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FINAL ENVIRONMENTAL IMPACT STATEMENT
VOLUME 1

NATURAL RESOURCE PLAN

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

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

JULY 2011

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Final Environmental Impact Statement **July 2011**

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

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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. The alternatives would result in few adverse impacts. Alternative C would result in the most beneficial impacts. The beneficial impacts of Alternative D would be less than Alternative C and more than Alternatives A and B.

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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 in a cost-effective manner while upholding TVA's mission. 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, cultural, water, and recreation resources; public engagement; and reservoir lands planning. 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, as well as 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, including campgrounds, day use areas, and stream access sites. 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 is 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 staff and from the public comments obtained during the scoping process described in Chapter 1. The alternatives were revised following the public review of the Draft NRP and EIS and additional analyses. 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 resources and partnerships, and capital projects associated with TVA 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. Relative to Alternative A, this alternative would reduce TVA's level of effort in some areas and increase it in others.

Alternative C — Flagship Management. Under Alternative C, TVA would aggresively explore, pilot test, and implement existing and new programs and activities to increase its resource stewardship to the "gold standard." TVA's proactive management of biological, cultural, and water resources would be greatly increased. Recreation management activities would emphasize enhancements of existing facilities while emphasizing sustainable technologies, develpment of trails, greenways and access areas, and repair of heavily impacted areas. This alternative takes into account the interconnectivity of the various programs and activities.

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. The level of effort in many program areas would be greater than that of Alternatives A and B, and some program and activities would be implemented at the same level as Alternative C.

AFFECTED ENVIRONMENT

The primary study area, the TVA region, 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. The biological, cultural, and recreation programs and activities would primarily be implemented on TVA reservoir lands. The water resource management programs would be implemented on TVA reservoirs and elsewhere in the Tennessee River watershed.

Recreation. TVA currently manages 12 campgrounds, 63 day use areas, and 81 stream access sites. 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 about 17 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 lands, shoreline, and waterways in response to this demand.

Natural Areas. Natural areas occurring on TVA lands include both TVA- and non-TVA-managed areas and ecologically significant sites. They include small wild areas, habitat protection areas, ecological study areas, and wildlife observation areas. TVA manages 154 natural areas and conducts specific management activities compatible with the goals for each area. There are 229 natural areas and ecologically significant sites occurring on or adjacent to TVA lands that are managed by other agencies under contractual agreements.

Terrestrial Ecology. The TVA region spans 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. TVA lands are dominated by relatively mature upland hardwood forests. Invasive plants occur on about 18 percent of TVA lands.

Approximately 55 species of reptiles, 72 species of 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. None of these aquatic species are known to occur on the TVA lands that are a major focus of this plan. However, many of these species occur in streams and reservoirs adjacent to these lands. *Terrestrial Animals.* There are 33 federally listed, protected or candidate terrestrial animal species occurring in the TVA region. Five of these species occur on TVA lands. These are the 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 lands. In recent decades, this species only occurs in isolated pockets in extreme southern portions of the region. Numerous state-listed species occur in the region and on TVA lands. *Plants.* There are 44 federally listed species, six federal candidate species, and 996 state-listed plant species within the TVA region. Over 80 percent of the federally listed species occur within four of the nine ecoregions: Eleven of the federally listed plant species, as well as numerous state-listed plants, occur on TVA lands.

Cultural Resources. The Tennessee Valley has 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 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 lands.

Land Use. The Tennessee River watershed includes approximately 40,913 square miles. The TVA power service area includes a total of 76,738 square miles, with 44,783 square

miles extending outside the Tennessee River watershed. Approximately 81 percent of the 293,000 acres (458 square miles) of TVA reservoir lands is forested, about 12 percent is in agricultural uses, and most of the remainder is developed. Adjacent non-TVA lands have less forest cover (63 percent), more agricultural land (24 percent), and more developed land (11 percent).

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 area farmed within the seven-state service area. About 12 percent of TVA reservoir land is prime farmland.

Visual Resources. TVA lands include dam reservations, power plant sites, and tracts of land adjacent to reservoirs that range in size from tenths of an acre to several hundred acres. Because the scenic features of the landscape are not limited by land boundaries, landscape character extends across TVA 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 TVA region is about 10.7 million, as of 2010. The larger population concentrations tend to be located along the corridors of the Tennessee, French Broad, Cumberland, and Tennessee rivers. In 2009, the total employment for the study area was 5.74 million. In 2009, the per capita personal income for the study area was $32,643, about 82 percent of the national average of $39,635. However, the 2009 average income levels vary widely across the study area. Minorities constitute 22.2 percent of the population within the TVA region. However, their 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 2009, the poverty level for the study area was estimated to be 17.4 percent, higher than the national average of 14.3 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.

Alternative C would create the greatest potential beneficial impacts for the following resource areas: recreation, natural areas, vegetation, wildlife, wetlands, water quality, aquatic ecology, endangered and threatened species, cultural resources, visual resources, land use, prime farmland, and socioeconomics.

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 beneficial 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 (Preferred Alternative)
Developed Recreation	Beneficial impacts but insufficient to meet recreation demand	Growing gap in meeting recreation demand	Increase in the quality and quantity of recreation opportunities	Increase in the quality of recreation opportunities but little change in quantity
Dispersed Recreation	Negative impact due to increased pressure on natural resources	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 invasive plants	Beneficial impact due to increase in invasive plant management	Provides the greatest beneficial impact due to increase in invasive plant management	Less beneficial than Alternative C

Resource	Alternative A - No Action	Alternative B - Custodial Management	Alternative C - Flagship Management	Alternative D - Blended Management (Preferred Alternative)
Terrestrial Ecology — Wildlife	No adverse impacts			
Wetlands	No materially different impacts		Provides the greatest beneficial impacts	Beneficial impacts due to identification, protection, and restoration efforts
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 materially different impacts	Provides the greatest beneficial impacts	More beneficial than Alternatives A and B
Endangered and Threatened Species	No impacts to listed aquatic species and terrestrial animal species; impacts to listed plant species due to the spread of invasive species			
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 lands	Increasingly beneficial impact in the scenic attraction of TVA lands	Most beneficial impact in the scenic attraction of TVA lands	Similar to Alternative C
Floodplains	Negligible loss of flood control and power storage, minimal effect on floodplain values			
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

Resource	Alternative A - No Action	Alternative B - Custodial Management	Alternative C - Flagship Management	Alternative D - Blended Management (Preferred Alternative)
Navigation	Minimal impacts to commercial navigation			
Air Quality	No negative impacts			
Climate	No impacts			

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

°C	Degree Celsius
°F	Degree Fahrenheit
ADA	Americans With Disabilities Act
ARPA	Archaeological Resources Protection Act
BMP	Best Management Practice
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	Environmental Assessment
EE	Environmental Education
EIS	Environmental Impact Statement
EO	Executive Order
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
GHG	Greenhouse Gas
GIS	Geographic Information System
HPA	Habitat Protection Area
HU	Hydrologic Unit
IBI	Index of Biotic Integrity
IPCC	Intergovernmental Panel on Climate Change
IRM	Integrated Resource Management
IRP	Integrated Resource Plan
LCA	Land Conditions Assessment
LNT	Leave No Trace
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
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
NGO	Nongovernment Organization
NHPA	National Historic Preservation Act
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	Reservoir Land Management Plan
ROS	*Reservoir Operations Study*
RRSC	Regional Resource Stewardship Council
SFI	Sport Fishing Index
SHPO	State Historic Preservation Officer(
SMI	Shoreline Management Initiative
SMP	Shoreline Management Policy
SMZ	Streamside Management Zone
SQN	Sequoyah Nuclear Plant
STM	Stream and Tailwater Monitoring
SWA	Small Wild Area
TCP	Traditional Cultural Property
TDA	Tennessee Department of Agriculture
TDEC	Tennessee Department of Environment and Conservation
TRI	Targeted Reservoir Initiative
TVA	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
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDA-WS	U.S. Department of Agriculture Wildlife Services
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHC	Wildlife Habitat Council
WOA	Wildlife Observation Area

CHAPTER 1 - PURPOSE AND NEED FOR ACTION

1.1. Introduction

For more than seven decades, the Tennessee Valley Authority (TVA) has been improving the quality of life in the Tennessee Valley region 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 managed by TVA 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 reduce flooding and provide the benefits of a navigable waterway and low-cost hydroelectricity. They are also the sites for power generating facilities and arteries for delivering that power. 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. TVA's public lands have 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 operations 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 and Improvement, 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 in the Plan 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 guiding principles for reducing the environmental impacts of TVA operations

while continuing to provide reliable and affordable power to the Valley. In 2010, a biennial review of the Environmental Policy was completed and did not result in major changes or revisions. 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.com/environment/policy.htm.

1.3.2. Land Policy

On behalf of the United States, 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 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 approximately 293,000 acres of reservoir lands, which continue to be managed pursuant to the TVA Act (Figure 1-1). As part of its management of these lands, TVA allocates them to various land use zones (see Sections 1.3.6 and 2.4). These TVA-managed lands are frequently referred to as "TVA lands" in this EIS.

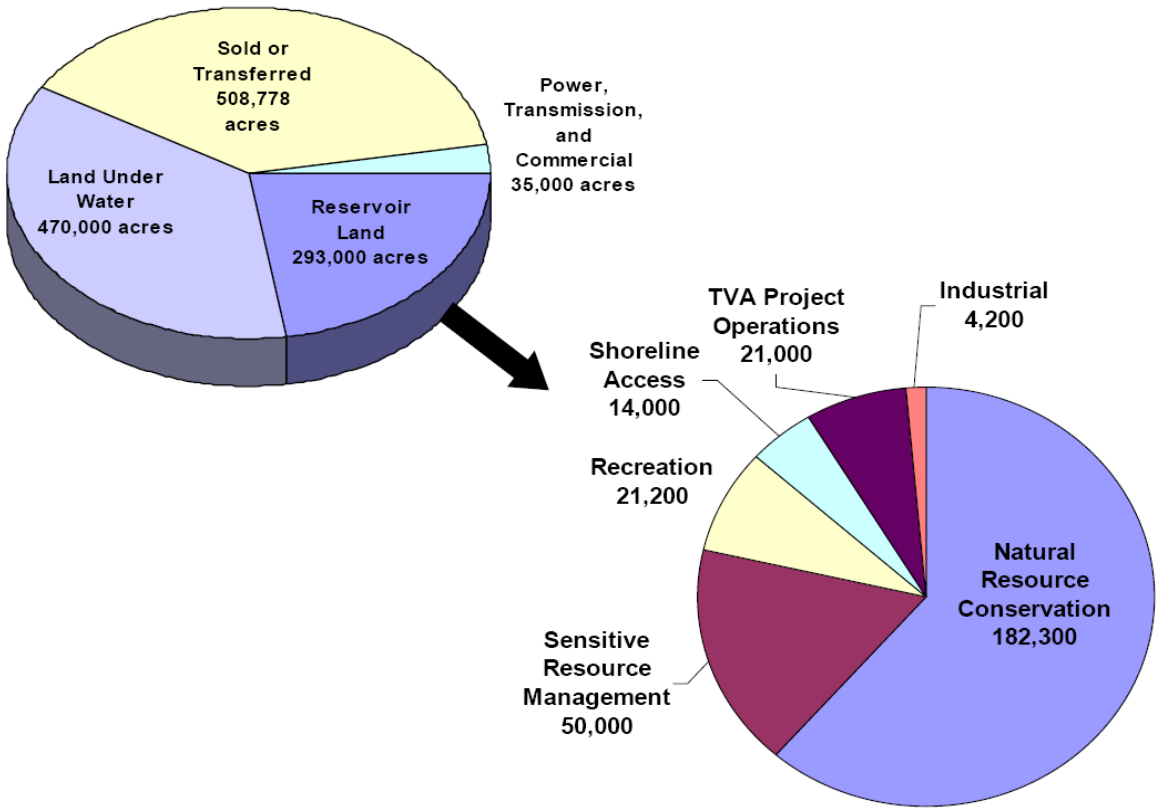


Figure 1-1. TVA-Managed Reservoir Land

In 2006, TVA adopted a Land Policy to guide retention, disposal, and planning of real property. Accordingly, it is TVA's policy to manage its lands 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 retain in public ownership the reservoir lands under its control except in those rare instances where the benefits to the public will be so significant that transferring lands

to private ownership or another public entity is justified. The Land Policy is available at http://www.tva.gov/river/landandshore/land_policy.htm.

1.3.3. Biological Resources Management

TVA manages biological resources while providing for many types of recreational opportunities. TVA has designated more than 182,000 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 50,000 acres for sensitive resource management, where the major focus is protecting and enhancing significant natural and cultural features. Together, these 232,000 acres of lands provide TVA with distinctive management opportunities in resource conservation and enhancement.

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 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, 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 both resident and migratory wildlife. In 1978, TVA initiated a wildlife restoration project aimed at restoring various animal populations. These efforts, 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 developing 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 plants and animals at approximately 40 sites on TVA lands.

1.3.4. Cultural Resources Management

The earliest TVA-related archaeological surveys began in 1933 with construction of 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, Hiwassee, Chickamauga, and Kentucky reservoir basins. Archaeological surveys conducted on TVA 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 of its reservoirs.

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 lands vary across the Valley. Of the approximate 293,000 acres of above-pool TVA lands along the reservoirs, about 30 percent (88,000 acres) has been systematically surveyed for cultural resources.

To date, TVA has documented an estimated 11,500 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). The NRHP is maintained by the National Park Service as 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 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 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.

1.3.5. Recreation Management

From its beginning, TVA has developed recreational facilities on its reservoirs and encouraged others to develop a wide variety of outdoor recreational facilities and opportunities in the Valley.

Some of the construction villages for the early dams were converted to park facilities following the completion of the dams and eventually became state parks or were managed by others under license with TVA. TVA also developed numerous other recreational areas on its reservoirs, some of which have also become state parks. TVA developed and continues to operate 12 campgrounds and 63 day use areas on its reservoirs. TVA has also acquired 81 stream access sites; TVA operates 31 sites and the remainder is operated by others under contractual agreements with TVA.

TVA has made approximately 485,300 acres of land available for recreational development by other entities (see Table 1-1). Much of this land has been transferred to local, state, and federal agencies for recreational use. In many cases, such as for lands transferred to the National Park Service, USFS, and state fish and wildlife agencies, recreation is one of several uses of the land. In other instances, lands were sold for recreational purposes through auctions 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 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 recreation areas 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 below and Section 2.4). 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 in 2006, it also directed staff to review TVA land designated for recreational development purposes to verify their suitability for this use. This review evaluated needs for public boat access, commercial marinas, campgrounds, recreational visitor lodging, developed land-based day use facilities, and dispersed land-based opportunities. The results indicate increasing needs for public boat access, land-based day use facilities, and informal or undeveloped land-based recreation opportunities. The report is available at http://www.tva.gov/environment/land/assessment/recreation.htm.

1.3.6. Reservoir Lands Planning

Throughout its history, TVA has managed the public lands in its custody 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. TVA lands, together with adjoining private lands, have been used for public parks, industrial development, commercial recreation, residential development, tourism development, and forest and wildlife areas, as well as to meet a variety of other needs of 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. As noted above, 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 their most appropriate uses. 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 reservoir land management plans (RLMPs) for 34 of its reservoirs using various methodologies. RLMPs allocate TVA lands to one of six broad land use zones, and a seventh zone reflects areas of private ownership where TVA has certain other land rights and/or regulatory responsibilities. A special study of the Muscle Shoals/Wilson Dam reservations and a recreation study for Fort Loudoun Reservoir have also been completed. Twelve of TVA's reservoirs do not have current RLMPs. More detailed information on the status of reservoir land plans is given in Section 2.4.

1.3.7. Water Resources Management

TVA operates the Tennessee River and its tributaries as an integrated system for the purposes of navigation, flood control, and power production, consistent with these purposes for other goals and public benefits 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, are designed to create measurable water quality improvement in Valley watersheds. These programs, originally known as the Clean Water Initiative, are currently implemented through the Targeted Watershed Initiatives (TWI).

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. Other monitoring programs are the Vital Signs Monitoring Program (see Section 4.5) and the Sport Fishing Index which assess water quality and aquatic community parameters in reservoirs. The data produced by these programs guide TWI efforts and are critical to several other programs and initiatives by TVA and other agencies and organizations.

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 in a cost-effective manner while upholding TVA's mission. 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, cultural, and water resources; recreation; reservoir lands planning; and public engagement. 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 increasing efficiencies in natural resources management
    - Strikes a balance between the competing and sometimes conflicting resource uses on TVA-managed lands
3. Increasing the efficiency of the planning and review of specific implementing 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, cultural, recreation, and water resources management; reservoir lands planning; and public engagement. During the development of this plan, TVA 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 and approximately 9,100 acres of power plant properties. These include active and former fossil and nuclear properties, Raccoon Mountain Pumped Storage Plant, and Buffalo Mountain Wind Power Project site, (Figure 1-2 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 activities, 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 lands.

Recreation management focuses on those recreation facilities and programs managed by TVA. While many of these facilities are on TVA reservoirs and power plant reservations, they also include stream access sites located on rivers and streams in the Tennessee River watershed.

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 water resource management focus is on those discretionary programs and activities implemented by TVA to proactively improve reservoir and watershed water quality. The Tennessee River watershed and TVA's power service area (PSA) are collectively referred to below as the TVA region.

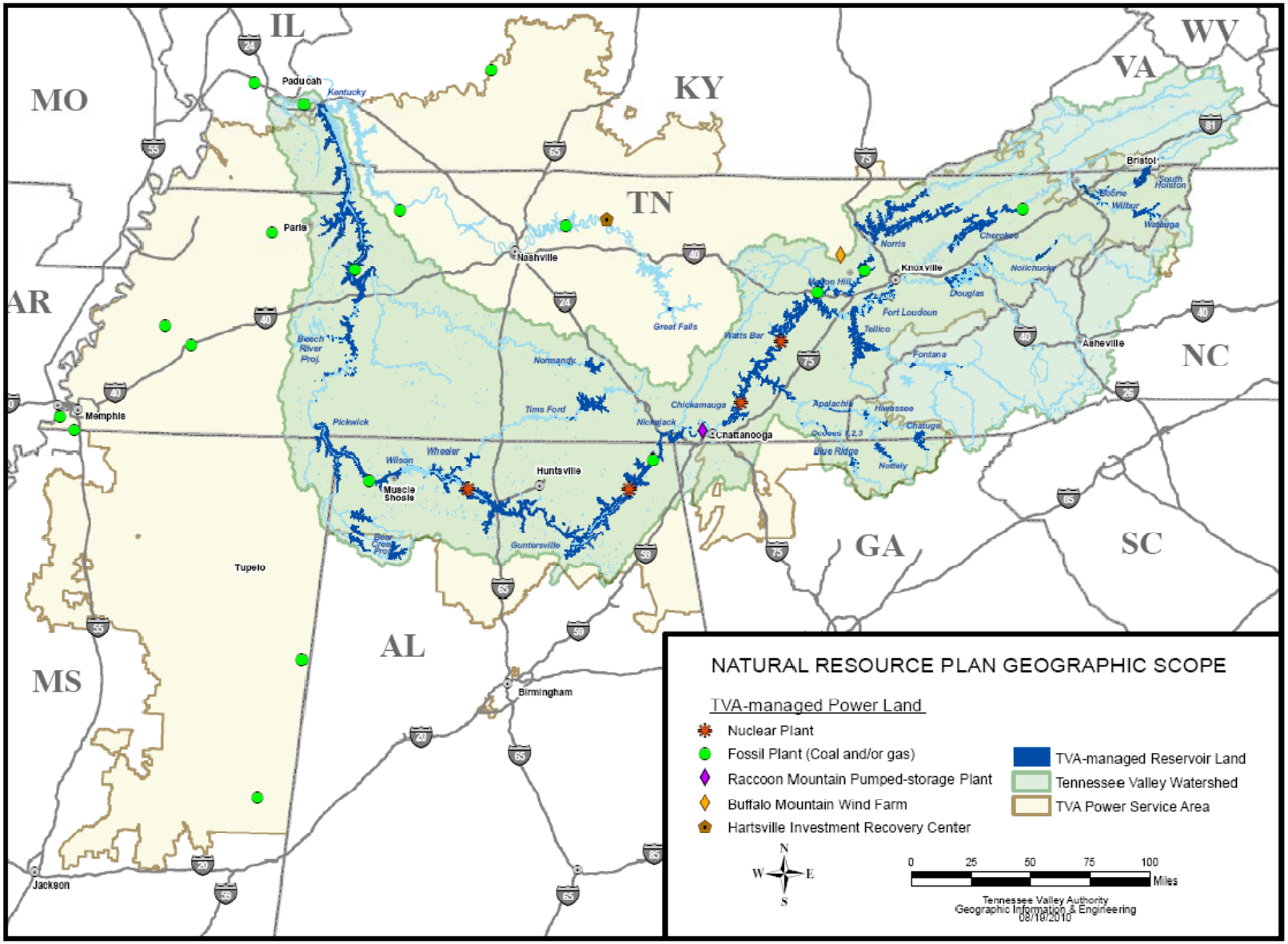


Figure 1-2. Natural Resource Plan Geographic Scope

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.

1.6. The Decision

The TVA Board of Directors 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. Scoping and Public Involvement

Public involvement in the development of the NRP and associated EIS began with the public scoping process in the summer of 2009 and continued with the issuance of the Draft NRP and EIS for public review and comment in the spring of 2011.

TVA also used the Regional Resource Stewardship Council (RRSC) throughout the development of the NRP as an advisory and review group. TVA established the RRSC in 1999 to advise TVA on its stewardship activities and the priorities among competing objectives and values. The RRSC was established and operates 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/. Agendas, presentations, and minutes of the RRSC meetings where the NRP was discussed are available at http://www.tva.gov/rrsc/readingroom5/index.htm and http://www.tva.gov/rrsc/readingroom6/index.htm.

1.7.1. Scoping

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.

On June 15, 2009, TVA published a notice of intent (NOI) (TVA 2009a) 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 including those focusing on management of natural resources.

The 60-day public scoping period for the project began on June 15, 2009. TVA issued press releases about the project and advertised it on its website (http://www.tva.gov/environment/reports/irp/index.htm). The IRP website 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 at different locations across the TVA region between July 20 and August 6, 2009. 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 website 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.

Shortly after the public scoping period began, TVA decided it would be better to address environmental stewardship activities in a separate process and therefore decided to separate the IRP and NRP. The IRP would focus on TVA's future energy needs, and the NRP would focus on TVA's future environmental stewardship needs. Consequently, 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 scoping periods, written comments were received from seven federal agencies, 16 state and regional agencies, and eight organizations or community groups. The additional NRP scoping period concluded with 76 additional comments on the NRP for a total of 685 comments. Summaries of the public scoping comments are located in Appendix C.

In addition to the general public participation opportunities, TVA directly solicited input from 11 federal and state agencies in October and November, 2010. The agencies included the U.S. Army Corps of Engineers, USFS, and National Park Service and state natural resource agencies in each of the seven TVA region states. TVA staff independently met with each agency and discussed the programs associated with biological resource management, 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.

1.7.1.1. 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 (http://www.tva.gov/environment/reports/nrp/index.htm) and in Appendix C.

1.7.1.2. 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, cultural, recreation, and water resources management, and reservoir lands planning 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 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 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, various land use practices, pollution, litter, and other factors.

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 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 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 adjacent back-lying land have been largely determined by TVA land acquisition, disposals, and land use agreements. Many TVA lands are committed to existing land uses with little to no potential for change. Proposed activities on TVA 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 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 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.

1.7.2. Public Review of the Draft NRP and EIS

TVA issued the Draft NRP and EIS to the public on March 25, 2011. The EPA published the notice of their availability on April 1, 2011, initiating a 46-day comment period that ended on May 16, 2011. TVA sent notices of the availability of the drafts to those on the project contact list and mailed printed or CD-ROM copies to agencies, federally recognized tribes, and others who requested them. The drafts were also posted on TVA's website.

TVA held three public meetings in April, 2011 to explain the NRP, answer questions, and receive comments on the drafts. The meetings were held in Knoxville, Tennessee, Benton, Kentucky, and Muscle Shoals, Alabama. Approximately 45 people attended the public meetings.

TVA accepted comments on the Draft NRP and EIS by mail and e-mail, through a form on the project website, and by written and oral comments at the public meetings. About 150 people, agencies, and organization submitted comments. About 40 percent of the comments were received via the project website, 27 percent by mail, 24 percent by e-mail, and the remainder was oral comments at meetings. TVA staff carefully reviewed the comment submissions and categorized them into 225 individual comments. These comments and TVA's responses to them are provided in Appendix N of this Final EIS. As a result of the comments, TVA made several changes to the Final NRP and EIS. TVA also considered the comments during the revisions to the Alternative D - Blended Alternative that appears in the Final NRP and this Final EIS.

1.8. Other Pertinent Environmental Reviews or Documentation

TVA's RLMPs and associated EISs and environmental assessments (EAs) are briefly described in this section, as are other environmental reviews and studies relevant to the resources under consideration in the NRP and this EIS. 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. These plans are available at http://www.tva.com/environment/land/land_mgmt_plans.htm.

- *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.
- *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 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.

Resource Management Unit Plans Plans

Between 1998 and 2001, TVA developed 10 plans and associated EAs that prescribe natural resource management activities on discrete areas of reservoir lands. An example is *Boone Management Unit — Boone Reservoir Resource Management Plan and Environmental Assessment* (TVA 2002b) that addresses 566 acres on Boone Reservoir in Sullivan and Washington 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 and to provide a structured process for public input.

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 result in discharges into 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 is consistent with CWA requirements and 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 are developed by each state; these plans outline how the state will protect air quality. They 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 Advisory Council on Historic Preservation, a federal agency, 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 to the extent possible, 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 two volumes as outlined below.

Volume 1:

- 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 describes TVA's existing and proposed stewardship programs, tools, and activities.
- Chapter 3 includes a description of the process of developing and evaluating the NRP alternatives, a listing of the components of each alternative, and a 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 Final EIS distribution list, and other supporting information, respectively.
- Glossary
- Index

Volume 2:

- Appendices, including comments received on the Draft EIS and NRP and responses to those comments.

CHAPTER 2 - 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 resources, cultural resources, recreation, reservoir lands planning, and water resources, as well as public engagement efforts. All programs and activities, tools, or elements that are components of the No Action or any Action Alternative are discussed in this chapter.

2.1. Biological Resources Management

TVA manages biological resources in the Valley while providing for many types of recreational opportunities. TVA has designated more than 182,000 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 50,000 acres for sensitive resource management, where activities that might endanger significant cultural or natural features are restricted. Together, these approximate 232,000 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 the resources it manages that meet the desired environmental conditions of sustainable recreation, ecological diversity, and cultural resource protection.

This section describes the existing and proposed programs and supporting activities associated with TVA's biological resource management and improvement efforts. These programs are summarized in Table 2-1. Their supporting activities are described in detail below, and the program and activity components of the alternatives are described in Chapter 3.

2.1.1. Sensitive Biological Resources Management

TVA is proposing to enhance sensitive biological resources management by establishing new programs and continuing and expanding existing programs.

Threatened and Endangered 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 and actions that it authorizes 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. TVA will continue to comply with ESA requirements.

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

Table 2-1. Summary of Biological Resources Management Programs

Program Category	Program
Sensitive Biological Resources Management	Threatened and Endangered Species Program
	Wetland Management
	Sensitive Resources Data Management
	Natural Areas Management
	Conservation Planning
	Migratory Birds Management
Terrestrial Habitat Management	Grasslands and Agricultural 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
TVA Land Management and Stewardship Programs	Boundary Maintenance
	Land Condition Assessment and Land Stewardship Maintenance
Public Outreach	Resource Stewardship Campaigns
Dispersed Recreation Management	Dispersed Recreation Management
	Leave No Trace
	Trails Management

In support of the Bald and Golden Eagle Protection Act and in conjunction with conservation partners, TVA monitors bald eagles in the vicinity of its 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 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 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.

Threatened and Endangered 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 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 (Table 2-2) 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. TVA proposes to continue this monitoring and to develop and implement monitoring plans for all federally listed species and other high priority species on TVA lands. Target species would be identified in consultation with the USFWS and state agencies with emphasis on those subject to opportunities for TVA to enhance the survival of the species.

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

Common Name	Scientific Name	Long-Term Monitoring	Short-Term Monitoring
	Animals		
Boulder darter[1, 2]	*Etheostoma wapiti*		X
Bald eagle[2, 3]	*Haliaeetus leucocephalus*	X	
Pink mucket[1, 2]	*Lampsilis abrupta*		X
Gray bat[1, 2]	*Myotis grisescens*	X	
Snail darter[1, 2]	*Percina tanasi*		X
	Plants		
False foxglove[2]	*Aureolaria patula*		X
Ruth's golden aster[1, 2]	*Pityopsis ruthii*	X	
Mountain skullcap[1, 2]	*Scutellaria montana*	X	
Green pitcher-plant[1, 2]	*Sarracenia oreophila*		X

[1]Federally listed as endangered or threatened
[2]State-listed as endangered or threatened
[3]Formerly federally listed as threatened, protected under Bald and Golden Eagle Protection Act

Wetlands Management

TVA would continue the implementation of its current wetland management and protection practices for wetlands on TVA lands. TVA is considering the establishment of a partnership

with the Tennessee Department of Environment and Conservation (TDEC) to develop a proactive program to identify high-quality reservoir wetlands on TVA lands as a "Blue Ribbon" or "Reference Site" Reservoir Wetland Pilot Project. This project would increase the knowledge of reservoir wetlands and establish characterized reference sites for use in impact assessment and rehabilitation projects.

Sensitive Resources Data Management
TVA maintains two databases to assist in its management of sensitive resources.

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 continuously added or updated using information from the following sources:

- 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 has established agreements to share natural heritage agreements with other state and federal resource agencies.

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.

As part of the NRP, TVA is proposing to expand its information gathering efforts for the identification of sensitive resources through partnerships with, for example, universities to develop predictive models for endangered and threatened species. It is also proposing to better integrate the natural heritage and wetlands databases.

Natural Areas Management
Natural areas include ecologically significant sites, lands designated for a particular resource management objective, and/or lands that contain sensitive biological, cultural, or scenic resources. 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 environmental education. 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 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. Invasive plant 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 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 natural areas occurring on TVA 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 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

In addition to the continued maintenance of natural areas, TVA proposes to monitor and assess the maintenance needs of one-third of the areas annually. The results of this monitoring and assessment would be used to prioritize maintenance activities. TVA also proposes to establish criteria for a planning process to designate new and/or remove existing natural areas on TVA lands. TVA also proposes to develop and implement comprehensive natural area management plans.

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 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. TVA proposes to continue and expand its participation in planning organizations and small- and large-scale conservation planning efforts.

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 its lands. A component of a management plan would include agency guidelines for compliance with EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). TVA would also develop a memorandum of understanding with the USFWS on the conservation of migratory birds. This memorandum, required by EO 13186 for agencies whose actions have, or are likely to have, a measureable negative effect on migratory bird populations, addresses actions agencies would take to reduce their impacts on migratory bird populations. 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 lands in cooperation with other federal and state partners. High priority birds for managing on TVA reservoirs include waterfowl, shorebirds, double-crested cormorants, and wading birds. TVA's management plans could be used in national and regional planning efforts to support the conservation of migratory birds.

Migratory Bird Management Planning Efforts — TVA is a signatory to a Partners in Flight (PIF) joint memorandum of understanding venture. PIF is a cooperative effort, among numerous agencies, to address the decline of land birds and their habitats. PIF projects have mostly occurred at Land Between the Lakes, a large area previously managed by TVA. Other national and regional migratory bird management planning efforts include the U.S. Shorebird Conservation Plan, North American Waterfowl Management Plan, Migratory Bird Joint Ventures, and Landscape Conservation Cooperatives. TVA proposes to support and participate in these efforts.

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. TVA proposes to continue its leadership role in this group.

2.1.2. Terrestrial Habitat Management

Terrestrial habitat management programs and activities are described below.

Grasslands and Agricultural 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 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 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 lands are available for public use, but public access can be restricted to protect crop investments.

In recent years TVA has converted several areas on dam reservations and other TVA lands from regularly mowed fields to NWSG. Several of these projects have been implemented in partnership with other organizations, as described below under Wildlife Habitat Enhancement Projects. Typical steps in these conversions include treating the field with herbicides to eliminate undesirable competing species, sowing NWSG seeds with a specialized planter, and periodic maintenance by controlled burning or mowing. TVA is considering increasing its efforts to establish and manage native grasslands in a prioritized manner on TVA lands.

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. TVA proposes to continue to manage agricultural licenses and cooperative agreements with federal and state agencies for the management of over 10,000 acres of TVA lands. TVA also proposes to partner with agencies and non-governmental organizations to manage and enhance TVA grasslands and agricultural lands.

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.

TVA is proposing to continue the management of the dewatering projects, including maintaining or upgrading contractual agreements. It is also considering refurbishing dewatering units based on the results of engineering and hydrologic reviews and operating and maintaining them at upgraded conditions. In recognition of the attractiveness of dewatering areas for both consumptive and non-consumptive wildlife uses, TVA is proposing to work with partners to incorporate nature-based tourism into their management.

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 management activities under consideration in the NRP include managing tree hazards and tree cutting/vegetation damage encroachments on TVA lands, continuing small-scale tree removal operations associated with storm or insect damages and forest wildlife habitat enhancements, and monitoring broad forest trends on TVA lands and conducting basic forest protection activities. Forest protection activities include treating insect and disease outbreaks, controlling invasive plants (described below in more detail), and prescribed burning. The four key forest management components are used when managing tree hazards, conducting tree removal operations, and conducting forest protection activities. The encroachments are often the actions of adjacent private landowners, from whom TVA may seek restitution. Other forest management activities under consideration are providing support to state forestry assessment plans, developing and maintaining a qualified fire management crew to protect TVA lands, and developing a formal forest resource inventory program.

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.

Several tracts of land used by the public have little or no vehicular parking. 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 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 invasive 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 Nonnative Invasive Plant Management) to maintain or improve forest health; and (16) prescribed burns to meet resource objectives such as maintaining established NWSG stands or for forest understory habitat enhancement.

Vegetation Management Planning — A written vegetation management action plan would be prepared prior to manipulation of areas 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 unauthorized vegetative clearings, and for habitat enhancement. 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 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

Invasive plants infest a variety of forested and nonforested habitats. They can reduce forest productivity, hinder forest use and management activities, and degrade diversity and wildlife habitat. Invasive plants can include trees, shrubs, vines, grasses, ferns, and forbs. Some have been introduced accidentally, but most were introduced as ornamentals or for livestock forage. Many infestations on TVA 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.

Practices to prevent the establishment of invasive plants include the following:

- 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 invasive plants 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 invasive plant 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.

Herbicides that currently may be used to manage invasive plants on TVA lands are listed below. Detailed descriptions of these chemicals, including comprehensive risk assessments, can be found on the USDA's website (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 invasive 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 invasive 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 invasive plants 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.
- Plant parts capable of starting new plants (seeds, rhizomes, cuttings) 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 invasive plants 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 a 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 treatments, TVA would conduct the appropriate environmental review.
- Following treatments, exposed soils would be promptly revegetated to avoid recolonization.

As described below in Sections 4.2 and 4.3.1, a significant proportion of TVA land is infested with invasive plants. In recent years, TVA has conducted invasive plant control activities on about 600 acres per year. TVA would continue controlling invasive plants and is considering increasing the acreage annually treated. A related consideration is the development of a prioritized plan to control invasive plant on areas with sensitive resources such as natural areas, areas with habitat enhancements, and areas of high public use. TVA is also considering continuing its active participation in state exotic pest plant councils.

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 such as the operation of transmission lines. Common nuisance wildlife species for TVA include 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 has expertise in this management and 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 impact assessments for specific animal damage control activities across the Valley. TVA proposes to continue the contractual arrangement with USDA-WS for nuisance animal control activities.

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 lands.
- Vultures roosting on TVA transmission line structures.

- Vultures damaging other structures including dam and lock walls and vehicles parked at boat launching ramps.
- Droppings from roosting pigeons, 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 birds and mammals from creating health and safety issues.

Feral animals, particularly cats, are a problem at some TVA facilities and other TVA lands. Feral animals can harm local populations of birds and other wildlife, spread disease, and cause sanitation problems. TVA is considering developing and implementing proactive strategies to manage feral animals on TV lands.

Terrestrial Greenhouse Gas Sequestration Management

Carbon sequestration is the capture and storage of carbon dioxide (CO_2) that would otherwise be emitted to or remains 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).

Mandatory reductions of GHGs, mainly CO_2, may 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 land or through bilateral contracts on land owned by others. Another option would be to consider purchasing 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

TVA is currently researching terrestrial carbon sequestration on 41 acres of TVA lands; current and potential research topics include the following:

- Ecological impacts of various carbon sequestration practices
- Reservoir carbon uptake
- Comparison of carbon offset generation and verification methodologies

- Soil and/or above ground measurement techniques

TVA has entered into two consortiums, the PowerTree Carbon Consortium and the UtiliTree Carbon Company engaged in reforestation and other forestry projects to sequester carbon and manage GHG emissions. As part of the NRP, TVA is considering increasing its involvement in terrestrial GHG sequestration management.

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.

As part of the NRP, TVA would continue to maintain its current WHC certified projects and initiate WHC certification of the Natural Resource Plan. It is considering initiating new WHC certified projects and establishing a third party review and certification process for its wildlife management activities.

Wildlife Habitat Enhancement Partnerships
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 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 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 TVA lands.

About 500 acres of TVA land is currently managed through these partnerships and TVA is considering increasing this area.

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 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 prescribed 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 for various 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 transferred land and water areas on many of its reservoirs to the USFWS and state game and fish agencies for wildlife management and refuge purposes (Table 2-3).

Table 2-3. Former TVA Land and Water Areas Used for Federal and State Wildlife Management and Refuge 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
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

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. TVA proposes to continue these relationships and develop cooperative agreements with resource management partners.

2.1.3. Land Management and Stewardship

TVA currently utilizes a number of assessment and maintenance tools and techniques to manage its public lands. These assessment tools and techniques are described below.

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 site to be maintained. Next, the boundary line is located on the ground and denoted with the appropriate paint color. The following data are then recorded and added to a GIS database: date of boundary maintenance, feet of boundary marked, TVA monument numbers and conditions, and type of additional maintenance needed (if any).

TVA's boundary maintenance activities are currently prioritized according to encroachments, the potential of adjacent land development to result in encroachments, and existing boundary maintenance needs as assessed in the field. TVA proposes to develop a regional prioritization process for determining boundary maintenance needs at the reservoir level. TVA is also considering addressing all regional boundary maintenance needs on a fixed cycle while incorporating recent and evolving survey technologies such as the use of lasers and geographic positioning systems.

Land Conditions Assessment and Land Stewardship Maintenance
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.

Comprehensive Land Conditions Assessment — 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 2-4). After the field assessment is completed, an overall parcel rating is determined as "good," "fair," or "poor." These ratings are internally reported and tracked in a GIS database.

Table 2-4. 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 Plants
	Nuisance or Invasive 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 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.

In the NRP, TVA is considering replacing the RLCA with increased use of the CLCA, and increasing the area annually assessed from the current 5,000 acres to as much as 50,000 acres.

Based on the results of the land condition assessments, TVA prioritizes and implements stewardship activities to address the following resource stewardship maintenance needs:

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

Integrated Resource Management Plans — Integrated Resource Management (IRM) is a collaborative process TVA has used to integrate 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. 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 reservoir lands.

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 is the Boone Unit Plan (TVA 2002b) available at http://www.tva.gov/environment/reports/boone/.

In the NRP, TVA proposes to transition from IRM plans and the unit plan implementation methodology to the RLCA task prioritization methodology used on other TVA lands.

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.

Resource Stewardship Campaigns

To increase effectiveness and serve a larger portion of the Valley, TVA proposes to develop and implement a new Resource Stewardship Campaigns program. It would 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. They would likely include materials for stakeholders developed in conjunction with other programs and activities listed in this chapter.

