TVA-managed reservoirs			●	

RESERVOIR LANDS PLANNING

This table is only intended to be a summary of the allocation designations under the four alternatives in Chapter 3. This table does not supersede the descriptions of alternatives within Chapter 3 or any similar tables displayed in the NRP.

Allocation Designation		Percent of Land per Alternative			
		A	B	C	D
Zone 2	Project Operations	10	4	5 - 7	5 - 7
Zone 3	Sensitive Resource Management	23	12	14 - 17	14 - 17
Zone 4	Natural Resource Conservation	53	70	50 - 68	50 - 68
Zone 5	Industrial	1	2	1 - 2	1 - 2
Zone 6	Developed Recreation	9	7	6 - 25	6 - 25
Zone 7	Shoreline Access	5	5	5	5
Number of Reservoirs Used to Determine Average		30	16	46	46

WATER RESOURCES MANAGEMENT

This table is only intended to be a summary of the programs, goals, and activities described under the four alternatives in Chapter 3. This table does not supersede the descriptions of alternatives within Chapter 3 or any similar tables displayed in the NRP. Furthermore, the NRP may reflect slightly different groupings of programs within each program category.

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
Aquatic Monitoring and Management	Aquatic Ecology Management	Partner and actively participate in restoring the aquatic biological communities			●	
		Develop and evaluate public outreach opportunities to raise public awareness of exotic and invasive aquatic animal species consistent with EO 13112			●	
	Stream and Tailwater Monitoring Program	Conduct __ stream assessments per year	110	50	150	50 - 150
		Share stream and reservoir data with other agencies and stakeholder groups	upon request	upon request	via Web site	upon request or via Web site
Partnership Programs	Case Studies and Research Initiatives	Conduct three case studies or research projects			●	
	Strategic Partnership Planning	Maintain existing relationships, partnerships, and contractual agreements	●	●	●	●
		Develop new and enhance existing relationships, partnerships, and contractual agreements			●	●
Public Outreach Programs	Quality Growth Program	Deliver __ communication products including workshops, new training products, various awards, and/or conferences per year	25 products	Captured under Water Resource Outreach Campaigns		
	Tennessee Valley Clean Marina Program	Maintain certification for 80 marinas	●	●	●	●
		Certify __ new marinas per year			2	
	Water Efficiency Program	Deliver __ educational workshops per year	10	Captured under Water Resource Outreach Campaigns		
	Water Resource Outreach Campaign	Deliver __ stakeholder products per year		20	70	20 - 70
Water Resource Improvement Programs	Reservoir Shoreline Stabilization	Stabilize 8 miles of critically eroding shoreline per year			●	●
	Targeted Reservoir Initiative Program	Develop a reservoir-specific improvement plan			●	●

Program Categories	Programs	Goals and Activities	Alternatives			
			A	B	C	D
		Reduce phosphorus reaching a TVA-managed reservoir by 5,000 per year			●	●
		Improve __ HU in __ years			1 HU / 4 years	up to 1 HU / 4 years
	Targeted Watershed Initiative Program	Reduce suspended sediment reaching streams by __ tons per year	234		1,300	
		Reduce phosphorus reaching streams by __ pounds per year	350		2,000	
		Improve __ HU in __ years	1 HU / 5 years		1 HU / 3 years	
		Deliver __ stakeholder products per year	50		75	
	Water Resource Grant Program	Develop and implement evaluation, management, and implementation processes			●	
	Water Resource Improvement Campaign	Reduce suspended sediment reaching streams by __ tons per year		720	360	720
		Reduce phosphorus reaching streams by __ pounds per year		1,100	550	1,100

Appendix I – Water Resource Pollutant Load Reduction Methodology

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POLLUTION REDUCTION CALCULATION METHODOLOGY

For most pollution reduction programs, pollution reduction levels are estimated with Equation 1:

$$PR_n = \frac{\{(B\$ + L\$)\}}{CR_n}$$

Where: PR_n is the amount of load reduction of pollutant n; *B$* is budgeted program expenditure; *L$* is amount of contributions from partners; and CR_n is the unit cost for load reductions for pollutant *n*. This calculation takes into account the large variety of practices that are likely to be used in any program, each of which has its own cost and pollution reduction characteristics.

For this document, it was assumed that these programs could generate a 100 percent match from partners. Based on modeling work from the Little River in Blount County, Tennessee (TVA unpublished), TVA estimated that average pollutant reduction costs were $3,000 per ton of sediment and $2,000 per pound of phosphorus.

The shoreline stabilization program focuses on a single group of practices. For this program, sediment reduction is calculated as shown in Equation 2:

$$PR_S = BL \times BR \times D \times H$$

Where: PR_S is the sediment load reduction; *BL* is the length of treated bank; *BR* is the recession rate of the bank; *D* is soil bulk density of the bank; and *H* is bank height. Average bank recession rate was assumed to be 0.5 foot per year; average bank soil bulk density was assumed to be 100 pounds/square-foot, and average bank height was assumed to be 10 feet. It was also assumed that total phosphorus reduction from bank stabilization was equal to 0.02 percent of the sediment reduction.*

The phosphorus loading reduction for the Targeted Reservoir Initiative is a ballpark professional-judgment estimate based on the cost of upgrading existing wastewater treatment plants and collection systems.

*Calculated incorrectly in the document and will require correction.

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Appendix J – Ranges in Reservoir Allocations for Alternatives C and D

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RANGES IN RESERVOIR ALLOCATIONS USING UPDATED LAND USE ZONE DEFINITIONS

Note: Zone 1 – Non-TVA Shoreland is not represented because the parcels are private land (on which TVA owns flowage rights) and will not change as a result of the land planning process. The figures in the following tables (1) have been rounded to the nearest whole number; (2) are an estimate based on the RLA; (3) are subject to change pending additional verification; and (4) contain a slight margin of error.

Apalachia Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	91	0	*	0	9	0
Recreation Focus	73	0	0	0	27	0
Conservation Focus	73	0	20	0	7	0

*Includes narrow strip of TVA-retained land along shoreline; acreage not calculated

Beaver Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	11	0	0	0	86	0
Recreation Focus	11	0	0	0	89	0
Conservation Focus	11	0	20	0	69	0

Beech River Project Reservoirs

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	6	0	51	0	43	0
Recreation Focus	5	0	41	0	54	0
Conservation Focus	5	0	61	0	34	0

Big Bear Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	7	82	0	0	10	0
Recreation Focus	6	66	0	0	28	0
Conservation Focus	6	66	20	0	8	0

Blue Ridge Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	62	3	6	0	3	26
Recreation Focus	50	2	5	0	17	26
Conservation Focus	50	2	20	0	2	26

Boone Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	24	17	51	0	9	<1
Recreation Focus	19	14	41	0	27	<1
Conservation Focus	19	14	61	0	7	<1

Cedar Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	10	66	10	0	8	5
Recreation Focus	8	53	8	0	26	5
Conservation Focus	8	53	27	0	7	5

Chatuge Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	22	1	49	0	24	4
Recreation Focus	17	1	39	0	38	4
Conservation Focus	17	1	58	0	19	4

Cherokee Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	7	12	68	0	9	3
Recreation Focus	5	10	55	0	27	3
Conservation Focus	5	10	74	0	7	3

Chickamauga Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	9	34	40	1	7	10
Recreation Focus	7	27	32	0	23	10
Conservation Focus	7	27	50	0	5	10

Clear Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation s					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	100	0	0	0	0	0
Recreation Focus	79	0	0	0	21	0
Conservation Focus	79	0	21	0	0	0

Douglas Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	50	3	40	0	6	1
Recreation Focus	40	3	32	0	25	1
Conservation Focus	40	3	52	0	5	1

Fontana Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	43	0	5	0	47	4
Recreation Focus	35	0	4	0	56	4
Conservation Focus	35	0	23	0	37	4

Fort Loudoun Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	33	3	18	<1	2	44
Recreation Focus	26	2	14	0	13	44
Conservation Focus	26	2	25	0	2	44

Fort Patrick Henry Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	27	7	41	0	14	10
Recreation Focus	21	6	33	0	30	10
Conservation Focus	21	6	51	0	12	10

Great Falls Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	100	0	0	0	0	0
Recreation Focus	10	0	0	0	90*	0
Conservation Focus	80	0	20	0	0	0

*The large change is Zone 6 allocation is due to an existing land use agreement for recreation purposes.

Guntersville Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	6	27	60	1	5	2
Recreation Focus	5	22	48	1	23	2
Conservation Focus	5	22	67	1	4	2

Hiwassee Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	36	11	44	0	4	4
Recreation Focus	29	9	35	0	23	4
Conservation Focus	29	9	54	0	3	4

Kentucky Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	1	2	84	2	5	6
Recreation Focus	1	1	67	1	23	6
Conservation Focus	1	1	86	1	4	6

Little Bear Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	18	69	2	1	6	4
Recreation Focus	14	55	2	1	24	4
Conservation Focus	14	55	21	1	5	4

Melton Hill Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	11	49	24	1	8	6
Recreation Focus	9	40	19	1	26	6
Conservation Focus	9	40	38	1	7	6

Nickajack Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	20	25	51	3	3	0
Recreation Focus	16	20	40	2	22	0
Conservation Focus	16	20	60	2	2	0

Nolichucky Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	5	57	13	<1	25	0
Recreation Focus	4	46	10	<1	40	0
Conservation Focus	4	46	30	<1	40	0

Normandy Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	13	15	67	0	4	<1
Recreation Focus	11	12	54	0	23	<1
Conservation Focus	11	12	74	0	3	<1

Norris Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	3	18	67	0	7	5
Recreation Focus	2	14	54	0	24	5
Conservation Focus	2	14	73	0	5	5

Nottely Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	53	0	33	0	11	2
Recreation Focus	43	0	26	0	29	2
Conservation Focus	43	0	46	0	9	2

Ocoee Reservoirs

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	100	0	0	0	0	0
Recreation Focus	80	0	0	0	20	0
Conservation Focus	80	0	20	0	0	0

Pickwick Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	7	8	69	3	8	6
Recreation Focus	5	7	55	2	25	6
Conservation Focus	5	7	73	2	6	6

South Holston Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	28	<1	46	6	19	1
Recreation Focus	22	1	37	4	35	1
Conservation Focus	22	1	57	4	15	1

Tellico Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	5	17	56	2	15	4
Recreation Focus	4	14	45	2	31	4
Conservation Focus	4	14	64	2	12	4

Tims Ford Reservoir*

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	9	15	58	1	6	10
Recreation Focus	7	12	47	1	23	10
Conservation Focus	7	12	65	1	5	10

*Tims Ford Reservoir contains an additional 64 acres allocated to Zone 8 or a conservation partnership. The allocation of public lands to Zone 8 has been discontinued. However, TVA would continue to manage lands allocated to Zone 8 per Agency policy.

Upper Bear Creek Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	6	81	8	0	3	2
Recreation Focus	5	65	6	0	22	2
Conservation Focus	5	65	26	0	2	3

Watauga Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	46	9	38	0	8	<1
Recreation Focus	36	7	30	0	26	<1
Conservation Focus	36	7	50	0	6	<1

Watts Bar Reservoir*

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	13	28	28	3	12	17
Recreation Focus	10	22	22	2	26	17
Conservation Focus	10	22	39	2	9	17

*TVA is currently reviewing eight parcels of land impacted by the Kingston ash spill. The percentage of land allocated to Zones 2 and 7 may change slightly if these parcels are placed under these zones.

Wheeler Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	4	24	65	2	8	<1
Recreation Focus	3	19	50	2	26	<1
Conservation Focus	3	19	69	2	6	<1

Wilbur Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	83	0	17	0	0	0
Recreation Focus	66	0	14	0	20	0
Conservation Focus	66	0	34	0	0	0

Wilson Reservoir

Rapid Lands Assessment Ranges	Range in Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline	0	0	7	0	63	30
Recreation Focus	0	0	6	0	65	30
Conservation Focus	0	0	20	0	50	30

Appendix K – Listed Species and Sensitive Ecosystems Within the TVA Region

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SENSITIVE OR THREATENED ECOSYSTEMS

Southern Appalachian Spruce-Fir Forests

The southern Appalachian spruce-fir forest occupies the highest elevation zone of the Blue Ridge and parts of the central Appalachians, generally dominated by Fraser fir and red spruce or a mixture of both. Due to topographic and geographic isolation, spruce-fir forests of the southern Appalachians are rich in rare and endemic species (White et al. 1993; Jenkins 2007). These species include rugel's ragwort, spruce-fir moss spider, Carolina and northern flying squirrels, and several species of mosses and liverworts only known from these forests. Commercial logging and associated fires of the early 1900s reduced the forests to a fraction of their former expanse (Korstian 1937). According to Pyle (1988), approximately 75 percent of the remaining southern Appalachian spruce-fir forests occur in the Great Smoky Mountain National Park. Currently these forests are being severely impacted by the balsam woolly adelgid, an imported insect first detected in the southern Appalachians in the late 1950s (Jenkins 2003). Coupled with the balsam wooly adelgid and high levels of acid deposition and ozone exposure, much of the spruce-fir forest has been decimated (Jenkins 2007).

Cedar Glades

Cedar glades are areas of exposed limestone bedrock, gravel, and/or shallow soil over limestone bedrock, sparsely vegetated with low-growing herbaceous plants and red cedars (Quarterman 1993). The greatest concentration occurs within the Interior Plateau ecoregion in central Kentucky, central Tennessee, and northern Alabama. A few glades also occur within the Ridge and Valley Province of Alabama, Georgia, Tennessee, and Virginia. Twenty-two species or subspecies of plants are endemic to these southeastern glades (Baskin and Baskin 1986; 2003). Three federally listed species (Tennessee coneflower, Pyne's ground plum, and leafy prairie clover) along with several state-listed species are found in the cedar glade ecosystem. The total area of cedar glades, most of which are within the TVA region, is only a few thousand acres. Many glades have been destroyed or heavily disturbed by urban development, highway construction, agricultural activities, and reservoir impoundment. Often these fragile ecosystems are used for illegal dumping grounds for household waste and recreational use by off-road vehicles. In addition, many glades are being invaded by exotic invasive plant species that outcompete the native plants for resources.

Remnant Grasslands, Prairies, and Barrens

In the southeastern U.S., native grasslands and prairies, while frequently being reduced to roadside remnants, occur sporadically throughout the region in a wide range of ecological settings (Pyne 2008). According to MacGowen et al. (2009), the open prairie habitat, dominated by little blue stem, also contains many other species of grasses and herbaceous plants (such as big blue stem, Indian grass, compass plant, and Mexican hat) characteristic of the Great Plains. Based on this correlation, it may suggest that during past geologic time, a grassland corridor connected the Great Plains to the southeastern U.S. A specific type of grassland community, the Southern Appalachian Grassy Bald, consists of treeless areas covered by grasses, sedges and forbs and surrounded by spruce-fir forests at high elevations in the Blue Ridge ecoregion (Jenkins 2007). The barrens ecosystems are a mosaic of open canopy woodlands with a grassy understory and areas of essentially treeless grassland. According to DeSelm and Murdock (1993), the barrens in the southern Appalachians are related by their dominant plants to prairies of the west and north but are unique in that they have strong local and southern plant relationships. Big blue stem, little blue stem, Indian grass, pale-purple coneflower, and prairie gentian are species in common with the tall grass prairies of the Midwest, and false asphodel and snowy orchids are

disjunct species from the coastal plain (United States Fish and Wildlife Service 2009). Other than human impacts, one of the main threats associated with these ecosystems is from encroachment of woody vegetation into the open areas.

One of the best examples of this ecosystem is the Southern Coastal Plain Blackland Prairie and Woodlands found in Mississippi and Alabama. Areas of Blackland Prairie are typically found on well-drained, slowly permeable, alkaline soils, while the Blackland Woodlands are mostly oak-hickory forests associated with strongly acidic soils. These open prairies are also home to several endemic and rare species of plants (celestial lily, old Cahaba rosinweed, purple prairie clover, and three-flowered hawthorn). However, due to the region's fertile soil, much of the prairie has been lost to agriculture and has been reduced to small remnants. It is estimated that less than 1 percent of the Black Belt's open prairie habitat remain intact. The remaining prairie remnants are threatened by development, erosion, encroachment of eastern red cedar, waste disposal, fire suppression, and other human activities. In recent years, areas in several of the higher-quality prairies have been disturbed by recreational driving and planting greenfields for deer hunting (MacGowen et al. 2009). In addition, the invasion of Chinese tallow tree, cogongrass, and kudzu alters the ecosystem and inhibits the growth of native species (Stanton and Wymer 2008).

Appalachian Highlands Bogs, Fens, and Seeps

Mountain fens and bogs are unique and uncommon wetlands found in the Appalachian Highlands of the southern U.S. They range in geographic distribution from West Virginia to Alabama and in size from approximately 2 to 120 acres. Appalachian fens occur in four principal landscape positions: headwater regions of mountain streams, stream valleys no longer subject to flooding, slopes intercepting the water table and subject to constant seepage from groundwater, and isolated systems over resistant rock strata (Moorhead et al. 2000). Appalachian Highland bogs and fens are naturally open and usually have a mixture of vegetation types, including patches of open tree canopy, shrub thickets, and beds of herbs, ferns, grasses, and sedges. Floristically, they are closely related to bogs of the northern United States and Canada; however, they often contain a combination of disjunct northern plant species and typical southern wetland species (NatureServe 2009). The federally listed rare plants known from these communities include bog asphodel, bunched arrowhead, green pitcher plant, monkey face orchid, mountain sweet pitcher plant, and swamp pink. According to Warren et al. (2004), southern Appalachian wetlands contain almost one-fifth of North Carolina rare plant species.

Due to the small sizes of most bogs and fens, this ecosystem is one of the most imperiled in the southern Appalachians and is highly susceptible to human alterations, such as draining, filing, or conversion to pasture. Such alterations affect these communities quickly and drastically.

Bottomland Hardwood Forests

Bottomland hardwood forests are deciduous forested wetlands found along rivers and streams of the Southeast and South Central United States, generally in broad floodplains (NatureServe 2009). These forests are dominated by bald cypress, gum (black or tupelo), and oak species (such as basket, overcup, water, and willow), which have the ability to survive in areas that are either seasonally flooded or covered with water much of the year. Bottomland hardwoods serve a critical role in the watershed by reducing the risk and severity of flooding to downstream communities by providing areas to store floodwater. In addition, these wetlands improve water quality by filtering and flushing nutrients, processing organic wastes, and reducing sediment before it reaches open water (United States Environmental Protection Agency [USEPA] 2008). It is estimated that bottomland

hardwood forests once covered almost 30 million acres across the southeastern U.S. and today, only about 40 percent of that area still supports these productive and unique ecosystems. The loss of bottomland hardwoods has been largely due to conversion of the land for agricultural purposes (USEPA 2008).

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Table K-1. Alabama State-Listed Species Located Within or in the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Cambarus hamulatus	Troglobitic Crayfish	S3?	SPCO
Cambarus jonesi	Troglobitic Crayfish	S2	SPCO
Cambarus veitchorum	A Troglobitic Crayfish	S1	TRKD
Orconectes australis australis	A Crayfish	S3	TRKD
Orconectes sheltae	Shelta Cave Crayfish	S1	POTL
Procambarus pecki	Troglobitic Crayfish	S2?	TRKD
Palaemonias alabamae	Alabama Blind Cave Shrimp	S1S2	SP
Gomphus consanguis	Cherokee Clubtail	S1S2	TRKD
Micrasema scotti	A Caddisfly	S1	TRKD
Agapetus gelbae	Glossosomatid Caddisfly	S1	RARE
Agapetus hessi	A Glossosomatid Caddisfly	S1	TRKD
Cheumatopsyche helma	Helma's Cheumatopsyche Caddisfly	S1	RARE
Cheumatopsyche kinlockensis	A Caddisfly	S1	RARE
Hydropsyche cuanis	A Caddisfly	S1	TRKD
Hydropsyche rotosa	A Caddisfly	S1	RARE
Hydropsyche simulans	A Caddisfly	S1	RARE
Ceraclea alabamae	A Caddisfly	S1	RARE
Ceraclea alces	A Caddisfly	S1	RARE
Triaenodes abus	A Caddisfly	S1	RARE
Psilotreta labida	A Caddisfly	S1	TRKD
Chimarra socia	A Caddisfly	S1	TRKD
Dolophilodes major	A Caddisfly	S1	TRKD
Phryganea sayi	A Caddisfly	S1	TRKD
Polycentropus nascotius	A Caddisfly	S1	TRKD
Rhyacophila alabama	A Caddisfly	S1	POTL
Rhyacophila carolae	A Caddisfly	S1	RARE
Rhyacophila fenestra	A Caddisfly	S1	RARE
Rhyacophila minor	A Caddisfly	S1	TRKD
Agarodes stannardi	Stannard's Agarodes Caddisfly	S2	RARE
Actinonaias ligamentina	Mucket	S2	TRKD
Actinonaias pectorosa	Pheasantshell	S1	TRKD
Alasmidonta marginata	Elktoe	SX	EXTI
Alasmidonta viridis	Slippershell Mussel	S1	PROT
Anodontoides radiatus	Rayed Creekshell	S1S2	TRKD
Arcidens confragosus	Rock Pocketbook	S3	TRKD
Cumberlandia monodonta	Spectaclecase	S1	PROT
Cyprogenia stegaria	Fanshell	S1	PROT

Scientific Name	Common Name	State Rank	State Status
Dromus dromas	Dromedary Pearlymussel	S1	PROT
Ellipsaria lineolata	Butterfly	S3	TRKD
Elliptio dilatata	Spike	S1	TRKD
Epioblasma arcaeformis	Sugarspoon	SX	EXTI
Epioblasma biemarginata	Angled Riffleshell	SX	EXTI?
Epioblasma brevidens	Cumberland Combshell	S1	PROT
Epioblasma capsaeformis	Oyster Mussel	SX	PROT
Epioblasma florentina florentina	Yellow-Blossom Pearlymussel	SX	PROT
Epioblasma florentina walkeri	Tan Riffleshell	SX	PROT
Epioblasma haysiana	Acornshell	SH	EXTI?
Epioblasma lenior	Narrow Catspaw	SX	EXTI?
Epioblasma metastriata	Upland Combshell	SX	PROT
Epioblasma obliquata obliquata	Purple Catspaw	SX	PROT
Epioblasma othcaloogensis	Southern Acornshell	SX	PROT
Epioblasma penita	Southern Combshell	S1	PROT
Epioblasma personata	Round Combshell	SX	EXTI
Epioblasma propinqua	Tennessee Riffleshell	SX	EXTI
Epioblasma stewardsonii	Cumberland Leafshell	SX	EXTI
Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	SX	PROT
Epioblasma triquetra	Snuffbox	S1	TRKD
Epioblasma turgidula	Turgid Blossom Pearlymussel	SX	EXTI
Fusconaia barnesiana	Tennessee Pigtoe	S1	TRKD
Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	PROT
Fusconaia cuneolus	Fine-Rayed Pigtoe	S1	PROT
Fusconaia subrotunda	Long-Solid	S1	TRKD
Hemistena lata	Cracking Pearlymussel	SX	PROT
Lampsilis abrupta	Pink Mucket	S1	PROT
Lampsilis fasciola	Wavy-Rayed Lampmussel	S1S2	TRKD
Lampsilis straminea straminea	Rough Fatmucket	S2	TRKD
Lampsilis virescens	Alabama Lampmussel	S1	PROT
Lasmigona complanata	White Heelsplitter	S2S3	TRKD
Lasmigona holstonia	Tennessee Heelsplitter	S1S2	TRKD
Lemiox rimosus	Birdwing Pearlymussel	SX	PROT
Leptodea leptodon	Scaleshell	SX	PROT
Lexingtonia dolabelloides	Slabside Pearlymussel	S1	PROT
Ligumia recta	Black Sandshell	S2	TRKD
Medionidus acutissimus	Alabama Moccasinshell	S1	PROT
Medionidus conradicus	Cumberland Moccasinshell	S1	PROT
Obovaria olivaria	Hickorynut	SX	EXTI

Scientific Name	Common Name	State Rank	State Status
Obovaria retusa	Ring Pink	S1	PROT
Obovaria subrotunda	Round Hickorynut	S2	TRKD
Obovaria unicolor	Alabama Hickorynut	S2	TRKD
Plethobasus cicatricosus	White Wartyback	S1	PROT
Plethobasus cooperianus	Orange-Foot Pimpleback	S1	PROT
Plethobasus cyphyus	Sheepnose	S1	PROT
Pleurobema clava	Clubshell	SX	PROT
Pleurobema cordatum	Ohio Pigtoe	S2	TRKD
Pleurobema decisum	Southern Clubshell	S2	PROT
Pleurobema furvum	Dark Pigtoe	S1	PROT
Pleurobema georgianum	Southern Pigtoe	S1	PROT
Pleurobema marshalli	Flat Pigtoe	SX	PROT
Pleurobema oviforme	Tennessee Clubshell	S1	TRKD
Pleurobema perovatum	Ovate Clubshell	S1	PROT
Pleurobema plenum	Rough Pigtoe	S1	PROT
Pleurobema rubellum	Warrior Pigtoe	S1	TRKD
Pleurobema rubrum	Pyramid Pigtoe	S2	PROT
Pleurobema sintoxia	Round Pigtoe	S1	TRKD
Pleurobema taitianum	Heavy Pigtoe	S1	PROT
Potamilus ohiensis	Pink Papershell	S3	TRKD
Ptychobranchus fasciolaris	Kidneyshell	S1	TRKD
Ptychobranchus greenii	Triangular Kidneyshell	S1	PROT
Ptychobranchus subtentum	Fluted Kidneyshell	SX	PROT
Quadrula cylindrica cylindrica	Rabbitsfoot	S1	PROT
Quadrula fragosa	Winged Mapleleaf	SX	PROT
Quadrula intermedia	Cumberland Monkeyface	S1	PROT
Quadrula metanevra	Monkeyface	S3	TRKD
Quadrula nodulata	Wartyback	S1S2	TRKD
Quadrula stapes	Stirrupshell	SH	PROT
Strophitus subvexus	Southern Creekmussel	S3	TRKD
Strophitus undulatus	Squawfoot	S1	TRKD
Toxolasma cylindrellus	Pale Lilliput	S1	PROT
Toxolasma lividus	Purple Lilliput	S2	TRKD
Toxolasma parvum	Lilliput	S3	TRKD
Truncilla truncata	Deertoe	S1	TRKD
Villosa fabalis	Rayed Bean	SX	PROT
Villosa iris	Rainbow	S3	TRKD
Villosa taeniata	Painted Creekshell	S3	TRKD
Villosa trabalis	Cumberland Bean	SX	PROT

Scientific Name	Common Name	State Rank	State Status
Athearnia anthonyi	Anthony's River Snail	S1	PROT
Campeloma decampi	Slender Campeloma	S1	PROT
Elimia interveniens	Slowwater Elimia	S2	TRKD
Elimia modesta	Coldwater Elimia	S3S4	TRKD
Elimia nassula	Round-Rib Elimia	S1	TRKD
Io fluvialis	Spiny Riversnail	SX	EXTI
Leptoxis minor	Knob Mudalia	S?	EXTI
Lithasia armigera	Armored Rocksnail	S1	TRKD
Lithasia geniculata	Ornate Rocksnail	S1	TRKD
Lithasia lima	Warty Rocksnail	SH	HIST
Lithasia salebrosa	Muddy Rocksnail	S1	TRKD
Lithasia verrucosa	Varicose Rocksnail	S3	TRKD
Pleurocera alveare	Rugged Hornsnail	S2	TRKD
Pleurocera annulifera	Ringed Hornsnail	S3S4	TRKD
Pleurocera brumbyi	Spiral Hornsnail	S2	TRKD
Pleurocera corpulenta	Corpulent Hornsnail	S1	TRKD
Pleurocera curta	Shortspire Hornsnail	S1S2	TRKD
Pleurocera nobilis	Noble Hornsnail	S2	TRKD
Pleurocera pyrenella	Skirted Hornsnail	S2	TRKD
Pleurocera walkeri	Telescope Hornsnail	S3	TRKD
Pyrgulopsis pachyta	Armored Marstonia	S1	PROT
Somatogyrus aureus	Golden Pebblesnail	SH	HIST
Somatogyrus coosaensis	Coosa Pebblesnail	SH	HIST
Somatogyrus excavatus	Ovate Pebblesnail	SH	HIST
Somatogyrus humerosus	Atlas Pebblesnail	SH	HIST
Somatogyrus obtusus	Moon Pebblesnail	SH	HIST
Somatogyrus strengi	Rolling Pebblesnail	SH	THR
Carpiodes carpio	River Carpsucker	S2	TRKD
Cyprinella caerulea	Blue Shiner	S1	PROT
Elassoma alabamae	Spring Pygmy Sunfish	S1	PROT
Erimonax monachus	Spotfin Chub	SX	PROT
Erimystax insignis	Blotched Chub	S2	TRKD
Etheostoma blennioides	Greenside Darter	S3	TRKD
Etheostoma boschungi	Slackwater Darter	S1	PROT
Etheostoma camurum	Bluebreast Darter	S1	TRKD
Etheostoma corona	Crown Darter	S2	TRKD
Etheostoma ditrema	Coldwater Darter	S1	PROT
Etheostoma douglasi	Tuskaloosa Darter	S2	TRKD
Etheostoma flabellare	Fantail Darter	S3	TRKD

Scientific Name	Common Name	State Rank	State Status
Etheostoma jessiae	Blueside Darter	S3	TRKD
Etheostoma kennicotti	Stripetail Darter	S3	TRKD
Etheostoma neopterum	Lollipop Darter	S1	PROT
Etheostoma rufilineatum	Redline Darter	S3	TRKD
Etheostoma simoterum	Snubnose Darter	S3	TRKD
Etheostoma trisella	Trispot Darter	SX	TRKD
Etheostoma tuscumbia	Tuscumbia Darter	S2	PROT
Etheostoma wapiti	Boulder Darter	S1	PROT
Hemitremia flammea	Flame Chub	S3	TRKD
Hybopsis amblops	Bigeye Chub	S3	TRKD
Ichthyomyzon castaneus	Chestnut Lamprey	S2	TRKD
Ichthyomyzon greeleyi	Mountain Brook Lamprey	S1	TRKD
Moxostoma anisurum	Silver Redhorse	S2	TRKD
Notropis albizonatus	Palezone Shiner	S1	PROT
Notropis cahabae	Cahaba Shiner	S2	PROT
Notropis micropteryx	Rosyface Shiner	S2	TRKD
Notropis photogenis	Silver Shiner	S1	TRKD
Notropis sp. 4	Sawfin Shiner	S2	TRKD
Noturus eleutherus	Mountain Madtom	S1	TRKD
Noturus exilis	Slender Madtom	S3	TRKD
Noturus flavus	Stonecat	S1	TRKD
Percina brevicauda	Coal Darter	S2	TRKD
Percina burtoni	Blotchside Logperch	S1	TRKD
Percina evides	Gilt Darter	S2	TRKD
Percina lenticula	Freckled Darter	S2S3	TRKD
Percina shumardi	River Darter	S3	TRKD
Percina sipsi	Bankhead Darter	S1	TRKD
Percina tanasi	Snail Darter	S1	PROT
Phenacobius uranops	Stargazing Minnow	S1	TRKD
Phoxinus erythrogaster	Southern Redbelly Dace	S3	TRKD
Polyodon spathula	Paddlefish	S3	PROT
Speoplatyrhinus poulsoni	Alabama Cavefish	S1	PROT
Typhlichthys subterraneus	Southern Cavefish	S3	PROT
Plant Species			
Leavenworthia alabamica	Alabama Glade-Cress	S2	SLNS
Jamesianthus alabamensis	Alabama Jamesianthus	S3	SLNS
Delphinium alabamicum	Alabama Larkspur	S2	SLNS
Cheilanthes alabamensis	Alabama Lipfern	S3	SLNS
Scutellaria alabamensis	Alabama Skullcap	S2	SLNS

