CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter 3 - Affected Environment and Environmental Consequences - consists of 17 individual sections that describe the baseline conditions and environmental consequences of the environmental resource areas evaluated in this Dam Safety Modifications EIS. The specific resource areas were chosen to reflect:

- Operating objectives of the TVA flood protection system (e.g., flood control and public safety);
- Issues raised during the scoping process (see Section 1.5); and
- Typical NEPA review topics (e.g., Solid and Hazardous Waste).

Information contained in this chapter establishes the baseline conditions against which the decision maker and the public can compare the potential effects of the alternatives under consideration. The Affected Environment discussion for each resource area identifies the issues of concern used to measure potential impacts on the resource, the study area (or boundaries) for the analysis, the regulatory programs and TVA management activities that govern the resource area, and the existing conditions and future trends for the resource area.

The Environmental Consequences of the Alternatives are also included in Chapter 3 and are broken down into the same 17 individual resource sections. The Environmental Consequences discussions describe the potential impacts of the proposed permanent dam safety modifications on each of the affected environmental resource areas.

Study Area

The general project area is the Tennessee River Valley (Figure 1-1). The study area for each resource area was tailored to the distribution of the resource in the vicinity of each of the four dams: Cherokee, Fort Loudoun, Tellico, and Watts Bar, and the potential effects of the permanent modification alternatives on the resource. For example, Water Resources focused on the reservoirs and tailwaters adjacent to the dams included in the Proposed Action. Cultural Resources focused on a different area of potential effect (APE) for each reservoir to ensure that the analysis included direct and indirect impacts resulting from the permanent modifications at each dam.

3.1. Geology and Soils

3.1.1. Affected Environment

The geology in East Tennessee includes a system of sedimentary sandstone, shale, and limestone formations and Paleozoic rock formations. The Appalachian Mountains are composed of compressed, folded, and faulted geologic units. Many of these units have been overturned. Thrust or reverse faults are common and result in repeating and overlapping units along each fault plane.

The project area is located in East Tennessee in the Valley and Ridge and Blue Ridge physiographic provinces of the Appalachian Mountains. The Appalachian mountain range includes a number of alternating north-south trending ridges and valleys including the

Tennessee River Valley within which the project area is situated. The Valley and Ridge province is a complexly folded and faulted area composed of alternating valleys and ridges. The ridges are composed of more resistant geologic units (typically dolomites and resistant sandstones) ranging up to 3000 feet in elevation. The Valleys are formed by units more susceptible to erosion such as more soluble limestones and dolomites. Dominant soils in this province are residual clays and silts derived from weathering and erosion of the geologic units. Karst topography, including sinkholes, caves, underground drainage systems, and springs, are numerous throughout this province. These karst features are formed when groundwater dissolves the soluble carbonate rocks. The Valley and Ridge province extends 1,200 miles from the coastal plains of Alabama to the St. Lawrence Valley in New York. In eastern Tennessee, the Valley and Ridge province is approximately 40 miles wide (U.S. Army Aviation & Missile Command 2001).

The Blue Ridge province is a narrow belt of mountains trending north-south approximately 12 to 14 miles wide in East Tennessee. The Blue Ridge Mountains are formed of a large, eroded anticline that is overturned to the west. The core of this anticline is composed of igneous and metamorphic formations. The outer flanks of the anticline are younger volcanic and sedimentary units (U.S. Army Aviation & Missile Command 2001). Geologic units in this province include shales, sandstones, conglomerates, and slate. The geologic units generally range from Precambrian (from over a billion years) to Cambrian (about 500 million years) in age.

Cherokee Dam

The geologic units present in the immediate vicinity of Cherokee Dam are the Upper Cambrian part of the Conasauga Shale or Conasauga Group (composed primarily of shale and some limestone) and the Copper Ridge Dolomite (Rodgers 1953). Geologic units present in the vicinity of the Cherokee Dam borrow area include the Chepultepec Dolomite and the Longview Dolomite, both part of the Knox Group (Rodgers 1953).

Soil within the project area for each dam segment includes: Dewey-Etowah complex at dam segment C-1 and arents clays at the other dam segments at Cherokee Dam. Dewey-Etowah complex soils generally include silt loam in the first 0 to 10 inches, silty clay and/or silty clay loam from 10 to 42 inches depth, and silty clay and/or clay from 42 to 60 inches depth. These soils are well drained. Arents clayey soils are found south of Cherokee Dam in the vicinity of the other dam segments. Depth to groundwater is more than 80 inches for each of these soils (National Resources Conservation Service [NRCS] 2012b).

Dunmore silt loam makes up the soil found in the Cherokee Dam borrow area. A typical soil profile is silt loam from 0 to 8 inches and clay from 8 to 80 inches. These are well-drained soils and the depth to groundwater is greater than 80 inches (NRCS 2012a).

Fort Loudoun Dam

Two geologic units are present in the vicinity of Fort Loudoun Dam, the Holston Formation (includes several different rock types but largely limestone or lime-sandstone and significant amounts of hematite), and the Ottosee Shale (with some limestone lenses) (Rodgers 1953). Soil in the vicinity of the FTL-1 dam segment project area includes: Tellico clay loam and possibly Alcoa loam in addition to gullied land containing a variety of limestone materials, rockland, and made land. The majority of the project site is located within made land created from imported fill. The western side of the FTL-1 project site is in Tellico clay loam. It is

possible a small portion of the project site may be in Alcoa loam to the north. This loam is likely found at the base of the slope where the construction would potentially occur and may or may not be actually within the construction zone. The Alcoa consists of a loam from 0 to 10 inches depth, clay loam from 10 to 21 inches depth, and clay from 21 to 60 inches depth on average. Both the Tellico clay loam and the Alcoa loam are well drained and the depth to water table is more than 80 inches (NRCS 2012c).

All of the soil in the vicinity of the FTL-2 dam segment and the majority of the soil in the vicinity of the FTL-3 segment is made land formed from imported fill. Additional soil on the south and west sides of the FTL-3 segment is Waynesboro loam. This soil consists generally of a loam from 0 to 11 inches depth, and a clay loam from 11 to 60 inches depth. The depth to groundwater is over 80 inches (NRCS 2012c).

Tellico Dam

The geologic units present at Tellico Dam are the Holston Formation and the Ottosee Shale, the same geologic units as described above for Fort Loudoun Dam. Three geologic units present in the vicinity of the Tellico Dam borrow area are the Conasauga Shale/Group, Copper Ridge Dolomite, and Chepultepec Dolomite. These are the same geologic units described in the area around Cherokee Dam and the Cherokee Dam borrow area above.

The soils in the vicinity of the T-1 dam segment from east to west include: Waynesboro loam (as described above in the vicinity of dam segment FTL-3), Emory silt loam (similar to that described at the Tellico borrow area above), and Cumberland silty clay loam. Cumberland silty clay loam generally consists of a silty clay loam from 0 to 12 inches and a clay loam from 12 to 60 inches. These are all well-drained soils and the depth to groundwater averages 60 to 80 inches (NRCS 2012c).

Soils in the vicinity of the T-2 dam segment include: Etowah silt loam, Congaree loam, and Sequatchie loam. A typical soil profile for Etowah includes silt loam from 0 to 8 inches depth and silty clay loam from 8 to 60 inches depth. This is a well-drained soil and the depth to groundwater is more than 80 inches. A typical soil profile for Sequatchie loam includes a loam from 0 to 12 inches depth and a clay loam from 12 to 60 inches depth. These are all well-drained soils. The depth to groundwater ranges from 30 to 48 inches to more than 80 inches (NRCS 2012c).

Dam segments T-3 and T-4 soils include Bland silty clay, Cumberland silty clay (as described above in the vicinity of dam segment T-1), and Fullerton silt loam. A typical profile for Bland soils is silty clay loam from 0 to 6 inches depth, silty clay from 6 to 20 inches depth, and unweathered bedrock at 20 to 40 inches depth. A typical Fullerton profile is silt loam from 0 to 14 inches, silty clay loam from 14 to 18 inches, and clay from 18 to 65 inches. These are well-drained soils and the depth to groundwater is more than 80 inches (NRCS 2012c).

In the vicinity of the northernmost borrow site for Tellico Dam, the soils include the Greendale silt loam, the Fullerton silt loam, the Fullerton cherty silt loam, the Fullerton cherty silty clay loam, and the Huntington loam. A typical Greendale soil profile is silt loam from 0 to 12 inches and gravelly silt loam from 12 to 48 inches. It is a well-drained soil and the depth to the water table is about 60 to 72 inches. A typical soil profile for the Fullerton silt loam is a silt loam from 0 to 14 inches, a silty clay loam from 14 to 18 inches, and clay from 18 to 65 inches. The Fullerton cherty silt loam typical soil profile that consists of a gravelly silt loam from 0 to 14 inches depth, a gravelly silty clay loam from 14 to 20 inches depth, and a gravelly clay from 20

to 60 inches depth. The Fullerton cherty silty clay loam typical soil profile is a gravelly silty clay loam from 0 to 20 inches and a gravelly clay from 20 to 60 inches. A typical soil profile for the Huntington loam is a loam from 0 to 12 inches and a silt loam from 12 to 60 inches. All of these soils are well drained and the depth to groundwater is more than 80 inches (NRCS 2012c).

At the southernmost borrow site for Tellico Dam, the soils include Melvin silt loam, Linside silt loam, Minvale silt loam, Fullerton silt loam (similar to that described for the northernmost borrow area above), Fullerton silty clay loam, Bolton silt loam, Emory silt loam, and Hermitage silt loam. The Melvin silt loam is a poorly drained soil and the depth to water table ranges from 0 to 12 inches. The Linside silt loam is a moderately well-drained soil and the depth to water table is about 18 to 36 inches. The Minvale silt loam typical soil profile is silt loam from 0 to 11 inches and silty clay loam from 11 to 60 inches depth. A typical soil profile for the Bolton silt loam is from 0 to 7 inches, silty clay loam from 7 to 22 inches, and clay from 22 to 60 inches. A typical soil profile for the Fullerton silty clay loam is silty clay loam from 0 to 18 inches and clay from 18 to 63 inches. A typical soil profile for the Hermitage silt loam is silt loam from 0 to 8 inches and silty clay loam from 8 to 54 inches. The Minvale, Bolton, Fullerton, Emory, and Hermitage silt loams are all well-drained soils and the depth to groundwater is more than 80 inches (NRCS 2012c).

Watts Bar Dam

Two geologic units are present within the Watts Bar Dam project area, the Rome Formation (a mix of sandstone, shale, dolomite, and limestone) and the Conasauga Group (same as that described in the area around Cherokee Dam) (Rodgers 1953).

In the vicinity of the dam segments and Watts Bar staging areas, soils include Waynesboro gravelly loam (similar to that described above for the borrow area) and Udorthents-Urban land complex. Urban land makes up approximately 55 percent of these soils. No description was available for the Udorthents soils which comprise an additional 35 percent of this soil complex in this area. The depth to water table is more than 80 inches (NRCS 2012d).

Soils in the Watts Bar borrow area are primarily Wanyesboro loam and some Waynesboro gravelly loam. The Waynesboro loam is similar to that described above for FTL-3; however, the soil profile in this area is typically a loam from 0 to 11 inches, a clay loam from 11 to 30 inches, and a clay from 30 to 72 inches. The Waynesboro gravelly loam profile typically consists of gravelly loam from 0 to 7 inches depth, loam from 7 to 11 inches depth, clay loam from 11 to 30 inches depth, and clay from 30 to 72 inches depth (NRCS 2012d).

3.1.2. Environmental Consequences

This section discusses the potential impacts to soils and geologic resources under the three project alternatives for all four project areas.

3.1.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. There would be no adverse direct, indirect, or cumulative impacts to soils or geologic resources within the project area or at the borrow sites beyond what already occurs during ongoing maintenance activities or borrow activities.

3.1.2.2. Alternative B – Combination Floodwalls and Embankment/Berms

Construction of the Proposed Action (floodwalls and berms) would have similar and minor impacts on the geology and soils at each of the dam segment locations. Construction activities would disturb existing soils and could extend into the upper portions of underlying geologic units at each dam segment. Impacts to the soils would be minor and temporary. Soils around the project area and underlying berms would be potentially disturbed during the construction process. Use of BMPs for control of dust mobilization such as application of water to control dust and periodic street sweeping and/or wetting down of paved surfaces would aid in preventing fugitive dust from becoming airborne. Construction activities would be phased across the project area minimizing potential dust activation. Following completion of project construction, sod would be repaired as needed in areas that were disturbed. For soils underlying newly constructed berms, some compaction would occur; however, the soils themselves would remain intact. Overall, impacts to soils would be minor and could range from short-term to long-term.

Impacts to geologic units at the dam segment project sites would be minor; construction activities could potentially disturb a few square feet of rock depending on how deep floodwall components were installed. Though disturbed rock would be permanently displaced, the amount of material disturbed would be minor and the disturbances would be concealed by the permanent presence of the floodwall. Overall, potential impacts to geologic resources are anticipated to be minor.

Use of soil from the four designated borrow areas would adversely impact the soils located within those borrows through permanent removal of those soil resources. Land use for these areas already includes use as a borrow site for construction projects; therefore, though adverse, these impacts would be commensurate with the existing impacts at these locations independent of the Proposed Action.

3.1.2.3. Alternative C – All Floodwalls

Potential impacts to geology in association with the implementation of the floodwalls only Alternative C action would be similar to those described for Alternative B for all dams. Impacts to soils would be restricted to the minor impacts resulting from excavation and construction of the floodwall foundations.

3.2. Water Resources

This section describes an overview of conditions at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, the water resources associated with these reservoirs, and the impacts on water resources from the No Action and Action alternatives. Components of water resources that are analyzed include surface water, groundwater, and water quality.

3.2.1. Affected Environment

TVA reservoirs affect the quality of valley waters by changing the thermal characteristics, residence times (length of time water spends in a reservoir), oxygen consumption and re-aeration, particle settling, algal growth, and cycling of nutrients and other substances (TVA 1978). Extended dry periods during the last 15 years have heightened public awareness of water as a finite resource and have raised questions concerning the availability of surface water and groundwater resources in the Tennessee River watershed. Increasingly, water is seen as a scarce resource that must be protected and managed. Groundwater supplies are limited in many areas of the watershed and some are of poor quality, but groundwater use has been in decline for the past 10 years and is anticipated to remain constant over the next 30 years (Bohac and Koroa 2004).

Groundwater supplies in the Tennessee River watershed are used for industry, public and domestic supplies, and irrigation. The median daily public use of groundwater in the Tennessee River watershed during the past 35 years is 245 mgd and the daily public use range is 170 mgd to 305 mgd (Bohac and Koroa 2004). The greatest groundwater withdrawals occur near the major population centers of the Tennessee Valley region.

