

Shoreline Management Initiative:

**An Assessment of
Residential Shoreline Development
Impacts
in the Tennessee Valley**

**Public Summary
of the
Final Environmental Impact Statement**

November 1998

FOR MORE INFORMATION

Copies of the entire SMI FEIS are available in most public libraries within the Tennessee Valley and at TVA's Land Management Offices. Readers interested in receiving the entire SMI FEIS should contact:

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Introduction

The public has entrusted TVA to manage 265,000 acres of land around 30 reservoir projects spanning seven states (*Summary Figure 1*). People throughout the Valley and visitors from other places highly value these public lands and waters. These special resources are viewed as national treasures which provide benefits that are becoming scarce or nonexistent in many other parts of the country.

People who visit TVA lakes for the first time are impressed by the scenery, abundance of fish and other wildlife, clean water, and easy recreational access to many miles of undeveloped public shoreline. For these reasons, people keep returning, and use of these lakes and public lands is rapidly increasing. This has prompted the public to express concerns about how increased use, especially those activities associated with shoreline development, may change the resources that are so important to them.

Many people have asked TVA to place high priority on conserving important resources when permitting docks and other shoreline alterations. Some believe the quality of public lands and waters can be best maintained by keeping the shoreline just like it is today. Others call for managed growth so that residential shoreline development is guided by environmentally responsible principles. Still others believe that development should be allowed to proceed with minimal standards or requirements. To determine how to best respond to these and many other diverse public issues, TVA began the Shoreline Management Initiative (SMI).

Decisions to Be Made

The SMI Final Environmental Impact Statement (FEIS) will help TVA choose one of the following shoreline management options identified through public involvement. Should TVA:

- Assume a more limited, compliance-oriented role in its permitting of docks and other residential shoreline alterations?

- Maintain its current permitting guidelines?
- Adopt a policy that establishes construction and land use standards for residential shoreline alterations?
or
- Assume a minimum-disturbance position with respect to future residential shoreline alterations?

In addition, TVA must decide whether to:

- Limit residential shoreline development (docks, boathouses, bank stabilization, etc.) to areas with existing access rights,
or
- Make additional shoreland available for residential access.

TVA's Board of Directors will make these decisions after the release of the FEIS.

Preferred Alternative

Based on both extensive public input and analysis of key resource issues, TVA developed the Blended Alternative. Under this alternative, TVA has emphasized conservation of shoreline resources, while providing for reasonable access and compatible use of the shoreline by adjacent residents. TVA staff proposes to recommend the Blended Alternative to the TVA Board as the preferred policy option. The TVA Board will make the final decision about the policy to be implemented.

Document Preview

The SMI FEIS shares TVA's investigation of the alternatives and their effects on key resource issues. The following is a list of chapters. The chapter names and numbers in this summary parallel the chapter names and numbers in the FEIS.

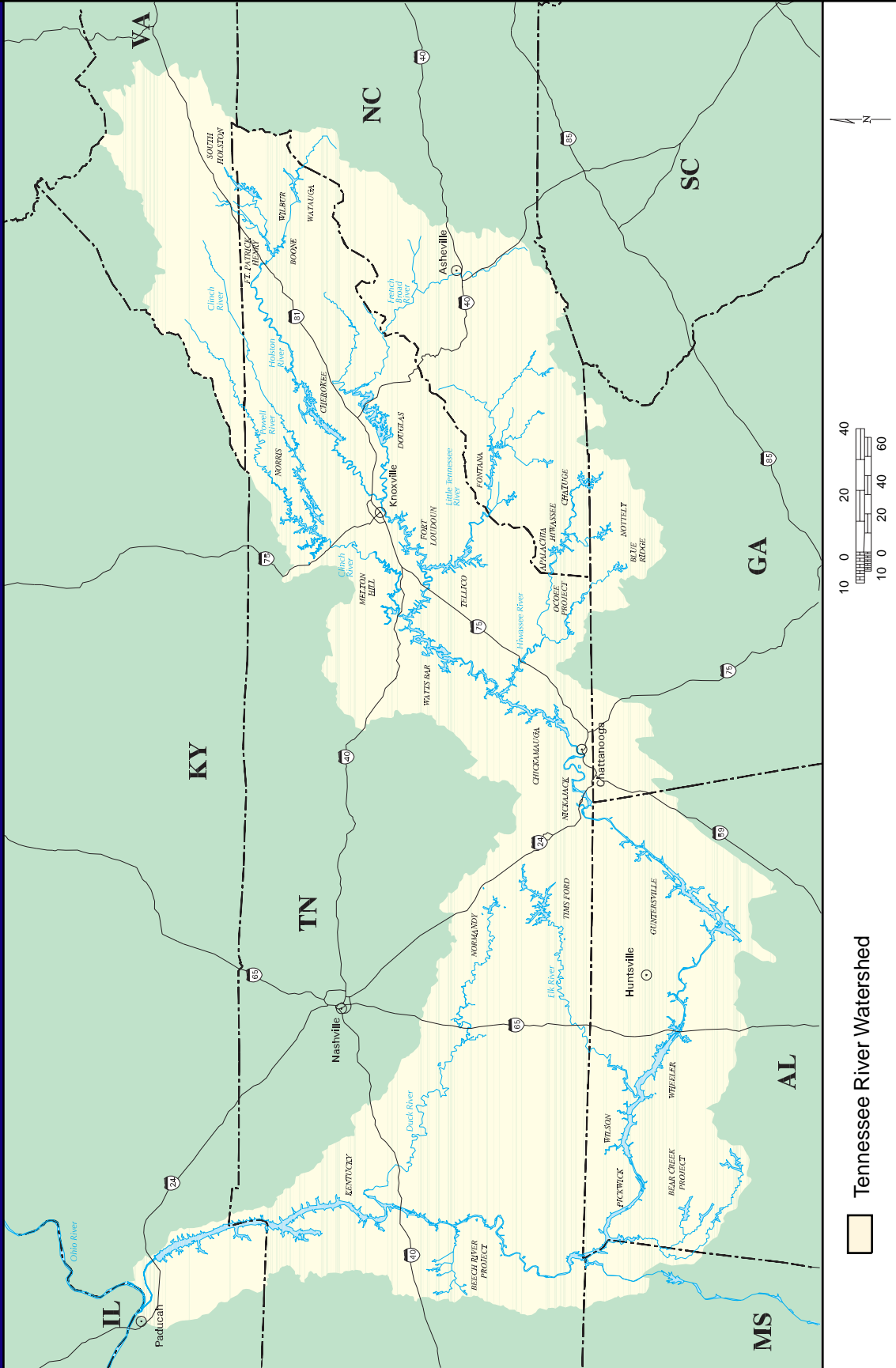
Chapter 1 — Purpose of and Need for Action

Chapter 2— Alternatives, Including the Proposed Action

Chapter 3— Affected Environment

Chapter 4— Environmental Consequences

Summary Figure 1. The Tennessee River and Reservoir System.



CHAPTER 1

Purpose of and Need for Action

Underlying Need for SMI

TVA began SMI to address growing public concern about how increases in residential shoreline development would affect shoreline resources. TVA agreed that it was time to review its existing permitting practices with the public and establish a policy which would better protect shoreland and aquatic resources, while allowing adjacent residents reasonable access to the water.

In addition, the SMI policy and associated standards would help TVA:

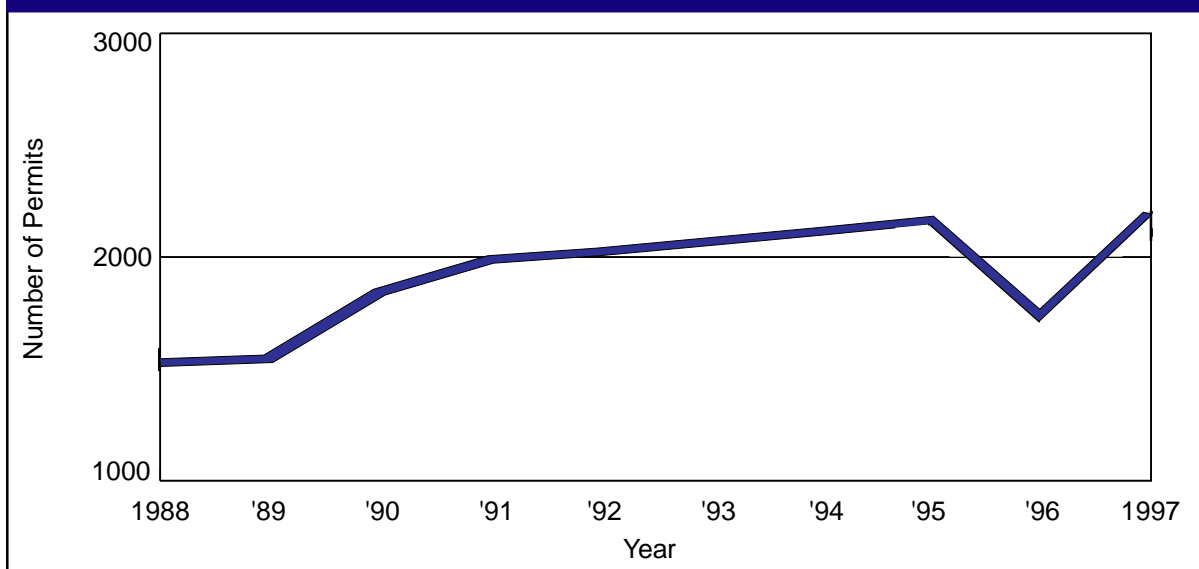
- Refine its stewardship role to better serve the public and conserve natural resources surrounding the Tennessee Valley reservoirs, and
- Handle the increased volume of TVA 26a permit requests in a way that protects public interests. As shown in *Summary Figure 2*, almost 19,000 individual requests were approved between 1988 and 1997.

Objectives of the SMI FEIS

TVA's principal objectives in better managing residential shoreline development are to:

- Respond to public issues and concerns regarding future shoreline alterations.
- Review existing permitting practices with the public and establish a Valleywide policy to guide future TVA permitting decisions about residential shoreline alterations.
- Examine environmental, social, and economic effects of anticipated residential shoreline alterations at a system-wide level.
- Determine the level of environmental protection (policies and practices) to appropriately conserve shoreline resources.

Summary Figure 2. Residential Shoreline Alteration Permits.¹



¹TVA implemented permit processing fees in 1995. In addition, the permit record-keeping system was modified in 1996, and other administrative changes were made in the process at that time. TVA believes these changes contributed substantially to the 1996 decline in permits. Based on the long-term trend between 1988 and 1997, it is assumed that the number of annual permits will continue on an upward trend.

- Improve the management of the 10,995 miles of shoreline by identifying areas appropriate for future residential shoreline alterations.
- Promote TVA's integrated resource management and water quality objectives.

Current TVA Practices and Shoreland Ownership Patterns

TVA's current shoreline management practices and associated landrights can be generally explained in the context of four categories, which are shown in *Summary Figure 3*. These ownership categories are briefly defined as:

Flowage easement shoreland: privately owned lakeshore properties where TVA has the right to flood the land as part of its reservoir operations.

TVA-owned residential access shoreland: TVA public land where the adjoining private property owner has access rights across the land.

TVA-owned-and-jointly-managed shoreland: TVA-owned shoreline that adjoins land sold, transferred, or otherwise conveyed to developers, entrepreneurs, or local, state, or federal agencies for commercial recreation, public recreation, industrial development, or natural resource management.