Scientific Name	Common Name	State Rank	State Status
Neviusia alabamensis	Alabama Snow-Wreath	S2	SLNS
Rubus allegheniensis	Allegheny Blackberry	S1	SLNS
Pachysandra procumbens	Allegheny-Spurge	S2S3	SLNS
Diarrhena americana	American Beakgrain	S2	SLNS
Frasera caroliniensis	American Columbo	S2	SLNS
Monotropa hypopithys	American Pinesap	S2	SLNS
Cotinus obovatus	American Smoke-Tree	S2	SLNS
Aralia racemosa	American Spikenard	S1	SLNS
Trichomanes boschianum	Appalachian Bristle Fern	S3	SLNS
Cimicifuga rubifolia	Appalachian Bugbane	SH	SLNS
Isoetes engelmannii	Appalachian Quillwort	S3	SLNS
Viburnum bracteatum	Arrow-Wood	S1	SLNS
Crataegus ashei	Ash's Hawthorn	S1	SLNS
Prenanthes barbata	Barbed Rattlesnake-Root	S1S2	SLNS
Comandra umbellata	Bastard Toad-Flax	S1	SLNS
Penstemon tenuiflorus	Beard-Tongue	S2S3	SLNS
Collinsia verna	Blue-Eyed Mary	S1	SLNS
Solidago uliginosa	Bog Goldenrod	SH	SLNS
Lobelia boykinii	Boykin's Lobelia	S1S2	SLNS
Asplenium bradleyi	Bradley's Spleenwort	S2	SLNS
Boykinia aconitifolia	Brook Saxifrage	S1	SLNS
Carex brysonii	Bryson's Sedge	S1	SLNS
Pyrularia pubera	Buffalo-Nut	S2	SLNS
Isoetes butleri	Butler's Quillwort	S2	SLNS
Juglans cinerea	Butternut	S1	SLNS
Lilium canadense	Canada Lily	S2	SLNS
Viola canadensis	Canada Violet	S2	SLNS
Anemone caroliniana	Carolina Anemone	S3	SLNS
Rhododendron minus	Carolina Rhododendron	S2	SLNS
Halesia carolina	Carolina Silverbell	S2	SLNS
Claytonia caroliniana	Carolina Spring-Beauty	S1	SLNS
Stylophorum diphyllum	Celandine Poppy	S1	SLNS
Celastrus scandens	Climbing Bittersweet	S2	SLNS
Callirhoe alcaeoides	Clustered Poppy-Mallow	S2	SLNS
Equisetum arvense	Common Horsetail	S2	SLNS
Eurybia surculosa	Creeping Aster	S1	SLNS
Croomia pauciflora	Croomia	S2	SLNS
Silphium brachiatum	Cumberland Rosinweed	S2	SLNS
Trillium decumbens	Decumbent Trillium	S3S4	SLNS

Scientific Name	Common Name	State Rank	State Status
Diphasiastrum tristachyum	Deep-Root Clubmoss	S1	SLNS
Amelanchier arborea	Downy Serviceberry	S1?	SLNS
Lesquerella densipila	Duck River Bladderpod	S1	SLNS
Dicentra cucullaria	Dutchman's Breeches	S2	SLNS
Trichomanes petersii	Dwarf Filmy-Fern	S2	SLNS
Rudbeckia auriculata	Eared Coneflower	S1	SLNS
Echinacea purpurea	Eastern Purple Coneflower	S3	SLNS
Carex eburnea	Ebony Sedge	S2	SLNS
Viola egglestonii	Eggleston's Violet	S1	SLNS
Sida elliottii	Elliott Sida	S2	SLNS
Melanthium parviflorum	False Helleborne	S1S2	SLNS
Enemion biternatum	False Rue-Anemone	S2	SLNS
Talinum mengesii	Fame-Flower	S2S3	SLNS
Hottonia inflata	Featherfoil	S2	SLNS
Arnoglossum plantagineum	Fen Indian-Plantain	S1?	SLNS
Dalea gattingeri	Gattinger Prairie-Clover	S3	SLNS
Athyrium pycnocarpon	Glade Fern	S1S2	SLNS
Fimbristylis brevivaginata	Glade Fimbristylis	S1	SLNS
Hydrastis canadensis	Goldenseal	S2	SLNS
Dryopteris goldiana	Goldie's Woodfern	S1	SLNS
Hymenophyllum tayloriae	Gorge Filmy Fern	S1	SLNS
Ribes curvatum	Granite Gooseberry	S2	SLNS
Cyperus granitophilus	Granite-Loving Flatsedge	S2	SLNS
Lysimachia graminea	Grass-Leaf Loosestrife	S1	SLNS
Spiranthes magnicamporum	Great Plains Ladies'-Tresses	S3	SLNS
Oxalis grandis	Great Yellow Wood-Sorrel	S1	SLNS
Synandra hispidula	Guyandotte Beauty	S1	SLNS
Cuscuta harperi	Harper's Dodder	S2	SLNS
Linum sulcatum var. harperi	Harper's Grooved-Yellow Flax	S1	SLNS
Eriogonum longifolium var. harperi	Harper's Umbrella-Plant	S1	SLNS
Plantago cordata	Heartleaved Plantain	S1	SLNS
Triosteum angustifolium	Horse-Gentian	S1	SLNS
Monarda clinopodia	Horsemint	S2	SLNS
Trillium pusillum var. 1	Interior Least Trillium	S2	SLNS
Parnassia asarifolia	Kidneyleaf Grass-of-Parnassus	S2	SLNS
Neobeckia aquatica	Lake-Cress	S1	SLNS
Trillium lancifolium	Lance-Leaf Trillium	S2S3	SLNS
Isotria verticillata	Large Whorled Pogonia	S2	SLNS
Cypripedium pubescens	Large Yellow Lady's-Slipper	S3	SLNS

Scientific Name	Common Name	State Rank	State Status
Ophioglossum engelmannii	Limestone Adder's-Tongue	S2S3	SLNS
Talinum calcaricum	Limestone Fame-Flower	S2	SLNS
Thalictrum mirabile	Little Mountain Meadow-Rue	S2	SLNS
Allium speculae	Little River Canyon Onion	S2	SLNS
Helianthus longifolius	Longleaf Sunflower	S1S2	SLNS
Asplenium trichomanes	Maidenhair Spleenwort	S2S3	SLNS
Leavenworthia uniflora	Michaux Leavenworthia	S2	SLNS
Silphium mohrii	Mohr's Rosin-Weed	S1	SLNS
Stewartia ovata	Mountain Camellia	S2S3	SLNS
Muhlenbergia sobolifera	Muhly Grass	S1	SLNS
Rhynchospora colorata	Narrow-Leaf Whitetop	S3S4	SLNS
Nestronia umbellula	Nestronia	S2	SLNS
Trillium flexipes	Nodding Trillium	S2S3	SLNS
Bigelowia nuttallii	Nuttall's Rayless Golden-Rod	S3	SLNS
Orobanche uniflora	One-Flowered Broomrape	S2	SLNS
Silene ovata	Ovate Catchfly	S2	SLNS
Geum virginianum	Pale Avens	S1	SLNS
Mirabilis albida	Pale Umbrella-Wort	S2	SLNS
Leavenworthia exigua var. lutea	Pasture Glade-Cress	S1	SLNS
Cypripedium acaule	Pink Lady-Slipper	S3	SLNS
Chelone lyonii	Pink Turtlehead	S1	SLNS
Trillium recurvatum	Prairie Trillium	S2	SLNS
Silphium pinnatifidum	Prairie-Dock	S1	SLNS
Ribes cynosbati	Prickly Gooseberry	S1S2	SLNS
Salix humilis	Pussy Willow	S2S3	SLNS
Aplectrum hyemale	Puttyroot	S2	SLNS
Platanthera lacera	Ragged Fringe Orchid	S2	SLNS
Huperzia porophila	Rock Clubmoss	S1	SLNS
Sabatia capitata	Rose-Gentian	S2	SLNS
Silene rotundifolia	Roundleaf Catchfly	S1S2	SLNS
Calamovilfa arcuata	Sandreed Grass	S1	SLNS
Castilleja coccinea	Scarlet Indian-Paintbrush	S1	SLNS
Carex purpurifera	Sedge	S2	SLNS
Polygala senega var. latifolia	Seneca Snakeroot	S1	SLNS
Trillium sessile	Sessile Trillium	S2	SLNS
Huperzia lucidula	Shining Clubmoss	S2	SLNS
Hymenocallis coronaria	Shoals Spider-Lily	S2	SLNS
Eurybia spectabilis	Showy Aster	S2	SLNS
Orchis spectabilis	Showy Orchid	S3	SLNS

Scientific Name	Common Name	State Rank	State Status
Stewartia malacodendron	Silky-Camellia	S2S3	SLNS
Allium tricoccum	Small White Leek	S1	SLNS
Diamorpha smallii	Small's Stonecrop	S3	SLNS
Blephilia subnuda	Smooth Blephilia	S1S2	SLNS
Symphyotrichum laeve var. concinnum	Smooth Blue Aster	S1	SLNS
Lathyrus venosus	Smooth Veiny Peavine	S1	SLNS
Onosmodium molle ssp. molle	Soft False Gromwell	S2	SLNS
Carex austrocaroliniana	South Carolina Sedge	S2?	SLNS
Polygonella americana	Southern Jointweed	S1	SLNS
Thalictrum debile	Southern Meadow-Rue	S2	SLNS
Trillium sulcatum	Southern Red Trillium	S1	SLNS
Listera australis	Southern Twayblade	S2	SLNS
Selaginella arenicola ssp. riddellii	Spikemoss	S2	SLNS
Selaginella rupestris	Spikemoss	S2S3	SLNS
Disporum maculatum	Spotted Mandarin	S1	SLNS
Andrachne phyllanthoides	Spurge	S2S3	SLNS
Hypericum nudiflorum	St. John's-Wort	S2	SLNS
Hypericum dolabriforme	Straggling St. John's-Wort	SH	SLNS
Rudbeckia heliopsidis	Sun-Facing Coneflower	S2	SLNS
Schoenolirion croceum	Sunnybell	S2	SLNS
Schoenolirion wrightii	Sunnybell	S1	SLNS
Panicum lithophilum	Swallen's Panic-Grass	S1	SLNS
Monotropsis odorata var. odorata	Sweet Pinesap	S1	SLNS
Acorus calamus	Sweetflag	S1	SLNS
Delphinium exaltatum	Tall Larkspur	SH	SLNS
Cystopteris tennesseensis	Tennessee Bladderfern	S2	SLNS
Polymnia laevigata	Tennessee Leafcup	S2S3	SLNS
Astragalus tennesseensis	Tennessee Milk-Vetch	S1S2	SLNS
Rhynchospora thornei	Thorne's Beakrush	S1	SLNS
Crataegus triflora	Three-Flowered Hawthorn	S2	SLNS
Silphium trifoliatum var. latifolium	Threeleaf Rosinweed	S3	SLNS
Pediomelum subacaule	Tuberous Scurfpea	S2	SLNS
Lilium superbum	Turk's Cap Lily	S2	SLNS
Jeffersonia diphylla	Twinleaf	S2	SLNS
Mitella diphylla	Two-Leaf Bishop's-Cap	S1	SLNS
Valeriana pauciflora	Valerian	S1	SLNS
Asplenium heteroresiliens	Wagner's Spleenwort	S1	SLNS
Euonymus atropurpureus	Wahoo	S3	SLNS
Asplenium ruta-muraria	Wall-Rue Spleenwort	S2	SLNS

Scientific Name	Common Name	State Rank	State Status
Hydrophyllum appendiculatum	Waterleaf	S2?	SLNS
Elodea canadensis	Waterweed	S1	SLNS
Silene caroliniana ssp. wherryi	Wherry's Catchfly	S1S2	SLNS
Cypripedium candidum	White Lady-Slipper	S1	SLNS
Erythronium albidum	White Trout-Lily	S1S2	SLNS
Helianthus glaucophyllus	White-Leaved Sunflower	SH	SLNS
Fothergilla major	Witch-Alder	S2	SLNS
Dryopteris x australis	Woodfern	S1	SLNS
Coreopsis pulchra	Woodland Tickseed	S2	SLNS
Agastache nepetoides	Yellow Giant-Hyssop	S1	SLNS
Ranunculus flabellaris	Yellow Water-Crowfoot	S1	SLNS
Cladrastis kentukea	Yellowwood	S3	SLNS
Terrestrial Animal Species			
Necturus alabamensis	Black Warrior Waterdog	S2	TRKD
Hemidactylium scutatum	Four-Toed Salamander	S3	TRKD
Aneides aeneus	Green Salamander	S3	PROT
Cryptobranchus alleganiensis	Hellbender	S2	PROT
Desmognathus ocoee	Mountain Dusky Salamander	S2	TRKD
Desmognathus aeneus	Seepage Salamander	S2	TRKD
Ambystoma texanum	Smallmouth Salamander	S3	TRKD
Plethodon serratus	Southern Redback Salamander	S2S3	TRKD
Gyrinophilus palleucus	Tennessee Cave Salamander	S2	PROT
Ambystoma tigrinum	Tiger Salamander	S3	TRKD
Plethodon websteri	Webster's Salamander	S3	TRKD
Rana sylvatica	Wood Frog	S2	TRKD
Botaurus lentiginosus	American Bittern	S1	TRKD
Thryomanes bewickii altus	Appalachian Bewick's Wren	S1	PROT
Aimophila aestivalis	Bachman's Sparrow	S3	TRKD
Vermivora bachmanii	Bachman's Warbler	SX	EXTI
Haliaeetus leucocephalus	Bald Eagle	S3	PROT
Thryomanes bewickii bewickii	Bewick's Wren	SH	PROT
Dendroica cerulea	Cerulean Warbler	S1	TRKD
Accipiter cooperii	Cooper’s Hawk	S3	PROT
Chondestes grammacus	Lark Sparrow	S3	TRKD
Ammodramus savannarum	Grasshopper Sparrow	S3	TRKD
Falco peregrinus	Peregrine Falcon	SH	PROT
Charadrius melodus	Piping Plover	S1	END/THR
Picoides borealis	Red-Cockaded Woodpecker	S2	PROT
Bonasa umbellus	Ruffed Grouse	S1	TRKD

Scientific Name	Common Name	State Rank	State Status
Vireo gilvus	Warbling Vireo	S1	TRKD
Mycteria americana	Wood Stork	S2	PROT
Neotoma magister	Allegheny Woodrat	S3	TRKD
Sylvilagus obscurus	Appalachian Cottontail	S1	TRKD
Tadarida brasiliensis	Brazilian Free-Tailed Bat	S3	TRKD
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S2	PROT
Myotis leibii	Eastern Small-Footed Bat	S1	TRKD
Spilogale putorius	Eastern Spotted Skunk	S2S3	TRKD
Myotis grisescens	Gray Bat	S2	PROT
Myotis sodalis	Indiana Bat	S2	PROT
Myotis lucifugus	Little Brown Bat	S3	TRKD
Mustela frenata	Long-Tailed Weasel	S3	PROT
Zapus hudsonius	Meadow Jumping Mouse	S3	PROT
Myotis septentrionalis	Northern Long-Eared Bat	S2	TRKD
Microtus ochrogaster	Prairie Vole	S2	TRKD
Sorex hoyi	Pygmy Shrew	SNR	TRKD
Myotis austroriparius	Southeastern Bat	S2	PROT
Graptemys pulchra	Alabama Map Turtle	S3	PROT
Macrochelys temminckii	Alligator Snapping Turtle	S3	PROT
Graptemys nigrinoda	Black-Knobbed Map Turtle	S3	TRKD
Pituophis melanoleucus lodingi	Black Pine Snake	S2	PROT
Masticophis flagellum	Coachwhip	S3	PROT
Eumeces anthracinus	Coal Skink	S3	TRKD
Lampropeltis triangulum triangulum	Eastern Milk Snake	S2	TRKD
Sternotherus depressus	Flattened Musk Turtle	S2	PROT
Graptemys geographica	Map Turtle	S3	TRKD
Lampropeltis calligaster rhombomaculata	Mole Kingsnake	S3	TRKD
Pituophis melanoleucus melanoleucus	Northern Pine Snake	S3	TRKD
Graptemys ouachitensis	Ouachita Map Turtle	S3	TRKD
Lampropeltis calligaster calligaster	Prairie Kingsnake	S1S2	TRKD
Lampropeltis triangulum syspila	Red Milk Snake	S2	TRKD
Eumeces inexpectatus	Southeastern Five-Lined Skink	S3	NOST
Batriasymmodes spelaeus	A Beetle	S3	TRKD
Batrisodes jonesi	A Beetle	S2	TRKD
Batrisodes tumoris	A Beetle	S1	TRKD
Batriasymmodes spelaeus	A Beetle	S3	TRKD
Batrisodes jocuvestus	A Beetle	S1	TRKD
Batrisodes specus	A Beetle	S2	TRKD
Batrisodes subterraneus	A Beetle	S1	TRKD

Scientific Name	Common Name	State Rank	State Status
Batrisodes valentinei	A Beetle	S2	TRKD
Catops gratiosa	A Beetle	S2	PROT
Lesteva pallipes	A Beetle	S1	TRKD
Ptomaphagus laticornis	A Beetle	S1	TRKD
Ptomaphagus valentinei	A Beetle	S2	TRKD
Speleochus synstygicus	A Cave Obligate Beetle	S1	TRKD
Ptomaphagus chromolithus	A Cave Obligate Beetle	S2	TRKD
Ptomaphagus longicornis	A Cave Obligate Beetle	S2	TRKD
Pseudanophthalmus fluviatilis	A Cave Obligate Beetle	S2	TRKD
Pseudanophthalmus profundus	A Cave Obligate Beetle	S2	TRKD
Pseudanophthalmus alladini	A Cave Obligate Beetle	S2	TRKD
Pseudanophthalmus meridionalis	A Cave Obligate Beetle	S2	TRKD
Pseudotremia nyx	A Cave Obligate Millipede	S1	TRKD
Alabamocreagris pecki	A Cave Obligate Pseudoscorpion	S1S2	TRKD
Aphrastochthonius tenax	A Cave Obligate Pseudoscorpion	S1S2	TRKD
Apochthonius russelli	A Cave Obligate Pseudoscorpion	S1	TRKD
Nesticus barri	A Cave Obligate Spider	S3	TRKD
Pseudanophthalmus distinguens	A Ground Beetle	S1	TRKD
Pseudanophthalmus lodingi	A Ground Beetle	S1S2	TRKD
Rhadine caudata	A Ground Beetle	S2	TRKD
Litocampa henroti	A Hexapod	S1	TRKD
Folsomia candida	A Springtail	S1	TRKD
Pseudosinella hirsuta	A Springtail	S3	TRKD
Pseudosinella violenta	A Springtail	S1	TRKD
Pseudanophthalmus assimilis	West Wills Valley Cave Beetle	S1	TRKD
Nesticus jonesi	Cave Spring Cave Spider	S1	TRKD

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Possibly extirpated; SNR = Not yet ranked; SX = Presumed extirpated

State status: END = Endangered; EXTI = Extinct; HIST = Historic records only; NOST = Species having no status but being tracked as sensitive; POTL = Potential/Species is being considered for state listing; PROT = Protected; RARE = Rare; SLNS = No state status; SP = Protected; SPCO = Species of concern; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species

Table K-2. Georgia State-Listed Species Located Within or In the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Epioblasma metastriata	Upland Combshell	S1	END
Epioblasma othcaloogensis	Southern Acornshell	S1	END
Epioblasma penita	Southern Combshell	S1	END
Lampsilis altilis	Fine-Lined Pocketbook	S2	THR
Medionidus acutissimus	Alabama Moccasinshell	S1	THR
Medionidus parvulus	Coosa Moccasinshell	S1	END
Pleurobema chattanoogaense	Painted Clubshell	S1	TRKD
Pleurobema decisum	Southern Clubshell	SH	END
Pleurobema georgianum	Southern Pigtoe	S1	END
Pleurobema hanleyianum	Georgia Pigtoe	S1	END
Pleurobema perovatum	Ovate Clubshell	SH	END
Ptychobranchus greenii	Triangular Kidneyshell	S1	END
Strophitus connasaugaensis	Alabama Creekmussel	S2S3	END
Villosa trabalis	Cumberland Bean	SH	HIST
Cyprinella caerulea	Blue Shiner	S1S2	END
Erimonax monachus	Spotfin Chub	SH	EXTI
Erimystax insignis	Blotched Chub	S2	THR
Etheostoma brevirostrum	Holiday Darter	S2	THR
Etheostoma cinereum	Ashy Darter	S1	TRKD
Etheostoma ditrema	Coldwater Darter	S1	THR
Etheostoma etowahae	Etowah Darter	S2	THR
Etheostoma scotti	Cherokee Darter	S2	THR
Etheostoma trisella	Trispot Darter	S1	THR
Etheostoma vulneratum	Wounded Darter	S2	END
Fundulus catenatus	Northern Studfish	S1	THR
Hemitremia flammea	Flame Chub	S1	END
Hybopsis amblops	Bigeye Chub	S1S2	RARE
Ichthyomyzon bdellium	Ohio Lamprey	S3?	RARE
Luxilus chrysocephalus	Striped Shiner	S3	TRKD
Micropterus cataractae	Shoal Bass	S3	TRKD
Moxostoma carinatum	River Redhorse	S2	RARE
Moxostoma sp. 2	Sicklefin Redhorse	S2	RARE
Notropis ariommus	Popeye Shiner	S1	THR
Notropis hypsilepis	Highscale Shiner	S2S3	THR
Notropis lineapunctata	Lined Chub	S3	TRKD
Notropis photogenis	Silver Shiner	S1	END
Noturus flavipinnis	Yellowfin Madtom	SH	EXTI

Scientific Name	Common Name	State Rank	State Status
Noturus munitus	Frecklebelly Madtom	S1	END
Percina antesella	Amber Darter	S1	END
Percina aurantiaca	Tangerine Darter	S1	THR
Percina aurolineata	Goldline Darter	S1	THR
Percina jenkinsi	Conasauga Logperch	S1	END
Percina kusha	Bridled Darter	S2	RARE
Percina lenticula	Freckled Darter	S1	END
Percina sciera	Dusky Darter	S1	RARE
Percina squamata	Olive Darter	S1	THR
Percina tanasi	Snail Darter	S1	THR
Phenacobius crassilabrum	Fatlips Minnow	S1	END
Phenacobius uranops	Stargazing Minnow	S1	THR
Typhlichthys subterraneus	Southern Cavefish	S1	RARE
Plant Species			
Neviusia alabamensis	Alabama Snow-Wreath	S1	THR
Viburnum bracteatum	Arrow-Wood	S1	END
Hypericum sphaerocarpum	Barrens St. Johns-Wort	S1	SPCO
Carex biltmoreana	Biltmore Sedge	S1	THR
Packera millefolia	BR Ragwort	S1	THR
Sanguisorba canadensis	Canada Burnet	S1	THR
Delphinium tricorne	Dwarf Larkspur	S2?	SPCO
Xerophyllum asphodeloides	Eastern Turkeybeard	S1	RARE
Viola egglestonii	Eggleston's Violet	S2	SPCO
Lindernia saxicola	False Pimpernel	SH	END
Lysimachia fraseri	Fraser Loosestrife	S1S2	RARE
Cymophyllus fraserianus	Fraser's Sedge	S1	THR
Gentianopsis crinita	Fringed Gentian	S1	THR
Leavenworthia exigua var. exigua	Glade Cress	S2	THR
Hydrastis canadensis	Goldenseal	S2	END
Spiranthes magnicamporum	Great Plains Ladies'-Tresses	S1	END
Polemonium reptans	Greek Valerian	S1	SPCO
Dryopteris celsa	Log Fern	S2	SPCO
Carex manhartii	Manhart Sedge	S2S3	THR
Sarracenia purpurea	Northern Pitcher-Plant	S1	END
Trientalis borealis	Northern Starflower	S1S2	END
Shortia galacifolia	Oconee-Bells	S1SE	END
Cypripedium acaule	Pink Lady-Slipper	S4	UNUS
Platanthera peramoena	Purple Fringeless Orchid	S1	SPCO
Sabatia capitata	Rose-Gentian	S2	RARE

Scientific Name	Common Name	State Rank	State Status
Silene regia	Royal Catchfly	S1	RARE
Carex misera	Sedge	S1	THR
Carex purpurifera	Sedge	S2	THR
Cypripedium parviflorum	Small Yellow Lady's-Slipper	S3?	UNUS
Thalictrum debile	Southern Meadow-Rue	S1	THR
Potentilla tridentata	Three-Toothed Cinquefoil	S1	END
Jeffersonia diphylla	Twinleaf	S1	END
Agastache nepetoides	Yellow Giant-Hyssop	S1	SPCO
Terrestrial Animal Species			
Desmognathus folkertsi	Dwarf Black-Bellied Salamander	S2	TRKD
Hemidactylium scutatum	Four-Toed Salamander	S3	TRKD
Aneides aeneus	Green Salamander	S2	RARE
Cryptobranchus alleganiensis	Hellbender	S2	RARE
Pseudacris brachyphona	Mountain Chorus Frog	S2	TRKD
Necturus maculosus	Mudpuppy	S1	TRKD
Plethodon petraeus	Pigeon Mountain Salamander	S1	RARE
Plethodon shermani	Red-Legged Salamander	S1	TRKD
Desmognathus aeneus	Seepage Salamander	S3	TRKD
Desmognathus marmoratus	Shovelnose Salamander	S3	TRKD
Plethodon teyahalee	Southern Appalachian Salamander	S2	TRKD
Plethodon metcalfi	Southern Gray-Cheeked Salamander	S2	TRKD
Gyrinophilus palleucus	Tennessee Cave Salamander	S1	THR
Plethodon websteri	Webster’s Salamander	S2	TRKD
Botaurus lentiginosus	American Bittern	S3?	TRKD
Falco sparverius	American Kestrel	S3	TRKD
Aimophila aestivalis	Bachman's Sparrow	S3	RARE
Haliaeetus leucocephalus	Bald Eagle	S2	THR
Thryomanes bewickii altus	Bewick's Wren	SNR	TRKD
Dendroica cerulea	Cerulean Warbler	S3?	RARE
Corvus corax	Common Raven	SU	RARE
Vermivora chrysoptera	Golden-Winged Warbler	S1	END
Ammodramus henslowii	Henslow’s Sparrow	S3	RARE
Empidonax minimus	Least Flycatcher	S3	TRKD
Falco peregrinus	Peregrine Falcon	S1	RARE
Charadrius melodus	Piping Plover	S1	THR
Loxia curvirostra	Red Crossbill	SU	TRKD
Picoides borealis	Red-Cockaded Woodpecker	S2	END
Limnothlypis swainsonii	Swainson’s Warbler	S3	TRKD
Mycteria americana	Wood Stork	S2	END

Scientific Name	Common Name	State Rank	State Status
Sylvilagus obscurus	Appalachian Cottontail	S1S2	RARE
Sorex cinereus	Common Shrew	S2S3	TRKD
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S3?	RARE
Myotis leibii	Eastern Small-Footed Bat	S2?	TRKD
Neotoma floridana	Eastern Woodrat	S3	TRKD
Myotis grisescens	Gray Bat	S1	END
Parascalops breweri	Hairy-Tailed Mole	S1	TRKD
Myotis sodalis	Indiana Bat	S1	END
Mustela nivalis	Least Weasel	S1	TRKD
Sorex dispar	Long-Tailed Shrew	S1	TRKD
Sorex hoyi	Pygmy Shrew	S2	TRKD
Neotoma floridana haematoreia	Southern Appalachian Woodrat	S3	TRKD
Synaptomys cooperi	Southern Bog Lemming	S1	TRKD
Condylura cristata	Star-Nosed Mole	S2?	TRKD
Sorex palustris	Water Shrew	S1	TRKD
Graptemys pulchra	Alabama Map Turtle	S1	RARE
Glyptemys muhlenbergii	Bog Turtle	S1	END
Eumeces anthracinus	Coal Skink	S2	TRKD
Lampropeltis triangulum triangulum	Eastern Milk Snake	S2	TRKD
Graptemys geographica	Map Turtle	S1	RARE
Pituophis nelanoleucus melanoleucus	Northern Pine Snake	S2	TRKD
Ophisaurus attenuatus	Slender Glass Lizard	S3	TRKD

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Possibly extirpated; SU = Unrankable; SNR = State not ranked; species is considered sensitive but has not yet been assigned a state rank
State status: END = Endangered; EXTI = Extinct; HIST = Historic records only; RARE = Rare; SPCO = Species of concern; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species; UNUS = Unusual