2.1.5. Dispersed Recreation Management

Dispersed recreation includes passive and unconfined recreational activities occurring on TVA lands and not associated with developed facilities. Examples of dispersed recreation include primitive camping, hiking, wildlife viewing, hunting, and bank fishing. Some improvements would be made to dispersed recreational areas to improve user access, increase health and safety, and/or mitigate damage to natural resources. In addition, dispersed recreational opportunities may occur on areas with highly concentrated or seasonally intensive use, as well as on noncontiguous lands. The current and proposed dispersed recreation activities are described below.

Dispersed Recreation Assessments

TVA quantitatively measures ecological and social impacts from dispersed recreational activities on TVA lands. The 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 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 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 2-5 lists 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.

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 the most pressing needs and take steps to provide the public with key dispersed recreational opportunities. Examples of key dispersed recreational opportunities include improved access and bank fishing.

Table 2-5. 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 and 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 stock or pets Restrict or prohibit the type of use in an area to protect environmental conditions
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 Management Plans
Dispersed Recreation Management Plans are Valley-wide multi-year plans. They would allow TVA to holistically look at all facets of dispersed recreation and to ensure their integration with other program areas. These plans would be a proactive measure that address scheduled maintenance and future projects to maximize the efficiency and effectiveness of dispersed recreation management.

Dispersed Recreation User Surveys
These surveys would allow TVA to make scientifically based decisions on dispersed recreation projects, such as where and what key projects to implement, based on the specific needs of user of TVA lands. They would be designed to gather the user information necessary to make the most informed dispersed recreation management decisions. The proposed sample size of 600 annually would provide a robust, area-wide sample.

Dispersed Recreation Regulations
TVA would issue formal regulations concerning dispersed recreational uses of TVA lands to enhance enforcement capabilities.

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 has completed the LNT trainer certification course to become better communicators of the LNT message to the recreating public.

TVA is considering increasing its promotion of LNT throughout the region by providing educational information to users at recreation facilities and sites, through information kiosks and interactions with recreationists in the field, at local businesses, and on its website.

Trails Management

Over 100 miles of marked trails are located on TVA lands. Several of the trails or segments of the trails meet the Americans With Disabilities Act (ADA) 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 lands. Activities associated with trails have recently become more popular across the U.S. For example, day hiking rose 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 lands are listed below. A map showing these trails is presented as Figure A-1 in Appendix A.

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

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

As part of the NRP, TVA proposes to more proactively manage its existing trail system by conducting a systematic inventory, developing a management plan, and a program for establishing new trails.

2.2. Cultural Resources Management

TVA is responsible for many historic properties that are located on lands it manages and on other lands potentially affected by TVA actions. 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 and executive orders 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 describes the existing and proposed programs and supporting activities associated with TVA's cultural resource management and improvement efforts. These programs are summarized in Table 2-6. Their supporting activities are described in detail below, and the program and activity components of the alternatives are described in Chapter 3.

Table 2-6. Summary of Cultural Resources Management Programs

Program Category	Program
Cultural Resource Management	Archaeological Monitoring and Protection
	Archaeological Resources Protection Act Program
	Native American Consultation
	Native American Graves Protection and Repatriation Act
	National Historic Preservation Act Section 106
	Preservation Program
	Preserve America Program
Cultural Resource Partnerships	Cultural Resource Partnerships
Public Outreach	Archaeological Outreach (Thousand Eyes)
	Corporate History Program

Archaeological 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 continue and potentially increase its monitoring of shoreline archaeological sites. As part of this effort, it 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 has historically taken measures to protect about 0.2 miles of shoreline containing archaeological resources per year. These measures often consist of protecting the area by covering it with geotextile fabric and rock riprap. The riprap is placed from either the bank or from a shallow draft barge, depending on the characteristics of the particular site. TVA is considering expansion of this program as described in Chapter 3.

Archaeological Resources Protection Act 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 described below.

ARPA Inspections and Investigations — Two TVA Police officers are currently dedicated to the enforcement of ARPA criminal provisions. They conduct approximately 1,000 security checks per year; these consist of visiting archaeological sites on TVA lands and monitoring for illegal activity. Between 10 and 20 cases are investigated each year, about 6 cases are submitted to the U.S. Attorney's office for further investigation, and about 6 per year are prosecuted. 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, also 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 lands per year.

ARPA Permitting Process — Any archaeological survey or excavation that occurs on TVA lands requires a permit issued by TVA under ARPA. TVA staff maintains and reviews all archaeological permit requests received by TVA 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 Archaeological Regulations — TVA is proposing to issue regulations to supplement TVA's investigative authority by prohibiting the removal of any artifacts or historic items from archaeological sites or historic sites on TVA lands.

Native American Consultation

TVA formally consults with federally recognized tribes to meet the objectives of NAGPRA, NHPA, the American Indian Religious Freedom Act, 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.

Native American Graves Protection and Repatriation Act
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. NAGPRA-related activities include the following:

- 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 Native American human remains, associated funerary objects, and objects of cultural patrimony curated prior to 1990.

National Historic Preservation Act Section 106
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 described below.

NHPA Section 106 Reviews — 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.

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.

Management of Existing Mitigation Obligations — TVA will continue to comply with existing obligations for mitigating impacts to cultural resources. TVA is proposing to establish a database to monitor and manage ongoing mitigation measures to ensure compliance with Section 106 of the NHPA agreements and NEPA documents.

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 described below.

Archaeological Identification Surveys — TVA has conducted systematic archaeological surveys on about 88,000 acres of its lands and currently surveys 2,000 - 3,000 acres per year. TVA is proposing to continue and potentially increase its annual archaeological identification surveys of TVA lands.

Historic Photo Collection — TVA currently maintains a collection of more than 17,000 photographic negatives documenting its 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.

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

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

NRHP Historic Property Nominations — 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 routinely evaluated or nominated sites for inclusion in the NRHP. TVA is proposing annually evaluate and nominate a number of significant historic properties under its management.

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 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 with GIS components would improve efficiency and the overall management of TVA's historic properties.

TVA Historic Collection — TVA would maintain the unique collection of historic artifacts that it has acquired throughout its history. TVA is considering improving its curation of this collection to meet the standards consistent with 36 CFR 79 *Curation of Federally-Owned and Administered Archaeological Collections*. Another potential improvement to this program is the development of implementation procedures.

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

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.

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 described below.

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

NHPA Section 3 Reporting on Section 110 Progress — Preserve America requires all federal agencies to prepare a report (Section 3 report) on these needs and submit it to the Secretary of the Interior and the Advisory Council on Historic Preservation by 2005. In addition, agencies are to submit progress reports every three years detailing the current status of their Section 110 progress.

Historic Properties and Heritage Tourism — TVA is proposing to develop and implement a plan to identify and maintain a list of properties suitable for supporting heritage tourism.

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.

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 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 lands and/or by providing grants to the field schools. Criteria for qualifying field schools would include research designs including use of new and emerging technologies, research benefits, schedules, consultation requirements, associated publication commitments, and site restoration plans.

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

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 TVA's cultural, biological, and water resource management programs where appropriate. TVA has established the Thousand Eyes Program specifically to meet the obligations under this portion of ARPA. Program elements include presentation to school and other groups and the distribution of brochures. TVA is proposing to expand the program by sponsoring more outreach activities and developing partnerships with other agencies, SHPOs, tribal governments, and other interested organizations to increase efforts in better reach target audiences.

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

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.

Oral History Program — TVA's proposed 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 TVA's history. Oral history frequently complements the written record.

TVA History Website and Outreach Program — TVA is proposing to develop a website on its history and historic programming showcasing the significant periods of TVA history.

TVA History and Archaeology Museum — TVA would create a center to interpret its role in the history of the region, nation, and the world. TVA's historic and archaeological collections and digital and digitized historic photographs would be used to develop exhibits for the museum. The museum would serve TVA'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.

2.3. Recreation Management

This section describes, in general terms, the existing and proposed facilities and programs associated with TVA's management of developed (facility-based) recreation. Programs for managing developed recreation are summarized in Table 2-7. Their supporting activities are described in detail below, and the program and activity components of the alternatives are described in Chapter 3. Activities associated with dispersed recreation are described in Section 2.1.

Table 2-7. Summary of Recreation Management Programs

Program Category	Programs
Campground Management	Management of Campgrounds on Dam or Power Plant Reservations
	Management of Campgrounds off Dam and Power Plant Reservations
	Day Use Areas on Dam Reservations
	Day Use Areas off Dam Reservations
	Greenways
	Stream Access Sites
Public Outreach	Annual Tours
	Tennessee Valley Camp-Right Campground Program
	Reservoir Lands Recreation Information

Program Category	Programs
	Management
	Recreation Management Regulations
Recreation Assessments and Design Tools	Boating Density Assessments
	Reservoir Lands Recreation Inventory Managements
	Recreation Design Principles
	Recreation Planning, Assistance, and Technical Support

2.3.1. 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 holds a lottery for the long-term or seasonal rentals of approximately 140 (21 percent) of the campsites. 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. From 2204 through 2009, TVA collected an annual average of $771,882 from campground and pavilion rentals; this amount exceeded the expenses of operating the facilities by an annual average of $260,910.

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

Cherokee Dam Campground is a self-service campground containing 42 campsites with water and electric hookups, three of which meet accessibility standards. 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 hookups and two that meet accessibility standards. 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 that meet accessibility standards. 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 that meet accessibility standards 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, and boat ramps above and below the dam. TVA employs a nonresident manager and a 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 water and electric hookups, three of which meet accessibility standards. 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.

TVA proposes to continue to operate these eight campgrounds. It also proposes to proactively upgrade them consistent with ADA accessibility guidelines and make other upgrades to incorporate emerging technologies and reduce the environmental impacts of their operation.

TVA has recently upgraded the Melton Hill Dam Campground to demonstrate and evaluate how renewable energy, energy efficiency measures, water conservation, and recycled coal combustion products can be integrated into a sustainable recreation area. TVA proposes to continue this demonstration and evaluation.

Campgrounds Off Dam or Power Plant Reservations — TVA manages four campgrounds located on other reservoir properties. Two are located in central Tennessee (Barton Springs and Foster Falls), one in northeast Tennessee (Loyston Point Campground), and one 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.

TVA proposes to manage all four of these campgrounds through third-party agreements. One of these campgrounds (Foster Falls) would likely be closed if no third-party agreement can be negotiated as it provides limited camping opportunities, is costly to maintain, and provides limited cash flow. TVA also proposes to proactively upgrade the campgrounds remaining open consistent with ADA accessibility guidelines and make other upgrades to incorporate emerging technologies and reduce the environmental impacts of their operation.

2.3.2. 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 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 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. TVA often develops partnerships for the planning, construction, and maintenance of boat access areas. In addition, TVA has acquired 81 stream access sites, as discussed below.

TVA proposes to continue to operate and manage the day use areas. It also proposes to proactively upgrade them consistent with ADA accessibility guidelines and make other upgrades to incorporate emerging technologies and reduce the environmental impacts of their operation. TVA is also considering entering into contractual agreements for others to manage the day use areas off of dam reservations, as well as the possibility of closing these areas.

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.

TVA would continue to assist partners and stakeholder groups with the development of additional greenways.

Stream Access Sites

TVA, along with various 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 has 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 others under contractual agreements and 31 managed by TVA (see Figure A-5, Appendix A). A typical stream access site consists of an access road, parking area, and access to the stream. The stream access typically varies from a primitive dirt path, boat ramp, or steps to aid in launching and retrieving small boats and for fishing access.

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.

TVA proposes to continue the present management of the stream access sites, along with the option of closing sites should contractual agreements be terminated. TVA would consider developing and improving stream access sites on TVA lands and assisting partners with the acquisition and development of stream access sites. TVA also proposes to develop additional sites to support blueways and investigate partnerships for the development of blueways utilizing TVA land.

2.3.3. Public Outreach Programs

Annual Tours
TVA proposes to host media and technology transfer tours of campgrounds and day use recreational areas where emerging technologies are featured and showcased.

Tennessee Valley Camp-Right Campground Program
The Camp-Right Campground Program is a program that TVA would model after the TVCMI (see Subsection 2.4.1). Camp-Right 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 Camp-Right 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 Camp-Right initiative would be rewarded for those efforts.

TVA proposes to establish the Camp-Right program and annually certify 1 to 2 campgrounds.

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 analyses for projects or proposals involving TVA. Recreation information is also provided to partners and stakeholders. This information can be provided upon request or obtained from TVA's website.

TVA proposes to improve its recreation information management and dissemination capabilities. Proposed activities include maintaining and enhancing signage on TVA recreation areas, improving the recreation information on TVA's website, developing interactive maps of TVA recreation lands, and developing applications for emerging media and devices.

Recreation Management Regulations
TVA proposes to use the federal rule-making process to develop and implement regulations governing the recreational use of TVA lands. The rules would be codified in the Code of

Federal Regulations. TVA would ensure consistency with the NRP when developing these regulations.

TVA is also considering the development of a Resource Ranger Program to supplement TVA Police efforts at TVA recreational areas and on undeveloped TVA lands across the Valley. The rangers would receive instructions on 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. On undeveloped lands, they would provide the public an interface and TVA presence. Resource rangers would ensure users abide by the rules and regulations governing TVA lands while providing education and outreach opportunities.

2.3.4. Recreation Assessment and Design Tools

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). TVA is considering partnering with state boating law administrators to annually conduct up to 2 comprehensive boating capacity studies.

Boating Density Assessments
TVA's recreational boating density assessments are similar to boating capacity studies. However, the boating density assessment methodology is specifically used for conducting impact analyses for TVA projects and proposals requiring TVA's approval. Collection and analysis of data provide useful tools for gaining a better understanding of future desired boating conditions and the need 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. TVA proposes to continue conducting these assessments.

Reservoir Lands Recreation Inventory Management
The purpose of this program is to create and maintain an up-to-date database on recreation facilities and services available on TVA reservoirs. This information is used by TVA 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 management plans and recreation capacity studies.

TVA's Developed Recreation Inventory includes public, private, and quasi-public recreational opportunities on or near TVA 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 is gathered at TVA recreational areas and includes information on ramp widths, elevations, and presence of a courtesy pier. Details on facilities and services offered by other public agencies and commercial recreation areas are collected. Because of limited availability to the public, various levels of details are collected for quasi-public recreational areas. Similarly, information about members-only boating clubs and private residential community docks are 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.

TVA proposes to continue maintaining this inventory and is considering increasing the frequency at which reservoirs are surveyed from every three years to annually.

Visitor Assessments

Visitor assessments are a tool that TVA uses to obtain additional recreation information and help the Agency understand recreation trends and needs. They examine visitor use, demand, and preferences, and the results are used to set priorities for future development and planning. Surveys include a variety of techniques and media (i.e., site, phone, and Web surveys). Specific guidelines and methodologies for surveys follow established criteria as recognized by social science researchers. TVA proposes to continue conducting these surveys.

Recreation Design Principles

TVA implements and proposes to continue implementing standard construction designs and products that promote compliance with accessibility guidelines, 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 provides guidance to various parks and recreation agencies, and recreation program managers on 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.

TVA proposes to continue providing this planning and technical assistance to local, state, and federal agencies, and for the potential development and expansion of recreation facilities on TVA lands zoned for developed recreation use.

2.4. Reservoir Lands Planning

2.4.1. Reservoir Lands Planning Methodologies

Over the years, TVA has implemented four different land planning methodologies for zoning reservoir lands: Forecast System, Multiple Use Tract Allocations, Single Use Parcel Allocations, and Rapid Lands Assessment (RLA). These land planning methodologies have guided land use decisions and, to varying degrees, have created systematic approaches to planning and managing multipurpose uses of TVA reservoir lands across the Valley. This section provides an overview and timeline of the four methodologies. Table 2-8 categorizes TVA reservoirs by land planning 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 TVA reservoir lands using a variable set of designations described in Appendix D. A forecast record book was prepared to serve as a general guide for land use or potential development of each TVA reservoir. Decisions on the best use of the land were made based on TVA expertise and incorporated local and regional needs for various land uses as determined by the professional judgment of TVA specialists. Fort Loudoun and Wilson reservoir land are still managed with 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. The lands were then subdivided into tracts and assigned multiple use designations.

Narrow strips of TVA land fronting property formerly owned by TVA, also known as marginal strips, were not planned using this methodology. For example, TVA shoreland fronting former TVA reservoir land that was sold for private development purposes with deeded rights to request 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 tracts encumbered by easements or used for TVA dam reservations or power plants.

Table 2-8. Land Planning Methodology Applied to TVA Reservoirs

Reservoir Lands Planning Methodology	Time Frame Applied	Reservoirs		
Unplanned	-	Beech River Project	Great Falls	Normandy
Forecast System	pre-1979	Fort Loudoun	Wilson	
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 River Project	Great Falls	Normandy
		Chickamauga	Kentucky	Wheeler
		Fort Loudoun	Nickajack	Wilson

* RLA was conducted to communicate consistent Valleywide statistics to the public. Land use decisions are not being made from the RLA methodology and RLA data are not considered to be completed RLMPs.

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 Single Use Parcel Allocations approach that TVA has used since 1999 is similar to the Multiple Use Tract Allocations approach in that the lands surrounding each reservoir are subdivided into small parcels. However, each parcel is designated for one of six single, generally broader uses or allocations listed in Table 2-9 and defined in Appendix F. A seventh zone, Zone 1 — Non-TVA Shoreland, is used by TVA to designate reservoir shoreland that TVA does not own and whose use is not affected by TVA RLMPs. These zone definitions have been modified slightly since 1999 to provide additional clarity and consistency. As part of the NRP, TVA is considering changes to some of the zone definitions. The most substantive of these changes is in the types of industrial development that could occur on Zone 5 lands. Under the current Zone 5 definition, industrial

development is restricted to “light manufacturing activities.” Under the proposed Zone 5 definition, the light manufacturing restriction is removed and industry could include manufacturing, fabrication, and distribution/processing/assembly involving chemical, electronics, metalworking, plastics, telecommunications, transportation, and other industries.

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 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. 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 Allocations approach when planning reservoirs or groups of reservoirs. Table 2-8 lists the reservoirs that currently use the Single Use Parcel Allocations approach for land management decisions. In order to have a consistent reservoir lands planning methodology across the Valley, reservoirs that have not been planned, have Forecast System designations, or have Multiple Use Tract Allocations would eventually be planned using the Single Use Parcel Allocations method.

RLMPs completed since the late 1990s using the Single Use Parcel Allocations methodology have generally taken between one and two years to complete. 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 Finding of No Significant Impact. Two exceptions are the Tellico and Watts Bar RLMPs. The Tellico RLMP required about 3.5 years, largely because of major changes to the alternatives while the plan was being developed. The Watts Bar RLMP required five years to complete. During this time frame, TVA developed the Land Policy and Environmental Policy. The Watts Bar planning efforts were suspended during the development of these policies and a supplemental draft plan and EIS were subsequently circulated for public review and comment. Each RLMP is anticipated to require from one to six years to complete.

Rapid Lands Assessment

With the varying methodologies and allocations, it was often difficult to calculate the acreage of TVA lands that had been planned for various uses such as sensitive resource management, natural resource conservation, industrial development, and developed recreation. In 2006, the Rapid Lands Assessment (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 desk-top high-level zoning assessments for most of the reservoirs with Multiple Use Tract Allocations or Forecast System designations (Table 2-8). 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 lands were divided into manageable parcels and assigned the single use allocation that best represented existing conditions or identified needs. A detailed description of the methodology associated with the RLA approach is presented in Appendix G.

Comprehensive Valleywide Land Plan

As part of the NRP, TVA is considering adopting a Comprehensive Valleywide Land Plan (CVLP) to help guide future reservoir land use decisions across the reservoir system. The 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 across the Valley. The CVLP would establish the range of allocated uses for the lands TVA manages across its reservoir system. It would enable 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 particular land uses on a system-wide basis. The system-wide current and proposed CVLP allocations are listed in Table 2-9. The current allocations are based on the RLMPs completed using the single use allocation methodology and the results of the Rapid Lands Assessment. Under the CVLP, the land use zone definitions would be slightly modified from those used in recent Single Use Parcel Allocations land plans; they are defined in Appendix F.

Table 2-9. Current Allocations and Proposed Comprehensive Valleywide Land Plan Allocation Ranges

Allocation Designation		Percent of Allocated Land Area	
		Current Allocation	CVLP Range
Zone 1	Non-TVA Shoreland	N/A*	N/A
Zone 2	Project Operations	7	5 - 7
Zone 3	Sensitive Resource Management	17	16 - 18
Zone 4	Natural Resource Conservation	61	58 - 65
Zone 5	Industrial	2	1 - 2
Zone 6	Developed Recreation	8	8 - 10
Zone 7	Shoreline Access	5	5

*Not applicable.

The above target ranges were developed by first creating a baseline using the allocations assigned in existing RLMPs with Single Use Parcel Allocation methodology. For all other reservoirs, the RLA methodology was used to assign comparable land use zone allocations. Together, these existing RLMPs and information obtained during RLA create a baseline of land use zone allocations for the CVLP (Table 2-10). Maps of the existing RLMPs and RLA data are available on TVA's website at http://www.tva.com/environment/land/land_mgmt_plans.htm and http://www.tva.com/environment/land/assessment/index.htm.

Table 2-10. 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
Reservoirs with Approved Single Use Allocation RLMP						
Apalachia	91	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
Watts Bar	12	28	29	3	12	17
Wilbur	83	0	17	0	0	0
Average Percentage	10	23	53	1	9	5
Reservoirs without Approved Single Use Allocation RLMP						
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

Reservoir	Percentage of Land Area by Single Use Allocation Designation					
	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Average Percentage - All Reservoirs	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. 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.

The ranges are based, in part, on the anticipation that some parcels of land may be better allocated to different land use zones 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 public input, that certain parcels of land should be used differently from how they have been used in the past.

TVA lands support multiple uses. TVA's reservoir land base supports important operational activities allocated to Zone 2 - Project Operations, such as its dams and hydroelectric and thermal generating facilities. The continued availability of adequate land to support project operations will remain a priority in reservoir land planning. Based on the projected future needs for project operations, the land area allocated to Zone 2 is unlikely to increase in the future.

Lands allocated for industrial uses make up the smallest zone (Zone 5). As directed in the 2006 Land Policy, TVA staff reviewed lands allocated to Zone 5 to verify their suitability for industrial use. The results of this review (see http://www.tva.com/environment/land/assessment/econ_dev.htm) showed that about a third of the 4,272 acres allocated for industrial use is currently committed through a land use agreement for industrial purposes. The results also indicated that approximately 1.5 percent of TVA reservoir lands meet the criteria for industrial use. These results form the basis of the proposed range of lands allocated to Zone 5 in the CVLP. Due to the restrictions on making additional TVA lands available for residential development that have been implemented through the Shoreline Management Policy and the Land Policy, the amount of land allocated to Zone 7 - Shoreline Access is unlikely to change in the future.

Future land requirements for lands allocated to Zone 3 - Sensitive Resource Management are driven by events such as the discovery of previously unknown sensitive resources, additions and removals of species from the list of endangered and threatened species, and trends in the distribution and abundance of other sensitive resources. Currently, 17 percent of TVA's lands are allocated to Sensitive Resource Management. Future changes to this proportion are expected to be small.

TVA's years of reservoir lands planning has created an understanding of the value of these properties in meeting public needs, and Zone 4 - Natural Resource Conservation and Zone 6 - Developed Recreation are the two uses that receive the most attention and pressure. As directed in the 2006 Land Policy, TVA staff reviewed the development and suitability of lands zoned for developed recreation (see http://www.tva.com/environment/land/assessment/recreation.htm). This study found that 90

percent of the 21,211 acres zoned for developed recreation are currently committed through a land use agreement for recreation purposes. Based on projected population growth in the TVA region (see Section 4-13), TVA would need to increase its land area zoned for developed recreation by about 20 percent to maintain the current level of facility-based recreation over the next 20 years. The remainder of TVA reservoir lands would likely continue to be allocated to Zone 4 - Natural Resource Conservation. The bounds of the proposed CVLP range for Zone 4 were defined by the upper and lower CVLP ranges for the other land use zones.

During subsequent planning efforts, lands that are no longer be suitable or needed for their current allocation would typically revert to a Natural Resource Conservation (Zone 4) designation. If the land is capable and suitable for another use and the change aligns with the allocation ranges of the CVLP, reallocation to a different zone is possible. As an example, a tract allocated for Project Operations (Zone 2) would be reallocated to Natural Resource Conservation (Zone 4) when its primary use is no longer needed to support project operations. If existing recreational infrastructure is present of if there is an identified need for developed recreation facilities in the local area, the tract could be reallocated to Developed Recreation (Zone 6). Lands previously allocated to Sensitive Resource Management (Zone 3) would only be reallocated if it is determined that the sensitive resource and/or its habitat is no longer present. In that case, the tract would be reallocated to the suitable land use identified in the planning process.

2.4.2. 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 land. All inquiries about or requests for the use of TVA 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 and industrial. 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 TVA 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 appropriate 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.

2.5. Water Resource Management

This section describes the existing and proposed programs and supporting activities associated with TVA's water resource management and improvement efforts. These programs are summarized in Table 2-11. Their supporting activities are described in detail below, and the program and activity components of the alternatives are described in Chapter 3.

Table 2-11. Summary of TVA's Water Resource Management Programs

Program Category	Programs
Aquatic Monitoring and Management	Aquatic Ecology Management
	Stream and Tailwater Monitoring Program
	Climate Change Sentinel Monitoring
Partnership Programs	Case Studies / 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 / Riparian Management
	Targeted Reservoir Initiatives
	Targeted Watershed Initiatives
	Water Resource Grant Program
	Nutrient Source-Watershed Identification and Improvement
	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reduction
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

2.5.1. Aquatic Monitoring and Management

Aquatic Ecology Management
TVA proposes to partner and actively participate in enhancing 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 information and opportunities to raise public awareness of land use practices that degrade aquatic communities and of 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 invasive species.

This program would include a collaborative focus on protection of aquatic biodiversity. The Tennessee River Watershed contains several of the most biologically diverse rivers in North America. Notably, the Clinch, Powell, and Duck Rivers support an almost unsurpassed variety of freshwater animal life that includes the most diverse assemblages of fish and mussel species in the entire world. This focus would include identifying protection needs of one or more of these three watersheds through biological monitoring and habitat assessment activities, fostering coordination efforts among stakeholders to make better management decisions, participating in public outreach to raise public awareness of exceptional biological diversity, and proactively implementing protection measures. TVA would leverage funding and resources to join with others in accomplishing these activities. This program aligns well with EPA's recent emphasis in its *Coming Together for Clean Waters* strategy (USEPA 2011) to identify and protect the Nation's "healthy waters."

Stream and Tailwater Monitoring
The U.S. Geological Survey (USGS) assigns each watershed a specific numerical hydrologic unit (HU) code. There are 611 HUs labeled with an 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 Index of Biotic Integrity (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 Targeted Watershed Initiative (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 Stream and Tailwater Monitoring (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 implemented following the ROS

and supporting the analysis needed for environmental reviews. These data are also shared with other agencies and partners, as appropriate.

Climate Change Sentinel Monitoring
Climate change represents an unknown, but predicted to occur, impact on water resources and diverse aquatic communities that include many species that are unique to cold-water habitats, as well as those that are already under stress, including those listed as endangered or threatened. To determine the vulnerability of these resources to climate change impacts, TVA is proposing a new program within the Tennessee Valley of long-term sentinel monitoring in targeted watersheds to provide an early warning of climate-related impacts in sub-basin parameters, stream habitat, water quality, and biological diversity. Monitoring stream habitat, health, and climatic variables would provide useful information pertaining to ecosystem changes over time and provide data for future management options to mitigate adverse impacts in the event they develop.

This program would be a collaborative partnership effort with other federal and state agencies to detect and plan for climate change impacts on water resources. Activities to monitor several sites in targeted watersheds of the five predominant ecoregions in the Tennessee Valley and to conduct long-term trending and reporting would be coordinated or merged with a larger national-scale climate-effects monitoring network. Currently there has been no coordinated sentinel aquatic monitoring program involving TVA within the Tennessee River watershed.

2.5.2. Partnership Programs

Case Studies / 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.

2.5.3. Public Outreach Programs

Tennessee Valley Clean Marina Initiative
TVCMI is a 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 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 website and in other TVCMI promotions and events. Since 2002, a total of 85 marinas have been certified through this program; their location is shown on Figure A-7 (see Appendix A).

Water Efficiency Program

This program is currently being conducted as part of TVA's Sustainability Plan. It 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 would include focused efforts to raise public awareness and involvement in storm water management issues and sustainable land-use practices, develop and promote TVA blueways (Section 2.3.2), protect and improve reservoir shorelines, and address TVA and/or stakeholder needs, emerging

issues, or other resource concerns. These concerns include nutrient and sediment reductions, climate change, and impacts of nutrients on downstream waterbodies. The campaigns would 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 campaign would include stakeholder products from various components of the Quality Growth Program, Water Efficiency Program, shoreline stabilization, water resource improvement tools, technical assistance, and organizational support. These campaigns would enhance the sense of public ownership in the day-to-day management of the Valley's water resources.

Quality Growth Program

The concept for the Quality Growth Program (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.

2.5.4. Water Resource Improvement Programs

Reservoir Shoreline Stabilization / Riparian Management
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. TVA would continue to assess, prioritize, and set targets to stabilize critically eroded reservoir shorelines, which would include protecting significant cultural and other sensitive resources that would also improve water quality and enhance aquatic and wildlife habitat.

Targeted Watershed Initiatives
The TWI Program has been TVA's delivery mechanism for proactive water quality improvement work for several years. 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 2-12 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.

Table 2-12. 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
2009	128	174	245	1872	2735	547	68.4
2010	126	176	245	1879	2735	547	68.7

*Percent is based on the sum of all stream IBI rating scores (poor = 1, fair = 3, good = 5) compared to the maximum best possible score (total number of streams rated x 5).

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 2-13 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 quality ratings 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.

Current goals of the TWI program are as follows:

- Reduce suspended sediment reaching streams by 234 tons per year
- Reduce phosphorus reaching streams by 350 pounds per year
- Improve 1 hydrologic unit in 5 years
- Deliver 50 stakeholder products per year

Table 2-13. 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.

Nutrient Source - Watershed Identification and Improvement

Consequences of not proactively addressing nutrients as a Valley-wide (and beyond) issue are great from both a current “needs” and a future regulatory perspective. EPA has identified the amount of nitrogen and phosphorus pollution entering our waters as being one of the costliest and most challenging environmental problems we face. The new Nutrient Source-Watershed Identification and Improvement Program would establish goals or targets to reduce nutrients in TVA reservoirs by identifying the three reservoirs having the greatest potential for nutrient source load reductions. TVA would then work in partnership with other agencies and stakeholders to reduce nutrient and sediment non-point source loading from major source watershed streams and nutrients from point sources to reservoirs. This program would develop reservoir-specific nutrient improvement plans and

target ranges of load reductions to be achieved in each reservoir. Specific program goals include the following:

- Developing reservoir-specific improvement plans for up to three reservoirs
- Implement plan activities to reduce point-source phosphorus reaching reservoirs by 5,000 pounds per reservoir per year
- Implement plan activities to reduce 720-1,080 tons per reservoir per year of suspended sediment transported from watershed streams into the reservoirs
- Implement plan to reduce 1,100- 1,650 pounds per reservoir per year of phosphorus transported from watershed streams into the reservoirs.

2.5.5. National Water Resource Recovery Programs

Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions
A nationally significant emerging water quality issue for the Tennessee River and other major tributaries to the Mississippi River Basin is nutrient loading (particularly nitrogen) and its effects on the northern Gulf of Mexico hypoxic zone. This expanding area of depleted oxygen concentrations, referred to as the "dead zone" in the Gulf, is having a tremendous ecological and economic impact and will be solved through reduction of nutrient loading from Mississippi River Basin's major tributaries, including the Tennessee River.

Although nutrient yields from the Tennessee River delivered to the Gulf may not be completely understood, TVA's proposed strategy is to demonstrate nutrient load identification and reduction techniques and opportunities that would target the major sources of nutrient loading for reducing non-point and point source inputs delivered to the northern Gulf of Mexico. This program would use existing and new data from lower Tennessee River reservoirs and watersheds to select one reservoir as the focus for nutrient source loading and delivery modeling and to develop a long-term action plan that supports the strategy of reducing nutrients delivered to the Gulf. Data sources for model development would include targeted sampling, and other data from TVA, U.S. Geological Survey, National Oceanographic and Atmospheric Administration, states, Mississippi River Basin Gulf of Mexico Hypoxia Task Force, and USEPA.

The nutrient reduction strategy would be tested by implementing practices, which would include many of those described below in Section 2.5.6, in a small watershed (reservoir embayment or tributary reservoir) to demonstrate nutrient yield reduction and validate the model. TVA would then work with partners to implement the strategies on a larger area.

This program would demonstrate TVA's commitment to improving water quality within the Tennessee River watershed to include protection and improvement of downstream uses. One option would use a number of effective water resource improvement tools to implement effective strategies to reduce nutrient yields from the Tennessee River.

2.5.6. Water Resource Improvement Tools

This section describes the existing and proposed tools and supporting activities associated with TVA's various water resource management and improvement efforts. These tools and activities were used in developing the programs chosen in the various alternatives. Several of these tools and activities are also used to implement activities listed under the Biological Resource Management, Cultural Resource Management, and Recreation Management programs and activities.

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 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 or 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 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 reduce the amount of storm water entering a stream and 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) are 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.

Storm Water Infiltration — 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. Stream restoration work performed by TVA under the programs in the NRP would use the principles of natural stream channel design and biostabilization techniques when possible. 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 is a market-based approach to improving water quality. Trades can take place between nonpoint sources (such as agriculture or urban runoff) and point sources (such as wastewater treatment plants or industrial facilities). Pollutant 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 water pollutant 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 pollutant 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 gap between the maximum possible pollution reduction and the required levels of pollution reduction.

Before this tool could be utilized, regulatory agencies (states with USEPA oversight) would need to establish a regulatory structure to administer and oversee the trading process. It might also be possible under a water pollutant trading program to allow “banking” of pollution reduction “credits” for voluntary pollutant load reductions ahead of regulatory requirements to reduce those loadings. Maximum utilization of this tool could occur if interstate and inter-watershed trading rules were established.

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 website 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 website.

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.

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) website, 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.

2.6. Public Engagement

TVA proposes to develop and implement programs to increase public awareness and involvement across the broad spectrum of natural resource management activities.

Environmental Education Program

The Environmental Education Program would consist of comprehensive and coordinated public outreach efforts that teach stakeholders about the values and functions of natural resources and on the challenges faced in preserving, enhancing, and/or managing these resources for future generations. The program would focus on efforts within the education system, from primary to post-secondary schools, and on a variety of other audiences such as civic and peer groups, elected officials, business leaders, and the general public. Efforts to educate these audiences would include formal programs, print materials, museum displays and interpretation, websites, media campaigns, and information kiosks.

Volunteer Program

TVA proposes to establish a volunteer program to better manage its resources by encouraging volunteers to actively participate in resource conservation and enhancement activities. Potential activities include trail establishment and maintenance, tree planting, invasive species removal, shoreline biostabilization, green campground projects, habitat enhancement, surveys and data collection, 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 engaging other types of service or volunteer organizations.

Foundation and Trust Fund

TVA proposes to create an independent Foundation and Trust Fund or partner with an existing fund to solicit private donations to support conservation- and natural resource-related projects and programs. The fund would be similar to a corporate partnership program in which a center or foundation would be established to oversee and managing fundraising campaigns, trust funds, and requests for proposals. Funding would be available for on-the-ground projects, contracted technical support services, plan development, and project implementation.

CHAPTER 3 - ALTERNATIVES

The purpose of this EIS is to analyze, in a programmatic manner, the environmental impacts anticipated to result from the implementation of the NRP and the alternatives to it. This chapter describes the four alternatives considered in detail in this EIS, as well as the process used to develop the alternatives. The alternatives encompass a variety of approaches for managing biological, cultural, recreation, and water resources, and for conducting reservoir lands planning.

3.1. Development of Alternatives

3.1.1. Development of Program Options

The purpose of the NRP is to develop a plan to guide TVA's responsible management of natural resources over the next 20 years in a cost-effective manner while upholding TVA's mission. In order to establish a reasonable range of the natural resource management programs and activities that would meet this purpose and make up the NRP, TVA staff reviewed various aspects of biological resource management, cultural resources management, terrestrial GHG management, recreation management, reservoir lands planning, and water resource management. They first considered the major issues affecting the natural resources in TVA's custody. They then documented existing and proposed programs, tools, and activities that could be used to manage these resources. Next, they reviewed the comments submitted during public scoping, recommendations from the RRSC, and results of discussions with other federal and state natural resource agencies. They then defined new programs and revised existing programs, as described in Chapter 2. Finally, they grouped the programs to develop options for TVA's future management of natural resources.

Four program options were developed for the management of biological, cultural, and water resources and for recreation (Table 3-1). Three program options were developed for reservoir lands planning (Table 3-2). These program options were developed to provide a range of possible future activities for each resource area. They were defined based on the current condition of the resources TVA is proposing to manage through the NRP, the professional opinion of TVA staff, and comments and recommendations from the public, the RRSC, and other natural resource management agencies. The Custodial, Enhanced, and Flagship options are displayed graphically in Figure 3-1. TVA's current management options are generally grouped around the Custodial level or in the Custodial to Enhanced range.

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

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, cultural, recreation, 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.

Program Option	Descriptions
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 primarily 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.

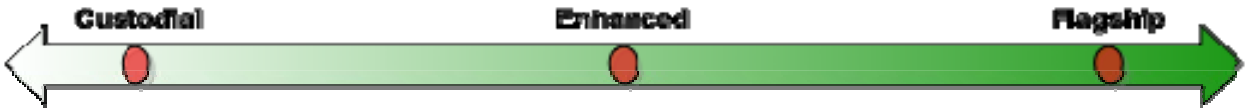


Figure 3-1. Range of Program Options Developed for the NRP

Once the program options were developed, costs were estimated using historical cost data and best professional judgment for:

- Full-time employees (FTEs)
- Program costs (in addition to FTEs)
- Capital expenditures and/or one-time costs (if applicable).

3.1.2. Natural Resource Plan Program Analysis Framework

The NRP analysis framework was developed to evaluate each program option based on a wide range of inputs to provide an accurate comparison of potential levels of implementation effort. Inputs to this framework included the results of scenario planning, input from external stakeholders, and other strategic considerations. The external stakeholder input at this stage included additional input from the RRSC, as well as the continued consideration of the scoping results, public comments on the draft, and discussions with other natural resource agencies.

3.1.2.1. 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 a range of plans across a number of potential scenarios provided an important data point when selecting a preferred alternative that is flexible and easily adapted to changing future conditions. Scenario planning aided in assessing the relevant risks, uncertainties, and challenges surrounding the various NRP alternatives. 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.

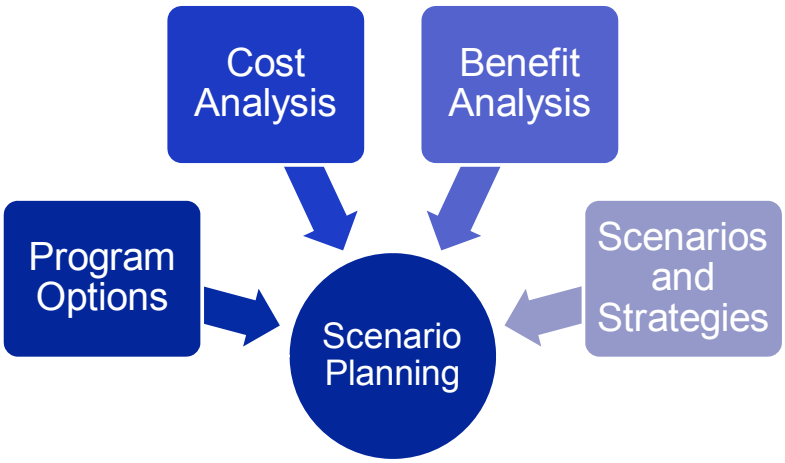


Figure 3-2. Various Scenario Planning Analysis Inputs

Costs of each program option were weighed against a benefit analysis that evaluated each program option based on the benefits it provides to the public, to TVA, and to the resource. To develop this benefit analysis, TVA retained a third-party natural resource economist to provide an independent evaluation of the expected benefits of each program option. This analysis (Cardno ENTRIX 2011) incorporated the varying nature of both qualitative and quantitative program benefits to the public and TVA.