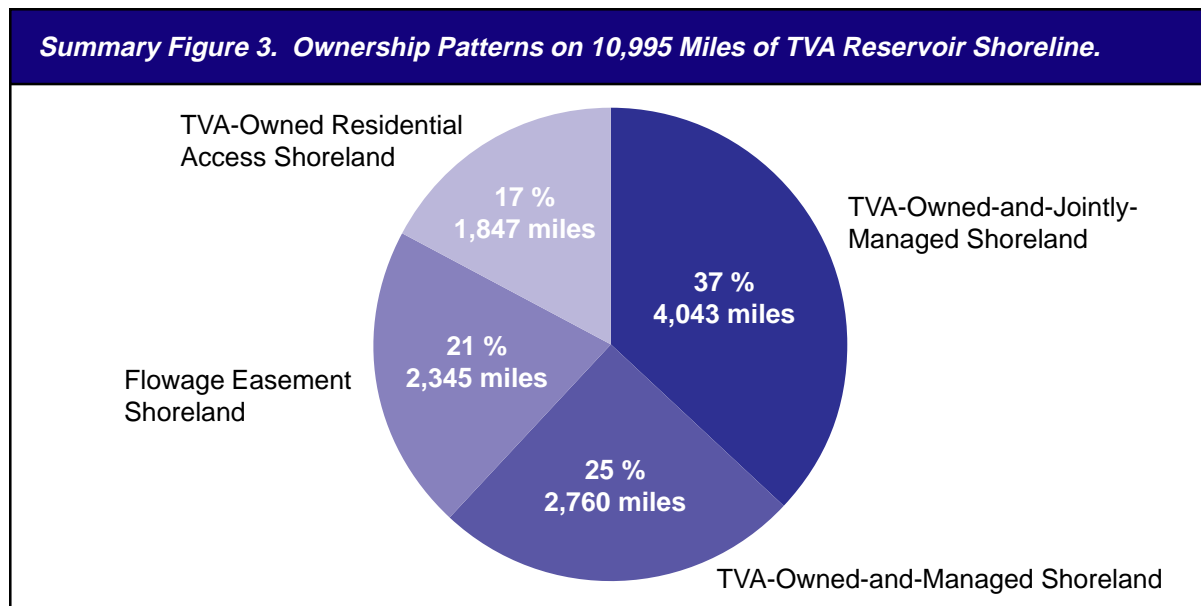
TVA-owned-and-managed shoreland: TVA-owned shoreline where there are no outstanding access rights potentially affecting its future use.

It is important to note that these categories are only broadly descriptive. The property rights affecting specific tracts of land can vary substantially.

Resource Issues

The public was involved in SMI from the beginning. During the early public involvement stages, TVA heard which resource issues were most important. These publicly identified resources are the focus of this FEIS:

- Shoreline Vegetation
- Wildlife
- Endangered and Threatened Species
- Soils
- Wetlands
- Floodplains/Flood Control
- Aquatic Habitat
- Water Quality
- Recreational Use of Shoreline
- Aesthetic Resources
- Cultural Resources
- Socioeconomics
- Navigation



Efforts were made to address impacts quantitatively. Based on public input, measurement indicators were developed to gauge the effects of the alternatives on each resource. These indicators are used consistently throughout the SMI FEIS and provide the reader a basis for comparison of the alternatives. In a few cases, data were not available and impacts were assessed qualitatively. A summary description of the resource issues and their measurement indicators are as follows.

Shoreline Vegetation. Plants and trees surrounding TVA reservoirs are important to the ecology, economics, and aesthetics of the reservoir area. Preservation of scenic beauty, protection of water quality and other natural resources, and maintenance/improvement of wildlife habitat were among the important issues identified during the public involvement process. All are directly affected by manipulation of shoreline vegetation. Residential shoreline development alters shoreline vegetation by reducing the area of forest, shrub/brushland, and cropland; reducing the diversity of plant species; and increasing the area of mowed lawns.

Indicators:

- Forest area within 25 feet of shoreline
- Total wooded area within 25 feet of shoreline
- Forest area within 1/4 mile of shoreline
- Tract size of contiguous forests within 1/4 mile of shoreline

Wildlife. Preservation of wildlife and wildlife habitats was one of the issues identified frequently during public involvement. Wildlife populations are dependent upon the quantity, quality, distribution, and variety of plants and trees surrounding TVA reservoirs. Some shoreline plant communities, especially upland forests and forested wetlands, support very high, diverse, and regionally important wildlife populations. Populations of many species using these habitats are declining. Residential shoreline development, through its effects on vegetation, reduces populations of many species and increases populations of a few very adaptable species.

Indicators:

- Forest wildlife populations
- Wintering waterfowl habitat suitability

Endangered and Threatened Species. TVA reservoirs and adjacent lands support several plants and animals listed as endangered or threatened under the Endangered Species Act of 1973, as amended. Changes in land use and in water quality are major causes of the historic population declines of listed species. Residential shoreline development could result in further population declines or slow the recovery of listed species.

TVA is obligated to protect listed species and determine if its activities are likely to affect these species. The preservation of listed species was also mentioned by SMI participants. TVA will continue to consider potential impacts to listed species during site-specific reviews of residential shoreline developments, regardless of the selected alternative.

Indicator:

- Potential habitat loss from indirect and cumulative effects

Soils. Shoreline erosion is a topic of great concern to most users of TVA reservoirs, as evidenced by comments during the public involvement process. Eroded soils and other sediments can clog streams, rivers, and reservoirs and alter water chemistry. Sedimentation can smother aquatic organisms, alter feeding and spawning habitats, and suffocate fish eggs deposited on the substrate. Residential shoreline construction activities (i.e., docks and other alterations) and associated removal of vegetation increase the potential for soil erosion and impact shoreline bank stability.

Indicators:

- Potential for shoreland soil erosion
- Shoreline bank stability index

Wetlands. Wetlands along TVA reservoir shorelines are highly productive and biologically diverse ecosystems. In addition to habitat for fish and wildlife resources, wetlands also provide multiple functions and values, such as shoreline stabilization and

erosion control, improved water quality, and recreational opportunities.

Executive Order 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. Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers and the Environmental Protection Agency, also applies to many waterfront construction activities, including wetlands alterations.

Residential shoreline development could result in filling, draining, or altering wetlands. Therefore, increasing shoreline development could negatively impact the functions and values of wetlands occurring along TVA reservoir shorelines.

Indicator:

- Potential loss of wetlands functions and values

Floodplains/Flood Control. Floodplains along TVA reservoirs are used to store flood waters until the flood crest has subsided and the reservoir returns to the normal operating level. In addition, floodplains provide or support many values and benefits, including natural wetlands and wildlife habitat, improved water quality, storm water management, recreational opportunities, and aesthetic quality.

Executive Order 11988 directs federal agencies to minimize adverse impacts to floodplains. Compliance with this executive order should prevent an increase in flood damage from residential shoreline development and ensure that the reservoir system can be operated for flood control benefits. However, shoreline development could negatively impact natural and beneficial floodplain values. The amount of shoreland made available for development would directly relate to the level of potential impacts.

Indicator:

- Potential loss of natural and beneficial floodplain values

Aquatic Habitat. Reservoirs are extremely important as spawning and nursery areas for many sport, commercial, and prey fish species, including black bass, crappie, catfish, buffalo-fish, shad, sunfish, minnows, and shiners. Shorelines provide cover for fish and habitat for aquatic insects and crayfish that serve as food for many fish species. SMI participants identified protection of aquatic resources and habitats as important considerations, especially regarding impacts to sport fisheries.

Increased residential shoreline development could reduce the amount of quality aquatic habitat available for sustaining fisheries resources and aquatic organisms. If reductions reach threshold levels, fish populations would be adversely impacted.

Indicator:

- Comparison of Shoreline Aquatic Habitat Index (SAHI) scores. The SAHI measures seven conditions (cover, substrate, bank stability, canopy cover, forested buffer strips, diversity of habitat, and amount of dredging) important to maintenance of desirable sport fish population levels.

Water Quality. TVA reservoirs support numerous human uses, as well as a diversity of fish, freshwater mussels, and other aquatic organisms. Multipurpose reservoir uses include recreation (such as swimming, wading, fishing, and boating), drinking water supplies, industrial water supplies, flood protection, generation of electricity, navigation, propagation and growth of aquatic life, irrigation, wildlife conservation, and livestock watering.

The quality of water determines if aquatic organisms can survive and whether desired human uses can be accommodated. During public involvement, TVA was urged to do more to protect the water quality of its reservoirs.

SMI participants are concerned with water pollution issues related to shoreline development, including lawn fertilizer and chemical runoff, sewage/septic tank runoff, siltation of the aquatic environment, and turbidity from shoreline erosion.

Water quality in the Tennessee River is generally considered good. However, increased residential shoreline development could increase the number of local areas not providing for desirable uses or not adequately supporting aquatic life.

- Indicators:*
- Amount of nutrient (total phosphorus) added to reservoirs from development
 - Potential for additional reservoir sites not meeting state water quality criteria for recreation due to bacterial contamination

Recreational Use of Shoreline. During public involvement, several recreation resource issues were identified, including the need for additional recreational opportunities such as camping, hunting, fishing, water recreation, hiking, and wildlife viewing. Residential shoreline development would primarily affect recreational use (especially informal) of public lands that are currently undeveloped.

- Indicator:*
- Number of day-use, informal camping, and hunting opportunities lost

Aesthetic Resources. In the context of SMI, *aesthetics* refers to the degree of compatibility among natural resources and residential shoreline development. During public involvement, participants stated that they wanted TVA to preserve the shoreline's natural beauty (aesthetics). The visual quality of the environment is important for ensuring quality outdoor experiences. Residential shoreline development would affect the visual quality of reservoir shorelines.

- Indicators:*
- Water-use facility design preference scores
 - Density preference scores
 - Amount of residential shoreline development preference scores
 - Shoreline vegetation alterations preference scores

Cultural Resources. Under federal law (National Historic Preservation Act of 1966 and the Archaeological Resources Protection Act of 1979), TVA is mandated to protect significant cultural resources, including archaeological and historic sites located on TVA lands or affected by TVA actions. Shoreline soil-disturbing activities — such as channel excavation or construction of docks, piers, and retaining walls — could affect important cultural resources. As residential shoreline development increases, so does the probability that such resources would be disturbed or require mitigation.

- Indicator:*
- Number of cultural sites potentially disturbed or mitigated

Socioeconomics. Public comments varied widely about the social and economic effects of residential shoreline development. Some SMI participants said development would improve the local economy. Others felt that managed growth could achieve environmental protection, protect property values, promote tourism, and provide other economic benefits. Still others preferred minimal development to preserve shoreline resources. Population growth along the shoreline would be affected by land availability, land use standards, and land prices. Income and employment would be influenced by population growth and by income levels of people who purchased property along and near the reservoir. Property values and the local tax base could be enhanced by standards for shoreline use, as well as by relative land scarcity.

- Indicators:*
- Population
 - Income and employment
 - Property values

Navigation. The TVA Act mandated the development of a 9-foot commercial navigation channel on the Tennessee River from Knoxville, Tennessee, to Paducah, Kentucky. TVA permit review guidelines would ensure that the construction of docks and other water-use facilities would not encroach upon the commercial navigation channel or marked recreational channels. However, increased demand for residential shoreline development could result in the loss of essential navigation safety harbors and landings.