Table K-3. Kentucky State-Listed Species Located Within or In the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Barbicambarus cornutus	Bottlebrush Crayfish	S2	SPCO
Cambarellus shufeldtii	Cajun Dwarf Crayfish	S2	SPCO
Orconectes lancifer	A Crayfish	S1	END
Orconectes pellucidus	Eyeless Crayfish	S3	SPCO
Palaemonias ganteri	Mammoth Cave Shrimp	S1	END
Stylurus notatus	Elusive Clubtail	S1	END
Alasmidonta atropurpurea	Cumberland Elktoe	S1	END
Alasmidonta marginata	Elktoe	S2	THR
Cumberlandia monodonta	Spectaclecase	S1	END
Cyprogenia stegaria	Fanshell	S1	END
Dromus dromas	Dromedary Pearlymussel	SX	EXTI
Epioblasma brevidens	Cumberland Combshell	S1	END
Epioblasma florentina florentina	Yellow-blossom Pearlymussel	SX	EXTI
Epioblasma florentina walkeri	Tan Riffleshell	S1	END
Epioblasma obliquata obliquata	Purple Catspaw	S1	END
Epioblasma torulosa rangiana	Northern Riffleshell	S1	END
Epioblasma triquetra	Snuffbox	S1	END
Fusconaia subrotunda subrotunda	Long-Solid	S3	SPCO
Hemistena lata	Cracking Pearlymussel	SX	EXTI
Lampsilis abrupta	Pink Mucket	S1	END
Lampsilis ovata	Pocketbook	S1	END
Lexingtonia dolabelloides	Slabside Pearlymussel	SH	HIST
Obovaria retusa	Ring Pink	S1	END
Pegias fabula	Little-Wing Pearlymussel	S1	END
Plethobasus cooperianus	Orange-Foot Pimpleback	S1	END
Plethobasus cyphyus	Sheepnose	S1	END
Pleurobema clava	Clubshell	S1	END
Pleurobema oviforme	Tennessee Clubshell	S1	END
Pleurobema plenum	Rough Pigtoe	S1	END
Pleurobema rubrum	Pyramid Pigtoe	S1	END
Potamilus capax	Fat Pocketbook	S1	END
Quadrula cylindrica cylindrica	Rabbitsfoot	S2	THR
Toxolasma lividus	Purple Lilliput	S1	END
Villosa lienosa	Little Spectaclecase	S3S4	SPCO
Villosa ortmanni	Kentucky Creekshell	S2	THR
Villosa trabalis	Cumberland Bean	S1	END
Villosa vanuxemensis	Mountain Creekshell	S2	THR

Scientific Name	Common Name	State Rank	State Status
Lithasia armigera	Armored Rocksnail	S3S4	SPCO
Lithasia geniculata	Ornate Rocksnail	S1	SPCO
Lithasia salebrosa	Muddy Rocksnail	S3S4	TRKD
Lithasia verrucosa	Varicose Rocksnail	S3S4	SPCO
Pleurocera curta	Shortspire Hornsnail	S2	SPCO
Acipenser fulvescens	Lake Sturgeon	S1	END
Alosa alabamae	Alabama Shad	S1	END
Amblyopsis spelaea	Northern Cavefish	S3	SPCO
Ammocrypta vivax	Scaly Sand Darter	SX	EXTI
Atractosteus spatula	Alligator Gar	S1	END
Crystallaria asprella	Crystal Darter	SX	EXTI
Cyprinella camura	Bluntface Shiner	S1	END
Cyprinella venusta	Blacktail Shiner	S3	SPCO
Erimystax insignis	Blotched Chub	S1	END
Erimyzon sucetta	Lake Chubsucker	S2	THR
Esox niger	Chain Pickerel	S3	SPCO
Etheostoma chienense	Relict Darter	S1	END
Etheostoma fusiforme	Swamp Darter	S1	END
Etheostoma lemniscatum	Tuxedo Darter	S1	END
Etheostoma lynceum	Brighteye Darter	S1	END
Etheostoma maculatum	Spotted Darter	S2	THR
Etheostoma microlepidum	Smallscale Darter	S1	END
Etheostoma parvipinne	Goldstripe Darter	S1	END
Etheostoma proeliare	Cypress Darter	S2	THR
Etheostoma pyrrhogaster	Firebelly Darter	S1	END
Etheostoma swaini	Gulf Darter	S1	END
Etheostoma tippecanoe	Tippecanoe Darter	S2	TRKD
Fundulus chrysotus	Golden Topminnow	S1	END
Fundulus dispar	Starhead Topminnow	S1	END
Hybognathus hayi	Cypress Minnow	S1	END
Ichthyomyzon castaneus	Chestnut Lamprey	S2	SPCO
Ichthyomyzon gagei	Southern Brook Lamprey	SH	HIST
Ichthyomyzon greeleyi	Mountain Brook Lamprey	S2	THR
Ictiobus niger	Black Buffalo	S3	SPCO
Lampetra appendix	American Brook Lamprey	S2	THR
Lepomis marginatus	Dollar Sunfish	S1	END
Lepomis miniatus	Redspotted Sunfish	S2	THR
Menidia beryllina	Inland Silverside	S2	THR
Moxostoma poecilurum	Blacktail Redhorse	S1	END

Scientific Name	Common Name	State Rank	State Status
Notropis albizonatus	Palezone Shiner	S1	END
Notropis amnis	Pallid Shiner	SH	HIST
Notropis maculatus	Taillight Shiner	S2S3	THR
Noturus hildebrandi	Least Madtom	S1	END
Noturus phaeus	Brown Madtom	S1	END
Noturus stigmosus	Northern Madtom	S2S3	SPCO
Percina macrocephala	Longhead Darter	S1	END
Percopsis omiscomaycus	Trout-Perch	S3	SPCO
Phenacobius uranops	Stargazing Minnow	S2S3	SPCO
Phoxinus cumberlandensis	Blackside Dace	S2	THR
Scaphirhynchus albus	Pallid Sturgeon	S1	END
Thoburnia atripinnis	Blackfin Sucker	S2	SPCO
Typhlichthys subterraneus	Southern Cavefish	S2S3	SPCO
Umbra limi	Central Mudminnow	S2S3	THR
Plant Species			
Cheilanthes alabamensis	Alabama Lipfern	S1	END
Limnobium spongia	American Frog's-Bit	S2S3	THR
Symphyotrichum pratense	Barrens Silky Aster	S3	SPCO
Lesquerella lescurii	Bladderpod	S1	SPCO
Clematis crispa	Blue Jasmine Leather-Flower	S2	THR
Phacelia ranunculacea	Blue Scorpion-Weed	S3	SPCO
Baptisia minor	Blue Wild-Indigo	S2S3	SPCO
Heterotheca subaxillaris var. latifolia	Broad-Leaf Golden-Aster	S2	THR
Myriophyllum heterophyllum	Broadleaf Water Milfoil	S3?	SPCO
Carex alata	Broadwing Sedge	S1S2	THR
Solidago buckleyi	Buckley's Goldenrod	S2S3	SPCO
Trifolium reflexum	Buffalo Clover	S1S2	END
Paspalum boscianum	Bull-Grass	S2S3	SPCO
Melanthium virginicum	Bunchflower	S1	END
Echinodorus berteroi	Burhead	S2	THR
Isoetes butleri	Butler's Quillwort	S1	END
Juglans cinerea	Butternut	S3	SPCO
Matelea carolinensis	Carolina Anglepod	S1?	END
Cabomba caroliniana	Carolina Fanwort	S2	THR
Delphinium carolinianum	Carolina Larkspur	S1S2	THR
Halesia tetraptera var. tetraptera	Common Silverbell	S1S2	END
Silphium laciniatum var. robinsonii	Compass Plant	S2	THR
Silphium laciniatum	Compass Plant	S2	THR
Baptisia bracteata var. leucophaea	Cream Wild Indigo	S3	SPCO

Scientific Name	Common Name	State Rank	State Status
Polygala cruciata	Crossleaf Milkwort	S1	END
Coreopsis pubescens	Downy Coreopsis	S2S3	SPCO
Gentiana puberulenta	Downy Gentian	S1	END
Viola egglestonii	Eggleston's Violet	S3	SPCO
Carex decomposita	Epiphytic Sedge	S2	THR
Ludwigia hirtella	False Loosestrife	S1	END
Amianthium muscitoxicum	Fly Poison	S1S2	THR
Lysimachia fraseri	Fraser Loosestrife	S1	END
Dodecatheon frenchii	French's Shootingstar	S3	SPCO
Sagittaria graminea	Grassleaf Arrowhead	S1S2	THR
Heteranthera dubia	Grassleaf Mud-Plantain	S3	SPCO
Utricularia macrorhiza	Greater Bladder-Wort	S1	END
Ptilimnium capillaceum	Hair-Like Mock Bishop-Weed	S1S2	THR
Onosmodium hispidissimum	Hairy False Gromwell	S1	END
Fimbristylis puberula	Hairy Fimbristylis	S2	THR
Hieracium longipilum	Hairy Hawkweed	S2	THR
Scleria ciliata var. ciliata	Hairy Nut-Rush	S1?	END
Scirpus hallii	Hall's Bulrush	S1	END
Hydrolea ovata	Hydrolea	S1	END
Neobeckia aquatica	Lake-Cress	S1S2	THR
Trillium pusillum	Least Trillium	S1	END
Stellaria longifolia	Longleaf Stitchwort	S2S3	SPCO
Philadelphus inodorus	Mock-Orange	S1S2	THR
Pycnanthemum albescens	Mountain-Mint	S1	END
Muhlenbergia glabriflora	Muhly	S2S3	SPCO
Najas gracillima	Naiad	S2S3	SPCO
Leavenworthia torulosa	Necklace Glade-Cress	S2	THR
Nemophila aphylla	Nemophila	S2?	THR
Sporobolus heterolepis	Northern Dropseed	S1	END
Ptilimnium nuttallii	Nuttall's Mock Bishop's-Weed	S1S2	END
Oldenlandia uniflora	Oldenlandia	S1	END
Silene ovata	Ovate Catchfly	S1	THR
Melanthium woodii	Ozark Bunchflower	S2	THR
Perideridia americana	Perideridia	S2	THR
Helianthemum bicknellii	Plains Frostweed	S1S2	END
Juncus filipendulus	Plain's Rush	S2?	THR
Koeleria macrantha	Prairie Junegrass	S1	END
Ceanothus herbaceus	Prairie Redroot	S2	THR
Agalinis skinneriana	Purple Gerardia	S1S2	END

Scientific Name	Common Name	State Rank	State Status
Iris fulva	Red Iris	S1	END
Glandularia canadensis	Rose Vervain	S2S3	THR
Sporobolus clandestinus	Rough Dropseed	S2S3	THR
Hedeoma hispida	Rough Pennyroyal	S2	THR
Prenanthes aspera	Rough Rattlesnake-Root	S1	END
Bartonia virginica	Screwstem	S2	THR
Ulmus serotina	September Elm	S3	SPCO
Sagittaria rigida	Sessile-Fruited Arrowhead	S1	END
Oenothera perennis	Small Sundrops	S1S2	END
Heteranthera limosa	Smaller Mud-Plantain	S2S3	SPCO
Onosmodium molle ssp. molle	Soft False Gromwell	S1	END
Lycopodiella appressa	Southern Bog Clubmoss	S1	END
Malus angustifolia	Southern Crabapple	S3	SPCO
Zizaniopsis miliacea	Southern Wildrice	S1S2	THR
Potamogeton pulcher	Spotted Pondweed	S1S2	THR
Aureolaria patula	Spreading False-Foxglove	S3	SPCO
Oenothera linifolia	Sundrops	S1S2	END
Oenothera triloba	Sundrops	S1S2	THR
Berchemia scandens	Supple-Jack	S1S2	END
Sphenopholis pensylvanica	Swamp Wedgescale	S1S2	SPCO
Rudbeckia subtomentosa	Sweet Coneflower	S1	END
Polymnia laevigata	Tennessee Leafcup	S1S2	END
Trepocarpus aethusae	Trepocarpus	S3	SPCO
Lilium superbum	Turk's Cap Lily	S1S2	THR
Forestiera ligustrina	Upland Swamp Privet	S2S3	THR
Carya aquatica	Water Hickory	S2S3	THR
Didiplis diandra	Water-Purslane	S2S3	SPCO
Baptisia tinctoria	Yellow Wild-Indigo	S1S2	THR
Terrestrial Animal Species			
Hyla gratiosa	Barking Treefrog	S3	SPCO
Hyla avivoca	Bird-Voiced Treefrog	S3	SPCO
Hyla versicolor	Gray Treefrog	S2S3	SPCO
Hyla cinerea	Green Treefrog	S3	SPCO
Cryptobranchus alleganiensis	Hellbender	S3	SPCO
Rana areolata circulosa	Northern Crawfish Frog	S3	SPCO
Eurycea guttolineata	Three-Lined Salamander	S2	THR
Plethodon wehrlei	Wehrle’s Salamander	S1	END
Fulica americana	American Coot	S1	END
Aimophila aestivalis	Bachman's Sparrow	S1	END

Scientific Name	Common Name	State Rank	State Status
Vermivora bachmanii	Bachman's Warbler	SX	EXTRP
Haliaeetus leucocephalus	Bald Eagle	S2	THR
Riparia riparia	Bank Swallow	S3	SPCO
Dendroica fusca	Blackburnian Warbler	S1S2	THR
Nycticorax nycticorax	Black-Crowned Night-Heron	S1S2	THR
Vireo bellii	Bell's Vireo	S2S3	SPCO
Thryomanes bewickii	Bewick's Wren	S3	SPCO
Anas discors	Blue-Winged Teal	S1S2	THR
Certhia americana	Brown Creeper	S1S2	END
Bubulcus ibis	Cattle Egret	S1S2	SPCO
Corvus corax	Common Raven	S1S2	END
Tyto alba	Barn Owl	S3	SPCO
Gallinula chloropus	Common Moorhen	S1S2	THR
Corvus ossifragus	Fish Crow	S3	SPCO
Vermivora chrysoptera	Golden-Winged Warbler	S2	THR
Ardea alba	Great Egret	S1	END
Ammodramus savannarum	Henslow's Sparrow	S3	SPCO
Lophodytes cucullatus	Hooded Merganser	S1S2	THR
Sterna a. athalassos	Interior Least Tern	S2	END
Rallus elegans	King Rail	S1	END
Chondestes grammacus	Lark Sparrow	S2S3	THR
Ixobrychus exilis	Least Bittern	S1S2	THR
Empidonax minimus	Least Flycatcher	S1	END
Egretta caerulea	Little Blue Heron	S1	END
Asio otus	Long-Eared Owl	S1	END
Ictinia mississippiensis	Mississippi Kite	S2	SPCO
Circus cyaneus	Northern Harrier	S1S2	THR
Anas clypeata	Northern Shoveler	S1	END
Pandioin haliaetus	Osprey	S2	THR
Falco peregrinus	Peregrine Falcon	S1	END
Podilymbus podiceps	Pied-Billed Grebe	S1	END
Charadrius melodus	Piping Plover	SU	END/THR
Passerculus sandwichensis	Savannah Sparrow	S2S3	SPCO
Cistothorus platensis	Sedge Wren	S3	SPCO
Accipiter striatus	Sharp-Shinned Hawk	S3	SPCO
Asio flammeus	Short-Eared Owl	S1	END
Egretta thula	Snowy Egret	S1	END
Actitis macularia	Spotted Sandpiper	S1	END
Pooecetes gramineus	Vesper Sparrow	S1	END

Scientific Name	Common Name	State Rank	State Status
Nyctanassa violacea	Yellow-Crowned Night-Heron	S2	THR
Ursus americanus	Black Bear	S2	SPCO
Sorex cinereus	Common Shrew	S3	SPCO
Peromyscus gossypinus	Cotton Mouse	S2	THR
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S3	SPCO
Myotis leibii	Eastern Small-Footed Bat	S2	THR
Spilogale putorius	Eastern Spotted Skunk	S2S3	SPCO
Nycticeius humeralis	Evening Bat	S3	SPCO
Myotis grisescens	Gray Bat	S2	END
Myotis sodalis	Indiana Bat	S1S2	END
Mustela nivalis	Least Weasel	S2S3	SPCO
Sorex dispar	Long-Tailed Shrew	S1	END
Myotis austroriparius	Southeastern Bat	S1S2	END
Corynorhinus townsendii virginianus	Virginia Big-Eared Bat	S1	END
Macrochelys temminckii	Alligator Snapping Turtle	S2	THR
Nerodia fasciata confluens	Broad-Banded Water Snake	S1	END
Eumeces anthracinus	Coal Skink	S2	THR
Nerodia erythrogaster neglecta	Copperbelly Water Snake	S3	SPCO
Elaphe guttata	Corn Snake	S3	SPCO
Thamnophis sauritus	Eastern Ribbon Snake	S3	SPCO
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	S2	THR
Clonophis kirtlandii	Kirkland's Snake	S2	THR
Apalone mutica mutica	Midland Smooth Softshell	S3	SPCO
Nerodia cyclopion	Mississippi Green Water Snake	S1	END
Pituophis melanoleucus melanoleucus	Northern Pine Snake	S2	THR
Lampropeltis triangulum elapsoides	Scarlet Kingsnake	S3	SPCO
Eumeces inexpectatus	Southeastern Five-Lined Skink	S3	SPCO
Chrysemys picta dorsalis	Southern Painted Turtle	S2	THR
Farancia abacura reinwardtii	Western Mud Snake	S3	SPCO
Sistrurus miliarius streckeri	Western Pigmy Rattlesnake	S2	THR
Thamnophis proximus	Western Ribbon Snake	S1S2	THR
Nicrophorus americanus	American Burying Beetle	SH	HIST
Pseudanophthalmus inexpectatus	A Cave Beetle	S2	THR
Pseudanophthalmus pubescens intrepidus	A Cave Beetle	S2	THR
Pseudanopthalmus transfluvialis	A Cave Beetle	S1S2	SPCO
Kleptochthonius cerberus	A Cave Pseudoscorpoion	S1S2	SPCO
Kleptochthonius erebicus	A Cave Pseudoscorpoion	S1S2	THR
Kleptochthonius hageni	A Cave Pseudoscorpoion	S1S2	SPCO
Kleptochthonius hubrichti	A Cave Pseudoscorpoion	S1S2	THR

Scientific Name	Common Name	State Rank	State Status
Kleptochthonius microphthalmus	A Cave Pseudoscorpoion	S1S2	THR
Tyrannochthonius hypogeus	A Cave Pseudoscorpoion	S1S2	SPCO
Pseudosinella espanita	A Cave Springtail	S1S2	SPCO
Tomocerus missus	A Cave Springtail	S1S2	THR
Pseudanophthalmus audax	Bold Cave Beetle	S1	THR
Satyrium favonius ontario	Northern Hairstreak	S2	SPCO

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Possibly extirpated; SU = Unrankable; SX = Presumed extirpated
State status: END = Endangered; EXTI = Extinct; EXTRP = Extirpated; HIST = Historic records only; SPCO = Species of concern; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species

Table K-4. Mississippi State-Listed Species Located Within or In the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Hobbseus petilus	Tombigbee Riverlet Crayfish	S2	TRKD
Orconectes hartfieldi	A Crayfish	SNR	TRKD
Procambarus lagniappe	Lagniappe Crayfish	S1	TRKD
Procambarus lylei	Shutispear Crayfish	S2	TRKD
Anodontoides radiatus	Rayed Creekshell	S2	TRKD
Arcidens confragosus	Rock Pocketbook	S2S3	TRKD
Cyclonaias tuberculata	Purple Wartyback	S1	END
Ellipsaria lineolata	Butterfly	S2S3	TRKD
Elliptio arca	Alabama Spike	S1S2	TRKD
Epioblasma penita	Southern Combshell	S1	END
Lampsilis perovalis	Orange-Nacre Mucket	S1	END
Lampsilis straminea straminea	Rough Fatmucket	S2	TRKD
Lasmigona complanata	White Heelsplitter	S2	TRKD
Ligumia recta	Black Sandshell	S1	TRKD
Medionidus acutissimus	Alabama Moccasinshell	S1	END
Obovaria jacksoniana	Southern Hickorynut	S1	TRKD
Obovaria unicolor	Alabama Hickorynut	S1S2	TRKD
Pleurobema curtum	Black Clubshell	SX	END
Pleurobema decisum	Southern Clubshell	S1	END
Pleurobema marshalli	Flat Pigtoe	SX	END
Pleurobema perovatum	Ovate Clubshell	S1	END
Pleurobema taitianum	Heavy Pigtoe	SX	END
Potamilus alatus	Pink Heelsplitter	S2	TRKD
Ptychobranchus fasciolaris	Kidneyshell	S1	END

Scientific Name	Common Name	State Rank	State Status
Quadrula rumphiana	Ridged Mapleleaf	S2	TRKD
Quadrula stapes	Stirrupshell	SX	END
Strophitus subvexus	Southern Creekmussel	S2	TRKD
Strophitus undulatus	Squawfoot	S1	TRKD
Uniomerus declivis	Tapered Pondhorn	S2S3	TRKD
Crystallaria asprella	Crystal Darter	S1	END
Percina lenticula	Freckled Darter	S2	TRKD
Noturus munitus	Frecklebelly Madtom	S2	END
Scaphirhynchus suttkusi	Alabama Sturgeon	S1	END
Cyprinella callistia	Alabama Shiner	S2	TRKD
Etheostoma flabellare	Fantail Darter	S2	TRKD
Lythrurus fasciolaris	Rosefin Shiner	S2S3	TRKD
Rhinichthys atratulus	Blacknose Dace	S1	TRKD
Cyprinella spiloptera	Spotfin Shiner	S2	TRKD
Cyprinella whipplei	Steelcolor Shiner	S3	TRKD
Ammocrypta meridiana	Southern Sand Darter	S3	TRKD
Percina kathae	Mobile Logperch	S2S3	TRKD
Etheostoma raneyi	Yazoo Darter	S2	TRKD
Etheostoma zonistium	Bandfin Darter	S2	TRKD
Etheostoma rupestre	Rock Darter	S3	TRKD
Etheostoma rufilineatum	Redline Darter	S2	TRKD
Etheostoma kennicotti	Stripetail Darter	S2	TRKD
Etheostoma asprigene	Mud Darter	S3	TRKD
Noturus stigmosus	Northern Madtom	S1	END
Moxostoma duquesnei	Black Redhorse	S1	TRKD
Moxostoma macrolepidotum	Shorthead Redhorse	S1	TRKD
Cycleptus elongatus	Blue Sucker	S3	TRKD
Hypentelium etowanum	Alabama Hog Sucker	S3	TRKD
Phoxinus erythrogaster	Southern Redbelly Dace	S2	END
Phenacobius mirabilis	Suckermouth Minnow	S1	END
Notropis micropteryx	Rosyface Shiner	S1	TRKD
Notropis sabinae	Sabine Shiner	S3	TRKD
Notropis edwardraneyi	Fluvial Shiner	S1	TRKD
Notropis boops	Bigeye Shiner	S1	END
Notropis amnis	Pallid Shiner	S3	TRKD
Morone saxatilis	Striped Bass	S1	TRKD
Plant Species			
Botrychium jenmanii	Alabama Grapefern	S1S2	SLNS
Neviusia alabamensis	Alabama Snow-Wreath	S1	SLNS

Scientific Name	Common Name	State Rank	State Status
Pachysandra procumbens	Allegheny-Spurge	S3	SLNS
Staphylea trifolia	American Bladdernut	S3	SLNS
Frasera caroliniensis	American Columbo	S2S3	SLNS
Dracocephalum parviflorum	American Dragonhead	S1S2	SLNS
Panax quinquefolius	American Ginseng	S3	SLNS
Aralia racemosa	American Spikenard	S1?	SLNS
Solidago flaccidifolia	Appalachian Golden-Rod	S1S2	SLNS
Isoetes engelmannii	Appalachian Quillwort	S1S2	SLNS
Crataegus ashei	Ash's Hawthorn	S1	SLNS
Solidago sphacelata	Autumn Goldenrod	S1S2	SLNS
Eleocharis erythropoda	Bald Spikerush	NR	SLNS
Symphyotrichum pratense	Barrens Silky Aster	S1	SLNS
Schisandra glabra	Bay Starvine	S3?	SLNS
Penstemon tenuiflorus	Beard-Tongue	S2S3	SLNS
Penstemon tenuis	Beard-Tongue	S2S3	SLNS
Carya laciniosa	Big Shellbark Hickory	S2S3	SLNS
Evax prolifera	Big-Head Evax	S1	SLNS
Cimicifuga racemosa	Black Bugbane	S1S2	SLNS
Isoetes melanopoda	Blackfoot Quillwort	S2	SLNS
Asplenium resiliens	Black-Stem Spleenwort	S1	SLNS
Lesquerella gracilis	Bladderpod	S2	SLNS
Fraxinus quadrangulata	Blue Ash	S2	SLNS
Cuphea viscosissima	Blue Waxweed	S1?	SLNS
Alisma subcordatum	Broad-Leaved Water-Plantain	S1?	SLNS
Carex scoparia var. scoparia	Broom Sedge	SNR	SLNS
Gutierrezia dracunculoides	Broom-Snakeroot	NA	SLNS
Melanthium virginicum	Bunchflower	S2S3	SLNS
Quercus macrocarpa	Bur Oak	S2	SLNS
Juglans cinerea	Butternut	S2	SLNS
Menispermum canadense	Canada Moonseed	S3	SLNS
Asarum canadense	Canada Wild-Ginger	S2S3	SLNS
Astragalus canadensis	Canadian Milkvetch	S2	SLNS
Matelea carolinensis	Carolina Anglepod	S3	SLNS
Trautvetteria caroliniensis	Carolina Tassel-Rue	S1	SLNS
Salix caroliniana	Carolina Willow	S3	SLNS
Celastrus scandens	Climbing Bittersweet	S2S3	SLNS
Matelea obliqua	Climbing Milkweed	S2?	SLNS
Desmodium ochroleucum	Creamflower Tick-Trefoil	S1	SLNS
Hexalectris spicata	Crested Coralroot	S2	SLNS

Scientific Name	Common Name	State Rank	State Status
Eulophia ecristata	Crested Fringed Orchid	S1	SLNS
Platanthera cristata	Crested Fringed Orchid	S3	SLNS
Goodyera pubescens	Downy Rattlesnake-Plantain	S1	SLNS
Viola pubescens var. eriocarpa	Downy Yellow Violet	S1S2	SLNS
Hedeoma drummondii	Drummond Pennyroyal	S1	SLNS
Dicentra cucullaria	Dutchman's Breeches	S1	SLNS
Delphinium tricorne	Dwarf Larkspur	S2	SLNS
Agalinis auriculata	Earleaf Foxglove	S1	SLNS
Stenanthium gramineum	Eastern Featherbells	S1S2	SLNS
Carex oligocarpa	Eastern Few-Fruit Sedge	S1	SLNS
Dirca palustris	Eastern Leatherwood	S2	SLNS
Echinacea purpurea	Eastern Purple Coneflower	S3S4	SLNS
Tradescantia ernestiana	Ernest's Spider-Wort	S1	SLNS
Hottonia inflata	Featherfoil	S1S2	SLNS
Carex communis	Fibrous-Root Sedge	S1	SLNS
Heuchera villosa var. macrorhiza	Giant Alumroot	S1	SLNS
Stellaria pubera	Giant Chickweed	S2S3	SLNS
Athyrium pycnocarpon	Glade Fern	S2S3	SLNS
Cacalia muehlenbergii	Great Indian-Plantain	S1	SLNS
Spiranthes magnicamporum	Great Plains Ladies'-Tresses	S2S3	SLNS
Polemonium reptans	Greek Valerian	S2S3	SLNS
Hybanthus concolor	Green Violet	S2	SLNS
Cheilanthes lanosa	Hairy Lipfern	S2	SLNS
Tiarella cordifolia	Heart-Leaved Foam-Flower	S2	SLNS
Triosteum angustifolium	Horse-Gentian	S3	SLNS
Carex impressinervia	Impressed-Nerved Sedge	S1	SLNS
Gymnocladus dioicus	Kentucky Coffee-Tree	S2	SLNS
Cypripedium kentuckiense	Lady-Slipper	S1	SLNS
Neobeckia aquatica	Lake-Cress	S1S2	SLNS
Rhamnus lanceolata	Lance-Leaved Buckthorn	S2	SLNS
Cypripedium pubescens	Large Yellow Lady's-Slipper	S2S3	SLNS
Oenothera grandiflora	Large-Flowered Evening-Primrose	S1	SLNS
Hexastylis shuttleworthii	Large-Flowered Heartleaf	S1	SLNS
Hydrophyllum macrophyllum	Large-Leaf Water-Leaf	S1	SLNS
Clematis beadlei	Leather-Flower	S1	SLNS
Spiranthes ovalis	Lesser Ladies'-Tresses	S2S3	SLNS
Ophioglossum engelmannii	Limestone Adder's-Tongue	S3	SLNS
Heuchera parviflora	Little Flowered Alumroot	S2?	SLNS
Coreopsis auriculata	Lobed Tickseed	S2S3	SLNS

Scientific Name	Common Name	State Rank	State Status
Ligusticum canadense	Lovage	S1S2	SLNS
Asplenium trichomanes	Maidenhair Spleenwort	S1	SLNS
Glyceria arkansana	Manna-Grass	S2S4	SLNS
Viburnum acerifolium	Mapleleaf Viburnum	S1	SLNS
Lilium michiganense	Michigan Lily	S1S2	SLNS
Philadelphus hirsutus	Mock-Orange	S1	SLNS
Philadelphus inodorus	Mock-Orange	S2	SLNS
Mimulus ringens	Monkey-Flower	S1S2	SLNS
Stewartia ovata	Mountain Camellia	S1	SLNS
Ilex montana	Mountain Holly	S3?	SLNS
Pycnanthemum muticum	Mountain-Mint	S2S3	SLNS
Pycnanthemum pilosum	Mountain-Mint	S1	SLNS
Muhlenbergia glabriflora	Muhly	NR	SLNS
Muhlenbergia sylvatica	Muhly	SU	SLNS
Muhlenbergia tenuiflora	Muhly	S1S2	SLNS
Nestronia umbellula	Nestronia	S1S2	SLNS
Salvia urticifolia	Nettle-Leaf Sage	S2S3	SLNS
Trillium flexipes	Nodding Trillium	S1	SLNS
Quercus oglethorpensis	Oglethorpe's Oak	S2	SLNS
Aesculus glabra	Ohio Buckeye	S2?	SLNS
Silene ovata	Ovate Catchfly	S1S2	SLNS
Perideridia americana	Perideridia	S1S2	SLNS
Phacelia bipinnatifida	Phacelia	S1	SLNS
Chelone lyonii	Pink Turtlehead	S1	SLNS
Asplenium pinnatifidum	Pinnatifid Spleenwort	S1	SLNS
Manisuris cylindrica	Pitted Jointgrass	S1	SLNS
Callirhoe triangulata	Poppy-Mallow	S1S2	SLNS
Polytaenia nuttallii	Prairie Parsley	S2	SLNS
Nemastylis geminiflora	Prairie Pleatleaf	S2	SLNS
Fraxinus profunda	Pumpkin Ash	S3	SLNS
Pellaea atropurpurea	Purple Cliff-Brake	S1S2	SLNS
Platanthera peramoena	Purple Fringeless Orchid	S2S3	SLNS
Aplectrum hyemale	Puttyroot	S1	SLNS
Platanthera lacera	Ragged Fringe Orchid	S1S2	SLNS
Hieracium venosum	Rattlesnake Hawkweed	S1	SLNS
Iris fulva	Red Iris	S3	SLNS
Carex virescens	Ribbed Sedge	S1	SLNS
Agalinis oligophylla	Ridge-Stem False-Foxglove	S2	SLNS
Sedum pulchellum	Rock Stonecrop	S1	SLNS