3.2.1.1. Surface Water

The water quality in TVA's Reservoir System is affected by many factors such as the quality of water in streams flowing into the reservoirs, land use practices on lands along the reservoirs, point and nonpoint source discharges into the reservoirs and TVA's operation of the many dams in the reservoir system. TVA monitors the health of its reservoirs through the Vital Signs Monitoring Program (VSMP). This program was initiated by TVA in 1990 and monitoring is typically on a two-year cycle. Reservoirs throughout the Tennessee Valley are monitored for physical and chemical characteristics of water, sediment contaminants, benthic macroinvertebrates (bottom-dwelling animals such as worms, mollusks, insects, and snails living in or on the sediments) and fish community assemblage. Five key indicators (dissolved oxygen [DO], chlorophyll, fish, bottom life, and sediment contaminants) are monitored and contribute to a final rating that describes the "health" and integrity of an aquatic ecosystem.

The Tennessee Department of Environment and Conservation has established water quality standards and designated uses for streams and lakes across the state and issues periodic reports on water bodies not meeting these standards and uses (the 303(d) list, TDEC 2010b). This section describes the water quality in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams based on VSMP results and TDEC reports. VSMP results for fish and bottom life are described in the aquatic ecology section.

Since the 1980s, TVA has worked through its Lake Improvement Plan and Reservoir Releases Improvement (RRI) program to improve water quality in its reservoirs and in the tailwaters below its dams. TVA has installed equipment at many dams, including Cherokee, Fort Loudoun, and

Watts Bar, to increase DO levels in tailwaters and has made operational changes to maintain minimum flows below dams when hydroelectric generators are not operating.

Cherokee Dam

Cherokee is a relatively deep storage impoundment with a long retention time and plentiful nutrient inputs, resulting in low DO levels, high chlorophyll levels, and strong vertical stratification during summer months. Due in large part to these factors, the overall VSMP rating for Cherokee Reservoir for 2010 was poor. The majority of the previous overall ratings have been poor except for 1995 and 2008, when the rating was fair (TVA 2012a). At the forebay monitoring location (a short distance upstream of the dam) in 2010, DO rated poor, chlorophyll rated good, and sediment rated fair. TVA has installed a turbine venting system, and in the forebay area, surface water pump and oxygen diffuser systems to improve DO conditions in the forebay and in the Holston River downstream of the dam. The fair rating for sediment is due to slightly elevated concentrations of copper. Chlordane, a pesticide previously used to control termites and crop pests, has been found in previous years at the forebay site and has been a factor in previous sediment ratings.

Designated use classifications for Cherokee Reservoir and the Holston River downstream of the dam are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, and irrigation (TDEC 2007). While the upper portion of Cherokee Reservoir is listed as impaired due to mercury contamination from atmospheric deposition and upstream sources, the lower portion of Cherokee Reservoir is considered to meet water quality criteria for designated uses. Mossy Creek, a tributary to the reservoir located a short distance upstream of the dam, is listed as impaired due the presence of zinc and *E. coli* bacteria, and the loss of biological integrity due to siltation. Sources of these pollutants are mining, the failure of wastewater collection systems, and municipal stormwater discharges (TDEC 2010b).

The Holston River downstream of Cherokee Dam is listed on the 2010 303(d) list as impaired due to low DO and habitat loss due to stream flow alteration; both impairments are suspected to have resulted from the impoundment of the river by the dam (TDEC 2010b).

Borrow and Staging Areas

The two proposed construction staging areas are located on established, impervious surface parking areas. Stormwater run-off from the staging area near the north embankment would most likely flow via sheet or channel run-off into established drainage ditches on the dam reservation and would eventually enter the river downstream of the dam. The south embankment staging area drains north into the tailwater because the elevation at the south staging area is lower than the crest of the dam on the downstream side.

The proposed borrow area is an established borrow site within the city limits of Morristown. Stormwater drainage from this area will flow via wet weather conveyance southwest of the site. This drainage appears to mix with established residential and commercial stormwater drainage and eventually drains either into Stubblefield Creek, which is approximately 0.6 miles west of the site, or to the east under U.S. Highway 25 and into nearby Spring Creek.

Fort Loudoun Dam

The overall TVA VSMP rating for Fort Loudoun Reservoir for 2009 was poor, largely due to low ratings for chlorophyll and bottom life (TVA 2012a). Previous overall ratings have most often been poor with occasional ratings of fair. Ratings at the forebay location in 2009 were poor for DO and chlorophyll, and good for sediment (TVA 2012a). TVA has installed an oxygen-injection system to improve DO conditions in the forebay area and downstream tailwater.

Designated uses for Fort Loudoun Reservoir and the Tennessee River downstream of the dam are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Fort Loudoun Reservoir is included on the State of Tennessee's Section 303(d) list as impaired due to sediment contamination by polychlorinated biphenyls (PCBs) (TDEC 2010b). Additionally, a precautionary fish consumption advisory for Fort Loudoun Reservoir is in place due to PCB contamination. Commercial fishing for catfish is prohibited by the Tennessee Wildlife Resources Agency (TWRA). Several tributary streams to Fort Loudoun Reservoir are listed as impaired for causes including siltation, habitat loss due to alteration of the substrate and stream-side vegetative cover, and the presence of *E. coli* bacteria (TDEC 2010a). The Fort Loudoun tailwater is listed as impaired due to sediment contaminated with PCBs and low DO resulting from the upstream impoundment.

Staging Areas

The three potential construction staging areas are all established impervious surface parking areas. The area adjacent to the north saddle dam near Fort Loudoun Marina is drained by sheet flow and ditches to Fort Loudoun Reservoir. The other two areas, which would also serve as construction staging areas for work at Tellico Dam, drain via sheet flow to Tellico Reservoir.

Tellico Dam

Most of the water in Tellico Reservoir flows through the canal connecting to Fort Loudoun Reservoir, and the exchange of water through the canal affects water quality within Tellico Reservoir. The canal is 20 to 25 feet deep, while the depth of Tellico Reservoir at the forebay is about 80 feet. Therefore, only the warmer surface layers are discharged, and water below about 25 feet is trapped in the forebay by thermal stratification and becomes anoxic (oxygen deprived) during much of the summer (TVA 2003b). Water released from Tellico Dam enters the Fort Loudoun tailwater, described above.

The overall TVA VSMP rating for Tellico Reservoir for 2009 was poor (TVA 2012a). Tellico has rated either poor or at the low end of the fair range, except in 1994 when it scored high in the fair range. Ratings at the forebay location in 2009 were poor for DO and chlorophyll, and good for sediment. Forebay dissolved oxygen ratings have historically fluctuated between good and poor due to weather-related changes in reservoir flows. Previous forebay ratings for chlorophyll and sediment have typically been poor and good, respectively.

Designated uses for lower Tellico Reservoir are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Tellico Reservoir is included on the state Section 303(d) list as impaired due to sediment contamination by PCBs and the presence of mercury from atmospheric deposition (TDEC 2010b). The State of Tennessee has issued fish consumption advisories due to the PCBs and

mercury. There were no swimming advisories for bacterial contamination on Tellico Reservoir as of 2010 (TDEC 2010a).

Borrow and Staging Areas

The two potential construction staging areas are established impervious surface parking areas (Figure 2-11). These areas drain via sheet flow to Tellico Reservoir. Stormwater run-off from the two proposed borrow areas adjacent to State Route 95/U.S. Highway 321 drains to small tributaries of Town Creek, which flows southward through Lenoir City to the Fort Loudoun tailwater.

Watts Bar Dam

The overall VSMP rating for Watts Bar Reservoir for 2010 was poor (TVA 2012a). Previous ratings have fluctuated between poor and fair based on weather-related flow conditions. Forebay ratings for 2010 were poor for DO and chlorophyll and fair for sediment. Forebay DO ratings have historically fluctuated between poor and good, primarily due to reservoir flows. TVA has installed an oxygen diffuser system in the forebay to increase DO levels in the forebay and tailwater. Forebay chlorophyll concentrations have historically fluctuated with no overall trend. While sediment quality rated fair, sampling since 1994 has periodically detected elevated amounts of arsenic, low levels of PCBs and the insecticide Chlordane and in 2006 the insecticide Lindane (TVA 2012a).

Designated uses for Watts Bar Reservoir and its tailwater are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Watts Bar Reservoir is included on the state (of Tennessee) Section 303(d) list as impaired due to sediment contamination by PCBs (TDEC 2010b). The State of Tennessee has issued fish consumption advisories due to the PCBs.

Borrow and Staging Areas

One of the potential construction staging areas is located in the recreation area and would utilize an impervious surface parking area. Stormwater run-off from this area flows via sheet or drainage ditches to Watts Bar Reservoir. The other potential construction staging area is an area of mowed lawn downstream of the dam and adjacent to the lock canal. Stormwater run-off from this area flows via sheet and/or ditches into the Tennessee River.

The proposed borrow area is located northeast of the project area off of County Road 461 and is an open field. Stormwater drainage from this area flows via wet weather conveyances to the south and west into nearby Watts Bar Reservoir.

3.2.1.2. Groundwater

The project area is located in the Valley and Ridge Physiographic Province and is underlain by Cambrian aged rocks of the Conasauga Group and Ordovician aged rocks of the Knox group. The Valley and Ridge aquifer consists of folded and faulted carbonate, sandstone, and shale. Soluble carbonate rocks and some easily eroded shales underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and cherty dolomite underlie ridges. The arrangement of the northeast-trending valleys and ridges are the result of a combination of folding, thrust faulting, and erosion. Compressive forces from the southeast have caused these rocks to yield, first by folding and subsequently by repeatedly breaking along a series of thrust

faults. The result of the faulting is that geologic formations are repeated several times across the region. Carbonate-rock aquifers in the Chickamauga, the Knox, and the Conasauga Groups are repeated throughout the Valley and Ridge Physiographic Province (Lloyd and Lyke, 1995). The general hydrogeologic characteristics of the entire Valley and Ridge Province are fairly consistent. However, unique characteristics can be attributed to local differences in rock type and geologic structure. Groundwater movement in the Valley and Ridge Province is localized, restricted by the repeating lithology created by thrust faulting. Older rocks, primarily the Conasauga Group and the Rome Formation, have been displaced upward over the top of younger rocks (the Chickamauga and the Knox Groups) along thrust fault planes thus forming a repeating sequence of permeable and less permeable hydrogeologic units. The repeating sequence, coupled with the stream network, divides the area into a series of adjacent, isolated, shallow groundwater flow systems. The water moves from the ridges where the water levels are high, toward lower water levels adjacent to major streams that flow parallel to the long axes of the valleys. Most of the groundwater is discharged directly to local springs or streams (Lloyd and Lyke 1995).

Yields of wells completed in the principal Valley and Ridge aquifers range from about 1 to 2,500 gallons per minute (gpm). The largest yields (2,500 gpm) are reported for wells completed in the Honaker Dolomite of the Conasauga Group. Large yields also are reported for wells completed in limestone or dolomite of the middle and lower parts of the Chickamauga Group, the Knox Group, and the Shady Dolomite (all about 500 gpm). The median yields of wells completed in the principal aquifers range from about 11 to 350 gpm; the largest median yields are for wells in the Shady Dolomite (350 gpm), the middle part of the Conasauga Group (100 gpm), and the Newman Limestone (55 gpm) (Lloyd and Lyke 1995).

The discharges of springs that issue from the principal Valley and Ridge aquifers in eastern Tennessee vary greatly; measured discharges range from about 1 to 5,000 gpm. The largest springs issue from the Newman Limestone and the Lenoir Limestone of the Chickamauga Group. Springs that issue from the Knox Group discharge as much as 4,000 gpm. The median discharges of springs that issue from the principal aquifers range from 20 to 175 gpm. The largest median discharges are from springs that issue from the Shady Dolomite (175 gpm), the Knox Group (50 gpm), and the upper part of the Conasauga Group (40 gpm). Many springs discharge as much as 10 times more water during periods of abundant rainfall than during extended periods of little or no rainfall (United States Geological Survey [USGS] 1995).

The chemical quality of water in the freshwater parts of the Valley and Ridge aquifers is similar for shallow wells and springs. The water is hard, is a calcium magnesium bicarbonate type, and typically has a dissolved-solids concentration of 170 milligrams per liter (mg/L) or less. The ranges of concentrations are thought to be indicators of the depth and rate at which groundwater flows through the carbonate-rock aquifers. In general, the smaller values for a constituent represent water that is moving rapidly along shallow, short flow paths from recharge areas to points of discharge. This water has been in the aquifers for a short time and has accordingly dissolved only small quantities of aquifer material. Conversely, the larger values represent water that is moving more slowly along deep, long flow paths. Such water has been in contact with aquifer minerals for a longer time and thus has had greater opportunity to dissolve the minerals (USGS 1995).

In places where the residuum that overlies the carbonate rocks is thin, the Valley and Ridge aquifers are susceptible to contamination by human activities. The complex network of fractures, bedding planes, and solution openings developed in the carbonate rocks allows rapid local groundwater movement. The natural groundwater quality is subject to degradation in

places where landfills and other waste-disposal sites, underground storage tanks, and septic tank systems are located (USGS 1995).

Groundwater supplies in the Tennessee River watershed are used for industry, public and domestic water supplies, and irrigation. The median daily public use of groundwater in the Tennessee River watershed during the past 35 years is 245 mgd; the daily public use in 2000 was 215 mgd. Groundwater withdrawal rates for each reservoir include: Cherokee groundwater withdrawals of 13.64 mgd; Fort Loudoun groundwater withdrawals of 2.3 mgd, Tellico groundwater withdrawals of 0.27 mgd; and Watts Bar withdrawals of 0.99 mgd (TVA 2004). These rates are groundwater withdrawals from each reservoir hydrologic unit.

3.2.2. Environmental Consequences

This section contains an analysis of potential impacts to water resources under the No Action and Action Alternatives proposed at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams.

3.2.2.1. Alternative A – No Action Alternative

Surface Water

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possible dam failure. None of the HESCO barriers are located in water; therefore, no direct or indirect impacts to surface water at Cherokee Dam, Fort Loudoun Dam, Tellico Dam, or Watts Bar Dam would occur.

Groundwater

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possibly dam failure. No HESCO barriers were installed in water; therefore, no direct or indirect impacts to groundwater would occur.

3.2.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Surface Water

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and, where feasible, raised earthen embankments or berms. Run-off of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels; however, BMPs used during construction of the concrete floodwalls and earthen embankments (such as silt fencing and diking) would be implemented to prevent any pollutants or sediment from entering the surface water at the construction, staging and borrow areas. No construction would occur in the water; therefore, as no sediment or pollutant would enter surface waters, no direct or indirect impacts are anticipated at Cherokee Dam, Fort Loudoun Dam, Tellico Dam, or Watts Bar Dam under Alternative B.