- Indicator:*
- Potential loss of navigation safety harbors and landings

Public Review of the Draft Environmental Impact Statement (DEIS)

TVA received over 9,400 public comments in response to the SMI DEIS. Comment topics included standards, public lands, resource conservation, fees, grandfathering, and other shoreline management issues. The Blended Alternative was created to address these comments and effectively balance shoreline development, recreation use, and conservation needs, while providing reasonable use of the shoreline by adjacent residents. A summary of how the Blended Alternative responds to issues raised during public involvement is provided in *Summary Table 1*. The complete listing of public comments and TVA responses can be found in Volume II of the FEIS. Further information about the Blended Alternative can be found in Chapter 2 of this summary and the FEIS.

Summary Table 1. An Overview of the Blended Alternative.	
Public Issues	How the Blended Alternative Responds
Fees should be eliminated.	<p>Fees</p> <ul style="list-style-type: none"> • Includes NO new fees from SMI <ul style="list-style-type: none"> - NO performance deposit - NO structure registration fee - NO vegetation management fee <p>Note: Existing permit processing fees would still be required.</p>
Existing uses should be grandfathered.	<p>Existing Uses</p> <ul style="list-style-type: none"> • Grandfathers existing mowing, structures, and other uses along shoreline that is open (where access rights now exist) • Provides for transfer of grandfathering to next owner(s) • Allows variance requests for uses that are compatible with surrounding existing development
Standards for docks, vegetation management, and erosion control should be modified.	<p>Standards for New Development</p> <ul style="list-style-type: none"> • Provides flexible and simple standards • Merges existing vegetation management guidelines with modified new approaches • Offers applicants choices in erosion control (riprap, biostabilization, gabions) • Allows design and size flexibility for docks <p>Important Considerations</p> <ul style="list-style-type: none"> • A transition period would be provided for additional applications under existing guidelines. • TVA standards apply to use of public lands and shorelines — not private property.
Public lands are highly valued.	<p>Public Lands</p> <ul style="list-style-type: none"> • Adopts a “maintain-and-gain” public shoreline policy that provides for no net loss of public shoreline • Allows shoreline development in areas open for access where navigation, flood control, power generation, and sensitive resources will not be affected
Resources should be conserved.	<p>Resource Conservation</p> <ul style="list-style-type: none"> • Emphasizes resource conservation and public recreation • Promotes voluntary donations of conservation easements • Completes inventory of wetlands, threatened and endangered species, and cultural resources • Adds shoreline categorization to reservoir plans

CHAPTER 2

Alternatives, Including the Proposed Action

Alternatives — The Heart of the SMI Process

This chapter presents five important categories of information:

- Alternatives Considered in Detail
- Alternatives Eliminated From Detailed Discussion
- Summary Comparison of the Effects of the Alternatives on Key Resource Issues
- Implementation Strategy
- Why the Blended Alternative Is Preferred

Alternatives Considered in Detail

TVA used public input to formulate alternatives for future TVA management of residential shoreline development. The following six alternatives were presented in the DEIS for public review:

- Alternative A — Limited TVA Role Along Open Shoreline and Additional Areas
- Alternative B1 — Existing Guidelines Along Open Shoreline and Additional Areas (No Change/No Action)
- Alternative B2 — Existing Guidelines Along Open Shoreline Only
- Alternative C1 — Managed Development Along Open Shoreline and Additional Areas
- Alternative C2 — Managed Development Along Open Shoreline Only
- Alternative D — Minimum Disturbance Along Open Shoreline Only

In response to extensive public comments about these alternatives and other information presented in the DEIS, TVA developed an

additional alternative. This alternative combines features of previous alternatives to provide flexible management standards along open shoreline, while increasing emphasis on shoreline conservation through a maintain-and-gain public shoreline policy. This alternative is identified in the FEIS as:

- Blended Alternative — Maintain and Gain Public Shoreline

The seven alternatives represent different approaches for responding to key questions:

- Should TVA continue existing permitting guidelines or adopt new standards?
- Should TVA permitting requirements apply only where access rights currently exist or should additional shorelines be opened for access?

These alternatives also respond in different ways to the resource issues that drive the FEIS analysis. For the purpose of this FEIS, *open shoreline* refers to areas where access rights now exist; this includes developed (13 percent of shoreline Valleywide) and undeveloped (25 percent of shoreline Valleywide) flowage easement and TVA-owned residential access shoreland (see definitions on page 6).

Alternative A: Limited TVA Role Along Open Shoreline and Additional Areas

Under this alternative, residential shoreline alterations could be approved for any of the four shoreland ownership categories described in Chapter 1 (see *Summary Figure 3*).

- TVA would review permit applications primarily for compliance with federal laws.
- There would generally be no predefined Valleywide standards for facility design or appearance, vegetation removal, or other shoreline alterations.

Alternative B1: Existing Guidelines Along Open Shoreline and Additional Areas (No Change/No Action)

TVA would continue approving docks and other shoreline alterations, using existing guidelines which:

- Limit the amount and type of vegetation that can be cleared/removed from TVA-owned residential access shoreland (i.e., prohibit cutting of trees over 3 inches in diameter at ground level).
- Seek to minimize channel excavation but do not define parameters for acceptable channel excavation activities.
- Provide for permitting of water- and land-based alterations, ranging from boat dock construction to placement of riprap.
- Limit the size of some facilities such as docks and boatslips, without defining a maximum land/water surface area per lot. (In some cases, existing guidelines allow for waiver of limitations.)
- Allow residential shoreline alterations along shorelines that are currently open for residential access.
- Open additional shoreline for residential access on a case-by-case basis.

Alternative B2: Existing Guidelines Along Open Shoreline Only

Alternative B2 is the same as Alternative B1, except that residential shoreline alterations would be limited to open shoreline.

Alternative C1: Managed Development Along Open Shoreline and Additional Areas

Under Alternative C1, TVA would:

- Enhance land management plans that are prepared for each reservoir with:

- A shoreline inventory that identifies sensitive shoreline resources, including wetlands, threatened and endangered species, and cultural resources.
 - A shoreline categorization system that designates open shorelines into use categories (Shoreline Protection,¹ Residential Mitigation,² and Managed Residential³).
 - Criteria for opening additional areas for residential access.
- Replace existing permitting guidelines with shoreline development standards that would:
 - Maintain a 100-foot-deep vegetative shoreline management zone (SMZ) on TVA property.
 - Define the maximum land/water surface area that could be disturbed per lot.
 - Offer educational materials about sound stewardship of shoreline resources.
 - Provide incentives for achieving shoreline management goals.

Alternative C2: Managed Development Along Open Shoreline Only

Alternative C2 is the same as Alternative C1, except that residential shoreline alterations would be limited to open shoreline.

Alternative D: Minimum Disturbance Along Open Shoreline Only

Under Alternative D, residential shoreline alterations would be limited to open shoreline. Under this alternative, TVA would:

- Apply minimum disturbance standards to future requests for residential shoreline alterations.
- Add a shoreline categorization system to land management plans prepared for

¹Shoreline Protection - applied to shorelines that support sensitive ecological resources and shorelines where navigation restrictions exist; shoreline development would not be permitted.

²Residential Mitigation - applied to shorelines where resource conditions or navigation issues would require special analysis of individual proposals and perhaps specific mitigation measures before a permit decision could be made; also includes shoreline where additional data are needed.

³Managed Residential - applied to shorelines where no wetlands, endangered or threatened species, or cultural resources are known to exist; permit standards would be applied.

individual reservoirs; the categorization system would designate open shorelines into use categories (Shoreline Protection, Residential Mitigation, and Managed Residential).¹

- Maintain a vegetative SMZ on all TVA property.
- Encourage Valley states to adopt laws that protect shoreline and riparian vegetation.
- Promote voluntary establishment of conservation easements that protect privately owned shoreline properties.
- Provide education materials and incentives.

Blended Alternative: Maintain and Gain Public Shoreline

The Blended Alternative combines some features of previous alternatives to provide flexible management standards along open shoreline. The Blended Alternative was created after extensive SMI DEIS public review indicated that previous alternatives could be modified and packaged into a more workable approach that:

- Responds to public concerns about specific standards,
- Addresses resource conservation needs, and
- Recognizes the public benefits of undeveloped shorelines.

Under the Blended Alternative, TVA would:

- Adopt a strategy of maintaining and gaining 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.
- Continue to allow docks and other alterations along open shorelines where sensitive resources, navigation, flood control, and power generation concerns do not exist.

- Limit consideration of requests for residential access across shorelines where such rights do not exist to (a) projects proposed by others for exchange of access rights that result in no net loss or preferably a net gain of undeveloped public shoreline, and (b) TVA projects that support the agency's integrated resource management mission. Other than these situations, no additional residential access rights would be considered.
- Continue to emphasize the ecological and recreational importance of public lands by placing high priority on resource conservation and public recreation in the management of other undeveloped public shorelands that are not available for residential shoreline development permits.
- Ensure that sensitive natural and cultural resources are conserved and retained by completing a resource inventory and adding a shoreline categorization system to land management plans prepared for individual reservoirs; the categorization system would designate open shorelines into use categories (Shoreline Protection, Residential Mitigation, and Managed Residential).¹
- Promote voluntary establishment of conservation easements across flowage easement or other shoreland to protect scenic landscapes, encourage clustered development, or provide other public benefits.
- Merge some features of existing permitting guidelines with upgraded standards that promote the use of best management practices for the construction of docks, management of vegetation, stabilization of shoreline erosion, and other shoreline alterations.
- Emphasize education activities and incentives as important components of shoreline management.

Summary Table 2 summarizes construction and land use standards for each of the seven alternatives.

¹Refer to footnotes 1-3 on page 14.

Summary Table 2. Summary of Construction and Land Use Standards for Use of TVA Land by Alternative.¹

Standards	Alternative				
	A	B1 and B2	C1 and C2	D	Blended
Maximum Allowable Footprint²	None	Docks - 400 sq. ft.; boat wells - 700 sq. ft.; no total footprint	Up to 1000 sq. ft.	Up to 300 sq. ft.	Up to 1000 sq. ft. - not including walkways
Covered Boat Slips²	No size standards	Up to 2 slips per lot, no more than 700 sq. ft. within boat wells	One or more covered slips per lot, within 1000-sq.-ft. footprint; no sides; roof color must blend with natural surroundings.	Uncovered slips only - 1 per lot, within 300-sq.-ft. footprint	One or more covered slips per lot, within 1000-sq.-ft. footprint; exterior siding allowed
Dock Sketches²	None	Sample sketches available from TVA. Applicants could use these or create their own.	Standardized designs available; not mandatory	Standardized designs available; not mandatory	Sample sketches available from TVA. Applicants could use these or create their own.
Flotation²	Commercially manufactured foam	Commercially manufactured foam	Commercially manufactured encased foam	Commercially manufactured encased foam	Commercially manufactured encased foam
Shoreline Management Zone³ (SMZ)	None	None	100-ft.-deep SMZ where TVA owns the land	All TVA land managed as an SMZ	25-ft.-deep SMZ where TVA owns the land
Management of Woody Understory³	No standards	As needed for pathway to lake and as described in "Tree Cutting," below	Only within designated vegetation management corridor established in front of lots with >100-ft. lot frontage; corridor width could be up to 20% of lot frontage up to a maximum of 50 ft.	Only as needed to provide minimum access to lake; 6-ft.-wide pathway or boardwalk	Clearing of poison ivy, Japanese honeysuckle, and other specified plants would be allowed within 25-ft.-deep SMZ and elsewhere on TVA property.
Tree Cutting³	No standards	Cutting of trees <3 in. diameter at ground level may be permitted, excluding certain species of flowering or fruit-bearing trees or shrubs.	Cutting of trees up to 5-in. diameter at breast height (dbh) may be permitted within vegetation management corridor only.	Cutting of trees up to 5-in. dbh may be permitted for pathway or boardwalk installation only.	Selective thinning of trees up to 3-in. diameter at ground level would be allowed outside 25-ft.-deep SMZ. Tree cutting would only be allowed within the SMZ to clear the access/view corridor and to make sites suitable for erosion control projects. Pruning of some side limbs would also be allowed.
Shoreline Stabilization²	No preferred approach	Riprap preferred to retaining walls	TVA prescribes stabilization technique; biostabilization preferred	TVA prescribes stabilization technique; biostabilization preferred	Applicants choose between riprap, biostabilization, or gabions.
Community Facilities²	No standards	Encouraged in small coves where there is insufficient shoreline to accommodate individual docks	Required in lieu of individual docks/slips where needed for resource protection.	Required in lieu of individual docks/slips where needed for resource protection. One community ramp/courtesy pier; no permanent mooring.	Required in small coves where there is insufficient shoreline to accommodate individual docks or where needed for resource protection
Boat Launching Ramps/Marine Railways³	No standards	Requests for individual ramps are considered.	Only ramps associated with community facilities would be considered.	Only where community ramps are proposed and no public ramps exist in the vicinity	Individual marine railways or ramps would be allowed within the 20-ft. access/visual corridor.
Channel Excavation³	No standards	Minimal	Individual boat channels considered (<150 cu. yds. of dredging)	Only considered in association with community facilities	Individual boat channels considered (<150 cu. yds. of dredging)