Scientific Name	Common Name	State Rank	State Status
Rudbeckia grandiflora	Rough Coneflower	S1	SLNS
Prenanthes aspera	Rough Rattlesnake-Root	S2	SLNS
Sabatia campestris	Sabatia	S2S3	SLNS
Castilleja coccinea	Scarlet Indian-Paintbrush	S1	SLNS
Carex jamesii	Sedge	S1S2	SLNS
Carex picta	Sedge	S2S3	SLNS
Carex prasina	Sedge	S1	SLNS
Carex stricta	Sedge	S2	SLNS
Ulmus serotina	September Elm	S3?	SLNS
Dodecatheon meadia	Shooting Star	S2	SLNS
Orchis spectabilis	Showy Orchid	S1	SLNS
Arabis canadensis	Sicklepod	S2S3	SLNS
Athyrium thelypterioides	Silvery Glade Fern	S1S2	SLNS
Antennaria solitaria	Single-Head Pussytoes	S3?	SLNS
Carex gracilescens	Slender Sedge	S3	SLNS
Dentaria heterophylla	Slender Toothwort	S2S3	SLNS
Palafoxia callosa	Small Palafoxia	S1	SLNS
Cypripedium parviflorum	Small Yellow Lady's-Slipper	S1	SLNS
Carex microdonta	Small-Toothed Sedge	S3	SLNS
Rhododendron arborescens	Smooth Azalea	S1	SLNS
Osmorhiza longistylis	Smoother Sweet-Cicely	S3	SLNS
Adiantum capillus-veneris	Southern Maidenhair Fern	S2	SLNS
Thalictrum debile	Southern Meadow-Rue	S1S2	SLNS
Chimaphila maculata	Spotted Wintergreen	S2	SLNS
Gentiana quinquefolia	Stiff Gentian	NR	SLNS
Thelesperma filifolium	Stiff-Greenthread	S1	SLNS
Sedum ternatum	Stonecrop	S2	SLNS
Oenothera triloba	Sundrops	SU	SLNS
Carya leiodermis	Swamp Hickory	S2S3	SLNS
Triphora trianthophora	Three-Birds-Orchids	S2S3	SLNS
Lilium superbum	Turk's Cap Lily	S3	SLNS
Dentaria diphylla	Two-Leaf Toothwort	S1S2	SLNS
Cyperus albomarginatus	Umbrella Sedge	S1?	SLNS
Forestiera ligustrina	Upland Swamp Privet	S2	SLNS
Mertensia virginica	Virginia Bluebells	S1S2	SLNS
Pinus virginiana	Virginia Pine	S2	SLNS
Euonymus atropurpureus	Wahoo	S2S3	SLNS
Asplenium rhizophyllum	Walking Fern	S1S2	SLNS
Hydrophyllum appendiculatum	Waterleaf	S1	SLNS

Scientific Name	Common Name	State Rank	State Status
Decodon verticillatus	Water-Willow	S2S3	SLNS
Carex seorsa	Weak Stellate Sedge	S1S2	SLNS
Symphyotrichum ericoides	White Heath Aster	S2	SLNS
Erythronium albidum	White Trout-Lily	S2	SLNS
Chelone glabra	White Turtlehead	S3	SLNS
Aquilegia canadensis	Wild Columbine	S1S2	SLNS
Camassia scilloides	Wild Hyacinth	S2S3	SLNS
Anemone quinquefolia	Wood Anemone	S1S2	SLNS
Luzula acuminata	Woodrush	S3	SLNS
Taenidia integerrima	Yellow Pimpernel	S1	SLNS
Erythronium americanum	Yellow Trout-Lily	S1S2	SLNS
Cladrastis kentukea	Yellowwood	S2	SLNS
Terrestrial Animal Species			
Eurycea lucifuga	Cave Salamander	S1	END
Rana areolata	Crawfish Frog	S3	TRKD
Hemidactylium scutatum	Four-Toed Salamander	S1S2	TRKD
Aneides aeneus	Green Salamander	S1	END
Cryptobranchus alleganiensis	Hellbender	S1	TRKD
Pseudacris brachyphona	Mountain Chorus Frog	S3	TRKD
Pseudotriton montanus	Mud Salamander	S2S3	TRKD
Pseudotriton ruber	Red Salamander	S3	TRKD
Plethodon ventralis	Southern Zigzag Salamander	S2	TRKD
Gyrinophilus porphyriticus	Spring Salamander	S1	END
Ambystoma tigrinum	Tiger Salamander	SH	TRKD
Plethodon websteri	Webster's Salamander	S3	TRKD
Falco sparverius	American Kestrel	S3	TRKD
Aimophila aestivalis	Bachman's Sparrow	S3	TRKD
Vermivora bachmanii	Bachman’s Warbler	SX	END
Haliaeetus leucocephalus	Bald Eagle	S2	END
Thryomanes bewickii bewickii	Bewick's Wren	S2	END
Nycticorax nycticorax	Black-Crowned Night-Heron	S3	TRKD
Dendroica cerulea	Cerulean Warbler	S2	TRKD
Tyto alba	Barn Owl	S3	TRKD
Ammodramus savannarum	Grasshopper Sparrow	S3	TRKD
Sterna antillarum athalassos	Interior Least Tern	S2	END
Ixobrychus exilis	Least Bittern	S3	TRKD
Pandion haliaetus	Osprey	S3	TRKD
Charadrius melodus	Piping Plover	S2	END
Picoides borealis	Red-Cockaded Woodpecker	S1	END

Scientific Name	Common Name	State Rank	State Status
Elanoides forficatus	Swallow-Tailed Kite	S2	TRKD
Nyctanassa violacea	Yellow-Crowned Night-Heron	S3	TRKD
Mycteria americana	Wood Stork	S2	END
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S3	TRKD
Spilogale putorius	Eastern Spotted Skunk	S2?	TRKD
Myotis grisescens	Gray Bat	S1	END
Lasiurus cinereus	Hoary Bat	S3	TRKD
Myotis sodalis	Indiana Bat	S1	END
Myotis lucifugus	Little Brown Bat	S3	TRKD
Ursus americanus luteolus	Louisiana Black Bear	S1	END
Zapus hudsonius	Meadow Jumping Mouse	S1	TRKD
Myotis septentrionalis	Northern Long-Eared Bat	S2?	TRKD
Peromyscus polionotus	Oldfield Mouse	S2S3	TRKD
Myotis austroriparius	Southeastern Bat	S1S2	TRKD
Graptemys pulcra	Alabama Map Turtle	S2S3	TRKD
Macrochelys temminckii	Alligator Snapping Turtle	S3	TRKD
Graptemys nigrinoda	Black-Knobbed Map Turtle	S2	END
Lampropeltis getula nigra	Black Kingsnake	S3	TRKD
Lampropeltis calligaster rhombomaculata	Mole Kingsnake	S2	TRKD
Regina septemvittata	Queen Snake	S2S3	TRKD
Farancia erytrogramma	Rainbow Snake	S2	END
Lampropelti triangulum syspila	Red Milk Snake	S3	TRKD
Graptemys oculifera	Ringed Map Turtle	S2	END
Ophisaurus attenuatus	Slender Glass Lizard	S2S3	TRKD
Eumeces anthracinus pluvialis	Southern Coal Skink	S2S3	TRKD
Graptemys flavimaculata	Yellow-Blotched Map Turtle	S2	END
Lytrosis permagnaria	A Geometrid Moth	SH	TRKD
Gymnocthebius maureenae	Maureen's Gymnochthebius Minute Moss Beetle	S1S3	TRKD
Gryllotalpa major	Prarie Mole Cricket	SH	TRKD
Dryobius sexnotatus	Six-Banded Longhorn Beetle	S?	TRKD

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; NA = Not Applicable; NR = Not yet ranked; SH = Possibly extirpated; SNR = State not ranked; species is considered sensitive by the state but has not yet been assigned a state rank; SU = Unrankable; SX = Presumed extirpated
State status: END = Endangered; SLNS = State-listed, no status; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species

Table K-5. North Carolina State-Listed Species Located Within or In the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Skistodiaptomus carolinensis	Yancey Sideswimmer	S1?	SPCO
Stygobromus carolinensis	Carolina Seep Scud	S1	SPCO
Stygobromus sp. 4	Plott Balsam Sideswimmer	S1?	WATC
Cambarus georgiae	Little Tennessee Crayfish	S1S2	SPCO
Cambarus hiwasseensis	Hiwassee Crayfish	S3?	SPCO
Cambarus parrishi	Parrish Crayfish	S1?	SPCO
Cambarus reburrus	French Broad Crayfish	S3	SPCO
Dactylocythere prinsi	Whitewater Crayfish Ostracod	S1	SPCO
Macromia margarita	Margaret's River Cruiser	S2S3	RARE
Alasmidonta raveneliana	Appalachian Elktoe	S1	END
Alasmidonta varicosa	Brook Floater	S1	END
Alasmidonta viridis	Slippershell Mussel	S1	END
Elliptio dilatata	Spike	S1	SPCO
Fusconaia barnesiana	Tennessee Pigtoe	S1	END
Fusconaia subrotunda	Long-Solid	S1	TRKD
Lampsilis fasciola	Wavy-Rayed Lampmussel	S1	SPCO
Lasmigona holstonia	Tennessee Heelsplitter	S1	END
Lasmigona subviridis	Green Floater	S1	END
Pegias fabula	Little-Wing Pearlymussel	S1	END
Pleurobema oviforme	Tennessee Clubshell	S1?	END
Villosa iris	Rainbow	S1	SPCO
Villosa trabalis	Cumberland Bean	S1	TRKD
Villosa vanuxemensis	Mountain Creekshell	S1	THR
Elimia interrupta	Knotty Elimia	S1	END
Etheostoma acuticeps	Sharphead Darter	S1	THR
Percina burtoni	Blotchside Logperch	S1	END
Percina sciera	Dusky Darter	SH	END
Polyodon spathula	Paddlefish	SH	END
Erimonax monachus	Spotfin Chub	S1	THR
Etheostoma vulneratum	Wounded Darter	S2	SPCO
Acipenser fulvescens	Lake Sturgeon	SX	SPCO
Percina caprodes	Logperch	S2	THR
Percina squamata	Olive Darter	S2	SPCO
Noturus eleutherus	Mountain Madtom	SH	SPCO
Hiodon tergisus	Mooneye	SH	SPCO
Aplodinotus grunniens	Freshwater Drum	S1	SPCO
Etheostoma simoterum	Snubnose Darter	SH	SPCO

Scientific Name	Common Name	State Rank	State Status
Etheostoma inscriptum	Turquoise Darter	S1	SPCO
Etheostoma jessiae	Blueside Darter	SH	SPCO
Noturus flavus	Stonecat	S1	END
Moxostoma sp. 2	Sicklefin Redhorse	S?	TRKD
Luxilus chrysocephalus	Striped Shiner	S2	THR
Carpiodes carpio	River Carpsucker	SH	SPCO
Erimystax insignis	Blotched Chub	S3	RARE
Phenacobius teretulus	Kanawha Minnow	S2	SPCO
Notropis lutipinnis	Yellowfin Shiner	S3	SPCO
Notropis rubescens	Rosyface Chub	S1	THR
Clinostomus funduloides ssp. 1	Smoky Dace	S2	SPCO
Cottus carolinae	Banded Sculpin	S1	THR
Lampetra appendix	American Brook Lamprey	S1	THR
Ichthyomyzon bdellium	Ohio Lamprey	S1	TRKD
Plant Species			
Cheilanthes alabamensis	Alabama Lipfern	S1	SR-P
Berberis canadensis	American Barberry	S2	SR-T
Coeloglossum viride var. virescens	American Frog Orchid	S1	SR-P
Trichomanes boschianum	Appalachian Bristle Fern	S1	THR
Huperzia appalachiana	Appalachian Fir-Clubmoss	S2	SR-P
Agrostis mertensii	Arctic Bentgrass	S1	END
Carex barrattii	Barratt's Sedge	SH	END
Geum geniculatum	Bent Avens	S2	THR
Calystegia catesbeiana ssp. sericata	BR Bindweed	S3	SR-T
Botrychium oneidense	Blunt-Lobe Grapefern	S2	SR-P
Arethusa bulbosa	Bog-Rose	S1	END
Coreopsis latifolia	Broad-Leaved Tickseed	S3	SR-T
Carex buxbaumii	Buxbaum's Sedge	S1	SR-P
Zigadenus leimanthoides	Death-Camas	S1	SR-O
Eurybia mirabilis	Dwarf Aster	S2	SR-T
Trichomanes petersii	Dwarf Filmy-Fern	S2	THR
Grammitis nimbata	Dwarf Polypody	S1	END
Carex oligosperma	Few-Seeded Sedge	S1	END
Cystopteris fragilis	Fragile Fern	S1	SR-P
Abies fraseri	Fraser Fir	S2	SR-L
Lysimachia fraseri	Fraser Loosestrife	S2	END
Hexastylis rhombiformis	French Broad Heartleaf	S2	THR
Gentianopsis crinita	Fringed Gentian	S1	E-SC
Euphorbia purpurea	Glade Spurge	S2	SR-T

Scientific Name	Common Name	State Rank	State Status
Hydrastis canadensis	Goldenseal	S2	E-SC
Lilium grayi	Gray's Lily	S3	T-SC
Alnus viridis ssp. crispa	Green Alder	S1	SR-D
Synandra hispidula	Guyandotte Beauty	SH	SR-T
Arabis hirsuta var. adpressipilis	Hairy Rockcress	S1	SR-P
Betula papyrifera var. cordifolia	Heart-Leaved Paper Birch	S1	SR-D
Conioselinum chinense	Hemlock Parsley	S1	END
Juncus trifidus	Highland Rush	S1	END
Vaccinium macrocarpon	Large Cranberry	S2	SR-P
Botrychium simplex var. simplex	Little Grape-Fern	S2	SR-P
Helianthemum propinquum	Low Frostweed	S1	SR-P
Helianthus occidentalis	McDowell Sunflower	SX	SR-P
Cardamine clematitis	Mountain Bitter Cress	S2	SR-T
Diervilla sessilifolia var. rivularis	Mountain Bush-Honeysuckle	SH	SR-T
Minuartia groenlandica	Mountain Sandwort	S2	SR-D
Muhlenbergia glomerata	Muhly	S1	SR-P
Phegopteris connectilis	Northern Beechfern	S2	SR-P
Sporobolus heterolepis	Northern Dropseed	S1	END
Silene ovata	Ovate Catchfly	S3	SR-T
Helianthemum bicknellii	Plains Frostweed	S1	SR-P
Filipendula rubra	Queen-of-the-Prairie	S1	END
Carex radfordii	Radford's Sedge	S1	END
Calamagrostis cainii	Reedgrass	S1	END
Dalibarda repens	Robin Runaway	S2	END
Sedum rosea	Roseroot Stonecrop	S1	END
Geum laciniatum var. trichocarpum	Rough Avens	S1	SR-P
Amelanchier sanguinea	Roundleaf Serviceberry	S2	SR-D
Cardamine rotundifolia	Roundleaf Water-Cress	S1	SR-P
Rugelia nudicaulis	Rugel's Ragwort	S3	THR
Buckleya distichophylla	Sapsuck	S2	END
Saxifraga caroliniana	Saxifrage	S3	SR-T
Packera schweinitziana	Schweinitz's Ragwort	S2	END
Carex aenea	Sedge	S1	END
Carex hitchcockiana	Sedge	S1	SR-P
Carex leptonervia	Sedge	S2	SR-P
Carex misera	Sedge	S3	SR-L
Carex pedunculata	Sedge	S2	SR-P
Carex projecta	Sedge	S1	SR-P
Carex purpurifera	Sedge	S1	SR-P

Scientific Name	Common Name	State Rank	State Status
Carex roanensis	Sedge	S2	SR-T
Carex schweinitzii	Sedge	S1	END
Helenium brevifolium	Shortleaf Sneezeweed	S2	END
Corydalis micrantha ssp. micrantha	Slender Corydalis	S1	SR-P
Elymus trachycaulus ssp. trachycaulus	Slender Wheatgrass	S1	SR-P
Glyceria nubigena	Smoky Mountain Manna-Grass	S2	THR
Hexastylis contracta	Southern Heartleaf	S1	END
Shortia galacifolia var. galacifolia	Southern Shortia	S2	E-SC
Arabis patens	Spreading Rockcress	S1	SR-T
Stachys clingmanii	Stachys	SH	SR-T
Allium cuthbertii	Striped Garlic	S2	SR-T
Hasteola suaveolens	Sweet-Scented Indian-Plantain	SH	SR-T
Delphinium exaltatum	Tall Larkspur	S2	E-SC
Arabis glabra	Tower-Mustard	SH	SR-P
Trichophorum cespitosum	Tufted Clubrush	S2S3	SR-D
Deschampsia cespitosa ssp. glauca	Tufted Hairgrass	S1	SR-P
Geum aleppicum	Yellow Avens	S1	SR-P
Terrestrial Animal Species			
Plethodon amplus	Blue Ridge Gray-Checked Salamander	S1S2	RARE
Plethodon chattahoochee	Chattahoochee Slimy Salamander	S2	RARE
Plethodon cheoah	Cheoah Bald Salamander	S2	RARE
Plethodon yonahlossee pop. 1	Crevice Salamander	S1	SPCO
Desmognathus folkertsi	Dwarf Black-Bellied Salamander	S1	TRKD
Hemidactylium scutatum	Four-Toed Salamander	S3	SPCO
Hyla versicolor	Gray Treefrog	S1	RARE
Aneides aeneus	Green Salamander	S2	END
Cryptobranchus alleganiensis	Hellbender	S3	SPCO
Desmognathus imitator	Imitator Salamander	S3	TRKD
Plethodon jordani	Jordan's Salamander	S3	TRKD
Eurycea junaluska	Junaluska Salamander	S2	THR
Erycea longicauda	Longtail Salamander	S1S2	SPCO
Ambystoma talpoideum	Mole Salamander	S2	SPCO
Pseudacris brachyphona	Mountain Chorus Frog	S1	SPCO
Necturus maculosus	Mudpuppy	S1	SPCO
Desmognathus wrighti	Pigmy Salamander	S3	RARE
Plethodon richmondi	Ravine Salamander	S3	TRKD
Plethodon shermani	Red-Legged Salamander	S2	RARE
Desmognathus santeetlah	Santeetlah Dusky Salamander	S2S3	RARE
Desmognathus aeneus	Seepage Salamander	S3	RARE

Scientific Name	Common Name	State Rank	State Status
Plethodon ventralis	Southern Zigzag Salamander	S1	SPCO
Plethodon meridianus	South Mountain Gray-Cheeked Salamander	S1S2	RARE
Plethodon aureolus	Tellico Salamander	S2	RARE
Ambystoma tigrinum	Tiger Salamanader	S2	THR
Desmognathus imitator pop.1	Waterrock Knob Salmander	S1	RARE
Plethodon wehrlei	Wehrle's Salamander	S1	THR
Plethodon welleri	Weller's Salamander	S2	SPCO
Empidonax alnorum	Alder Flycatcher	S2	RARE
Thryomanes bewickii altus	Appalachian Bewick's Wren	SH	END
Aimophila aestivalis	Bachman's Sparrow	S3	SPCO
Haliaeetus leucocephalus	Bald Eagle	S3	THR
Riparia riperia	Bank Swallow	SU	RARE
Coccyzus erythropthalmus	Black-Billed Cuckoo	S2	RARE
Poecile atricapilla	Black-Capped Chickadee	S3	SPCO
Vermivora pinus	Blue Winged Warbler	S2	RARE
Certhia americana	Brown Creeper	S3	SPCO
Dendroica cerulea	Cerulean Warbler	S2	RARE
Tyto alba	Common Barn Owl	S3	TRKD
Corvus corax	Common Raven	S3	TRKD
Vermivora chrysoptera	Golden-Winged Warbler	S3	RARE
Ammodramus savannarum	Grasshopper Sparrow	S3	TRKD
Catharus guttatus	Hermit Thrush	S2	RARE
Lanius ludovicianus	Loggerhead Shrike	S3	SPCO
Dendroica magnolia	Magnolia Warbler	S1S2	RARE
Aegolius acadicus	Northern Saw-Whet Owl	S2	THR
Falco peregrinus	Peregrine Falcon	S1	END
Contopus cooperi	Olive-Sided Flycatcher	SU	SPCO
Picoides borealis	Red-Cockaded Woodpecker	S2	END
Loxia curvirostra	Red Crossbill	S3	SPCO
Passerculus sandwichensis	Savannah Sparrow	S2	RARE
Accipiter striatus	Sharp-Shinned Hawk	S2	RARE
Pooecetes gramineus	Vesper Sparrow	S2	RARE
Vireo gilvus	Warbling Vireo	S2	RARE
Sphyrapicus varius	Yellow-Bellied Sapsucker	S3	SPCO
Neotoma magister	Allegheny Woodrat	S2	SPCO
Sylvilagus obscurus	Appalachian Cottontail	S3	RARE
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	S2	END
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S2	THR
Puma concolor couguar	Eastern Cougar	SH	END

Scientific Name	Common Name	State Rank	State Status
Sciurus niger	Eastern Fox Squirrel	S1?	RARE
Myotis leibii	Eastern Small-Footed Bat	S3	SPCO
Spilogale putorius	Eastern Spotted Skunk	S3	TRKD
Myotis grisescens	Gray Bat	S1?	END
Lasiurus cinereus	Hoary Bat	S2?	RARE
Myotis sodalis	Indiana Bat	S1?	END
Mustela nivalis	Least Weasel	S2	RARE
Zapus hudsonius	Meadow Jumping Mouse	S3	TRKD
Myotis septentrionalis	Northern Long-Eared Bat	S3	SPCO
Sorex hoyi	Pygmy Shrew	S3	TRKD
Lasionycteris noctivagans	Silver-Haired Bat	S2?	RARE
Neotoma floridana haematoreia	Southern Appalachian Woodrat	S3	SPCO
Synaptomys cooperi	Southern Bog Lemming	S3	TRKD
Microtus chrotorrhinus carolinensis	Southern Rock Vole	S3	SPCO
Sorex palustris punctulatus	Southern Water Shrew	S2	SPCO
Corynorhinus townsendii virginianus	Virginia Big-Eared Bat	S1	END
Glyptemys muhlenbergii	Bog Turtle	S2	THR
Eumeces anthracinus	Coal Skink	S2S3	RARE
Lampropeltis triangulum triangulum	Eastern Milk Snake	S2S3	TRKD
Apalone spinifera spinifera	Eastern Spiny Softshell	S1	SPCO
Pituophis melanoleucus melanoleucus	Northern Pine Snake	S3	SPCO
Sistrurus miliarus	Pigmy Rattlesnake	S3	SPCO
Lampropeltis t. elapsoides	Scarlet Kingsnake	S3	TRKD
Ophisaurus attenuatus	Slender Glass Lizard	S3	TRKD
Sternotherus minor	Stripeneck Musk Turtle	S1	SPCO
Crotalus horridus	Timber Rattlesnake	S3	SPCO
Trechus balsamensis	A Carabid Beetle	SU	TRKD
Trechus mitchellensis	A Carabid Beetle	SU	TRKD
Trechus novaculosus	A Carabid Beetle	SU	TRKD
Trechus roanicus	A Carabid Beetle	SU	TRKD
Trechus rosenbergi	A Carabid Beetle	SU	TRKD
Trechus satanicus	A Carabid Beetle	SU	TRKD
Trechus subtilis	A Carabid Beetle	SU	TRKD
Hypochilus coylei	A Cave Spider	S3?	RARE
Nesticus brimleyi	A Cave Spider	S1?	RARE
Nesticus crosbyi	A Cave Spider	S1?	RARE
Nesticus gertschi	A Cave Spider	S1?	RARE
Nesticus mimus	A Cave Spider	S2?	RARE
Nesticus nasicus	A Cave Spider	S3?	RARE

Scientific Name	Common Name	State Rank	State Status
Nesticus reclusus	A Cave Spider	S3?	RARE
Nesticus sheari	A Cave Spider	S2?	RARE
Nesticus silvanus	A Cave Spider	S2?	RARE
Nesticus Sp. 1	A Cave Spider	S2?	RARE
Nesticus Sp. 2	A Cave Spider	S1S3	RARE
Hepialus sciophanes	A Ghost Moth	S1S3	RARE
Hypochilus sheari	A Lampshade Spider	S2S3	RARE
Lithophane georgii	A Noctuid Moth	S1?	RARE
Speyeria aphrodite cullasaja	Apphrodite Fritillary	S1?	RARE
Cicindela ancocisconensis	A Tiger Beetle	S1	RARE
Euphydryas phaeton	Baltimore	S2	RARE
Itame subcessaria	Barred Itame	S1S3	RARE
Vaejovis carolinianus	Carolina Scorpion	S2?	TRKD
Celastrina ebenina	Dusky Azure	S2?	RARE
Erora laeta	Early Hairstreak	S2S3	RARE
Satyrium edwardsii	Edwards' Hairstreak	S2?	RARE
Semiothisa fraserata	Fraser Fir Geometrid Moth	S1S2	RARE
Callophrys irus	Frosted Elfin	S2	RARE
Autochton cellus	Golden-Banded Skipper	S2	RARE
Chlosyne gorgone	Gorgone Cherkerspot	S1	RARE
Polygonia progne	Gray Comma	S1	RARE
Polygonia faunus	Green Comma	S2	RARE
Satyrium caryaevorum	Hickory Hairstreak	S1?	RARE
Hesperia sassacus	Indian Skipper	S3	TRKD
Nesticus carolinensis	Linville Caverns Spider	S1	RARE
Nesticus cooperi	Lost Nantahala Cave Spider	S1	RARE
Eulonchus marialiciae	Mary Alice's Small-Headed Fly	S1S3	RARE
Erynnis martialis	Mottled Dusky Wing	S3	RARE
Euchloe olympia	Olympia Marble	S1	RARE
Speyeria idalia	Regal Fritillary Butterfly	SH	HIST
Trimerotropis saxatilis	Rock-Loving Grasshopper	S1S2	RARE
Polygonia faunus smythi	Smyth's Green Coma	S2	RARE
Pyrgus wyandot	Southern Grizzled Skipper	S1	RARE
Microhexura montivaga	Spurce-Fir Moss Spider	S1	RARE
Sympetrum obtrusum	White-Faced Meadowfly	S1?	RARE

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Possibly extirpated; SU = Unrankable; SX = Presumed extirpated
State status: END = Endangered; E-SC = Endangered-special concern; HIST = Historic records only; RARE = Rare; SPCO = Species of concern; SR-D = Significantly rare-disjunct; SR-L = Significantly rare-limited; SR-O = Significantly rare-other; SR-P = Significantly rare-peripheral; SR-T = Significantly rare-throughout; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species; T-SC = Threatened-special concern; WATC = On the state watch list for potential formal listing

Table K-6. Tennessee State-Listed Species Located Within or In the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Cambarus bouchardi	Big South Fork Crayfish	SNR	END
Cambarus brachydactylus	A Crayfish	S2	TRKD
Cambarus extraneus	Chickamauga Crayfish	S1,S2	THR
Cambarus obeyensis	Obey Crayfish	S2	THR
Cambarus pristinus	A Crayfish	S2	END
Cambarus sp. 1	Emory River Crayfish	S1?	TRKD
Cambarus williami	'Brawley's Fork Crayfish'	SNR	END
Fallicambarus hortoni	Hatchie Burrowing Crayfish	SNR	END
Orconectes alabamensis	A Crayfish	SNR	NMGT
Orconectes incomptus	Tennessee Cave Crayfish	SNR	END
Orconectes shoupi	Nashville Crayfish	S1	END
Orconectes wrighti	A Crayfish	S2	END
Gomphus consanguis	Cherokee Clubtail	S1	TRKD
Gomphus sandrius	Tennessee Clubtail Dragonfly	S1	TRKD
Ophiogomphus acuminatus	Acuminate Snaketail	S2	TRKD
Ophiogomphus edmundo	Edmund's Snaketail	S1	TRKD
Ophiogomphus incurvatus alleghaniensis	Allegheny Snaketail	S1	TRKD
Macromia margarita	Margaret's River Cruiser	S2S3	TRKD
Hadenoecus opilionides	A Cave Cricket	S2?	TRKD
Glyphopsyche sequatchie	Owen Spring Limnephilid Caddisfly	SNR	POTL
Alasmidonta atropurpurea	Cumberland Elktoe	S1S2	END
Alasmidonta raveneliana	Appalachian Elktoe	S1	END
Cumberlandia monodonta	Spectaclecase	S2S3	TRKD
Cyprogenia stegaria	Fanshell	S1	END
Dromus dromas	Dromedary Pearlymussel	S1	END
Epioblasma biemarginata	Angled Riffleshell	SX	EXTI
Epioblasma brevidens	Cumberland Combshell	S1	END
Epioblasma capsaeformis	Oyster Mussel	S1	END
Epioblasma florentina florentina	Yellow-Blossom Pearlymussel	SX	EXTI
Epioblasma florentina walkeri	Tan Riffleshell	S1	END
Epioblasma lewisii	Forkshell	SX	EXTI
Epioblasma metastriata	Upland Combshell	SH	END
Epioblasma obliquata obliquata	Purple Catspaw	S1	END
Epioblasma torulosa gubernaculum	Green Blossom Pearlymussel	SX	EXTI
Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	SX	EXTI
Epioblasma triquetra	Snuffbox	S3	TRKD
Epioblasma turgidula	Turgid Blossom Pearlymussel	SX	EXTI

Scientific Name	Common Name	State Rank	State Status
Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	END
Fusconaia cuneolus	Fine-Rayed Pigtoe	S1	END
Hemistena lata	Cracking Pearlymussel	S1	END
Lampsilis abrupta	Pink Mucket	S2	END
Lampsilis altilis	Fine-Lined Pocketbook	S1S2	THR
Lampsilis siliquoidea	Fatmucket	S2	NOST
Lampsilis virescens	Alabama Lampmussel	S1	END
Lasmigona holstonia	Tennessee Heelsplitter	S2	TRKD
Lemiox rimosus	Birdwing Pearlymussel	S1	END
Lexingtonia dolabelloides	Slabside Pearlymussel	S2	TRKD
Medionidus acutissimus	Alabama Moccasinshell	S1	THR
Medionidus parvulus	Coosa Moccasinshell	S1	END
Obovaria jacksoniana	Southern Hickorynut	S1	TRKD
Obovaria retusa	Ring Pink	S1	END
Obovaria subrotunda	Round Hickorynut	S3	TRKD
Pegias fabula	Little-Wing Pearlymussel	S1	END
Plethobasus cicatricosus	White Wartyback	S1	END
Plethobasus cooperianus	Orange-Foot Pimpleback	S1	END
Plethobasus cyphyus	Sheepnose	S2S3	TRKD
Pleurobema chattanoogaense	Painted Clubshell	S1?	TRKD
Pleurobema clava	Clubshell	SH	END
Pleurobema georgianum	Southern Pigtoe	S1	END
Pleurobema gibberum	Cumberland Pigtoe	S1	END
Pleurobema hanleyianum	Georgia Pigtoe	S1	TRKD
Pleurobema oviforme	Tennessee Clubshell	S2S3	TRKD
Pleurobema perovatum	Ovate Clubshell	SH	END
Pleurobema plenum	Rough Pigtoe	S1	END
Pleurobema rubrum	Pyramid Pigtoe	S2S3	TRKD
Ptychobranchus greenii	Triangular Kidneyshell	S1	END
Ptychobranchus subtentum	Fluted Kidneyshell	S2S3	TRKD
Quadrula cylindrica cylindrica	Rabbitsfoot	S3	TRKD
Quadrula cylindrica strigillata	Rough Rabbitsfoot	S2	END
Quadrula intermedia	Cumberland Monkeyface	S1	END
Quadrula sparsa	Appalachian Monkeyface	S1	END
Simpsonaias ambigua	Salamander Mussel	S1	TRKD
Strophitus connasaugaensis	Alabama Creekmussel	S1	TRKD
Toxolasma cylindrellus	Pale Lilliput	S1	END
Toxolasma lividus	Purple Lilliput	S1S2	TRKD
Villosa fabalis	Rayed Bean	S1	TRKD
Villosa perpurpurea	Purple Bean	S1	END