Each program option was then ranked based on its benefit per dollar and assessed across four scenarios. The scenarios used in this analysis were adapted from those used in TVA's recently completed Integrated Resource Plan (TVA 2011; www.tva.gov/irp), and included those scenarios that were most strongly related to NRP programs and activities.

The results of scenario planning were used to analyze three potential strategies for the NRP, and there was limited variation across the resulting program mixes. Therefore, TVA selected a blended alternative for further analysis in the draft NRP; this alternative included components from each of the current, custodial, flagship, and enhanced program options.

3.1.2.2. Other Strategic Considerations

Once the initial NRP program mix was identified using the scenario planning process described above, TVA identified strategic or high-priority programs integral to the successful implementation of the NRP. These strategic considerations provided a third data point, along with scenario planning and stakeholder input, used in identifying the final program mix for the NRP and the preferred alternative in the EIS.

Any programs identified as a strategic consideration align with TVA's commitment to manage lands under its control to meet the desired land conditions for their defined purpose. Several of the programs establish infrastructure or provide essential assessments of resource conditions necessary to successfully implement other programs. Examples of these programs include the various databases and the biological, dispersed recreation, cultural, and water resource monitoring and assessment programs. 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) needs of nonrenewable resources, breadth of beneficial impact, partnership potential, and economic development.

3.1.2.3. The NRP Program Mix

The above analyses were used to define the programs and their level of implementation included in the draft NRP. The draft NRP identified three priority levels for implementation - Custodial, Blended, and Advanced. These levels were comprised of different levels of program options. The Custodial priority level included all custodial program options for each resource area and aligns with Alternative B in the EIS. The Blended priority level included the enhanced or flagship program options from each resource area that were identified as being strategic or high-priority and integral to the successful implementation of the NRP. These Blended priority level program options, as well as the Custodial program options for non-strategic and low-priority activities represent Alternative D (the preferred alternative) in the EIS. The Advanced priority level consisted of all remaining enhanced or flagship program options for each resource areas that were not identified as strategic or high-priority; these program options are included in Alternative C in the EIS. Programs in the Advanced priority level could be considered for implementation depending upon available resources and partnerships, and only to the extent that their implementation does not undermine implementation efforts of the program options identified in the Custodial and Blended priority levels.

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.

3.1.4. Alternatives Development

The mix of programs identified for implementation in the draft NRP formed the basis for Alternative D, Blended Management. In addition to the No Action Alternative, two additional

action alternatives, Custodial Management and Flagship Management, were developed that spanned the range of program options. These alternatives are described in more detail below.

3.1.5. Revisions Following Public Review of Draft NRP and EIS

The program mix included in the draft NRP and the basis for Alternative D was refined in response to comments on the draft NRP and EIS, additional input from the RRSC, and additional discussions with other natural resource agencies. Some programs were eliminated from some alternatives and replaced with new programs. The implementation levels were changed for other programs. A frequent comment was that the discussion of the various program options, priority levels, and alternatives was confusing. As a result, their presentation was simplified and both the final NRP and the alternatives descriptions in the final EIS were revised to better define the goals and/or quantities associated with many programs. The major change to the reservoir lands planning alternatives was to narrow the range of the proportion of land that would be allocated to each of the zones under the Comprehensive Valleywide Land Plan.

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.

Under all alternatives, TVA would implement the programs and activities that address safety, TVA's mission and relevant laws, regulations, EOs, and policies. As laws, regulations, and policies are created or amended, implementation activities would be revised to reflect the changes and ensure continued 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 No Action Alternative, Alternative A, represents the continuation of TVA's current natural resource management programs and activities. This alternative represents the baseline necessary to evaluate the action alternatives, both in terms of their environmental impacts and their effectiveness in meeting the needs of the various natural resources TVA manages. It emphasizes regulatory and technical requirements, assessments of TVA resources and partnerships, and projects associated with TVA 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 Action Alternatives represent a range of effort and resources committed to minimal, primarily reactive natural resource management (Alternative B - Custodial Management) to aggressive proactive management (Alternative C - Flagship Management. Alternative D - Blended Management is TVA's preferred alternative and incorporates varied levels of effort and commitment of resources. The components of the four alternatives, other than those associated with reservoir lands planning, are listed in Tables 3-3 through 3-7. They are organized by resource area, program category, program, and activity. The programs and activities are described in Chapter 2. The unique characteristics of the four alternatives, including the different quantities associated with many activities (e.g., number of areas, acres, miles of

shoreline) and the different reservoir lands planning approaches, are described in more detail below.

Table 3-3. Biological Resources Management Components of Alternatives A - D

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Sensitive Biological Resources Management	Threatened and Endangered Species Program	Continue to comply with the requirements of the Endangered Species Act and implementation of biological opinion requirements.	●	●	●	●
Sensitive Biological Resources Management	Threatened and Endangered Species Program	Continue monitoring of select species populations.	●	●	●	●
Sensitive Biological Resources Management	Threatened and Endangered Species Program	Create monitoring plans, develop and implement management actions, seek partnerships and catalog select species where management opportunities and/or emergent issues exist within the region.			●	●
Sensitive Biological Resources Management	Threatened and Endangered Species Program	Continue cave protection activities.	●	●	●	●
Sensitive Biological Resources Management	Wetland Management	Continue implementation of current TVA wetland management and protection practices on TVA-managed lands.	●	●	●	●
Sensitive Biological Resources Management	Wetland Management	Investigate opportunity and potential establishment of a partnership with TDEC to develop a proactive program to identify high-quality reservoir wetlands on TVA-managed lands as a “Blue Ribbon” or “Reference Site” Reservoir Wetland Pilot Project.			●	
Sensitive Biological Resources Management	Sensitive Resources Data Management	Continue current management of TVA Natural Heritage and wetlands databases.	●	●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Sensitive Biological Resources Management	Sensitive Resources Data Management	Honor data sharing agreements among TVA and other state and federal resource agencies.	●	●	●	●
Sensitive Biological Resources Management	Sensitive Resources Data Management	Expand information gathering efforts for identification of sensitive resources through partnerships. Incorporate wetlands identified during these surveys into the database.			●	
Sensitive Biological Resources Management	Sensitive Resources Data Management	Develop predictive models for federally and state-listed species.			●	
Sensitive Biological Resources Management	Sensitive Resources Data Management	Add new data users for environmental review and planning purposes.			●	●
Sensitive Biological Resources Management	Natural Areas Management	Monitor and assess TVA's natural areas to develop a prioritized list of maintenance or improvement needs (approx. 1/3 of natural areas assessed annually).	●	●	●	●
Sensitive Biological Resources Management	Natural Areas Management	Designate or remove natural areas via the reservoir lands planning process.	●			
Sensitive Biological Resources Management	Natural Areas Management	Develop and implement comprehensive natural area management plans (approx. __ natural areas annually).			33	15
Sensitive Biological Resources Management	Natural Areas Management	Establish criteria for a natural areas planning process to designate new and/or remove existing natural areas on TVA-managed lands.			●	●
Sensitive Biological Resources Management	Conservation Planning	Continue to be advisers/participants in planning organizations.	●	●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Sensitive Biological Resources Management	Conservation Planning	Partner with regulatory and resource management agencies in state, local, and regional conservation planning efforts.		●		●
Sensitive Biological Resources Management	Conservation Planning	Expand role in large-scale planning efforts across the region via partnerships.			●	
Sensitive Biological Resources Management	Migratory Birds Management	Comply with Executive Order 13186.	●	●	●	●
Sensitive Biological Resources Management	Migratory Birds Management	Support and participate in national and regional migratory bird management planning efforts.		●	●	●
Sensitive Biological Resources Management	Migratory Birds Management	Continue leadership role in Tennessee River Valley Shorebird Working Group.	●	●	●	●
Sensitive Biological Resources Management	Migratory Birds Management	Partner with other agencies and NGOs to implement conservation projects and to manage migratory bird populations on TVA reservoirs.			●	●
Terrestrial Habitat Management	Grasslands and Agricultural Lands Management	Continue to manage agricultural licenses and cooperative Federal and State Agency agreements on over 10,000 acres of TVA-managed lands.	●	●		●
Terrestrial Habitat Management	Grasslands and Agricultural Lands Management	Partner with Federal and State Agencies and NGOs in efforts to manage and enhance TVA grasslands and agricultural lands.	●	●	●	●
Terrestrial Habitat Management	Grasslands and Agricultural Lands Management	Increase efforts to reestablish and manage native grassland plant communities in a prioritized manner on TVA lands.			●	

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Terrestrial Habitat Management	Dewatering Projects Management	Continue management of current projects (includes maintaining or upgrading existing contractual agreements).	●	●		
Terrestrial Habitat Management	Dewatering Projects Management	Refurbish dewatering areas based on dewatering unit engineering and hydrologic reviews.			●	●
Terrestrial Habitat Management	Dewatering Projects Management	Operate, manage, and maintain dewatering area projects at upgraded conditions.			●	●
Terrestrial Habitat Management	Dewatering Projects Management	Work with local and regional partners to incorporate nature-based tourism into management of dewatering areas projects.			●	●
Terrestrial Habitat Management	Forest Resource Management	Manage tree hazards and tree cutting/vegetation damage encroachments.	●	●	●	●
Terrestrial Habitat Management	Forest Resource Management	Continue small-scale vegetation (tree removal) operations associated with storm or insect damages and forest wildlife habitat enhancements.	●	●	●	●
Terrestrial Habitat Management	Forest Resource Management	Monitor broad forest trends on TVA-managed lands and conduct basic forest protection activities.		●	●	●
Terrestrial Habitat Management	Forest Resource Management	Provide support to state forestry assessment plans.	●		●	●
Terrestrial Habitat Management	Forest Resource Management	Develop and maintain a qualified fire management crew for local responses and to protect TVA assets.			●	●
Terrestrial Habitat Management	Forest Resource Management	Develop a formal forest resource program to guide future inventory efforts.			●	

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Terrestrial Habitat Management	Nonnative Invasive Plant Management	Control nonnative invasive plant management on __ acres of TVA-managed lands per year.	600	1,000	40,000	1,000
Terrestrial Habitat Management	Nonnative Invasive Plant Management	Develop a prioritized plan to control nonnative invasive plants on areas with sensitive resources, habitat enhancements, and/or high public use, emphasizing areas with high partnership potential.		●	●	●
Terrestrial Habitat Management	Nonnative Invasive Plant Management	Actively participate in state exotic pest plant councils along with regional early detection and rapid response initiatives.	●		●	
Terrestrial Habitat Management	Nuisance Animal Control	Resolve animal damage conflicts via existing contractual agreement with USDA-WS.	●	●	●	●
Terrestrial Habitat Management	Nuisance Animal Control	Develop and implement proactive strategies to manage feral animals on TVA-managed lands.		●	●	●
Terrestrial Habitat Management	Nuisance Animal Control	Develop programmatic TVA guidelines for addressing nuisance animals, establishing memoranda of agreement with agencies responsible for regulating wildlife, and developing and sharing BMPs with partners.			●	
Terrestrial Habitat Management	Terrestrial Greenhouse Gas Sequestration Management	Develop and implement a terrestrial GHG management plan that identifies a range of voluntary and carbon compliance-assistance opportunities.			●	

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Terrestrial Habitat Management	Terrestrial Greenhouse Gas Sequestration Management	Conduct research projects on __ acres focusing on issues related to terrestrial greenhouse gas management.	41	41	500	41
Terrestrial Habitat Management	Terrestrial Greenhouse Gas Sequestration Management	Continue existing or expand involvement in __ third-party consortiums focusing on issues related to terrestrial GHG management practices.	2	2	8	2
Terrestrial Habitat Management	Terrestrial Greenhouse Gas Sequestration Management	Maintain existing or conduct new demonstration projects (___#) focusing on issues related to terrestrial greenhouse gas management practices.	2	2	6	2
Terrestrial Habitat Management	Wildlife Habitat Council – Third Party Certifications	Continue management of current certified projects.	●	●	●	●
Terrestrial Habitat Management	Wildlife Habitat Council – Third Party Certifications	Apply for Wildlife Habitat Council certification of TVA Natural Resource Plan.		●	●	●
Terrestrial Habitat Management	Wildlife Habitat Council – Third Party Certifications	Initiate 5 Wildlife Habitat Council certified projects at 5 new locations on TVA-managed lands.			●	
Terrestrial Habitat Management	Wildlife Habitat Council – Third Party Certifications	Establish a third-party review and certification process for wildlife management activities on 10 percent of appropriate TVA–managed lands annually.			●	
Terrestrial Habitat Management	Wildlife Habitat Enhancement Partnerships	Improve habitat on __ acres of TVA-managed lands per year through partnership efforts (only).	500	750	20,000	750

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Terrestrial Habitat Management	Wildlife Habitat Enhancement Partnerships	Engage existing partners and seek opportunities to partner in the management of licensed lands on TVA property (target of 20,000 acres per year - specific to TVA-managed lands).			●	
Terrestrial Habitat Management	Wildlife Habitat Enhancement Partnerships	Develop cooperative agreements for use with resource management partners.			●	
TVA Land Management and Stewardship Programs	Boundary Maintenance	Conduct boundary maintenance at the reservoir level.	●	●	●	●
TVA Land Management and Stewardship Programs	Boundary Maintenance	Develop a regional prioritization process for determining boundary maintenance needs at the reservoir level.		●	●	●
TVA Land Management and Stewardship Programs	Boundary Maintenance	Address all regional boundary maintenance needs on a __ -year cycle while incorporating the latest and future survey technologies to assist in the process.			5	10
TVA Land Management and Stewardship Programs	Land Condition Assessment and Land Stewardship Maintenance	Assess __ acres of TVA-managed lands annually. Execute a comprehensive approach for assessing all TVA-reservoir properties in an effort to eventually replace the past rapid land condition assessments with a comprehensive land assessment.	5,000	20,000	50,000	35,000
TVA Land Management and Stewardship Programs	Land Condition Assessment and Land Stewardship Maintenance	Implement prioritized stewardship activities addressing public health and safety, asset preservation, and resource management needs based on land assessments.		●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
TVA Land Management and Stewardship Programs	Land Condition Assessment and Land Stewardship Maintenance	Transition from the unit plan implementation methodology to the RLCA/LCA task prioritization methodology.	●	●	●	●
Public Outreach (Biological)	Resource Stewardship Campaigns	Develop and implement this new program to promote natural resources improvements and protection; deliver 25 stakeholder products annually.			●	
Dispersed Recreation Management	Dispersed Recreation Management	Evaluate 70 dispersed recreation areas annually.	●			
Dispersed Recreation Management	Dispersed Recreation Management	Collect data on dispersed recreation sites identified during lands condition assessment.	●	●	●	●
Dispersed Recreation Management	Dispersed Recreation Management	Repair __ heavily impacted dispersed recreation sites annually.	1	5	25	15
Dispersed Recreation Management	Dispersed Recreation Management	Implement __ key projects annually.	1	5	20	10
Dispersed Recreation Management	Dispersed Recreation Management	Distribute 600 dispersed recreation user surveys annually.			●	
Dispersed Recreation Management	Dispersed Recreation Management	Conduct 100 outdoor clinics annually.			●	
Dispersed Recreation Management	Dispersed Recreation Management	Implement web based educational campaign to promote ecofriendly dispersed recreation.		●	●	●
Dispersed Recreation Management	Dispersed Recreation Management	Develop and implement multiyear dispersed recreation plans.			●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Dispersed Recreation Management	Dispersed Recreation Management	Issue regulations on dispersed recreation facilities to enhance enforcement capabilities.			●	●
Dispersed Recreation Management	Leave No Trace	Continue to participate in Leave No Trace program.	●	●	●	●
Dispersed Recreation Management	Leave No Trace	Promote the Leave No Trace program throughout the Valley by providing educational information to users at recreation facilities/sites, local businesses, and on the web.			●	●
Dispersed Recreation Management	Trails Management	Proactively manage existing trail systems to include a systematic inventory and management/maintenance plan.	●	●		●
Dispersed Recreation Management	Trails Management	Develop and implement a Valleywide trails establishment and maintenance program.			●	
Dispersed Recreation Management	Trails Management	Add 20 trail miles per year in accordance with Dispersed Recreation multiyear plans.			●	

Table 3-4. Cultural Resources Management Components of Alternatives A - D

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management	B - Custodial Management	C - Flagship Management	D - Blended Management
Cultural Resource Management	Archaeological Monitoring and Protection	Protect archaeological sites of __ tributary shoreline miles or __ mainstem shoreline miles per year.	mitigation projects only	0.3 - 0.4 / 0.4 - 0.6	1.1 - 1.3 / 1.9 - 2.1	0.4 - 0.6 / 0.9 - 1.1
Cultural Resource Management	Archaeological Monitoring and Protection	Monitor archaeological sites along __ miles of shoreline per year.	mitigation projects only	150	500	250
Cultural Resource Management	Archaeological Resources Protection Act	Conduct Archaeological Resources Protection Act inspections with __ security checks per year.	1,000	1,000	5,000	1,000
Cultural Resource Management	Archaeological Resources Protection Act	Train and outfit new officers and train Archaeological Resources Protection Act specialist.			●	
Cultural Resource Management	Archaeological Resources Protection Act	Issue regulations to supplement investigative authority.			●	
Cultural Resource Management	Native American Consultation	Coordinate and conduct consultation with federally recognized Indian tribes.	●	●	●	●
Cultural Resource Management	Native American Consultation	Conduct formal consultation workshops with federally recognized tribes every __ years.	5	5	2	5
Cultural Resource Management	Native American Grave Protection and Repatriation Act	Comply with Native American Grave Protection and Repatriation Act.	●	●	●	●
Cultural Resource Management	National Historic Preservation Act Section 106	Manage existing mitigation obligations.	●	●	●	●
Cultural Resource Management	National Historic Preservation Act Section 106	Conduct reviews required by National Historic Preservation Act Section 106.	●	●	●	●
Cultural Resource Management	National Historic Preservation Act Section 106	Establish database for managing mitigation obligations.		●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management	B - Custodial Management	C - Flagship Management	D - Blended Management
Cultural Resource Management	National Historic Preservation Act Section 106	Develop and implement programmatic agreements with individual states regarding compliance for repetitive actions.			●	
Cultural Resource Management	National Historic Preservation Act Section 106	Develop emergency procedures for requirements under National Historic Preservation Act Section 106.			●	
Cultural Resource Management	Preservation Program	Conduct archaeological surveys of __ acres of TVA-managed lands per year.	2,000	1,000	5,000	3,000
Cultural Resource Management	Preservation Program	Maintain historic photo collection, cemetery database, and TVA's historic agency information.	●	●	●	●
Cultural Resource Management	Preservation Program	Maintain the current database or develop a comprehensive database to unify TVA's cultural resource data sources in one location for improved resource management	●	●	●	●
Cultural Resource Management	Preservation Program	Improve curation and management of TVA Historic Collection.		●	●	●
Cultural Resource Management	Preservation Program	Conduct identification surveys of historic structures on TVA-managed lands.		●	●	●
Cultural Resource Management	Preservation Program	Annually evaluate and nominate __ sites to the National Register of Historic Places.		2	6	2 - 4
Cultural Resource Management	Preservation Program	Improve the preservation program through development of implementation procedures.		●	●	●
Cultural Resource Management	Preservation Program	Partner with stakeholders to identify traditional cultural properties.			●	
Cultural Resource Management	Preservation Program	Develop an online interactive cemetery database for public use.			●	
Cultural Resource Management	Preserve America	Conduct adaptive reuse studies of TVA historic buildings.	●	●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management	B - Custodial Management	C - Flagship Management	D - Blended Management
Cultural Resource Management	Preserve America	Submit National Historic Preservation Act Section 3 report on Section 110 progress every three years.		●	●	●
Cultural Resource Management	Preserve America	Develop and implement a plan for TVA-owned historic properties suitable for heritage tourism.		●	●	●
Cultural Resource Management	Preserve America	Develop 3-5 new partnerships per year to promote heritage tourism and historic properties.			●	
Cultural Resource Partnerships	Cultural Resource Partnerships	Provide 1 - 2 grant opportunities for archaeological and/or historical research for both academic and nonacademic publications.			●	
Cultural Resource Partnerships	Cultural Resource Partnerships	Provide support for 1 - 2 archaeological field schools.			●	
Public Outreach (Cultural)	Archaeological Outreach (Thousand Eyes)	Conduct __ events each year involving ___ partners.	2 - 3 events	3 - 5	10 - 15 events involving 5 - 10 partners	5 - 10 events involving 3 - 5 partners
Public Outreach (Cultural)	Corporate History Program	Develop a formal TVA corporate history program and provide regular updates to the TVA Timeline.			●	●
Public Outreach (Cultural)	Corporate History Program	Develop an oral history program.			●	●
Public Outreach (Cultural)	Corporate History Program	Develop an annual history public outreach component with 3-5 events and associated Web site.			●	website only
Public Outreach (Cultural)	Corporate History Program	Develop a history and archaeology museum.			●	

Table 3-5. Recreation Management Components of Alternatives A - D

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Campground Management	Management of Campgrounds on Dam or Power Plant Reservation	Manage 8 campgrounds.	●	●	●	●
Campground Management	Management of Campgrounds on Dam or Power Plant Reservation	Make proactive upgrades to __ campgrounds consistent with ADA accessibility guidelines and provide new or upgraded fixed assets with best tested sustainable technologies.	2	1	8	8
Campground Management	Management of Campgrounds on Dam or Power Plant Reservation	Establish and maintain one flagship campground for installation and testing of emerging technologies with innovative design and efficiency measures.	●		●	●
Campground Management	Management of Campgrounds off Dam and Power Plant Reservations	See third-party management agreements for __ campgrounds and consider closure of at least one if third-party agreement is unavailable.	4	3	4	4
Campground Management	Management of Campgrounds off Dam and Power Plant Reservations	Proactively upgrade up to __ campgrounds consistent with ADA accessibility guidelines and provide new or upgraded fixed assets with best tested sustainable technologies.			4	3
Campground Management	Management of Campgrounds off Dam and Power Plant Reservations	Seek and implement contractual agreements to manage campgrounds located on other reservoir properties.	●	●	●	●
Day-Use Area Management	Day Use Areas on Dam Reservations	Continue to operate and manage 30 day use areas located on dam reservations.	●	●	●	●

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Day-Use Area Management	Day Use Areas on Dam Reservations	Implement __ best-tested sustainable initiatives per year and upgrades to meet the ADA accessibility guidelines.	1		4	2
Day-Use Area Management	Day Use Areas off Dam Reservations	Continue to operate and manage 33 day use areas .	●		●	●
Day-Use Area Management	Day Use Areas off Dam Reservations	Proactively upgrade up to __ day use areas per year consistent with ADA accessibility guidelines.	1		4	2
Day-Use Area Management	Day Use Areas off Dam Reservations	Seek, develop, and implement contractual agreements to manage up to 33 areas or review the areas for closure.	●	●	●	●
Day-Use Area Management	Greenways	Assist with development of 20 greenway miles per year.			●	
Day-Use Area Management	Stream Access Sites	Manage 31 stream access sites and investigate blueways partnerships on TVA land.	●	●		●
Day-Use Area Management	Stream Access Sites	Manage fee ownership of 81 stream access sites.	●	●	●	●
Day-Use Area Management	Stream Access Sites	Develop and implement 81 improved stream access sites on TVA managed lands.			●	
Day-Use Area Management	Stream Access Sites	Continue to manage and/or seek, develop, and implement additional third party agreements for up to __ stream access sites. Includes option to close sites.	50	81	81	81
Day-Use Area Management	Stream Access Sites	Assist partners with acquisition and development of 6 stream access sites per year.			●	
Day-Use Area Management	Stream Access Sites	Develop __ sites per year to increase length of blueways.	1		4	

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Public Outreach (Recreation)	Annual Tours	Conduct up to __ annual tours that feature emerging green technologies on recreation areas.			6	4
Public Outreach (Recreation)	Recreation Information Management	Maintain and strive to enhance existing internet presence in support of the Environmental Information Center, partners and stakeholders.	●	●		●
Public Outreach (Recreation)	Recreation Information Management	Enhance current management to provide self-service and automated support for the Environmental Information Center.			●	
Public Outreach (Recreation)	Recreation Information Management	Develop interactive dispersed recreation land maps.			●	
Public Outreach (Recreation)	Recreation Management Regulations	Issue regulations on use of TVA recreational facilities to enhance enforcement capabilities.			●	
Public Outreach (Recreation)	Recreation Management Regulations	Develop and implement a Resource Rangers program to support enforcement of regulations.			●	
Public Outreach (Recreation)	Tennessee Valley Camp-Right Campground Program	Establish certification program to promote environmentally responsible campgrounds and camping practices.			●	●
Public Outreach (Recreation)	Tennessee Valley Camp-Right Campground Program	Certify 1 to 2 campgrounds per year.			●	●
Recreation Assessment and Design Tools	Boating Density Assessments	Conduct assessments as needed to support evaluation of permit requests and land use proposals.	●	●	●	●
Recreation Assessment and Design Tools	Boating Density Assessments	Partner with state boating law administrators to complete 2 comprehensive boating capacity studies per year.			●	

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Recreation Assessment and Design Tools	Reservoir Lands Recreation Inventory Management	Update recreation inventory for __ TVA-managed reservoirs per year.	15		46	23
Recreation Assessment and Design Tools	Reservoir Lands Recreation Inventory Management	Conduct user surveys, field reconnaissance, and assessments to ensure ongoing compliance with regulations.	●	●	●	●
Recreation Assessment and Design Tools	Recreation Design Principles	Implement standard construction designs that promote compliance with the ADA accessibility guidelines, principles of universal design, or other accredited design standards.	●	●	●	●
Recreation Assessment and Design Tools	Recreation Planning, Assistance, and Technical Support	Utilize regional recreation data to guide potential expansion of new campgrounds on TVA-managed lands allocated for developed recreation use.	●	●	●	●
Recreation Assessment and Design Tools	Recreation Planning, Assistance, and Technical Support	Utilize TVA technical staff, existing and emerging standards, and plan library to support Valley recreation plans and projects requested by local, state, and federal agencies on a fee basis.	●	●	●	●
Recreation Assessment and Design Tools	Recreation Planning, Assistance, and Technical Support	Provide technical support to other agencies and stakeholders and share recreation information.	●		●	

Table 3-6. Water Resources Management Components of Alternatives A - D

Program Category	Program	Goal / Activity	Alternatives			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Aquatic Monitoring and Management	Aquatic Ecology Management	Partner and actively participate in maintaining and enhancing aquatic biological communities.		●	●	●
Aquatic Monitoring and Management	Aquatic Ecology Management	Join and support collaborative partnerships to identify and implement protection needs, foster partnerships, and conduct outreach efforts in up to ___ healthy watersheds (Clinch, Powell, and Duck watersheds).		1	3	3
Aquatic Monitoring and Management	Stream and Tailwater Monitoring	Conduct __ stream assessments per year.	110	110	150	125
Aquatic Monitoring and Management	Stream and Tailwater Monitoring	Share stream and reservoir data.	as requested	as requested	online interactive data	online
Aquatic Monitoring and Management	Climate Change Sentinel Monitoring	Monitor __ watershed(s) per year in each of the five predominant ecoregions in the Tennessee Valley (long-term trending analysis).		1	2	2
Aquatic Monitoring and Management	Climate Change Sentinel Monitoring	Monitor __ sentinel locations per watershed.		2	3	2
Aquatic Monitoring and Management	Climate Change Sentinel Monitoring	Manage data, conduct trending analysis, and report findings on a 5-year cycle.		●	●	●
Partnership Programs (Water)	Case Study / Research Initiative Program	Conduct 3 water improvement case studies/research projects per year and share results to increase partner awareness and education.			●	
Partnership Programs (Water)	Strategic Partnership Planning	Maintain existing relationships and partnerships for water quality protection and improvement efforts.	●	●	●	●

Program Category	Program	Goal / Activity	Alternatives			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Partnership Programs (Water)	Strategic Partnership Planning	Develop new or enhance existing strategic relationships and partnerships focused on regional water resource planning efforts.			●	●
Public Outreach (Water)	Tennessee Valley Clean Marina Program	Collaborate with marina owners to maintain their clean marina certifications.	●	●	●	●
Public Outreach (Water)	Tennessee Valley Clean Marina Program	Develop and provide marina owners/operators with outreach materials and training on existing obligations and best management practices to protect water quality			●	●
Public Outreach (Water)	Tennessee Valley Clean Marina Program	Certify ___ new marina(s) per year			2	1
Public Outreach (Water)	Water Efficiency Program (Current Only)	Deliver 10 educational workshops per year	●			
Public Outreach (Water)	Water Resource Outreach Campaign	Evaluate, develop, and execute public outreach activities to raise awareness of water resource protection and improvement efforts.		●	●	●
Public Outreach (Water)	Quality Growth Program (Current Only)	Deliver 25 communication products including workshops, new training products, various awards, and/or conferences per year	●			
Water Resource Improvement Programs	Reservoir Shoreline Stabilization / Riparian Management	Stabilize __ miles of critically eroding shoreline per year.			8	3
Water Resource Improvement Programs	Targeted Watershed Initiative Program (Current Only)	Reduce suspended sediment reaching streams by 234 tons per year.	●			

Program Category	Program	Goal / Activity	Alternatives			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Water Resource Improvement Programs	Targeted Watershed Initiative Program (Current Only)	Reduce phosphorus reaching streams by 350 pounds per year	●			
Water Resource Improvement Programs	Targeted Watershed Initiative Program (Current Only)	Improve 1 hydrologic units in 5 years	●			
Water Resource Improvement Programs	Targeted Watershed Initiative Program (Current Only)	Deliver 50 stakeholder products per year	●			
Water Resource Improvement Programs	Water Resource Grant Program	Develop and implement evaluation, management and implementation processes to establish a grant program.			●	
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Conduct current targeted TVA Vital Signs and Fixed Station water chemistry monitoring programs		●	●	●
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Use existing and new nutrient data combined with flow data to determine and quantify the top three reservoirs receiving the greatest phosphorus and nitrogen loadings.		●	●	●
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Develop a reservoir-specific improvement plan for ___ of the top three reservoirs over the life of the NRP.		1	3	2
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Implement plan to reduce point-source phosphorus reaching ___ reservoir(s) by 5,000 pounds per reservoir.			3	1

Program Category	Program	Goal / Activity	Alternatives			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Implement plan to reduce 720 - 1,080 tons per reservoir of suspended sediment transported from watershed streams into ___ of the top three reservoirs.		1	3	2
Water Resource Improvement Programs	Nutrient Source - Watershed Identification and Improvement	Implement plan to reduce 1,100 - 1,650 pounds per reservoir of phosphorus transported from watershed streams into ___ of the top three reservoirs.		1	3	2
National Water Resource Recovery Programs	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions	Obtain, consolidate, and evaluate existing data from lower Tennessee River reservoirs and watersheds and select one reservoir as the focus for nutrient source loading and delivery modeling.			●	●
National Water Resource Recovery Programs	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions	Monitor selected reservoir for one year in order to support model development.			●	●
National Water Resource Recovery Programs	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions	Develop a strategy and long-term action plan with partners that supports the strategy of nutrient load reduction to the Mississippi River Basin and Gulf of Mexico.			●	●
National Water Resource Recovery Programs	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions	Test strategy by implementing practices in a small watershed (reservoir embayment or tributary reservoir) to demonstrate nutrient yield reduction and validate the model.			●	

Program Category	Program	Goal / Activity	Alternatives			
			A - Current Management (No Action)	B - Custodial Management	C - Flagship Management	D - Blended Management
National Water Resource Recovery Programs	Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions	Work with partners to implement modeled effective strategies to reduce nutrient discharge (yield) from the Tennessee River to the Mississippi River Basin and Northern Gulf of Mexico hypoxic zone.			•	

Table 3-7. Public Engagement Components of Alternatives A - D

Program Category	Program	Goal / Activity	Alternative			
			A - Current Management (No Action)	B - Custodial Management	C- Flagship Management	D- Blended Management
Public Outreach (Overarching)	Environmental Education	Develop and implement a comprehensive and coordinated Environmental Education Program.			●	●
Public Outreach (Overarching)	Volunteer Program	Establish and implement a formal volunteer program.		●	●	●
Public Outreach (Overarching)	Foundation and Trust Fund	Establish an independent "Foundation and Trust Fund" or form ties with an existing conservation focused foundation/trust fund (or equivalent) to solicit private donations to support conservation and natural resource related projects and programs.			●	●

3.2.1. Alternative A – Current Management - No Action

Under the Alternative A, 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 resources and partnerships, and projects associated with TVA 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. Tables 3-3 through 3-6 list the programs and activities comprising Alternative A for biological resources, cultural resources, recreation, and water resources, respectively. The programs and activities are described in Chapter 2. There are no cross-media public engagement programs and activities (Table 3-7) associated with Alternative A.

Under Alternative A, TVA would continue to apply the Single Use Parcel Allocation methodology described in Section 2.4.1 and current 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. Table 2-8 lists the nine reservoirs that are unplanned, use the Forecast System, or have Multiple Use Tract Allocations and for which Single Use Parcel Allocation plans have not yet been prepared. These reservoirs have a total of 143,000 acres of land to be planned.

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 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, EOs, and other policies 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). Tables 3-3 through 3-7 list the programs and activities comprising Alternative B for biological resources, cultural resources, recreation, water resources, and public engagement, respectively. The programs and activities are described in Chapter 2. Characteristics of programs and activities specific to Alternative B are described below.

3.2.2.1. Biological Resources Management

Under this alternative, TVA would continue the current activities (as described for Alternative A) necessary to meet the requirements of laws, regulations, and policies relating to the management and protection of biological resources. A few activities not considered necessary would be eliminated and a few would be implemented at higher levels.

Sensitive Biological Resources Management

Natural Areas Management — TVA would no longer designate or remove natural areas through the reservoir lands planning process.

Terrestrial Habitat Management
Nonnative Invasive Plant Management — Under this alternative, TVA would increase its invasive plant control activities from about 600 to 1,000 acres per year. This increased acreage is based on existing commitments to manage invasive species (primarily Oriental bittersweet on the Fontana Dam Reservation) and the annual treatment of 5 percent of the 17,000 acres of TVA natural areas. TVA would also develop a new prioritized plan for controlling invasive species on areas with sensitive resources. TVA would cease participating in state exotic pest plant councils and regional early detection and rapid response initiatives.

Wildlife Habitat Enhancement Partnerships — The area of annual habitat improvements through partnership efforts would be increased from 500 to 750 acres. This increased area is based largely on the professional judgment of TVA wildlife biologists and their knowledge of the interests and available resources of existing and potential partners.

Land Management and Stewardship Programs
Land Conditions Assessment and Land Stewardship Maintenance — TVA would increase the area assessed annually from 5,000 to 20,000 acres. This increase is based on a schedule that would result in all Zone 3 and Zone 4 lands being assessed on about a 10-year cycle. Prioritized stewardship activities addressing public safety, asset preservation, and resource management needs would be implemented based on the land assessment results.

Dispersed Recreation Management
Dispersed Recreation Assessments — Under this alternative, TVA would stop the current annual evaluation of 70 dispersed recreation areas and replace them with the expanded land conditions assessments.

Dispersed Recreation Management — TVA would increase the number of heavily impacted sites annually repaired from 1 to 5; this represents about 10 percent of the known heavily impacted sites. This would provide for all of the heavily impacted sites to be repaired within 10 years, and is considered the minimum level to properly manage dispersed recreation as stated in the Environmental Policy. The number of key projects annually implemented would also increase from 1 to 5 based on the goal of dispersing a minimum number of projects across the reservoir system.

3.2.2.2. Cultural Resources Management

Under this alternative, TVA would continue and in some cases increase the current activities (as described for Alternative A) necessary to meet the requirements of laws, regulations, and policies relating to the management and protection of cultural resources. A few activities not considered to be essential custodial management would be eliminated and a few would be implemented at higher levels.

Cultural Resources Management
Archaeological Monitoring and Protection — Under this alternative, TVA would increase its efforts for protecting shoreline archaeological sites from the current amount required by project-specific mitigation to between 0.3 and 0.4 tributary shoreline miles or between 0.4 and 0.6 mainstem shoreline miles per year. This is considered to be a minimal level of effort focused on the most vulnerable shoreline sites. The length of shoreline annually monitored would similarly increase from the current mitigation-only basis to 150 miles. This

too is considered to be a minimal level of effort focused on identifying and monitoring the shoreline most threatened by erosion and looting.

Preservation Program — TVA would reduce its annual archaeological survey effort from the current 2,000 acres to about 1,000 acres; surveying this reduced area would allow TVA to meet its cultural resource responsibilities. TVA would initiate surveys to identify historic structures on its lands and set a goal of annually evaluating and nominating 2 sites to the National Register of Historic Places. This goal is based on a minimal level to better understand, raise awareness, and promote the preservation of these historic properties.

Public Outreach Programs

Archaeological Outreach (Thousand Eyes) — TVA would increase the annual number of events from 2-3 to 3-5 to better meet the minimal educational needs for archaeological resource protection and requirements for agencies to provide public outreach on this topic.

3.2.2.3. 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 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

Management of Campgrounds on Dam or Power Plant Reservations — TVA would reduce its efforts to make proactive upgrades consistent with ADAAG and to provide more sustainable technologies from two to one campgrounds per year. While these upgrades are not otherwise defined as custodial, continuing one upgrade per year would maintain at least one area as a test and demonstration site. TVA would cease establishing and maintaining flagship campgrounds for the installation of emerging technologies and efficiency measures.

Management of Campgrounds off Dam and Power Plant Reservations — Under this alternative, TVA would either transfer one campground (Foster Falls) to third-party management or close it. TVA would continue to manage the other 3 campgrounds with annual positive cash flow.

Day Use Areas Management

Under Alternative B, TVA would reduce its operation of day use areas by transferring the 33 day use areas located off dam reservation properties to local, state, or federal agencies or closing them. 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. Unlike the other alternatives, TVA would not upgrade the off-dam reservation day use areas to meet ADA guidelines.

Stream Access Sites — TVA would close any of the 50 stream access sites currently managed under contractual agreements if the contracts cannot be renewed or new contractors found. TVA would stop its efforts to develop blueway sites.

Recreation Assessment and Design Tools
Reservoir Lands Recreation Inventory Management — TVA would stop updating the reservoir recreation inventory.

Recreation Planning, Assistance, and Technical Support — TVA would stop providing technical support and sharing recreational information with other agencies and stakeholders.

3.2.2.4. 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 slightly in terminology from those used for Alternative A. Table 3-8 lists the nine reservoirs for which Single Use Parcel Allocation plans have not yet been prepared. These reservoirs have a total of 143,000 acres of land to be planned.

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 nine reservoirs that have not been planned using the Single Use Parcel Allocation methodology are the Beech River Project1[1], Chickamauga, Fort Loudoun, Great Falls, Kentucky, Nickajack, Normandy, Wilson, and Wheeler reservoirs.

The land use zone definitions used for Alternative B are for the most part 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, "light industrial" has been replaced with the less restrictive "industry" that includes manufacturing, fabrication, and distribution, processing, and assembly for a variety of industrial sectors including chemical, electronics, metalworking, plastics, telecommunications, and transportation. 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

[1] 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.

can be found on TVA's Web site at http://www.tva.com/environment/land/assessment/index.htm.

Table 3-8. 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.

3.2.2.5. 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 Nutrient Source-Watershed Identification and Improvement program 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 H.

Aquatic Monitoring and Management

Aquatic Ecology Management — TVA would initiate a new activity to join and support collaborative partnerships for enhancing one highly diverse watershed (the Clinch, Powell, or Duck watershed). The goal of working in one of these watersheds is based on professional judgment and meeting the goals of TVA's Environmental Policy.

Climate Change Sentinel Monitoring — This new program would be implemented by monitoring one watershed per year in each of the five predominant ecoregions. Within each watershed, two sentinel sites including headwater streams would be monitored. These are considered the minimum numbers necessary to establish a baseline to detect change.

Public Outreach (Water)

Under this alternative and Alternatives C and D, the Quality Growth and Water Efficiency Programs would be eliminated and replaced, in part, with the Water Resource Outreach Campaign.