¹TVA will meet the requirements of Endangered Species Act, National Historic Preservation Act, Executive Order 11988, Executive Order 11990, and other applicable laws/regulations, regardless of the alternative selected.

²Construction standards for residential water-use facilities apply to all structures requiring 26a approval on TVA land and on flowage easement property.

³These standards would be required on TVA-owned residential access shoreland. TVA approval is not required for management of vegetation on flowage easement property. Channel excavation on flowage easement areas in association with a water-use facility would require approval. Individual ramps/railways would be allowed in flowage easement areas.

Alternatives Eliminated From Detailed Discussion

The following alternatives were eliminated from detailed discussion because they did not meet TVA's objectives or were otherwise considered unreasonable.

- Prohibit future residential shoreline development, remove existing shoreline development, and/or restore previously developed areas.
- Allow residential shoreline development to continue but limit maximum buildout to less than 38 percent of the shoreline.
- Discontinue TVA's role in shoreline management.

Summary Comparison of the Effects of the Alternatives on Key Resource Issues

Differences in the impacts that the seven alternatives could have on the 13 resource issues depend upon:

- The type and extent of management standards adopted.
- The estimated maximum amount of shoreline that could potentially be developed.

The number of permits issued by TVA for residential shoreline alterations is increasing at the rate of 6 percent per year. Using this trend and reservoir-specific growth projections

as a basis, TVA has estimated the maximum amount of shoreline that could be developed Valleywide under each alternative (*Summary Table 3*).

It should be noted that these Valleywide buildout percentages (i.e., 38, 48, and 63) represent nothing more than TVA's estimate of the upper limit or maximum amount of development that could occur across the Tennessee Valley region over SMI's 25-year planning horizon under certain conditions. This does not mean that buildout necessarily would occur, because these percentages are not development goals or targets of the alternatives. These upper limits were needed for analysis purposes only and were used primarily to assess the environmental impacts that the alternatives could have on each of the 13 resources.

Because of physical and environmental constraints present on some sites, conservation features of some alternatives, and other variables that influence development, it is possible that some of the shoreline with existing access rights will not be developed. The eventual buildout level will be influenced by these variables and the amount of additional development, if any, authorized by TVA.

Potential impacts over the next 25 years are summarized by alternative and issue in *Summary Table 4*, using the measurement indicators described in Chapter 1. These data support the detailed comparisons presented in Chapter 4.

Summary Table 3. Estimated Maximum Amount of Shoreline Valleywide That Could Be Developed¹ With Residential Alterations, by Alternative.

Alternative	Total Miles of Shoreline That Could Be Developed	Total Percent of Shoreline That Could Be Developed	Existing Miles of Shoreline That Are Developed	Additional Miles of Shoreline That Could Be Developed	Additional Percent of Shoreline That Could Be Developed
A	6,893	63	1,383	5,510	50
B1	6,893	63	1,383	5,510	50
B2	4,192	38	1,383	2,809	25
C1	5,247	48	1,383	3,864	35
C2	4,192	38	1,383	2,809	25
D	4,192	38	1,383	2,809	25
Blended	4,192	38	1,383	2,809	25

¹Within the next 25 years.

Summary Table 4. Summary of Comparison of Alternatives by Resource and Measurement Indicators.

Resource and Indicators	Alternative						
	A	B1	B2	C1	C2	D	Blended
Shoreline Vegetation							
Forest area within 25 ft. of shoreline	Decrease of 1850 miles of forest area within 25 ft. of shoreline	Decrease of 1829 miles of forest area within 25 ft. of shoreline	Decrease of 909 miles of forest area within 25 ft. of shoreline	Decrease of 253 miles of forest area within 25 ft. of shoreline	Decrease of 323 miles of forest area within 25 ft. of shoreline	Decrease of 101 miles of forest area within 25 ft. of shoreline	Decrease of 242 miles of forest area within 25 ft. of shoreline
Total wooded area within 25 ft. of shoreline	Decrease of 146 miles of total wooded area within 25 ft. of shoreline	Decrease of 29 miles of total wooded area within 25 ft. of shoreline	Little change in total wooded area within 25 ft. of shoreline	Increase of 222 miles of total wooded area within 25 ft. of shoreline	Increase of 95 miles of total wooded area within 25 ft. of shoreline	Same as Alternative C2	Same as Alternative C2
Forest area within 1/4 mile of shoreline	Greater than 10% decrease of forest area within 1/4 mile of shoreline	About 10% decrease of forest area within 1/4 mile of shoreline	About 6% decrease of forest area within 1/4 mile of shoreline	7 to 8% decrease of forest area within 1/4 mile of shoreline	Less than 6% decrease of forest area within 1/4 mile of shoreline	Smallest decrease of forest area within 1/4 mile of shoreline	Same as Alternative C2
Tract size of contiguous forests within 1/4 mile of shoreline	Greatest decrease in forest tract size within 1/4 mile of shoreline	Same as Alternative A	Moderate decrease in forest tract size within 1/4 mile of shoreline	Forest tract size decreases slightly more than Alternative B2	Forest tract size decreases slightly less than Alternative B2; second smallest decrease	Smallest decrease in forest tract size within 1/4 mile of shoreline	Forest tract size decreases slightly less than Alternative B2
Wildlife							
Forest wildlife populations	Greatest decrease in forest wildlife populations	Decrease in forest wildlife populations less than Alternative A	Decrease in forest wildlife populations less than Alternative C1	Decrease in forest wildlife populations less than Alternative B1	Decrease in forest wildlife populations less than the Blended Alternative	Smallest decrease in forest wildlife populations	Decrease in forest wildlife populations less than Alternative B2
Wintering waterfowl habitat suitability	At least 50% decrease of moderate and high suitability habitat	Same as Alternative A	At least 25% decrease of moderate and high suitability habitat	Same as Alternative B2	At least 20% decrease of moderate and high suitability habitat	At least 15% decrease of moderate and high suitability habitat	From 15 to 20% decrease of moderate and high suitability habitat
Endangered and Threatened Species							
Potential habitat loss from indirect and cumulative effects	Greatest potential for indirect and cumulative impacts on habitat	Same as Alternative A	Moderate potential for indirect and cumulative impacts on habitat	Moderate to low potential for indirect and cumulative impacts on habitat	Low potential for indirect and cumulative impacts on habitat	Lowest potential for indirect and cumulative impacts on habitat	Same as Alternative C2
Soils							
Potential for shoreland soil erosion	Greatest shoreland erosion potential	Shoreland erosion potential less than Alternative A	Shoreland erosion potential less than Alternative B1	Shoreland erosion potential less than Alternative B2	Shoreland erosion potential less than the Blended Alternative	Lowest shoreland erosion potential	Shoreland erosion potential less than Alternative C1, but slightly higher than Alternative C2
Shoreline bank stability index	11% decrease in shoreline bank stability	8% decrease in shoreline bank stability	4% decrease in shoreline bank stability	Nearly the same as Alternative B2	3% decrease in shoreline bank stability	4% increase in shoreline bank stability	Same as Alternative C2
Wetlands							
Potential loss of wetlands functions and values	Greatest potential loss of wetlands functions and values	Potential loss of wetlands functions and values less than Alternative A	Potential loss of wetlands functions and values less than Alternative B1	Potential loss of wetlands functions and values less than Alternative B2	Potential loss of wetlands functions and values less than Alternative C1	Lowest potential loss of wetlands functions and values	Similar to Alternative C2
Floodplains/ Flood Control							
Potential loss of natural and beneficial floodplain values	Greatest potential loss of natural and beneficial floodplain values	Potential loss of natural and beneficial floodplain values less than Alternative A	Potential loss of natural and beneficial floodplain values less than Alternative B1	Potential loss of natural and beneficial floodplain values less than Alternative B2	Potential loss of natural and beneficial floodplain values less than the Blended Alternative	Lowest potential loss of natural and beneficial floodplain values	Potential loss of natural and beneficial floodplain values less than Alternative C1
Aquatic Habitat							
Comparison of SAHI (Shoreline Aquatic Habitat Index) scores	24% decrease in aquatic habitat quality	17% decrease in aquatic habitat quality	9% decrease in aquatic habitat quality	10% decrease in aquatic habitat quality	8% decrease in aquatic habitat quality	7% increase in aquatic habitat quality	Same as Alternative C2

Summary Table 4 (Cont.). Summary of Comparison of Alternatives by Resource and Measurement Indicators.