Scientific Name	Common Name	State Rank	State Status
Villosa trabalis	Cumberland Bean	S1	END
Villosa vibex	Southern Rainbow	S2	TRKD
Athearnia anthonyi	Anthony's River Snail	S1	END
Elimia interrupta	Knotty Elimia	S1	TRKD
Io fluvialis	Spiny Riversnail	S2	TRKD
Leptoxis subglobosa umbilicata	Umbilicate River Snail	S1	TRKD
Leptoxis virgata	Smooth Mudalia	S1	TRKD
Lithasia armigera	Armored Rocksnail	S1S2	TRKD
Lithasia duttoniana	Helmet Rock Snail	S2	TRKD
Lithasia geniculata	Ornate Rocksnail	S3	TRKD
Lithasia jayana	Rugose Rocksnail	S2	TRKD
Lithasia lima	Warty Rocksnail	S2	TRKD
Lithasia salebrosa	Muddy Rocksnail	S2	TRKD
Pleurocera alveare	Rugged Hornsnail	S2	TRKD
Pleurocera corpulenta	Corpulent Hornsnail	S1	TRKD
Pleurocera curta	Shortspire Hornsnail	S2	TRKD
Pyrgulopsis ogmorhaphe	Royal Marstonia	S1	END
Somatogyrus sp. 2	A Freshwater Snail	S1	TRKD
Acipenser fulvescens	Lake Sturgeon	S1	END
Ammocrypta beani	Naked Sand Darter	S2	NMGT
Ammocrypta clara	Western Sand Darter	S1	THR
Ammocrypta vivax	Scaly Sand Darter	S2	NMGT
Atractosteus spatula	Alligator Gar	S1	NMGT
Carpiodes velifer	Highfin Carpsucker	S2S3	NMGT
Clinostomus funduloides ssp. 1	Smoky Dace	S1S2	NMGT
Crystallaria asprella	Crystal Darter	SX	NMGT
Cycleptus elongatus	Blue Sucker	S2	THR
Cyprinella caerulea	Blue Shiner	S1	END
Erimonax monachus	Spotfin Chub	S2	THR
Erimystax cahni	Slender Chub	S1	THR
Etheostoma akatulo	Bluemask Darter	S1	END
Etheostoma aquali	Coppercheek Darter	S2S3	THR
Etheostoma baileyi	Emerald Darter	S2	NMGT
Etheostoma barbouri	Teardrop Darter	S2	NMGT
Etheostoma barrenense	Splendid Darter	S3	NMGT
Etheostoma bellum	Orangefin Darter	S3	NMGT
Etheostoma boschungi	Slackwater Darter	S1	THR
Etheostoma brevirostrum	Holiday Darter	S1	THR
Etheostoma cinereum	Ashy Darter	S2S3	THR
Etheostoma corona	Crown Darter	S1S2	END

Scientific Name	Common Name	State Rank	State Status
Etheostoma denoncourti	Golden Darter	S2	NMGT
Etheostoma ditrema	Coldwater Darter	S1	THR
Etheostoma etnieri	Cherry Darter	S3	TRKD
Etheostoma forbesi	Barrens Darter	S1	END
Etheostoma gutselli	Tuckasegee Darter	S1	END
Etheostoma lemniscatum	Tuxedo Darter	S1	END
Etheostoma luteovinctum	Redband Darter	S4	NMGT
Etheostoma marmorpinnum	Marbled Darter	S1	END
Etheostoma microlepidum	Smallscale Darter	S2	NMGT
Etheostoma neopterum	Lollipop Darter	S1S2	TRKD
Etheostoma olivaceum	Sooty Darter	S3	NMGT
Etheostoma pseudovulatum	Egg-Mimic Darter	S1	END
Etheostoma pyrrhogaster	Firebelly Darter	S2	NMGT
Etheostoma sagitta	Arrow Darter	S2	NMGT
Etheostoma sitikuense	Citico Darter	S1	END
Etheostoma striatulum	Striated Darter	S1	THR
Etheostoma susanae	Cumberland Darter	S1	END
Etheostoma tippecanoe	Tippecanoe Darter	S1S2	NMGT
Etheostoma trisella	Trispot Darter	S1	THR
Etheostoma tuscumbia	Tuscumbia Darter	SX	NMGT
Etheostoma wapiti	Boulder Darter	S1	END
Fundulus chrysotus	Golden Topminnow	S1S2	NMGT
Fundulus julisia	Barrens Topminnow	S1	END
Hemitremia flammea	Flame Chub	S3	NMGT
Hybognathus placitus	Plains Minnow	S1	NMGT
Ichthyomyzon gagei	Southern Brook Lamprey	S1	NMGT
Ichthyomyzon unicuspis	Silver Lamprey	S2	NMGT
Macrhybopsis gelida	Sturgeon Chub	S1	NMGT
Macrhybopsis meeki	Sicklefin Chub	S2	NMGT
Macrhybopsis sp. 1	Cf. M. Aestivalis	S1	TRKD
Moxostoma lacerum	Harelip Sucker	SX	NMGT
Notropis albizonatus	Palezone Shiner	SH	END
Notropis buccatus	Silverjaw Minnow	S2	THR
Notropis dorsalis	Bigmouth Shiner	S1	NMGT
Notropis lineapunctata	Lined Chub	S3	NMGT
Notropis rubellus	Rosyface Shiner	S2	TRKD
Notropis rupestris	Bedrock Shiner	S2	NMGT
Noturus baileyi	Smoky Madtom	S1	END
Noturus crypticus	Chucky Madtom	S1	END
Noturus fasciatus	Saddled Madtom	S2	THR

Scientific Name	Common Name	State Rank	State Status
Noturus flavipinnis	Yellowfin Madtom	S1	END
Noturus munitus	Frecklebelly Madtom	S1	THR
Noturus stanauli	Pygmy Madtom	S1	END
Noturus stigmosus	Northern Madtom	S3	NMGT
Percina antesella	Amber Darter	S1	END
Percina aurantiaca	Tangerine Darter	S3	NMGT
Percina burtoni	Blotchside Logperch	S2	NMGT
Percina jenkinsi	Conasauga Logperch	S1	END
Percina kathae	Mobile Logperch	S3	TRKD
Percina kusha	Bridled Darter	S1	TRKD
Percina macrocephala	Longhead Darter	S2	THR
Percina phoxocephala	Slenderhead Darter	S3	NMGT
Percina squamata	Olive Darter	S2	NMGT
Percina stictogaster	Frecklebelly Darter	S1	NMGT
Percina tanasi	Snail Darter	S2S3	THR
Phoxinus cumberlandensis	Blackside Dace	S2	THR
Phoxinus saylori	Laurel Dace	S1	END
Phoxinus tennesseensis	Tennessee Dace	S3	NMGT
Polyodon spathula	Paddlefish	S3	TRKD
Scaphirhynchus albus	Pallid Sturgeon	S1	END
Thoburnia atripinnis	Blackfin Sucker	S1	NMGT
Typhlichthys subterraneus	Southern Cavefish	S3	NMGT
Plant Species			
Amsonia tabernaemontana var. gattingeri	A Blue-Star	S3	SPCO
Sporobolus junceus	A Dropseed	S1	SPCO
Solidago stricta var. gracillima	A Goldenrod	S1	SPCO
Arenaria lanuginosa	A Sandwort	S1	END
Botrychium jenmanii	Alabama Grapefern	S1	THR
Neviusia alabamensis	Alabama Snow-Wreath	S2	THR
Rhamnus alnifolia	Alderleaf Buckthorn	S1	END
Berberis canadensis	American Barberry	S2	SPCO
Castanea dentata	American Chestnut	S2S3	SPCO
Lonicera canadensis	American Fly-Honeysuckle	S1	THR
Coeloglossum viride var. virescens	American Frog Orchid	S1	END
Panax quinquefolius	American Ginseng	S3S4	S-CE
Pilularia americana	American Pillwort	S1S2	SPCO
Cotinus obovatus	American Smoke-Tree	S2	SPCO
Veronica americana	American Speedwell	S1	SPCO
Hydrocotyle americana	American Water-Pennywort	S1	END

Scientific Name	Common Name	State Rank	State Status
Pyrola americana	American Wintergreen	S2	END
Trichomanes boschianum	Appalachian Bristle Fern	S1S2	THR
Cimicifuga rubifolia	Appalachian Bugbane	S3	THR
Woodsia scopulina var. appalachiana	Appalachian Cliff-Fern	S1S2	SPCO
Huperzia appalachiana	Appalachian Fir-Clubmoss	S1	THR
Gentiana austromontana	Appalachian Gentian	S3	SPCO
Agrostis mertensii	Arctic Bentgrass	S1	SH
Viburnum bracteatum	Arrow-Wood	S1	END
Thermopsis fraxinifolia	Ash-Leaved Bush-Pea	S3	THR
Prenanthes barbata	Barbed Rattlesnake-Root	S2	SPCO
Carex barrattii	Barratt's Sedge	S2	END
Symphyotrichum pratense	Barrens Silky Aster	S1	END
Schisandra glabra	Bay Starvine	S2	THR
Diarrhena obovata	Beak Grass	S1	SPCO
Rhynchospora perplexa	Beakrush	S2	THR
Rhynchospora rariflora	Beakrush	S1	END
Rhynchospora wrightiana	Beakrush	SH	E-P
Bulbostylis ciliatifolia var. coarctata	Beak-rush	SH	E-P
Brachyelytrum erectum var. septentrionale	Bearded Short-Husk	S2	SPCO
Gymnopogon brevifolius	Beardgrass	S1S2	SPCO
Geum geniculatum	Bent Avens	S1	END
Cardamine flagellifera	Bitter Cress	S2	THR
Isoetes melanopoda	Blackfoot Quillwort	S1S2	END
Caulophyllum giganteum	Blue Cohosh	S1	THR
Hypericum mitchellianum	BR St. John's-Wort	S2	THR
Salvia azurea var. grandiflora	Blue Sage	S3	SPCO
Phacelia ranunculacea	Blue Scorpion-Weed	S2S3	SPCO
Collinsia verna	Blue-Eyed Mary	S1	END
Botrychium oneidense	Blunt-Lobe Grapefern	S1	SPCO
Thelypteris simulata	Bog Fern	SH	E-P
Danthonia epilis	Bog Oat-Grass	S1S2	SPCO
Lachnocaulon anceps	Bog-Buttons	SH	E-P
Polygala boykinii	Boykin's Milkwort	S2	THR
Aristida ramosissima	Branched Three-Awn Grass	SH	E-P
Sparganium androcladum	Branching Burreed	S1	END
Draba ramosissima	Branching Whitlow-Wort	S2	SPCO
Marshallia trinervia	Broadleaf Barbara's-Buttons	S2S3	THR
Melanthium latifolium	Broadleaf Bunchflower	S1S2	END
Solidago lancifolia	Broad-Leaf Golden-Rod	S1	END

Scientific Name	Common Name	State Rank	State Status
Coreopsis latifolia	Broad-Leaved Tickseed	S1S2	END
Carex bromoides ssp. montana	Brome-Like Sedge	S1	THR
Trifolium reflexum	Buffalo Clover	S1	END
Ribes odoratum	Buffalo Currant	SH	THR
Ophioglossum crotalophoroides	Bulbous Adder's-Tongue	SH	SPCO
Melanthium virginicum	Bunchflower	S1	END
Juglans cinerea	Butternut	S3	THR
Eryngium integrifolium	Button Snakeroot	S1	THR
Carex buxbaumii	Buxbaum's Sedge	S1	THR
Sanguisorba canadensis	Canada Burnet	S1	END
Helianthemum canadense	Canada Frostweed	SH	E-P
Lilium canadense	Canada Lily	S3	THR
Taxus canadensis	Canadian Yew	S1	END
Lobelia canbyi	Canby's Lobelia	S2S3	THR
Paxistima canbyi	Canby's Mountain-Lover	S1	END
Anemone caroliniana	Carolina Anemone	S1S2	END
Tsuga caroliniana	Carolina Hemlock	S3	THR
Ulmus crassifolia	Cedar Elm	S2	SPCO
Acer leucoderme	Chalk Maple	S3	SPCO
Tridens flavus var. chapmanii	Chapman's Redtop	SH	SPCO
Carex chapmanii	Chapman's Sedge	S1	THR
Prunus virginiana	Chokecherry	S1	SPCO
Streptopus amplexifolius	Clasping Twisted-Stalk	S1	THR
Phlox bifida ssp. stellaria	Cleft Phlox	S3	THR
Adlumia fungosa	Climbing Fumitory	S2	THR
Clintonia borealis	Clinton Lily	S2S3	SPCO
Festuca paradoxa	Cluster Fescue	S1	SPCO
Clethra alnifolia	Coast Pepper-Bush	S1	END
Triantha racemosa	Coastal False-Asphodel	S1	END
Xyris ambigua	Coastal-Plain Yellow-Eyed-Grass	S1	END
Silphium laciniatum	Compass-Plant	S2	THR
Heracleum maximum	Cow Parsnip	S2	SPCO
Desmodium ochroleucum	Creamflower Tick-Trefoil	S1	END
Potamogeton epihydrus	Creekgrass	S1S2	SPCO
Acmella oppositifolia	Creeping Spot-Flower	S2	SPCO
Hypericum adpressum	Creeping St. John's-Wort	S1	END
Dryopteris cristata	Crested Woodfern	S2	THR
Silphium brachiatum	Cumberland Rosinweed	S2	END
Thaspium pinnatifidum	Cutleaf Meadow-Parsnip	S1	END
Carex davisii	Davis' Sedge	S1	SPCO

Scientific Name	Common Name	State Rank	State Status
Acalypha deamii	Deam's Copperleaf	S1	SPCO
Zigadenus leimanthoides	Death-Camas	S2	THR
Trillium decumbens	Decumbent Trillium	S1	END
Carex sterilis	Dioecious Sedge	SH	E-P
Gentiana puberulenta	Downy Gentian	S1	END
Poa saltuensis	Drooping Bluegrass	S1	THR
Lesquerella densipila	Duck River Bladderpod	S3	THR
Trichomanes petersii	Dwarf Filmy-Fern	S2	THR
Gaylussacia dumosa	Dwarf Huckleberry	S3	THR
Polygala nana	Dwarf Milkwort	S1	END
Goodyera repens	Dwarf Rattlesnake-Plantain	S1	SPCO
Drosera brevifolia	Dwarf Sundew	S2	THR
Solidago auriculata	Eared Goldenrod	S1	THR
Agalinis auriculata	Earleaf Foxglove	S2	END
Xerophyllum asphodeloides	Eastern Turkeybeard	S3	THR
Dichanthelium acuminatum ssp. spretum	Eaton's Witchgrass	S1	END
Vaccinium elliottii	Elliott's Blueberry	S1	END
Evolvulus nuttallianus	Evolvulus	S3	SPCO
Rhynchospora caduca	Falling Beaked-Rush	S1	SPCO
Krigia montana	False Dandelion	S1	THR
Onosmodium molle ssp. subsetosum	False Gromwell	S1	END
Talinum mengesii	Fame-Flower	S2	THR
Hottonia inflata	Featherfoil	S2	SPCO
Arnoglossum plantagineum	Fen Indian-Plantain	S2	THR
Menziesia pilosa	Fetterbush	S2	SPCO
Leucothoe racemosa	Fetter-bush	S2	THR
Epilobium angustifolium	Fireweed	S1	THR
Eleocharis compressa	Flat-Stemmed Spike-Rush	S1	SPCO
Gratiola floridana	Florida Hedge-Hyssop	S1	END
Lysimachia quadriflora	Four-Flowered Loosestrife	S1	SPCO
Poa palustris	Fowl Bluegrass	S1	END
Lycopodiella alopecuroides	Foxtail Clubmoss	S2	THR
Carex alopecoidea	Foxtail Sedge	SH	E-P
Galium uniflorum	Fragrant Bedstraw	S1	SPCO
Abies fraseri	Fraser Fir	S1S2	THR
Lysimachia fraseri	Fraser Loosestrife	S2	END
Triadenum fraseri	Fraser's Marsh St. Johns-Wort	S1?	SPCO
Cymophyllus fraserianus	Fraser's Sedge	S3	SPCO
Polygonum cilinode	Fringed Black Bindweed	S1S2	THR

Scientific Name	Common Name	State Rank	State Status
Xyris fimbriata	Fringed Yellow-Eyed-Grass	S1	END
Solidago gattingeri	Gattinger's Goldenrod	S1	END
Agastache scrophulariifolia	Giant Hyssop	S1S2	THR
Sacciolepis striata	Gibbous Panic-Grass	S1	SPCO
Leavenworthia exigua var. exigua	Glade Cress	S3	SPCO
Allium stellatum	Glade Onion	S1	END
Ludwigia sphaerocarpa	Globe-Fruited Ludwigia	S1	THR
Minuartia godfreyi	Godfrey's Stitchwort	S1	END
Hydrastis canadensis	Goldenseal	S3	S-CE
Hymenophyllum tayloriae	Gorge Filmy Fern	S2	SPCO
Ribes curvatum	Granite Gooseberry	S1	THR
Sagittaria graminea	Grassleaf Arrowhead	S1	THR
Lilium grayi	Gray's Lily	S1	END
Spiranthes magnicamporum	Great Plains Ladies'-Tresses	S1	SPCO
Alnus viridis ssp. crispa	Green Alder	S1	SPCO
Chrysogonum virginianum	Green-and-Gold	S2	THR
Onosmodium hispidissimum	Hairy False Gromwell	S1	END
Fimbristylis puberula	Hairy Fimbristylis	S1S2	THR
Hieracium longipilum	Hairy Hawkweed	S1	SPCO
Carex oxylepis var. pubescens	Hairy Sharp-Scaled Sedge	S1	SPCO
Fuirena squarrosa	Hairy Umbrella-Sedge	S1	SPCO
Polygonum arifolium	Halberd-Leaf Tearthumb	S1	THR
Crataegus harbisonii	Harbison Hawthorn	S1	END
Fimbristylis perpusilla	Harper's Fimbristylis	S1	END
Eriogonum longifolium var. harperi	Harper's Umbrella-Plant	S1	END
Carex argyrantha	Hay Sedge	S1	THR
Betula papyrifera var. cordifolia	Heart-Leaved Paper Birch	S1	END
Plantago cordata	Heartleaved Plantain	S1	END
Carex gravida	Heavy-Fruited Sedge	S1	SPCO
Pseudognaphalium helleri	Heller's Catfoot	S2	SPCO
Geranium robertianum	Herb-Robert	S1	SPCO
Rhynchospora capillacea	Horned Beakrush	SH	E-P
Utricularia cornuta	Horned Bladderwort	S1	END
Symplocos tinctoria	Horsesugar	S2	SPCO
Eleocharis equisetoides	Horse-Tail Spikerush	S1	END
Hydrolea ovata	Hydrolea	S1	SPCO
Silphium wasiotense	Kentucky Rosin-Weed	S2	END
Athyrium filix-femina ssp. angustum	Lady Fern	S2	SPCO
Cypripedium kentuckiense	Lady-Slipper	S2	END
Neobeckia aquatica	Lake-Cress	S2	SPCO

Scientific Name	Common Name	State Rank	State Status
Iris brevicaulis	Lamance Iris	S1	END
Kalmia angustifolia var. carolina	Lambkill	SX	E-P
Trillium lancifolium	Lance-Leaf Trillium	S1	END
Eleocharis lanceolata	Lance-Like Spikerush	S1	SPCO
Vaccinium macrocarpon	Large Cranberry	S2	THR
Platanthera grandiflora	Large Purple Fringed Orchid	S2	END
Platanthera orbiculata	Large Roundleaf Orchid	S3	THR
Marshallia grandiflora	Large-Flowered Barbara's-Buttons	S2	END
Potamogeton amplifolius	Large-Leaf Pondweed	S1	THR
Parnassia grandifolia	Large-Leaved Grass-of-Parnassus	S3	SPCO
Coreopsis delphiniifolia	Larkspur-Leaved Coreopsis	S1	END
Solidago tarda	Late Goldenrod	SH	SPCO
Trillium pusillum	Least Trillium	S2	END
Clematis glaucophylla	Leather-Flower	S1	END
Thalictrum coriaceum	Leatherleaf Meadowrue	S1	THR
Lechea pulchella	Leggett's Pinweed	S1	END
Trifolium calcaricum	Leo's Trifolium	S1	END
Talinum calcaricum	Limestone Fame-Flower	S3	SPCO
Carex echinata ssp. echinata	Little Prickly Sedge	S1?	SPCO
Liparis loeselii	Loesel's Twayblade	S1	THR
Stellaria longifolia	Longleaf Stitchwort	S1	END
Rhynchospora chalarocephala	Loose-Head Beakrush	S1	THR
Orobanche ludoviciana	Louisiana Broomrape	SH	SPCO
Helianthemum propinquum	Low Frostweed	S1S2	END
Scleria verticillata	Low Nutrush	S2	SPCO
Ageratina luciae-brauniae	Lucy Braun's White Snakeroot	S3	THR
Panicum hemitomon	Maidencane	S2	SPCO
Carex manhartii	Manhart Sedge	S2	END
Glyceria acutiflora	Manna-Grass	S2	SPCO
Heuchera longiflora var. aceroides	Maple-Leaf Alumroot	S2	SPCO
Galium palustre	Marsh Bedstraw	S1	SPCO
Campanula aparinoides	Marsh Bellflower	S2	SPCO
Lathyrus palustris	Marsh Pea	S1	SPCO
Caltha palustris	Marsh-Marigold	S1	END
Veronica scutellata	Marsh-Speedwell	S1	END
Polygala mariana	Maryland Milkwort	S1	SPCO
Botrychium matricariifolium	Matricary Grapefern	S1	SPCO
Helianthus occidentalis	Mcdowell Sunflower	S2	SPCO
Meehania cordata	Meehania Mint (Heart-Leaf Meehania)	S2	THR

Scientific Name	Common Name	State Rank	State Status
Lilium michiganense	Michigan Lily	S3	THR
Oenothera macrocarpa ssp. macrocarpa	Missouri Evening-Primrose	S2	THR
Ribes missouriense	Missouri Gooseberry	S2	SPCO
Phlox subulata	Moss Phlox	S1	THR
Cardamine clematitis	Mountain Bitter Cress	S2	THR
Diervilla sessilifolia var. rivularis	Mountain Bush-Honeysuckle	S2	THR
Pieris floribunda	Mountain Fetter-Bush	S2	THR
Lonicera dioica	Mountain Honeysuckle	S2	SPCO
Hypericum graveolens	Mountain St. John's-Wort	S3	END
Pycnanthemum verticillatum	Mountain-Mint	SH	E-P
Muhlenbergia glabriflora	Muhly	S1	SPCO
Iris prismatica	Narrow Blue Flag	S2S3	THR
Lespedeza angustifolia	Narrowleaf Bushclover	S2	THR
Gentiana linearis	Narrowleaf Gentian	S1	THR
Spiraea alba	Narrow-Leaved Meadow-Sweet	S1	END
Allium burdickii	Narrow-Leaved Wild Leek	S1S2	T-CE
Dichanthelium aciculare	Needleleaf Witchgrass	S1	END
Nestronia umbellula	Nestronia	S1	END
Sedum nevii	Nevius' Stonecrop	S1	END
Prenanthes crepidinea	Nodding Rattlesnake-Root	S2	END
Utricularia resupinata	Northeastern Bladderwort	S1	SPCO
Phegopteris connectilis	Northern Beechfern	S1	SPCO
Diervilla lonicera	Northern Bush-Honeysuckle	S2	THR
Sporobolus heterolepis	Northern Dropseed	S1	SPCO
Oenothera parviflora	Northern Evening-Primrose	S1	SPCO
Glyceria canadensis var. laxa	Northern Manna-Grass	S1	SPCO
Zanthoxylum americanum	Northern Prickly-Ash	S2	SPCO
Trientalis borealis	Northern Starflower	S1	THR
Thuja occidentalis	Northern White Cedar	S3	SPCO
Marshallia obovata	Obovate Marshallia	S1	THR
Carex ouachitana	Ouachita Sedge	S1	SPCO
Silene ovata	Ovate Catchfly	S2	END
Sagittaria platyphylla	Ovate-Leaved Arrowhead	S2S3	SPCO
Melanthium woodii	Ozark Bunchflower	S1	END
Corydalis sempervirens	Pale Corydalis	S1S2	END
Platanthera flava var. herbiola	Pale Green Orchid	S2	THR
Torreyochloa pallida	Pale Manna Grass	S1	SPCO
Hypericum ellipticum	Pale St. John's-Wort	S1	END
Mirabilis albida	Pale Umbrella-Wort	S2	THR

Scientific Name	Common Name	State Rank	State Status
Echinacea pallida	Pale-purple Coneflower	S1	THR
Dichanthelium acuminatum ssp. leucothrix	Panic-Grass	S1	SPCO
Dichanthelium ensifolium ssp. curttfolium	Panic-Grass	S1	END
Leavenworthia exigua var. lutea	Pasture Glade-Cress	SH	E-P
Perideridia americana	Perideridia	S2	END
Tetragonotheca helianthoides	Pineland Squarehead	SH	E-P
Cypripedium acaule	Pink Lady-Slipper	S4	S-CE
Clematis pitcheri	Pitcher Leather-Flower	SH	THR
Helianthemum bicknellii	Plains Frostweed	SH	E-P
Muhlenbergia cuspidata	Plains Muhlenbergia	S1	END
Cyperus plukenetii	Plukenet's Cyperus	SH	SPCO
Ammoselinum popei	Pope Sand-Parsley	S2	THR
Calamagrostis porteri	Porter's Reedgrass	S1	END
Agalinis heterophylla	Prairie False-Foxglove	S1	THR
Solidago ptarmicoides	Prairie Goldenrod	S1S2	END
Polytaenia nuttallii	Prairie Parsley	S1	THR
Packera plattensis	Prairie Ragwort	SH	SPCO
Silphium pinnatifidum	Prairie-Dock	S2	THR
Ceratophyllum echinatum	Prickly Hornwort	S1	SPCO
Asclepias purpurascens	Purple Milkweed	S1	SPCO
Dalea purpurea	Purple Prairie-Clover	S1	END
Ruellia purshiana	Pursh's Wild-Petunia	S1S2	SPCO
Crotalaria purshii	Rattlebox	SH	E-P
Iris fulva	Red Iris	S2	THR
Lachnanthes caroliana	Red Root	S1	END
Chelone obliqua	Red Turtlehead	S1	SPCO
Calamagrostis cainii	Reedgrass	S1	END
Agalinis oligophylla	Ridge-Stem False-Foxglove	S1	END
Bolboschoenus fluviatilis	River Bulrush	S1	SPCO
Solidago rupestris	Rock Goldenrod	S1	END
Scutellaria saxatilis	Rock Skullcap	S3	THR
Eurybia saxicastellii	Rockcastle Aster	S1S2	END
Pogonia ophioglossoides	Rose Pogonia	S2	END
Sabatia capitata	Rose-Gentian	S2	END
Streptopus roseus	Rosy Twisted-Stalk	S2	SPCO
Geum laciniatum	Rough Avens	S1	SPCO
Galium asprellum	Rough Bedstraw	S1	SPCO
Hieracium scabrum	Rough Hawkweed	S2	THR

Scientific Name	Common Name	State Rank	State Status
Prenanthes aspera	Rough Rattlesnake-Root	S1	END
Talinum teretifolium	Roundleaf Fameflower	S2	THR
Amelanchier sanguinea	Roundleaf Serviceberry	S2	THR
Drosera rotundifolia	Roundleaf Sundew	S1	THR
Cardamine rotundifolia	Roundleaf Water-Cress	S2S3	SPCO
Silene regia	Royal Catchfly	SH	E-P
Rugelia nudicaulis	Rugel's Ragwort	S2	END
Prunus pumila	Sand Cherry	S1	END
Vitis rupestris	Sand Grape	S1	END
Quercus margaretta	Sand Post Oak	S1	SPCO
Calamovilfa arcuata	Sandreed Grass	S2	END
Buckleya distichophylla	Sapsuck	S2	THR
Saxifraga caroliniana	Saxifrage	S1S2	END
Eurybia schreberi	Schreber Aster	S1	SPCO
Packera schweinitziana	Schweinitz's Ragwort	S1	THR
Carex comosa	Sedge	S2	THR
Carex hirtifolia	Sedge	S1S2	SPCO
Carex hitchcockiana	Sedge	S1	THR
Carex lacustris	Sedge	S1	THR
Carex misera	Sedge	S2	THR
Carex muskingumensis	Sedge	SH	E-P
Carex pallescens	Sedge	S1	SPCO
Carex reniformis	Sedge	S1	SPCO
Carex roanensis	Sedge	S2	END
Carex ruthii	Sedge	S2	THR
Carex vestita	Sedge	SH	E-P
Carex x aestivaliformis	Sedge	S1	SPCO
Veronica catenata	Sessile Water-Speedwell	S1	END
Sagittaria rigida	Sessile-Fruited Arrowhead	S1	SPCO
Ponthieva racemosa	Shadow-Witch Orchid	S1	END
Spiranthes lucida	Shining Ladies'-Tresses	S1S2	THR
Sagittaria brevirostra	Short-Beak Arrowhead	S1	THR
Juncus brachycephalus	Short-Head Rush	S2	SPCO
Helenium brevifolium	Shortleaf Sneezeweed	S1	END
Arabis shortii	Short's Rock-Cress	S1S2	SPCO
Cypripedium reginae	Showy Lady-Slipper	S1	END
Paronychia argyrocoma	Silverling	S1S2	THR
Symplocarpus foetidus	Skunk Cabbage	S1	END
Liatris cylindracea	Slender Blazing-Star	S2	THR
Penstemon tubiflorus	Small Flowered Beardtongue	S1	SPCO