Water Resource Improvement Programs

Nutrient Source - Watershed Identification and Improvement — This program, a component of Alternatives B, C, and D, would replace the Targeted Watershed Initiative Program of Alternative A. Under Alternative B, TVA would develop a reservoir-specific improvement

plan for one reservoir. TVA would then implement the plan to reduce suspended sediment transported into the reservoir by 720 - 1,080 tons per year and phosphorus transported into the reservoir by 1,100 - 1,650 pounds per year. The target of one reservoir is based on the intent of meeting TVA's Environmental Policy with a minimal level of invested resources. The sediment and phosphorus reduction targets are based on best professional judgment. These reductions would be achieved through partnership projects that over time will result in noticeable water quality improvements.

3.2.3. Alternative C – Flagship Management

Under Alternative C, TVA would aggressively implement existing and new programs and activities to increase its resource stewardship to the "gold standard." TVA's proactive management of biological, cultural, and water resources would be greatly increased. Recreation management activities would emphasize enhancements of existing facilities and use of sustainable technologies; development of trails, greenways, and access areas; and repair of heavily impacted areas. This alternative takes into account the interconnectivity of the various programs and activities described in Chapter 2. Tables 3-3 through 3-7 list the programs and activities comprising Alternative C for biological resources, cultural resources, recreation, water resources, and public engagement, respectively. The programs and activities are described in Chapter 2. Characteristics of programs and activities specific to Alternative C are described below.

3.2.3.1. Biological Resources Management

Under this alternative, TVA would continue the current activities (as described for Alternative A) necessary to meet the requirements of laws, regulations, and policies relating to the management and protection of biological resources. Many other programs and other activities would be implemented at higher levels than under Alternatives A and B.

Sensitive Biological Resources Management

Wetland Management — TVA would initiate a new pilot project to identify and characterize high quality "reference site" wetlands on TVA lands.

Sensitive Resources Data Management — TVA would increase its information gathering efforts and develop predictive models for endangered and threatened species.

Natural Areas Management — TVA would continue to maintain the current 154 ecologically and visually sensitive areas while monitoring a third of them annually. TVA would more proactively manage the natural areas by annually developing and implementing management plans for 33 areas until all areas are operating under a comprehensive management plan. The goal of 33 plans per year is based on having management plans developed for all current natural areas within 5 years.

Conservation Planning — TVA would increase its involvement in large-scale conservation planning by partnerships with planning efforts across the region.

Terrestrial Habitat Management

Grasslands and Agricultural Lands Management — TVA would transition from the agricultural licenses and cooperative agreements under Alternatives A, B, and D to increased efforts to reestablish and manage native grasslands in cooperation with partners.

Dewatering Projects Management — Under both this alternative and Alternative D, TVA would more proactively manage dewatering projects by refurbishing them based on the

results of engineering and hydraulic reviews, upgrade their operation, and work closely with partners to better incorporate public use into their management.

Nonnative Invasive Plant Management — TVA would increase the scale of its invasive plant control activities to 40,000 acres per year. This would annually address a large proportion of the Zone 3 and Zone 4 lands infested with invasive species. It would also allow for the necessary repeated treatments of areas to eliminate stump sprouts and seedlings expected to be present after the initial treatment.

Nuisance Animal Control — TVA would more comprehensively address nuisance animal problems by developing programmatic guidelines on their control, establishing memoranda of agreement with agencies responsible for regulating wildlife, and developing and sharing best management practices for their control.

Terrestrial Greenhouse Gas Sequestration Management — Under this alternative, TVA develop a terrestrial GHG management plan and pursue carbon offset projects on 500 acres of TVA lands for research purposes to build institutional knowledge of terrestrial carbon sequestration programs. This goal is based on best professional judgment of the land area needed for a robust research program while taking advantage of economies of scale and limiting the amount of land committed for the multi-decade span of the research program. TVA would also have a goal of entering into eight consortiums focusing on issues related to terrestrial GHG management and conducting up to six terrestrial GHG management demonstrations. These numbers are based on TVA assuming a leadership role in this research area to aggressively achieve GHG reductions.

Wildlife Habitat Council/Third-Party Certifications — TVA would initiate five new projects for WHC certification at five new locations on TVA lands. These target numbers are based on TVA's history with WHC certifications and professional judgment on the practicality of certifying facilities across the TVA region. TVA is a corporate sponsor of the WHC certification program and through this goal would show leadership in this area. TVA would also establish a third-party review and certification process for wildlife management activities on 10 percent of appropriate TVA lands annually. This annual goal is based on what TVA considers to be a sustainable level of effort on an approximate 10-year cycle to meet WHC certification criteria.

Wildlife Habitat Enhancement Partnerships — Through cooperative partnerships, TVA would improve wildlife habitat on 20,000 acres per year. This goal is in addition to existing Unit Plan implementation commitments. It is based on TVA becoming a leader in habitat enhancement partnerships on its lands under existing agreements with state and other federal agencies and through the creation of additional habitat enhancement partnerships with other organizations.

Land Management and Stewardship

Boundary Maintenance — TVA would set the goal of addressing all regional boundary maintenance needs on a 5-year cycle while incorporating new survey technologies. The 5-year goal is based on best professional judgment of the life expectancy of painted boundary markers and boundary signs and would result in all markings and signs being continuously visible and legible.

Land Conditions Assessments and Land Stewardship Maintenance — Approximately 50,000 acres would be assessed per year. This goal would result in all lands being

assessed in an approximately 5-year cycle to promote a more timely overview of their conditions and more responsive management activities.

Public Outreach (Biological)
Resource Stewardship Campaigns — In implementing this new program, TVA would deliver 25 stakeholder products annually. This number is based on the goal of addressing a variety of issues at multiple locations across the region.

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. This number is based on the minimum sample size needed for a statistically valid sample stratified by activity and region.

TVA would repair 25 heavily impacted dispersed recreational areas annually. This number represents about a quarter of the heavily impacted sites and would result in all of these sites being repaired within the 5-year cycle to review and update the NRP. TVA would implement 20 key dispersed recreational opportunities consistent with TVA's intent to provide ecofriendly dispersed recreation.

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. This number is based on the plan to hold one clinic in most of the 125 counties in the Tennessee River watershed each year.

Trails Management — TVA would develop and implement a system-wide trails establishment and maintenance plan to more proactively and systematically address trail system needs. The target of adding 20 trail miles per year, while potentially exceeding the rate of increase in the popularity of day hiking (Cordell et al. 2004), would allow more trails designated for particular uses, reduce the potential for overuse of trails, and increase the feeling of solitude for trail users.

3.2.3.2. Cultural Resources Management

Under Alternative C, TVA would greatly increase its cultural resources management efforts to proactively survey for, monitor, and protect archaeological sites; improve relationships with federally recognized tribes; nominate TVA historic properties to the National Register of Historic Places (NRHP); promote heritage tourism; support archaeological research; and increase its public outreach efforts.

Archaeological Site Monitoring and Protection — TVA would monitor approximately 500 shoreline miles per year and establish targets to protect between 1.1 and 1.3 tributary shoreline miles or between 1.9 and 2.1 mainstem shoreline miles per year. These goals are based on the desirability of more proactive approaches to monitoring and protecting critically eroding or looted shoreline sites. Even at these greatly increased levels, about 4 percent of the total reservoir shoreline would be monitored each year and less than 0.1 percent of critically eroding sites on TVA land would be protected each year.

Archaeological Resources Protection Act Program — TVA would greatly increase its ARPA inspections by training and outfitting new officers to achieve a target of 5,000 security

checks per year. This level would help ensure adequate monitoring of archaeological sites and provide an increased police presence on TVA lands and waters. TVA would also issue regulations to supplement its investigative authority.

National Historic Preservation Act Section 106 — TVA would develop procedures for compliance with Section 106 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 Tribal Consultation — TVA would hold more frequent tribal consultation workshops (every two years) to improve relationships and partnerships on the management of archaeological resources on TVA lands.

Preservation Program — TVA would expand its archaeological identification surveys to cover 5,000 acres each year. This level is based on a significant increase in the resources dedicated to this activity to accelerate the completion of this inventory to about the year 2050. TVA would increase the number of nominations of TVA historic properties to the NRHP to six per year. This number is based on best professional judgment of an aggressive approach to better understand, raise awareness, and promote the preservation of these historic properties. TVA would also partner with stakeholders to identify traditional cultural properties on TVA land and develop an online interactive cemetery database for public use.

Preserve America — TVA would develop 3-5 new partnerships per year to promote heritage tourism and historic properties in a manner that benefits both the resource and the public. This range of numbers is based on best professional judgment of the interest in heritage tourism and potentially available staff resources to manage the partnerships.

Cultural Resources Partnerships — TVA would provide 1-2 grant opportunities for research leading to both academic and nonacademic publications. This number is based on the assumed availability of $100,000 to support the research; the exact number would depend on the proposals received from applicants. TVA would also provide support for 1-2 archaeological field schools per year hosted by universities at TVA sites. The number of field schools is based on available funding and academic interest in archaeological sites on TVA land.

Archaeological Outreach (Thousand Eyes) — TVA would continue this public outreach effort to sponsor 10 - 15 outreach programs per year involving 5 - 10 partners. These numbers are based on TVA proactively seeking partners to support educational activities throughout the region. By supporting 10-15 events per year, TVA would be able to reach audiences across the valley to promote widespread support for archaeological resource protection.

Corporate History Program — TVA would greatly increase its corporate history program activities including the development of a public outreach component with 3 - 5 events per year. This number is based on TVA providing opportunities across the TVA region to promote awareness of TVA's significant history. The number of events would ensure appropriate representation across the region for special events. TVA would also develop a history and archaeology museum.

3.2.3.3. Recreation Management

As described above, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process and would continue to entertain commercial or public recreation requests for development of lands already zoned for developed recreation and manage existing contractual agreements.

Campground Management

TVA Campgrounds on Dam and Power Plant Reservations — TVA would continue to operate and manage the eight campgrounds and would proactively upgrade all of them.

TVA Campgrounds off Dam and Power Plant Reservations — TVA would continue to operate and manage the four campgrounds and would proactively upgrade all of them.

Day Use Areas Management

TVA would continue to operate and manage the 63 day use areas located across the Valley. TVA would proactively upgrade four day use areas on dam reservations per year and four day use areas off dam reservations per year. These targets are based on the need to complete accessibility upgrades to all areas during the first 7-10 years of the 20-year planning period.

Greenways — TVA would assist with the development of 20 greenway miles per year; this goal is based on TVA's ability to provide the land rights to support partnerships for the greenway expansions.

Stream Access Sites — Of the 81 stream access sites owned by TVA, approximately 50 sites are managed under contractual agreements. TVA would maintain these agreements or seek new agreements for their operation. TVA would continue to operate the remaining 31 stream access sites. TVA also proposes to implement improvements at all 81 sites. TVA would assist partners with the acquisition and development of six stream access sites per year and develop four sites per year to increase the length of blueways. These goals are based on the anticipated availability of more funding, partnership opportunities, and meeting the increasing demand for stream access for paddle sports and fishing access.

Public Outreach (Recreation)

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. This goal is based on gaining maximum exposure of TVA's efforts in this area.

Recreation Information Management — TVA would greatly increase its efforts to make recreation information more available to the public by developing online interactive maps highlighting dispersed recreation opportunities and adding more self-service features to TVA's website and other media.

Tennessee Valley Camp-Right Campground Program — Under both this alternative and Alternative D, TVA would establish a program to certify one to two environmentally responsible commercial campgrounds per year.

Recreational Assessment and Design Tools

Boating Capacity Studies — TVA would partner with state boating law administrators to complete two studies per year. This number is based on the perceived willingness of partners to manage these studies and TVA's ability to provide funding assistance.

Reservoir Lands Recreation Inventory Management — TVA would maintain and annually update its inventory of recreation facilities at all 46 of its reservoirs. This goal of a complete annual update is based on the need to provide 100 percent accurate information on reservoir recreation opportunities.

3.2.3.4. Reservoir Lands Planning

Under Alternative C, TVA would adopt the Comprehensive Valleywide Land Plan (CVLP) described in Section 2.4.1. RLMPs would subsequently be developed and updated for a portion of a reservoir, an entire reservoir, or a group of reservoirs using the Single Use Parcel Allocation methodology. The sequence of reservoirs to be planned would be based on a prioritized list, and the highest priority reservoirs are likely to be Kentucky, Nickajack, and Wheeler. The planning process would validate and revise, as appropriate, the allocation baseline created by the existing RLMPs and the RLA methodology. At a minimum, the reservoir lands planning process would consist of the following steps:

- Collaboration with other federal and state agencies to share information and data pertaining to developed recreation, natural resource management, and water resources.
- Identification of existing conditions by assimilating existing resource data, conducting capability and suitability analysis (as appropriate), and predicting future public needs for specific allocations.
- Creation of draft plans 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.
- Consideration of proposals for alternative uses of TVA lands.
- Seeking and incorporation of input from the public on the draft plans.
- Issuance of a final plan, which would include an overview of the lands planning process, parcel allocations, and a set of detailed maps.
- Inclusion of the outcomes of each planning effort in future updates of the NRP. TVA would track allocation changes to assure that they continued to fall within the CVLP total allocation percentages.

TVA would also adopt the proposed changes in the land use zone definitions (Appendix F). As described above for Alternative B, the largest change in definition is the removal of the restriction to "light industrial" development on Zone 5 lands.

In summary, Alternative C includes the key components of the new lands planning implementation strategy and target ranges for Valleywide land use allocations (Table 2-11). In addition, any specific development proposal on TVA land would be subject to a site-specific environmental review.

3.2.3.5. Water Resource Management

Under Alternative C, TVA would implement programs and activities to foster increased 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. TVA's methodology for measuring reductions in pollutant loads is described in Appendix H.

Aquatic Monitoring and Management

Aquatic Ecology Management — Under this alternative, TVA would join and support collaborative partnerships for enhancing the three highly diverse Clinch, Powell, and Duck watersheds. The inclusion of all three watersheds is based on best professional judgment of a flagship level of commitment and meeting the goals of TVA's Environmental Policy by enhancing the most biodiverse major watersheds in the Tennessee River drainage.

Stream and Tailwater Monitoring — Under this alternative, TVA would conduct 150 stream assessments per year; this target is a 37 percent increase over the current/custodial level and would result in better coverage of large sub-watersheds not sufficiently covered by the current single samples, additional sampling for quality assurance in areas exhibiting large changes in results, and increased ability to take advantage of new cooperative monitoring opportunities. All streams would continue to be sampled on a least a fixed, five-year rotation.

Climate Change Sentinel Monitoring— This new program would be implemented by monitoring two watersheds per year in each of the five predominant ecoregions. Three sentinel sites (an increase of one site) would be monitored to include headwater streams within each watershed. These targets would provide a more robust data set than the Alternative B and D targets with a moderate expenditure of resources. Because climate change impacts are unlikely to occur equally across the entire Tennessee River watershed, or among watersheds in the major ecoregions, the flagship number of waterbodies and sites provide the more sensitive level of sentinel monitoring to detect onset of climate change impacts.

Partnership Programs

Case Studies and Research Initiatives — TVA would undertake three case studies or research projects annually. The goal of three annual studies would expose stakeholders across the Valley to information that would help them protect and improve water resources.

Public Outreach Programs

Tennessee Valley Clean Marina Program — This program would aim to certify two new marinas per year. This goal is based on best professional judgment of the interests of marina owners and outreach materials and incentives available to them.

Water Resource Improvement Programs

Reservoir Shoreline Stabilization / Riparian Management — The goal of this program would be to stabilize eight miles of critically eroding shoreline per year and would result in a total of 160 miles of shoreline stabilized during the 20-year NRP planning period. This goal is based on the upper end of the range of past annual shoreline stabilization efforts.

Nutrient Source Watershed Identification and Improvement — Under Alternative C, TVA would develop and implement reservoir-specific improvement plans for three reservoirs. This target is based on best professional judgment and the intent of meeting TVA's Environmental Policy with a higher level of invested resources. The suspended sediment and phosphorus transport goals described for Alternative B would be increased from one to three reservoirs and there would be the additional goal of reducing point-source phosphorus reaching three reservoirs by 5,000 pounds per reservoir per year. These goals are based on best professional judgment of the achievable reductions by project partners and the amount of reduction necessary to noticeably improve reservoir water quality.

National Water Resource Recovery Programs

Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions — Under both Alternatives C and D, TVA would establish this program focusing on modeling nutrient source loading and delivery and developing a strategy and action plan to reduce nutrient loading. Under Alternative C, TVA would extend the program by testing and implementing nutrient reduction measures.

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, EOs, and policies. 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. Tables 3-3 through 3-7 list the programs and activities comprising Alternative D for biological resources, cultural resources, recreation, water resources, and public engagement, respectively. The programs and activities are described in Chapter 2. Many programs and activities would be implemented at levels between those of alternatives A or B and C. Characteristics of programs and activities specific to Alternative D are described below.

3.2.4.1. Biological 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 resources.

Sensitive Biological Resources Management

Natural Areas Program — TVA would continue to maintain the current 154 ecologically and visually sensitive areas while monitoring a third of them annually. TVA would more proactively manage the natural areas by annually developing and implementing management plan for 15 areas until all areas are operating under a comprehensive management plan. The goal of 15 plans per year is based on having management plans developed for all current natural areas within 10 years.

Terrestrial Habitat Management

Nonnative Invasive Plant Management — TVA would control invasive plants on 1,000 acres per year, as under Alternative B. This goal is based on existing commitments to manage invasive species (primarily Oriental bittersweet on the Fontana Dam Reservation) and the annual treatment of 5 percent of the 17,000 acres of TVA natural areas.

Wildlife Habitat Enhancement Partnerships — Through cooperative partnerships, TVA would improve wildlife habitat on 750 acres per year. This goal is based on professional

judgment of TVA wildlife biologists and their knowledge of the interests and available resources of existing and potential partners.

Land Management and Stewardship
Boundary Maintenance — TVA would set the goal of addressing all regional boundary maintenance needs on a 10-year cycle while incorporating new survey technologies. The 10-year goal is based on best professional judgment of the cycle necessary to maintain adequately marked boundaries.

Land Conditions Assessments and Land Stewardship Maintenance — Approximately 35,000 acres would be assessed per year. This goal is based on what TVA considers to be a sustainable level of effort to holistically address needs on Zone 3 and Zone 4 lands to meet the spirit of the Environmental Policy.

Dispersed Recreation Management
Under this alternative, TVA would repair 15 heavily impacted dispersed recreational areas annually. This number represents about 15 percent of the heavily impacted sites and was selected as an intermediate level between the numeric goals of the other alternatives. TVA would implement 10 key dispersed recreational opportunities; this goal also represents an intermediate level between the goals of the other alternatives.

3.2.4.2. Cultural Resources Management

Under Alternative D, TVA would increase several of its cultural resources management efforts to more proactively survey for, monitor, and protect archaeological sites; nominate TVA historic properties to the National Register of Historic Places (NRHP); and increase its public outreach efforts.

Archaeological Site Monitoring and Protection — TVA would monitor approximately 250 shoreline miles per year and establish targets to protect between 0.4 and 0.6 tributary shoreline miles or between 0.9 and 1.1 mainstem shoreline miles per year. These goals are based on an intermediate level of effort between Alternatives B and C. They would likely result in the stabilization of the two to four sites annually, 0.05 percent of critically eroding sites.

Preservation Program — TVA would expand its archaeological identification surveys to cover 3,000 acres each year. This represents an intermediate level between level between Alternatives A, B, and C and would result in the inventory being completed in about year 2070. TVA would evaluate and nominate two to four TVA historic properties to the NRHP per year. This number is based on an intermediate level of effort to promote more sites each year when funding is available.

Archaeological Outreach (Thousand Eyes) — TVA would continue this public outreach effort to sponsor 5 - 10 outreach programs per year involving 3 - 5 partners. These numbers are based on providing a more proactive intermediate level of support of public outreach across the valley. Because TVA covers such a broad geographic area, the events would to be distributed across the valley. By seeking 3-5 partners per year, TVA would solicit support from other groups, agencies or academic institution to reach a broader audience and offset the costs for public outreach activities.

3.2.4.3. Recreation Management

As described above, TVA would continue to allocate lands for developed recreation purposes through the reservoir lands planning process and would continue to entertain commercial or public recreation requests for development of lands already zoned for developed recreation and manage existing contractual agreements.

Campground Management

TVA Campgrounds on Dam and Power Plant Reservations — TVA would continue to operate and manage the eight campgrounds and would proactively upgrade all of them.

TVA Campgrounds off Dam and Power Plant Reservations — TVA would continue to operate and manage the four campgrounds and would proactively upgrade the three with annual positive cash flow. Foster Falls campground would not be upgraded.

Day Use Areas Management

TVA would continue operate and manage the 63 day use areas located across the Valley. TVA would proactively upgrade two day use areas on dam reservations per year and two day use areas off dam reservations per year. These targets are based on the need to complete accessibility upgrades to all areas during the 20-year planning period.

Public Outreach Programs

Annual Tours — TVA would host four annual media and technology transfer tours of upgraded campgrounds and day use recreational areas, likely two each in the spring and fall.

Recreational Assessment and Design Tools

Reservoir Lands Recreation Inventory Management — TVA would maintain and annually update its inventory of recreation facilities on half of its reservoirs. This goal of a complete update on a two-year cycle is based on the need to provide reasonably accurate information on reservoir recreation opportunities.

3.2.4.4. Reservoir Lands Planning

Under Alternative D, TVA would adopt and implement the same reservoir lands planning strategies, land use zone definitions (including the “light industrial” restriction), and ranges in allocations as described in Alternative C (Section 3.2.3.4), including the Comprehensive Valleywide Land Plan (CVLP) described in Section 2.4.1.

3.2.4.5. Water Resource Management

Under Alternative D, TVA would implement most of the programs and activities associated with Alternative C but at a somewhat lower level of effort.

Aquatic Monitoring and Management

Aquatic Ecology Management — Under this alternative, TVA would join and support collaborative partnerships for enhancing the three highly diverse Clinch, Powell, and Duck watersheds as in Alternative C. This target is based on best professional judgment of a flagship level of commitment and meeting the goals of TVA’s Environmental Policy with a moderate investment of resources.

Stream and Tailwater Monitoring — Under this alternative, TVA would conduct 125 stream assessments per year; this target is based on an intermediate level of effort between those

of Alternatives A and B and Alternative C. All streams would continue to be sampled on a least a fixed, five-year rotation.

Climate Change Sentinel Monitoring— This new program would be implemented by monitoring two watersheds per year in each of the five predominant ecoregions. Two sentinel sites would be monitored in headwater streams within each watershed. These targets would provide a more robust data set than the Alternative B targets and would collect the minimal amount of data needed for trending analysis.

Public Outreach Programs
Tennessee Valley Clean Marina Program — This program would aim to certify one new marinas per year. This goal is based on best professional judgment and a minimal increase in program funding.

Water Resource Improvement Programs
Reservoir Shoreline Stabilization / Riparian Management — The goal of this program would be to stabilize three miles of critically eroding shoreline per year, resulting in a total of 60 miles of shoreline stabilized during the 20-year NRP planning period. This goal is based on the lower end of the range of past annual shoreline stabilization efforts.

Nutrient Source Watershed Identification and Improvement — Under Alternative C, TVA would develop reservoir-specific improvement plans for two reservoirs. This target is based on best professional judgment and the intent of meeting TVA's Environmental Policy with a moderate level of invested resources. The plans would be implemented to reduce point source phosphorus entering one reservoir and reduce suspended sediment and phosphorus inputs into two reservoirs. The numbers of reservoirs are again based on a moderate level of invested resources. The goals for nutrient reductions in terms of pounds and tons per reservoir per year are the same as those for Alternatives B and C.

3.3. Other Program Options Considered

This section describes program options and approaches that were considered but eliminated from detailed evaluation in this EIS because they either do not align with TVA's Environmental Policy or did not otherwise fulfill the NRP purpose and need.

3.3.1. Biological Program Options

Forest and Terrestrial Greenhouse Gas Management Focus
TVA would only conduct those programs and activities associated with forest management while seeking opportunities for increased terrestrial GHG sequestration. In addition, TVA would continue to implement those programs and activities to maintain or improve the health of TVA lands. The TVA lands allocated for Natural Resource 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.

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 lands while balancing the protection of cultural and ecological resources. In

addition, TVA would continue to implement those programs and activities to maintain or improve the health of its lands. The lands allocated for Natural Resource 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. Recreation Program Options

Terminate Management of Recreation Facilities
Under this program option, TVA would terminate all of the programs and activities related to recreation facility management described in Section 2.3. Those contractual agreements relating to recreation management would be honored per the terms of the agreements. 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 Section 2.3. In the circumstance where a transfer or contractual agreement could not be reached, TVA would close the facility and/or conclude the program.

3.3.3. Water Resource Program Option

Terminate 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 terminate all of the water resource management programs described in Section 2.5. Those contractual agreements relating to water resource improvements would be honored per the terms of the agreements.

3.4. Comparison of Alternatives

Regardless of the alternative selected, some resources would not be directly affected, either adversely or beneficially, while other resources would likely be directly or indirectly affected to a 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.

Alternative C would create the greatest potential beneficial impacts for the following resource areas: recreation, natural areas, vegetation, wildlife, wetlands, water quality, endangered and threatened species, cultural resources, land use, prime farmland, visual resources, socioeconomics, and environmental justice. Alternative A would create the least potential beneficial impacts for the following resource areas: natural areas, vegetation, wildlife, wetlands, endangered and threatened species, 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 3-9 provides a comparison of resources and explains how each alternative would

affect the resource. Relative beneficial impacts to the resource are shown in figures in Chapter 5.

Table 3-9. 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 opportunities	Increase in the quality of recreation opportunities but little change in quantity
Dispersed Recreation	Negative impact due to increased pressure on natural resources	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
Vegetation	Negative Impacts anticipated due to spread of invasive plants	Beneficial impact due to increase in invasive plant management	Provides the greatest beneficial impact due to increase in invasive plant management	Less beneficial than Alternative C
Wildlife	No adverse impacts			
Wetlands	No materially different 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 materially different 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 invasive plants			
Cultural Resources	Potential negative impacts to historic properties with the exception of programs	Less negative impacts than Alternative A	Greatest beneficial impacts due to proactively promoting protection and	More beneficial than Alternatives A and B but less than Alternative

Resource	Alternative A (No Action)	Alternative B (Custodial Management)	Alternative C (Flagship Management)	Alternative D (Blended Management)
	associated with Archaeological Resources Protection Act		preservation of resources	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 lands	Increasingly beneficial impact in the scenic attraction of TVA lands	Most beneficial impact in the scenic attraction of TVA lands	Similar to Alternative C
Floodplains	Negligible loss of flood control and power storage, minimal effect on floodplain values			
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 adverse impacts			
Climate	Minimal adverse impacts			

3.5. The Preferred Alternative

TVA's Preferred Alternative for the NRP is Alternative D. The programs described in 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.

CHAPTER 4 - 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

4.1.1. Facility-Based Recreation

For the purpose of this EIS, the discussion of facility-based recreation focuses primarily on those recreation areas and facilities owned by TVA. The majority of TVA recreation facilities occur on TVA dam reservations and on other TVA reservoir lands allocated to Zone 6 - Developed Recreation. Developed recreation facilities are also located on TVA's.Bellefonte and Browns Ferry Nuclear, Raccoon Mountain Pumped-Storage, and John Sevier, Cumberland, and Kingston Fossil Plant reservations. TVA also owns 81 stream access sites located on streams and rivers throughout the Tennessee River watershed. Recreation facilities on dam and power plant reservations are typically operated by TVA. Other TVA recreation facilities are either operated by TVA or by another party under contract with TVA. TVA recreation facilities make up a notable proportion of all of the recreation facilities located in the TVA region (Table 4-1).

Table 4-1. Recreation Facilities Located Within the TVA Region

Facility Type	Number in TVA region	Number of TVA Facilities	Percent of Facilities in Region Managed by TVA
Picnic tables	4,000	400	10
Pavilions	400	16	4
Trail miles	3,100	100	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 courses	500	0	0
Amusement parks	65	0	0
Visitor centers	40	9	23
Overlooks	75	22	29
Museums	400	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

Facility Type	Number in TVA region	Number of TVA Facilities	Percent of Facilities in Region Managed by TVA
Stream access sites	200	81	41

Source: Extracted from State Comprehensive Outdoor Recreation Plans inventory data for TVA region states

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 about 17 percent for the TVA region (Table 4-15). Assuming that current participation rates remain relatively constant, recreation demand is anticipated to grow in direct proportion to the population. Consequently, public use of TVA lands, shoreline, and waterways to fill the recreation demand will likely increase.

TVA currently has around 21,200 acres committed to helping fill demand for developed recreation through their designation as Zone 6 - Developed Recreation in RLMPs. About 2,100 acres (10 percent) of this Zone 6 land is not committed through a land use agreement to developed recreation and a small portion of the committed land is not yet developed. If TVA chooses to assist in filling the projected increase in recreation demand over the next 20 years and provide the same proportion of facilities as listed in Table 4-1, 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. 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.

As described in Section 2.3, TVA operates several campgrounds and day use recreation areas. TVA currently has land use agreements for the operation of 164 campground and 135 marinas on its Zone 6 lands by private and other public operators. These are a major component of the approximately 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 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 the increasing population increases demand for recreation facilities in the region. Probable locations for these state parks include lands at 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." TVA staff provides planning and technical services for new or existing parks, recreational programs and other public-oriented facilities in the TVA power service area on a fee or sponsorship basis. Services include recreation consultation and access to TVA's library of standard plans and site plans.

4.1.2. Dispersed Recreation

TVA manages approximately 220,000 acres that are available for dispersed recreation activities. Examples of popular dispersed recreation activities on TVA lands include hiking, bank fishing,

wildlife observation, hunting, and primitive camping. Lands suitable for dispersed recreation are primarily those zoned for Natural Resource Conservation (Zone 4) and Sensitive Resource Management (Zone 3). Dispersed recreation opportunities also occur on several dam reservations (Zone 2) and on some lands zoned for Developed Recreation (Zone 6) but not yet developed. It is estimated that 6 million people engage in dispersed recreation activities on TVA lands annually (Cardno ENTRIX 2011). The general trend is rising participation rates for dispersed recreation in the Tennessee Valley region (Table 4-2).

Table 4-2. Dispersed Recreation Participation in the 125-County Tennessee River Watershed

Dispersed Recreation Activities	Participants in 2004, Millions	Projected Participants in 2010, Millions
Canoeing	0.35	0.5
Day Hiking	1.76	2.48
Migratory Bird Hunting	0.08	0.11
Kayaking	0.11	0.15
Rock climbing	0.2.0	0.27
Orienteering	0.06	0.08
Primitive Camping	0.84	1.12
Backpacking	0.44	0.58
Warmwater fishing	1.54	1.92
Swimming	1.78	2.02
View birds	1.57	1.96
Big Game Hunting	0.48	0.52
Small Game Hunting	0.51	0.65
Total All Activities	**9.72**	**12.36**

Source: Cordell et al. 2006

Most TVA land is in relatively narrow strips along the shoreline of TVA reservoirs. Of the approximately 11,000 miles of reservoir shoreline, approximately 6,800 miles is TVA-owned and managed and not encumbered by the access rights of adjacent residential landowners (TVA 1998). The spatial configuration of TVA lands is unique in that many large population centers are in close proximity to TVA land and dispersed opportunities. That is, for many Tennessee Valley residents, TVA land is the closest land to their residence which offers dispersed opportunities. While many dispersed recreation enthusiasts will travel once or twice a year to engage in their chosen activity, lands close to home provide “everyday” access to these activities.

In times of economic downturn and uncertainty recreational activities which are close to home and cost effective are often preferred. This highlights the importance of TVA lands being in close proximity to large population centers. In addition, dispersed activities on TVA lands do not require user fees which allow members from all economic classes to participate. With general trends in participation of dispersed recreation activities rising and these opportunities being available to a wide segment of the public, TVA lands are experiencing increased pressures and only become more valuable to the public as dispersed recreation assets.

TVA lands also serve as the conduit which allows the public access to the reservoirs. Recreationists who engage in water-based reservoir recreation utilize TVA lands to facilitate those activities. On many reservoirs, TVA lands are the only free public access to the water allowing for many dispersed opportunities.

TVA manages over 100 miles of trails for public use. Many trails offer multi-use opportunities such as hiking, horseback riding, and mountain biking while others are considered for foot traffic only. Trails are an important aspect of dispersed recreation management as they facilitate some of the most popular, and growing, dispersed activities such as day hiking. Trails also offer access to interior portions of TVA managed lands and facilitate other popular activities such as wildlife observation and bank fishing.

As discussed above, dispersed recreation use of TVA lands is growing. As use increases, the associated impacts resulting from this use increases as well. Impacts from use can damage the ecology of an area as well as diminish the experience of the user. For example, dispersed camping can alter or kill vegetation where tents and fire rings are placed and litter left behind after the activity is unsightly for the next user of that area. In addition, as different types of use increases the potential for user conflicts grows. Proper management is key to ensuring environmental impact is kept to a minimum and user experience remains positive.

4.2. Natural Areas

Natural areas are lands designated for a particular management objective or lands that are known to contain sensitive features or resources (TVA 2002e). For example, TVA has designated 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, environmental education, or high-quality, nature-oriented recreation.

TVA natural areas (Figure A-9, Appendix A) include small wild areas (SWAs), habitat protection areas (HPAs), ecological study areas, and wildlife observation areas (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 2.1.2. 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. Appropriate development is undertaken (e.g., foot trails, signs, parking areas, backcountry campsites) to provide recreational opportunities for the public while also protecting and enhancing their exceptional qualities. SWAs require on-site assessments for determination of their condition and maintenance needs to ensure that management objectives are met and the integrity of the areas and their sensitive resources are intact.

There are 111 TVA HPAs (Figure A-9, Appendix A). HPAs are 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 may also be designated as HPAs. They normally have little to no development to accommodate public use. HPAs require on-site assessments for determination of their condition, status of their target species or features, and maintenance needs to ensure that management objectives are met and the integrity of the HPA and their sensitive resources are intact.

There are five TVA ecological study areas (Figure A-9, Appendix A). They consist of locations suitable for ecological research or environmental education. 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 their condition, status of plant and animal populations 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 their 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 lands and managed by other agencies under contractual agreements (Figure A-10, Appendix A). 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, streams listed on the Nationwide Rivers Inventory, 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 natural areas and ecologically significant sites throughout the TVA region not occurring on TVA 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 lands. They are not necessarily managed by TVA. Several criteria are used to designate ecologically significant sites, including 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 ecologically significant sites 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.

Status, Trends, and Management Needs of TVA Natural Areas

Several factors can affect the condition of natural areas. Natural events such as landslides, storm damage, wildfire, and plant succession can radically alter important habitat; human disturbance can eliminate plant and animal populations; and litter or overuse can destroy aesthetic qualities. Often a "hands off" policy with regular monitoring of significant elements is sufficient. However, some plant and animal populations and other natural features are vulnerable to human disturbance and stringent measures must be taken to protect them. Roads may have to be blocked, trails may need to be maintained or obscured, and cave entrances may need to be gated. Several species require active management to ensure their survival. Wetlands or meadows may have to be burned; other areas may require hand clearing.

Current management issues for TVA natural areas include: frequency of monitoring, lack of management plans, invasive species, vegetation management, trail maintenance, boundary marking and signage, maintenance of facilities, gates and barriers, litter and dumping, improper use, adjacent land-use and encroachment.

Because of budget constraints, TVA does not monitor its natural areas on a regular cycle. TVA staff has recently opportunistically assessed 9 of TVA's 154 natural areas; these 9 areas comprise about 15 percent of the approximately 15,000 acres of TVA natural areas. An additional 19 natural areas totaling 1439 acres have been recently assessed as part of the Land Condition Assessment (LCA; see Section 2.1.3). Five TVA natural areas have area-specific management plans.

Vegetation management of natural areas is important in eradicating or controlling invasive plants, maintaining trails, and wildlife enhancement. Invasive species are a large threat to TVA Natural Areas and were present on 6 of the 9 opportunistically inspected areas. Based on the LCA invasive plant assessment criteria, 5.4 percent of the natural area acreage was considered poor (greater than 25% coverage of invasive plants), 53.4 percent considered fair (between 5% and 25% coverage), and 41.2 percent considered good (less than 5% coverage). Using these criteria estimates, 180 acres (12.5%) are infested with one or more invasive plants. Assuming the 12 assessed natural areas are representative of all TVA natural areas, approximately 1,875 acres of TVA's approximately 15,000 acres of natural areas are infested with invasive plants.

Developed trails occur on 19 TVA natural areas. LCA results identified four natural areas with trails that needed maintenance in the form of tree removal or had recently had downed trees removed. Four of the nine opportunistically assessed natural areas contained formal trails; all of these trails were in relatively good shape with only minor repairs needed to hand railings and steps. This is not typical of SWA trails, where tree removal and minor to major repairs to bridges, steps, and hand railings are commonly needed. Other trail maintenance activities can include repairing erosion and washouts, installing and maintaining erosion control devices, and maintaining and restoring trail tread (footpath surface).

Boundary marking and signage maintenance is necessary for all TVA natural areas to ensure that the property and trails, if present, are properly marked. Signs are used to direct the public to the natural areas where low impact recreation is allowed and are placed on roads, trailheads, along trails for directional use. Signs also alert the public to use cautionary measures along bluffs or waterfalls. Of the 9 opportunistically assessed natural areas, 7 had proper boundary markers and the 4 with formal trails had proper trail markers. All 9 of these areas needed signs replaced or added and trail markers repainted due to fading. Twelve of the 19 areas assessed by the LCA needed signs replaced or added and boundaries marked.

A common problem at TVA natural areas is littering and illegal dumping; trash was noted at all 28 areas recently assessed by the two methods. Littering and illegal dumping are less of a problem at cooperatively managed TVA natural areas where there may be more frequent visitation by interested user groups and schedule trash clean-ups. Another improper use of high management concern is inappropriate use by off-road vehicles (ORVs), mountain bikers, horseback riders, rock climbers, and cavers and campers. Evidence of these improper uses, mainly from ORVs, was found on 10 of the recently assessed natural areas.

Incompatible adjacent land uses and encroachment are management issues due to their potential for introduction of invasive plants from urban and suburban gardens, tree-cutting, trampling of vegetation from heavy pedestrian or high-impact recreational use, and increased noise. Many TVA natural areas along shorelines have also been impacted by residential encroachment. Of the 9 opportunistically assessed natural areas, 3 had encroachments ranging from slight to major in severity. Encroachments were noted at 11 of the 19 assessed through the LCA.

Identification, protection and management of significant natural areas are a continuing process. As new information regarding occurrences of rare plant and animal species on TVA lands becomes available, additional areas are assessed and those judged significant are proposed for TVA natural area designation. Established natural areas that are consistently monitored are more likely to meet management objectives and ensure that significant elements of each area receive adequate protection. Condition assessments can then be analyzed for issues and resolutions to problems identified can be made. Management practices can be changed, if necessary, to benefit the natural area.

4.3. Terrestrial Ecology

4.3.1. Vegetation

For the purpose of this EIS, the terrestrial ecology discussion focuses on the lands within the combined watershed and power service area. This 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 and approximately 4,000 species of herbs, shrubs, and trees (A. Weakley and B. E. Wofford, personal communication, July 6, 2010). Much of the region is heavily forested.