Groundwater

No in-water construction would occur and the Proposed Action would not require any major excavation activities. Construction of the floodwalls would require excavation to a relatively shallow depth at the project sites, but it would not impact the water table. Under Alternative B, extraction of fill material from borrow areas for construction of earthen embankments/berms could affect the local water balance by the removal of saturated materials; however, no aquifers would be de-watered for excavation of fill material and BMPs would be implemented to prevent run-off of sediment and pollutants to surface water. Thus, no direct or indirect impacts to groundwater at any of the dam locations are anticipated.

3.2.2.3. Alternative C – All Floodwalls

Surface Water

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments and berms. Similar BMPs to those implemented under Alternative B would be in place. Therefore, no direct or indirect impacts to surface water are anticipated under Alternative C.

Groundwater

Under Alternative C, floodwalls would be constructed to raise the embankments. Similar BMPs to those implemented under Alternative B would be in place. Therefore, no direct or indirect impacts to groundwater under Alternative C would be anticipated at any of the dams.

3.3. Air Quality and Greenhouse Gas Emissions

3.3.1. Affected Environment

Air Quality

Through its passage of the Clean Air Act of 1963 (CAA) and its amendments, Congress has mandated the protection and enhancement of our nation's air quality. The U.S. Environmental Protection Agency (USEPA) has established the National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants to protect the public health and welfare:

- sulfur dioxide (SO_2)
- ozone (O_3)
- nitrogen dioxide (NO_2)
- particulate matter whose particles are <= 10 micrometers (PM_{10})
- particulate matter whose particles are <= 2.5 micrometers ($PM_{2.5}$)
- carbon monoxide (CO)
- lead (Pb)

The primary NAAQS were promulgated to protect public health, and the secondary NAAQS were promulgated to protect public welfare (e.g., visibility, crops, forests, soils and materials) from any known or anticipated adverse effects of air pollutants. Areas in violation of the NAAQS are designated as nonattainment areas, and new sources being located in or near these areas may be subject to more stringent air permitting requirements. Nonattainment areas are usually defined by county. In the vicinity of some large metropolitan areas, a group of counties can be designated as being in nonattainment. In some cases, a portion of a county impacted by a large emission source can be designated as a partial nonattainment area. National standards (Table 3.3-1), other than annual standards, are not to be exceeded more than once per year (except where noted).

Table 3.3-1.
National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide (CO)	9 ppm	8-hour (1)	None	
	35 ppm	1-hour (1)		
Lead (Pb)	0.15 µg/m^3	Rolling 3-month average	Same as Primary	
	1.5 µg/m^3	Quarterly average	Same as Primary	
Nitrogen Dioxide (NO_2)	0.053 ppm	Annual (arithmetic average)	Same as Primary	
	0.100 ppm	1-hour	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour	Same as Primary	

Table 3.3-1.
National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (arithmetic average)	Same as Primary	
	35 µg/m^3	24-hour	Same as Primary	
Ozone (O_3)	0.075 ppm (2008 std)	8-hour	Same as Primary	
	0.08 ppm (1997 std)	8-hour	Same as Primary	
	0.12 ppm	1-hour	Same as Primary	
Sulfur Dioxide (SO_2)	0.03 ppm	Annual (arithmetic average)	0.5 ppm	3-hour (1)
	0.14 ppm	24-hour	None	
	75 ppb	1-hour	None	

Source: USEPA NAAQS http://www.epa.gov/air/criteria.html ppm = parts per million, ppb = parts per billion, mg/m^3 = milligrams per cubic meter, µg/m^3 = micrograms per cubic meter

Air quality in the vicinity of the four dams is generally good. Rhea and Meigs County, which are connected by Watts Bar Dam, are in attainment for all air pollutants. The other counties in which the dams are located, Jefferson and Grainger, are in attainment for all pollutants (USEPA 2012a, USEPA 2012b, and USEPA 2012c).

Greenhouse Gas Emissions

Gases which trap heat in the atmosphere are called Greenhouse Gases (GHG) and most have both natural and anthropogenic sources. These compounds trap and convert sunlight into infrared heat. In this way, greenhouse gases act as insulation in the stratosphere and contribute to the maintenance of global temperatures. As the levels of greenhouse gases increase at ground level, the result is an increase in temperature on earth, commonly known as global warming. The climate change associated with global warming is predicted to produce negative economic and social consequences across the globe through changes in weather (e.g., more intense hurricanes, greater risk of forest fires, flooding).

The most common GHG emitted from natural processes and human activities include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The primary GHG emitted by human activities in the U.S. is CO_2, representing approximately 85 percent of total GHG emissions. The largest source of CO_2 and of overall GHG emissions is fossil fuel combustion. Emissions of CH_4, which have declined from 1990 levels, result primarily from enteric fermentation (digestion) associated with domestic livestock, decomposition of wastes in landfills, and natural gas systems. Agricultural soil management and mobile source fuel combustion are the major sources of N_2O emissions in the U.S (USEPA 2012c).

The final USEPA mandatory GHG reporting rule was published on 30 October 2009 and became effective on 29 December 2009. The rule requires GHG emissions (in metric tons/year) to be evaluated at the facility level for facilities emitting at least 25,000 metric tons/year.

Beginning 1 January 2010, ongoing annual emissions must be calculated and submitted in an electronic report to the EPA by March 31st of each year, with the first year being 2011. The report must describe the methodology used to calculate the GHG emissions. This rule would apply to the various power plants TVA operates in the Tennessee Valley.

3.3.2. Environmental Consequences

The section presents the potential direct, indirect, and cumulative impacts on air quality and GHG emissions associated with the project alternatives.

3.3.2.1. Alternative A – No Action Alternative

Air Quality

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. Maintenance of the HESCO barriers would require periodic replacement of portions of the barriers if they become damaged or as they begin to age. The modification of these barriers would have associated transient air pollutant emissions. In addition to fugitive dust emissions from the removal and recycling of HESCO barriers, there will be fugitive emissions associated with the hauling of the barriers and the gravel they contain using trucks driven over paved and unpaved surfaces. Finally, there will be pollutant emissions from the exhaust of internal combustion engines powering the machinery used for removal of existing structures and installation of replacement HESCO barriers. It should be noted that the fugitive emissions associate with material hauling is not from the materials in the trucks but from the silt on paved and unpaved surfaces that haul trucks are driven over.

Fugitive emissions from demolition and replacement activities will produce particles that will primarily be deposited near the site of the dams. Ninety-five percent (by weight) of fugitive emissions from vehicular traffic over paved roads will also be comprised mainly of particles that will be deposited near the roadways (AP-42 Paved Road emission factors). The remaining fraction of the dust would be subject to transport beyond the property boundaries or roadway right-of-ways. A large fraction of fugitive emissions from vehicle traffic in unpaved areas would also be deposited near the unpaved areas. If necessary, emissions from construction areas, paved, and unpaved roads will be mitigated using BMPs including wet suppression. From roadways and unpaved areas, wet suppression can reduce fugitive dust emissions by as much as 95 percent.

Combustion of gasoline and diesel fuels by internal combustion engines (haul trucks and off-road vehicles) would generate local emissions of PM, nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), and sulfur dioxide (SO_2). The total amount of these emissions would be small and would result in minimal off-site impacts.

Air quality impacts from HESCO barrier replacements would be temporary and dependent on both manmade factors (e.g., intensity of activity, control measures) and natural factors (e.g., wind speed, wind direction, soil moisture). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on offsite air quality and be well below the applicable ambient air quality standard. Overall, the air quality impact of maintenance activities for the HESCO barriers under the no action alternative would not be significant.

GHG Emissions

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. Maintenance of the HESCO barriers would require periodic replacement of portions of the barriers if they become damaged or as they begin to age. The modification of these barriers would have associated transient GHG emissions due to the combustion of fossil fuels by the required equipment. The GHG impacts from HESCO barrier replacement or routine maintenance activities would be temporary and minimal given the size of other local GHG sources.

3.3.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Air Quality

The modification of these dams would have associated transient air pollutant emissions similar to those described above for the no action alternative. In addition to fugitive dust emissions from the removal and recycling of HESCO barriers, there would be fugitive emissions associated with the hauling of concrete and borrow material for modifying the dams. As described above, use of wet suppression or other BMPs for fugitive dust control would minimize the potential adverse air quality impacts associated with construction of the dam modifications.

Air quality impacts from dam modifications would be temporary and dependent on both manmade factors (e.g., intensity of activity, control measures, etc.) and natural factors (e.g., wind speed, wind direction, soil moisture, etc.). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on offsite air quality and be well below the applicable ambient air quality standard. Overall, the air quality impact of construction-related activities for these projects would not be significant.

GHG Emissions

The modification of these dams would have associated transient GHG emissions similar to those described above for the no action alternative. Due to the longer time period necessary for construction in comparison to maintenance, the GHG emissions associated with Alternative B would be larger than those associated with the no action alternative. The GHG impacts from dam modifications would be still be considered minimal and temporary in relation to other local GHG sources.

3.3.2.3. Alternative C – All Floodwalls

Air Quality

The impacts to air quality under Alternative C would be similar to those described for the No Action Alternative and the Proposed Action. Because this alternative consists of the construction of floodwalls only (no berms), fewer impacts to air quality would be expected given that there would be less particulate matter with the potential to mobilize than compared with the Proposed Action. Similarly to the No Action Alternative and Proposed Action, the use of BMPs, such as wet suppression, would minimize any potential impacts associated with the construction activities. Overall, air quality impacts associated with implementation of Alternative C would be short-term and minor.

GHG Emissions

The impacts to GHG emissions under Alternative C would be similar to those described for the Proposed Action. Construction duration would likely be slightly shorter, so this alternative could have slightly smaller GHG emissions. Overall, however; GHG emissions would still be minimal in relation to other GHG sources nearby.

3.4. Flooding and Floodplains

This section describes the regulations and baseline conditions associated with flooding and floodplains in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, and the potential impacts on flooding and floodplains from the No Action and Action alternatives.

3.4.1. Affected Environment

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a one-percent annual chance of flooding (100-year flood) in any given year is normally called the 100-year floodplain. Executive Order (EO) 11988, Floodplain Management directs federal agencies to evaluate their proposed development projects in the 100-year floodplain to ensure that they are consistent with the requirements of the EO. Delineation of the 100-year floodplain is also important for the regulation of development by communities participating in the National Flood Insurance Program[2] (NFIP). For certain "Critical Actions," the minimum floodplain of concern is the area subject to inundation from a 500-year (0.2 percent annual chance) flood. "Critical Actions" are those for which even a slight chance of flooding would be too great.

TVA developed the Flood Risk Profile (FRP) for the mainstem Tennessee River reservoirs. The FRP is the elevation of the 500-year flood that has been adjusted for surcharge at the dam. Surcharge is the ability to raise the water level behind the dam above the top-of-gates elevation (defined with the gates in the closed position) without causing damage to the project. A similar analysis was never completed for the tributary dams. TVA uses the FRP to control flood damageable development for TVA projects and on TVA lands along the mainstem reservoirs, and uses the 500-year flood elevation to control development on tributary reservoirs such as Cherokee. Also, due to the nature of the permanent dam modifications project, it is necessary to evaluate the flood risk associated with the PMF elevation for all alternatives. The relevant floodplain elevations for the four dams are listed in Table 3.4.1. All of the proposed borrow areas and staging areas are located outside of the 100-year floodplain.

All of the counties in which the four dams are located (Jefferson and Grainger for Cherokee, Loudon for Fort Loudoun and Tellico, Meigs and Rhea for Watts Bar) participate in the NFIP and any development must be consistent with NFIP regulations. The 100-year flood elevation is typically used to delineate flood hazard areas subject to NFIP regulations.

Table 3.4-1.
Flood Elevations in Feet above Mean Sea Level*

Dam	100-year	500-year	FRP	PMF
Cherokee	1075.0	1075.0	not applicable	1093.6
Fort Loudoun	816.0	817.0	817.0	835.6
Tellico	816.2	817.0	817.0	833.3
Watts Bar	746.5	746.8	747.0	768.1

* All elevations are based on the National Geodetic Vertical Datum (NGVD) of 1929

[2] The National Flood Insurance Program is a program created by the U. S. Congress in 1968 through the National Flood Insurance Act of 1968 (Public Law [P. L.] 90-448). The program enables property owners in participating communities to purchase insurance protection from the government against losses from flooding.

3.4.2. Environmental Consequences

As a Federal agency, TVA is subject to the requirements of EO 11988. The objective of EO 11988 is "…to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (U.S. Water Resources Council 1978). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative. For certain "Critical Actions," the minimum floodplain of concern is the area subject to inundation from a 500-year (0.2 percent annual chance) flood. Also, due to the nature of this Proposed Action, it is necessary to evaluate the flood risk associated with the PMF elevations for all alternatives.

3.4.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the existing HESCO barriers that currently raise the heights of the earthen embankments at Fort Loudoun, Tellico, Watts Bar and Cherokee dams to prevent overtopping during the PMF would remain in place. The concrete mat installed on the downstream embankment of Watts Bar Dam would also remain in place. The barriers and the concrete mat are located outside of the 100-year floodplain and well above the 500-year and TVA FRP elevations. Therefore, there would be no changes to the pre-project 100-year, 500-year, and FRP flood elevations at any of dams. As there would be no change from the current condition, no direct or indirect impacts to flooding or floodplains would occur under the No Action Alternative.

3.4.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls or, where feasible, raised earthen berms. Under this alternative, overtopping of each dam during a PMF event would be prevented by construction of a floodwall on the earthen embankments and/or raising the earthen embankments to the same height or higher than the existing HESCO barriers.

At Cherokee Dam a floodwall the same height or higher than the existing HESCO barriers would be constructed along the downstream side of the existing earthen embankment except for the area at the boat ramp parking area where the existing earthen embankment would be raised to the same height or higher than the existing HESCO barriers.

At Fort Loudoun Dam, this alternative would involve the construction of floodwalls to the same height or higher than the existing HESCO barriers to prevent overtopping of the dam during the PMF.

At Tellico Dam, this alternative would involve the construction of a floodwall and raising a portion of the earthen embankment and saddle dams to the same height or higher than the existing HESCO barriers to prevent overtopping of the dam during the PMF. A berm would be constructed along saddle dams Nos. 1, 2 and 3.

At Watts Bar Dam, this alternative would involve raising the earthen embankment to the same height or higher than the existing HESCO barriers to prevent overtopping of the dam during the PMF.