Scientific Name	Common Name	State Rank	State Status
Platanthera psycodes	Small Purple Fringe Orchid	S2	SPCO
Allium tricoccum	Small White Leek	S1S2	S-CE
Heteranthera limosa	Smaller Mud-Plantain	S1S2	THR
Dichanthelium ensifolium ssp. ensifolium	Small-Leaved Panic Grass	S2	SPCO
Diamorpha smallii	Small's Stonecrop	S1S2	END
Glyceria nubigena	Smoky Mountain Manna-Grass	S1S2	THR
Platanthera nivea	Snowy Orchid	S1	END
Polygonella americana	Southern Jointweed	S1S2	END
Lobelia amoena	Southern Lobelia	S1S2	THR
Trillium rugelii	Southern Nodding Trillium	S2	END
Stylisma humistrata	Southern Morning-Glory	S1	THR
Listera australis	Southern Twayblade	S1S2	END
Eleocharis intermedia	Spike-Rush	S1	END
Dryopteris carthusiana	Spinulose Woodfern	S1	THR
Corallorhiza maculata	Spotted Coral-Root	S1	THR
Aureolaria patula	Spreading False-Foxglove	S3	SPCO
Arabis patens	Spreading Rockcress	S1	END
Stachys clingmanii	Stachys	S1S2	THR
Maianthemum stellatum	Starflower Solomons-Seal	S1	END
Lycopodium annotinum	Stiff Clubmoss	SH	E-P
Lesquerella stonensis	Stones River Bladderpod	S1	END
Sullivantia sullivantii	Sullivantia	S1	END
Drosera capillaris	Sundew	S1	THR
Schoenolirion croceum	Sunnybell	S3	THR
Elymus svensonii	Svenson's Wild-Rye	S2	END
Lysimachia terrestris	Swamp Loosestrife	S1	END
Pedicularis lanceolata	Swamp Lousewort	S1S2	SPCO
Saxifraga pensylvanica	Swamp Saxifrage	S1	END
Rudbeckia subtomentosa	Sweet Coneflower	S2	THR
Comptonia peregrina	Sweet Fern	S1	END
Monotropsis odorata	Sweet Pinesap	S2	THR
Magnolia virginiana	Sweetbay Magnolia	S2	THR
Spiranthes odorata	Sweetscent Ladies'-Tresses	S1	END
Hasteola suaveolens	Sweet-Scented Indian-Plantain	S2	THR
Utricularia inflata	Swollen Bladderwort	S1	SPCO
Delphinium exaltatum	Tall Larkspur	S2	END
Eriophorum virginicum	Tawny Cotton-Grass	S1S2	END
Eriocaulon decangulare	Ten-angle Pipewort	S1	END
Astragalus tennesseensis	Tennessee Milk-Vetch	S3	SPCO

Scientific Name	Common Name	State Rank	State Status
Potamogeton tennesseensis	Tennessee Pondweed	S2	THR
Agalinis setacea	Thread-Leaved Gerardia	SH	SPCO
Viola tripartita var. tripartita	Three-Parted Violet	S2S3	SPCO
Potentilla tridentata	Three-Toothed Cinquefoil	S1S2	SPCO
Carex hyalina	Tissue Sedge	S1	SPCO
Cyperus dentatus	Toothed Sedge	S1	SPCO
Muhlenbergia torreyana	Torrey Muhly	S1	END
Arabis glabra	Tower-Mustard	S1	SPCO
Stellaria alsine	Trailing Stitchwort	S1	END
Aconitum reclinatum	Trailing Wolfsbane	S1	END
Lycopodium dendroideum	Treelike Clubmoss	S1	SPCO
Trichophorum cespitosum	Tufted Clubrush	S1	END
Eleocharis tortilis	Twisted Spike-Rush	S1	SPCO
Cerastium velutinum	Velvety Cerastium	S1	END
Woodwardia virginica	Virginia Chainfern	S2	SPCO
Hexastylis virginica	Virginia Heartleaf	S2	SPCO
Sida hermaphrodita	Virginia Mallow	SH	E-P
Rosa virginiana	Virginia Rose	SH	SPCO
Hydrophyllum virginianum	Virginia Waterleaf	S3	THR
Echinochloa walteri	Walter's Barnyard Grass	S1	SPCO
Schoenoplectus subterminalis	Water Bulrush	S1	SPCO
Stellaria fontinalis	Water Stitchwort	S3	THR
Myriophyllum pinnatum	Water-Milfoil	S1	THR
Didiplis diandra	Water-Purslane	S1	THR
Elodea nuttallii	Waterweed	S2	SPCO
Echinacea simulata	Wavy-Leaf Purple-Coneflower	S2	THR
Draba cuneifolia	Wedge-Leaf Whitlow-Grass	S1S2	SPCO
Onosmodium molle ssp. occidentale	Western False Gromwell	S1S2	THR
Arabis hirsuta	Western Hairy Rock-Cress	S1	THR
Erysimum capitatum	Western Wallflower	S1S2	END
Rhynchospora alba	White Beakrush	SH	E-P
Zigadenus glaucus	White Camas	S1	END
Symphyotrichum ericoides	White Heath Aster	SH	THR
Dalea candida	White Prairie-Clover	S2	SPCO
Ranunculus aquatilis var. diffusus	White Water Buttercup	S1	END
Eupatorium leucolepis	White-Bract Thoroughwort	S1	END
Helianthus glaucophyllus	White-Leaved Sunflower	S1	THR
Silene caroliniana ssp. pensylvanica	Wild Pink	S1S2	THR
Symphyotrichum praealtum	Willow Aster	S1	END
Epilobium ciliatum	Willow-Herb	S1	THR

Scientific Name	Common Name	State Rank	State Status
Epilobium leptophyllum	Willow-Herb	S1	THR
Fothergilla major	Witch-Alder	S2	THR
Lilium philadelphicum	Wood Lily	S1	END
Geum aleppicum	Yellow Avens	S1	SPCO
Platanthera integra	Yellow Fringeless Orchid	S1	END
Lonicera flava	Yellow Honeysuckle	S1	THR
Gelsemium sempervirens	Yellow Jessamine	S1S2	SPCO
Spiranthes ochroleuca	Yellow Nodding Ladies'-Tresses	SH	E-P
Erythronium rostratum	Yellow Trout-Lily	S2	SPCO
Ranunculus flabellaris	Yellow Water-Crowfoot	S2	THR
Xyris laxifolia var. iridifolia	Yellow-Eyed-Grass	S2	THR
Utricularia subulata	Zigzag Bladderwort	S1	THR
Terrestrial Animal Species			
Hyla gratiosa	Barking Treefrog	S3	NMGT
Desmognathus welteri	Black Mountain Salamander	S3	NMGT
Hemidactylium scutatum	Four-Toed Salamander	S3	NMGT
Rana capito	Gopher Frog	S1	TRKD
Cryptobranchus alleganiensis	Hellbender	S3	NMGT
Desmognathus imitator	Imitator Salamander	S3	TRKD
Eurycea junaluska	Junaluska Salamander	S2	NMGT
Desmognathus wrighti	Pigmy Salamander	S2	NMGT
Plethodon shermani	Red-Legged Salamander	S2	TRKD
Desmognathus aeneus	Seepage Salamander	S1	NMGT
Ambystoma barbouri	Streamside Salamander	S2	NMGT
Gyrinophilus palleucus	Tennessee Cave Salamander	S2	THR
Plethodon wehrlei	Wehrle’s Salamander	S1	NMGT
Plethodon welleri	Weller's Salamander	S1	NMGT
Empidonax alnorum	Alder Flycatcher	S1	TRKD
Botaurus lentiginosus	American Bittern	S1	TRKD
Anhinga anhinga	Anhinga	S1	NMGT
Aimophila aestivalis	Bachman's Sparrow	S2	END
Haliaeetus leucocephalus	Bald Eagle	S3	NMGT
Tyto Alba	Barn Owl	S3	NMGT
Thryomanes bewickii	Bewick's Wren	S1	END
Laterallus jamaicensis	Black Rail	S1	TRKD
Poecile atricapilla	Black-Capped Chickadee	S2	NMGT
Bubulcus ibis	Cattle Egret	S2	TRKD
Dendroica cerulea	Cerulean Warbler	S3	NMGT
Gallinula chloropus	Common Moorhen	S1	NMGT
Corvus corax	Common Raven	S2	THR

Scientific Name	Common Name	State Rank	State Status
Aquila chrysaetos	Golden Eagle	S1	THR
Vermivora chrysoptera	Golden-Winged Warbler	S3	NMGT
Ardea alba	Great Egret	S2	NMGT
Ammodramus henslowii	Henslow's Sparrow	S1	NMGT
Sterna a. athalassos	Interior Least Tern	S2S3	END
Rallus elegans	King Rail	S2	NMGT
Chondestes grammacus	Lark Sparrow	S1	THR
Ixobrychus exilis	Least Bittern	S2	NMGT
Egretta caerulea	Little Blue Heron	S2	NMGT
Lanius ludovicianus	Loggerhead Shrike	S3	NMGT
Ictinia mississippiensis	Mississippi Kite	S2S3	NMGT
Circus cyaneus	Northern Harrier	S4	NMGT
Aegolius acadicus	Northern Saw-Whet Owl	S1	THR
Contopus cooperi	Olive-Sided Flycatcher	S1	NMGT
Falco peregrinus	Peregrine Falcon	S1	END
Charadrius melodus	Piping Plover	S2	END/THR
Loxia curvirostra	Red Crossbill	S1	TRKD
Passerculus sandwichensis	Savannah Sparrow	S1	TRKD
Tyrannus forficatus	Scissor-Tailed Flycatcher	S1	TRKD
Accipiter striatus	Sharp-Shinned Hawk	S3	NMGT
Egretta thula	Snowy Egret	S2	NMGT
Limnothlypis swainsonii	Swainson's Warbler	S3	NMGT
Pooecetes gramineus	Vesper Sparrow	S1	NMGT
Sphyrapicus varius	Yellow-Bellied Sapsucker	S1	NMGT
Rallus limicola	Virginia Rail	S1	TRKD
Neotoma magister	Allegheny Woodrat	S3	NMGT
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	S1	END
Sorex cinereus	Common Shrew	S4	NMGT
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S3	NMGT
Myotis leibii	Eastern Small-Footed Bat	S2S3	NMGT
Spilogale putorius	Eastern Spotted Skunk	S3	TRKD
Neotoma floridana illinoensis	Eastern Woodrat	S3	NMGT
Myotis grisescens	Gray Bat	S2	END
Parascalops breweri	Hairy-Tailed Mole	S3	NMGT
Myotis sodalis	Indiana Bat	S1	END
Mustela nivalis	Least Weasel	S2	TRKD
Sorex dispar	Long-Tailed Shrew	S2	NMGT
Zapus hudsonius	Meadow Jumping Mouse	S4	NMGT
Sylvilagus obscurus	Appalachian Cottontail	S3	NMGT
Sorex hoyi	Pygmy Shrew	S2	TRKD

Scientific Name	Common Name	State Rank	State Status
Sorex fumeus	Smoky Shrew	S4	NMGT
Sorex longirostris	Southeastern Shrew	S4	NMGT
Neotoma floridana haematoreia	Southern Appalachian Woodrat	S2	NMGT
Synaptomys cooperi	Southern Bog Lemming	S4	NMGT
Microtus chrotorrhinus carolinensis	Southern Rock Vole	S2	NMGT
Sorex palustris punctulatus	Southern Water Shrew	S2	NMGT
Condylura cristata	Star-Nosed Mole	S2	NMGT
Napaeozapus insignis	Woodland Jumping Mouse	S4	NMGT
Macrochelys temminckii	Alligator Snapping Turtle	S2S3	NMGT
Glyptemys muhlenbergii	Bog Turtle	S1	THR
Eumeces anthracinus	Coal Skink	S1	NMGT
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	S3	NMGT
Nerodia cyclopion	Mississippi Green Water Snake	S2	NMGT
Pituophis melanoleucus melanoleucus	Northern Pine Snake	S3	THR
Sistrurus miliarius streckeri	Western Pigmy Rattlesnake	S2S3	THR
Batrisodes pannosus	A Beetle	S1S2	TRKD
Batrisodes subterraneus	A Beetle	S1S2	TRKD
Batrisodes valentinei	A Beetle	S1?	TRKD
Nelsonites walteri	A Beetle	S3	TRKD
Trechus luculentus	A Carabid Beetle	S3	TRKD
Trechus novaculosus	A Carabid Beetle	S2	TRKD
Trechus roanicus	A Carabid Beetle	S1	TRKD
Hadenoecus opilionides	A Cave Cricket	S2?	TRKD
Chaetaspis mollis	A Cave Millipede	S1	TRKD
Batrisodes barri	A Cave Obligate Beetle	S1S2	TRKD
Batrisodes clypeospecus	A Cave Obligate Beetle	S1S2	TRKD
Batrisodes ferulifer	A Cave Obligate Beetle	S1S2	TRKD
Batrisodes gemmoides	A Cave Obligate Beetle	S1S2	TRKD
Batrisodes gemmus	A Cave Obligate Beetle	S1S2	TRKD
Tychobythinus strinatii	A Cave Obligate Beetle	S1S2	TRKD
Ptomaphagus barri	A Cave Obligate Beetle	S1S2	TRKD
Ptomaphagus chromolithus	A Cave Obligate Beetle	S1?	TRKD
Ptomaphagus fecundus	A Cave Obligate Beetle	S1	TRKD
Pseudanophthalmus scutilus	A Cave Obligate Beetle	S1	TRKD
Pseudanophthalmus farrelli	A Cave Obligate Beetle	S1S2	TRKD
Pseudanophthalmus hesperus	A Cave Obligate Beetle	S1	TRKD
Pseudanophthalmus loganensis	A Cave Obligate Beetle	S1S2	TRKD
Pseudanophthalmus macradei	A Cave Obligate Beetle	S1S2	TRKD
Pseudanophthalmus robustus	A Cave Obligate Beetle	S3	TRKD
Pseudanophthalmus scutilu	A Cave Obligate Beetle	S1	TRKD

Scientific Name	Common Name	State Rank	State Status
Pseudanophthalmus templetoni	A Cave Obligate Beetle	S1S2	TRKD
Pseudanophthalmus tennesseensis	A Cave Obligate Beetle	S2	TRKD
Pseudanophthalmus vanburenensis	A Cave Obligate Beetle	S1S2	TRKD
Tychobythinus strinatii	A Cave Obligate Beetle	S1S2	TRKD
Pseudanophthalmus fulleri	A Cave Obligate Ground Beetle	S2S3	TRKD
Phalangodes appalachius	A Cave Obligate Harvestman	S3	TRKD
Scoterpes ventus	A Cave Obligate Millipede	S1S2	TRKD
Tetracion tennesseensis	A Cave Obligate Millipede	S1S2	TRKD
Kleptochthonius daemonius	A Cave Obligate Pseudoscorpion	S1S2	TRKD
Nesticus barri	A Cave Obligate Spider	S2S3	TRKD
Nesticus barrowsi	A Cave Obligate Spider	S1S2	TRKD
Pseudosinella aera	A Cave Obligate Springtail	S1	TRKD
Pseudosinella christianseni	A Cave Obligate Springtail	S2	TRKD
Pseudosinella spinosa	A Cave Obligate Springtail	S2?	TRKD
Arrhopalites sp. 4	A Cave Springtail	S1	TRKD
Cambarincola alienus	A Cave Obligate Worm	S1	TRKD
Cambarincola leptadenus	A Cave Obligate Worm	S1	TRKD
Pseudanophthalmus humeralis	A Ground Beetle	S2	TRKD
Pseudanophthalmus rotundatus	A Ground Beetle	S1S2	TRKD
Trechus luculentus unicoi	A Ground Beetle	S3	TRKD
Theromaster sp. 1	A Harvestman From Cummings Cove Cave	S1	TRKD
Appaleptoneta sp. 1	A Leptonetid Spider From Ghost River Cave	S1	TRKD
Aloconota diversiseta	A Rove Beetle	S1	TRKD
Atheta lucifuga	A Rove Beetle	S2	TRKD
Pseudosinella hirsuta	A Springtail	S2S3	TRKD
Sinella cavernarum	A Springtail	S2?	TRKD
Folsomia sp.2 nr. macrochaeta	A Springtail From Indian Cave	S1	TRKD
Pseudosinella sp. 7 nr. nata	A Springtail From Upper Cummings Cove Cave	S1	TRKD
Hypogastrura sp. 1	A Viatica Group Springtail	S1	TRKD
Pseudanophthalmus insularis	Baker Station Cave Beetle	S1	TRKD
Pseudanophthalmus bendermani	Benderman's Cave Beetle	S1S2	TRKD
Pseudanophthalmus ventus	Blowing Cave Beetle	S1	TRKD
Pseudanophthalmus catherinae	Catherine's Cave Beetle	S1	TRKD
Triacanthella copelandi	Copeland's Springtail	S1	TRKD
Nesticus furtivus	Crystal Caverns Cave Spider	S1	TRKD
Trechus cumberlandus	Cumberland Ground Beetle	S2	TRKD
Speyeria diana	Diana	S3	TRKD
Pseudanophthalmus tullahoma	Duck River Cave Beetle	S1	TRKD

Scientific Name	Common Name	State Rank	State Status
Pseudanophthalmus acherontis	Echo Cave Beetle	S1S2	TRKD
Pseudanophthalmus engelhardti	Engelhart's Cave Beetle	S1	TRKD
Pseudanophthalmus fowlerae	Fowler's Cave Beetle	S1	TRKD
Pseudanophthalmus jonesi	Grassy Cove Cave Beetle	S1S2	TRKD
Hesperia sassacus	Indian Skipper	S1?	TRKD
Pseudanophthalmus tiresias	Indian Cave Point Cave Beetle	S1	TRKD
Pseudanophthalmus longiceps	Long-headed Cave Beetle	S1	TRKD
Pseudanophthalmus nickajackensis	Nickajack Cave Beetle	S1	TRKD
Pseudanophthalmus paulus	Nobletts Cave Beetle	S1	TRKD
Pseudanophthalmus nortoni	Norton's Cave Beetle	S1	TRKD
Pseudanophthalmus pallidus	Pale Cave Beetle	S1S2	TRKD
Aunguispira picta	Painted Snake Coiled Forest Snail	S1	END
Pseudanophthalmus paynei	Payne's Cave Beetle	S1S2	TRKD
Pseudanophthalmus paradoxus	Ridgetop Cave Beetle	S1	TRKD
Pseudanophthalmus sp. 27	Rumbling Falls Cave Beetle	S1	TRKD
Litocampa sp. 5	Rumbling Falls Cave Dipluran	S1	TRKD
Pseudanophthalmus simplex	Simple Cave Beetle	S1S2	TRKD
Microhexura nomtivaga	Spruce-Fir Moss Spider	S1	TRKD
Neanura sp. 1	Swamp River Cave Neanura	S1	TRKD
Onychiurus sp. 2	Swamp River Cave Onychiurus	S1	TRKD
Pseudosinella sp. 5	Swamp River Cave Pseudosinella	S1	TRKD
Pseudanophthalmus pusillus	Tiny Cave Beetle	S1	TRKD
Pseudanophthalmus unionis	Union County Cave Beetle	S1	TRKD
Pseudanophthalmus wallacei	Wallace’s Cave Beetle	S1	TRKD
Pseudanophthalmus occidentalis	Western Cave Beetle	S1	TRKD

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Possibly extirpated; SNR = Sate not ranked; species is considered sensitive by the state but has not yet been assigned a state rank; SX = Presumed extirpated
State status: END = Endangered; E-P = Endangered-proposed; EXTI = Extirpated; NMGT = Deemed in need of management; NOST = No Status; tracked as sensitive by the state but has no formal listing status;
POTL = Potential/Species is being considered for state listing; S-CE = Special concern-commercially exploited;
SH = Historically reported from the state, but no recent records of this species are known; SPCO = Species of concern; T-CE = Threatened-commercially exploited; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species

Table K-7. Virginia State-Listed Species Located Within or in the Vicinity of the TVA Region

Scientific Name	Common Name	State Rank	State Status
Aquatic Species			
Cambarus bouchardi	Big South Fork Crayfish	SNR	END
Cambarus brachydactylus	A Crayfish	S2	TRKD
Cambarus extraneus	Chickamauga Crayfish	S1S2	THR
Cambarus obeyensis	Obey Crayfish	S2	THR
Cambarus pristinus	A Crayfish	S2	END
Cambarus sp. 1	Emory River Crayfish	S1?	TRKD
Cambarus williami	'Brawley's Fork Crayfish'	SNR	END
Fallicambarus hortoni	Hatchie Burrowing Crayfish	SNR	END
Orconectes alabamensis	A Crayfish	SNR	NMGT
Orconectes incomptus	Tennessee Cave Crayfish	SNR	END
Orconectes shoupi	Nashville Crayfish	S1	END
Orconectes wrighti	A Crayfish	S2	END
Gomphus consanguis	Cherokee Clubtail	S1	TRKD
Gomphus sandrius	Tennessee Clubtail Dragonfly	S1	TRKD
Ophiogomphus acuminatus	Acuminate Snaketail	S2	TRKD
Ophiogomphus edmundo	Edmund's Snaketail	S1	TRKD
Ophiogomphus incurvatus alleghaniensis	Allegheny Snaketail	S1	TRKD
Macromia margarita	Margaret's River Cruiser	S2S3	TRKD
Hadenoecus opilionides	A Cave Cricket	S2?	TRKD
Glyphopsyche sequatchie	Owen Spring Limnephilid Caddisfly	SNR	POTL
Alasmidonta atropurpurea	Cumberland Elktoe	S1S2	END
Alasmidonta raveneliana	Appalachian Elktoe	S1	END
Cumberlandia monodonta	Spectaclecase	S2S3	TRKD
Cyprogenia stegaria	Fanshell	S1	END
Dromus dromas	Dromedary Pearlymussel	S1	END
Epioblasma biemarginata	Angled Riffleshell	SX	EXTI
Epioblasma brevidens	Cumberland Combshell	S1	END
Epioblasma capsaeformis	Oyster Mussel	S1	END
Epioblasma florentina florentina	Yellow-blossom Pearlymussel	SX	EXTI
Epioblasma florentina walkeri	Tan Riffleshell	S1	END
Epioblasma lewisii	Forkshell	SX	EXTI
Epioblasma metastriata	Upland Combshell	SH	END
Epioblasma obliquata obliquata	Purple Catspaw	S1	END
Epioblasma torulosa gubernaculum	Green Blossom Pearlymussel	SX	EXTI

Scientific Name	Common Name	State Rank	State Status
Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	SX	EXTI
Epioblasma triquetra	Snuffbox	S3	TRKD
Epioblasma turgidula	Turgid Blossom Pearlymussel	SX	EXTI
Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	END
Fusconaia cuneolus	Fine-Rayed Pigtoe	S1	END
Hemistena lata	Cracking Pearlymussel	S1	END
Lampsilis abrupta	Pink Mucket	S2	END
Lampsilis altilis	Fine-Lined Pocketbook	S1S2	THR
Lampsilis siliquoidea	Fatmucket	S2	NOST
Lampsilis virescens	Alabama Lampmussel	S1	END
Lasmigona holstonia	Tennessee Heelsplitter	S2	TRKD
Lemiox rimosus	Birdwing Pearlymussel	S1	END
Lexingtonia dolabelloides	Slabside Pearlymussel	S2	TRKD
Medionidus acutissimus	Alabama Moccasinshell	S1	THR
Medionidus parvulus	Coosa Moccasinshell	S1	END
Obovaria jacksoniana	Southern Hickorynut	S1	TRKD
Obovaria retusa	Ring Pink	S1	END
Obovaria subrotunda	Round Hickorynut	S3	TRKD
Pegias fabula	Little-wing Pearlymussel	S1	END
Plethobasus cicatricosus	White Wartyback	S1	END
Plethobasus cooperianus	Orange-foot Pimpleback	S1	END
Plethobasus cyphyus	Sheepnose	S2S3	TRKD
Pleurobema chattanoogaense	Painted Clubshell	S1?	TRKD
Pleurobema clava	Clubshell	SH	END
Pleurobema georgianum	Southern Pigtoe	S1	END
Pleurobema gibberum	Cumberland Pigtoe	S1	END
Pleurobema hanleyianum	Georgia Pigtoe	S1	TRKD
Pleurobema oviforme	Tennessee Clubshell	S2S3	TRKD
Pleurobema perovatum	Ovate Clubshell	SH	END
Pleurobema plenum	Rough Pigtoe	S1	END
Pleurobema rubrum	Pyramid Pigtoe	S2S3	TRKD
Ptychobranchus greenii	Triangular Kidneyshell	S1	END
Ptychobranchus subtentum	Fluted Kidneyshell	S2S3	TRKD
Quadrula cylindrica cylindrica	Rabbitsfoot	S3	TRKD
Quadrula cylindrica strigillata	Rough Rabbitsfoot	S2	END
Quadrula intermedia	Cumberland Monkeyface	S1	END
Quadrula sparsa	Appalachian Monkeyface	S1	END
Simpsonaias ambigua	Salamander Mussel	S1	TRKD

Scientific Name	Common Name	State Rank	State Status
Strophitus connasaugaensis	Alabama Creekmussel	S1	TRKD
Toxolasma cylindrellus	Pale Lilliput	S1	END
Toxolasma lividus	Purple Lilliput	S1S2	TRKD
Villosa fabalis	Rayed Bean	S1	TRKD
Villosa perpurpurea	Purple Bean	S1	END
Villosa trabalis	Cumberland Bean	S1	END
Villosa vibex	Southern Rainbow	S2	TRKD
Athearnia anthonyi	Anthony's River Snail	S1	END
Elimia interrupta	Knotty Elimia	S1	TRKD
Io fluvialis	Spiny Riversnail	S2	TRKD
Leptoxis subglobosa umbilicata	Umbilicate River Snail	S1	TRKD
Leptoxis virgata	Smooth Mudalia	S1	TRKD
Lithasia armigera	Armored Rocksnail	S1S2	TRKD
Lithasia duttoniana	Helmet Rock Snail	S2	TRKD
Lithasia geniculata	Ornate Rocksnail	S3	TRKD
Lithasia jayana	Rugose Rocksnail	S2	TRKD
Lithasia lima	Warty Rocksnail	S2	TRKD
Lithasia salebrosa	Muddy Rocksnail	S2	TRKD
Pleurocera alveare	Rugged Hornsnail	S2	TRKD
Pleurocera corpulenta	Corpulent Hornsnail	S1	TRKD
Pleurocera curta	Shortspire Hornsnail	S2	TRKD
Pyrgulopsis ogmorhaphe	Royal Marstonia	S1	END
Somatogyrus sp. 2	A Freshwater Snail (From Tennessee)	S1	TRKD
Acipenser fulvescens	Lake Sturgeon	S1	END
Ammocrypta beani	Naked Sand Darter	S2	NMGT
Ammocrypta clara	Western Sand Darter	S1	THR
Ammocrypta vivax	Scaly Sand Darter	S2	NMGT
Atractosteus spatula	Alligator Gar	S1	NMGT
Carpiodes velifer	Highfin Carpsucker	S2S3	NMGT
Clinostomus funduloides ssp. 1	Smoky Dace	S1S2	NMGT
Crystallaria asprella	Crystal Darter	SX	NMGT
Cycleptus elongatus	Blue Sucker	S2	THR
Cyprinella caerulea	Blue Shiner	S1	END
Erimonax monachus	Spotfin Chub	S2	THR
Erimystax cahni	Slender Chub	S1	THR
Etheostoma akatulo	Bluemask Darter	S1	END
Etheostoma aquali	Coppercheek Darter	S2S3	THR
Etheostoma baileyi	Emerald Darter	S2	NMGT

Scientific Name	Common Name	State Rank	State Status
Etheostoma barbouri	Teardrop Darter	S2	NMGT
Etheostoma barrenense	Splendid Darter	S3	NMGT
Etheostoma bellum	Orangefin Darter	S3	NMGT
Etheostoma boschungi	Slackwater Darter	S1	THR
Etheostoma brevirostrum	Holiday Darter	S1	THR
Etheostoma cinereum	Ashy Darter	S2S3	THR
Etheostoma corona	Crown Darter	S1S2	END
Etheostoma denoncourti	Golden Darter	S2	NMGT
Etheostoma ditrema	Coldwater Darter	S1	THR
Etheostoma etnieri	Cherry Darter	S3	TRKD
Etheostoma forbesi	Barrens Darter	S1	END
Etheostoma gutselli	Tuckasegee Darter	S1	END
Etheostoma lemniscatum	Tuxedo Darter	S1	END
Etheostoma luteovinctum	Redband Darter	S4	NMGT
Etheostoma marmorpinnum	Marbled Darter	S1	END
Etheostoma microlepidum	Smallscale Darter	S2	NMGT
Etheostoma neopterum	Lollipop Darter	S1S2	TRKD
Etheostoma olivaceum	Sooty Darter	S3	NMGT
Etheostoma pseudovulatum	Egg-Mimic Darter	S1	END
Etheostoma pyrrhogaster	Firebelly Darter	S2	NMGT
Etheostoma sagitta	Arrow Darter	S2	NMGT
Etheostoma sitikuense	Citico Darter	S1	END
Etheostoma striatulum	Striated Darter	S1	THR
Etheostoma susanae	Cumberland Darter	S1	END
Etheostoma tippecanoe	Tippecanoe Darter	S1S2	NMGT
Etheostoma trisella	Trispot Darter	S1	THR
Etheostoma tuscumbia	Tuscumbia Darter	SX	NMGT
Etheostoma wapiti	Boulder Darter	S1	END
Fundulus chrysotus	Golden Topminnow	S1S2	NMGT
Fundulus julisia	Barrens Topminnow	S1	END
Hemitremia flammea	Flame Chub	S3	NMGT
Hybognathus placitus	Plains Minnow	S1	NMGT
Ichthyomyzon gagei	Southern Brook Lamprey	S1	NMGT
Ichthyomyzon unicuspis	Silver Lamprey	S2	NMGT
Macrhybopsis gelida	Sturgeon Chub	S1	NMGT
Macrhybopsis meeki	Sicklefin Chub	S2	NMGT
Macrhybopsis sp. 1	Cf. M. Aestivalis	S1	TRKD
Moxostoma lacerum	Harelip Sucker	SX	NMGT
Notropis albizonatus	Palezone Shiner	SH	END