Resource and Indicators	Alternative						
	A	B1	B2	C1	C2	D	Blended
Water Quality							
Amount of nutrient (total phosphorus) added to reservoirs from development	Changes to aquatic communities would occur reservoir-wide in tributaries and in embayments. Algal growth would increase to problem levels in some tributary embayments.	Same as Alternative A	Changes to aquatic communities would occur in embayments. Algal growth would increase to problem levels in some tributary embayments.	Changes to aquatic communities would occur in tributary embayments.	Same as Alternative C1	Same as Alternative C1	Same as Alternative C1
Potential for additional reservoir sites not meeting state water quality criteria for recreation due to bacterial contamination	Greatest potential for additional sites not meeting state water quality criteria for recreation	Same as Alternative A	Lowest potential for additional sites not meeting state water quality criteria for recreation	Moderate potential for additional sites not meeting state water quality criteria for recreation	Same as Alternative B2	Same as Alternative B2	Same as Alternative B2
Recreational Use of Shoreline							
Number of informal recreational opportunities lost	About 726,000 informal recreational opportunities lost	Same as Alternative A	About 269,000 informal recreational opportunities lost	About 443,000 informal recreational opportunities lost	Same as Alternative B2	Same as Alternative B2	Same as Alternative B2
Aesthetic Resources							
Water-use facility design preference scores¹	50% preferred this design.	52% preferred designs representing this alternative.	Same as Alternative B1	73% preferred this design.	Same as Alternative C1	65% preferred this design.	Same as Alternative B1
Density preference scores (87% preferred some minimum distance between docks)	No standard proposed	Same as Alternative A	Same as Alternative A	50-ft. minimum distance between docks proposed	Same as Alternative C1	100-ft. minimum distance between docks proposed	Same as Alternative C1
Amount of residential shoreline development preference scores (Recreational visitors preferred that residential shoreline development not exceed an average of 18%; property owners preferred 33%)	63% residential shoreline development possible	Same as Alternative A	38% residential shoreline development possible	48% residential shoreline development possible	Same as Alternative B2	Same as Alternative B2	Same as Alternative B2
Shoreline vegetation alterations preference scores¹	33% preferred the scene of vegetation alterations representing this alternative.	69% preferred scenes of vegetation alterations representing this alternative.	Same as Alternative B1	45% preferred the scene of vegetation alterations representing this alternative.	Same as Alternative C1	52% preferred the scene of vegetation alterations representing this alternative.	Less preferred than Alternatives B1/B2, more preferred than Alternative D
Cultural Resources							
Number of cultural sites potentially disturbed or mitigated	About 2750 cultural sites (50%) potentially could be disturbed or mitigated.	Same as Alternative A	About 1375 cultural sites (25%) potentially could be disturbed or mitigated.	About 1045 cultural sites (19%) potentially could be disturbed or mitigated.	About 935 cultural sites (17%) potentially could be disturbed or mitigated.	About 842 cultural sites (15%) potentially could be disturbed or mitigated.	About 895 cultural sites (16%) potentially could be disturbed or mitigated.
Socioeconomics							
Population	Increase of 746,000 persons	Same as Alternative A	Increase of 396,000 persons	Increase of 530,000 persons	Same as Alternative B2	Same as Alternative B2	Same as Alternative B2
Income and employment	Annual increase of \$213 million and 8500 jobs	Annual increase of \$164 million and 7200 jobs	Annual increase of \$87 million and 3900 jobs	Annual increase of \$108 million and 4900 jobs	Annual increase of \$80 million and 3700 jobs	Annual increase of \$70 million and 3400 jobs	Same as Alternative B2
Property values	Smallest increase in property values	Property values would increase more than Alternative A.	Property values would increase more than Alternative B1.	Same as Alternative B2	Property values would increase more than Alternative C1.	Property values 25% less than Alternative C2	Greatest increase in property values
Navigation							
Potential loss of navigation safety harbors and landings	Greatest potential loss of navigation safety harbors and landings	Same as Alternative A	Lowest potential loss of navigation safety harbors and landings	Moderate potential loss of navigation safety harbors and landings	Same as Alternative B2	Same as Alternative B2	Same as Alternative B2

¹Percentages do not total 100 percent because respondents were asked to rate their preference for each design/vegetation scene separately.

Implementation Strategy

SMI Policy. TVA will implement the shoreline management policy provisions as part of its public lands management and shoreline permitting responsibilities provided for in the TVA Act. Once the TVA Board has made a decision about the SMI policy to be implemented, a Record of Decision will be issued. TVA would wait six months from the date of Board action before actually implementing any new standards. This would provide time to talk with the public about the chosen policy. It would also allow additional time for existing homeowners to apply for permits under current guidelines.

Environmental Review. Regardless of the policy implemented, TVA will continue its current practice of evaluating the impacts of each permitting or land-use action. TVA plans to complete an ongoing inventory of its shorelines to identify endangered and threatened species populations, wetlands, and cultural resources. TVA will use this inventory for evaluating individual permit requests.

If Alternative C1, C2, D, or the Blended Alternative is selected, the inventory data would also be used for allocating appropriate shoreline segments to either a Shoreline Protection, Residential Mitigation, or Managed Residential category.¹ This shoreline categorization process would occur as land management plans are developed for individual reservoirs. TVA expects to complete this planning effort for priority tributary reservoirs within five years of adoption of the SMI policy.

Grandfathering of Preexisting Residential Shoreline Alterations. Grandfathering provisions would apply to existing development and uses (those that are established prior to the effective implementation date of any new SMI policy) along open shorelines. Within these areas, use of existing docks, as well as established mowing and other existing vegetation management practices, could be continued by current and future property owners.

¹Refer to footnotes 1-3 on page 14.

Why the Blended Alternative Is Preferred

The Blended Alternative is intended to better meet TVA's stated purpose of protecting shoreline and aquatic resources, while allowing reasonable access to the water. This alternative emphasizes conservation of sensitive resources and provides for permitting of compatible shoreline development.

TVA presented six alternatives in the DEIS for public review and comment. Alternative C1 was identified in the DEIS as TVA's preferred alternative at that time. In response to extensive public comments, the Blended Alternative was developed. TVA staff now proposes to recommend the Blended Alternative to the TVA Board as the preferred policy option.

TVA staff believes that the Blended Alternative is the most responsive alternative to the wide range of issues raised by various stakeholder groups and individuals. TVA received comments ranging from those who want no more or minimal development to those who advocate maximum flexibility for adjacent landowners to determine appropriate shoreline uses. Through the Blended Alternative, TVA is seeking to address this full spectrum of views in reasonable, fair, and practical ways.

The cornerstone of this alternative is a maintain-and-gain public shoreline policy. For those who support additional shoreline development, the Blended Alternative provides for continued residential shoreline alterations along the developed and undeveloped shorelines that are currently open by virtue of outstanding access rights. Approximately 13 percent of the shoreline Valleywide has been developed, and access rights exist on another 25 percent that is now undeveloped. Under the Blended Alternative, TVA would allow docks and other alterations along these open shorelines where sensitive resources, navigation, flood control, and power generation concerns do not exist. Therefore, additional environmentally responsible shoreline development can be expected.

The Blended Alternative would limit consideration of requests for access across shorelines where such rights do not exist to (a) projects proposed by others for exchange of access rights that result in no net loss or preferably a net gain of undeveloped public shoreline, and (b) TVA projects that support the agency's integrated resource management mission. Other than these situations, no additional residential access rights would be considered.

This approach provides flexibility for agency projects that may be initiated in the future. It also provides for development by others in additional areas where the maintain-and-gain public shoreline objectives can be met. This policy would achieve results similar to no-net-loss resource conservation programs administered by other agencies.

The maintain-and-gain policy responds to those who called for heightened protection of natural and cultural resources by placing greater emphasis on conservation. Like Alternatives C1, C2, and D, the Blended Alternative provides for an inventory of wetlands, threatened and endangered species, and cultural resources to be used with a shoreline categorization system in the preparation of individual reservoir plans.

The inventory and categorization approach are important conservation tools that would increase the protection of sensitive resources and optimize the quality of environmental reviews associated with individual permits. This information would also assist developers in planning adjacent developments that are more compatible with resource conditions and would help prospective buyers identify adjacent private land that best meets their needs.

Like Alternative D, the Blended Alternative promotes the voluntary establishment of conservation easements across flowage easement or other shoreland to protect scenic landscapes, encourage clustered development, or provide other public benefits. These easements have the proven advantage of being custom-tailored to meet site-specific resource protection needs and protect land-

owner interests. The Blended Alternative also promotes the use of education and incentives as important tools of effective shoreline management.

The estimated buildout level of the Blended Alternative is responsive to those participants who preferred limited shoreline development. Under the Blended Alternative, TVA estimates that up to 38 percent of the shoreline potentially could be developed Valleywide within the next 25 years. This level of development is the same for Alternatives B2, C2, and D.

The Blended Alternative responds to public comments about the importance of protecting public shorelines and keeping them available for resource conservation, public use, and other benefits. It should be noted that the greatest portion of TVA's undeveloped shorelines are currently managed for natural resource management/protection.

The standards for docks, vegetation management, erosion control, and other shoreline uses are designed to promote clean water, conserve aquatic habitat, complement reservoir aesthetics, and meet other stewardship objectives. The standards provide for a simple, flexible SMZ and other conservation measures that are consistent with national initiatives such as the Clean Water Action Plan. TVA views protection of existing vegetation on public land as a solid investment and a prudent way to avoid future riparian vegetation restoration costs.

In addition to accomplishing stewardship objectives, the standards in the Blended Alternative better reflect the needs and interests of people applying for TVA permits. In response to public comments, the standards are a reasonable blend of current permitting practices and modified proposals from other alternatives. The standards give applicants wide latitude in designing water-use facilities; they offer options for erosion control; and they provide a framework for vegetation management that combines a modified SMZ with existing guidelines.

Public Summary

Many participants raised important questions about whether and to what extent their existing shoreline facilities and uses would be grandfathered. In response to these questions and comments, the Blended Alternative includes grandfathering provisions which address issues such as mowing of established lawns, change of ownership, and other concerns.

In response to those who called for elimination of the performance deposit, structure registration fee, and vegetation management fee, these proposals have been withdrawn by

TVA. Instead of implementing these fees, the agency would continue to mobilize volunteers for shoreline cleanup, seek voluntary compliance for removal of dilapidated structures, and explore other cost-effective ways to improve shoreline conditions.

These are some of the ways the Blended Alternative responds to public issues. For these reasons, TVA staff prefers it over other alternatives. Additional information about how this alternative addresses issues raised by the public can be found in Volume II of the FEIS.

CHAPTER 3

Affected Environment

Introduction

Chapter 3 provides the baseline information to help the public and TVA measure the effects of the alternatives on the resource issues discussed in Chapter 4 — Environmental Consequences.

Chapter 3 presents information about study area boundaries, existing shoreline conditions, and resource issues identified through public scoping and TVA analysis.

Study Area Boundaries

The study area boundaries used in Chapter 4 are shown in *Summary Figure 4*. For direct effects, the boundary includes the area between winter pool elevation and the maximum shoreline contour or TVA backlying property line, whichever is farther from the shoreline.

For potential indirect effects, the boundary includes private lands one-fourth mile from the maximum shoreline contour or TVA backlying property line; the remainder of the reservoir area above and below the surface; and the counties adjacent to the reservoirs. However, the study area boundaries of some resources will vary, especially the boundaries associated with consideration of cumulative impacts.

Existing Shoreline Conditions

As of 1994, about 17 percent (1,833 miles) of the 10,995 miles of shoreline along the Tennessee River system had been developed.

- Residential shoreline development accounted for about 13 percent
- Recreation development, 2.9 percent
- Industrial development, 0.5 percent
- Other uses, 0.7 percent

The majority of residential shoreline alterations consists of fixed and floating piers and docks, retaining walls, decks, patios, steps, riprap, and boathouses. As of 1994, there were 67,692 residential shoreline alterations along reservoir shorelines. This was an average of 49 land- and water-based alterations per developed mile of residential access shoreline.