At Cherokee, Fort Loudoun, and Tellico dams, the floodwalls would be located outside of the 100-year floodplain and well above the 500-year flood elevation, which would be consistent with EO 11988. Portions of the fill for the raised earthen embankments at Cherokee, Tellico, and Watts Bar dams would be located within the 100-year floodplain. Under EO 11988, the placement of fill within the 100-year floodplain for raising an existing berm is not considered to be a repetitive action in the 100-year floodplain. As stated in Section 2.1.1, TVA has evaluated alternatives to the fill and the selection of this alternative would support a determination of "No Practicable Alternative" to the placement of the fill in the 100-year floodplain. The fill would also be located below the 500-year or FRP elevation and would therefore displace flood control storage. Consistent with TVA's Flood Control Storage Loss Guideline, the amount of lost flood control storage would be minimized while achieving the project objectives. At all of the dams, the current 100-year flood, 500-year flood, FRP, and PMF elevations would not change and there would be no increase in flood risk.

At all dam locations, beneficial impacts are anticipated as the floodwalls and berms would reduce the risk of downstream flooding in the event of a PMF.

3.4.2.3. Alternative C – All Floodwalls

Under Alternative C, overtopping of each dam during a PMF event would be prevented by the construction of floodwalls on the earthen embankments. At Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, floodwalls would be constructed along the existing embankments to the same height or higher than the existing HESCO barriers. The walls would be located outside of the 100-year floodplain and well above the 500-year flood elevation which would be consistent with EO 11988. Under this alternative, the current 100-year flood, 500-year flood, and PMF elevations would not change and there would be no increase in flood risk.

Beneficial impacts are anticipated under Alternative C since the floodwalls would reduce the risk of downstream flooding in the event of a PMF.

3.5. Wetlands

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). Wetlands exist within and adjacent to TVA reservoirs and tailwaters, and are influenced by surface water and groundwater connections to the water levels in these reservoirs and tailwaters. Wetlands depend on the timing and duration of the presence of water; consequently, they may be affected by reservoir operations.

3.5.1. Affected Environment

Wetlands are highly productive and biologically diverse ecosystems that provide multiple public benefits such as flood control, shoreline stabilization, improved water quality, and habitat for fish and wildlife resources.

EO 11990 (Protection of Wetlands) directs Federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In addition, activities in wetlands are regulated under the authority of the Federal Clean Water Act (CWA) and state laws and regulations. Wetlands can be defined as areas inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, mud flats, and natural ponds.

The types and acreages of potentially affected wetlands were estimated based on data selected from the National Wetlands Inventory (NWI). The NWI data include information on the type of vegetation, water regime, and setting. The wetlands included, as potentially affected in this EIS, meet the wetland definition used by the USFWS (Cowardin et al. 1979). This definition is the national standard for wetland mapping, monitoring, and data reporting as determined by the Federal Geographic Data Committee. The NWI data were compiled using high-altitude aerial photography with limited field verification. Some of the data are now over 15 years old. Because of their age and manner of acquisition, the data were not strictly interpreted in terms of changes in acreage.

All of the dams proposed for modifications are within the Ridge and Valley ecoregion. Wetlands within this region occupy a relatively small percent of the landscape relative to uplands; land use/land cover data compiled from satellite data indicates wetlands occupy less than 0.1 percent of the total landscape (Friesen and Stier 2008). This ecoregion is marked by relatively steep topography and deeply incised stream channels; wetlands are typically small and isolated or linear and associated with the floodplain areas of streams, rivers, and creeks (Hefner et al. 1994).

Field surveys were conducted to determine if wetlands were present within the immediate project area at each dam. No wetlands were found within the site specific areas where permanent dam modifications are proposed. Additional evaluation of construction yard and borrow areas indicates no wetlands are present within these areas. Wetlands within the floodplain areas of Fort Loudoun, Tellico, Cherokee, and Watts Bar reservoirs and their tributaries are primarily forested wetlands. Small scrub-shrub and emergent wetlands occur along some nearby reservoir shorelines or within coves and embayments.

3.5.2. Environmental Consequences

Based on a survey of the NWI, there are no wetlands in, or immediately adjacent to the proposed project areas. There is a small freshwater emergent wetland to the southeast of the Marina at Fort Loudoun, approximately 0.25 miles from the proposed project site. There is a small forested wetland approximately 0.75 miles southeast of the Watts Bar Dam project area. Tellico Dam and Cherokee Dam do not have any wetlands within an approximately 1-mile radius (USFWS 2012a).

Given the complete absence of wetlands within the four site-specific areas, where permanent dam modifications are proposed, no direct or indirect impacts would result from the No Action or Action alternatives.

Under the No Action Alternative, no construction would occur and the HESCO barriers would remain in place and existing maintenance activities would continue to have no effect on wetlands. Similarly, all construction activities associated with the project areas under Alternatives B and C would occur entirely on uplands, including the potential use of any construction staging and/or borrow areas; therefore, Alternatives B and C would have no impact on wetlands.

3.6. Aquatic Ecology

3.6.1. Affected Environment

TVA systematically monitors the ecological conditions of its reservoirs through the VSMP described in Section 3.2.1. VSMP monitoring activities focused on aquatic life include benthic macroinvertebrate community sampling and fish assemblage sampling (Dycus and Baker 2001; TVA 2012a). Data from these sampling efforts were used to characterize the aquatic community near each of the proposed project sites. Other relevant VSMP results are described in Section 3.2-1.

Benthic macroinvertebrates are bottom-dwelling invertebrates large enough to be seen with the naked eye, and include animals such as crayfish, mussels and snails, and larvae of aquatic insects. They are included in aquatic monitoring programs because of their importance to the aquatic food chain and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis were based on seven parameters that include species diversity, presence of selected taxa that are indicative of good water quality, occurrence of long-lived organisms, total abundance of all organisms except those indicative of poor water quality, proportion of total abundance comprised by pollution-tolerant oligochaetes (segmented worms), proportion of total abundance comprised by the two most abundant taxa, and proportion of samples with no organisms present.

The fish assemblage is monitored by electrofishing and gill netting to determine the diversity and health of the fish community. Fish are included in aquatic monitoring programs because they are important to the aquatic food chain and because they have a long life cycle which allows them to reflect conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Monitoring results for each sampling station are analyzed to arrive at a Reservoir Fish Assemblage Index (RFAI) rating, which is based primarily on fish community structure and function. Also considered in the rating are the percentage of the sample represented by omnivores and insectivores, overall number of fish collected, and the occurrence of fish with anomalies such as diseases, lesions, parasites, and deformities (Dycus and Baker 2001).

TVA monitors the quality of sport fishing with the Sport Fishing Index (SFI; Hickman 2000). The SFI is based on the results of fish population sampling by TVA and state resource agencies and, when available, results of angler success as measured by state resource agencies (i.e., bass tournament results and creel surveys).

<u>Cherokee Dam</u>

Compared to the stations of other TVA run-of-the-river reservoirs, the benthic community in the Cherokee Reservoir forebay has consistently rated as poor to fair since 2000 with the exception of 2004 when it rated good. It rated poor in 2010 monitoring. The fish assemblage rated fair from 2000 through 2004 and rated good from 2006 through 2010.

Cherokee Reservoir provides many opportunities for sport anglers. In 2008, SFI ratings for Cherokee were better than average for largemouth bass and striped bass and below average for black basses, channel catfish, smallmouth bass, spotted bass, and walleye (Table 3.6-1; TVA 2012b). There are no fish consumption advisories in effect for Cherokee Reservoir.

Table 3.6-1.
SFI Scores for Selected Sport Fish Species in Cherokee Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	35	37
Black Crappie	31	31
Channel Catfish	32	34
Largemouth Bass	40	35
Smallmouth Bass	24	31
Spotted Bass	28	33
Striped Bass	44	35
Walleye	28	38

TVA conducted a bioassessment of the tailwater of the Holston River at mile 51.1, 1.2 miles below Cherokee Dam. Fish were sampled from 2003 to 2009 following TVA's Index of Biological Integrity (IBI) protocol based on Karr et al. (1986). Benthic macroinvertebrates were sampled from 2005-2009 following TVA's Benthic Index for Biotic Integrity (Kerans and Karr 1994). Results of these sampling efforts are combined to produce IBI indices and classifications (TVA 2009b). The annual fish IBI ratings were "Very Poor" or "Poor" and the annual benthic IBI ratings were "Poor" or "Fair."

Fort Loudoun Dam

The benthic community in the Fort Loudoun Reservoir forebay consistently rated poor or very poor during annual monitoring from 2000 through 2007, and poor in 2009. With the exception of 2005, when it rated fair, the forebay fish assemblage rated good from 2000 through 2007, and in 2009. Neither the benthic community nor the fish assemblage was sampled in 2008.

In 2008, Fort Loudoun rated better than average for largemouth bass and smallmouth bass; the SFI rating was below average for black basses, crappie, and white crappie (Table 3.6-2).

Table 3.6-2.
SFI Scores for Selected Sport Fish Species in Fort Loudoun Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	33	37
Black Crappie	30	31
Crappie	28	31
Largemouth Bass	38	35
Smallmouth Bass	35	31
White Crappie	31	33

TVA has also sampled the fish assemblage and benthic community at Tennessee River mile 601.0 in the Fort Loudoun and Tellico tailwater a short distance downstream of the junction with the Little Tennessee River. The fish assemblage was consistently rated good and the benthic community was consistently rated poor at this location in biennial sampling from 2000 through 2010.

Tellico Dam

The benthic community in the Tellico Reservoir forebay rated very poor in biennial sampling between 2001 and 2009. The forebay fish assemblage rated good or fair during this same period. In 2008, Tellico rated below average for black basses, largemouth basses, smallmouth basses, spotted bass, and white crappie (Table 3.6-3).

Table 3.6-3.
SFI Scores for Selected Sport Fish Species in Tellico Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	29	37
Largemouth Bass	26	35
Smallmouth Bass	22	31
Spotted Bass	22	33
White Crappie	22	33

Watts Bar Dam

The benthic community in the Watts Bar Reservoir forebay, sampled two miles upstream of the dam, has consistently rated poor during biennial monitoring from 2000 through 2010. The forebay fish assemblage has rated fair or good during this same time period. In 2008, Watts Bar rated better than average for largemouth bass, black crappie, and spotted bass; the SFI rating was below average for black basses, channel catfish, crappie, smallmouth bass, striped bass, white bass, and white crappie (Table 3.6-4).

Table 3.6-4.
SFI Scores for Selected Sport Fish Species in Watts Bar Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	30	37
Black Crappie	33	31
Channel Catfish	26	34
Crappie	28	31
Largemouth Bass	40	35
Smallmouth Bass	26	31

Table 3.6-4.
SFI Scores for Selected Sport Fish Species in Watts Bar Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Spotted Bass	40	33
Striped Bass	24	35
White Bass	36	40
White Crappie	31	33

Both the benthic community and the fish assemblage in the Watts Bar tailwater have consistently rated good during biennial monitoring from 2000 through 2010.

The Watts Bar tailwater has a relatively diverse population of mussels. The 10-mile stretch of Watts Bar tailwater from the dam downstream to Tennessee River Mile 520.0 is designated as the Chickamauga Reservoir State Mussel Sanctuary due to the high diversity of mussels in the river. This designation prohibits the taking of mussels by any means and the destruction of their habitat. The mussel fauna in mainstem Tennessee River has greatly changed over the last century, with many species disappearing or becoming greatly reduced in range and distribution. Some other mussel species, more tolerant of reservoir conditions, have increased in numbers on overbank habitats (i.e., inundated areas on former floodplains outside of the original river channel). The Watts Bar tailwater is one of the few areas, on the mainstem of the Tennessee River in the eastern Tennessee Valley, where a relatively diverse mussel population persists.

3.6.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts that could occur if any of the alternatives were implemented.

3.6.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possibly dam failure. Longer term use (greater than five years) would require maintenance and/or replacement to continue their effectiveness. None of the HESCO barriers occur in water or would require stream disturbance. Therefore, no direct or indirect impacts to aquatic ecology would occur with the adoption of the No Action Alternative.

3.6.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and, where feasible, raised earthen berms. Runoff of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals; however, BMPs used during construction would minimize any significant run-off of sediment or pollutants. No direct or indirect impacts to listed aquatic ecology are anticipated under Alternative B.

3.6.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be replaced with concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments or berms. However, with the use of BMPs the difference in potential impacts associated with run-off compared to Alternative B would be negligible. No direct or indirect impacts on listed aquatic species are anticipated under Alternative C.

3.7. Terrestrial Ecology

3.7.1. Affected Environment

Dam area field surveys were conducted in May 2011 to assess the vegetative community structure, wildlife habitat, and plant and animal species on the four dam reservations. All four dams occur in the Southern Limestone/Dolomite Valleys and Low Rolling Hill subdivision of the Ridge and Valley Ecoregion (Griffith et al. 1998). The Southern Limestone/Dolomite Valleys and Low Rolling Hills form a heterogeneous region composed predominantly of limestone and cherty dolomite. Ridges are typically forested and valleys are typically a mixture of agriculture and urban/suburban land uses interspersed with patches of forest. Because they are in the same ecoregion and subdivision, the terrestrial ecology of the four dam reservations has much in common and is described below. This is followed by descriptions of features specific to each dam.

Fields are a major habitat type at all four dams. These include extensive frequently mowed lawns dominated by tall fescue and somewhat more diverse hayfields with tall fescue, brome grass, orchard grass, several clover species, buttercups, garden vetch, sheep sorrel, and ragwort. The diversity of wildlife using these fields is low. Mammals likely present include eastern cottontail, woodchuck, white-tailed deer, eastern mole, white-footed mouse, and prairie vole. Birds present include Canada goose, eastern kingbird, American robin, eastern bluebird, northern mockingbird, savannah sparrow, eastern meadowlark, and red-winged blackbird. Reptiles likely present include black racer, black rat snake, and common garter snake. Scattered brushy areas and fencerows are present and support northern cardinals, indigo buntings, blue grosbeaks, and field and song sparrows. Coyotes, red foxes, red-tailed hawks, and American kestrels hunt the fields and brushy areas. Invasive plants in these areas include autumn olive, Bradford pear, bush honeysuckle, mimosa, and tree-of-heaven.

Varying amounts of forest are present. These are primarily mixed deciduous forests dominated by black, southern red, chestnut and white oaks, and tulip poplar. Other trees present include red and sugar maples, dogwood, red bud, hackberry, sweetgum, American sycamore, eastern red cedar, white ash, hickory, shortleaf and white pine, and planted loblolly pine. Invasive plants are common in the understory and include bush honeysuckle, Chinese privet, Japanese honeysuckle, Japanese stiltgrass, and multiflora rose. Wildlife present in the forested habitats likely includes white-tailed deer, eastern gray squirrel, raccoon, wild turkey, downy pileated, and red-bellied woodpeckers, American crow, blue jay, white-breasted nuthatch, Carolina chickadee, eastern tufted titmouse, America robin, several Neotropical migrant birds such as red-eyed and yellow-throated vireo, wood thrush, and yellow-throated and black-and-white warblers, and eastern box turtle and ring-necked snake.