Scientific Name	Common Name	State Rank	State Status
Notropis buccatus	Silverjaw Minnow	S2	THR
Notropis dorsalis	Bigmouth Shiner	S1	NMGT
Notropis lineapunctata	Lined Chub	S3	NMGT
Notropis rubellus	Rosyface Shiner	S2	TRKD
Notropis rupestris	Bedrock Shiner	S2	NMGT
Noturus baileyi	Smoky Madtom	S1	END
Noturus crypticus	Chucky Madtom	S1	END
Noturus fasciatus	Saddled Madtom	S2	THR
Noturus flavipinnis	Yellowfin Madtom	S1	END
Noturus munitus	Frecklebelly Madtom	S1	THR
Noturus stanauli	Pygmy Madtom	S1	END
Noturus stigmosus	Northern Madtom	S3	NMGT
Percina antesella	Amber Darter	S1	END
Percina aurantiaca	Tangerine Darter	S3	NMGT
Percina burtoni	Blotchside Logperch	S2	NMGT
Percina jenkinsi	Conasauga Logperch	S1	END
Percina kathae	Mobile Logperch	S3	TRKD
Percina kusha	Bridled Darter	S1	TRKD
Percina macrocephala	Longhead Darter	S2	THR
Percina phoxocephala	Slenderhead Darter	S3	NMGT
Percina squamata	Olive Darter	S2	NMGT
Percina stictogaster	Frecklebelly Darter	S1	NMGT
Percina tanasi	Snail Darter	S2S3	THR
Phoxinus cumberlandensis	Blackside Dace	S2	THR
Phoxinus saylori	Laurel Dace	S1	END
Phoxinus tennesseensis	Tennessee Dace	S3	NMGT
Polyodon spathula	Paddlefish	S3	TRKD
Scaphirhynchus albus	Pallid Sturgeon	S1	END
Thoburnia atripinnis	Blackfin Sucker	S1	NMGT
Typhlichthys subterraneus	Southern Cavefish	S3	NMGT
Plant Species			
Botrychium jenmanii	Alabama Grapefern	S1	SLNS
Cimicifuga rubifolia	Appalachian Bugbane	S2	SLNS
Cardamine flagellifera	Bitter Cress	S1	SLNS
Packera millefolia	BR Ragwort	S1	SLNS
Hypericum mitchellianum	BR St. John's-Wort	S2	SLNS
Poa paludigena	Bog Bluegrass	S2	SLNS
Gaylussacia brachycera	Box Huckleberry	S2	SLNS
Paxistima canbyi	Canby's Mountain-Lover	S2	SLNS

Scientific Name	Common Name	State Rank	State Status
Chelone cuthbertii	Cuthbert Turtlehead	S2	SLNS
Abies fraseri	Fraser Fir	S1	SLNS
Euphorbia purpurea	Glade Spurge	S2	SLNS
Lilium grayi	Gray's Lily	S2	SLNS
Parnassia grandifolia	Large-Leaved Grass-of-Parnassus	S2	SLNS
Phlox amplifolia	Large-Leaved Phlox	S2	SLNS
Trifolium calcaricum	Leo's Trifolium	S1	SLNS
Ilex collina	Long-Stalked Holly	S2	END
Cardamine clematitis	Mountain Bitter Cress	S1	SLNS
Lycopodiella margueriteae	Northern Prostrate Clubmoss	S1	SLNS
Silene ovata	Ovate Catchfly	S1	SLNS
Buckleya distichophylla	Sapsuck	S2	END
Saxifraga careyana	Saxifrage	S2?	SLNS
Saxifraga caroliniana	Saxifrage	S2?	SLNS
Carex schweinitzii	Sedge	S1	SLNS
Carex sp. 2	Sedge	S1	SLNS
Cleistes bifaria	Spreading Pogonia	S2	SLNS
Phlox buckleyi	Sword-Leaved Phlox	S2	SLNS
Trillium pusillum var. virginianum	Virginia Least Trillium	S2	SLNS
Terrestrial Animal Species			
Desmognathus orestes	Blue Ridge Dusky Salamander	S3	TRKD
Eurycea wilderae	Blue Ridge Two-Lined Salamander	S2	TRKD
Hyla gratiosa	Barking Treefrog	S1	THR
Plethodon yonahlossee	Crevice Salamander	S3	TRKD
Plethodon kentucki	Cumberland Plateau Salamander	S3	TRKD
Aneides aeneus	Green Salamander	S3	TRKD
Cryptobranchus alleganiensis	Hellbender	S2S3	SPCO
Ambystoma talpoideum	Mole Salamander	S2	SPCO
Necturus maculosus	Mudpuppy	S2	TRKD
Desmognathus wrighti	Pigmy Salamander	S2	SPCO
Desmognathus marmoratus	Shovelnose Salamander	S2	SPCO
Ambystoma tigrinum	Tiger Salamander	S1	END
Plethodon welleri	Weller's Salamander	S2	SPCO
Empidonax alnorum	Alder Flycatcher	S1	SPCO
Fulica americana	American Coot	S1	TRKD
Thryomanes bewickii altus	Appalachian Bewick's Wren	S1	END

Scientific Name	Common Name	State Rank	State Status
Aimophila aestivalis	Bachman's Sparrow	S1	THR
Haliaeetus leucocephalus	Bald Eagle	S2S3	THR
Tyto alba	Barn Owl	S3	SPCO
Dendroica fusca	Blackburnian Warbler	S2	TRKD
Nycticorax nycticorax	Black-Crowned Night-heron	S3	TRKD
Laterallus jamaicensis	Black Rail	S2	TRKD
Vermivora pinus	Blue Winged Warbler	S3	TRKD
Certhia americana	Brown Creeper	S3	SPCO
Gallinula chloropus	Common Moorhen	S1	SPCO
Accipiter cooperii	Cooper's Hawk	S3	TRKD
Spiza americana	Dickcissel	S2S3	SPCO
Regulus satrapa	Golden-Crowned Kinglet	S2	SPCO
Vermivora pinus	Golden-Winged Warbler	S3	SPCO
Ardea alba	Great Egret	S2S3	SPCO
Ammodramus henslowii	Henslow's Sparrow	S1	THR
Catharus guttatus	Hermit Thrush	S1	SPCO
Ixobrychus exilis	Least Bittern	S3	TRKD
Egretta caerulea	Little Blue Heron	S2	SPCO
Lanius ludovicianus	Loggerhead Shrike	S2	THR
Asio otus	Long-Eared Owl	S1	SPCO
Dendroica magnolia	Magnolia Warbler	S2	SPCO
Circus cyaneus	Northern Harrier	S1S2	SPCO
Aegolius acadicus	Northern Saw-Whet Owl	S1	SPCO
Falco peregrinus	Peregrine Falcon	S1	THR
Carpodacus purpureus	Purple Finch	S1	SPCO
Loxia curvirostra	Red Crossbill	S1	SPCO
Sitta canadensis	Red-Breasted Nuthatch	S2	SPCO
Picoides borealis	Red-Cockaded Woodpecker	S1	END
Cistothorus platensis	Sedge Wren	S1	SPCO
Asio flammeus	Short-Eared Owl	S1	TRKD
Egretta thula	Snowy Egret	S2	TRKD
Actitis macularia	Spotted Sandpiper	S2	TRKD
Limnothlypis swainsonii	Swainson's Warbler	S2	SPCO
Egretta tricolor	Tricolor Heron	S2	SPCO
Bartramia longicauda	Upland Sandpiper	S1	THR
Empidonax flaviventris	Yellow-Bellied Flycatcher	S1	SPCO
Nyctanassa violacea	Yellow-Crowned Night-heron	S2S3	SPCO
Neotoma magister	Allegheny Woodrat	S3	TRKD
Peromyscus gossypinus	Cotton Mouse	S3	TRKD

Scientific Name	Common Name	State Rank	State Status
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	S1	END
Corynorhinus rafinesquii	Eastern Big-Eared Bat	S2	END
Myotis leibii	Eastern Small-Footed Bat	S1	TRKD
Sciurus niger	Fox Squirrel	S3	TRKD
Myotis grisescens	Gray Bat	S1S2	END
Myotis sodalis	Indiana Bat	S1	END
Mustela nivalis	Least Weasel	S3	TRKD
Sorex dispar	Long-Tailed Shrew	S3	TRKD
Lontra canadensis	River Otter	S4	SPCO
Lepus americanus	Snowshoe Hare	S1	END
Microtus chrotorrhinus carolinensis	Southern Rock Vole	S1	END
Sorex palustris punctulatus	Southern Water Shrew	S1S2	END
Corynorhinus townsendii virginianus	Virginia Big-Eared Bat	S1	END
Glaucomys sabrinus fuscus	Virginia Northern Flying Squirrel	S1	END
Lampropeltis getula nigra	Black Kingsnake	S2	TRKD
Glyptemys muhlenbergii	Bog Turtle	S2	END
Trachemys scripta troostii	Cumberland Slider	S1	TRKD
Apalone spinifera	Spiny Softshell	S2	TRKD
Graptemys geographica	Map Turtle	S2S3	TRKD
Virginia valeriae pulchra	Mountain Earthsnake	S1	SPCO
Pituophis melanoleucus	Pine Snake	S1S3	TRKD
Lampropeltis triangulum elapsoides	Scarlet Kingsnake	S1S3	TRKD
Liochloropis vernalis	Smooth Green Snake	S3	TRKD
Sternotherus minor	Stripeneck Musk Turtle	S2	TRKD
Pseudanophthalmus rotundatus	A Ground Beetle	S1	TRKD
Pseudanophthalmus sp. 4	A Ground Beetle	S1	TRKD
Pseudanophthalmus sp. 5	A Ground Beetle	S1	TRKD
Pseudanophthalmus sp. 6	A Ground Beetle	S1	TRKD
Pseudanophthalmus sp. 9	A Ground Beetle	S1	TRKD
Pseudanophthalmus sp. 10	A Ground Beetle	S1	TRKD
Rhadine caudata	A Ground Beetle	S3	TRKD
Brachoria cedra	A Millipede	S1	TRKD
Euchlaena milnei	A Moth	S2	TRKD
Pseudosinells hirsuta	A Springtail	S1	TRKD
Cicindela ancocisconensis	A Tiger Beetle	S2	TRKD

Scientific Name	Common Name	State Rank	State Status
Paravitrea septadens	Brown Supercoil	S1	THR
Erora laeta	Early Hairstreak	S3	TRKD
Calloprys irus	Frosted Elfin	S2?	TRKD
Autochton cellus	Golden-Banded Skipper	S3	TRKD
Pseudanophthalmus holsingeri	Holsinger's Cave Beetle	S1	END
Pseudanophthalmus longiceps	Long-Headed Cave Beetle	S1	TRKD
Glyphyalinia raderi	Maryland Glyph	S1S2	SPCO
Erynnis martialis	Mottled Dusky Wing	S1S3	TRKD
Euchloe olympia	Olympia Marble	S2S3	TRKD
Catocala dulciola	Quite Underwing	S1S3	TRKD
Helicodiscus diadema	Shaggy Coil	S1	END
Dryobius sexnotatus	Six-banded Longhorn Beetle	S1S3	TRKD
Pyrgus wyandot	Southern Grizzled Skipper	S1S2	THR

State rank: S1 = Critically imperiled; S2 = Imperiled; S3 = Vulnerable; S4 = Apparently secure; S#S# = Occurrence numbers are uncertain; ? = Inexact numeric rank; SH = Historically reported from the state, but no recent records of this species are known; SNR = State not ranked; SX = Presumed extirpated
State status: END = Endangered; EXTI = Extirpated; NOST = No status; NMGT = Deemed in need of management; POTL = Potential; this species is being considered for listing but has no formal state status; SLNS = State listed, no status; SPCO = Species of concern; THR = Threatened; TRKD = Species having no official status but having a state rank of or combination of S1-S3 indicating a rare species

Table K-8. Federally Listed Aquatic Species Within the TVA Region

Scientific Name	Common Name	Federal Status
Cumberlandia monodonta	Spectaclecase	C
Glyphopsyche sequatchie	Owen Spring Limnephilid Caddisfly	C
Lexingtonia dolabelloides	Slabside Pearlymussel	C
Moxostoma sp. 2	Sicklefin Redhorse	C
Noturus crypticus	Chucky Madtom	C
Phoxinus saylori	Laurel Dace	C
Plethobasus cyphyus	Sheepnose	C
Ptychobranchus subtentum	Fluted Kidneyshell	C
Quadrula cylindrica cylindrica	Rabbitsfoot	C
Villosa fabalis	Rayed Bean	C
Alasmidonta raveneliana	Appalachian Elktoe	LE
Athearnia anthonyi	Anthony's River Snail	LE
Campeloma decampi	Slender Campeloma	LE
Cyprogenia stegaria	Fanshell	LE
Dromus dromas	Dromedary Pearlymussel	LE
Epioblasma brevidens	Cumberland Combshell	LE
Epioblasma capsaeformis	Oyster Mussel	LE

Scientific Name	Common Name	Federal Status
Epioblasma florentina walkeri	Tan Riffleshell	LE
Epioblasma obliquata obliquata	Purple Catspaw	LE
Epioblasma torulosa gubernaculum	Green Blossom Pearlymussel	LE
Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	LE
Epioblasma turgidula	Turgid Blossom Pearlymussel	LE
Etheostoma marmorpinnum	Marbled Darter	LE
Etheostoma percnurum	Duskytail Darter	LE
Etheostoma sitikuense	Citico Darter	LE
Etheostoma wapiti	Boulder Darter	LE
Fusconaia cor	Shiny Pigtoe Pearlymussel	LE
Fusconaia cuneolus	Fine-Rayed Pigtoe	LE
Hemistena lata	Cracking Pearlymussel	LE
Lampsilis abrupta	Pink Mucket	LE
Lampsilis virescens	Alabama Lampmussel	LE
Lemiox rimosus	Birdwing Pearlymussel	LE
Notropis albizonatus	Palezone Shiner	LE
Noturus baileyi	Smoky Madtom	LE
Noturus stanauli	Pygmy Madtom	LE
Obovaria retusa	Ring Pink	LE
Palaemonias alabamae	Alabama Blind Cave Shrimp	LE
Pegias fabula	Little-Wing Pearlymussel	LE
Plethobasus cicatricosus	White Wartyback	LE
Plethobasus cooperianus	Orange-Foot Pimpleback	LE
Pleurobema clava	Clubshell	LE
Pleurobema gibberum	Cumberland Pigtoe	LE
Pleurobema plenum	Rough Pigtoe	LE
Potamilus capax	Fat Pocketbook	LE
Pyrgulopsis ogmorhaphe	Royal Marstonia	LE
Pyrgulopsis pachyta	Armored Marstonia	LE
Quadrula cylindrica strigillata	Rough Rabbitsfoot	LE
Quadrula intermedia	Cumberland Monkeyface	LE
Quadrula sparsa	Appalachian Monkeyface	LE
Scaphirhynchus albus	White Sturgeon	LE
Speoplatyrhinus poulsoni	Alabama Cavefish	LE
Toxolasma cylindrellus	Pale Lilliput	LE
Villosa perpurpurea	Purple Bean	LE
Villosa trabalis	Cumberland Bean	LE

Scientific Name	Common Name	Federal Status
Anguispira picta	Painted Snake Coiled Forest Snail	LT
Erimonax monachus	Spotfin Chub	LT
Erimystax cahni	Slender Chub	LT
Etheostoma boschungi	Slackwater Darter	LT
Mesodon clarki nantahala	Noonday Globe	LT
Noturus flavipinnis	Yellowfin Madtom	LT
Percina tanasi	Snail Darter	LT
Phoxinus cumberlandensis	Blackside Dace	LT

C= Candidate; LE= Listed endangered; LT= Listed threatened

Table K-9. Federally Listed Terrestrial Animal Species Within the TVA Region

Scientific Name	Common Name	Federal Status	Ecoregion
Mammals			
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	LE	BR
Puma concolor couguar	Eastern Cougar	LE	BR
Myotis grisescens	Gray Bat	LE	BR, CA, IP, IRVH, RV, SP, SA
Myotis sodalis	Indiana Bat	LE	BR, CA, IP, IRVH, MAP, RV, SP, SA
Ursus americanus luteolus	Louisiana Black Bear	LT	SP
Corynorhinus townsendii virginianus	Virginia Big-Eared Bat	LE	BR, RV
Birds			
Vermivora bachmanii	Bachman's Warbler	LE	IP, RV
Haliaeetus leucocephalus	Bald Eagle	PROT	BR, CA, IP, IRVH, MAP, RV, SP, SA
Sterna antillarum athalassos	Interior Least Tern	LE	IRVH, MAP
Charadrius melodus	Piping Plover	LT/LE	BR, IP, RV
Picoides borealis	Red-Cockaded Woodpecker	LE	IP, RV, SP, SA
Grus americana	Whooping Crane	LE	SA, IP
Mycteria americana	Wood Stork	LE	IP
Amphibians			
Necturus alabamensis	Black Warrior Waterdog	C	SA
Reptiles			
Pituophis melanoleucus lodingi	Black Pine Snake	C	
Glyptemys muhlenbergii	Bog Turtle	LT	BR
Sternotherus depressus	Flattened Musk Turtle	LT	RV, SA
Graptemys oculifera	Ringed Map Turtle	LT	MAP, SP
Graptemys flavimaculata	Yellow-Botched Map Turtle	LT	SP
Invertebrates			
Pseudanophthalmus inexpectatus	A Cave Beetle	C	IP
Nicrophorus americanus	American Burying Beetle	LE	IP

Scientific Name	Common Name	Federal Status	Ecoregion
Pseudanophthalmus insularis	Baker Station Cave Beetle	C	IP
Pseudanophthalmus colemanensis	Coleman Cave Beetle	C	IP
Pseudanophthalmus fowlerae	Fowler's Cave Beetle	C	IP
Pseudanophthalmus holsingeri	Holsinger's Cave Beetle	C	RV
Pseudanophthalmus inquisitor	Inquirer Cave Beetle	C	IP
Pseudanophthalmus tiesias	Indiana Cave Point Cave Beetle	C	IP
Neonympha mitchellii	Mitchell's Satyr	LE	SP
Pseudanophthalmus paulus	Noblett's Cave Beetle	C	RV
Mesodon clarki nantahala	Noonday Globe	LT	BR
Somatochlora hineana	Ohio Emerald Dragonfly	LE	SA
Anguispira picta	Painted Snake Coiled Forest Snail	LT	SA
Microhexura montivaga	Spruce-Fir Moss Spider	LE	BR

Federal status abbreviations: C = Candidate; LE = Listed endangered; LT = Listed threatened
Ecoregion abbreviations: BR = Blue Ridge, CA = Central Appalachians, IP = Interior Plateau, IRVH = Interior River Valley and Hills, MAP = Mississippi Alluvial Plain, RV = Ridge and Valley, SA = Southwestern Appalachians, SP = Southeastern Plains

Table K-10. Federally Listed Terrestrial Animal Species Known From TVA-Managed Lands or Reservoirs

Facility	Terrestrial Animal Species				
	Bald Eagle	Interior Least Tern	Piping Plover	Gray Bat	Indiana Bat
Allen Fossil Plant	X	X			
Bull Run Fossil Plant	+			X	+
Colbert Fossil Plant	+		X	X	
Cumberland Fossil Plant	X			+	+
Gallatin Fossil Plant	X			X	
John Sevier Fossil Plant	X			X	+
Johnsonville Fossil Plant	X			X	
Kingston Fossil Plant	X		X	+	
Paradise Fossil Plant					+
Shawnee Fossil Plant		+			X
Widow's Creek Fossil Plant	X			X	+
Browns Ferry Nuclear Plant	X			X	
Sequoyah Nuclear Plant	X			+	
Watts Bar Nuclear Plant	X			+	
Raccoon Mountain Pumped Storage Plant	X			X	
Apalachia Reservoir	+				
Bear Creek Project Reservoirs	X			X	+
Beech River Project Reservoirs	+			+	+
Blue Ridge Reservoir					
Boone Reservoir				X	

Facility	Terrestrial Animal Species				
	Bald Eagle	Interior Least Tern	Piping Plover	Gray Bat	Indiana Bat
Cedar Creek Reservoir				+	+
Clear Creek Reservoir					
Chatuge Reservoir	+		X		
Cherokee Reservoir	X			X	+
Chickamauga Reservoir	X		X	X	
Douglas Reservoir	X			X	+
Fontana Reservoir	X				X
Fort Loudoun Reservoir	X			X	
Great Falls Reservoir	+				
Guntersville Reservoir	X			X	X
Hiwassee Reservoir	+				+
Kentucky Reservoir	X			X	X
Melton Hill Reservoir	X			X	+
Nickajack Reservoir	X			X	X
Nolichucky Reservoir	+			X	+
Normandy Reservoir	+			X	
Norris Reservoir	X			X	X
Nottely Reservoir			X		
Ocoee Reservoirs	X				+
Pickwick Reservoir	X			X	X
South Holston					
Tellico Reservoir	X			X	+
Tims Ford Reservoir	X			X	+
Upper Bear Creek Reservoir	+			X	+
Watauga Reservoir					
Watts Bar Reservoir	X			X	
Wheeler Reservoir	X			X	
Wilbur Reservoir					
Wilson Reservoir	X			X	
Buffalo Mountain Wind Farm					

Species that have been encountered at or adjacent to these sites are indicated with an X. Species that are likely to occur in the area based upon the presence of suitable habitat are indicated with a +.

Table K-11. Critically Imperiled Globally Ranked Plant Communities (G1) Found Within Rare or Uncommon Ecosystems and Associated Ecoregion

G1 Rank Plant Community and Physiognomic Vegetation Classification	Rare or Uncommon Ecosystem	Ecoregion
Evergreen Forests, Woodland, and Shrublands		
Fraser Fir Forest (Deciduous Shrub Type)	Spruce-Fir (NC, TN)	BR
Fraser Fir / (Catawba Rosebay, Carolina Azalea) Forest	Spruce-Fir (NC, TN)	BR
Fraser Fir / Hobblebush / Mountain Woodfern - Mountain Woodsorrel / Stairstep Moss Forest	Spruce-Fir (NC, TN, VA)	BR
Red Spruce - (Fraser Fir) / (Catawba Rosebay, Great Laurel) Forest	Spruce-Fir (NC, TN)	BR
Red Spruce / Skunk Currant Forest	Spruce-Fir (NC, TN?, VA?)	BR
Carolina Hemlock Forest (Mesic Type)	(NC, TN)	BR

G1 Rank Plant Community and Physiognomic Vegetation Classification	Rare or Uncommon Ecosystem	Ecoregion
Southern Appalachian Pitch Pine Bog Forest	Appalachian Bog, Fen, Seep (GA, NC)	BR
Southern Appalachian Northern White-Cedar Slope Woodland	(KY?, TN, VA)	RV, IP, BR
Southern Appalachian Heath Bald	(NC, TN)	BR
Heath Bald (Southern Mixed Type)	(NC, TN)	BR
Southern Appalachian Sand-Myrtle Heath Bald	(GA?, NC, TN)	BR
Deciduous Forests, Woodlands, Shrublands		
Water Tupelo Sinkhole Pond Swamp	Bottomland Hardwood (TN)	IP
Swamp Tupelo / Common Buttonbush - Shining Fetterbush Sagpond Forest	Bottomland Hardwood (AL, GA, TN)	RV, SA
Sinking Pond Overcup Oak Swamp	Bottomland Hardwood (TN)	IP
Highland Rim Upland Depression Flatwoods	Bottomland Hardwood (TN)	IP
Upper East Gulf Calcareous Bluff Forest	(AL, MS)	MAP
Montane Floodplain Slough Forest	(NC, TN?)	BR
Southern Appalachian Beech Gap (South Slope Sedge Type)	(NC, TN, VA?)	BR
Southern Appalachian Beech Gap (North Slope Tall Herb Type)	(GA?, NC, TN, VA?)	BR
Southern Crowley's Ridge Dry-Mesic Oak Forest	(MS, TN?)	MAP
Southern Crowley's Ridge Dry Post Oak Forest	(MS, TN?)	MAP
Appalachian Calcareous Oak — Walnut Forest	(NC, VA?)	BR
Southern BR Ultramafic Outcrop Barrens (Deciduous Forest Type)	Prairies, Grasslands, Barrens (NC)	BR
Southern BR Mafic Woodland Seep	Appalachian Bog, Fen, Seep (NC, VA)	BR
Alabama Ketona Dolomite Woodland	(AL)	SA
Chinkapin Oak / Prairie Willow / Rattlesnake-Master Woodland	(VA)	RV
Ridge-and-Valley Calcareous Shrubby Fen / Seep	App Bog, Fen, Seep (VA)	RV
Bushy St. John's-Wort — Hazel Alder / AL Warbonnet — TN Yellow-Eyed-Grass Shrubland	Bottomland Hardwood (AL)	IP
Bushy St. John's-Wort — Hazel Alder / Eastern Gammagrass Shrubland	Bottomland Hardwood (AL)	IP
Southern Appalachian Alder Bald	(NC, TN)	BR
Montane Buttonbush Pond	Appalachian Bog, Fen, Seep (VA)	BR
Moulton Valley Buttonbush Pond	Bottomland Hardwood (AL, TN)	SA

G1 Rank Plant Community and Physiognomic Vegetation Classification	Rare or Uncommon Ecosystem	Ecoregion
Mixed Evergreen-Deciduous Forests, Woodlands, Shrublands		
Southern Loess Hills Hardwood — Pine Forest	(MS)	MAP
Red Spruce — Northern Hardwood Forest (Shrub Type)	Spruce-Fir (NC?, TN, VA?)	BR
Southern Appalachian Pitch Pine Bog Forest	Appalachian Bog, Fen, Seep (GA, TN)	BR
East Gulf Coastal Plain Shortleaf Pine — Post Oak	(Al, GA?, MS, TN?)	SP
Eastern Hemlock / Catawba Rhododendron Forest	(VA)	BR
Cumberland Plateau Mesic Hemlock — Hardwood Forest	(AL)	SA
Southern BR Ultramafic Outcrop Barrens (Pitch Pine Woodland Type)	(NC, TN)	BR
Southern BR Ultramafic Woodland (Prairie Type)	(TN, VA)	BR
Low-Elevation BR Serpentine Woodland	(GA, NC)	BR
Southern BR Mafic Woodland Seep	Appalachian Bog, Fen, Seep (NC?, VA)	BR
Southern Appalachian Shrub Bog (Typic Type)	Appalachian Bog, Fen, Seep (NC, TN?, VA?)	BR
Southern Appalachian Low Mountain Seepage Bog	Appalachian Bog, Fen, Seep (AL, GA, NC, TN?)	BR, SA
Southern Appalachian Bog (Low-Elevation Type)	Appalachian Bog, Fen, Seep (GA, NC, TN, VA)	BR
Southern Appalachian Ultramafic Fen (Tall Herb Type)	Appalachian Bog, Fen, Seep (VA)	BR
Southern Appalachian Fen (Muck Type)	Appalachian Bog, Fen, Seep (NC, VA)	BR
Southern Appalachian Bog (French Broad Valley Type)	Appalachian Bog, Fen, Seep (NC, TN?)	BR
Southern Appalachian Shrub Bog (Long Hope Valley Type)	Appalachian Bog, Fen, Seep (NC, VA)	BR
Herbaceous Grassland (Perennial Graminoid) Vegetation		
Highland Rim Wet-Mesic Prairie	Prairie, Grasslands, Barrens (TN, MS)	IP, SP
Kentucky Mesic Tallgrass Prairie	Prairie, Grasslands, Barrens (KY, TN)	IP
Grassy Bald (Sedge Type)	Prairie, Grasslands, Barrens (NC, TN)	BR
Grassy Bald (Southern Grass Type)	Prairie, Grasslands, Barrens (NC, TN, VA)	BR
Southern BR Mafic Barrens	Prairie, Grasslands, Barrens (VA)	BR
Highland Rim Dry-Mesic Prairie	Prairie, Grasslands, Barrens (TN)	IP
Southern Appalachian Ultramafic Barrens	Prairie, Grasslands, Barrens (VA)	RV

G1 Rank Plant Community and Physiognomic Vegetation Classification	Rare or Uncommon Ecosystem	Ecoregion
Black Belt Prairie	Prairie, Grasslands, Barrens (AL, MS, TN)	SP
Mississippi Jackson Calcareous Clay Prairie	Prairie, Grasslands, Barrens (AL, MS)	SP
Kentucky Prairie Cordgrass Marsh	Prairie, Grasslands, Barrens (KY, TN,)	IP
High-Elevation Greenstone Barrens	Prairie, Grasslands, Barrens (TN, VA)	BR
Southern Appalachian Herb Bog (Long Hope Valley Type)	Appalachian Bog, Fen, Seep (NC)	BR
Southern Appalachian Herb Bog (Typic Type)	Appalachian Bog, Fen, Seep (NC, TN?, VA?)	BR
Southern Appalachian Herb Bog (Low-Elevation Type)	Appalachian Bog, Fen, Seep (GA, TN, VA)	BR
Cumberland Plateau Wet Sandstone Cliff	App Bog, Fen, Seep (AL, TN?, KY?)	SA
Southern Appalachian Ultramafic Fen (Short Graminoid Type)	Appalachian Bog, Fen, Seep (NC?, VA)	BR
Highland Rim Parnassia Seepage Fen	Appalachian Bog, Fen, Seep (KY, TN)	IP
Appalachian Calcareous Artesian Seepage Fen	Appalachian Bog, Fen, Seep (TN)	BR
BR High-Elevation Seep (Mount Le Conte Type)	Appalachian Bog, Fen, Seep (TN)	BR
Southern Appalachian Ultramafic Fen	Appalachian Bog, Fen, Seep (NC)	BR
Interior Highland Maidencane Pond	Appalachian Bog, Fen, Seep (TN)	IP
Southern Appalachian Montane Upland Pool	Appalachian Bog, Fen, Seep (GA, NC, TN, VA)	BR
Southern Appalachian High-Elevation Mafic Glade	Cedar Glades (NC, TN?, VA)	BR
Alabama Ketona Dolomite Glade	Cedar Glade (AL)	SA
Herbacious (Perennial Forb) Vegetation		
Doe River Gorge Seepage Cliff	Appalachian Bog, Fen, Seep (TN)	BR
Broadleaf Cattail — Yellow Marsh-Marigold Herbaceous Vegetation	Appalachian Bog, Fen, Seep (VA)	BR
Highland Rim Pond (Pickerelweed — Arrowhead Type)	Appalachian Bog, Fen, Seep (TN)	IP
Southern Appalachian High-Elevation Rocky Summit (Anakeesta Type)	(TN)	BR
Southern Appalachian High-Elevation Rocky Summit (High Peak Type)	(NC, TN)	BR
Southern Appalachian High-Elevation Rocky Summit (Little Bluestem Type)	(NC, TN)	BR

G1 Rank Plant Community and Physiognomic Vegetation Classification	Rare or Uncommon Ecosystem	Ecoregion
Low-Elevation Rocky Summit (Basic Type)	(GA?, NC)	BR
Low-Elevation Basic Glade (Montane Type)	(NC, VA?)	BR
Consolidated Rock Sparse Vegetation		
Southern Appalachian Limestone Sinkhole	(AL, TN)	SA
Appalachian Montane Mafic Cliff (Mid- to High-Elevation Type)	(NC, TN)	BR

State abbreviations: AL = Alabama; GA = Georgia; KY = Kentucky; MS = Mississippi; NC = North Carolina; TN = Tennessee; VA = Virginia
Ecoregion abbreviations: BR = Blue Ridge; CA = Central Appalachians; IP = Interior Plateau; IRVH = Interior River Valley and Hills; MAP = Mississippi Alluvial Plain; RV = Ridge and Valley; SA = Southwestern Appalachians; SP = Southeastern Plains

Table K-12. Federally Listed Plant Species Within the TVA Region

Scientific Name	Common Name	Federal Status	Ecoregion
Clematis socialis	Alabama Leather Flower	LE	RV
Thelypteris pilosa var. alabamensis	Alabama Streak-Sorus Fern	LT	SA
Asplenium scolopendrium var. americanum	American Hart's-Tongue Fern	LT	RV, SA
Sagittaria secundifolia	Arrowhead	LT	RV, SA
Solidago spithamaea	Blue Ridge Goldenrod	LT	BR
Narthecium americanum	Bog Asphodel	C	BR
Arabis perstellata	Braun's Rock-Cress	LE	IP
Sagittaria fasciculata	Bunched Arrowhead	LE	BR
Schwalbea americana	Chaffseed	LE	
Conradina verticillata	Cumberland Rosemary	LT	SA
Minuartia cumberlandensis	Cumberland Sandwort	LE	SA
Helianthus eggertii	Eggert's Sunflower	DM	IP, SA, IRVH
Leavenworthia crassa	Fleshy-Fruit Gladecress	C	IP, SA
Symphyotrichum georgianum	Georgia Aster	C	RV, SA
Arabis georgiana	Georgia Rock-Cress	C	IP, RV
Sarracenia oreophila	Green Pitcher Plant	LE	BR, RV, SA
Ptilimnium nodosum	Harperella	LE	RV, SA
Liatris helleri	Heller's Blazing Star	LT	BR
Scutellaria montana	Large-Flowered Skullcap	LT	RV, SA
Dalea foliosa	Leafy Prairie-Clover	LE	IP, SA
Lesquerella lyrata	Lyre-Leaf Bladderpod	LT	IP
Marshallia mohrii	Mohr's Barbara's Buttons	LT	RV, SA
Platanthera integrilabia	Monkey-Face Orchid	C	BR, SA, SP
Clematis morefieldii	Morefield's Leather-Flower	LE	IP, SA
Hedyotis purpurea var. montana	Mountain Bluet	LE	BR
Sarracenia jonesii	Mountain Sweet Pitcher-Plant	LE	BR
Trillium persistens	Persistent Trillium	LE	BR
Lindera melissifolia	Pondberry	LE	MAP
Apios priceana	Price's Potato-Bean	LT	IP, IRVH, SA, SP
Astragalus bibullatus	Pyne's Ground Plum	LE	IP
Sisyrinchium dichotomum	Reflexed Blue-Eyed Grass	LE	BR
Gymnoderma lineare	Rock Gnome Lichen	LE	BR
Pityopsis ruthii	Ruth's Golden Aster	LE	BR
Lesquerella globosa	Shorts Bladderpod	C	IP
Isotria medeoloides	Small Whorled Pogonia	LT	BR, SA, CA
Echinacea laevigata	Smooth Coneflower	LE	RV
Geum radiatum	Spreading Avens	LE	BR
Lesquerella perforata	Spring Creek Bladderpod	LE	IP
Helonias bullata	Swamp-Pink	LT	BR
Echinacea tennesseensis	Tennessee Coneflower	LE	IP
Betula uber	Virginia Round-Leaf Birch	LT	RV

Scientific Name	Common Name	Federal Status	Ecoregion
Spiraea virginiana	Virginia Spiraea	LT	BR, SA, CA
Helianthus verticillatus	Whorled Sunflower	C	RV, SP
Xyris tennesseensis	Yellow-Eyed-Grass	LE	IP, RV, SP

Status abbreviations: C = Candidate; DM = Delisted, in need of management; LE = Endangered; LT = Threatened
Ecoregion abbreviations: BR = Blue Ridge; CA = Central Appalachians; IP = Interior Plateau; IRVH = Interior River Valley and Hills; MAP = Mississippi Alluvial Plain; RV = Ridge and Valley; SA = Southwestern Appalachians; SP = Southeastern Plains.