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

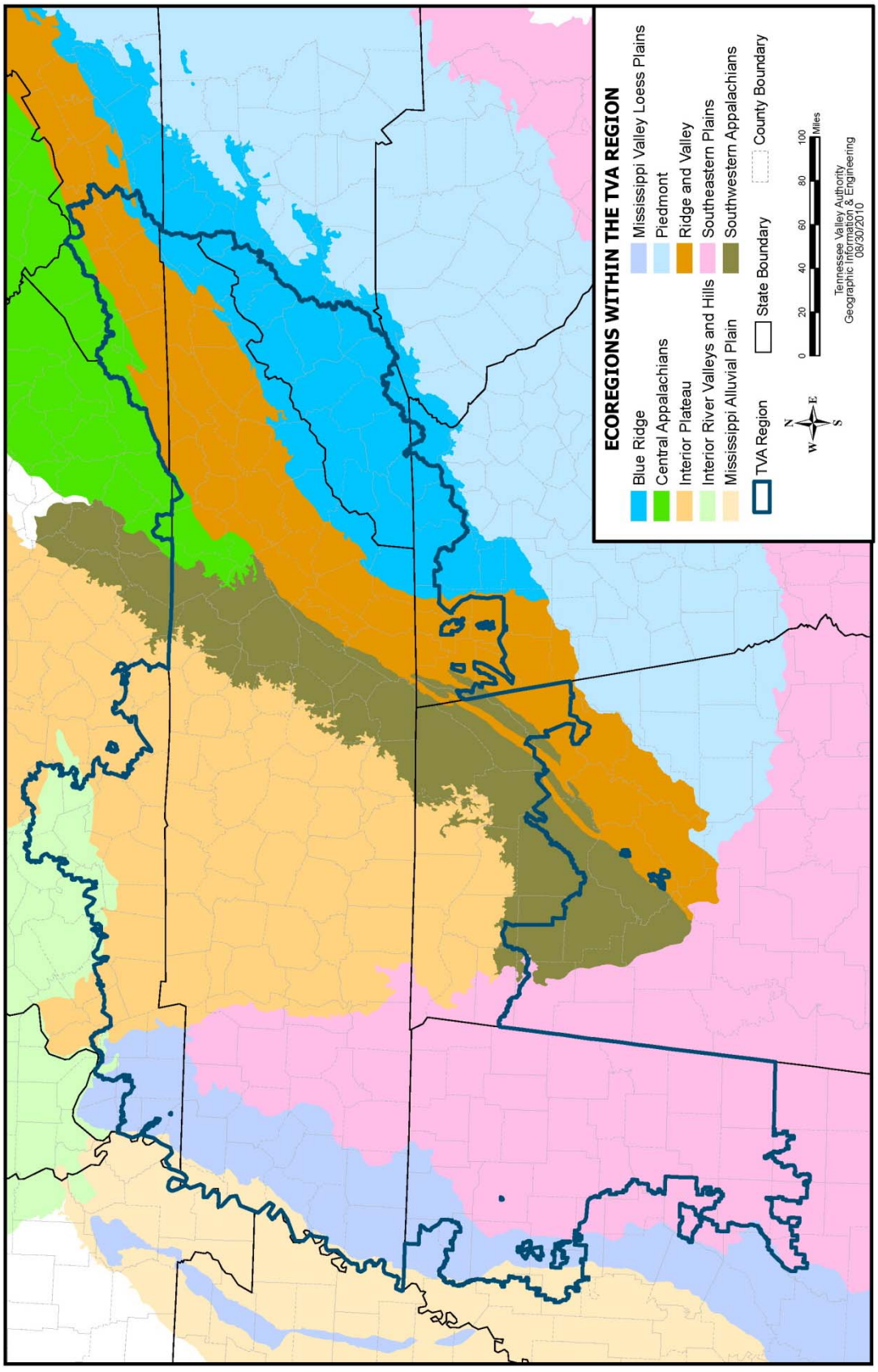


Figure 4-1. Ecoregions Within the TVA Region. Adapted from Omernik (1987).

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 Wilbur.

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 4-3 lists the TVA reservoirs and facilities located with the Ridge and Valley ecoregion.

Table 4-3. TVA Reservoirs and Facilities Located Within the Ridge and Valley Ecoregion

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
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 and Nickajack reservoirs, 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. TVA reservoirs found within the Interior Plateau include Great Falls, Normandy, Tims Ford, Wheeler, Wilson, and a portion of Kentucky. Power plants in the Interior Plateau are Cumberland and Gallatin Fossil Plants on the Cumberland River, and Colbert and Johnsonville Fossil Plants and Browns Ferry Nuclear Plant on the Tennessee River.

A small portion of the Interior River Valley and Hills ecoregion occurs in the TVA region in northwest Kentucky where it is comprised 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 a portion of the Illinois Basin coalfield where both underground and surface coal mining are 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 on the Ohio River occur within the Interior River Valley and Hills ecoregion.

The Southeastern Plains ecoregion, the largest ecoregion in the eastern U.S., 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 in the ecoregion are the Beech River projects, the Bear Creek projects, Pickwick, and a portion of Kentucky Reservoir.

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. 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 and Southhaven Combined-Cycle Plant occur within the Mississippi Alluvial Plain.

Forest Regions

Based on recent forest inventory and analysis plot data Dyer (2006) recognized three forest regions and two subregions in the TVA area. 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.

Globally Rare Communities and Sensitive or Threatened Ecosystems
NatureServe (2009) recognizes 83 community associations (distinct assemblages of plants classified by their dominant and diagnostic species) 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 J. 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.

These globally rare communities are often 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 J). Most of these sensitive ecosystems are being threatened by anthropogenic-related causes such as urban development, agricultural practices, and the introduction of exotic species. The Blue Ridge contains almost two-thirds of the globally rare communities reported from the TVA region, followed by the Interior Plateau with 17 percent and the Southwestern Appalachians with 10 percent.

Invasive Plants
Most lands in and around the TVA region have been affected by invasive plants. According to NatureServe (2009), invasive plants are the second-leading threat to imperiled native species. Not all nonnative plants pose threats to our native ecosystems. Many plants 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 invasive and do pose threats to the natural environment. EO 13112 defines an invasive 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). This executive order directs all federal agencies to address invasive species concerns and to refrain from actions likely to result in the introduction and/or spread of invasive species.

Invasive plants infest under and beside forest canopies and occupy small forest openings, increasingly eroding forest productivity, hindering forest use and management activities, and degrading diversity and wildlife habitat. They occur as trees, shrubs, vines, grasses, ferns, and forbs. Some have been introduced into this country accidentally, but most were brought here as ornamentals or for livestock forage. 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).

Four plants designated as noxious weeds under the Federal Noxious Weed List of 2006 (USDA 2007b, 2009) occur in the TVA region: cogongrass, giant salvinia, hydrilla, and tropical soda apple. In addition, SE-EPPC (2008) provides a list of invasive plants that could pose threats to native ecosystems and human health in southeastern states. 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).

Invasive plants are known to occur across southern Appalachian forests, accounting for 15-20 percent of the documented flora (USFS 2009). Miller et al. (2008) estimated the acres covered by 33 invasive plants 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 one or more of the invasive plants listed in Table 4-4.

Table 4-4. Invasive Plants in the TVA Region

Growth Form	Species
Trees	Tree-of-heaven (*Ailanthus altissima*)
	Silktree or mimosa (*Albizia julbrissin*)
	Princesstree or paulownia (*Paulownia tomentosa*)
	Chinaberrytree (*Melia azedarach*)
	Tallowtree or popcorntree (*Triadica sebifera*)
	Russian olive (*Elaeagnus angustifolia*)
Shrubs	Silverthorn (*Elaeagnus pungens*)
	Autumn olive (*Elaeagnus umbellata*)
	Winged burning bush (*Euonymus alatus*)
	Chinese and European privets (*Ligustrum sinense* and *L. vulgare*)
	Japanese and glossy privets (*Ligustrum japonicum* and *L. lucidum*)
	Nonnative bush honeysuckles (*Lonicera maackii, L. morrowii, L., tartarica, L. fragrantissima,* and *L. xbella*)
	Nandina (*Nandina domestica*)
	Nonnative roses (*Rosa multifora, R. bracteata,* and *R. laevigata*)
Vines	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*)
Grasses and canes	Giant reed (*Arundo donax*)
	Tall fescue (*Lolium arundinaceum*)
	Cogongrass (*Imperata cylindrica*)
	Nepalese browntop or microstegium (*Microstegium vimineum*)
	Chinese silvergrass (*Miscanthus sinensis*)
	Nonnative bamboos (*Phyllostachys aurea,* other *Phyllostachys* spp., and *Bambusa* spp.)

Growth Form	Species
Ferns and forbs (broad-leaved plants)	Japanese climbing fern (*Lygodium japonicum*)
	Garlic mustard (*Alliaria petiolata*)
	Shrubby lespedeza (*Lespedeza bicolor*)
	Chinese lespedeza (*Lespedeza cuneata*)
	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

Vegetation Types and Trends On TVA Lands

Major Vegetation Types — Based on an analysis of land use/land cover data for typical Zone 3 and Zone 4 reservoir lands, the dominant vegetation types are upland deciduous hardwood , bottomland hardwood, mixed, and evergreen forests (predominantly pine and eastern red cedar) (Figure 4-2). These four vegetation types cover about 85 percent of the land area. Four other vegetation types cover the remainder of the land area.

Forests on TVA lands are similar to forests found in Tennessee as reported by Oswalt et al (2009), where the most common forest type are deciduous hardwood forests dominated by oak-hickory. A large portion of the evergreen or pine-dominated forests on TVA lands are mature loblolly pine plantations in the southern and western Valley. Compared to Tennessee as a whole, TVA land contains a higher percentage of bottomland forest. This is largely due to the location of most TVA lands along the Tennessee River and its tributaries, where bottomlands can be extensive.

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

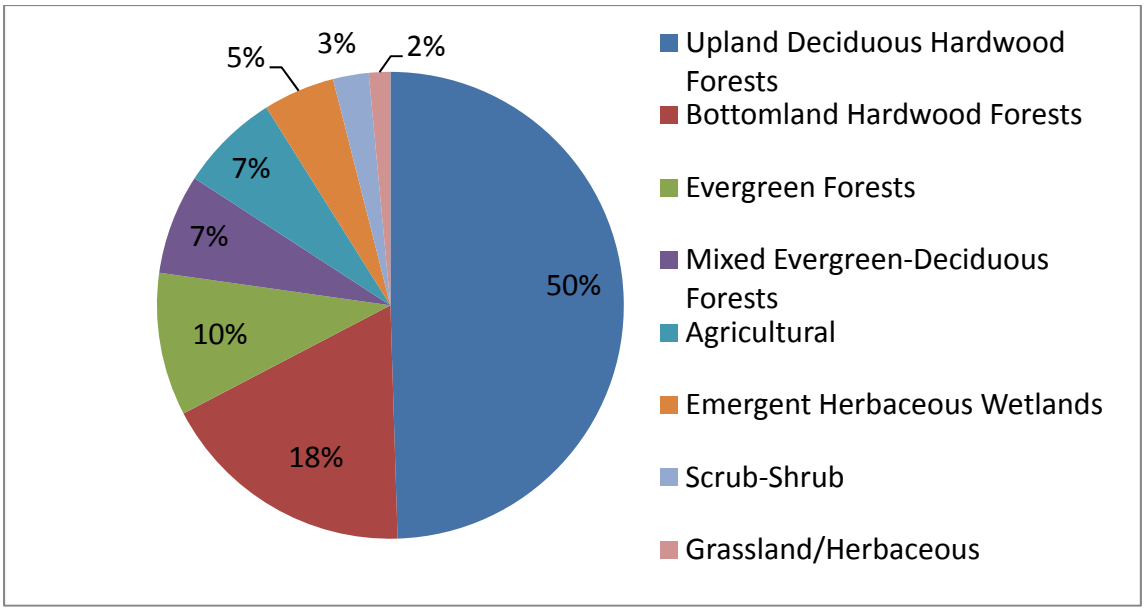


Figure 4-2. Vegetation Types on TVA Zone 3 and Zone 4 Reservoir Lands by Percent of Land Cover

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

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

Invasive Plants

Land Conditions Assessments (LCA; see Section 2.1.3) conducted over the last three years on 33,113 acres on six reservoirs (Norris, Tellico, Melton Hill, Guntersville, Kentucky and Watts Bar) identified the extent of invasive plant infestation on TVA lands as follows:

- Good (between 0 and 5% invasive plant coverage): 11,174 acres (33.7 percent)
- Fair (between 5% and 25% invasive plant coverage): 17,435 acres (52.7 percent)
- Poor (greater than 25% invasive plant coverage): 4,504 acres (13.6 percent).

Based on these data, a total of 5,800 of the 33,113 acres (17.5%) assessed is infested with one or more invasive plant species. Using this estimate and assuming similar conditions across

other reservoir lands, at least 38,000 of the 220,000 acres of Zone 3 and 4 reservoir properties are likely infested with invasive plants.

The magnitude of invasive plant infestations on TVA lands is due in large part to the configuration of its land base. Much of TVA land is relatively linear and narrow with extensive edges where most invasive plants tend to become established. Invasive plants established for landscaping on adjacent private lands can spread onto TVA lands. Reservoirs, waterways, transmission and highway ROWs can serve as vectors for the transport of invasive plants Past efforts by TVA and other resource agencies to plant several species now considered invasive for erosion control, wildlife habitat improvement, and landscaping purposes have also contributed to the introduction and spread of invasive species.

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 species of 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 2007, 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.

Federal legislation and policies that apply to wildlife 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 established the framework for regulated hunting of migratory birds and otherwise prohibited harm to migratory birds and their parts (including eggs, nests, and feathers). Conflicting decisions in various federal district courts disagree on whether this prohibition applies to the actions of 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. TVA has not developed this MOU. The Migratory Bird Treaty Act provides for the conservation of all native birds in the U.S. except non-migratory game birds that are managed by states.

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.

TVA Lands

While TVA manages lands across the region, most TVA lands are concentrated around its reservoirs. Habitats on TVA 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.

TVA partners with federal and state agencies to manage wildlife habitat on a number of wildlife management areas. In many cases, TVA lands are managed in conjunction with back-lying lands to form larger wildlife management units providing a more diverse and extensive land base to attract wildlife for both consumptive and nonconsumptive uses. Key Cave National Wildlife Refuge, for example, is managed collectively by USFWS, TVA, and the Alabama Department of Conservation and Natural Resources. The cave entrance is located on TVA land, and much of the aquifer underlies land 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 endangered Alabama cavefish.

Hunting, Fishing, and Wildlife-Associated Recreation
Wildlife-related recreation is prevalent on TVA 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 lands and reservoirs play an important role in supporting wildlife-related recreation. TVA works with federal and state agencies, universities, NGOs, and volunteers to support these activities. The dewatering projects on Kentucky and Wheeler reservoirs are examples of areas that are collectively managed by TVA and its partners. These areas provide a host of benefits for the public and wildlife that use them and provide economic benefits to surrounding communities.

Although hunting is not allowed at most TVA power generating 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 generating facilities also allow access to warm-water discharge areas to provide additional fishing opportunities, especially during winter and spring. Ash handling and water treatment facilities at some TVA fossil plants also provide wildlife viewing opportunities.

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.

Nuisance Wildlife Management
TVA has a contract with the U.S. Department of Agriculture's Wildlife Services (USDA-WS) group to address nuisance animal issues throughout the TVA region. Based on review of annual and quarterly reports provided by USDA-WS, the most common species creating issues at TVA facilities (fossil, hydro and nuclear plants) and other infrastructure (e.g., transmission line towers) are pigeons, vultures and beavers. Species creating the most issues on TVA reservoir land and recreational areas are beavers and vultures. Based on review of USDA-WS 2010 annual report, nuisance animal issues were managed at 32 individual facility or infrastructure sites and at 24 different sites on TVA reservoir properties. Some sites, such as transmission line towers with vulture roosts, require almost constant surveillance and continuous actions while some others can be handled as one time occurrences. Additional species that can create damage and/or health and safety issues include striped skunk, raccoon, feral cat, groundhog, vole, muskrat, opossum, river otter, little brown bat, coyote, great blue heron, osprey, common grackle, Canada geese, red-tailed hawk, mourning dove, house finch, European starling and English sparrow. In general, issues with nuisance animals have increased over the last five to ten years particularly associated with increasing populations of certain species, in particular vultures, beaver, great blue heron and osprey.

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. The abundance of wetlands varies across the nine ecoregions encompassing the TVA region (Table 4-5). 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). Farther west, the topography levels out and wetlands become more common. Broad, flat floodplain areas are common features, and various types of wetland habitats, especially bottomland hardwood forested wetlands, are widespread.

Table 4-5. Regional Variation of Wetland Abundance by Ecoregion — 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

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 more recent aerial photography and land use/land cover analyses (Table 4-6).

Table 4-6. Proportion of TVA Lands With Wetlands — 2010

Location	Proportion (Percent) of Forested/Scrub-Shrub Wetlands in Study Area	Proportion (Percent) of Emergent Wetlands in Study Area
Adjacent to Reservoirs	16.0	<0.2
On Power Generation Facility Reservations	11.0	<0.4
Total	**15.0**	**0.8**

Source: TVA Data 2010

Approximately 90 percent of the wetlands on TVA lands are located on the mainstem Tennessee River reservoirs. Tributary reservoirs have few wetlands because of the steeper slope of the shorelines and the larger drawdown for flood control. The topography around mainstem reservoirs is flatter, lending itself to the establishment of wetlands. In addition, there is much less drawdown from summer pool elevation to winter pool elevation on mainstem reservoirs. In addition, there is about three times as much shoreline on mainstem reservoirs as there is on tributary reservoirs (Snoddy and Cooney 1999).

The above conclusions are supported by data prepared for the ROS (TVA 2004), 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 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.

The data showed that vegetated wetlands occur with greater frequency and size along the mainstem reservoirs and tailwaters than along the tributary reservoirs and tailwaters. This is due in part to the larger-sized watersheds of mainstem 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.

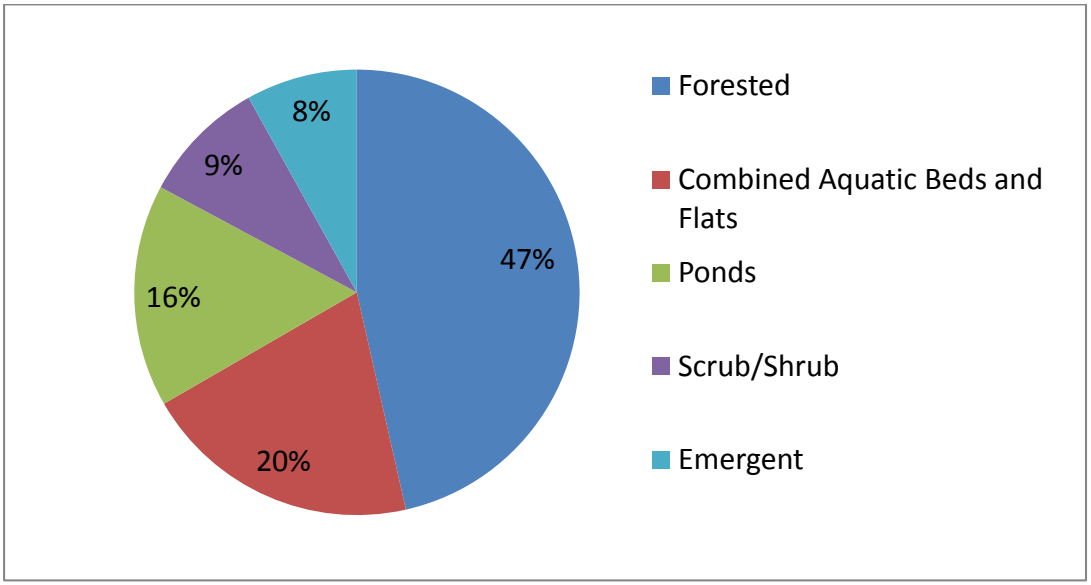
Within mainstem reservoirs, wetlands occur on flats between summer and winter pool elevations, on islands, along reservoir shorelines, in dewatering areas, in floodplains, on river terraces, along connecting rivers and streams, around springs and seeps, in natural depressions, in areas dammed by beaver, in and around constructed reservoirs and ponds

(diked and/or excavated), and in additional areas that are isolated from other surface waters. On tributary reservoirs, wetlands are typically located at the backs of coves where tributary streams enter the reservoir, and in very patchy, small (<0.01 acre) areas along the shoreline.

As shown in Figure 4-3, forested wetlands are the most common wetland type found on TVA 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 4-4 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 lands adjacent to reservoirs. This analysis showed that wetlands are less common on TVA 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.

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.



Source: TVA data.

Figure 4-3. Wetlands of the TVA Reservoir System by Vegetation Class

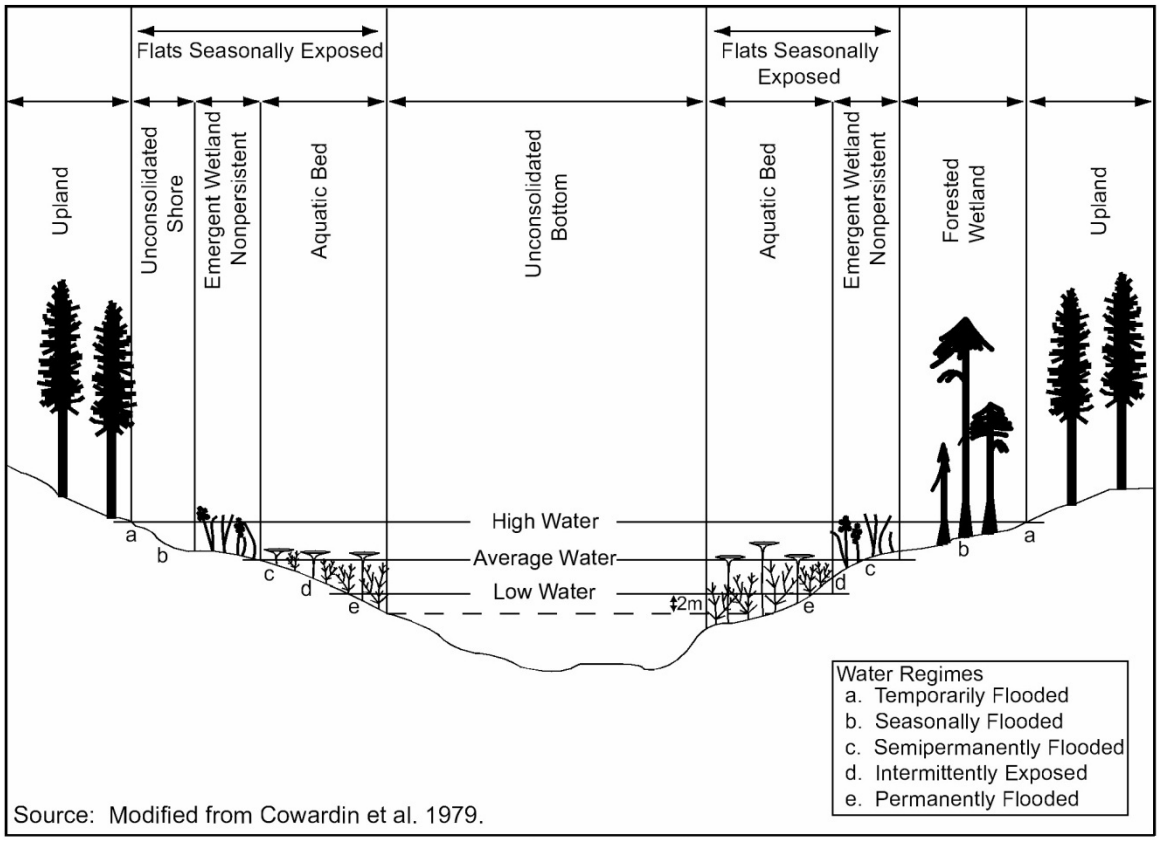


Figure 4-4. Reservoir Wetland Types and Locations

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).

Current Management Issues
In general, wetlands on TVA lands face less threat of direct impacts related to development than wetlands on private land. Where direct impacts do occur as the result of TVA projects or land disposal actions, impacts are typically mitigated to offset any immediate or cumulative effects. Common problems across TVA lands are typically more indirect types of impacts including:

- Invasive species
- Lack of buffer zones
- ATV impacts
- Encroachments, especially unauthorized removal or alteration of wetland vegetation
- Changes in vegetation community structure (e.g., decline of buttonbush on Kentucky reservoir)
- Impacts of beaver populations/impoundments on forested wetlands (e.g., conversion to open water, scrub/shrub and emergent wetlands)
- Impacts of climate change.

These types of problems are recorded during land condition assessments and their trends will be assessed in future assessment efforts. Overall, these management problems are not unique to TVA lands, and lead to subtle changes in the type, extent, and quality of wetland habitats.

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 from the Ohio River to Knoxville. Virtually all the major tributaries have at least one dam. In addition to the nine reservoirs on the mainstem of the Tennessee River, TVA operates 38 tributary dams for various combinations of power generation, flood control, pumped storage, navigation, recreation, water supply, economic development, and fish and wildlife habitat. 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 Monitoring Program. This 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 Vital Signs monitoring, along with state 303(d) and 305(b) information and state-issued fish consumption advisories, are summarized in Table 4-7.

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 reservoir 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.

Table 4-7. Ecological Health Ratings of TVA Reservoirs

Reservoir	Ecological Health Rating	Score	Latest Survey Date	Concerns	State Listing as Impaired	Causes	Sources	Fish Consumption Advisory
Apalachia	Good	84	2008		None			Hg North Carolina statewide
Bear Creek	Fair	64	2007	DO	AL, 654 acres	Organic enrichment, low DO		Hg
Beech	Poor	51	2008	DO, chlorophyll	None			None
Blue Ridge	Good	83	2007	DO	None			Hg
Boone	Poor	50	2007	DO, chlorophyll, bottom life	TN, 1968 acres	PCBs, Chlordane	Contaminated sediment	PCBs, chlordane
Cedar Creek	Fair	69	2007	DO	None			None
Chatuge	Fair	59	2008	DO, bottom life, sediment quality	None			Hg
Cherokee	Fair	63	2008	DO, chlorophyll, bottom life	TN, 2816 acres	Mercury	Atmospheric deposition-sources outside state	None
Chickamauga	Good	78	2009	Chlorophyll, bottom life	TN, total of 4,235 acres (Hiwassee River Embayment)	Mercury, E. coli	Industrial point source and/or atmospheric deposition (Hg); undetermined source (E. coli)	None
Douglas	Fair	59	2009	DO, chlorophyll	None			None
Fontana	Fair	69	2008	Bottom life	NC, 171 acres (Tuckasegee arm)	Fecal coliform		Hg North Carolina statewide
Fort Loudoun	Poor	50	2007	DO, chlorophyll, bottom life	TN, 14,066 acres PCBs; 534 acres Mercury and PCBs	Contaminated sediment (PCBs) Atmospheric deposition (Hg)		PCBs

Reservoir	Ecological Health Rating	Score	Latest Survey Date	Concerns	State Listing as Impaired	Causes	Sources	Fish Consumption Advisory
Fort Patrick Henry	Fair	60	2007	Chlorophyll, bottom life	None			None
Guntersville	Good	79	2009	Chlorophyll	None			None
Hiwassee	Fair	67	2008	DO, chlorophyll	NC, 143 acres	Low pH		None
Kentucky	Fair	70	2009	DO, chlorophyll	None			Hg Kentucky statewide
Little Bear Creek	Fair	70	2009	DO, bottom life	AL, 1,435 acres	Nutrients	unknown	None
Melton Hill	Fair	65	2008	Bottom life	TN, 5,690 acres	PCBs, Chlordane	Contaminated sediment	PCBs
Nickajack	Good	85	2009	Chlorophyll	TN, 10,370 acres	PCBs, Dioxin	Contaminated sediment	PCBs
Normandy	Poor	52	2008	DO, chlorophyll	None			None
Norris	Fair	60	2007	DO, chlorophyll, bottom life	TN, 23,198 acres (Clinch River portion)	Mercury	Atmospheric deposition	None
Nottely	Poor	50	2009	DO, chlorophyll, bottom life	None			Hg
Parksville	Good	81	2009	Sediment quality	TN, 1,280 acres	Copper, iron, zinc, loss of biological integrity due to siltation	Mill tailings, mine tailings, contaminated sediments, impacts from abandoned mines	None
Pickwick	Good	78	2006	Chlorophyll	None			None
South Holston	Fair	60	2008	DO, chlorophyll, bottom life	TN, 7,577 acres VA, 1,699 acres	Mercury (TN); mercury and PCBs in fish tissue (VA)	Atmospheric deposition (TN)	Hg (TN and VA); PCBs (VA)
Tellico	Poor	55	2009	DO, chlorophyll, bottom life	TN,16,500 acres	PCBs, mercury	Contaminated sediment (PCBs); atmospheric deposition (Hg)	PCBs
Tims Ford	Poor	52	2008	DO, bottom life	None			None
Watauga	Good	75	2008	DO	TN, 6,427 acres	Mercury	Atmospheric deposition	None

Reservoir	Ecological Health Rating	Score	Latest Survey Date	Concerns	State Listing as Impaired	Causes	Sources	Fish Consumption Advisory
Watts Bar	Fair	59	2008	DO, chlorophyll, bottom life	TN, Total of 36,050 acres	PCBs, low DO	Contaminated sediments (PCBs, 36,050 acres); upstream impoundment (low DO, 1,971 acres)	PCBs, Hg
Wheeler	Poor	57	2007	DO, chlorophyll, bottom life	AL, 1569 acres	pH, nutrients	pasture grazing, non-irrigated crop production	DDT
Wilson	Poor	54	2008	DO, chlorophyll	None			None

Abbreviations: DDT = Dichlorodiphenyltrichloroethane; DO = Dissolved oxygen; Hg = Mercury; PCBs = Polychlorinated biphenyls

Nine dewatering areas are associated with TVA reservoirs (see Section 2.1.2). To prevent mosquito breeding, certain areas that would be shallow backwater at normal summer pool elevations are regulated with dikes and pumps. These areas are kept dry and farmed during the summer and flooded to provide waterfowl habitat in the winter. Water discharged from these areas can contain fertilizer and other agricultural chemicals from summer farming, along with nutrients and bacteria from the large winter waterfowl populations. Most of these areas discharge directly to the reservoir and quickly diluted. However, 3.7 acres of the West Sandy Embayment is listed by the state of Tennessee as impaired by nutrients, low dissolved oxygen and siltation, caused at least in part by discharges from the West Sandy Creek Dewatering Area.

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). This discussion of affected aquatic environments focuses on two distinct categories of water bodies: the TVA reservoir system within the Tennessee River watershed 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 (TVA 2004) 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).

Tributary Reservoirs and Tailwaters — 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).

Mainstem Reservoirs — The nine mainstem 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 mainstem 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 mainstem 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 watershed.

The TVA Vital Signs 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, prescribed spring flows are provided downstream of Watts Bar Reservoir to enhance sauger spawning.

"Free-Flowing" Streams and Rivers in the Tennessee River Watershed
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 management practices such as agriculture; industrial, residential and recreational development; and forestry 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

A total of approximately 94 aquatic animals, 33 terrestrial animals, and 44 plants listed under the Endangered Species Act as endangered, threatened, proposed for listing, or candidates for listing have been reported from the TVA region. Numerous additional species listed as endangered, threatened, or of other conservation concern by one or more of the TVA region states also occur in the TVA region. Several of these species would potentially be affected by the NRP alternatives. These species are described in more detail below.

4.7.1. Aquatic Animals

The Tennessee River and its tributaries contain 62 species of aquatic animals that are federally listed as endangered, threatened, or proposed or candidates for such listing. Many more species are listed by the states in the Tennessee River watershed. A summary of the number of state- and federally listed aquatic animal species known from the Tennessee River watershed is presented in Table 4-8. Because almost all proposed NRP activities that could result in direct physical impacts (beneficial or adverse) would be conducted on TVA lands, or within the Tennessee River watershed, only aquatic species known from the Tennessee River watershed are discussed here. The exceptions to this would be small-scale activities occurring on generation facility properties on the Cumberland River (Cumberland and Gallatin Fossil Plants), the Green River (Paradise Fossil Plant), the Ohio River (Shawnee Fossil Plant), and the Mississippi River (Allen Fossil Plant).

Detailed lists of the species reported from the Tennessee River watershed in each of the seven Valley states are presented in Appendix J. None of these species are known to occur on TVA lands that are a part of this plan. However, many of these species occur in streams and reservoirs adjacent to these lands.

Table 4-8. State- and Federally Listed Aquatic Animal Species Present in the Tennessee River Watershed

State	Crustaceans		Insects		Mollusks		Fish		Total	
	State	Federal	State	Federal	State	Federal	State	Federal	State	Federal
Alabama	8	1	14	0	73	26	38	6	133	33
Georgia	0	0	0	0	3	0	35	4	38	4
Kentucky	0	0	0	0	26	6	15	0	41	6
Mississippi	0	0	0	0	8	0	14	0	22	0
North Carolina	9	0	1	0	18	4	31	2	59	6
Tennessee	15	0	9	1	67	37	56	13	147	51
Virginia	10	1	2	0	41	18	46	6	99	25
Tennessee River Watershed	37	2	22	1	124	42	123	17	306	62

The Tennessee River watershed supports an unusually diverse group of aquatic animals. Although their diversity was historically higher, exceptional species diversity is still observed in fish; mollusks, crayfish, aquatic insects, and various other invertebrate groups. Even before impoundments were constructed on the Tennessee River system, human activities resulted in adverse impacts to streams and the animals living there. Hughes and Parmalee (1999) presented convincing evidence that the pristine stream habitats in the Tennessee River system that had been inhabited by nearly 100 freshwater mussel species were beginning to be affected by human activities by the mid-1800s, and that many of these freshwater mussels were already extirpated before the Tennessee River mainstem impoundments were constructed (see Ortmann 1918, 1925; van der Schalie 1939; Stansbery 1964; Isom 1969). The paucity of early fish collections do not allow a similar comment about the impact of these activities to Tennessee River mainstem fish assemblages, but Etnier et al. (1979) speculated that there are probably species of Tennessee River fish that became extinct before they were known to science.

The historic loss of the Tennessee River watershed's exceptional aquatic diversity is of global significance (Stein et al. 2000). Ichthyology books (Boschung and Mayden 2004, Etnier & Starnes 1993, Jenkins and Burkhead 1993, and Mettee et al. 1996) discuss the historic diversity of the Tennessee River watershed and the extirpation and extinction of various fish. Likewise, Parmalee and Bogan (1998) discuss the same topics with regard to mussels. There are no definitive texts, however, that describe the status of the other components of the aquatic community. Population trends vary among species groups with the majority of listed species experiencing declines across their ranges.

4.7.2. Terrestrial Animals

There are 33 federally listed, protected, or candidate terrestrial animal species occurring in the TVA region (Appendix J). Of these species, five occur on TVA lands (Table 4-9). A

sixth species, red-cockaded woodpecker, historically occurred on or near TVA lands. In recent decades, this species has only occurred in isolated pockets in extreme southern portions of the region. TVA's resource management activities would not result in impacts to this species.

Table 4-9. Federally Listed Endangered, Threatened, and Candidate Terrestrial Animals and Plants Potentially Impacted by the Natural Resource Plan

Common Name	Scientific Name	Federal Status
Terrestrial Animals		
Bald eagle	*Haliaeetus leucocephalus*	PROT
Interior least tern	*Sterna antillarum athalassos*	LE
Piping plover	*Charadrius melodus*	LT/LE
Gray bat	*Myotis grisescens*	LE
Indiana bat	*Myotis sodalis*	LE
Plants		
Cumberland rosemary	*Conradina verticillata*	LT
Fleshy-fruit gladecress	*Leavenworthia crassa*	C
Green pitcher plant	*Sarracenia oreophila*	LE
Large-flowered skullcap	*Scutellaria montana*	LT
Monkey-face orchid	*Platanthera integrilabia*	C
Morefield's leather-flower	*Clematis morefieldii*	LE
Price's potato-bean	*Apios priceana*	LT
Ruth's golden aster	*Pityopsis ruthii*	LE
Shorts bladderpod	*Lesquerella globosa*	C
Small whorled pogonia	*Isotria medeoloides*	LT
Virginia spiraea	*Spiraea virginiana*	LT

Federal status abbreviations: C=Candidate; LE=Endangered; LT=Threatened; PROT=Protected under the Bald and Golden Eagle Protection Act

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 high quality habitat for this species and both breeding and wintering populations regularly occur on TVA lands (see Appendix J). Breeding pairs are 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. They 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, results of recent surveys performed by TVA and others show that bald eagles 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.

Although the bald eagle was removed from the federal list of endangered and threatened species in 2007, it remains protected under the Bald and Golden Eagle Protection Act. TVA incorporates recommendations from the National Bald Eagle Management Guidelines (USFWS 2007) during planning and stewardship activities.

Gray bats are widely distributed throughout the region (see Appendix J); 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 lands and adjacent to power generation properties throughout north Alabama. TVA routinely monitors and protects all known gray bat populations on TVA 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. They nest in colonies on exposed sandbars at numerous sites in the Mississippi River during summer months. There are a few records of them nesting on more mainland sites along the Mississippi River, including recently at the TVA Allen Fossil Plant. After breeding, least terns often disperse along adjacent tributaries and are occasionally observed on Kentucky Reservoir. Least terns are not known to nest on the Tennessee 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. Piping plovers use exposed mudflats on the Mississippi, Ohio, Cumberland, and Tennessee rivers as stopover sites during migration. They are 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). They hibernate 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 lands. TVA's Nickajack Cave is the type of locality for the species although it has not been observed there in recent years. Indiana bats have also been reported from TVA's Little Bayou Creek Ridge HPA at Shawnee Fossil Plant. A small maternity population occurs on USFS land near a TVA tract adjacent to Tellico 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 Indiana bats while evaluating resource stewardship activities, land plans, 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.

Approximately 701 state-listed or state-ranked terrestrial animal species occur in the TVA region (Appendix J). 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, and 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 J occur on TVA lands and are considered during the TVA'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 recently discovered populations of green salamanders and other species that occur in these areas.

Trends of Listed Terrestrial Animals

Populations of several listed species have improved since the ESA was enacted. Results of surveys performed by TVA and others show that bald eagles and gray bats appear to have increasing or stable numbers in the TVA region. Numbers of some other 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 highly virulent 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 the listing status of gray bats from endangered to threatened has been dropped, and both gray and Indiana bats are being monitored closely to see how they cope with this new threat. White-nose syndrome has spread throughout many states in the eastern U.S. and portions of Canada. It has recently been discovered in bat populations in Virginia, Kentucky, North Carolina and Tennessee. TVA has closed the caves on its lands to public access, as requested by the USFWS, in an effort to control the spread of this disease; and works with several conservation agencies to monitor the spread of the disease through the region.

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, subsequent reductions in many cave invertebrates dependent on cave-dwelling bats are likely.

4.7.3. Plants

Forty-four plant species listed as endangered or threatened under the Endangered Species Act, 6 candidate plant species for such listing, 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 J.

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 have the potential to be impacted by TVA actions associated with the NRP (Table 4-9). These species are discussed below.

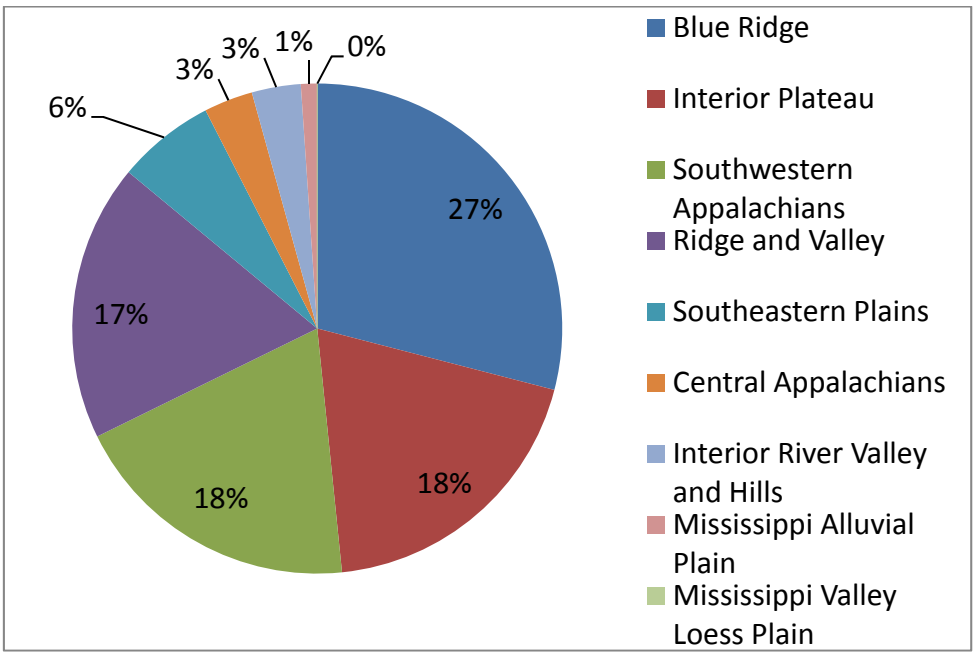


Figure 4-5. Percentage of Federally Listed Endangered, Threatened, and Candidate Species per Ecoregion

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 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.