Several species of water birds occur in the vicinity of each dam. Canada geese and mallards are present throughout the year. Migratory waterfowl such as redheads and lesser scaup are often present in the reservoir forebay area during the late fall, winter, and early spring. Also present at this time are common loons, pied-billed and horned grebes, and American coots. Large numbers of ring-billed and Bonaparte's gulls and small numbers of herring gulls use both the forebay and tailwater areas from fall through spring. Double-crested cormorants, great blue herons, and black-crowned night-herons are present throughout the year and most numerous in summer and fall. Killdeer occur throughout the year along the reservoir shorelines and on mowed lawns, and small numbers of other shorebirds, most commonly spotted and solitary sandpipers, may occur along the reservoir shorelines in spring and fall.

Cherokee Dam

At Cherokee Dam, the majority of the current HESCO barriers is placed on earthen embankments topped with a paved or gravel road and covered with rock riprap on the upstream reservoir side and with either grass or riprap on the downstream side. Little other vegetation occurs in the immediate vicinity of these floodwalls. The remainder of the dam reservation is mowed lawns and fields and fragmented deciduous woodlands.

No caves, wading bird (i.e., heron and egret) colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of Cherokee Dam.

Fort Loudoun Dam

The embankment near Fort Loudoun Marina is faced with riprap on the downstream side and vegetated with a mix of native and non-native grasses and forbs on the upstream side. This area is periodically mowed. The west end of the embankment is adjacent to a narrow roadside strip of forest. A small area of mixed deciduous-coniferous forest adjoins the east end of the embankment. The HESCO barriers along U.S. Highway 321 south of the dam are built on the sparsely vegetated road shoulder. The adjacent embankment slope is covered with riprap and, towards the southern end of the embankment, regularly mowed lawn.

A small cedar barren, approximately 1.5 acres in size, occurs near the parking area west of the embankment. The area is dominated by eastern red cedar, redbud and winged elm. Several species of native grasses and sedges are present along with ebony spleenwort. A small depressional pond is located in a woodland downstream of the dam, adjacent to the tailwater access parking lot. This pond area contains several ferns and wetland species including adder's tongue fern, broad beech fern, ebony spleenwort, netted chain fern, rattlesnake fern, sensitive fern, button-bush, silky dogwood, soft rush, and several *Carex* sedges. The pond and associated woodland provide suitable habitat for several amphibians including green frog, spring peeper, and green and gray tree frogs.

Aside from the pond described above, no caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of Fort Loudoun Dam. The nearest known heron colony is about one mile upstream of the dam and the nearest reported cave is about 1.7 miles from the dam. Ospreys nest within about three miles of the dam.

Tellico Dam

The saddle dam extending to the east of the main Tellico Dam is covered with riprap on the upstream slope. On the downstream slope, the upper portion of the downstream slope is regularly mowed lawn and the lower portion is riprap. Saddle Dam No. 2, located southwest of the main Tellico Dam, is forested on part of its upstream slope and covered with regularly mowed lawn on the downstream slope. Saddle Dam No. 3 is covered with riprap on the upstream slope and regularly mowed lawn on the downstream slope.

The 65-acre Hall Bend TVA Habitat Protection Area is located 0.6 miles south of Tellico Dam and adjacent to Saddle Dam No. 1. This area was established to protect an uncommon

limestone bluff and associated barrens plant community. Characteristic barrens plants include little bluestem, side-oat gramma grass, orange coneflower, yucca, and eastern red cedar. No caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations other than the habitat protection area are known from the immediate vicinity of Tellico Dam.

Watts Bar Dam

The existing HESCO barriers are constructed along a roadside adjacent to regularly mowed lawns. A portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest. Common overstory tree species include American beech, black gum, hickories, and black, southern red and white oaks. Several invasive plants are present in the understory.

No caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of the HESCO barriers. The closest heron colony is about 0.25 miles from the dam and ospreys nest a short distance downstream of the dam.

Staging and Borrow Areas

Both Alternatives B and C would require the use of material staging areas during the construction period. Staging areas for Cherokee, Fort Loudoun, Tellico, and Watts Bar dams are shown in Figures 2-2, 2-7, 2-11, and 2-17, respectively. All of the potential staging areas identified by TVA are located within existing parking lots (impervious surfaces), with the exception of the southernmost staging area at Watts Bar dam (Figure 2-17), which is a regularly mowed lawn.

Borrow areas will be required for collection of earthen fill material under Alternative B. Figures 2-3, 2-8, and 2-17 depict these areas. All of these areas are already disturbed and have previously been used for fill material. The estimated volumes of required fill material for the construction of embankments or berms at Cherokee, Tellico, and Watts Bar dams are provided in Chapter 2.

3.7.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts to terrestrial ecology if any of the alternatives are implemented.

3.7.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, TVA would continue to use the HESCO barriers at each of the four dams. No construction would occur; therefore, there would be no need for any borrow material or staging areas and no terrestrial habitats would be disturbed. No direct or indirect impacts to terrestrial ecology are anticipated under this alternative.

3.7.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with a combination of floodwalls and, where feasible, raised earthen berms. Runoff of fine sediments and pollutants (such as gasoline and oil associated with construction equipment) could occur temporarily during construction. This runoff could affect plants and wildlife inhabiting any areas where sediment and pollutants are deposited, as well as any species dependent on aquatic habitats receiving

the runoff. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels; BMPs used during construction would minimize any significant run-off of sediment or pollutants that could be mobilized during construction. Construction noise and movement of vehicles could disturb wildlife in the area, resulting in a negative indirect impact. Additional potential indirect impacts to terrestrial habitat could include damage to adjacent areas or loss of habitat integrity or connectivity. All construction would take place within the existing TVA right-of-way; no impacts to terrestrial ecology are anticipated outside of this area.

At Cherokee Dam, the majority of the current HESCO barriers are built on earthen embankments topped with a paved or gravel road and covered with rock riprap on the upstream reservoir side and with either grass or riprap on the downstream side. The only section of embankment that would be lifted with a berm is the area adjacent to the boat ramp parking lot; all other areas would have floodwalls constructed. Little vegetation exists in the immediate vicinity of the existing flood control structures, other than mowed grass. Mowed grass does not represent a habitat that would support a diverse species assemblage. Minor, potentially negative impacts to the mowed grass areas could occur permanently if additional area is required for floodwall and berm construction. Any additional area required for the footprints would be either returned to mowed grass, or be covered in concrete. These potentially permanent impacts would occur on a very small area immediately adjacent to the existing structures. Any areas damaged during construction would presumably be returned to their original state. While construction equipment is present, minor and temporary negative impacts to terrestrial ecology could occur under Alternative B. Additionally, during construction, noise and equipment may disturb resident wildlife in the area; this indirect negative impact would be minor and temporary, as wildlife would be expected to return once construction is complete.

At Fort Loudoun Dam, site constraints prevent TVA from constructing any berms; all permanent modifications at this dam would be floodwalls. The embankment with HESCO barriers near Fort Loudoun Marina is faced with riprap on the downstream side and vegetated with a mix of native and non-native grasses and forbs on the upstream side. The west end of the embankment is adjacent to a narrow roadside strip of forest. The HESCO barriers along U.S. Highway 321 south of the dam are built on the sparsely vegetated road shoulder. The direct and indirect impacts at Fort Loudoun Dam would be similar to those at Cherokee Dam. However, a small area of mixed deciduous-coniferous forest adjoins the east end of the embankment. The small cedar barren and associated pond area adjacent to the parking lot could experience larger negative impacts to terrestrial ecology, including physical damage and runoff of pollutants and sediment. BMPs would be used in order to protect both the pond and the surrounding barren from run-off of sediment and pollution and prevent physical damage. With these BMPs in place, direct and indirect negative impacts to terrestrial ecology are anticipated to be minor and temporary.

At Tellico Dam, the flood control structures at Saddle Dam No. 1 are covered with riprap on the upstream slope and on the downstream slope, the upper portion is regularly mowed lawn and the lower portion is riprap. Saddle Dam No. 2 is forested on part of its upstream slope and covered with regularly mowed lawn on the downstream slope. Saddle Dam No. 3 is covered with riprap on the upstream slope and regularly mowed lawn on the downstream slope. These areas should experience similar direct and indirect impacts to the Cherokee and Fort Loudoun Dam areas. Saddle dams Nos. 2 and 3 would experience moderate negative impacts if berms are constructed here due to the large footprint necessary to lift the existing berm. Forested

areas may experience slightly more severe negative impacts if the removal of trees and other large vegetation is required.

The 65-acre Hall Bend TVA Habitat Protection Area is located adjacent to Saddle Dam No.1 at Tellico Dam. This area was established to protect an uncommon limestone bluff and associated barrens plant community. The use of BPMs to protect this area during construction would eliminate or severely reduce any potential negative direct or indirect impacts to the Habitat Protection Area. Minor and temporary indirect impacts to terrestrial ecology could occur due to the disturbance of wildlife during construction.

At Watts Bar Dam, the existing HESCO barriers are constructed along a roadside adjacent to regularly mowed lawns. Under this alternative, all lifts would be accomplished by constructing berms. The areas adjacent mowed lawns would experience similar impacts to those at Cherokee and Tellico dams where berms are constructed; a minor temporary negative impact to terrestrial ecology. Berm construction requires a large footprint; however, it is expected that upon completion of the berms, the berms would be seeded and returned to their current condition. Therefore, for the areas adjacent to the road, minor temporary impacts to terrestrial ecology could occur, but no permanent impacts are anticipated. A portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest. The area of forest that would be removed to tie into the higher ground would experience moderate negative direct impacts due to permanent loss of habitat. This area is small in size; however, it is not a unique habitat in the area. Overall, the loss of habitat would be very small and easily recovered as wildlife impacted would simply move to another forested area nearby.

Overall, under Alternative B, minor and temporary negative impacts to terrestrial ecology would occur during construction. Some potential direct negative impacts could be avoided by the use of specially designed BMPs. A minor loss of terrestrial habitat could occur at all dams, especially at Watts Bar Dam; however, these losses would be very minor in relation to the surrounding existing similar undisturbed habitat. Minor and temporary indirect negative impacts could occur during construction to nearby wildlife. Wildlife is expected to return to the area once construction is complete.

Staging and Borrow Areas

Under Alternative B, borrow areas would be required to provide fill material for the earthen berms. Both proposed borrow areas have been previously disturbed and have been used for fill before. A permanent, minor direct impact to terrestrial resources could occur under this alternative. Potential impacts would include destruction of habitat, removal of trees and shrubs, and accidental injuries to wildlife in the area. Potential indirect impacts could occur if the construction noise caused wildlife to vacate the project area. The degree of potential impact is directly related to the amount of fill material required at each dam (Section 2.1.1).

All proposed staging areas are located within existing parking lots (impervious surfaces) in the vicinity of the dams, with the exception of a small, grassy area (low quality habitat) south of Watts Bar Dam (Figure 2-17). No direct or indirect impacts to terrestrial resources would occur at any of the borrow or staging areas identified under the Proposed Action.

3.7.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be replaced by permanent concrete floodwalls at each segment for all four dams; no in-water work would occur. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments/berms. Potential direct impacts to terrestrial ecology include permanent loss of habitat if needed for the foundations of the floodwalls or additional riprap. Construction noise and movement of vehicles could disturb wildlife in the area, resulting in a negative indirect impact. Additional potential indirect impacts to terrestrial habitat could include damage to adjacent areas or loss of habitat integrity or connectivity.

The direct and indirect impacts to terrestrial ecology would be similar, but considerably smaller than those experienced under Alternative B. Floodwalls require a smaller area for foundation; therefore, fewer habitats would be lost or temporarily affected during construction. Conversely, existing habitat at the dams is primarily characterized by existing berms, floodwalls, mowed grass, and paved roadways. Potential direct and indirect impacts to terrestrial resources under Alternative C would be minor.

Staging and Borrow Areas

All proposed staging areas would be located within existing parking lots in the vicinity of the dams. Under Alternative C, no borrow material would be required; therefore, no direct or indirect impacts to terrestrial ecology associated with borrow and/or staging areas would occur.

3.8. Threatened and Endangered Species

Threatened and endangered species are regulated by a number of federal and state laws. The federal laws relevant to the Proposed Action include:

- The ESA (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984, and 1988); and
- The Bald and Golden Eagle Protection Act (BGEPA) (1940).

Endangered Species Act (ESA)

As discussed above, Section 7 of the ESA requires Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species listed as endangered or threatened or impact critical habitats. If listed species are present (or likely to be present) in the project area, then the action agency must determine whether the project would affect them. If so, consultation is required with USFWS. If it is determined that the project is not likely to adversely affect any listed species or critical habitat, informal consultation can be concluded with concurrence from the USFWS. If the effects are likely to be adverse, the action agency formally consults with the USFWS. Formal consultation is typically concluded with the issuance of a Biological Opinion and incidental take permit by USFWS. The incidental take permit authorizes to proceed with the action while taking measures to reduce and/or mitigate the effects on the listed species.

Bald and Golden Eagle Protection Act (BGEPA)

The BGEPA, enacted in 1940 and amended several times since then, prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles, including their parts, nests, or eggs. The BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or any manner, any bald eagle [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

For purposes of these guidelines, "disturb" means “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." This definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

3.8.1. Affected Environment

3.8.1.1. Aquatic Fauna

Aquatic fauna that are endangered, threatened, or of state concern (ETSC) and are known to occur within a 10-mile radius of one or more of the four dams include 23 species of fish, amphibians, and invertebrates. Of these, 11 are federally and state-listed as endangered, one is federally listed as threatened, one is state-listed as threatened, two are proposed for Federal listing as endangered, and 10 are of state concern and tracked by the Tennessee Natural Heritage Inventory Program or designated as in need of management by the Tennessee Wildlife Resources Agency (Table 3.8-1).