Most (83 percent or 9,162 miles) of the shoreline remains undeveloped. Current land use designations for these undeveloped shorelines are:

- Natural resource management/protection, 48 percent
- Residential access, about 25 percent
- Recreation, 7.6 percent
- Industrial, 2.2 percent

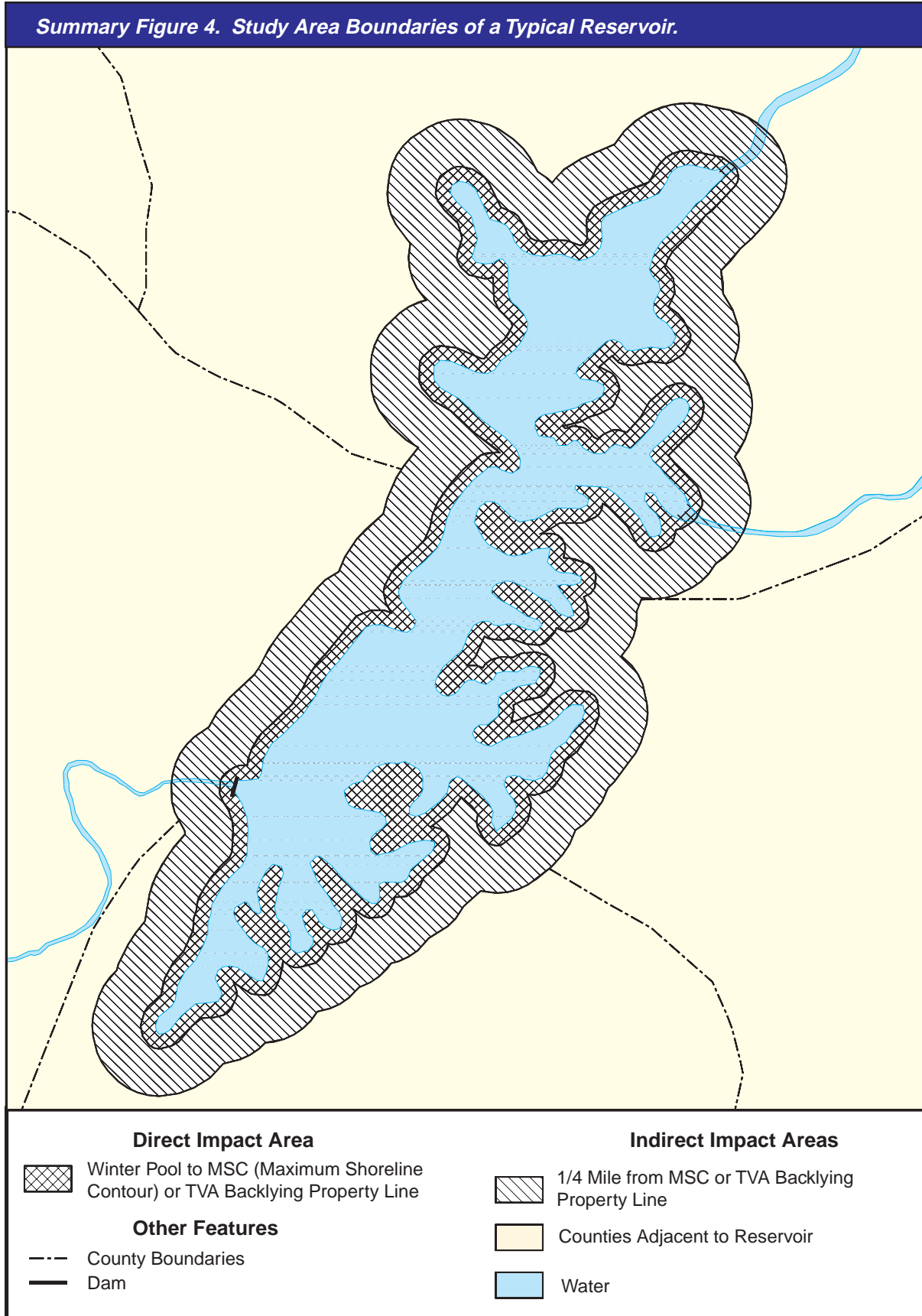
Resource Issues

Shoreline Vegetation. Forest is the principal vegetation type for shorelines and adjacent counties. Two-thirds of the shoreline is forested. Other types include grass/forb, shrub/brush, shrub/grass, tree/grass, tree/shrub, and no vegetation. Undeveloped shorelines are more heavily forested than developed shorelines.

Wildlife. Although population trend information is limited for most wildlife species, several species of herons have greatly increased since the 1940s because of new reservoir habitat. Most waterfowl have decreased in recent years.

Currently,

- 35 percent of the drawdown zone of representative reservoirs has a low suitability rating for wintering waterfowl habitat
- 41 percent has a moderate rating
- 24 percent has a high rating.



White-tailed deer and turkeys are generally increasing, but species that depend on brushland habitat are decreasing. Several birds that depend on large tracts of forest are also decreasing.

Endangered and Threatened Species.

Twenty-five endangered, threatened, proposed, or high probability candidate plant and animal species are known or believed to occur in the study area. These species vary greatly in their distribution in the reservoir area.

Three plant species and one bird species occur in a small portion of the region. The other terrestrial species — two bats and two birds — are more widespread.

Two aquatic species occur in relatively unique habitats: underground pools for Alabama cave fish; and slow-moving, open water pools with underwater vegetation for the spring pygmy sunfish. Most other federally protected aquatic species potentially affected by shoreline management alternatives occur downstream from dams where river-like habitats persist.

Soils. In the Tennessee River watershed, soils range from shallow loam to deep clay. Based on the analysis of six representative reservoirs,

- A little more than 5 percent of the shoreland is moderately eroded;
- About 3 percent is severely eroded;
- Less than 1 percent is critically eroded.

In terms of shoreline bank stability,

- About 64 percent of the shoreline currently has fair bank stability;
- 8 percent has poor bank stability;
- 28 percent is in good condition.

Wetlands. Wetlands are productive fish and wildlife habitats along TVA reservoirs. These wetlands help control soil erosion, improve water quality, and provide recreational opportunities. Although federal law and executive orders provide wetlands some protection, residential shoreline development could negatively impact wetlands functions and values.

There are four types of wetlands in the study area:

- Aquatic bed (where plants grow on or below the water surface)
- Emergent (from 1.5 feet below to 1.5 feet above summer pool)
- Scrub-shrub (dominated by shrubs)
- Forested (in lowlands above summer pool)

While the area of aquatic bed wetlands may vary annually, the area of emergent, scrub-shrub, and forested wetlands appear to have remained stable. Wetlands are less common along developed shorelines.

Floodplains/Flood Control. The TVA reservoir system is operated to reduce flood damage in the Tennessee Valley. The floodplain areas adjacent to TVA reservoirs are used for the storage of flood waters. In addition, floodplains provide or support many values and benefits that include natural wetlands and wildlife habitat, improved water quality, storm water management, recreational opportunities, and aesthetics. During construction of the reservoir system, TVA purchased most floodplain land or bought the right to flood these areas.

Aquatic Habitat. Reservoir construction greatly impacted the character of the Tennessee River. Reservoirs trap sediments which increases productivity, and this, in turn, generally enhances fishery quality. Negative impacts have included seasonal stratification in deep reservoirs and resultant declines in dissolved oxygen in lower layers of the reservoir. This condition severely impacts benthic macroinvertebrate communities which lack the mobility to leave the affected areas. Fish communities were also altered to favor species such as black bass, crappie, and bluegill, which thrive in more stabilized, lower flow conditions.

Currently, TVA reservoirs provide 2 million recreational fishing trips per year. Shorelines are the most productive regions for the sought-after species (black bass and crappie), as these areas provide spawning areas; cover such as submerged vegetation, brush, stumps, and rock; and a readily available food source.

The SAHI was developed to determine the quality of aquatic habitat adjacent to the shoreline. The average SAHI score for existing conditions is 24.3 out of a best score of 35. Based on the SAHI, aquatic habitat quality along TVA reservoir shorelines is classified as:

- 60 percent fair
- 7 percent poor
- 33 percent good

Water Quality. Current water quality in the river system is generally good. Many pollution problems are related to nonpoint sources (i.e., runoff) resulting from watershed development and improper land use practices. These problems include nutrient enrichment, causing occasional nuisance growth of aquatic plants (i.e., algae), and bacterial contamination.

Phosphorus and nitrogen are the most important added nutrients that affect water quality. These and other nutrients come from several major nonpoint sources, including:

- Industrial/commercial processes
- Municipal sewage
- Agricultural areas and urban development
- Soils

Nutrient concentrations added by residential shoreline development currently do not exceed levels likely to produce changes in aquatic communities or affect suitability of water bodies for human use. Bacterial contamination in reservoirs is typically caused by animal waste, urban runoff, and inadequate municipal wastewater treatment. Presently there are only a few reservoir sites which do not meet state criteria for water-contact recreation.

Recreational Use of Shoreline. An estimated 113 million visits were made to TVA reservoirs in 1995. This estimate encompasses all recreational visits to TVA reservoirs and surrounding developed and undeveloped lands. Fishing is the most popular shoreline activity. Picnicking, swimming, camping, walking, and hunting are other popular activities.

Undeveloped public lands along TVA reservoirs are used for informal recreation activities, including day use, camping, and hunting. These public lands can accommodate an estimated 1,344,000 visits annually.

Aesthetic Resources. During the public involvement process, components of scenic and natural beauty were identified. These included the presence of:

- Viewable wildlife
- Abundant trees
- Natural landscape features

The public indicated development preferences. Important development considerations included maintenance and design of facilities and the distance between docks. Detriments to visual quality were identified as trash, water quality problems, erosion, natural debris, and poorly maintained facilities.

Cultural Resources. Surveys conducted along 3,370 miles of shoreline identified 1,722 archaeological sites. Conservatively estimated, as many as 5,500 archaeological sites could be affected by shoreline development.

For the past 12,000 years, through changing climates and environmental conditions, the Tennessee River Valley has attracted humans because of its system of water routes and its abundance of natural resources. Areas where Native Americans once dwelled are often the same places where current generations want to live. Just as people do today, prehistoric Native Americans chose living sites that were reasonably level, well drained, not prone to flooding, and near water sources. As in the past, one popular area for habitation today is along waterways. Distributed along these water routes are numerous archaeological sites.

Archaeological resources include remains of surface or subsurface structures, such as domestic, cooking, or ceremonial structures, earthworks, fortifications, cooking pits, refuse pits, and burial pits or graves. Other examples of archaeological resources include whole or fragmentary tools, weapons, containers, ceramics, human remains, rock carvings or rock paintings, and shipwrecks.

Socioeconomics. The current social and economic situation is best understood by looking at population, income, employment, and property values. About 3.1 million people live in counties bordering TVA reservoirs. From 1980 to 1994, population in reservoir counties grew 10.6 percent, compared to national growth of 14.9 percent. However, from 1990 to 1994, these counties grew by 5.6 percent, compared to the national rate of 4.7 percent. An estimated 137,000 people live on the lakefront or in backlots associated with lakefront development.

Per capita income grew by 28.3 percent in reservoir counties from 1980 to 1992 (as measured in 1992 dollars), compared with the national rate of 18.8 percent. Employment grew by 27.6 percent in reservoir counties from 1980 to 1993, compared with the national rate of 23.6 percent.

Property values vary among and around individual reservoirs, depending on location, access to urban centers, amenities, utilities, lake access, quality of development, availability of land, and quality of view. Property taxes are levied by local and/or state governments and reflect the actual market value of the

property. Property taxes are directly tied to property values, which can vary widely among shoreland properties.

Navigation. The TVA Act mandated the development of a 9-foot channel to promote navigation on the Tennessee River and its tributaries. Development of the navigation channel was essentially completed in 1945 with the construction of a series of 10 dams and navigational locks extending navigation from Knoxville, Tennessee, to Paducah, Kentucky.

The Coast Guard installs and maintains navigation aids on the commercial navigation channel. TVA provides designated shoreline areas along the waterway called *safety harbors* and *landings* where commercial traffic can tie-off during fog, inclement weather, equipment malfunctions, and emergencies. TVA maintains 142 safety harbors and landings. TVA also maintains about 1,700 navigation aids for 345 miles of recreational navigation channels, most of which lead from the commercial channel into larger creeks and embayments.