Green pitcher plant is a carnivorous plant restricted to acidic seepage bogs and boggy stream edges in northeast Alabama, northeast Georgia, and southwest North Carolina. Threats include degradation of habitat by residential and road construction, encroachment of woody vegetation due to fire suppression, drainage from agricultural practices, flooding and streambank changes due to human disturbances, and commercial/amateur collection of live plants (NatureServe 2009). The populations on Chatuge Reservoir are monitored by the Georgia and North Carolina Nature Conservancy aided by TVA staff.

Large-flowered skullcap is a member of the mint family commonly encountered on wooded slopes with rocky outcrops within the Tennessee River Gorge in southeast Tennessee and northwest Georgia. Numerous occurrences are known from TVA lands along Chickamauga and Nickajack Reservoirs, on the Raccoon Mountain Pumped Storage Plant Reservation, and in close proximity to Sequoyah Nuclear Plant.

The 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 lands adjacent to Yellow Creek, but the population is now thought to have been extirpated.

Morefield's leather-flower is restricted to rocky limestone bluffs and boulder fields. Smoke tree is an indicator species. In several locations throughout the Valley, Morefield's leather-flower 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 prefers disturbed portions of rocky limestone areas in forest openings, wood edges, and regions where bluffs descend to streams. Threats to the species include development and encroachment of invasive species.

Ruth's golden aster 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, Tennessee (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.

Short's bladderpod, a member of the mustard family, 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) but has not been reported as occurring on TVA lands.

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. It is often found growing with Cumberland rosemary on the Cumberland Plateau. 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 occurrences of 996 state-listed plant species are known from the TVA region (Appendix J). Thirty-two (4.1 percent) of these species are known to occur within a mile of TVA facilities (Table 4-10). 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 land surrounding the Raccoon Mountain Pumped Storage Plant not only is home to the federally listed large-flowered skullcap but also harbors five state-listed species.

Table 4-10. State-Listed Plant Species Found Within 1 Mile of TVA Facilities

Common Name	Scientific Name	State Rank	State Status	Facility
American ginseng	*Panax quinquefolius*	S3S4	S-CE	Melton Hill Dam, Raccoon Mountain
American pillwort	*Pilularia americana*	S1S2	SPCO	Dogwood Reservation Dam
Appalachian bugbane	*Cimicifuga rubifolia*	S3	THR	Norris Dam
Big shellbark hickory	*Carya laciniosa*	S2S3 (MS)	SLNS (MS)	Yellow Creek
Butternut	*Juglans cinerea*	S3	THR	Melton Hill Dam
Canada lily	*Lilium canadense*	S3	THR	Bull Run Fossil Plant
Crested fringed orchid	*Platanthera cristata*	S3 (MS)	SLNS (MS)	Yellow Creek
Dutchman's breeches	*Dicentra cucullaria*	S2 (AL)	SLNS (AL)	Wilson Dam
Dwarf larkspur	*Delphinium tricorne*	S2 (MS)	SLNS (MS)	Yellow Creek
Fame-flower	*Talinum mengesii*	S2	THR	Raccoon Mountain
Fetter-bush	*Leucothoe racemosa*	S2	THR	Kingston Fossil

Common Name	Scientific Name	State Rank	State Status	Facility
				Plant
Green violet	*Hybanthus concolor*	S2 (MS)	SLNS (MS)	Yellow Creek
Heavy-fruited sedge	*Carex gravida*	S1	SPCO	Melton Hill Dam; Tellico Dam
Horsesugar	*Symplocos tinctoria*	S2	SPCO	Ocoee 3 Dam
Meehania mint	*Meehania cordata*	S2	THR	Norris Dam
Mountain bush-honeysuckle	*Diervilla sessilifolia var rivularis*	S2	THR	Raccoon Mountain
Northern white cedar	*Thuja occidentalis*	S3	SPCO	Bull Run Fossil Plant
Purple cliff-brake fern	*Pellaea atropurpurea*	S1S2 (MS)	SLNS (MS)	Yellow Creek
Pursh's wild-petunia	*Ruellia purshiana*	S1S2	SPCO	Melton Hill Dam
Round-leaf serviceberry	*Amelanchier sanguinea*	S2	THR	Raccoon Mountain
Sedge	*Carex stricta*	S2 (MS)	SLNS (MS)	Yellow Creek
Shooting star	*Dodecantheon meadia*	S2 (MS)	SLNS (MS)	Yellow Creek
Slender toothwort	*Dentaria heterophylla*	S2S3 (MS)	SLNS (MS)	Yellow Creek
Spotted wintergreen	*Chimaphila maculata*	S2 (MS)	SLNS (MS)	Yellow Creek
Spreading false-foxglove	*Aureolaria patula*	S3	SPCO	Kingston Fossil Plant, Bull Run Fossil Plant,
				Melton Hill Dam
Stonecrop	*Sedum ternatum*	S2 (MS)	SLNS (MS)	Yellow Creek
Sullivantia	*Sullivantia sullivantii*	S1	END	Norris Dam
Tall larkspur	*Delphinium exaltatum*	S2	END	Bull Run Fossil Plant
Three-parted violet	*Viola tripartata*	S2S3	SPCO	Raccoon Mountain, Melton Hill Dam
Virginia pine	*Pinus virginiana*	S2 (MS)	SLNS (MS)	Yellow Creek
Wild hyacinth	*Camassia scilloides*	S2S3 (MS)	SLNS (MS)	Yellow Creek
Yellow trout-lily	*Erythronium rostratum*	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

TVA has surveyed many of its reservoir lands during the development of reservoir land management plans and for other purposes. These lands have relatively few plant species of conservation concern as compared to the many state-listed species known to occur within the vicinity of these reservoirs. For example, 109 state-listed plant species occur in the counties surrounding Guntersville Reservoir while 15 state-listed plants have been observed on the reservoir lands (TVA 2001). Three state-listed plants were observed on TVA lands included in the Northeastern Tributary Reservoirs land plan (TVA 2010) while 30 species have been reported within 5 miles of these reservoirs. Fourteen state-listed plant species have been found on reservoir lands included in the Mountain Lakes Reservoirs land plan (TVA 2009) while 67 species have been reported within 5 miles of these reservoirs. Many of the endangered and threatened plants on TVA lands are located on tracts allocated for Sensitive Resource Management or Natural Resource Conservation (see Section 4.2 on TVA Natural Areas).

Within the TVA region, 75 percent of the state-listed plant species are found in the Interior Plateau, the Blue Ridge, the and Southwestern Appalachians ecoregions (Figure 4-6). The three ecoregions with high numbers of state-listed plants also contain a large proportion of the rare plant associations known from the TVA region.

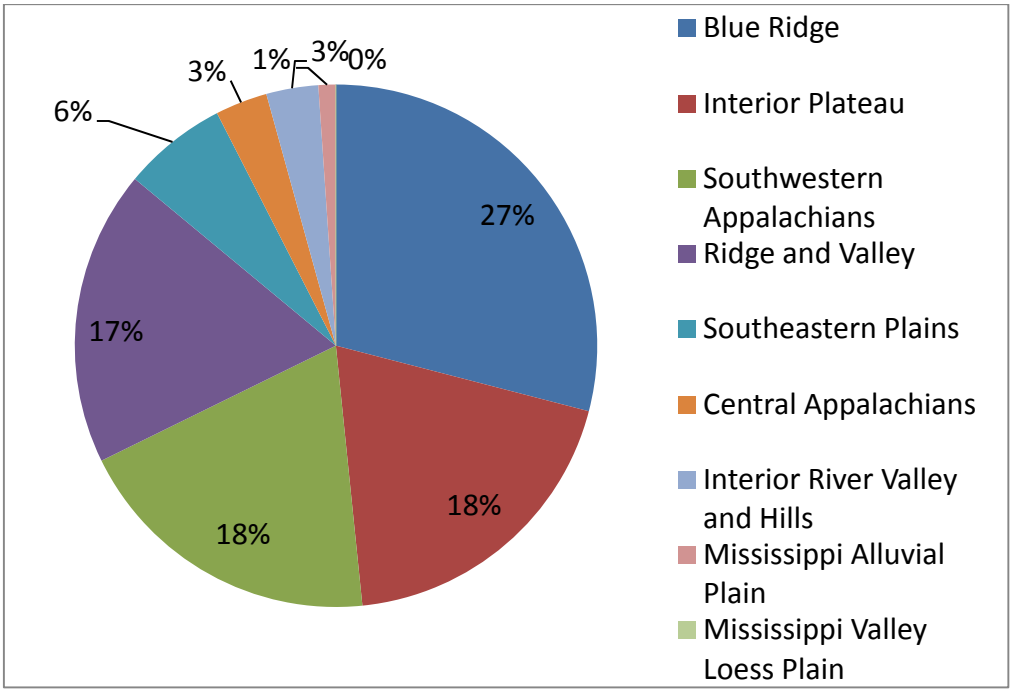


Figure 4-6. Percentage of State-Listed Plant Species per Ecoregion

Status of Endangered and Threatened Plants on TVA Lands

Three of the 46 TVA reservoirs, Chatuge, Chickamauga and Nickajack have known populations of federally listed plants along their shorelines. Green pitcher plant is managed on lands owned by the Georgia and North Carolina Nature Conservancy, and large-flowered skullcap occurs on private and public lands on Chickamauga and Nickajack Reservoirs 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. TVA annually monitors populations of large-flowered skullcap in May, green pitcher plant in June, and Ruth's golden aster in September.

Raccoon Mountain Pumped Storage Plant and Sequoyah Nuclear Plant are the only TVA power plants with known records of federally listed plant species occurring within or in the immediate vicinity of their reservations. Recent field surveys have reported more than 30 records of large-flowered skullcap growing on the Cumberland escarpment of Raccoon Mountain.

Despite continued threats from invasive species and residential and commercial development within the TVA region, there are success stories about endangered and threatened plants being removed from the Endangered Species List or being proposed for removal. Previously unknown populations of other species have recently been discovered. One success story is Eggert's sunflower which when listed as threatened in 1997 was known from 34 populations in Kentucky and Tennessee. Due to conservation efforts on federal lands and surveys additional of additional, nearly 300 populations were known in three states by 2005. The newly discovered populations included several on TVA reservoir lands in northwest Alabama, and TVA has zoned several of these areas for Sensitive Resource Management. In 2006, Eggert's sunflower was removed from listing under the Endangered Species Act. A similar story is emerging for the Tennessee coneflower, listed as Endangered in 1979. After 30 years of conservation management, the USFWS considers this species as no longer in need of protection by the ESA. New populations have also recently been discovered for Braun's rock-cress, large-flowered skullcap, Morefield's leather-flower, and purple prairie clover.

Unfortunately there are also listed plant species in decline due to environmental and economic development stresses. These species include the green pitcher plant, Pyne's ground plum, small whorled pogonia, and Virginia spiraea.

Conservation efforts lead by TVA for spreading false foxglove contributed to its downlisting from Endangered to Species of Special Concern in Tennessee. Because insufficient population data are known for many state-listed plants, field surveys conducted by TVA staff have added to the distributional data for many of these species and aided in the reassessment of listing status by states within the TVA region.

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 Institution (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). Archaeological surveys conducted on TVA 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, TVA 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 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 4-11). 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 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.

Table 4-11. Approximate Number of Archaeological Sites Identified on and Percent of TVA Lands Systematically Surveyed

Location	Percent of Land Systematically Surveyed	Number of Inundated Sites	Number of Sites Above Normal Summer Pool	Total Number of Sites Recorded*
TVA Reservoir Lands				
Apalachia	16	14	2	16
Bear Creek Project	75	152	454	606
Beaver Creek	2	0	1	1

Location	Percent of Land Systematically Surveyed	Number of Inundated Sites	Number of Sites Above Normal Summer Pool	Total Number of Sites Recorded*
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
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

Location	Percent of Land Systematically Surveyed	Number of Inundated Sites	Number of Sites Above Normal Summer Pool	Total Number of Sites Recorded*
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.

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 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.

TVA manages a number of significant archaeological sites that have had an important contribution to the understanding of prehistory in the Southeast. These 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 the subject of 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 iron furnace sites across the Valley, and several archaeological sites excavated and inundated on Tellico Reservoir.

Humans have prehistorically and historically tended to settle near main river channels in order to be to close the necessary resources for survival (i.e., food and water). TVA lands are primarily located along the Tennessee River and its tributaries and consequently contain numerous archaeological sites. While the total acreage of TVA land is small in comparison with many other Federal agencies, the archaeological resources are dense and their vulnerability to various threats significant (most being easily accessible by water and land and exposed to substantial annual erosion). With only about 30 percent of its lands systematically surveyed, TVA must make prudent choices in its annual inventory allowance while making a good-faith effort to meet its responsibilities under the laws and regulations protecting these resources.

Current conditions of archaeological sites on TVA lands vary according to their location within the TVA system. Inundated site conditions vary depending on local erosion or siltation. TVA has limited data on the condition of sites that are normally inundated

throughout the year. In a recent survey conducted during an unusually deep drawdown of Bear Creek Reservoir, a large percentage normally inundated sites had been destroyed by heavy erosion. This situation may not be typical of other TVA reservoirs.

Archaeological sites located within the normal drawdown zones or on shorelines are subject to a different level of disturbance. These sites are easily accessible to looting and vulnerable to erosion from reservoir fluctuations, discharges from dams, and wave action from boat traffic. With limited funding available to monitor and protect these resources annually, there has been an overall deterioration of archaeological resources.

4.8.2. Historic Structures

Approximately 5,320 historic structures have been recorded on or near TVA lands (Table 4-12). Examples of these structures include gristmills, dams, powerhouses associated with the dams, diversion flumes, fossil plants, homes, bridges, and cemeteries. Approximately 230 of the 5,320 historic structures are considered either eligible or potentially eligible for listing in the NRHP and 85 historic structures are currently listed in the NRHP. Nine NRHP historic districts are on TVA lands; these include districts at Little Bear, Normandy, Pickwick, Tims Ford, and Wheeler reservoirs, and four 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 4-12). 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 of historic structures 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. These plants have not been systematically surveyed. Historical resource surveys of the fossil plants and associated contiguous lands are conducted on a case-by-case basis as TVA proposes projects.

Table 4-12. Numbers of Historic Structures Surveyed

Reservoir and Location	Recorded Historic Structures	NRHP-Eligible or Potentially Eligible Historic Structures	NRHP-Listed Historic Structures/Districts
Mainstem Reservoirs			
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 Mainstem	**2,797**	**73**	**52**
Tributary Reservoirs			
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 Reservoirs	**5,322**	**233**	**94**

Current conditions of the historic structures on TVA lands vary and limited inventory data is available to fully describe the current state of most of them. In general, TVA has conducted little maintenance or management of the historic structures under its control. Those historic structures that are currently occupied are in good condition. TVA's dams and power facilities are maintained for general safety and, as a result, are mostly in good condition. Others, such as those located in remote locations or those that are unoccupied have fallen into a state of disrepair.

4.9. Land Use

The Tennessee River 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. The TVA power service includes a total of 76,738 square miles, with 44,783 square miles extending outside the Tennessee River watershed. TVA lands adjacent to reservoirs include approximately 293,000 acres (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 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 reservoir shoreline. In addition, TVA manages approximately 9,100 acres of land located adjacent to TVA's power facilities throughout the region.

Land use and land cover on TVA reservoir lands, as well as on a 0.25-mile surrounding area of influence, was quantified from 2008 and 2009 aerial photography from the USDA's National Agricultural Imagery Program and GIS mappings. The current land cover on TVA reservoir lands is dominated by "natural" habitats, with 81 percent of TVA lands forested (Figure 4-7a). Compared to adjacent non-TVA lands (Figure 4-7b), TVA lands are more heavily forested, have lower proportions of pasture and cropland, and are less developed.

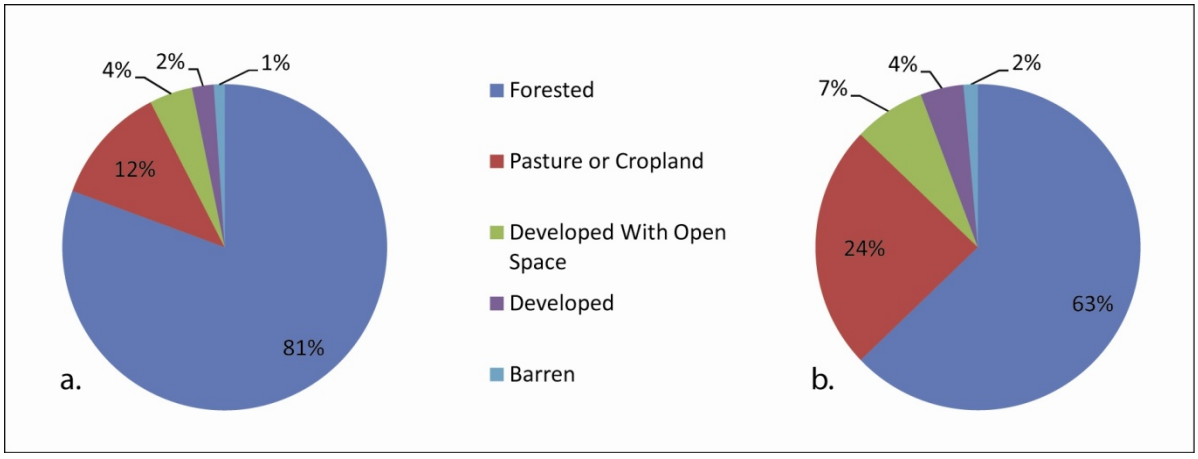


Figure 4-7. Land Use/Land Cover of TVA Reservoir Lands (a) and Non-TVA Lands within 0.25 Mile of TVA Reservoir Lands (b).

Across the TVA reservoir system, approximately 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

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 FPPA requires that all federal agencies evaluate impacts to farmland prior to converting such land permanently to nonagricultural land use.

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 (Table 4-13). On average, this represents 33.2 percent of the total area farmed within the seven-state power service area.

Table 4-13 Acreage of Prime/Unique Farmland and Farming Trends in the Seven States Comprising the TVA Power 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 power service area increased between 2 to 25 percent. During the same period, the average size of farms within these same states 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 had the greatest decline in the number of farms and the land area committed to farming, and Alabama and North Carolina both had large declines in the average size of farms (Table 4-13).

Prime farmland and farmland of statewide or local importance make up about 12 percent of TVA reservoir lands. For those reservoirs with available soil survey data, the proportion of this farmland ranges from 0 to 48 percent (Table 4-14).

Table 4-14. Area of Prime/Unique Farmland Surrounding TVA Reservoirs

Reservoir	Total Area (acres)	Percent of Farmland Protected by FPPA	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Farmland of 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

Reservoir	Total Area (acres)	Percent of Farmland Protected by FPPA	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Farmland of Local Importance (acres)
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 lands allocated for conservation partnerships

Many of TVA's non-hydroelectric generating facilities were established 40 to 50 years ago and 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.

The evaluation of the extent and magnitude of potential changes in the visual environment that could result from a proposed action is typically based on:

- 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, stand 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.

Visual Characteristics of TVA Lands

TVA lands and areas of jurisdiction include power plants, dam reservations, reservoirs, and tracts of land adjacent to the reservoirs that range in size from tenths of an acre to several hundred acres. Because the scenic features of the landscape are not limited by land boundaries, the attractive landscape character extends across TVA lands and other public and private lands alike. The natural elements together with the communities and other cultural development often provide a scenic, rural countryside.

Land uses adjacent to the reservoirs include residential development, public parks, commercial development, and sporadic industrial facilities. The reservoirs offer abundant water-recreation opportunities along with a variety of scenery. Most 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 (TVA 2004), 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 headwater and embayment areas. Headwater areas often revert to characteristics of the original river environment, including wide, barren shorelines and discolored rock bluffs along the former river channel. Exposure of reservoir bottom areas is common to both tributary and mainstem reservoirs.

The visual effect for mainstem 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 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 is 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 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 mainstem 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 mainstem reservoirs to residential developments that are common to both mainstem 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 that 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 reservations 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, river, or reservoir 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 lands and other lands where TVA owns flowage easements.

Floodplains provide and support many natural resources and functions of considerable economic, social, and environmental value. These values and benefits include 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 development in 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 10.7 million, as reported by the 2010 Census (U.S. Bureau of the Census, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml). Appendix K includes a table showing historical and projected population for the counties in the region.

The total population of the TVA region increased by 10.9 percent from 2000 to 2010. This was a slower growth rate than the 15.5 percent increase from 1990 to 2000. Nevertheless, these growth rates exceeded the national rates of 9.7 percent from 2000 to 2010 and 13.2

percent from 1990 to 2000. If recent trends continue, the region will have a total population of about 11.6 million in 2020 and 12.5 million in 2030 (Table 4-15).

Table 4-15. Resident Population, Tennessee Valley States

Area	Census Results		Projected Population	
	2000	2010	2020	2030
TVA Region	9,674,255	10,732,758	11,586,384	12,548,086
Alabama	4,447,100	4,779,736	5,088,401	5,410,837
Georgia	8,186,453	9,687,653	10,756,852	12,048,802
Kentucky	4,041,769	4,339,367	4,575,877	4,838,109
Mississippi	2,844,658	2,967,297	3,171,981	3,354,460
North Carolina	8,049,313	9,535,483	10,357,770	11,465,210
Tennessee	5,689,283	6,346,105	6,868,376	7,462,676
Virginia	7,078,515	8,001,024	8,783,469	9,627,145
United States	281,421,906	308,745,538	333,510,007	360,104,340

Source: Historical data from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.
Projections are trends based on 1970 to 2010 Census of Population data.

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.

About 6.7 million people live in the 16 metropolitan areas located within the study area (Table 4-16; see Figures A-13 and A-14, Appendix A). Notable clusters of counties with relatively low populations are located on the Cumberland Plateau in Tennessee, along the Tennessee River in western 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	1,316,100	1,254,420	61,680
Jackson, Tennessee	115,425	115,425	
Florence-Muscle Shoals, Alabama	147,137	147,137	
Decatur, Alabama	153,829	153,829	
Huntsville, Alabama	417,593	417,593	
Chattanooga, Tennessee-Georgia	528,143	528,143	
Dalton, Georgia	142,227	142,227	
Cleveland, Tennessee	115,788	115,788	
Knoxville, Tennessee	698,030	698,030	
Morristown, Tennessee	136,608	136,608	

Metropolitan Area	Total Population	Population Within Study Area	Population Outside Study Area
Kingsport-Bristol-Bristol, Tennessee-Virginia	309,544	309,544	
Johnson City, Tennessee	198,716	198,716	
Bowling Green, Kentucky	125,953	125,953	
Clarksville, Tennessee-Kentucky	273,949	273,949	
Nashville-Davidson-Murfreesboro, Tennessee	1,589,934	1,589,934	
Asheville, North Carolina	424,858	424,858	
Total	**6,693,834**	**6,632,154**	**61,680**

Source: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.
Note: 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/bulletins/b10-02.pdf).

Employment

In 2009, the total employment for the TVA region was 5.74 million (http://www.bea.gov/regional/reis/). Regionally, manufacturing accounted for approximately 10.4 percent of all employment, somewhat higher than the national average of 7.1 percent. Manufacturing accounts for a substantial share of employment in many rural areas of the region (see Figure A-15, Appendix A) and exceeds 20 percent of all employment in some counties.

However, the level of employment in manufacturing has been declining, both regionally and nationally, for a number of years. As of 2009, the estimated manufacturing employment in the region was about 596,000. This figure is a sharp decrease from about 852,000 a decade ago. 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 2.8 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 source of income. 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 2009, the per capita personal income for the study area was $32,643, about 82 percent of the national average of $39,635 (http://www.bea.gov/regional/reis/). However, the 2009 average income levels vary widely across the study area. For example, the average income for Williamson County, Tennessee, was 135 percent of the national average at

$53,392, and Hancock County, Tennessee, was 48 percent of the national average at $19,186 (see Figure A-17, Appendix A).

Most counties with relatively high per capita income levels are in metropolitan or metropolitan areas. 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 have somewhat higher costs of living, especially for housing.

Minority Populations
Minorities constitute 22.2 percent of the population within the study area, well below the national average of 36.3 percent (http://factfinder.census.gov/home/saff/aff_transition.html). 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 2009, the poverty level for the study area is estimated to be 17.4 percent, higher than the national average of 14.3 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.

Table 4-17. Navigation Locks 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 (TVA data).

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 mainstem 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 mainstem 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).

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 ppm = parts per million µg/m^3 = micrograms per cubic meter

(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.

The implementation of some NRP activities 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 both NSR programs 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.

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 4-8, 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.

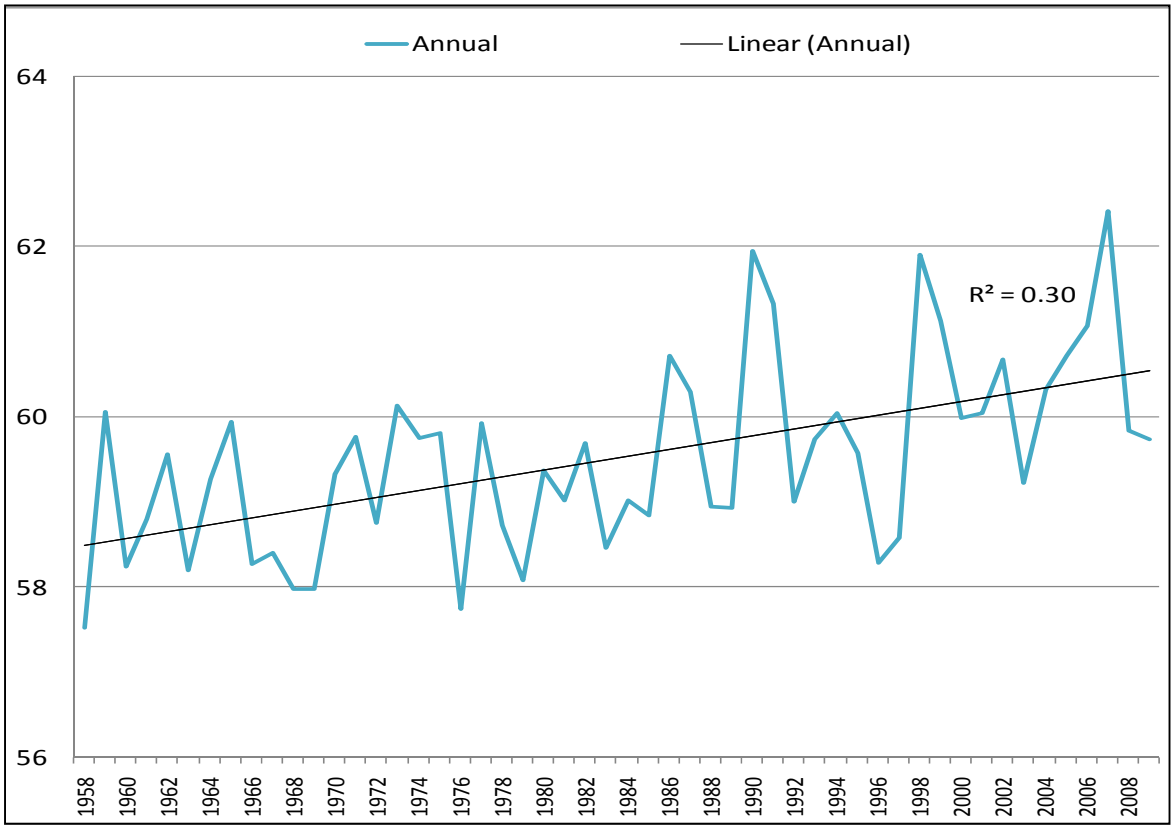


Figure 4-8. 1971-2000 TVA Region Annual Average Temperature (°F) Based on Data from Six National Weather Service Stations

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).

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).

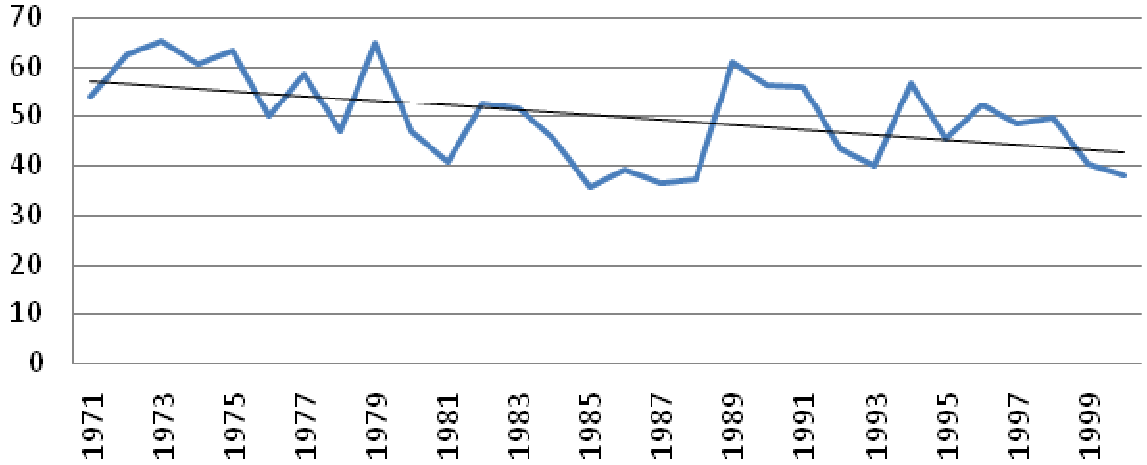
Table 4-20. Monthly, Seasonal, and Annual Precipitation Averages in the Tennessee River Watershed for 1971-2000

	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 4-9). 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 4-9. 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

[2] Data for 1971 and 1972 are not available from the National Climatic Data Center.

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 4-10). 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.

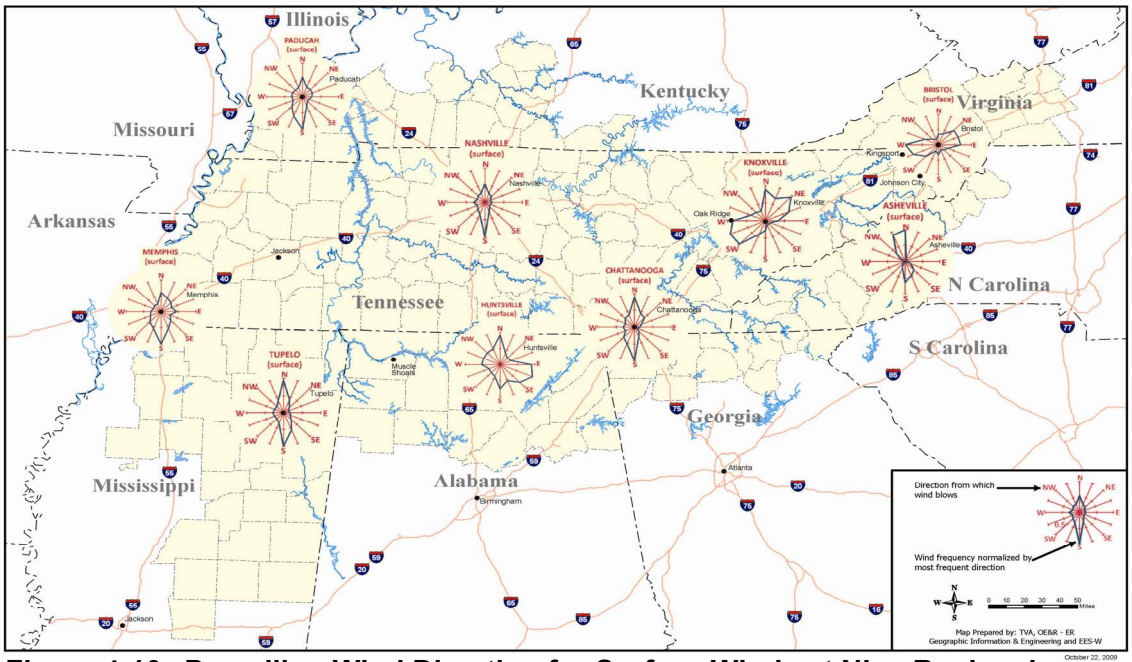


Figure 4-10. Prevailing Wind Direction for Surface Winds at Nine Regional Airports, 1973-2000

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 and Browns Ferry Nuclear Plant since the 1970s. Figure 4-11 shows these monitoring results as well as cloud cover measurements at the Chattanooga airport (about 15 miles from Sequoyah) and at the Huntsville airport (about 21 miles from Browns Ferry). Cloud cover at the Chattanooga airport was negatively correlated (correlation coefficient of -0.35) with solar radiation at Sequoyah, and cloud cover at Huntsville airport was negatively correlated (correlation coefficient of -0.38) with solar radiation at Browns Ferry. 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 the two plants 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.

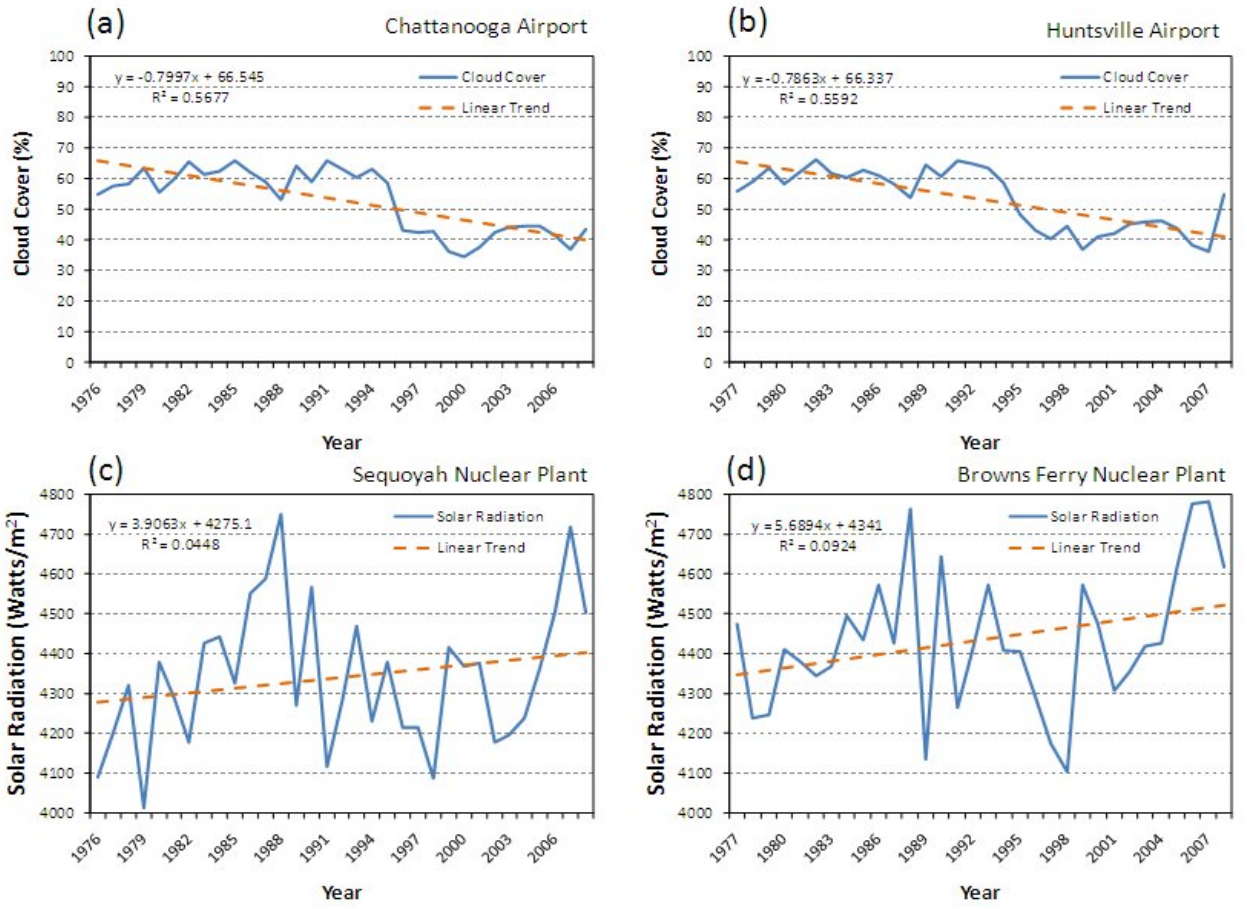


Figure 4-11. Annual Observations and Fitted Trend Lines for Cloud Cover at Selected Airports (a and b) and Solar Radiation at Selected Nuclear Plants (c and d) for 1976/1977-2008

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CHAPTER 5 - 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.

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 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, reduce flood damage, 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 reservoir lands total approximately 293,000 acres (458 square miles) encompassing parts of the seven Valley states. In addition, TVA manages approximately 9,100 acres of land at its power facilities throughout the region. Historically, TVA has made approximately 485,300 acres of land available for resource conservation purposes, including recreational developments (Table 1-1). Today, TVA manages between 5 and 10 percent of the recreation facilities in the region (Section 4.1.1, Table 4-1). As described in Figure 4-7, approximately 6 percent of TVA reservoir lands are developed, 12 percent are pasture or cropland, and 81 percent are forested. These figures are in significant contrast to the approximately 11 percent developed, 24 percent pasture or cropland, and 63 percent forested on the surrounding lands within 0.25 mile of TVA lands. 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 to be implemented over 20 years. Over this period, existing conditions in the TVA region are expected to change. 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 (TVA 2011). 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 3-9).

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 lands 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 2-9), TVA estimated that system-wide percentages of land in Zones 2, 3, 5, and 7 would change very little. The potential for change is greater 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 6 allocations normally results in a decrease in Zone 4 allocations and vice versa.

Under all alternatives, TVA would continue to allocate most lands 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, be expected to conserve sensitive resources on their lands, pursuant to federal and state regulations. Other regional efforts such as land trusts and programs operated by The Nature Conservancy and other non-governmental organizations 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 undeveloped 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 undeveloped lands. Similarly, should the proportion of TVA lands allocated to conservation purposes increase, the area of undeveloped TVA lands would remain relatively stable. The proportion of the system-wide reservoir shoreline that is undeveloped, however, would continue to decrease due primarily to the development of residential shoreline. The changes on TVA lands would not result in regionally significant cumulative effects. However, on an individual reservoir, depending upon existing shoreline development, conversion of undeveloped lands to developed recreation facilities could be noticeable. Furthermore, conversion of shoreline forests and other habitats may have important local impacts 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 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 agencies, 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 recreation opportunities in the TVA region. Likewise, reduction of TVA recreation programs and facilities, as proposed under Alternative B, would negatively affect the cumulative total of recreation 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 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 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 activities associated with the resource management programs described in Chapter 2, TVA would conduct a site-specific environmental review for a proposed action, as appropriate. However, the typical impacts associated with these programs are described below.

5.1.1. Biological Resources Management

The biological resource management programs would mostly be implemented on the 231,000 acres of TVA lands allocated for natural resource conservation and sensitive resource management. These programs are expected to enhance the quality of targeted natural resources and to be beneficial overall. Such beneficial effects or impacts are described in the context of the program descriptions in Chapter 2. However, programs could have collateral adverse environmental impacts. The risk and severity of such collateral impacts would be mitigated by a variety of measure and activities. These include the replacement of nonnative vegetation with native plants; use of construction activity BMPs to avoid or reduce potential impacts to wetlands, aquatic life, and water quality; and the incorporation of design features to lessen the impact on visual integrity when appropriate. Site-specific review processes also would identify actions to avoid or reduce potential adverse impacts. These processes include the ESA Section 7 consultation process to address potential impacts on threatened and endangered species, the NHPA Section 106 consultation process to address potential impacts on cultural resources; and the NEPA review process itself that would identify measures to mitigate, reduce, or avoid potential impacts on wetlands, floodplains, and other important natural resources.

The remainder of this sub-section describes the typical impacts resulting from implementing specific biological resources programs and activities.

Dispersed Recreation — The types of dispersed recreation activities seen most often on TVA lands are picnicking, primitive camping, hiking, bank fishing, hunting, 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 and other management activities 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, public outreach programs would have indirect environmental effects through implementing some of the programs and activities described elsewhere in this section.