Table 3.8-1.
Threatened and Endangered Aquatic Fauna Known to Occur within a 10-mile radius of a Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
Fish							
Blotchside logperch	*Percina burtoni*	NMGT (S2)	-		X	X	
Blue sucker	*Cycleptus elongatus*	THR (S2)	-	X	X	X	
Flame chub	*Hemitremia flammea*	NMGT (S3)	-		X	X	X
Snail darter	*Percina tanasi*	THR (S2S3)	THR		X	X	X
Tangerine darter	*Percina aurantiaca*	NMGT (S3)	-		X	X	X
Mollusks							
Anthony's riversnail	*Athearnia anthonyi*	END (S1)	END		X	X	
Birdwing pearlymussel	*Lemiox rimosus*	END (S1)	END	X			
Dromedary pearlymussel	*Dromus dromas*	END (S1)	END				X
Fanshell	*Cyprogenia stegaria*	END (S1)	END		X	X	X
Fine-rayed pigtoe	*Fusconaia cuneolus*	END (S1)	END		X	X	
Orange-foot pimpleback	*Plethobasus cooperianus*	END (S1)	END		X	X	X
Pink mucket	*Lampsilis abrupta*	END (S2)	END	X	X	X	X
Pyramid pigtoe	*Pleurobema rubrum*	TRKD (S2S3)	-				X
Ring pink	*Obovaria retusa*	END (S1)	END		X	X	
Rough pigtoe	*Pleurobema plenum*	END (S1)	END				X
Sheepnose	*Plethobasus cyphyus*	TRKD (S2S3)	PE	X	X	X	
Shiny pigtoe pearlymussel	*Fusconaia cor*	END (S1)	END				X
Spectaclecase	*Cumberlandia monodonta*	TRKD (S2S3)	PE	X			
Spiny riversnail	*Io fluvialis*	TRKD (S2)	-	X	X	X	
Tennessee clubshell	*Pleurobema oviforme*	TRKD (S2S3)	-		X	X	X

Table 3.8-1.
Threatened and Endangered Aquatic Fauna Known to Occur within a 10-mile radius of a Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
White wartyback	*Plethobasus cicatricosus*	END (S1)	END	X			
Insects							
Cherokee clubtail	*Gomphus consanguis*	TRKD (S1)	-				X
Salamanders							
Hellbender	*Cryptobranchus alleganiensis*	NMGT (S3)	-	X	X	X	

[1]Status Codes: END = Listed Endangered; PE = Proposed Listed Endangered; THR = Listed Threatened; NMGT = In Need of Management; TRKD = Tracked by Tennessee Natural Heritage Inventory Program due to conservation concern.

[2]State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable

No critical habitat has been designated in the project areas for any of the federally listed species. No listed aquatic animals are known or likely to occur on or in the immediate vicinity of the proposed borrow areas. Based on their habitat requirements, collection records, and population status, 12 of the species listed in Table 3.8-1 are known to occur or, based on records since the 1970s, likely to occur in the immediate vicinity of or in the upper tailwater downstream of one or more of the dams. These species are described in more detail below.

The **blue sucker** inhabits deep pools of large, free-flowing rivers with swift currents and gravel or other hard substrates. It was historically common throughout its range but has declined, possibly as a result of overfishing and impoundment and siltation of large rivers (Etnier and Starnes 1993; Boschung and Mayden 2004). Its abundance may be underestimated due to the difficulty of collecting it in its deep water habitat. Recent records of the blue sucker in the project area have been reported from the Holston River and from the Tennessee River below the Fort Loudoun and Watts Bar dams.

The **snail darter** was for many years only known from the lower Little Tennessee River and part of the adjacent Tennessee River (Hickman and Fitz 1978, USFWS 1984a). Although this population was eliminated by the closure of Tellico Dam, snail darters from this population were transplanted to other sites, including the lower Holston River, in the 1970s. Populations were subsequently found in other locations, and the species is generally considered to be increasing in distribution and population size. Adult snail darters occur and reproduce in stream reaches with extensive areas of clean-swept, sand-gravel shoals (Hickman and Fitz 1978; Etnier and Starnes 1993). After hatching, larvae apparently drift downstream into deeper areas for a time before returning to upstream shoals as adults. Some snail darters apparently are able to tolerate reservoir conditions and can disperse in enough numbers to establish new populations in adjacent streams. Within the project area, snail darters occur in the Holston River about 20 miles downstream from Cherokee Dam, and in the tailwaters of the Fort Loudoun and Watts Bar dams.

The **dromedary pearlymussel** typically occurs in moderate- to fast-flowing current in clean-swept rubble, gravel, and sand substrates of both small and large rivers (USFWS 1984b). This

once abundant species is presently restricted to a few river reaches in the Cumberland and Tennessee River systems. Likely causes of its decline include impoundments, siltation, and pollution. The only known recent occurrence within the project area is in the Watts Bar Dam tailwater, where it was observed in the late 1970s and early 1980s between 8 and 11 miles downstream of the dam (Gooch et al. 1979; TVA 1986b).

The **fanshell** formerly occurred in the Ohio, Wabash, Cumberland, and Tennessee River systems (USFWS 1991). Identified causes for its decline include the construction and operation of reservoirs and other impacts on water and substrate quality. Recent records of this species in the Tennessee River system are from the Clinch River in Tennessee and Virginia, and from the tailwaters of several mainstem dams, including Watts Bar. The Watts Bar records have been of single individuals between about 1 and 10 miles downstream of the dam. Typical fanshell habitat is gravel or cobble substrate in medium to large rivers (USFWS 1991).

The **orangefoot pimpleback** historically occurred in parts of the Ohio, Cumberland, Kanawha, Tennessee, and Wabash Rivers (USFWS 1984c). Since the early 1970s, it has been found in the lower Ohio River, in the middle reach of the Cumberland River, and in the tailwaters of mainstem dams on the Tennessee River (USFWS 1984c, Parmalee and Bogan 1998). Project area records include one in the late 1970s between 6 and 8 miles downstream of Fort Loudoun Dam, and one, also in the late 1970s, between 13 and 15 miles downstream of Watts Bar Dam. The reasons for the decline of this species are not totally understood but, due to its longevity and sedentary nature, it appears especially vulnerable to stream perturbations such as impoundment, siltation, and pollution (USFWS 1984c). The orangefoot pimpleback occurs in shoals in large rivers, typically in sand and coarse gravel.

The **pink mucket** once occurred in a variety of cobble, gravel, and other substrate types in medium to large rivers in the Ohio, Cumberland, Tennessee, and middle Mississippi River systems (Parmalee and Bogan 1998). In recent years, it has been found at locations scattered across the former range where suitable riverine habitat still exists. These locations extend from the Kanawha River in West Virginia west to the Gasconade River in Missouri, south to the Black River in Arkansas, and east to the Tennessee and Cumberland River basins (USFWS 1985). In many of these locations, the pink mucket is regularly encountered in low numbers that suggest relatively stable populations. Within the project area, there are multiple recent records of the pink mucket between 20 and 25 miles downstream of Cherokee Dam, at several locations within a few miles downstream of Fort Loudoun Dam, and at several locations within a few miles downstream of Watts Bar Dam, beginning about one mile below the dam (TVA unpublished records). The causes of the decline for this species are not totally understood but are likely related to impoundments, siltation, and pollution (USFWS 1985).

The **pyramid pigtoe** was once widespread in the Ohio, Cumberland, and Tennessee rivers and their larger tributaries, as well as into Kansas and Arkansas (Parmalee and Bogan 1998). Since the early 1970s, it has been found alive in the Barren and Green rivers in Kentucky, and in the Clinch, Cumberland, and Tennessee rivers in Tennessee (USFWS 1984d). Within the project area, it has been reported in recent years from the Watts Bar Dam tailwaters within about 1.5 miles downstream of the dam. The reasons for the decline of this species are not totally understood but, due to the longevity of most mussel species, they are especially vulnerable to stream perturbations such as impoundments, siltation, and pollution (USFWS 1984d). It typically occurs in large river habitats and is found in firmly packed mixtures of sand and gravel.

The **sheepnose** was added to the list of endangered species in 2012 due to its apparent range-wide decline likely due to impoundments, channelization, chemical contaminants, mining, and sedimentation (USFWS 2012b). It has recently been reported from scattered locations across its broad historic range that extends from Minnesota to Arkansas, Alabama, Virginia, and Pennsylvania. Within the project area, the sheepnose occurs in the Holston River between about 18 and 22 miles downstream of Cherokee Dam. It typically occurs in areas of large rivers with moderate to swift currents and sand and gravel substrates.

The historic range of the **shiny pigtoe** is the Tennessee River system upstream of Muscle Shoals (Parmalee and Bogan 1998). One historic record of the shiny pigtoe has been reported from the Watts Bar Dam tailwater; the species has not been recently reported in this area. They shiny pigtoe is typically found in riffle and shoal areas with moderate to fast currents in small to medium-sized rivers.

The **spectaclecase** historically occurred in numerous streams in the Mississippi, Ohio, and Missouri River basins, including the Cumberland and Tennessee River systems. Because of an apparent rangewide decline, it was added to the list of endangered species in 2012 (USFWS 2012b). The only project area record of the spectaclecase is from the 1960s, when it was reported from the Holston River within the first three miles downstream of Cherokee Dam. It occurs in medium to large rivers and in gravel, sand, and mud substrates (Parmalee and Bogan 1998).

The **white wartyback** historically occurred in the Cumberland, Ohio, Kanawha, Tennessee, and Wabash Rivers (Parmalee and Bogan 1998, USFWS 1984e). Its current populations appear restricted to the Tennessee River in the tailwaters of the Pickwick and Wilson dams. Like the spectaclecase, the only project area record of the white wartyback is from the 1960s, when it was reported from the Holston River within the first three miles downstream of Cherokee Dam. The white wartyback occurs in big rivers in shoals and riffle areas with sand and gravel substrate.

The **hellbender** occurs primarily in medium-sized to large free-flowing streams in the Tennessee and Cumberland River drainages. It is typically found under large rocks or logs in shallow rapids (NatureServe 2009). It was found in the lower Little Tennessee River prior to its impoundment by Tellico Dam; this population is likely extirpated. It could persist in tailwaters below the dams.

3.8.1.2. Terrestrial Fauna

No listed terrestrial fauna are known or likely to occur on or in the immediate vicinity of the four dams or the proposed borrow areas. No federally or state-listed terrestrial animal species were observed during field surveys of the project areas conducted in May 2011. The only listed terrestrial animal documented within three miles of one or more of the four dams is the bald eagle (*Haliaeetus leucocephalus*). It was formerly on the Federal list of endangered species but was delisted in 2007 due to the recovery of its population. The bald eagle remains protected under the BGEPA and the Migratory Bird Treaty Act (MBTA) and it is designated by the State of Tennessee as In Need of Management. The gray bat (*Myotis grisescens*), federally listed as endangered, has been reported from other locations in Jefferson County (site of Cherokee Dam) and from Meigs and Rhea Counties (site of Watts Bar Dam). The Indiana bat (*Myotis sodalis*), also federally listed as endangered, has been reported from other locations in Jefferson County. These species are described in more detail below.

Bald eagles nest in forested areas near large bodies of water, such as rivers and reservoirs, where they forage (Bryan et al. 2005; Thompson et al. 2005). Bald eagles nest in the counties where the dams are located (Grainger, Jefferson, Loudon, Meigs and Rhea). The closest documented active nest to Fort Loudoun and Tellico dams is approximately 1,400 feet from Tellico Dam, at the junction of the Tennessee and Little Tennessee Rivers. In recent years, a pair of eagles has built two nests about a mile downstream of Cherokee Dam. All of the nests in Meigs and Rhea counties are more than three miles from Watts Bar Dam. With the exception of Tellico Saddle dams Nos. 2 and 3, located about 1.4 miles south of the main Tellico Dam, suitable forested perching and nesting habitat does not occur in the immediate vicinity of any of the sites where the proposed permanent modifications would occur. All of the reservoirs and their tailwaters provide suitable foraging habitat for bald eagles.

Occurrence of the gray bat has been documented in Meigs and Rhea counties, where Watts Bar Dam is located, and Grainger and Jefferson counties, where Cherokee Dam is located. All records from these counties are greater than three miles from the dams. Gray bats inhabit caves throughout the year, migrating between summer roosts and winter hibernacula, and forage over streams, rivers, and reservoirs (Tuttle 1976). No caves were identified within the project area during field surveys. Reservoirs and tailwaters adjacent to each of the project areas provide suitable foraging habitat.

Indiana bats hibernate in caves during winter and roost in forested habitat during summer. Typical summer roosts are in the cracks and crevices of damaged trees or under sloughing bark on dead or live trees (Tuttle and Kennedy 2002; Harvey 2002). Wintering Indiana bats have been reported from a cave in Jefferson County and a cave in Grainger County. Both of these caves are more than three miles from Cherokee Dam and the Grainger County population is likely extirpated. There are no summer records of Indiana bats from the immediate vicinity of any of the four dams, and no suitable winter caves or summer roosting habitats were identified during field surveys of the project areas.

3.8.1.3. Aquatic and Terrestrial Flora

No plants that are federally listed as endangered or threatened or are candidates proposed for listing are known from the five counties where the dams are located. Three plant species state-listed in Tennessee as threatened and three species of special concern have been reported as occurring within five miles of the four dams (Table 3.8-2).

Table 3.8-2.
Threatened and Endangered Plants Known to Occur within a Five-mile radius of each Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
Appalachian bugbane	*Cimicifuga rubifolia*	THR (S3)	-	X			
Large-leaf pondweed	*Potamogeton amplifolius*	THR (S1)	-			X	
Mountain honeysuckle	*Lonicera dioica*	SPCO (S2)	-		X	X	
Prairie goldenrod	*Solidago ptarmicoides*	SPCO (S1)	-				X
Slender blazing Star	*Liatris cylindracea*	THR (S2)	-				X
Spreading false-	*Aureolaria patula*	SPCO (S3)	-		X	X	X

Table 3.8-2.
Threatened and Endangered Plants Known to Occur within a Five-mile radius of each Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
foxglove							

[1]Status Codes: THR = Listed Threatened; SPCO - Special Concern.
[2]State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable

No ETSC plants were found during field surveys of the dam reservations conducted in May 2011 and, based on the habitats present, none are likely to occur.

3.8.2. Environmental Consequences

This section contains an analysis describing any potential direct or indirect impacts that could occur to ETSC species as a result of the implementation of any of the Proposed Alternatives.

3.8.2.1. Alternative A – No Action Alternative

Aquatic Fauna

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possibly dam failure. Longer term use (greater than five years) would require maintenance and/or replacement to continue their effectiveness. None of the HESCO barriers occur in water or would require stream disturbance. Therefore, no direct or indirect impacts to aquatic ETSC species would occur under the No Action Alternative.

Terrestrial Fauna

Under the No Action Alternative, TVA would maintain the existing HESCO barriers and other facilities at each of the four dams. This would not affect the hellbender, bald eagle, gray bat, Indiana bat, or any other terrestrial ETSC species. The status and conservation of these species would continue to be determined by other actions and changes that would occur in the area over time, such as population trends; land use and development; quality of air/water/soil; recreational patterns; and cultural, ecological, and educational changes. Therefore, there would be no direct or indirect impacts on endangered and threatened species and their critical habitats under the No Action Alternative.