CHAPTER 4

Environmental Consequences

Introduction

Chapter 4 addresses the environmental, social, and economic impacts of the seven alternatives as they affect the resource issues referred to throughout the FEIS. This chapter provides the scientific, analytical, and technical basis for assessing these effects.

The relative impacts of the alternatives on each of the 13 resources are shown in *Summary Figures 5 - 17*. Use of slashes between alternatives (e.g., Alternatives C2/D) means they are considered equal.

Effects of the Alternatives

This chapter summarizes the direct, indirect, and cumulative effects of each alternative on the following resource issues:

- Shoreline Vegetation
- Wildlife
- Endangered and Threatened Species
- Soils
- Wetlands
- Floodplains/Flood Control
- Aquatic Habitat
- Water Quality
- Recreational Use of Shoreline
- Aesthetic Resources
- Cultural Resources
- Socioeconomics
- Navigation

Most cumulative impacts to shoreline resources are expected to occur as a result of increased residential shoreline development. Over the next 25 years, it is estimated that a maximum of 1 percent of additional shoreline

could be developed for recreation and 2.2 percent for industrial use.

Cumulative impacts from these and other land uses (i.e., forest management and agricultural practices) are not expected to be regionally significant. However, at a reservoir level, they could be locally important.

Shoreline Vegetation. Shoreline development results in the removal of some shoreline vegetation and alters the structure and species composition of the remaining vegetation. These impacts result from clearing for water-use facilities, establishing lawns and other landscaping, clearing vistas through shoreline forests, and constructing access roads.

Shoreline vegetation types would change under all alternatives. Forest area within 25 feet of shoreline would decrease the most under Alternatives A and B1, followed by Alternatives B2, C2, C1, the Blended Alternative, and D. Total wooded area (combined forest, tree/grass, and tree/shrub types) within 25 feet of shoreline would decrease under Alternatives A and B1, remain about stable under Alternative B2, and increase under Alternatives C2/D/Blended Alternative and Alternative C1.

Under all of the alternatives, forest area and tract size of contiguous forests within one-fourth mile of the shoreline would decrease, and the presence of nonnative species would increase. Impacts to forest area within one-fourth mile of the shoreline would be greatest under Alternatives A and B1, followed by Alternatives C1, B2, and Alternatives C2/Blended Alternative — and least under Alternative D.

Tract size of contiguous forests would decrease the most under Alternatives A/B1, followed by Alternatives C1, B2, the Blended Alternative and Alternative C2 — and the least under Alternative D. The increase in nonnative species would follow a similar pattern.

Summary Figure 5. Relative Impacts of the Alternatives on Shoreline Vegetation.¹

Indicators							
Forest Area Within 25 Feet of Shoreline	Greatest Decrease				Smallest Decrease		
	A	B1	B2	C2	C1	Blended	D
Total Wooded Area Within 25 Feet of Shoreline	Greatest Decrease				Greatest Increase		
	A	B1	B2	C2/D/Blended		C1	
Forest Area Within 1/4 Mile of Shoreline	Greatest Decrease				Smallest Decrease		
	A	B1	C1	B2	C2/Blended		D
Tract Size of Contiguous Forests Within 1/4 Mile of Shoreline	Greatest Decrease				Smallest Decrease		
	A/B1		C1	B2	Blended		C2

¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Wildlife. Alternative A would result in the greatest impacts to forest wildlife populations, since many species depend upon forest cover and large, contiguous blocks of forest for their habitat (see preceding section on shoreline vegetation). In addition to the loss of forest habitat, the increase in the amount of shoreline dominated by lawns would lead to increased populations of brown-headed cowbirds (a nest parasite), which could contribute to the decline of several songbird species.

Forested shorelines connecting larger forested tracts and providing travel corridors for wildlife moving between forested tracts would be impacted the most under this alternative. The absence of these corridors could, therefore, cumulatively impact population densities and diversity of wildlife species within the larger forests.

Compared to Alternative A, Alternative B1 would result in slightly fewer impacts to forest wildlife because of constraints on shoreline vegetation management. Impacts to forest wildlife from Alternative C1 would be less than under Alternatives A and B1 but greater than those projected under Alternative B2. This is because forest area within one-fourth mile of the shoreline (i.e., wildlife habitat) would decrease more under Alternative C1 than under Alternative B2.

The Blended Alternative would result in a smaller decrease of forest area within one-fourth mile of shoreline than Alternative B2. Consequently, impacts to forest wildlife populations would be less under the Blended Alternative than under Alternative B2. Alternative C2 would result in slightly fewer impacts than the Blended Alternative, and Alternative D would result in the lowest level of impacts to forest wildlife populations.

Wintering waterfowl populations would also be impacted by varying degrees of residential shoreline development. Impacts would result from the increased human presence along the shoreline, effects on wetlands, and effects on wildlife refuges and management areas. Impacts would be greatest under Alternatives A/B1, followed by Alternatives B2/C1, Alternative C2, the Blended Alternative, and least under Alternative D.

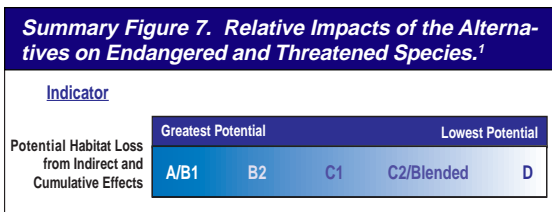
Summary Figure 6. Relative Impacts of the Alternatives on Wildlife.¹

Indicators							
Forest Wildlife Populations	Greatest Decrease				Smallest Decrease		
	A	B1	C1	B2	Blended	C2	D
Wintering Waterfowl Habitat Suitability	Greatest Decrease				Smallest Decrease		
	A/B1		B2/C1		C2	Blended	

¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Endangered and Threatened Species.

Because TVA would comply with the provisions of the Endangered Species Act under any of the alternatives, direct impacts to listed species would not occur. However, as shorelines are developed, the continued recovery of some listed terrestrial species (i.e., the bald eagle and mountain skullcap) could be indirectly and cumulatively impacted by the reduction of potentially suitable, but presently unoccupied, habitat. Exactly at what point in time this might occur is uncertain. This potential impact would be greatest under Alternatives A/B1, followed by Alternatives B2, C1, and C2/Blended Alternative — and least under Alternative D.

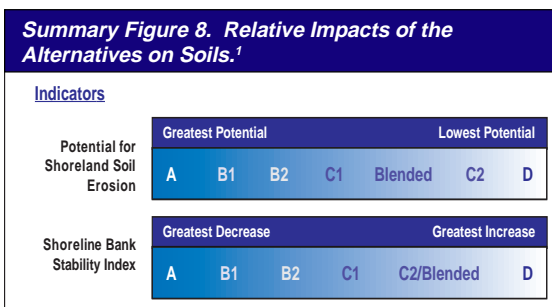


¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Soils. The impact on soils from shoreland erosion is directly related to the number of miles of development and the degree to which vegetative cover is manipulated or removed. These two factors would have a varying influence on the potential for soil erosion for each of the seven alternatives.

Wave action from boats and other factors contribute to shoreline erosion, and establishment of no-wake zones has often been suggested as a way to reduce these effects. It is questionable whether such regulations could be implemented and enforced on a large enough scale to have a positive cumulative impact. Therefore, the SMZ plays a critical role in reducing the erosive effects of wave action on the shoreland. In some cases, vegetation alone will not curb erosion, and other solutions such as riprap must be used. Many adjacent landowners are helping control erosion, and TVA appreciates their past and continuing efforts.

The potential for shoreland soil erosion would be greatest under Alternative A, followed by Alternatives B1, B2, C1, the Blended Alternative, and Alternative C2 — and lowest under Alternative D. Potential impacts to shoreline bank stability would follow a similar pattern, although the impacts under Alternatives C2 and the Blended Alternative would be about the same, and a slight improvement would occur under Alternative D.

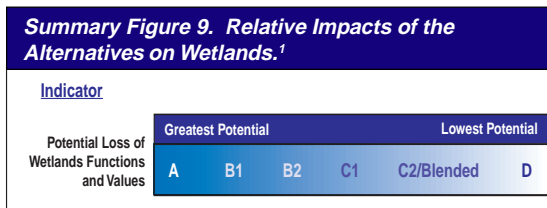


¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Wetlands. TVA would comply with Executive Order 11990 (Protection of Wetlands) under any of the alternatives. Alternative A would result in the greatest potential impacts on wetlands functions and values. These would include both direct and indirect effects, such as contamination from adjacent development, extensive shoreline alterations, and increased human activity. Since most wetlands occur along undeveloped shorelines, expanded development would increase the potential for impacts.

Alternative B1 would maintain the present level of impacts (primarily indirect) resulting from residential shoreline development. Impacts from Alternative B2 would be lower than Alternative B1, since additional shoreland would not be opened for development.

Alternatives C1 and C2/Blended Alternative would lessen the scope and significance of impacts to wetlands functions and values by providing a shoreline categorization system, shoreline development standards, and materials for educating landowners about the beneficial values of shoreline wetlands. Impacts would be slightly greater under Alternative C1, since more shoreline could be opened for development. Alternative D would have the lowest impacts because of fewer shoreline miles affected by residential shoreline development, application of the shoreline categorization system, and more protective shoreline development standards.



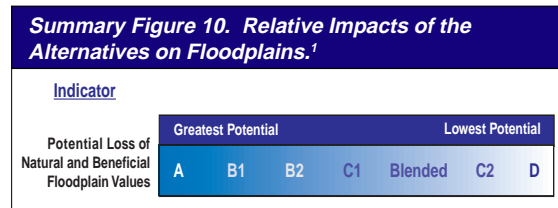
¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Floodplains/Flood Control. Compliance with Executive Order 11988 (Floodplain Management) should prevent an increase in flood damages and ensure that the reservoir system can be operated for flood control benefits. Adverse impacts to facilities would be minimized during design and construction. Also, sedimentation impacts to flood control

and/or power storage capacity should be negligible. However, natural and beneficial floodplain values could be negatively impacted. The amount of shoreland made available for development would directly relate to the level of potential impacts.

Adoption of Alternative A would result in the greatest potential loss of natural and beneficial floodplain values, followed by Alternatives B1 and B2. Under Alternatives C1, the Blended Alternative, C2, and D, potential impacts would be significantly less because of the use of a shoreline categorization system and shoreline development standards.

Under the Blended Alternative, impacts would be less than under Alternative C1, because less shoreland would be available for development. Impacts under Alternative C2 would be less than those expected under the Blended Alternative, because more stringent development standards would be implemented. Alternative D would result in the lowest potential loss of natural and beneficial floodplain values.



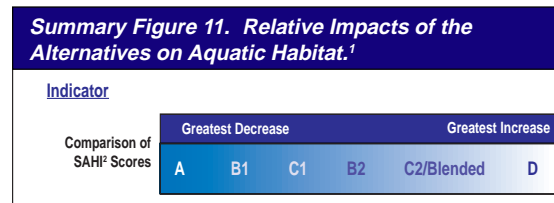
¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Aquatic Habitat. Direct impacts to aquatic habitat would include increased siltation as a result of removal of riparian vegetation for lawns and road construction. Aquatic habitat could also be impacted by dredging, clearing of the drawdown zone, use of riprap or retaining walls, and placement of docks and piers. Indirect effects to aquatic habitat would probably be minimal on both the local and regional scale. Direct and indirect impacts on aquatic habitat were estimated using the SAHI.