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 Wildlife Habitat Council (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 prescribed 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. Cultural Resources Management

The cultural resource management programs would be implemented on all TVA lands, including power plant reservations. The typical activities associated with managing cultural resources as described in Section 2.2 include the identification of cultural resource locations, protection of eroding archaeological sites and rehabilitation/reuse or documentation 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. Most other cultural resource management activities include site inspection, evaluation, and monitoring activities, various

consultations, and public outreach activities with little potential for direct environmental impacts.

5.1.3. Recreation Management

The recreation management programs would be implemented at those recreation facilities and stream access sites managed by TVA both on and off TVA reservoirs. The various alternatives focus on the operation and maintenance of these existing facilities and the remainder of this sub-section describes the typical impacts associated with the different program areas.

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 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 proposed in the NRP, relate to upgrades consistent with ADA guidelines, incorporation of innovative designs, and installation of measures to increase reduce power and water consumption and waste generation. These upgrades and installations may require limited 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 include upgrades similar to those described above for campgrounds. The development of additional greenways and reservoir and stream access sites would result in the construction of access roads and parking areas, trails and any associated foot bridges, and boat launching ramps or other facilities. 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 recreation public outreach programs, themselves, would not directly impact the environment. Programs and activities promoted by such outreach efforts could have minor adverse impacts that are addressed in the context of those programs.

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.

5.1.4. Reservoir Lands Planning

The methodology which drives reservoir lands planning would not directly impact the environment. The proposed Comprehensive Valleywide Land Plan (CVLP) would establish a range in land use zone allocations (Table 2-9). 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 lands for each land use zone is defined in Appendix F. Prior to approving any proposal to use TVA land, TVA would conduct an appropriate site-specific environmental review.

Zone 2 (Project Operations) — Between five and seven percent of TVA lands would be allocated for project operations. Currently, seven percent of TVA lands are allocated to this use across the reservoir system, the upper limit of the CVLP range. Consequently, there would be no increase in potential impacts from allocating lands to Zone 2. The largest potential change would result in a 29 percent reduction in the land available for project operations. Land removed from Zone 2 would most likely be allocated to Zone 4 - Natural Resource Conservation or Zone 6 - Developed Recreation. Allocation to Zone 4 would result in minimal environmental impact. Allocation to Zone 6 would likely result in the development of recreation facilities and the resulting impacts from site clearing and grading, establishment of lawns, and the construction of access roads, parking areas, boat launching areas, restrooms and other buildings. These impacts can include increases in runoff, altered wildlife habitats, and localized increases in vehicle and boat traffic. Typical activities associated with project operations on Zone 2 lands include lawn mowing and landscaping and building maintenance. Some TVA lands allocated for project operations also contain day use areas. The impacts associated with operation and maintenance of day use areas have been described above.

Zone 3 (Sensitive Resource Management) — The 17 percent of lands allocated to sensitive resource management could decrease to 16 percent or increase to 18 percent. This is the equivalent of about a 6 percent decrease or increase in land area in Zone 3. 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. Lands removed from Zone 3 would likely be allocated to Zone 4 - Natural Resource Conservation or to Zone 6 - Developed Recreation. The impacts of these allocations would be similar to those described above for allocating lands from Zone 2 to Zones 4 and 6.

Zone 4 (Natural Resource Conservation) — Sixty-one percent of TVA lands are presently allocated to natural resource conservation; this allocation could change to between 58 and 65 percent. The potential change would vary from a 5 percent reduction to a 7 percent increase. The typical types of projects implemented within Zone 4 lands are biological and cultural resource management activities. The impacts associated with implementing these have been described above. Lands removed from Zone 4 would likely be allocated to Zone 3 - Sensitive Resource Management or to Zone 6 - Developed Recreation. Allocation to Zone 3 would result in minimal environmental impact. The impacts of allocating lands from Zone 4 to Zone 6 would be similar to those described above for allocating lands from Zone 2 to Zone 6.

Zone 5 (Industrial) — Between one and two percent of TVA 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, but a loss of the potential economic benefits associated with such use. Lands removed

from Zone 5 would likely be allocated to Zone 4 - Natural Resource Conservation or to Zone 6 - Developed Recreation. Most of the lands that would be removed from Zone 5 are likely undeveloped, and thus allocating them to Zone 4 would likely result in minimal environmental impact. The impacts of allocating them to Zone 6 would be similar to those described above for allocating lands from Zone 2 to Zone 6. Typical impacts of industrial development result from site clearing and grading, construction of access roads, parking areas, and utility connections, and construction of buildings. Depending on the type of industry, there could also be air emissions, discharges of water pollutants, and production of solid waste. Under Alternatives B, C, and D, the restriction of industrial development on Zone 5 lands to "light industrial" would be removed (see Section 2.4.1 and Appendix F). This would allow for a broader range of industrial development and potentially greater environmental impacts. Because of applicable regulatory and permitting requirements, the likelihood of these impacts being significant is low.

The impacts of recreational development of reallocated Zone 5 lands would likely be less than those resulting from industrial development.

Zone 6 (Developed Recreation) — Eight percent of TVA lands are currently allocated for developed recreation purposes. This allocation could increase to 10 percent for a 25 percent increase in Zone 6 land area. Most of this land would likely be reallocated Zone 4 - Natural Resource Conservation lands, and it would eventually be developed to accommodate the forecasted increase in demand for recreation resulting from population increases and changing leisure activities. The typical impacts associated with the development of recreation facilities result from site clearing and grading, establishment of lawns, and the construction of access roads, parking areas, boat launching areas, restrooms and other buildings. These impacts can include increases in runoff, altered wildlife habitats, and localized increases in vehicle and boat traffic. Depending on the location of the new facilities, there could be unavoidable impacts to wetlands which would be mitigated by wetland enhancement or the purchase of mitigation credits.

Zone 7 (Shoreline Access) — Approximately 5 percent of TVA lands is allocated for shoreline access purposes; this proportion is expected to remain unchanged. 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 lands is equal to approximately 1,847 miles of shoreline. In these areas, the adjoining private property owner can access the reservoir across TVA–managed land. The future allocations for shoreline access are guided by TVA's Land Policy.

5.1.5. Water Resource Management

The water resource management programs have been limited to those 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 short-term increases in sedimentation and very localized alterations of shoreline and stream-bottom habitats. 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 invasive species. Sedimentation from the installation of aquatic habitat enhancements such as fish attractors would be 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.

Public Outreach Programs — Projects resulting from the Clean Marina and water resource outreach campaigns directly benefit the environment. The implementation of the QGP and water efficiency program would not directly impact the environment. Clean Marina certification 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. The indirect beneficial impacts may include localized improvements in water quality due to the implementation of non-point pollution best practices and promotion of water conservation.

Water Resource Improvement Programs — The beneficial impacts from water resource improvement programs range from sediment reductions in tributary streams to nutrient reductions in TVA 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.

5.1.6. Public Engagement

The proposed volunteer program and the foundation and trust fund would, respectively, increase TVA's use of volunteer labor and provide a source of funding for natural resource management projects. These programs have little potential for adverse impacts.

5.2. Recreation

5.2.1. Developed Recreation

Under all of the alternatives, TVA proposes to maintain and/or upgrade varying numbers of its existing campgrounds, day use areas, and stream access sites. TVA would assist in the development of greenways and stream access sites under Alternative C, and would develop blueway access sites under Alternatives A and C. New recreation facilities on TVA reservoirs would primarily be provided by other public and private agencies, either on land they control or on TVA lands zoned for developed recreation. TVA would be involved in the development of these facilities through the Section 26a approval process for shoreline facilities and in providing the rights for the use of any TVA land.

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 population and recreation needs over the

next 20 years. In general, this alternative would generate a higher level of public recreation benefits and opportunities than Alternative B, a lower level than what would be achieved under Alternative C, and a slightly lower level than 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 accessibility 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 deterioration of high use sites. However, progress in meeting both sustainability objectives and accessibility standards would be slower compared to Alternatives C and D.

TVA would continue to provide limited assistance to partners and stakeholder groups in trail, greenway, and blueway development. However, TVA would not proactively participate in the development of additional blueway, trail, and greenway corridors and would contribute little to meeting the growth in future needs within the region. TVA would continue to 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 management agreements. However, efforts to enhance sustainability of resources at some sites would not be undertaken under this alternative and ongoing environmental degradation would not be as effectively addressed.

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 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 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 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 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. In addition, environmental conditions at unmaintained and closed facilities could increasingly deteriorate over time.

Under this alternative, three of the four campgrounds and the 33 day use areas 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, picnicking, boat launching, swimming and related facilities and services at those areas. However, changes in 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. Operators could also charge fees for use of swimming areas, trails, boat ramps, and picnic facilities, traditionally available free of charge under TVA management. The closure of Mallard Creek, Loyston Point, or Barton Springs would significantly reduce opportunities for camping and related day use activities on Wheeler, Norris, and Normandy reservoirs. Closure of Loyston Point could also result in restricting access to the 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.

Depending on the number of campgrounds and day use areas closed, negative impacts could range from small (only a few relatively remote and lightly used areas closed) to significant (large number of heavily used areas closed). Negative impacts resulting from area closings include:

- Loss of existing accommodations for camping and related activities.
- Loss of existing accommodations for water-based recreation activities including boat launching, picnicking, and swimming on TVA 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. 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 more environmentally sensitive development and management of recreation areas on TVA 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 accessibility 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 accessibility standards. In addition, TVA would undertake additional resource conservation and sustainability measures to reduce the environmental impacts of its recreation areas. Increased partnership agreements to develop additional trails, greenways, 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.

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 land. Expansion of the LNT Program could result in recreation users changing their habits to reduce their impacts.

New outreach initiatives that would be implemented include annual tours, the Camp-Right Campground Program, 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. Camp-Right would result in a reduction in the environmental footprint of developed commercial and public campgrounds. The establishment of the Resource Ranger Program could result in increased compliance with recreation regulations and/or guidelines, reduced criminal activity, and increased 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 noticeably greater public recreation benefits than Alternative B, a somewhat greater level of benefits than Alternative A, and fewer benefits than Alternative C.

The campgrounds located on dam or power plant reservations would be upgraded to meet accessibility 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 accessibility 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. 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.

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.

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 its current dispersed recreation management activities. This level of management would likely 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 affects 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 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 lands.

One heavily impacted dispersed recreation area would be mitigated annually. Based on available data, there are over 800 existing dispersed recreation areas on TVA 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 100 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 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 comply with regulations and meet policy objectives. This alternative would be an increase in effort from Alternative A. However, it would focus only on existing impacts and issues as currently known and provide little flexibility to adapt to emerging issues during the life of the NRP.

The process of collecting data on dispersed recreation areas would be modified to align with the LCA methodology. 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 lands are often 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 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 region who are unfamiliar with TVA lands or the appropriate use of these areas. The implementation of this campaign would help TVA meet its management objectives by providing users with information to be better stewards of TVA lands.

Five heavily impacted dispersed recreation areas would be improved annually. Based on past data collection, there are an estimated 108 heavily impacted dispersed recreation areas on TVA lands. Improving five areas annually would result in all known areas within the next 20 years and result in long-term benefits to the users of these sites, and to adjacent land and reservoir areas.

TVA would continue to manage its existing 100 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). The minimal management of existing dispersed recreation trails is correction of hazards to public safety. TVA would not construct new trails which would likely result in the demand for trails exceeding the supply.

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 align 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 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 lands.

TVA would implement 20 key dispersed recreation opportunities annually. This effort is specifically designed to meet current 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 unfamiliar with TVA 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 lands. The level of effort for this educational campaign would be greater than under Alternative B. In addition to basic information on TVA 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 lands and their associated needs.

Twenty-five heavily impacted dispersed recreation areas would be improved annually. This would result in all of the estimated 108 heavily impacted areas being improved 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 the other alternatives.

This alternative also includes the development and implementation of formal regulations on recreational use of TV lands. The enforcement of these regulations would be a vital component in reducing abuse by providing a meaningful deterrent to actions that degrade the integrity of TVA 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 100 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. It would formally inventory existing trails and monitor population/demand to ensure that existing and future trails are effectively meeting the needs of trail users. The addition

of 20 miles of new trails per year would greatly expand the TVA trails system. These additions are taking into account the most popular of trail activities including hiking, bird watching, and nature observation. This expansion from Alternatives A, B and D would allow the full utilization of all dispersed activities that are facilitated by trails maintenance and development.

The change in reservoir lands planning to the CVLP under Alternative C could result in a change in the land area allocated to Sensitive Resource Management and Natural Resource Conservation, where a large proportion of dispersed recreational activities occur. The potential reduction in lands allocated to these zones is relatively small and adverse impacts to dispersed recreation opportunities would likely be at a local rather than regional scale.

Potential cumulative impacts of Alternative C are the most positive of 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 beneficial than Alternative C and more beneficial 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 annually implement enough projects Valleywide to benefit a wide variety of stakeholders needs. The impacts of this alternative are less beneficial than Alternative C and more beneficial than Alternatives A or B.

Under Alternative D, TVA would implement the same dispersed recreation educational programs and develop and implement formal regulations as under Alternative C. TVA would not conduct the user surveys included in Alternative C, which would result in less available information about dispersed recreational uses of TVA lands. TVA would develop and implement multiyear dispersed recreation plans but would have less user information available during the planning process.

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 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.

The impacts to trails would be similar to those under Alternatives A and B. TVA would continue to manage its existing 100 miles of trails and correct potential public safety hazards. TVA would not construct new trails which would likely result in the demand for trails exceeding the supply.

The change in reservoir lands planning to the CVLP under Alternative D would be the same as under Alternative C. The potential reduction in lands allocated to Sensitive Resource Management and Natural Resource Conservation is relatively small and adverse impacts to dispersed recreation opportunities would likely be at a local rather than regional scale.

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.

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 natural areas preservation and management would continue to deteriorate. Currently, TVA does not actively manage all of its natural areas and most of them do not have an area-specific management plan. This alternative has the greatest potential to result in continued degradation of natural areas because of the lack of active management. Eventually, some or all of TVA's natural areas would no longer have the scenic, aesthetic, and exemplary biological values that define them. TVA natural areas designated for low-impact recreational use may no longer meet safety standards for public use, which would result in their closure.

Annual monitoring of eight TVA natural areas allows for assessments of their condition and inventories of plant and animal communities. Because only a few HPAs benefit are currently monitored, the information about the condition of the remaining TVA natural areas would remain haphazard and inconsistent; this would adversely affect their maintenance.

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 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 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 low frequency at 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, the preservation and management of TVA natural areas would be adversely impacted due to lack of both active management and management plans specific to each area. Monitoring of TVA natural areas would continue under Alternative B, with one-third monitored annually. Alternative B would result in slightly less adverse effects to natural areas than Alternative A due to increased monitoring and assessment of management needs.

Under Alternative B, the duration of reservoir land planning efforts would be reduced. This would benefit natural areas because RLMPs would be completed in a shorter amount of time compared to Alternative A. Therefore, opportunities for designation of new natural areas would potentially occur more frequently.

Alternative C **— Flagship Management Alternative**
Alternative C would result in the greatest beneficial impacts to TVA natural areas. The major differences between this alternative and Alternatives A and B are the inclusion of the development and implementation of comprehensive management plans for about 33 natural areas per year and the establishment of new criteria for designating new natural areas and removing existing natural areas. Other activities currently associated with natural areas management and protection would continue as described under Alternatives A and B.

Developing and implementing area specific monitoring and management plans would result in more opportunities to identify issues and implement maintenance needs to ensure management objectives are met on a larger number of natural areas. These actions would have a positive effect on the natural areas program.

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 more 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 designated as a TVA natural area within a shorter time period. Non-TVA natural areas occurring on TVA lands would be affected similar to Alternative A.

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 natural areas; to encourage and support research; to conduct environmental education 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 educational programs) is expected to outweigh any negative impacts.

The proposed increased monitoring of natural areas would improve TVA's ability to detect and respond to management needs resulting from various factors, including the impacts of anticipated increased future demand for dispersed recreation use (both authorized and unauthorized activities).

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 effects to natural areas would be beneficial and more beneficial compared to Alternatives A, B, and C.

Alternative D **— Blended Management Alternative**
Under Alternative C, the impacts to TVA natural areas would be similar to those of Alternative C. The major difference would be that under Alternative D about 15 natural area plans would annually be developed and implemented, less than the 33 under 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.

The process of designating new natural areas under Alternative D would be the same as under Alternative C and result in the same beneficial impacts. 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 effects to natural areas would be more beneficial under Alternative D than 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 to develop and implement fewer management plans specific to each natural area would result in somewhat less beneficial impacts than under Alternative C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to natural areas under the four alternatives are shown in Figure 5-3.

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 implementing the current land management programs and activities. TVA would continue to address invasive plant encroachment into natural areas consistent with EO 13112 and actively participate in the Cooperative Weed Management Areas established in Mississippi, Georgia, and Tennessee. At least 38,000 acres of the 220,000 acres of Zone 3 and Zone 4 reservoir lands are likely infested with invasive plants (see Section 4.3.1). Outside of TVA natural areas, the relatively small of area on which invasive plants would be managed would likely not be sufficient to significantly reduce the infested area or reverse the spread of invasive plants, resulting in adverse impacts to both rare and more common native plant communities. Globally rare plant communities identified on reservoir lands would remain allocated in areas of sensitive resource management and natural resource conservation in RLMPs.

Cumulative impacts are expected to the terrestrial communities and biodiversity of the TVA region as a result of uncontrolled invasive plants and animals as well as 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 some 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 invasive plant encroachments into those areas with existing environmental commitments and/or sensitive resources while following EO 13112. TVA would develop the appropriate plans to ensure consistency with EO

13112. These plans would aid in preventing the inadvertent movement of invasive plants within the aquatic and terrestrial environment that can occur during routine operations. TVA would also increase the area on which invasive plants are managed from the 600 acres/year under Alternative A to 1,000 acres/year; given the large area of TVA lands infested with invasive plants, this area may not be sufficient to prevent adverse impacts to native plant communities.

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 somewhat more direct positive impact to prevent the introduction and spread of invasive plants 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. Unplanned tracts would be surveyed for rare communities and listed species, and habitat protection areas containing rare communities and species would be resurveyed in order to determine their viability. In addition, TVA would work cooperatively with other federal and state agencies to develop a more comprehensive land condition assessment.

TVA would expand invasive species control measures, enhancing consistency with EO 13112. TVA would develop work plans to aid in preventing the inadvertent movement of invasive species within the aquatic and terrestrial environment that can occur during routine operations. In cooperation with the state Cooperative Weed Management Areas, TVA would develop an Early Detection and Rapid Response Management Plan to identify and ultimately control invasive species on TVA lands. Educational programs would be implemented across the Valley to make stakeholders aware of the issues surrounding invasive species and methods by which they can avoid transporting them to other areas in the TVA region. The goal of managing invasive plants on 40,000 acres/year would likely result in their control and the rehabilitation of much of the infested area.

Direct, indirect, and cumulative impacts to plant communities would be similar to those described under Alternative A. The plans associated with EO 13112 would have a direct positive impact to prevent the introduction and spread of invasive species within the TVA region.

Alternative D **— Blended Management Alternative**
Globally rare plant communities identified on TVA 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 invasive plants would continue as described in Alternative B. Direct, indirect, and cumulative adverse impacts to plant communities would be comparable to those of Alternative B and less than those of Alternative C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to vegetation under the four alternatives are shown in Figure 5-4.

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 and policy 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 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 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 and policy objectives 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 invasive plant-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 localized adverse impacts to wildlife from alterations of wildlife habitat and increased levels of human disturbance. These 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. Adoption of the Blended Management Alternative would not result in significant 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.

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. TVA 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 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, applicable 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.

The current management issues identified in Section 4.4 would continue; some site-specific impacts to wetlands would be addressed when identified during land condition assessments (e.g., ATV access to wetlands blocked if identified as high priority), but in general, there would be negligible gains in wetland condition associated with this alternative.

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 lands.

TVA would conduct additional activities in support of database development, maintenance, and use. Activities would consist of an information-gathering effort on TVA 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 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. These activities would address some of the specific management issues and problems identified in Section 4.4.

This alternative would include a change to the CVLP methodology for planning TVA reservoir lands. The CVLP identifies target ranges for allocations to each land use zone for the Valley as a whole (Table 2-9); this could result in an increase in lands allocated to developed recreation, and a decrease in lands allocated to conservation (Zones 3 and 4). Despite this change, the CVLP would continue to allocate TVA lands including wetlands to either sensitive resource management or natural resource management. In cases where high-quality or unique wetland habitats are identified on TVA lands, these parcels may be designated as natural areas and managed appropriately.

Under this alternative, 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 this alternative would result in a positive effect on wetlands on TVA 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.

Figure 5-6. Relative Beneficial Impacts of the Alternatives on Wetlands

5.6. Water Quality

Alternative A — No Action Alternative
Improving water quality is the primary focus of the current and proposed Water Resources Management programs. Many of the current and proposed Biological, Cultural, and Recreation programs (including dispersed recreation management) would also likely result in net improvements to water quality. The practices and levels of active management are generally adequate to comply with regulations and to control pollutants in runoff from TVA 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. Shoreline erosion generates much larger amounts of sediment, but this is still a slight impact compared to other background sources.

TVA land under contractual agreements for agriculture, especially areas that allow grazing or row crops, can generate pollutants such as sediment, nutrients, bacteria, and pesticides. These areas total about 10,000 acres. For several years, TVA has been working with the licensees to reduce in impacts of the agricultural operations; these efforts would continue and the continued grassland and agricultural land management activities are not likely to result n significant environmental impacts.

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.

Erosion of shoreline archaeological sites, as well as the illegal exploration and excavation of artifacts on TVA land can generate sediment and associated pollutants. Shoreline erosion generates much larger amounts of sediment and sometimes impacts cultural resources. These sources create a slight impact compared to other background sources. Active protection of archaeological sites and enforcement of laws that protect cultural resources decrease these impacts.

The scope of current Recreation Management actions is on the maintenance and upgrading of 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. Water quality is not a primary focus of the recreation programs but the practices are generally adequate to comply with regulations and control potential runoff pollutants from TVA lands developed for recreation, although some pollutants reach adjacent water bodies in storm water runoff. However, good design, construction, and maintenance practices would make any impacts very slight. Waste treatment facilities would continue to be 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 throughout the Tennessee River watershed and create public support for water quality and water resources improvement.

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. Vital Signs and Fixed Station monitoring provides data for running the reservoir system, evaluating environmental impacts of any change to system operations, and for water quality improvement and protection activities.

Partnerships and relationships with state and federal agencies and non-governmental organizations that are concerned with water quality are important in water quality improvement and protection activities. TVA would continue to maintain these relationships.

The TVCMI Program provides education material to the public and certifies those marinas that take efforts to improve and protect water quality. The WEP promotes water provides educational workshops with the goal of reducing water use. 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 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 measurable 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.

In summary, TVA 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 of TVA lands generate substantial amounts of pollutants, activities on these lands are unlikely to have any measurable effect on water quality other than locally. TVA's management practices create opportunities for leadership by example, and management practices used by TVA can influence attitudes and expectations among visitors.

Management practices are generally adequate to comply with regulations and to control pollutants in runoff from TVA 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, there would be many changes to biological, cultural, and recreation management programs, but only a few of these would affect water quality. The removal of the restriction to "light industry" on Zone 5 — Industrial lands and the subsequent potential development of heavy industry could also affect water quality due to increased requirements for process water and increased discharges. TVA would review the potential impacts of proposed industrial developments on its lands and the facilities would be subject to NPDES discharge limits and other regulations and permitting requirements. These reviews and requirements would reduce the potential for significant impacts to water quality.

Increased management of sensitive biological resources and terrestrial habitat generally improves vegetative cover 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 negative impacts would be minor and short term. An increase in the number of heavily-impacted dispersed recreation sites repaired would also create a slight water quality benefit.

The small increase in shoreline stabilization of archaeological sites would create a slight water quality benefit. Although there is some potential for slight water quality impacts during construction, these impacts would be brief and would be minimized by appropriate management practices. TVA would close day use areas located off dam reservations. This would most likely have no impact on water quality, but aggressive conservation management by a new manager or reversion to forest if the facilities were closed may have a slight beneficial impact; poor management by a new manager or continued heavy recreation use after closing would have a slight adverse impact.

Water Resource Management programs have a direct connection to water quality and changes to these programs can therefore be expected to affect water quality. There would be several changes under this alternative.

Creation of the new Aquatic Ecology Management outreach and implementation program would target a watershed that is already in good shape for protection and enhancement. This would create a net water quality benefit, but the amount of water quality benefit would be difficult to predict because goals and activities would be specific to a particular project.

Stream assessments would be continued at the same rate, which would maintain the availability of current stream-condition data for decision-making. An aquatic monitoring program to evaluate climate change would be initiated under this alternative. This program would not provide direct water quality benefits but would provide information for any future mitigation activities.

Strategic Partnership planning would be continued, as would the TVCMP. The WEP and the QGP would be discontinued, but the Water Resource Outreach Campaign Program would be initiated. The WRICP would operate at a smaller scale than WEP and QGP combined, but would have more flexibility in terms of the water resource issues chosen for outreach activities.

The TWI Program would be eliminated. This program is intended to create significant measureable water quality improvement within the watershed-level project areas. Any water quality improvements generated by this program would also be eliminated.

The Nutrient Source Watershed Identification and Improvement 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. If effectively targeted, this program could create more water quality benefit than TWI at its current scale of operation.

The net direct impact of Alternative B would be slightly beneficial for the biological, cultural and recreation programs. The changes to the water resource programs would also likely create a positive impact, but the lack of water quality condition goals in addition to the currently undefined goals for some new programs makes it difficult to compare this alternative directly with the No Action alternative.

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 of TVA actions 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 in which 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 Aquatic Ecology Management, Climate Change Sentinel Monitoring, Nutrient Source Watershed Identification and Improvement Program, and Water Resource Improvement Campaign program, and the continuation of Strategic Partnership Planning and TVCMP would compensate for the elimination of the WEP, QGP and TWI programs. The cumulative impact of this alternative would be diffuse and difficult to quantify, but would result in greater water resource improvements than under the No Action Alternative, assuming greater total resource investment from TVA.

Alternative C — Flagship Management Alternative
Under this alternative, there would be additional changes to biological, cultural, and recreation management programs that would affect water quality. Probably the largest change would be the conversion of all current agricultural lease land to grassland or other appropriate wildlife habitat. After very slight potential negative water quality impacts during establishment of the new cover, this would be a slight long-term benefit to water quality. As with Alternative B, the proposed change to the reservoir lands planning Zone 5 definition could increase the potential for water quality impacts.

Refurbishment of dewatering areas would likely cause some short-term generation of pollutants, especially sediment, during construction, which would be minimized by use of appropriate construction management practices. This would not change the long-term negative water quality impacts of operating these areas.

Compared to the other alternatives, there would be a largest increase in acreage of terrestrial habitat improved. This 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 negative impacts would be minor and short term. An increase in the number of heavily-impacted dispersed recreation sites repaired would also create a slight water quality benefit.

A goal of 20 miles of trails would be constructed per year under this alternative; no trail construction is proposed for the other three alternatives. 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. There would also be a large increase in the number of heavily impacted dispersed recreation areas repaired. This would generate a slight water quality benefit.

This alternative would result in the greatest increase in shoreline stabilization for both archaeological site protection and erosion control. Although the benefits would be fairly localized and small on a regional basis, they would be greater than those of the other alternatives. Although there is some potential for slight water quality impacts during construction, these impacts would be brief and would be minimized by appropriate management practices.

Water Resource Management programs have a direct connection to water quality and changes to these programs can therefore be expected to affect water quality. There would be several changes under this alternative.

The new Aquatic Ecology Management outreach and implementation program would be larger than in Alternative B, expanding to three watersheds. This would create a net water quality benefit, but the amount of water quality benefit would be difficult to predict because goals and activities would be specific to a particular project.

Stream assessments would be expanded, which would improve the availability of current stream-condition data for decision-making. An aquatic monitoring program to evaluate climate change would be initiated under this alternative, and would have an expanded scope compared to Alternative B. This program would not provide direct water quality benefits but would provide important information for any future mitigation activities.

A new Case Study/Research Initiative Program would be initiated. This program would likely contribute information that could lead to additional water quality benefits; whether it directly results in water quality improvement would depend on the particular studies and initiatives.

Strategic Partnership planning would be expanded compared to Alternatives A and B. The TVCMP would also be expanded, with new education efforts and a net increase in the number of certified marinas. The WEP and the QGP would be discontinued, but the Water Resource Outreach Campaign Program would be initiated and expanded relative to Alternative B. Under this alternative, the WRICP would operate at a scale comparable to WEP and QGP combined, and would have more flexibility in terms of the water resource issues chosen for outreach activities.

A new grant program would be initiated to support water quality projects managed by other entities; this program is proposed only for this alternative. 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.

The TWI Program would be eliminated. This program is intended to create significant measurable water quality improvement within the watershed-level project areas. It would be replaced by the new Nutrient Source Watershed Identification and Improvement Program. Under Alternative C, this new program would be expanded to three reservoirs

and include sufficient resources to address point sources of pollution, compared to one reservoir and non-point source only for Alternative B. This program would reduce the pollutant loading to each water body by a greater amount than the TWI Program. If effectively targeted, this program could create more water quality benefit than the current TWI Program.

The Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions program would be initiated under this alternative. This program would study sources and transport of nutrients within the Valley that have the potential to impact the Gulf of Mexico and explore strategies for reducing the export of these nutrients from the Valley. Because of the scale of the Gulf hypoxia issue, this program is unlikely to have a measurable impact on water quality, but it would contribute to the knowledge base that is necessary to make progress on the issue.

The changes to the water resources programs under this alternative likely would create a positive impact compared to either preceding alternative, but the lack of water quality condition goals in addition to loading goals for the new programs makes it difficult to compare this alternative directly with the No Action alternative.

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 of TVCA's actions 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 in which TVA cannot directly participate; these programs, along with planning, assessment, and outreach programs in the biological, cultural, and recreation management 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 Aquatic Ecology Management, Climate Change Sentinel Monitoring, Case Study/Research Initiative Program, Water Resource Grant Program, Nutrient Source Watershed Identification and Improvement Program, and Water Resource Improvement Campaign program, and the expansion of Strategic Partnership Planning and TVCMP would compensate for the elimination of the WEP, QGP and TWI programs. The cumulative impact of this alternative would be greater water resource improvements than under both Alternatives A and B.

Alternative D — Blended Management Alternative

Most of the new programs and activities in Alternative C that would affect water quality are also present in Alternative D, although many of them would be implemented at a smaller scale. As with Alternative B, the proposed change to the reservoir lands planning Zone 5 definition could increase the potential for water quality impacts.

As under Alternatives A and B and unlike Alternative C, TVA would continue to lease land for agricultural uses, so this minor source of pollutants would continue. As in Alternative C, refurbishment of dewatering areas would likely cause some short-term generation of pollutants, especially sediment, during construction, which would be minimized by use of appropriate construction management practices. This would not change the long-term negative water quality impacts of operating these areas.

The acreage of terrestrial habitat improved under this alternative would be greater than in Alternative A, the same as in Alternative B, and much less than in Alternative C. This generally improves vegetative cover of soil and thereby provides slightly beneficial water quality impacts over the long term. During the process of improving habitat, bare soil and herbicide use may generate pollutants, but any negative impacts would be minor and short term. There would be an increase in the number of heavily impacted dispersed recreation areas repaired over Alternatives A and B, but a reduction compared to Alternative C. Water quality benefit would be proportional to the number of sites repaired.

Shoreline stabilization activity for archaeological site protection and erosion control would be greater than in Alternatives A and B and less than in Alternative C, and water quality benefits would be proportional to the amount of shoreline stabilized. Although there is some potential for slight water quality impacts during construction, these impacts would be brief and would be minimized by appropriate management practices.

Water resource management programs have a direct connection to water quality and any changes to these programs can therefore be expected to have greater water quality impacts than the other programs evaluated. There would be several changes under this alternative.

The new Aquatic Ecology Management outreach and implementation program would be larger than in Alternative B, expanding to three watersheds, as in Alternative C. This would create a net water quality benefit, but the amount of water quality benefit would be difficult to predict because goals and activities would be specific to a particular project.

Stream assessments would be expanded over Alternatives A and B, though not as much as in Alternative C. This would improve the availability of current stream-condition data for decision-making compared to Alternatives A and B, but reduce the availability compared to Alternative C.

An aquatic monitoring program to evaluate climate change would be initiated under this alternative, and would have a larger scope compared to Alternative B but smaller compared to Alternative C. This program would not provide direct water quality benefits but would provide information for any future mitigation activities.

As in Alternative C, Strategic Partnership planning would be expanded compared to Alternatives A and B. The TVCMP would also be expanded, with new education efforts and a net increase in the number of certified marinas. The WEP and the QGP would be discontinued, but the Water Resource Outreach Campaign Program would be initiated and expanded over Alternative B. Under this alternative, the WRICP would operate at a scale smaller than Alternative C and somewhat smaller than the current scope of WEP and QGP combined, and would have more flexibility in terms of the water resource issues chosen for outreach activities.

The TWI Program would be eliminated. This program is intended to create significant measurable water quality improvement within the watershed-level project areas. It would be replaced by the Nutrient Source Watershed Identification and Improvement Program which would be implemented at a scale greater than Alternative B but less than Alternative C. The program under this alternative would address two reservoirs with sufficient resources to address point sources of pollution. If effectively targeted, this program could create more water quality benefit than TWI.

The Northern Gulf of Mexico / Mississippi River Basin Nutrient Load Reductions program would be initiated under this alternative and Alternative C, but would be scaled back compared to Alternative C . This program would study sources and transport of nutrient sources within the Valley that have the potential to impact the Gulf of Mexico. In this alternative, activities would limited to studying, monitoring, and planning, with no on-the-ground component. This program would have no direct water quality impact, but it would contribute to the knowledge base that is necessary to make progress on the issue.

The net direct impact of Alternative D to water resources likely would create a positive impact compared to Alternatives A, more positive impact than Alternative B but less than Alternative C. The lack of water quality condition goals in addition to sediment and nutrient loading goals for the new programs makes it difficult to compare this alternative directly with the No Action alternative.

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 of TVA's actions 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 in which TVA cannot directly participate; these programs, along with planning, assessment, and outreach programs in the biological, cultural, and recreation management 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 Aquatic Ecology Management, Climate Change Sentinel Monitoring, Nutrient Source Watershed Identification and Improvement Program, and Water Resource Improvement Campaign, and the expansion of Strategic Partnership Planning and TVCMP would compensate for the elimination of the WEP, QGP and TWI programs. The cumulative impact of this alternative would be greater water resource improvements than under Alternatives A and B, but since these programs would be at a smaller scale than Alternative C, the benefits would be less than under Alternative C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to water quality under the four alternatives are shown in Figure 5-7.

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, cultural, and recreation management programs, as well as reservoir lands planning occur on TVA lands and not in aquatic environments, these activities rarely result in direct impacts to aquatic resources. Some of the activities associated with these programs would reduce sediment runoff, which would benefit aquatic resources.

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 minor short-term, direct adverse effect on instream water quality and habitats. Project planning and appropriate implementation of BMPs would be utilized to minimize these effects.

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 directly affect aquatic habitats and communities. These activities would be carefully planned and implemented to minimize adverse impacts and would result in long-term beneficial, although fairly localized, impacts.

This alternative would continue to apply the existing methodology when planning lands along TVA reservoirs. Lands 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 land, the specific tract 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. Long-term effects on aquatic resources 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 Alternative B 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. Implementation of the Aquatic Ecology Management program in one healthy, high biological diversity watershed in the Tennessee River system would result in direct benefits to aquatic resources located within this watershed.

No significant adverse direct, indirect, or cumulative impacts to aquatic communities are expected to occur from implementation of Alternative B. However, many of the beneficial effects on water quality and aquatic communities that would result from Alternatives C and D would not be realized by Alternative B.

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. 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 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. Implementation of the Aquatic Ecology Management program in three healthy, high biological diversity watersheds in the Tennessee River system would result in direct benefits to aquatic resources located within this watershed.

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 Alternative C, 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 Alternative C is expected to result in a long-term 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 alternative.

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. Several of the programs associated with water quality improvements would be implemented at a higher level of effort than identified Alternatives A and B. Additional water quality and wildlife habitat improvements would be realized under this alternative when compared to Alternatives A and B. Implementation of the Aquatic Ecology Management program in three healthy, high biological diversity watersheds in the Tennessee River system would result in direct benefits to aquatic resources located within this watershed. These improvements would have a net long-term benefit to aquatic communities in the TVA region.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to aquatic ecology under the four alternatives are shown in Figure 5-8.

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 jeopardize the continued existance of any species listed as threatened or endangered or 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. USFWS has regulations that establish this consultation process and TVA has established a process for consultation with USFWS; see Appendix I for a summary of this process. The ESA also requires federal agencies, including TVA, to carry out programs for the conservation of endangered and threatened species. Under all alternatives, TVA will continue to comply with these ESA requirements. TVA will also continue its current monitoring of populations of endangered and threatened species and its cave protection activities on TVA lands, and continue to maintain its Natural Heritage database and honor agreements to share this data with other state and federal resource agencies. TVA will also continue to comply with the CWA, state regulations, EO 13112 (Invasive Species), and other applicable federal and state regulations through its environmental review process.

5.8.1. Aquatic Animals

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. TVA's natural resource management programs currently 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.

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. Implementation of the Aquatic Ecology Management program in one healthy, high biological diversity watershed in the Tennessee River system would result in direct benefits to aquatic resources (including endangered and threatened species) within this watershed. Because one of the criteria for choosing the targeted watershed is the presence of federally listed species, adoption of Alternative B is likely to have more direct benefit to endangered and threatened aquatic animals than 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. Any potential direct, indirect, or cumulative impacts to aquatic resources would be assessed during planning of NRP implementation projects. As part of the planning process, these impacts would be avoided, and/or minimized via existing regulatory mechanisms (particularly NEPA and ESA). 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 adverse 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. 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.

Implementation of the Aquatic Ecology Management program in three healthy, high biological diversity watersheds in the Tennessee River system would result in direct benefits to aquatic resources (including endangered and threatened species) within these systems. Because one of the criteria for choosing targeted watersheds is the presence of federally listed species, adoption of Alternative C is likely to directly benefit endangered and threatened aquatic animals. Because up to three watersheds would be addressed by this program, the benefits to endangered and threatened aquatic species would be greater than either the No Action Alternative, or Alternative B.

Due to the number of additional programs addressing endangered species management, conservation planning, and water quality and the level of effort proposed under the Flagship program alternatives, Alternative C would result in the most benefit to endangered and threatened aquatic animals.

Alternative D — Blended Management Alternative
Implementation of the Blended Management Alternative is expected to result in a positive effect listed aquatic species) in the TVA region. No long-term direct or indirect adverse impacts to aquatic habitats or communities are expected to result from this alternative.

Implementation of the Aquatic Ecology Management program in three healthy, high biological diversity watersheds in the Tennessee River system would result in direct benefits to endangered and threatened aquatic species within these systems. Because one of the criteria for choosing targeted watersheds is the presence of federally listed species, adoption of Alternative D is likely to directly benefit endangered and threatened aquatic animals. 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 No Action Alternative, or Alternative B. Adoption of Alternative D would result in fewer benefits to endangered and threatened aquatic species than Alternative C.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to listed aquatic species under the four alternatives are shown in Figure 5-9.

Figure 5-9. Relative Beneficial Impacts of the Alternatives on Listed Aquatic Species

5.8.2. Terrestrial Animals and Plants

Alternative A — No Action Alternative
Under the No Action Alternative, TVA would continue current stewardship activities designed to protect and enhance populations of endangered and threatened terrestrial

animals and plants and their habitats while providing recreational opportunities. TVA currently implements a variety of stewardship programs benefiting these species and meeting regulatory responsibilities for protecting them and their habitats. These programs mostly focus on federally listed species. Adoption of this alternative would not result in direct, indirect, or cumulative adverse impacts to federally listed species or their habitats. Adverse impacts to some state-listed species, particularly plants, could occur due to the likely continued spread of invasive species on TVA and adjacent lands. Reservoir lands planning would continue as it is currently implemented and most tracts containing listed terrestrial animals and plants, particularly federally listed species, would continue to be allocated to Sensitive Resource Management.