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Appendix L – Population Trend Data

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Table L-1. Population by County Within the TVA Region

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
Tennessee River Watershed (125 Counties)								
AL	Blount	26,853	36,459	39,248	51,024	58,345	66,388	74,356
AL	Colbert	49,632	54,519	51,666	54,984	54,639	54,902	55,278
AL	Cullman	52,445	61,642	67,613	77,483	81,778	90,459	97,719
AL	DeKalb	41,981	53,658	54,651	64,452	69,380	75,339	81,202
AL	Etowah	94,144	103,057	99,840	103,459	103,645	103,883	104,430
AL	Franklin	23,933	28,350	27,814	31,223	31,091	32,660	33,864
AL	Jackson	39,202	51,407	47,796	53,926	52,838	54,215	55,293
AL	Lauderdale	68,111	80,546	79,661	87,966	89,599	93,678	97,335
AL	Lawrence	27,281	30,170	31,513	34,803	34,106	36,619	38,192
AL	Limestone	41,699	46,005	54,135	65,676	78,572	89,457	100,689
AL	Madison	186,540	196,966	238,912	276,700	327,744	371,805	416,053
AL	Marion	23,788	30,041	29,830	31,214	29,116	29,727	29,599
AL	Marshall	54,211	65,622	70,832	82,231	90,399	99,559	108,385
AL	Morgan	77,306	90,231	100,043	111,064	117,293	128,709	138,234
AL	Winston	16,654	21,953	22,053	24,843	23,997	25,562	26,493
GA	Catoosa	28,271	36,991	42,464	53,282	64,035	73,057	82,508
GA	Dade	9,910	12,318	13,147	15,154	16,127	17,685	19,071
GA	Fannin	13,357	14,748	15,992	19,798	22,945	25,741	28,660
GA	Gilmer	8,956	11,110	13,368	23,456	29,021	35,830	42,401
GA	Lumpkin	8,728	10,762	14,573	21,016	27,528	33,201	39,035
GA	Rabun	8,327	10,466	11,648	15,050	16,611	19,130	21,382
GA	Towns	4,565	5,638	6,754	9,319	11,010	13,039	14,963
GA	Union	6,811	9,390	11,993	17,289	21,252	25,609	29,818

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
GA	Walker	50,691	56,470	58,340	61,053	64,983	67,532	70,432
GA	Whitfield	55,108	65,775	72,462	83,525	93,698	103,502	113,260
KY	Calloway	27,692	30,031	30,735	34,177	36,348	38,639	40,943
KY	Graves	30,939	34,049	33,550	37,028	37,719	39,358	40,851
KY	Livingston	7,596	9,219	9,062	9,804	9,598	9,915	10,111
KY	Lyon	5,562	6,490	6,624	8,080	8,291	9,161	9,870
KY	McCracken	58,281	61,310	62,879	65,514	65,880	68,173	69,867
KY	Marshall	20,381	25,637	27,205	30,125	31,200	33,658	35,684
KY	Trigg	8,620	9,384	10,361	12,597	13,290	15,049	16,491
MS	Alcorn	27,179	33,036	31,722	34,558	35,822	36,677	37,823
MS	Itawamba	16,847	20,518	20,017	22,770	23,000	24,235	25,288
MS	Prentiss	20,133	24,025	23,278	25,556	25,709	26,551	27,306
MS	Tishomingo	14,940	18,434	17,683	19,163	19,034	19,434	19,772
NC	Avery	12,655	14,409	14,867	17,167	17,932	19,446	20,774
NC	Buncombe	145,056	160,934	174,821	206,330	231,452	256,529	281,537
NC	Cherokee	16,330	18,933	20,170	24,298	26,307	29,259	31,965
NC	Clay	5,180	6,619	7,155	8,775	10,333	11,530	12,840
NC	Graham	6,562	7,217	7,196	7,993	8,001	8,425	8,751
NC	Haywood	41,710	46,495	46,942	54,033	57,109	61,266	65,275
NC	Henderson	42,804	58,580	69,285	89,173	103,669	120,528	136,508
NC	Jackson	21,593	25,811	26,846	33,121	36,891	40,931	44,996
NC	Macon	15,788	20,178	23,499	29,811	33,233	38,525	43,216
NC	Madison	16,003	16,827	16,953	19,635	20,442	21,986	23,381
NC	Mitchell	13,447	14,428	14,433	15,687	15,634	16,321	16,826
NC	Swain	8,835	10,283	11,268	12,968	13,404	14,871	16,016

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
NC	Transylvania	19,713	23,417	25,520	29,334	30,203	33,436	35,938
NC	Watauga	23,404	31,666	36,952	42,695	45,479	51,515	56,393
NC	Yancey	12,629	14,934	15,419	17,774	18,548	20,107	21,469
TN	Anderson	60,300	67,346	68,250	71,330	74,849	77,070	79,694
TN	Bedford	25,039	27,916	30,411	37,586	45,947	51,334	57,619
TN	Benton	12,126	14,901	14,524	16,537	16,025	16,913	17,473
TN	Bledsoe	7,643	9,478	9,669	12,367	12,967	14,552	15,911
TN	Blount	63,744	77,770	85,969	105,823	122,784	138,303	154,231
TN	Bradley	50,686	67,547	73,712	87,965	97,710	108,967	119,753
TN	Campbell	26,045	34,923	35,079	39,854	40,970	43,677	46,042
TN	Carroll	25,741	28,285	27,514	29,475	28,517	29,157	29,437
TN	Carter	43,259	50,205	51,505	56,742	59,043	62,639	65,912
TN	Chester	9,927	12,727	12,819	15,540	16,312	17,858	19,248
TN	Claiborne	19,420	24,595	26,137	29,862	31,243	34,131	36,575
TN	Cocke	25,283	28,792	29,141	33,565	36,047	38,687	41,380
TN	Coffee	32,572	38,311	40,339	48,014	52,521	57,873	63,052
TN	Cumberland	20,733	28,676	34,736	46,802	54,109	64,080	73,189
TN	Decatur	9,457	10,857	10,472	11,731	11,525	12,001	12,340
TN	Dickson	21,977	30,037	35,061	43,156	48,230	55,441	61,904
TN	Fentress	12,593	14,826	14,669	16,625	17,677	18,675	19,754
TN	Franklin	27,289	31,983	34,725	39,270	41,310	45,304	48,664
TN	Giles	22,138	24,625	25,741	29,447	29,082	31,704	33,478
TN	Grainger	13,948	16,751	17,095	20,659	22,857	25,020	27,270
TN	Greene	47,630	54,422	55,853	62,909	66,282	70,957	75,349
TN	Grundy	10,631	13,787	13,362	14,332	14,130	14,427	14,634

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
TN	Hamblen	38,696	49,300	50,480	58,128	63,033	67,917	72,940
TN	Hamilton	255,077	287,643	285,536	307,896	337,175	348,662	366,127
TN	Hancock	6,719	6,887	6,739	6,786	6,588	6,531	6,444
TN	Hardin	18,212	22,280	22,633	25,578	26,258	28,067	29,603
TN	Hawkins	33,757	43,751	44,565	53,563	57,784	63,197	68,457
TN	Henderson	17,360	21,390	21,844	25,522	27,037	29,312	31,437
TN	Henry	23,749	28,656	27,888	31,115	31,876	33,233	34,559
TN	Hickman	12,096	15,151	16,754	22,295	23,805	27,719	30,974
TN	Houston	5,853	6,871	7,018	8,088	8,154	8,819	9,328
TN	Humphreys	13,560	15,957	15,795	17,929	18,274	19,356	20,294
TN	Jefferson	24,940	31,284	33,016	44,294	51,722	58,923	66,386
TN	Johnson	11,569	13,745	13,766	17,499	18,006	20,063	21,769
TN	Knox	276,293	319,694	335,749	382,032	435,725	470,451	510,907
TN	Lawrence	29,097	34,110	35,303	39,926	41,314	44,503	47,212
TN	Lewis	6,761	9,700	9,247	11,367	11,521	12,435	13,218
TN	Lincoln	24,318	26,483	28,157	31,340	33,374	36,047	38,506
TN	Loudon	24,266	28,553	31,255	39,086	46,725	52,572	58,975
TN	McMinn	35,462	41,878	42,383	49,015	52,739	56,686	60,719
TN	McNairy	18,369	22,525	22,422	24,653	25,796	26,975	28,213
TN	Marion	20,577	24,416	24,860	27,776	28,068	29,904	31,340
TN	Marshall	17,319	19,698	21,539	26,767	30,279	34,180	37,985
TN	Maury	44,028	51,095	54,812	69,498	84,302	94,543	106,273
TN	Meigs	5,219	7,431	8,033	11,086	12,108	14,115	15,878
TN	Monroe	23,475	28,700	30,541	38,961	45,830	51,522	57,666
TN	Moore	3,568	4,510	4,721	5,740	6,096	6,772	7,368

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
TN	Morgan	13,619	16,604	17,300	19,757	18,738	20,441	21,369
TN	Perry	5,238	6,111	6,612	7,631	7,826	8,656	9,294
TN	Polk	11,669	13,602	13,643	16,050	15,648	16,978	17,867
TN	Rhea	17,202	24,235	24,344	28,400	31,516	33,834	36,492
TN	Roane	38,881	48,425	47,227	51,910	53,508	55,439	57,487
TN	Rutherford	59,428	84,058	118,570	182,023	257,048	311,442	371,250
TN	Sequatchie	6,331	8,605	8,863	11,370	13,915	15,460	17,349
TN	Sevier	28,241	41,418	51,043	71,170	86,243	102,656	118,572
TN	Stewart	7,319	8,665	9,479	12,370	13,340	15,373	17,119
TN	Sullivan	127,329	143,968	143,596	153,048	154,552	159,532	163,786
TN	Unicoi	15,254	16,362	16,549	17,667	17,740	18,453	18,996
TN	Union	9,072	11,707	13,694	17,808	19,164	22,505	25,242
TN	Van Buren	3,758	4,728	4,846	5,508	5,480	5,905	6,208
TN	Washington	73,924	88,755	92,315	107,198	120,598	130,842	142,179
TN	Wayne	12,365	13,946	13,935	16,842	16,506	18,082	19,181
TN	Williamson	34,423	58,108	81,021	126,638	176,838	214,861	256,133
VA	Bland	5,423	6,349	6,514	6,871	6,791	7,074	7,249
VA	Dickenson	16,077	19,806	17,620	16,395	16,087	14,231	12,945
VA	Grayson	15,439	16,579	16,278	17,917	15,793	16,494	16,436
VA	Lee	20,321	25,956	24,496	23,589	25,166	23,903	23,548
VA	Russell	24,533	31,761	28,667	30,308	29,250	28,456	27,846
VA	Scott	24,376	25,068	23,204	23,403	22,585	21,673	20,924
VA	Smyth	31,349	33,345	32,370	33,081	31,738	31,579	31,162
VA	Tazewell	39,816	50,511	45,960	44,598	44,907	41,705	39,808
VA	Washington	40,835	46,487	45,887	51,103	53,018	55,568	58,121

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
VA	Bristol city	14,857	19,042	18,426	17,367	17,690	16,783	16,249
VA	Wise	35,947	43,863	39,573	40,123	41,773	39,775	39,158
VA	Norton city	4,172	4,757	4,247	3,904	3,713	3,247	2,887
VA	Wythe	22,139	25,522	25,466	27,599	28,868	30,020	31,271
Total Watershed (125 Counties and 2 Independent Cities)		**4,023,778**	**4,768,207**	**5,025,692**	**5,837,174**	**6,425,319**	**7,016,111**	**7,610,967**
AL	Cherokee	15,606	18,760	19,543	23,988	24,448	27,305	29,531
GA	Chattooga	20,541	21,856	22,242	25,470	26,619	28,607	30,413
GA	Gordon	23,570	30,070	35,072	44,104	53,292	61,062	69,151
GA	Murray	12,986	19,685	26,147	36,506	40,621	49,832	57,394
KY	Allen	12,598	14,128	14,628	17,800	18,982	21,001	22,830
KY	Butler	9,723	11,064	11,245	13,010	13,329	14,395	15,280
KY	Carlisle	5,354	5,487	5,238	5,351	5,209	5,134	5,060
KY	Christian	56,224	66,878	68,941	72,265	80,938	83,993	88,642
KY	Cumberland	6,850	7,289	6,784	7,147	6,706	6,625	6,483
KY	Edmonson	8,751	9,962	10,357	11,644	11,926	12,846	13,589
KY	Fulton	10,183	8,971	8,271	7,752	6,814	6,138	5,420
KY	Grayson	16,445	20,854	21,050	24,053	25,581	27,348	29,116
KY	Hickman	6,264	6,065	5,566	5,262	4,851	4,409	4,002
KY	Logan	21,793	24,138	24,416	26,573	27,174	28,511	29,673
KY	Monroe	11,642	12,353	11,401	11,756	11,569	11,245	11,037
KY	Muhlenberg	27,537	32,238	31,318	31,839	31,274	31,052	30,809
KY	Simpson	13,054	14,673	15,145	16,405	17,019	17,971	18,827

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
KY	Todd	10,823	11,874	10,940	11,971	12,253	12,314	12,534
KY	Warren	57,884	71,828	76,673	92,522	108,669	120,175	133,146
MS	Attala	19,570	19,865	18,481	19,661	19,755	19,652	19,735
MS	Benton	7,505	8,153	8,046	8,026	7,981	7,912	7,856
MS	Calhoun	14,623	15,664	14,908	15,069	14,422	14,092	13,725
MS	Chickasaw	16,805	17,851	18,085	19,440	18,683	19,539	19,944
MS	Choctaw	8,440	8,996	9,071	9,758	9,023	9,428	9,514
MS	Clay	18,840	21,082	21,120	21,979	20,722	21,194	21,181
MS	DeSoto	35,885	53,930	67,910	107,199	158,719	188,472	224,723
MS	Kemper	10,233	10,148	10,356	10,453	9,833	9,990	9,907
MS	Lafayette	24,181	31,030	31,826	38,744	43,975	48,258	52,956
MS	Leake	17,085	18,790	18,436	20,940	23,132	24,339	25,929
MS	Lee	46,148	57,061	65,581	75,755	81,913	92,166	100,914
MS	Lowndes	49,700	57,304	59,308	61,586	59,658	61,958	62,946
MS	Marshall	24,027	29,296	30,361	34,993	36,900	40,032	42,862
MS	Monroe	34,043	36,404	36,582	38,014	36,905	37,767	38,080
MS	Neshoba	20,802	23,789	24,800	28,684	30,302	32,993	35,408
MS	Noxubee	14,288	13,212	12,604	12,548	11,631	11,258	10,767
MS	Oktibbeha	28,752	36,018	38,375	42,902	44,544	48,315	51,425
MS	Panola	26,829	28,164	29,996	34,274	35,245	38,586	41,226
MS	Pontotoc	17,363	20,918	22,237	26,726	29,248	32,449	35,485
MS	Scott	21,369	24,556	24,137	28,423	29,341	31,467	33,389
MS	Tallahatchie	19,338	17,157	15,210	14,903	12,638	11,384	9,961
MS	Tate	18,544	20,119	21,432	25,370	27,337	30,226	32,864
MS	Tippah	15,852	18,739	19,523	20,826	21,661	22,809	23,847

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
MS	Union	19,096	21,741	22,085	25,362	27,263	29,265	31,306
MS	Webster	10,047	10,300	10,222	10,294	9,852	9,843	9,714
MS	Winston	18,406	19,474	19,433	20,160	19,309	19,672	19,702
MS	Yalobusha	11,915	13,183	12,033	13,051	13,773	13,717	13,997
TN	Cannon	8,467	10,234	10,467	12,826	13,860	15,289	16,652
TN	Cheatham	13,199	21,616	27,140	35,912	39,876	47,711	54,276
TN	Clay	6,624	7,676	7,238	7,976	7,895	8,060	8,204
TN	Crockett	14,402	14,941	13,378	14,532	14,492	14,276	14,252
TN	Davidson	447,877	477,811	510,784	569,891	635,710	686,766	741,506
TN	DeKalb	11,151	13,589	14,360	17,423	18,954	21,065	23,039
TN	Dyer	30,427	34,663	34,854	37,279	37,811	39,246	40,471
TN	Fayette	22,692	25,305	25,559	28,806	38,785	40,838	45,284
TN	Gibson	47,871	49,467	46,315	48,152	49,468	48,784	48,956
TN	Hardeman	22,435	23,873	23,377	28,105	27,613	29,919	31,573
TN	Haywood	19,596	20,318	19,437	19,797	18,881	18,588	18,183
TN	Jackson	8,141	9,398	9,297	10,984	10,875	11,740	12,374
TN	Lake	8,074	7,455	7,129	7,954	7,303	7,568	7,610
TN	Lauderdale	20,271	24,555	23,491	27,101	26,471	27,857	28,828
TN	Macon	12,315	15,700	15,906	20,386	22,057	24,638	27,064
TN	Madison	65,774	74,546	77,982	91,837	97,317	106,819	115,294
TN	Montgomery	62,721	83,342	100,498	134,768	160,978	189,347	216,852
TN	Obion	30,247	32,781	31,717	32,450	31,431	31,241	30,903
TN	Overton	14,866	17,575	17,636	20,118	21,060	22,462	23,794
TN	Pickett	3,774	4,358	4,548	4,945	4,783	5,100	5,275
TN	Putnam	35,487	47,690	51,373	62,315	72,431	80,543	89,292

State	County	Decennial Census				Census Estimate	Trend Projections, 1980-2009	
		1970	1980	1990	2000	2009	2020	2030
TN	Robertson	29,102	37,021	41,494	54,433	66,581	76,240	86,678
TN	Scott	14,762	19,259	18,358	21,127	21,866	22,901	23,989
TN	Shelby	722,111	777,113	826,330	897,472	920,232	986,032	1,037,812
TN	Smith	12,509	14,935	14,143	17,712	19,201	20,742	22,423
TN	Sumner	56,266	85,790	103,281	130,449	158,759	183,462	208,766
TN	Tipton	28,001	32,930	37,568	51,271	59,495	69,604	79,223
TN	Trousdale	5,155	6,137	5,920	7,259	7,922	8,545	9,232
TN	Warren	26,972	32,653	32,992	38,276	40,481	43,581	46,543
TN	Weakley	28,827	32,896	31,972	34,895	33,459	34,534	35,021
TN	White	16,329	19,567	20,090	23,102	25,444	27,405	29,525
TN	Wilson	36,999	56,064	67,675	88,809	112,377	130,536	150,063
Total Area (203 Counties and 2 Independent Cities)		**6,797,199**	**7,928,344**	**8,373,818**	**9,674,255**	**10,598,952**	**11,563,240**	**12,521,417**

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Appendix M – Additional Climate Change Information

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ADDITIONAL CLIMATE CHANGE INFORMATION: POTENTIAL IMPACTS TO TVA-MANAGED LANDS DUE TO THE CHANGING CLIMATE

A great deal of uncertainty remains regarding the response of climate to a broad range of natural and anthropogenic influences, making climate forecasts quite difficult. It is possible that under current management plans, climate change itself could impact natural resources that TVA manages. The current program option may provide some indication of change over time and serve as a basis for options that mitigate detrimental impacts of climate change and positively manage the beneficial impacts. Current natural resources management that enacts conservation and enhancement serves to restore lands and water quality thus enhancing carbon storage.

Biological and Cultural Resources Management

It is possible that under current management, climate change itself could impact natural resources that TVA manages, including changes to ecosystem type and consequently sensitive biological resources due to increased temperature and changes in precipitation, and changes in forest and agricultural production (both positive and negative) due to potential changes in temperature, precipitation, and the availability of ambient carbon dioxide.

Under climate change extremes, sensitive species may face ecosystem loss and fragmentation, intensified impacts of invasive species and pests, and changes in the timing of ecological events triggered by seasonal temperature changes. Sensitive biological resources that are already rare could become more restricted or eliminated from an area.

Agricultural crops could be impacted by higher temperature and changes in evapotranspiration, the timing and magnitude of precipitation, and the need for irrigation or could alternatively be impacted by soil erosion. Crops could become more susceptible to disease and invasive species (Electric Power Research Institute [EPRI] 2009).

Forest management could potentially face two different climate impact scenarios. Certain forest types may benefit from increased growth and expanded growth range, while other types may experience detrimental effects including reduced forest growth, decreased forest area, shifts in tree species composition, and dieback caused by disturbance such as bug infestations and fire.

The current natural and cultural resources management plans utilize land stewardship assessment tools and sensitive biological resources management programs that serve to monitor ecosystems and species. Current management may provide some indication of change over time and serve as a basis for management options that mitigate detrimental impacts of climate change and positively manage the beneficial impacts. Current terrestrial habitat management through conservation and enhancement serve to restore lands and water quality thus enhancing carbon storage, while management of nonnative invasive plant and animal species would positively impact species at risk.

Terrestrial carbon sequestration is the capture and secure storage of carbon dioxide (CO_2) that would otherwise be emitted to or remain in the atmosphere. Terrestrial carbon sequestration is the process where atmospheric CO_2 is absorbed by trees, by plants through photosynthesis, and is stored as carbon in the biomass (trunks, branches, roots) and soil. This transformation of free-floating atmospheric carbon to a fixed-state carbon

can be achieved through methods, such as tree planting, grass planting, and using forestry best management practices.

Recreation Management

It is possible that under current management, climate change itself could impact future management, including the demand for specific types of recreation by affecting the attractiveness of a recreational opportunity due to increased temperature or precipitation; participants may begin to change their recreational activities and destinations, including ceasing recreational activities altogether. Changes in streamflow also have a significant impact on the suitability of a resource for recreation. Fishing also stands to be heavily affected by climate change given that water flows and temperature both play important roles in the health of the fish population. Cold water fish populations, such as trout, may be diminished while warm water populations may increase (EPRI 2009). In regard to water-based recreation, rising lake and river temperatures could cause warm water fishing to be substituted for cold water fishing. Changes to water resources, which diminish habitats or lead to species loss, could also affect the availability or quality of wildlife viewing, hunting, fishing, and other activities involving wildlife.

Research has not clearly established how recreation would be affected within the TVA region, as this depends both on the effects of climate change on recreation resources and participants' adaptation and substitution decisions, neither of which appears to have been the subject of academic or other research.

Reservoir Lands Planning

No impacts are anticipated as a result of reservoir lands planning.

Water Resource Management

It is possible that under current management, climate change itself could impact management options including impacts to water quality and availability and impacts to wildlife habitat and biodiversity due to instream flow levels changes. Increased temperature in conjunction with no major increases in streamflow could reduce dissolved oxygen in water bodies, resulting in a reduction in water quality, in particular water's suitability to support oxygen-dependent aquatic organisms.

Reductions in hydrologic resources may leave less dilution flows in streams, leading to degraded water quality. Droughts and increasing temperatures may cause changes in biological composition of water bodies, and changes in flow may provide entry pathways for invasive species. Water demands for agricultural use, such as livestock and irrigation, could compete with industrial and municipal uses (EPRI 2009).

The current water resource management programs utilize public outreach workshops that educate stakeholders and promote water efficiency. Such programs could serve to promote efficient water use and consumption to support regional water use in the event that the demand for water increases in response to potential climate change. TVA's Stream and Tailwater Monitoring Program under the current management option use biological monitoring to evaluate watershed conditions. While specific long-term changes in biodiversity to climate change are not predictable at this time, monitoring stream habitat and health could provide useful information pertaining to ecosystem changes over time and provide data for future management options to mitigate adverse impacts in the event they should occur.

Literature Cited

Electric Power Research Institute (EPRI). 2009. *Potential Impact of Climate Change on Natural Resources in the Tennessee Valley Authority Region*. Palo Alto, Ca.: EPRI Report No. 1020420.

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GLOSSARY

acre	A unit of measure of land area equal to 43,560 square feet
analysis framework	Evaluation of each program option based on a wide range of inputs and perspectives to provide an accurate comparison of potential implementation efforts
best management practices	Accepted construction practices designed to reduce environmental effects
biostabilization	Use of vegetative plants to control erosion
contiguous	Adjacent; touching
cultural resources	Archaeological and historic resources
danger tree	A tree located on TVA-managed land that could pose a threat to private property if allowed to fall
drawdown	Area of reservoirs exposed between full pool and winter pool levels during annual drawdown of the water level for flood control
ecoregion	A geographic area with characteristic, distinct assemblages of natural communities and species
embayment	A bay or arm of the reservoir
endangered species	A species in danger of extinction throughout all or a significant part of its range
Environmental Policy	A TVA Board-approved policy that communicates guiding principles to lead TVA successfully in the reduction of its environmental impact while continuing to provide reliable and competitively priced power to the Valley
geographic information system	A collection of computer hardware and software that efficiently captures, stores, updates, manipulates, analyzes, and displays information about the location of the Earth's natural, cultural, economic, and human resources, and the man-made environment. Location is normally shown on maps with associated textual and numeric information that describes the characteristics of those resources.
Land Policy	A TVA Board-approved policy that guides retention, disposal, and planning of interests in real property
mitigation	An action that either will result in avoidance of an effect or cause the results of an activity to be minor in significance
program options	Varying future levels of effort used to implement components of the Natural Resource Plan
population (related to species)	Population is an ecological term that refers to the entirety of a group of individuals of a certain species. One population can contain numerous occurrences. A population includes that there is the potential for exchange of genetic material between individuals.
qualitative	Analysis based on professional judgment of quality
recreation strategy	A TVA strategy to collaborate with regional partners to enhance existing recreation opportunities and address unmet recreation needs, while managing resources on and along the Tennessee River system

Regional Resource Stewardship Council	A group of diverse stakeholders established to advise TVA on its stewardship activities and the priorities among competing objectives and values
reservoir lands planning	The development of plans used to guide future decisions on TVA-managed lands adjacent to reservoirs
riparian	Related to or located on the banks of a river or stream
runoff	That portion of total rainfall that eventually enters a stream or river
scenario planning	Method for determining the expected benefit per dollar spent of each program within the Natural Resource Plan
shoreland	The surface of land lying between the minimum pool elevation of a TVA reservoir and the maximum shoreline contour or TVA back-lying property (whichever is further)
tailwater	The part of a river just downstream from a dam where the flow and quality of the water are substantially affected by the dam discharge
threatened species	A species likely to become endangered in the foreseeable future
water resource management	A grouping of programs that encourages and helps implement efforts that protect and improve water resources for human health, fishing, swimming, boating, drinking, agricultural use, aquatic habitat, and economic development.

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