In general, aquatic habitat quality declines as residential shoreline development increases and as development standards become less protective. Alternative A would result in the greatest decrease in adjacent aquatic habitat quality, followed by Alternatives B1, C1, B2,

and Alternatives C2/Blended Alternative. Due to more extensive conversion of open land to forest land, Alternative D would result in a small increase in aquatic habitat quality.

Responses of near-shore biological communities to various levels of impact on aquatic habitat as a result of the different SMI alternatives are difficult to predict. However, there is probably a threshold at which additional destruction of shoreline aquatic habitat would adversely impact fish populations. The potential for reaching this threshold would be highest under Alternatives A and B1 and least under Alternative D. However, under Alternatives C1, C2, the Blended Alternative, or Alternative D, incentives could be offered to install habitat structures which would increase aquatic habitat quality.



¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

²The SAHI measures seven conditions important to healthy sport fish populations: cover, substrate, bank stability, canopy cover, forested buffer strips, diversity of habitat, and amount of dredging.

Water Quality. Alternatives A/B1, followed by Alternative B2, would add the most nutrient phosphorus to reservoirs and, consequently, have the greatest potential for adverse impacts to aquatic communities and the suitability of reservoir waters for human use. Cumulative deterioration of embayment and near-shore water quality could result from these alternatives, and in some cases, effects could extend reservoir-wide. Substantially lower levels of nutrient additions and lesser impacts to water quality would result from Alternatives C1/C2/D/Blended Alternative.

Alternatives A/B1 would have the greatest risk for additional reservoir sites not meeting state water quality criteria for recreation due to bacterial contamination. The potential risk would be somewhat less under Alternative C1 and least under Alternatives B2/C2/D/Blended Alternative.

Summary Figure 12. Relative Impacts of the Alternatives on Water Quality.¹

Indicators		
Amount of Total Phosphorus Added	Greatest Increase	Smallest Increase
	A/B1	B2
Potential for Additional Reservoir Sites Not Meeting State Water Quality Criteria	Greatest Potential	Lowest Potential
	A/B1	C1

¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Recreational Use of Shoreline. Alternatives A/B1 would result in the greatest loss of informal recreational opportunities, followed by Alternative C1. Alternatives B2/C2/D/Blended Alternative would result in the least impact to recreational use of the shoreline.

Alternatives A and B1 would also have the greatest impact on existing public parks and commercial recreation areas. If people are displaced from informal recreation areas, they would switch to using other undeveloped areas or developed public and commercial recreation areas. This could increase the potential for crowding of these areas and conflicts between users.

Summary Figure 13. Relative Impacts of the Alternatives on Recreational Use of the Shoreline.¹

Indicator		
Number of Day-Use, Informal Camping, and Hunting Opportunities Lost	Greatest Loss	Smallest Loss
	A/B1	C1

¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Aesthetic Resources. Impacts to aesthetic resources were measured by analyzing preference scores obtained from the survey *Viewing Tennessee Valley Shoreline*. Water-use facility design, density (of docks), amount of residential shoreline development, and shoreline vegetation alterations were used as indicators.

This visual survey was conducted before the Blended Alternative was crafted. However, since the Blended Alternative was developed by merging and modifying standards included in the original proposed alternatives, the

visual survey results can be used to make inferences about the Blended Alternative's impacts to aesthetic resources.

Water-use facility designs characteristic of Alternatives C1/C2 were most preferred, followed by those representative of Alternative D. Alternatives B1/B2/Blended Alternative, followed by Alternative A, were preferred less than Alternatives C1/C2 and D.

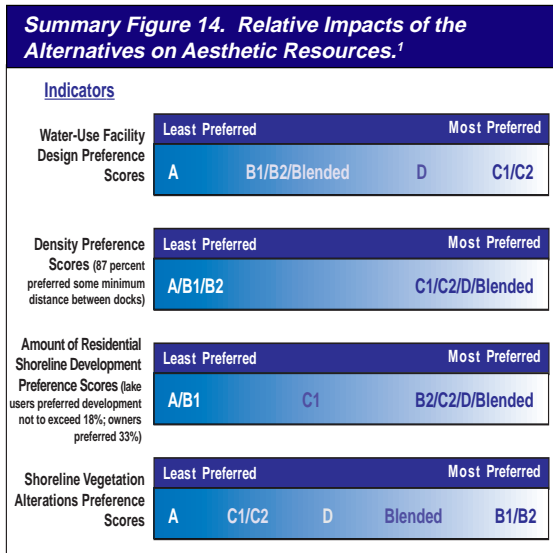
Approximately 87 percent of respondents supported a minimum distance between docks (i.e., a density standard). Alternatives A/B1/B2 do not propose a density standard. Alternatives C1/C2/Blended Alternative propose a 50-foot minimum distance between docks, and Alternative D would require 100 feet. Therefore, these alternatives would have a beneficial effect on aesthetic resources.

Overall, respondents stated that the amount of residential shoreline development should not exceed 29 percent of the total shoreline. Recreational visitors preferred that residential shoreline development not exceed an average of 18 percent, while lakefront property owners preferred 33 percent. Using this indicator, Alternatives B2/C2/D/Blended Alternative (at a 38 percent potential buildout) would, therefore, result in the lowest adverse impacts to aesthetic resources. Impacts from Alternative C1 would be somewhat higher, at 48 percent potential buildout. Alternatives A/B1 would result in the greatest visual impacts, since up to 63 percent could potentially be developed for residential purposes.

Based on survey preferences, shoreline vegetation alterations characterized by Alternatives B1/B2 would have the most beneficial aesthetic impact. This is followed by the Blended Alternative, Alternative D, and Alternatives C1/C2. Vegetation alterations characterized by Alternative A would have the least beneficial impact.

Respondents were also asked if they would prefer a buffer strip along the shoreline. A buffer depth of 25 to 50 feet was most preferred. During public review of the DEIS, many comments were received both in support of and in opposition to SMZs. Vegetation standards in the Blended Alternative were designed to address these issues.

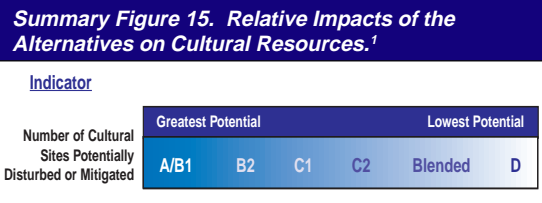
When analyzed collectively, respondent preference results derived from the survey questions point to Alternative C2 as the option with the most acceptable impacts, followed by the Blended Alternative and Alternative D. Alternative B2 would be next, followed by Alternatives C1 and B1. Alternative A would result in the greatest adverse impacts to aesthetic resources.



¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Cultural Resources. Cultural resources affected by residential shoreline development primarily include archaeological sites located along the shoreline or on adjacent shorelands. These resources are protected by federal legislation. Any ground-disturbing activity is reviewed by TVA, and archaeological sites are avoided whenever possible. If resources cannot be avoided, then impacts are mitigated.

Alternatives A/B1 would allow the most development with the fewest restrictions and, consequently, would have the most soil-disturbing potential. Therefore, these alternatives would result in the greatest potential impacts to cultural resources, followed by Alternative B2. Standards associated with Alternatives C1, C2, the Blended Alternative, and Alternative D would provide better protection of significant sites and, therefore, would result in the lowest impacts to cultural resources.



¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

Socioeconomics. Residential shoreline development would result in population growth along the shoreline, increased construction and other activities related to this growth, and rising property values. The increase in population along and near the shoreline would be greatest under Alternatives A/B1. The next largest increase would occur under Alternative C1. Alternatives B2/C2/D/Blended Alternative would result in the smallest increase. This increased population would be only a very small share of the Valley total and would be primarily persons who otherwise would live in the same general area.

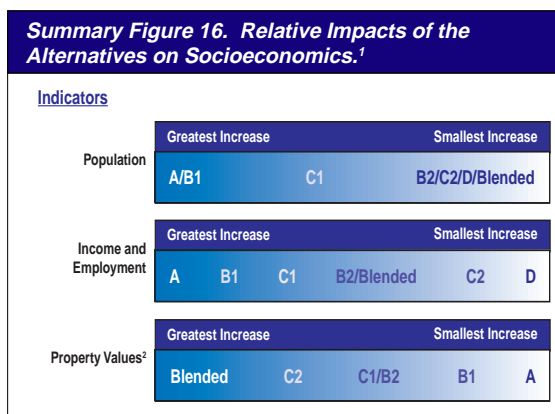
Since the net Valleywide population impact would be small, there would be little direct influence on shoreline residents' income and employment. However, income and employment would increase from money spent by part-time residents and guests. Increases would also result from construction of water-use facilities. There would also be a small decrease in spending due to a reduction in informal recreational opportunities. Employment and income opportunities would be greatest under Alternative A, followed by Alternatives B1, C1, B2/Blended Alternative, C2, and D, respectively.

Property values would be lower under Alternative A than under Alternative B1, due to diminished views and lack of development standards. Values would be higher under Alternative B2 than under Alternative B1 because less land would be available. Under Alternative C1, property values would be higher than under Alternative B1 and about equal to those projected under Alternative B2. Under Alternative C2, they would be higher than under Alternative C1, due to scarcity of available land.

Due to diminished views, especially panoramic views, Alternative D would result in lower property values than under Alternatives

C1 and C2. However, it is not clear whether this effect would result in property values lower than those projected for Alternative B1.

Under the Blended Alternative, high development standards would be maintained, and property owners would have more flexibility than under Alternatives C1, C2, and D. The availability of water-access sites would be about the same as under Alternatives C2 and D. Therefore, property values could be highest under the Blended Alternative. Impacts on property taxes and the local tax base would follow the same pattern as property values.

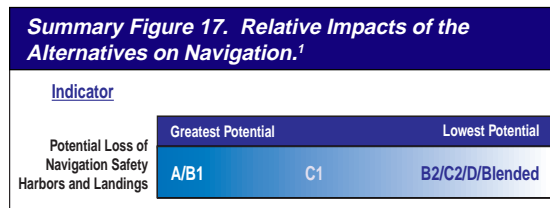


¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

²Alternative D is not shown because its impact with respect to the other alternatives is not clear.

Navigation. There would be no direct impacts on commercial navigation from the construction of water-use facilities under any of the alternatives. TVA’s permit review would ensure that construction of these facilities would not encroach on the commercial navigation channel or marked recreational channels.

However, as a result of increasing lakefront development, TVA expects an increase in requests from backlying property owners for the use of navigation safety harbors and landings to construct water-use facilities. Overall, it is assumed that the loss of essential safety harbors and landings would decrease navigation safety on the Tennessee River. The potential loss of safety harbors and landings would be greatest under Alternatives A/B1, followed by Alternative C1, and least under Alternatives B2/C2/D/Blended Alternative.



¹Impact bars are provided to qualitatively rank the alternatives and are not intended to show the magnitude of difference between alternatives.

<i>Metric Conversion</i>	
<u>U.S. Unit</u>	<u>Metric Equivalent</u>
acre	0.405 hectares, 4,047 square meters
foot	30.48 centimeters
inch	2.54 centimeters
mile	1.609 kilometers
ton	0.907 metric tons
yard	0.9144 meters
square foot	0.093 square meters
cubic yard	0.765 cubic meters
<u>Metric Unit</u>	<u>U.S. Equivalent</u>
centimeter	0.39 inches
hectare	2.47 acres
kilometer	0.62 miles
meter	39.37 inches
metric ton	1.102 tons
square meter	1.196 square yards
cubic meter	1.307 cubic yards