Alternative B — Custodial Management Alternative
Stewardship activities described under the Custodial Management Alternative would benefit listed species and their habitats. Impacts to federally listed species would differ little from those described in the No Action Alternative, and TVA would continue to allocate most tracts of TVA reservoir lands containing listed terrestrial animals and plants to Sensitive Resource Management. The increase in the area of invasive plant management efforts from 600 acres under Alternative A to 1,000 acres annually would be beneficial to listed plants and animals.

The transfer to other operators 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 areas. TVA would inform future operators of potential conflicts with listed species and provide information on how to avoid impacts to these resources.

Adoption of this alternative would have no direct or indirect adverse impacts to listed terrestrial animals and plants or their habitats. Adverse cumulative impacts could occur, particularly to state-listed species which receive a lower level of legal protection, from the continued development of other lands in the TVA region.

Alternative C — Flagship Management Alternative
Adoption of the Flagship Management Alternative would result in the highest level of beneficial impacts to endangered and threatened terrestrial animals and plants and their habitats. TVA would greatly increase its lands and natural area assessment and management activities, and increase its annual invasive plant management from 1,000 acres under Alternatives B and D to 40,000 acres. These activities would have a large direct beneficial effect on listed species and allow TVA to more rapidly identify and respond to threats to them, such as could result from encroachments, new invasive species introductions, and changes resulting from climate change. The change in reservoir lands planning methodology could result in a small decrease or increase in the area allocated to Sensitive Resource Management. Allocation of lands to this zone that contain sensitive resources, including endangered and threatened species, would continue to be a high priority during reservoir lands planning and any change in the area allocated would not likely result in a reduced level of protection for sensitive resources. Under Alternative C, TVA would increase its monitoring and management of listed species on TVA lands as well as its involvement in landscape-level conservation planning efforts over those of the other alternatives; these efforts would benefit many listed animals and plants.

Adoption of this alternative would have no direct or indirect adverse impacts to listed terrestrial animals and plants or their habitats. Adverse cumulative impacts could occur,

particularly to state-listed species which receive a lower level of legal protection, from the continued development of other lands in the TVA region.

Alternative D — Blended Management Alternative
Adoption of the Blended Management Alternative would result in a level of beneficial impacts somewhat greater than those resulting from Alternatives A and B, but noticeably less than those of Alternative C. The reservoir lands planning approach would be the same as Alternative C, with the same potential impacts to the amount of land allocated to Sensitive Resource Management. TVA's natural area management efforts, which would benefit several listed species, would increase over those of Alternatives A and B. Invasive plant control efforts would be similar to those under Alternative B.

Adoption of this alternative would have no direct or indirect adverse impacts to listed terrestrial animals and plants or their habitats. Adverse cumulative impacts could occur, particularly to state-listed species which receive a lower level of legal protection, from the continued development of other lands in the TVA region.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to listed terrestrial species under the four alternatives are shown in Figure 5-10.

Figure 5-10. Relative Beneficial Impacts of the Alternatives on Listed Terrestrial Species

5.9. Cultural Resources

The alternatives under consideration propose several programs designed to protect, preserve, enhance, and minimize adverse effects to historic properties located on TVA land. 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 programmatic agreement (PA) is being developed that addresses potential adverse effects and stipulates 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. In addition, the PA stipulates that TVA will prepare a Cultural Resource Management Plan within 3 years of the approval of the NRP in order to set specific long term cultural resource management goals for each of programs that are implemented under the NRP. This PA will be executed prior to the TVA Board's decision on the NRP.

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.

With the current state of deteriorating cultural resources under TVA management, this alternative would have the greatest overall 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.

As part of TVA's ARPA Program, two police investigators are dedicated to ARPA violation enforcement. While not a requirement under ARPA or its associated regulations, TVA took this proactive approach to the extensive looting and vandalism problem. By having these investigators on staff, TVA has been able to better protect numerous sites and deter vandals and looters. TVA manages approximately 11,500 recorded archaeological sites, and many sites are vulnerable to both looting and erosion due to their location along TVA's reservoirs. As a result, many archaeological sites on TVA lands have been extensively damaged. The ARPA investigators have been invaluable in deterring looting and vandalism of historic properties on TVA reservoirs and their work has resulted in several convictions. Continuation of this program would be very beneficial to archaeological sites on TVA 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 survey and identification of archaeological sites on about 2,000-3,000 acres of TVA lands annually. This focus has been limited to archaeological sites and does not include historic structures located on or within the viewshed of TVA lands. Evaluation of historic properties has been conducted through NHPA Section 106 for TVA-related undertakings and therefore have not been proactively focused on the most significant resources. Nominations to the NRHP have been limited to efforts by universities and community groups. At the current survey rate, it would take TVA over 60 years to complete its inventory of archaeological resources. However, this effort would be greater than the proposed inventory effort in the custodial alternative, which would increase this time to nearly 200 years. With a lack of historic structures data or inventory management, TVA buildings and structures eligible for listing in the NRHP would likely continue to deteriorate.

Records of historic properties managed by TVA are maintained through various data sources and TVAs 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 TVA. Continuation of the current form of data management would result in errors in the management of historic properties and may lead to inadvertent adverse effects to historic properties. Consolidated data on the resources under TVA management would continue to be a "best guess" making long-term management goals difficult and far less efficient than with a comprehensive database.

TVA currently conducts its monitoring and archaeological site protection, typically through shoreline stabilization and other means such as gating caves, under Section 106 mitigation agreements on TVA-related projects rather than through needs systematic assessments. Under the current archaeological site protection program, TVA has stabilized an average of 0.2 miles of shoreline per year, less than 0.01 percent of the estimated amount of critically eroding archaeological shoreline. Many sites in need of stabilization have not been protected. Where stabilization does occur, TVA takes the appropriate steps to ensure that the process of protection does not further impact the resource. Stabilization measures include the placement of rock riprap built out to an appropriate angle rather than shaping the bank. This requires additional costs, but ensures that no additional damage is done to the already deteriorated resource.

TVA has recently begun evaluating historic buildings associated with the Muscle Shoals Reservation for potential adaptive reuse. This type of study is consistent with 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 being developed 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 Alternative A would mean this integrative approach would not likely occur.

Alternative B — Custodial Management Alternative

Under the Custodial Management Alternative, TVA would establish programs to heighten adherence to 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 adverse effects under Alternative B would be fewer than under Alternative A as more programs would be implemented to benefit the resources. 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 all of 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.

The two TVA Police staff positions dedicated to ARPA enforcement would continue with approximately 1,000 security checks per year. While this effort continues to be minimal (11% of the overall sites recorded on the land), it is beneficial to maintain the dedicated investigators to build relationships with the U.S. Attorneys and other federal agencies with the same responsibilities. Funding would be included for archaeological support to assist in these cases, as well.

Although TVA nominally has a program to promote 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 with an annual budget, 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 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. Public education offers the greatest long-term effects to the resources by providing the public with a greater understanding of the need for protection in order to reduce the on-going looting problem. This alternative would support these efforts.

Under Alternative B, 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. This delay would push the completion of this inventory out to over 200 years vs. the 60 year plan currently being conducted. 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 lands to the NRHP. Under this alternative, historic structures on TVA lands would be enhanced through preservation and protection, reversing the deterioration rate of these resources. 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 risk of adverse effects to these properties as well as improve stakeholder relations 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.

Under 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 TVA 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). As a part of the cultural resource management plan specified in the PA being developed for the NRP, TVA would develop long term monitoring goals for approximately 150 shoreline miles per year and protect a specific number of sites from erosion and looting. The plan would help prioritize the resources in need of protection and

would be a great benefit to the resource. While limited in effort, it would demonstrate TVA's good faith effort 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.

Many new natural resource programs proposed for Alternative B 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 will be described in Appendix B of the PA being developed for the NRP. 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 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, Alternative C 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. This option would result in the greatest improvement in the current state of cultural resources on TVA land.

Under Alternative C, 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 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 environmental education 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 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.

Alternative C 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 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 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 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). 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 Alternative B. 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 being developed for this undertaking.

Alternative C includes a number of integrated land management activities that would be highly beneficial to biological and cultural resources on TVA land. In particular, a larger human presence on TVA 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, Alternative D would result in fewer adverse effects than Alternatives A and B and would provide greater benefit to those resources that are at greatest risk. This alternative would include the ARPA investigation program outlined in the Alternatives A and B. ARPA investigations curb adverse effects to archaeological sites resulting from illegal acts on TVA 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 Alternative B, 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 lands, implementing this alternative would be more beneficial than Alternatives A and B. 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 Alternative B. Those activities that would be enhanced in this alternative beyond the custodial level include the following:

- Identification of Archaeological Sites – The more rapidly TVA lands are inventoried for archaeological resources, the lower the risk of adverse effect. Under this alternative, the inventory would be completed three times.
- 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. 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 Alternative B.

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 Alternative B. In regards to the ARPA Enforcement Program, the effects of this alternative would be the same as Alternative A.

Under this alternative, other biological resource, recreation, and water resource management activities would be enhanced above Alternative B, and reservoir lands planning would create a CVLP. However, these activities have a potential to adversely affect historic properties as described under Alternative B. 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 being developed for this undertaking.

As with Alternative B, 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 5-11.

Figure 5-11. Relative Beneficial Impacts of the Alternatives on Cultural Resources

5.10. Land Use

Alternative A — No Action Alternative
Under the No Action Alternative activities currently associated with the management of TVA lands would not change. TVA would continue to plan its reservoir properties on an individual basis, and both the land use plans and subsequent implementing actions that result in changes in the use of particular tracts of land would be reviewed in accordance with TVA guidelines and policies and for compatibility with surrounding land uses. The most likely changes in the use of TVA lands would result from industrial development of Zone 5 lands and recreational development of Zone 6 lands. While the area allocated to Zone 5 is unlikely to increase, the future demand for developed recreation could result in an increase in the area allocated to Zone 6. These developments could result in adverse impacts to land use.

Alternative B — Custodial Management Alternative
The impacts to land use resulting from Alternative B would be somewhat greater than those of Alternative A. The differences result from the broadened definition of land use Zone 5 - Industrial that removes the light manufacturing restriction (see Section 3.2.2.4). While the impacts to land use resulting from the development of land allocated to Zone 5 - Industrial Development could increase, the total land area allocated to Zone 5 is unlikely to increase. The increased historic preservation efforts could also result in small beneficial impacts on land use.

Alternatives C — Flagship Management Alternative and D - Blended Management Alternative
These alternatives would have similar impacts to land use, although the impacts of Alternative D would likely be slightly greater than those of Alternative C. Under both alternatives, the same change in the land use Zone 5 definition described above for Alternative B would occur, resulting in the potential for industrial developments with greater land use impacts. The land area allocated to Zone 5 would not increase and could decrease, resulting in reduced land use impacts from industrial development. The land area allocated to Zone 6 - Developed Recreation would likely increase resulting in a reduction of land allocated to Zone 4 - Natural Resource Conservation with adverse impacts to the vegetation, wildlife, and the dispersed recreation use of these lands. Conversion of undeveloped area to developed recreation could adversely affect nearby land uses; these effects would be localized and TVA would assess them during the lands planning process and review of individual recreation developments. Many of the other programs and activities proposed under Alternatives C and D would reduce the impacts from current land uses.

Under all of the alternatives, residential and commercial development of privately owned lands adjacent to the TVA reservoirs would continue, as would the development of the TVA-managed residential access shorelands. As described in the SMI EIS (TVA 1996), this could result in adverse cumulative impacts to land use at some reservoirs.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to land use under the four alternatives are shown in Figure 5-12.

Figure 5-12. 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 is 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 tracts 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. The largest change in zoning designation would likely be from Zone 4 - Natural Resource Management, which is generally compatible with prime farmland protection, to Zone 6 - Developed Recreation. Depending on the characteristics of the individual tracts being rezoned, the eventual recreational development could adversely affect prime farmland.

Under all of the alternatives, proposed actions that could affect prime farmland would be reviewed according to FPPA procedures, including the 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. For sites receiving scores greater than 160 points (out of a possible 260), TVA would consider alternative locations or other modifications to the proposed action in order to reduce or avoid impacts to prime farmland.

Alternative A — No Action Alternative

Under Alternative A, minor adverse impacts are expected as lands 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 programs. 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.

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. Although the definition of reservoir land planning Zone 5 (Industrial) would be broadened, this is unlikely to increase potential impacts to prime farmland because the land area allocated to Zone 5 is unlikely to increase. Positive impacts to prime and unique farmlands under this alternative are related primarily to enhanced dewatering activities, continued forest management, invasive plant control, and increased public awareness of the importance of environmental stewardship.

Alternative C — Flagship Management Alternative
Under Alternative C, overall adverse impacts to prime farmland are expected to be minimal. 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, some minor adverse impacts are expected as lands are converted to uses incompatible with agriculture. As with Alternative B, the change in the definition of reservoir land planning Zone 5 (Industrial) is unlikely to increase potential impacts to prime farmland because the land area allocated to Zone 5 is unlikely to increase. The likely increase in Zone 6 - Developed Recreation land could affect prime farmland.

Positive impacts to prime and unique farmlands under this alternative would be related to both existing and new programs and activities:

- 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 forested, the proposed focus on forest management under this alternative can be beneficial to soil resources through protection and vegetation management (i.e., invasive plants).
- 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.

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.

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 5-13.

Figure 5-13. Relative Beneficial Impacts of the Alternatives on Prime Farmlands

5.12. Visual Resources

Although the NRP alternatives do not include programs specifically designed to improve the scenic quality of TVA lands and adjacent areas, the implementation of many programs would affect scenic quality. Under all alternatives, 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 (see Section 4.11). 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, and other factors 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.

Under all alternatives, TVA would continue to evaluate visual resources on a case-by-case basis and during the development of reservoir land management plans. The protection of lands with outstanding visual quality would continue to be a criterion for allocating them to Zone 3 - Sensitive Resource Conservation. The gradual change in the appearance of reservoir shorelines due to residential and commercial development of private lands and residential development of TVA-managed residential access shoreland would also continue under all alternatives.

Alternative A — No Action Alternative
Under this alternative, TVA would continue to evaluate visual resources on a case-by-case basis and during the development of reservoir land management plans. This would include TVA 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 and the other alternatives would likely result in the continued preservation of specific scenic areas through the reservoir lands planning process. A gradual loss of natural undisturbed areas would continue on some other lands. 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
As with Alternative A, TVA would continue to evaluate visual resources on a case-by-case basis and during the development of reservoir land management plans. This would include TVA 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.

Compared to Alternative A, Alternative B includes more programs that would result in localized improvements in the scenic quality of TVA lands. These include increased wildlife habitat enhancement partnerships, prioritized boundary maintenance, increased land condition assessment and maintenance activities, and increased efforts to repair heavily impacted dispersed recreation sites. The localized improvements in scenic quality, however, would likely not offset the continued decline in visual quality resulting from residential and commercial development and cumulative adverse impacts to visual resources would likely continue.

Alternative C — Flagship Management Alternative
The cumulative adverse impacts to visual resources resulting from residential and commercial development would likely continue. This alternative, however, would result in the implementation of the most programs and activities that would result in localized improvements in the scenic quality of TVA lands. These would include the implementation of the programs listed above for Alternative B at greatly increased levels, as well as increased upgrades to recreation facilities and increased shoreline stabilization. The various increased monitoring and assessment efforts would also allow TVA to respond more quickly to issues that degrade visual resources. As a result of these programs, Alternative C would result in the greatest beneficial impacts to visual resources.

Alternative D — Blended Management Alternative
Alternative D includes most of the programs included in Alternative C that would result in localized improvement in the scenic quality of TVA lands, but at lower levels of implementation. The beneficial impacts of this Alternative D would be greater that those of Alternatives A and B, but less than those of Alternative C. The cumulative adverse impacts to visual resources resulting from residential and commercial development would likely continue.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to visual resources under the four alternatives are shown in Figure 5-14.

Figure 5-14. 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 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 limit increases 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). The amount of shoreland made available for development would directly relate to the amount of potential impacts to natural and beneficial floodplain values. TVA would continue to require BMPs and other measures such as those described in the SMI EIS (1996) 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 5-15.

Figure 5-15. 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. This could result in slower growth in recreation expenditures, employment, and tax revenues that would otherwise occur. The overall adverse socioeconomic impacts on a regional basis, however, would be very small.

Alternative B — Custodial Management Alternative
Under this alternative, legal and policy requirements 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. The change in the Zone 5 land use definition could change the socioeconomic effects of the resulting industrial developments. Whether this would result in increased or decreased employment, personal income, and tax revenues is difficult to predict without knowing more details about the particular industries. Under this alternative, many recreation areas would be managed by third parties or closed. Third party management could result in user fees and thus increased costs to recreation users. Closure of areas would reduce recreation opportunities and cause recreation users to travel farther to alternative areas. Generally, this alternative is likely to have small localized negative socioeconomic 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. These programs would result in the greatest increase in the quality of visitors' experience on TVA lands and result in positive socioeconomic impacts. New lands planning strategies and ranges in land use zone allocations would be implemented, which could lead to significant changes that generate greater total benefits from TVA lands. While the potential increase in land zoned for developed recreation would directly result in socioeconomic effects, the resulting development of this land would result in local increases in employment, expenditures, and tax revenues. The change in the Zone 5 land use definition could change the socioeconomic effects of the resulting industrial developments. Whether this would result in increased or decreased employment, personal income, and tax revenues is difficult to predict without knowing more details about the particular industries.

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, the increased pressure on available resources as population grows, could result in some cumulative impacts. However, adverse 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. The change in the Zone 5 land use definition could change the socioeconomic effects of the resulting industrial developments. Whether this would result in increased or decreased employment, personal income, and tax revenues is difficult to predict without knowing more details about the particular industries.

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 5-16.

Figure 5-16. 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). Cumulative impacts could result if opportunities to better serve the public overall are lost. Alternative recreational opportunities likely would be located at greater distances and be more expensive. Although detailed information on users of TVA recreation areas is limited, any such negative cumulative impacts would be proportionately somewhat greater on 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, either through imposition of fees or increased travel. 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 Alternative A, although somewhat greater.

Alternative C — Flagship Management Alternative
The changes in reservoir lands planning under both this alternative and Alternative D would likely have little to no disproportionate impact to disadvantaged populations. TVA would continue to operate and upgrade most campgrounds and day use areas. Overall, the impact on disadvantaged populations 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 Alternative B but fewer than under Alternative C.

Therefore, the positive impacts to environmental justice would be fewer than under Alternative C. Cumulative impacts would be similar to those of Alternative C and may be somewhat less beneficial. However, they likely would be fewer than under Alternatives A and B.

Relative Beneficial Impacts of the Alternatives
The beneficial relative impacts to socioeconomics under the four alternatives are shown in Figure 5-17.

Figure 5-17. Relative Beneficial Impacts of the Alternatives on Environmental Justice

5.15. Navigation

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 navigation uses 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 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 5-18.

Figure 5-18. Relative Beneficial Impacts of the Alternatives on Navigation

5.16. Air Quality

Under all alternatives, adverse impacts to air quality would be small. Direct sources of emissions of air pollutants during the implementation of the alternatives are primarily from vehicles used in accessing TVA lands and from construction, farming, and forest management equipment. These emissions would have negligible effects on air quality. The proposed prescribed burns would also result in emissions of air pollutants. TVA would comply with local air quality regulations when planning any prescribed burns. The proposed change under Alternatives B, C, and D in the Zone 5 land use definition would allow a greater variety of industrial development on TVA land and the potential for increased industrial emissions of air pollutants. Any such industries would have to comply with applicable emissions requirements and are unlikely to result in significant adverse impacts to air quality.

Relative Beneficial Impacts of the Alternatives

The relative beneficial impacts to air quality under the four alternatives are shown in Figure 5-19.

Figure 5-19. 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 and TVA 2009). The report summarizes temperature and precipitation forecasts for the TVA region based on General Circulation Model results presented in the 2007 IPCC report (Christensen et al. 2007). These forecasts are based on the A1B scenario; GHG projections associated with this scenario are in the middle of the range of the scenarios analyzed by the IPCC. The potential effects and causes of climate change continue to be the subject of scientific debase and discussion.

The TVA region spans two model regions, the Central and Eastern North America region. Temperature forecasts for the TVA region are similar for the two model regions and predict an increase in annual mean temperatures in the TVA region of about 0.8°C (1.4°F) from 1990 to 2020 and up to 4.0°C (7.2°F) by 2100. Precipitation forecasts for the two model

regions are more variable. In the central region, winter precipitation is forecast to increase by 2.6 percent from 1990 to 2020 and by 3.6 percent by 2100. Central region summer precipitation is forecast to decrease by 6.1 percent from 1990 to 2020 and by 3 percent by 2100. In the eastern region, winter precipitation is forecast to increase by 11.3 percent from 1990 to 2020 and by 13 percent by 2100. No change in eastern region summer precipitation is forecast from 1990 to 2020 or by 2100. It is important to note that these forecasts are based on coarse-scale model results; more localized downscaled analyses are required to refine the forecasts (USCCSP 2008).

TVA received and reviewed comments on the 2009 EPRI report from Christy (2009). 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.

The direct emissions of greenhouse gases from implementation of the various alternatives are likely to be less than the 25,000 metric tons of CO2-equivalent GHGs on an annual basis that CEQ (2010) proposes as an indicator of the need for a more detailed assessment. This guidance does not apply to federal land and resource management actions which are the primary actions considered in the NRP. The operation of fossil-fueled machinery to implement many of the actions would result in GHG emissions, as would prescribed burns and some forest management activities. Over the long term, some forest management activities, as well as efforts to improve the management of agricultural lands, could result in a net increase in the sequestration of GHGs. The overall increases in GHG emissions and any resulting impacts on climate change resulting from any of the alternatives are expected to be negligible.

Climate change effects forecasted for the TVA region would be relatively modest over the next decade and increase in magnitude by mid-century (EPRI and TVA 2009). Potential effects on water resources include increased water temperatures, increased stratification of reservoirs, reduced dissolved oxygen levels, and increased water demand for crop irrigation. Potential effects on agriculture include increased plant evapotranspiration, altered pest and pathogen regimes, and changes in the types of crops grown. Potential effects on forest resources include increased tree growth, altered disturbance regimes, changes in forest community composition with declines in species currently at the southern limit of their ranges, and expansion of the oak-hickory and oak-pine forest types. Potential effects on fish and wildlife include range retractions and expansions, altered community composition, loss of cool to cold aquatic habitats and associated species such as brook trout, and increased threats to many endangered and threatened species. Potential effects on recreation include lengthening the summer recreation season, reduced cold water fishing (i.e., trout) and increased warm water fishing. These potential effects are described in more detail in Appendix M.

Under Alternatives B, C, and D, TVA would increase its natural resource monitoring and assessment activities. These increases include a new Climate Change Sentinel Monitoring program that would target streams in the TVA area's major ecoregions. This program would be most fully implemented under Alternatives C and D. Under Alternatives C and D, TVA would also increase its ongoing stream and tailwater monitoring, and endangered and threatened species monitoring. The land condition assessment monitoring would increase under Alternatives B, C, and D, with the greatest increase under Alternative C. Under these three alternatives, TVA would also increase its forest monitoring efforts. These increased

monitoring efforts would allow TVA to better detect and respond to impacts to natural resources resulting from climate change, if appropriate.

The management activities that TVA proposes under the various alternatives are designed to be flexible and driven, in part, by the results of the monitoring and assessment activities. These should give TVA the ability to adapt them to changing conditions resulting from climate change, population changes, and other factors. TVA also proposes to regularly review and, as necessary, revise the NRP. This will also help it adapt to changing conditions.

Relative Beneficial Impacts of the Alternatives
The relative beneficial impacts to climate under the four alternatives are shown in Figure 5-20.

Figure 5-20. 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 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 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 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, management of invasive plants and other activities described in Chapter 2.

Energy is 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 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 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 environmental review to determine the potential site-specific 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 lands subject to the NRP. All activities would be conducted in accordance with the stipulations defined in this PA.

CHAPTER 6 - LIST OF PREPARERS

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Role: Aquatic Ecology/Threatened and Endangered Species
Education: M.S. and B.S., Zoology
Experience: 21 years in Protected Aquatic Species Monitoring, Habitat Assessment, and Recovery; 13 years in Environmental Review

Chellye L. Campbell
Role: Reservoir Lands Planning
Education: B.S., Biology
Experience: 13 years in Planning and Managing Land

Stephen C. Cole
Role: Cultural Resources
Education: Ph.D., Anthropology
Experience: 9 years in Cultural Resource Management, 4 years Teaching Anthropology

Patricia B. Cox
Role: Terrestrial Ecology, Invasive Plant Species, and Threatened and Endangered Species
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

Evan R. Crews
Role: Reservoir Lands Planning
Education: M.S., Environmental Science; B.S., Environmental Science and Geology
Experience: 10 years in Natural Resource Management and Lands Planning

James H. Eblen
Role: Socioeconomics and Environmental Justice
Education: Ph.D., Economics; B.S., Business Administration
Experience: 44 years in Economic Analysis and Research

Frank B. Edmondson
Role: Reservoir Lands Planning
Education: B.S., Biology
Experience: 30 years in Land Management and Lands Planning

Patricia Bernard Ezzell
Role: Cultural Resources, Tribal Consultation
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

L. Suzanne Fisher
Role: Climate Change
Education: M.S., Environmental Health; B.S., Ecology and Evolutionary Biology
Experience: 11 years in Assessments of Environmental Health and Ecological Trends

Tiffany L. Foster
Role: Water Resource Management, Public Engagement
Education: M.S., Soil Science; B.S., Biology
Experience: 8 years in Watershed Management

Jerry G. Fouse
Role: Recreation Management
Education: M.B.A.; B.S., Forestry and Wildlife
Experience: 35 years in Natural Resources – Recreation Planning and Economic Development

S. Clay Guerry
Role: Dispersed Recreation Management
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

Ella Christina Guinn
Role: Technical Staff Coordinator, Lands Planning
Education: M.S. and B.A., Geography
Experience: 15 years in Land Use Analysis and Project Management

James R. Hagerman, P.E.
Role: Surface Water Resources, Erosion, and Sedimentation; Water Resource Management
Education: M.S. and B.S., Agricultural Engineering
Experience: 21 years in Nonpoint Source Pollution and Water Quality

Patricia A. Hamlett
Role: Land Use and Geographic Information System Maps
Education: B.S. and M.A., Geography
Experience: 18 years in remote sensing and GIS technologies

Kelie H. Hammond, P.E.
Role: Navigation
Education: M.S., Environmental Engineering, Specializing in Water Resources; B.S., Civil Engineering
Experience: 10 years in Navigation

David A. Hankins
Role: Geographic Information System Maps
Education: B.S., Fish and Wildlife Management
Experience: 30 years in Geographic Information and Engineering

Barry D. Hart
Role: Biological and Cultural Resources Management
Education: B.S., Biology and Music; M.S., Ecology and Evolutionary Biology
Experience: 20 years in Terrestrial and Aquatic Ecosystem Monitoring and Management

Heather M. Hart
Role: Managed Areas
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

Amy Burke Henry
Role: Cumulative Impacts Analysis
Education: M.S., Zoology and Wildlife; B.S., Biology
Experience: 14 years in Biological Surveys, Natural Resources Management Planning, and Environmental Reviews

Travis Hill Henry
Role: Terrestrial Ecology, Threatened and Endangered Species
Education: M.S., Zoology; B.S., Wildlife Biology
Experience: 22 years in Zoology and Endangered Species; 15 years in NEPA Compliance

John M. Higgins, P.E.
Role: Surface Water and Wastewater
Education: Ph.D., Environmental Engineering; B.S. and M.S., Civil Engineering
Experience: 40 years in Environmental Engineering and Water Resources Management

Mary E. Jacobs
Role: Air Resources
Education: B.S., Mathematics
Experience: 20 years in Air Quality Analysis

Wesley K. James
Role: Biological Resources Management
Education: B.S., Wildlife and Fisheries Science
Experience: 34 years in Terrestrial and Wildlife Management and Environmental Impacts Evaluation

Gary D. Jenkins
Role: Biological Resources Management
Education: B.S., Wildlife and Fisheries Science
Experience: 33 years in Aquatic and Terrestrial Habitat Assessments and Management

Clinton E. Jones
Role: Aquatic Ecology and Aquatic Threatened and Endangered Species
Education: B.S., Wildlife and Fisheries Science
Experience: 18 years in Environmental Consultation and Fisheries Management

Holly G. Le Grand
Role: Terrestrial Ecology and Threatened and Endangered Species
Education: M.S., Wildlife; B.S., Biology
Experience: 7 years in Biological Surveys, Natural Resource Management, and Environmental Reviews

P. Alan Mays
Role: Prime Farmland
Education: B.S., Plant and Soil Science
Experience: 33 years in Soil-Plant-Atmospheric Studies

Mark McCreedy
Role: Biological Resources Management
Education: B.S., Forestry
Experience: 37 years in Forest, Land, and Natural Resource Management

Mark S. McNeely
Role: Document Layout and Publishing Coordinator
Education: M.S., Education; B.S., Biological Sciences
Experience: 17 years in Resource Stewardship; 6 years in Environmental Education

Roger A. Milstead, P.E.
Role: Floodplains
Education: B.S., Civil Engineering
Experience: 34 years in Floodplain and Environmental Evaluations

Aurora D. Moldovanyi
Role: Recreation Management
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

Mark Odom
Role: Water Resource Management
Education: M.S., Biology; B.S., Agriculture/Animal Science
Experience: 16 years in Watershed and Aquatic Ecosystems Management

Danny E. Olinger
Role: Cultural Resources
Education: M.A., Anthropology
Experience: 34 years in Archaeology and Cultural Resource Management

T. Shannon O'Quinn
Role: Water Resource Management
Education: M.S., Geosciences; B.S., Environmental Studies
Experience: 10 years in Watershed Management

W. Chett Peebles, RLA; ASLA
Role: Visual Resources and Historic Architectural Resources
Education: Bachelor of Landscape Architecture
Experience: 22 years in Site Planning, Design, and Scenic Resource Management; 5 years in Architectural History and Historic Preservation

Kim Pilarski
Role: Wetlands
Education: M.S., Geography, Minor Ecology
Experience: 15 years in Wetlands Assessment and Delineation

Erin E. Pritchard
Role: Cultural Resources Management
Education: M.A., Anthropology
Experience: 13 years in Archaeology and Cultural Resource Management

Laura D. Smith
Role: Project Team and Communications Liaison
Education: B.A.
Experience: Production and Project Management, Advisory

Dana M. Vaughn
Role: Reservoir Lands Planning
Education: B.A., Biology
Experience: 3 years in Land and Shoreline Management

Donald C. Wade
Role: Water Resource Management and Water Quality
Education: M.S. and B.S., Biology
Experience: 38 years in Aquatic Biology, Aquatic Toxicology, Water Permitting, and Water Regulatory Issues

6.4. Cardno ENTRIX Economics

John Cary
Role: Natural Resource Economics
Education: M.A., Applied Economics

Rush Childs
Role: Natural Resource Economics
Education: M.E.M., Environmental Economics and Policy

Doug McNair
Role: Natural Resource Economics
Education: Ph.D., Economics

Barbara Wyse
Role: Natural Resource Economics
Education: M.S., Environmental and Resource Economics

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CHAPTER 7 - FINAL ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

The following agencies, organizations, and individuals were either sent a copy of the Final EIS and NRP or notified of their availability.

6.5. Federal Agencies

Advisory Council on Historic Preservation
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

6.6. Federally Recognized Indian Tribes

Absentee Shawnee Tribe of Oklahoma
Alabama-Coushatta Tribe of Texas
Alabama Quassarte Tribal Town
Cherokee Nation
The Chickasaw Nation
Choctaw Nation of Oklahoma
Eastern Band of Cherokee Indians
Eastern Shawnee Tribe of Oklahoma
Jena Band of Choctaw Indians
Kialegee Tribal Town
Mississippi Band of Choctaw Indians
Muscogee (Creek) Nation of Oklahoma
Poarch Band of Creek Indians
Seminole Tribe of Florida
Seminole Nation of Oklahoma
Shawnee Tribe
Thlopthlocco Tribal Town
United Keetoowah Band of Cherokee Indians in Oklahoma

6.7. 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
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 State Nature Preserves Commission
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 Department of Environment and Natural Resources
North Carolina Division of Archives and History
North Carolina Division of Environmental Health
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 Environmental Quality - Office of Environmental Impact Review
Virginia Department of Environmental Quality - Division of Water
Virginia Department of Game and Inland Fisheries
Virginia Department of Historic Resources
Virginia Department of Transportation

6.8. Regional and Local Agencies and Private Organizations

Advocates for the Oak Ridge Reservation
Alabama Elk River Development Agency
Bear Creek Development Authority
Beech River Watershed Development Authority
Blue Ridge Parkway
Boone Watershed Partnership
Bowling Green Municipal Utilities
East Tennessee Development District
Environmental Integrity Project
First Tennessee Development District
Foundation for Global Sustainability
French Broad Preservation Association
The Friends of Norris Lake
Greater Nashville Regional Council
Memphis Area Association of Governments
Memphis Aviation Services
Mount Rogers Planning District Commission
Newport (TN) Utilities
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 Chamber of Commerce and Industry
Tennessee Citizens for Wilderness Planning
Tennessee Clean Water Network
Tennessee Duck River Development Agency
Tennessee Marina Association
Tombigbee River Valley Water Management District
Top of Alabama Regional Council of Governments
Upper Cumberland Development District
Upper Tennessee River Roundtable/Keep Southwest Virginia Beautiful
Virginia Tourism Corporation
Watershed Association of Tellico Reservoir

6.9. Individuals

Allen, Bo, Memphis, TN
Allen, Louis F., Memphis, TN
Alvarez, Robert, Germantown, TN
Askins, Wendy, Cookeville, TN
Aslinger, Tom, Sale Creek, TN
Baber, Rodney, Memphis, TN

Bean, Ben, Arab, AL
Bennett, William, Dandridge, TN
Black, Bill, Dandridge, TN
Blackwell, Steve and Debbie
Bourland, David L., Memphis, TN
Bourland, Donald E., Collierville, TN
Boyer, Edward, Germantown, TN
Braff, Douglas, Locust Valley, NY
Brown, Keith, Memphis, TN

Campen, Mark, Knoxville, TN
Chambers, Ralph, Hixson, TN
Cobb, Andy and Pam 193
Cowan, William

Dale, Virginia, Oak Ridge, TN
Dale, Wood, Glendora, MS
Dalton, Frank, Corinth, MS
Dalton, Kathleen, Corinth, MS
Dalton, Martha Frances
Davis, Frank, Corinth, MS
Davis, III, Hugh L., Jackson, MS
Davis, Layton W., Jackson, MS
Delich, David, Arlington, TN
Denton, Gus, Memphis, TN
Donnelly, Lloyd J., Loudon, TN
Doss, Carol, Abingdon, VA
Doyle, Bonnie
Dunlap, David, Cumberland, TN

Edelen, Dena, Memphis, TN
Elmore, Jean, Tupelo, MS

Farnsworth, Thomas, Memphis, TN
Feeman, Joe, Norris, TN
Field, Robert, Germantown, TN
Frere, Ronald E.
Fugatt, Ron, Newport, TN

Gilbert, Timothy, Guntersville, AL
Gorenflo, Louise, Crossville, TN
Goss, Sandra K., Knoxville, TN
Griffith, Gloria, Mountain City, TN

Haaga, Marietta, Memphis, TN
Habenicht, Glenn W., Cordova, TN
Hamilton, Betsey, New Albany, MS
Hammond, Josh, Memphis, TN
Harrison, Russ, Bluff City, TN

Hargrove, Paul, Athens, AL
Hayes, Tim, Counce, TN
Heflin, John and Mary Ben, Memphis, TN
Heflin, Rob, Tuscaloosa, AL
Herald, Glen, Collierville, TN
Hester, Martha, Germantown, TN
Hines, Martina, Frankfort, KY
Hodges, Earl, Langston, AL
Hollis, Jeanne, Memphis, TN
Hoyos, Renee, Knoxville, TN
Huie, Martha H., Memphis, TN
Hunt, Ann Day, Birmingham, AL
Hutchins, Jim, Dandridge, TN

Jameson, Richard and Andrea, Holly Springs, MS
Johnston, Bill and Pat
Johnson, Tommy, Florence, AL
Johnston, Will, Nashville, TN
Jones, John Marshall, Memphis, TN
Jones, Kenneth P., Memphis, TN
Jones, Mitch, Knoxville, TN

Kendrick, Cindy, Knoxville, TN
Kennamer, Judy, Guntersville, AL
Kennedy, Avis, Nashville, TN
Kesterson, Todd, Dandridge, TN
Ketron, Sarah, Johnson City, TN
King, Jeff and Heather, Lithia, FL
Kline, Keith L., Oak Ridge, TN
Kruger, M., Collierville, TN
Kuebbing, Sara, Knoxville, TN

LaDuke, Jared, Cleveland, TN
Lendrum Jamie
Lewis, Robert, Dayton, TN
Lichterman, John, Memphis, TN
Liddon, Robert, Memphis, TN
Littlepage, Tom, AL
Lloyd, Jeremy, Walland, TN
Long, Ben, Corinth, MS

Maddigan, Ruth, Knoxville, TN
Magill, H. Lynn, Germantown, TN
Magill, Nancy
Mallory, Margaret, Memphis, TN
Marascuilo, Vincent and Marsha, Williston, TN
Marlar, Vic, Corinth, MS
Martin, Clyde, Athens, AL
Matney John
Matthews, Paul A., Memphis, TN
Maury II, William P., Memphis, TN
McArtor, Jerry, Benton, KY
Melvin, Joan and Sarah, Memphis, TN
Miller, Allen, Hixson, TN
Miller, Marc, Atlanta, GA
Minor, Lancelot, Memphis, TN
Mitchell, Jake, Collegedale, TN
Mullins, Kimbrough, Memphis, TN

Naegeli, Wolf, Knoxville, TN
Nenon, Carroll
Netherly, Charles, Olive Branch, MS
Noel, Lissa, Memphis, TN
Nolan, Larry, Iuka, MS

O'Dell, Deb, Knoxville, TN
O'Keefe, Ryan, Dayton, TN

Pleasant, Martin, Knoxville, TN
Palmer, Marvin, Memphis, TN
Peatross, Scott B., Memphis, TN
Phillipy, Anne, Yellow Creek, TN
Pinstein, Robert J., Memphis, TN
Preston, Richard, Munford, TN
Poehler, David, Dandridge, TN

Sarah Ramberg, Greenville, SC
Reddoch, Bill, Germantown, TN
Reddoch, Diane, Memphis, TN
Reddoch, Michael, Memphis, TN
Reynolds, Donald, AL
Ricks, Howard, Soddy Daisy, TN
Ringe, Axel C., New Market, TN
Robertson, Grace, Memphis, TN
Robertson, Sue, Chickamauga, GA
Rogers, King W., Memphis, TN
Rudolph, David M., Memphis, TN

Schwarzbart, Mary Linda, Knoxville, TN
Shawkey, J. Tyler, Memphis, TN
Sloan, Crystal, Rockwood, TN
Slone, Tim K., Caryville, TN
Smith, Louis, TN
Smith, William, Collierville, TN
Snow, Patrick D., Bartlett, TN
Stanley, Michael
Sweat, Richard, Germantown, TN
Stokes, Allen, Clinton, TN

Freda P. Taylor, Guntersville, AL
Thornton, Matthew, Memphis, TN
Turner, Zoe, Knoxville, TN

Liz Upchurch, Knoxville, TN

Varhola, Matthias, Sevierville, TN
Vigander, Dagny, Norris, TN

John Wells, Burnsville, MS
Whitehead, Wayne, Knoxville, TN
Whitten, Sherry, Iuka, MS
Wilfong, Catherine, Memphis, TN
Williams, Bailey
Williams, Darrell, Memphis, TN
Williams, David, Cordova, TN
Williams, Gloria
Williams, Jennifer, Washington, DC
Williams, Nora, Ridgewood, NJ
Wilson, Drew, Memphis, TN
Woolley, Deborah, Nashville, TN

Young, Edwin J., Loudon, TN
Youngblood, Gina M., Memphis, TN

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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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