Aquatic and Terrestrial Flora

Under the No Action Alternative, the current modifications, using HESCO barriers to raise the height of the dams, Saddle dams, and embankments, at Cherokee, Fort Loudoun, Tellico and Watts Bar dams will remain in place with periodic maintenance needed to replace or repair damaged units. Since neither rare plants nor habitat to support those species were found in the areas of the dam reservations, embankments, and Saddle dams where HESCO barriers are currently placed, no direct or indirect impacts are anticipated to ETSC plant populations as a result of the No Action Alternative.

3.8.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Aquatic Fauna

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and raised earthen berms, where feasible. Run-off of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels. However, BMPs used during construction would minimize any significant run-off of sediment or pollutants that could be mobilized during construction and the establishment of vegetation cover on the earthen berms would prevent erosion and run-off from these areas after construction. Therefore, no direct or indirect impacts to aquatic ETSC species are anticipated under Alternative B.

Terrestrial Fauna

Under Alternative B, the construction of earthen berms increases the potential for siltation into the adjacent reservoirs and tailwaters. The use of standard BMPs to control siltation during construction and the establishment of vegetation cover on the berms after construction would minimize adverse effects on fish and aquatic insects that are components of the food supply for the terrestrial ETSC species reported from the vicinity of the dams. In addition, to protect the bald eagle in accordance with management guidelines under the BGEPA, TVA will resurvey the areas surrounding Tellico Saddle dams No. 2 and No. 3 for eagle nests prior to scheduling the construction work. In the event that an active eagle nest is located within 660 feet of either site, TVA will schedule the work to avoid the December 16 to May 31 eagle nesting season. With the adoption of this measure, no direct or indirect impacts to terrestrial ETSC animals are anticipated to result from Alternative B.

Aquatic and Terrestrial Flora

Neither ETSC plants nor their habitats occur in the areas of the dam reservations, embankments, and saddle dams where HESCO barriers would be replaced by floodwalls and berms. Consequently, no direct or indirect impacts to ETSC plants are anticipated under Alternative B.

3.8.2.3. Alternative C – All Floodwalls

Aquatic Fauna

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the flood-walls alone compared to Alternative B, which includes earthen embankments. Therefore, no direct or indirect impacts on aquatic ETSC species are anticipated under Alternative C.

Terrestrial Fauna

Suitable habitat was not identified in the project area for the gray bat or Indiana bat. Potentially suitable nesting habitat for the bald eagle is available in woodlands adjacent to Tellico Saddle

dams Nos. 2 and 3. In accordance with management guidelines under the BGEPA, TVA will resurvey these areas for eagle nests prior to scheduling the construction work. In the event that an active eagle nest is located within 660 feet of either site, TVA will schedule the work to avoid the December 16 to May 31 eagle nesting season. With the adoption of this measure, no direct or indirect impacts to terrestrial ETSC animals are anticipated to result from Alternative C.

Aquatic and Terrestrial Flora

Neither ETSC plants nor their habitats occur in the areas of the dam reservations, embankments, and saddle dams where HESCO barriers would be replaced by floodwalls. Consequently, no direct or indirect impacts to ETSC plants are anticipated under Alternative C.

3.9. Land Use

Shoreline development along TVA reservoirs is managed in accordance with the Shoreline Management Policy (SMP) established by the 1999 Shoreline Management Initiative (SMI; TVA 1999); TVA Reservoir Land Management Plans (RLMPs) for individual reservoirs (see Section 1.7); and applicable Federal, state, county, and municipal regulations. TVA also manages reservoir shoreline development through the Section 26a permitting process, which regulates the construction of shoreline structures. TVA does not otherwise regulate private property, except as specifically provided for in individual property flowage easements or in deeds where TVA sold property but retained rights to protect flood control interests and manage certain construction activities. Flowage easements vary widely among reservoirs and provide TVA with varying levels of control over construction on and use of flowage easement shore lands (TVA 2004).

Section 26a of the TVA Act requires that TVA approve the construction, operation, and maintenance of any obstruction affecting navigation, flood control, or public lands—across, along, or in the Tennessee River or its tributaries—even when TVA has no land rights involved. NEPA, the National Historic Preservation Act (NHPA), and the ESA indirectly affect implementation of Section 26a. These statutes require TVA to evaluate the environmental impacts of their proposed actions. This process leads to approval, denial, or revision of proposed project plans in order to avoid adverse environmental impacts. Once approved, permit recipients are required to follow the construction procedures and environmental protection measures specified. Coupled with these and other environmental requirements, Section 26a ensures that development along the Tennessee River and its tributaries receives adequate planning and review. The SMI indicated that 85 percent or more of all Section 26a permit approvals were for structures directly associated with shoreline residential property, such as private docks, piers, and boathouses (TVA 1999).

In the 1990s, TVA developed and implemented the SMI to better protect shoreline and aquatic resources while allowing adjacent residents reasonable access to the water due to growing public concern for potential effects on reservoir shoreline resources due to increasing shoreline residential development. Access rights to the water determine the geographical pattern for residential development around specific reservoirs. Specific standards for facility size and vegetation management were established in the SMI. The SMI also established a shoreline classification system wherein shoreline environmental constraints would be identified and appropriate management strategies implemented (TVA 1999).

TVA also manages shoreline development through its land management planning process. Eleven watershed teams are responsible for the implementation of shoreline management, through both Section 26a and the SMP that was created by the SMI. In addition to other responsibilities, these teams oversee and coordinate the land use planning and management of one or more TVA reservoirs within a defined watershed. RLMPs define allowable development for recreational, commercial, residential access, and industrial uses along TVA shorelines (TVA 2004).

Cherokee Dam

The RLMP for Cherokee Dam designates the project area as 'Zone 2 – Project Operations' (TVA 2001). Land uses within this category include:

- Land adjacent to established navigation operations—Locks, lock operations and maintenance facilities, and the navigation work boat dock and bases.
- Land used for TVA power projects operations—Generation facilities, switchyards, transmission facilities, and rights-of-way.
- Dam reservation land—Areas used for developed and dispersed recreation, maintenance facilities, Watershed team offices, research areas, and visitor centers.
- Navigation safety harbors/landings—Areas used for tying off commercial barge tows and recreational boats during adverse weather conditions or equipment malfunctions.
- Navigation day boards and beacons—Areas with structures placed on the shoreline to facilitate navigation.
- Public works projects—Includes fire halls, public water intakes, public treatment plants, etc. (These projects are placed in this category as a matter of convenience and may not relate specifically to TVA projects).
- Highways adjusted due to the development of the Tellico Project— Includes highways that were relocated or elevated to a location or an elevation that would allow continued use during normal flood events.
- Land planned for any of the above uses in the future (TVA 2000).

The definition for this land use is the same as that for Tellico and Watts Bar Reservoirs. This operations zone encompasses the entire project area for Cherokee Dam (Figure 3.9-3).

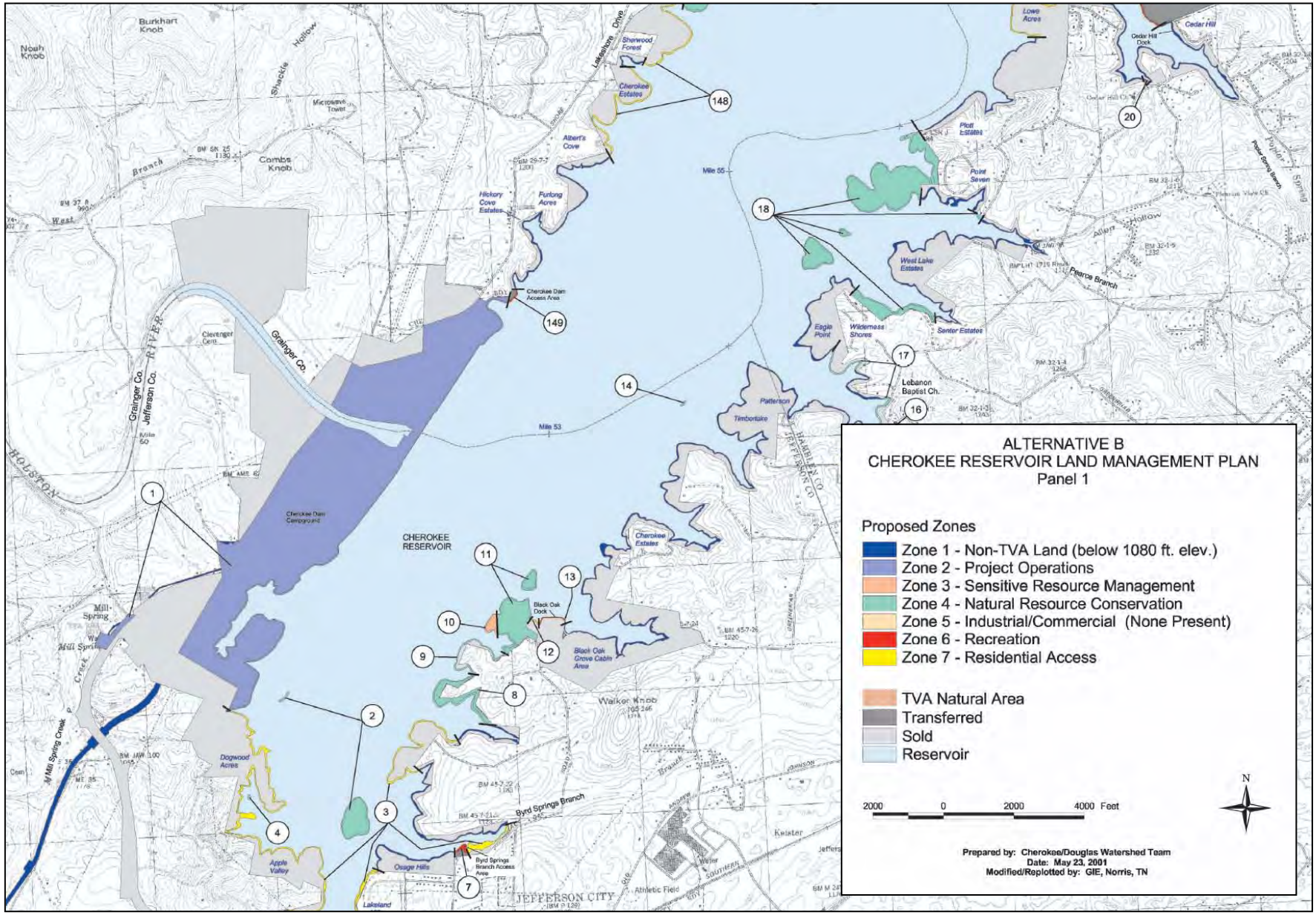


Figure 3.9-1. Cherokee Reservoir Land Use Designations (TVA 2001)

Fort Loudoun Dam

TVA does not have a formal reservoir land management plan for Fort Loudoun. The TVA-owned lands in the immediate vicinity of the dam and the proposed floodwalls are managed as if they had the formal Zone 2 – Project Operations allocation. Deed and/or lease restrictions specify that the tract where the nearby Fort Loudoun Marina is located be used for commercial recreation, and the nearby Lenoir City Park be used for public recreation (personal communication, TVA 2012c).

Tellico Dam

The Tellico RLMP designates the land surrounding Tellico Dam under Zone 2, the 'TVA Project Operations' category. The parcel containing Tellico Dam and the adjacent flood control structures is described as follows:

- "Parcel 1 (614.2 acres [248.56 hectares]) hydraulic unit (HUC) Nos. TN-06010201-130; TN-06010201-140; and TN-06010204-140. Zone 2, TVA Project Operations
- Public Access Ramp
- Tellico Dam and Spillways
- Navigation Safety Landing
- Canal Daybeacon - Mile 0.61"

Parcel 1 begins at Little Tennessee River mile 0 on both sides of the inter-reservoir canal and then stretches up the left (descending) bank to approximately River mile 3.6. On the Tennessee River side of this parcel, it reaches from the Fort Loudoun Dam down the left descending bank to Tennessee River mile 598.6" (TVA 2000). Figure 3.9-2 shows the land use designations for the Tellico Dam area.

The RLMP further describes the purpose of the land use designation at Tellico; this description should apply to all other dams and their reservations. The primary purpose of this land designation is to manage the property for protection of the integrity of the dam and associated switchyards and power lines. Secondarily, this property contains amenities and facilities that are designed for use by the general public for a variety of recreational purposes (TVA 2000).

Watts Bar Dam

The Watts Bar RLMP also designates all the land surrounding the dam as 'TVA Project Operations' (Figure 3.9-3) (TVA 2009a). The definition associated with this land use at Tellico Dam also applies here. The parcels surrounding the dam have been retained in their current use after the ROD for the Final EIS for the RLMP was published (TVA 2009a).

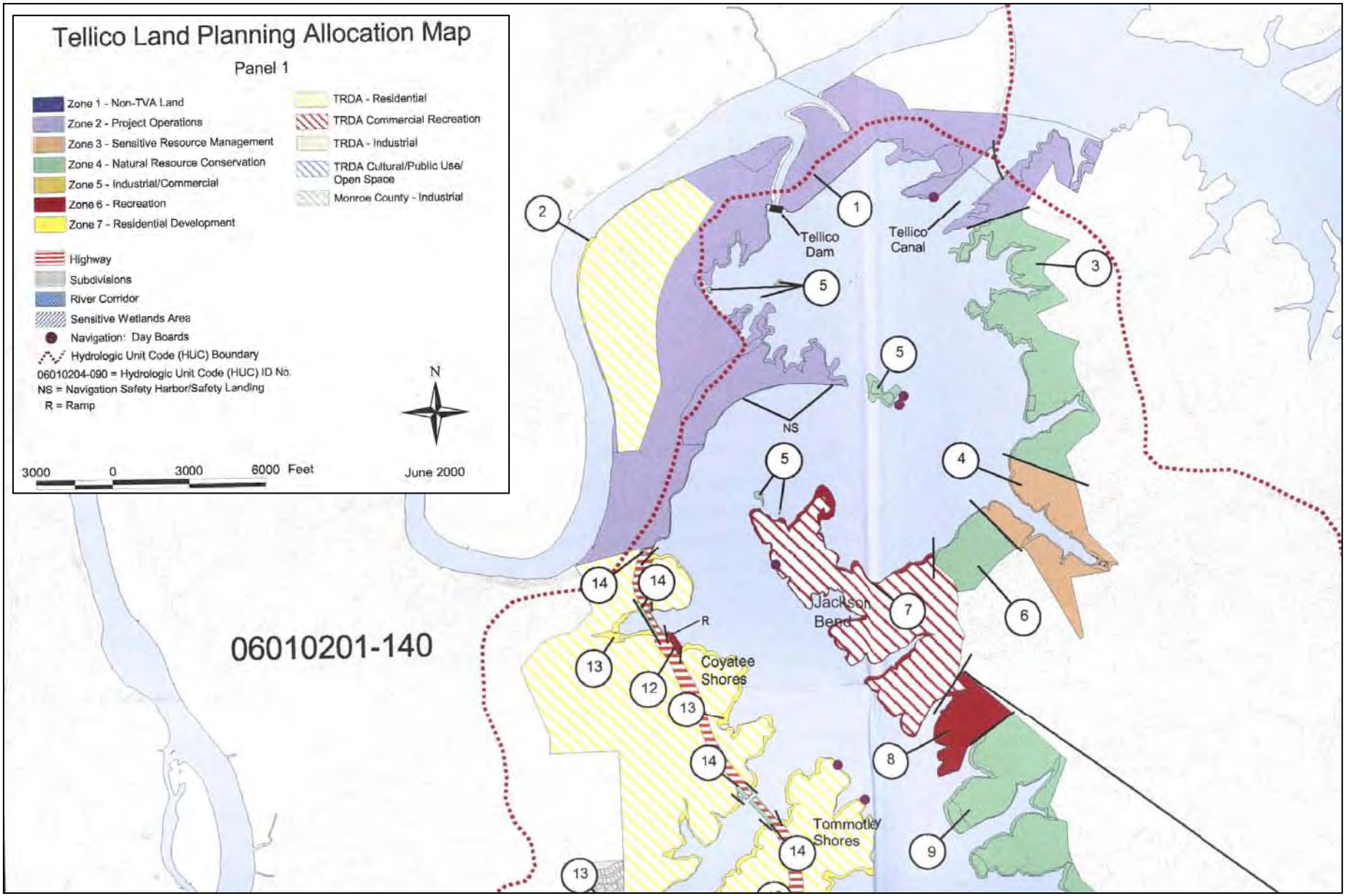


Figure 3.9-2. Tellico Dam Area Land Use Designations (TVA 2000)

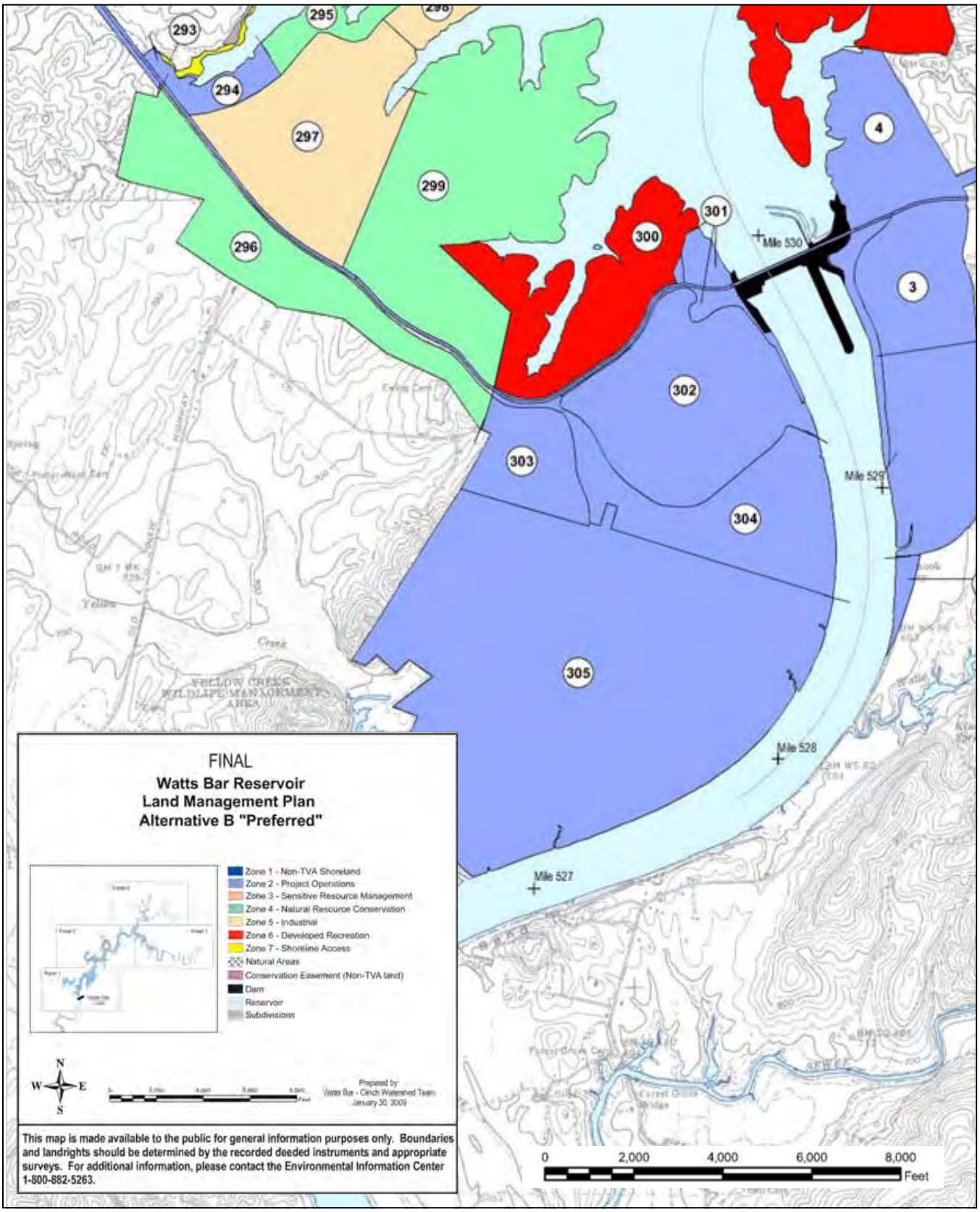


Figure 3.9-3. Watts Bar Dam LMP Designations near Watts Bar Dam

3.9.1. Affected Environment

The Proposed Action of modifying the dam embankment heights would affect land use primarily at the shoreline immediately adjacent to the existing flood control structures. Therefore, the analysis of land use impacts is focused on shoreline land use in the immediate vicinity of TVA shorelines adjacent to the proposed alternatives.

A total of approximately four shoreline miles comprise the four project areas (1.2 miles at Cherokee; 0.75 miles at Fort Loudoun; 1.75 miles at Tellico; and 0.3 miles at Watts Bar). This land use analysis does not include any residential development in the area, as any changes in land use would be within the immediate vicinity of the existing dams and levees. Types of land use within this area would be associated with the existing levees and dams and recreation areas.

The Proposed Action would raise existing flood containment structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. All construction would be on TVA property at each dam. The existing dams and floodwalls are composed of reinforced concrete; levees are generally earthen embankments with varying amounts of concrete hardening and riprap.

Cherokee Dam is 175 feet high and 6,760 feet long. The dam consists of a 2,150-foot long north earthen embankment, a central 1,697-foot long concrete portion containing the spillway and penstock intakes, and a 2,913-foot long south earthen embankment. Three separate earth-fill saddle dams, totaling 1,770 feet in length, are located to the south of the main dam. Fort Loudoun Dam is 122 feet high and 4,190 feet long. The 1,550-foot long concrete portion of the dam, containing the spillway, lock and penstock intakes, is located on the north side against a rock bluff. The remainder of the dam of the dam to the south is an earthen embankment faced with rock. A separate saddle dam about 550-feet long spans a low area near Fort Loudoun Marina, about 3/4 mile northeast of the main dam. Tellico Dam is 129 feet high and 3,238 feet long. The main concrete portion, approximately 538 feet long and containing the spillway, is located at the west end of the dam. The remainder of the dam is earthen fill faced with rock. Three separate earthen fill saddle dams totaling 2,980 feet in length are located to the south of the main dam. Watts Bar Dam is 112 feet high and 2,960 feet long. The concrete portion of the dam adjoins a rock bluff on the west side of the river. It is 1,726 feet long and includes the penstock intakes, spillway, and lock. A 1,234-foot long earthen embankment faced with stone extends east from the concrete portion of the dam. All four dams and associated flood control structures currently have gravel-filled HESCO barriers on them in order to increase the height of the dams to prevent overtopping and failure in the event of a PMF.

Recreation Areas

TVA has developed recreation facilities on all four dam reservations. These facilities include parking areas, visitor overlooks, restrooms, picnic areas, and boat launching ramps above and below the dams. These facilities are normally open and used by the public year-round. This discussion focuses on areas which could be potentially impacted by the Proposed Action. In terms of land use designation, all recreation facilities potentially impacted by the Proposed Action are designated as ‘TVA Project Operations’ areas.

At Cherokee Dam, recreation facilities are concentrated on the south side of the dam. A paved sidewalk extends from the south end of the south main dam embankment for approximately 2,275 feet. Because of the construction of the HESCO barriers on a portion of this walkway, a

700-foot section does not presently meet Americans with Disabilities Act (ADA) guidelines. This trail is accessible from the south overlook and day use area parking lots. There is also a day use area parking lot and a tailwater parking lot to the south of the dam. Recreation facilities on the south bank below the dam include a tailwater boat launching ramp that provides access to the Holston River, parking lots at the base of the dam, open space areas with a trail as described above, and a concrete stairway that provides pedestrian access to the top of Cherokee dam.

At Fort Loudoun Dam, recreation facilities include a parking area and a tailwater fishing berm on the south bank below the dam. Additional parking areas, restrooms, tailwater fishing berms, and a boat ramp are located on the north bank below the dam. TVA also maintains a parking area, visitor overlook, and picnic area on the north bank upstream of the dam. Fort Loudoun Marina is located in a cove immediately east of the dam reservation. Facilities include boat ramps, covered and uncovered boat slips, dry boat storage, fuel pumps, boat rentals, and restaurants.

At Tellico Dam, TVA maintains several recreation facilities. Immediately south of the junction of Tellico Parkway and U.S. Highway 321/State Route 95 is a parking area, restroom building, and ADA accessible fishing area along the canal connecting Fort Loudoun and Tellico reservoirs. To the west of this is a large boat ramp and parking area, and a separate day use area with swim beaches, restrooms, picnic area, and a paved, ADA accessible walking trail. A separate boat launch ramp and parking area is located on the east bank below the dam. A parking area adjacent to Tellico Parkway on the side of the dam provides access to a five-mile-long trail system that runs through the Hall Bend Habitat Protection Area.

At Watts Bar Dam the TVA day use area on the east bank of the reservoir above the dam is one of the most heavily used recreation areas on the reservoir. Facilities include parking areas, a swimming beach, playground, picnic area with group pavilion, restrooms with showers, and a boat ramp. An overlook and parking area are located on the west bank immediately upstream of the dam. TVA maintains parking lots, fishing berms, and a boat launching ramp on the east bank downstream of the dam.

Roads

Some of the existing dams and flood control structures are immediately adjacent to roads. At Cherokee Dam, approximately 6,685 feet of the existing embankment has a road either on top of it, or immediately adjacent. At Fort Loudoun Dam, approximately 3,800 feet of embankment have a road either on or adjacent to it. Additionally, approximately 3,300 feet of embankment is adjacent to U.S. Highway 321. At Tellico Dam, approximately 4,625 feet of embankment have a road either on top of or immediately adjacent. At Watts Bar Dam, approximately 1,600 feet of embankment have a road on or immediately adjacent. Portions of the roads at Cherokee, Fort Loudoun, and Tellico Dams are used for project operations and maintenance access and closed to public vehicular access. The public can walk or bicycle most of these access roads.

Undeveloped - Shrubs and Trees

A small area adjacent to the Proposed Action project areas consists of shrubby or treed areas. At Watts Bar Dam, a portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest (350 feet at WB-1). At Tellico Dam, a portion of the project area near Saddle dams Nos. 2 (525 feet at T-3) and 3 (300 feet at T-4) is forested or shrubby. Common overstory tree species include American beech, black gum,

hickories, and black, southern red, and white oaks. Several invasive plants are present in the understory.

3.9.2. Environmental Consequences

3.9.2.1. Alternative A - No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. The dams and other flood control structures are currently part of the existing flood protection system and would continue to be so designated. Therefore, no direct or indirect impacts to the existing land use on the dams, levees and floodwalls would occur under the No Action Alternative.

Recreation Areas

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the recreation areas would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing recreation areas are deemed unsafe or otherwise unusable in the current configuration. A minor loss of recreation area could occur as an indirect impact under the No Action Alternative.

Roads

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the public roads on or adjacent to the existing embankments would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing roads are deemed unsafe or otherwise unusable in the current configuration. A minor loss of road could occur as an indirect impact under the No Action Alternative.

Undeveloped - Shrubs and trees

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the undeveloped areas would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing undeveloped areas are deemed unsafe or otherwise unusable in the current configuration. Additionally, undeveloped areas adjacent to the HESCO barriers could be designated undevelopable for safety reasons. A minor gain or loss of undeveloped area could occur as an indirect impact under the No Action Alternative. However, as all the land is designated as Project Operations, and would continue to be so designated, no direct or indirect impacts to land use would occur.

3.9.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, TVA would permanent modify approximately 18,460 linear feet of existing flood containment structures. The dams and berms are currently part of the existing flood protection system and would continue to be so designated. Therefore, no direct or indirect impacts to the existing land use on the dams and/or embankments would occur under Alternative B. The construction and operation of the permanent modifications would not result in changes in TVA's operation of the dams and reservoirs and would not affect land use or land

rights, including flowage easements, on privately-owned and TVA-managed reservoir shorelands elsewhere on the reservoirs.

Recreation Areas

Under the combined Floodwall/Berm Alternative, recreation areas could be directly negatively impacted. Earthen berms take up considerably more space than floodwalls. Berms would be constructed at one portion of Cherokee Dam (near the boat ramp), at no locations at Fort Loudoun Dam, and at all segments at Tellico Dam and Watts Bar Dam. At Cherokee Dam, a 500 foot section of the walkway along the embankment is currently ADA inaccessible due to the HESCO barriers. The construction of a floodwall in this area could lead to the return of this section of walkway to ADA accessible status. This would constitute a minor positive direct impact to recreation areas at Cherokee Dam.

In areas where berms would be constructed, large portions of existing recreational walkways, roads, parking lots, and potentially boat ramps and fishing berm could be temporarily negatively impacted. Small portions of these areas could be permanently converted from recreational land use to flood control related land use. This is unlikely however, as most of the recreation areas would be returned to recreational use after construction. Walkways and other access points would be rebuilt atop the new berms or adjacent to the new floodwalls. No indirect impacts are anticipated under the combined Floodwall/Berm Alternative. All land in the vicinity of the dams would still be designated TVA Project Operations and all work would be conducted within the existing TVA right-of-way. The size of the footprints required for the berms is not currently decided. When the project specifications are complete, additional analysis may be conducted if deemed necessary.

Roads

Most of the embankments at all four dams either have access roads or public roads either on top of them of immediately adjacent. Some of these roads are currently unsafe due to the positioning of the HESCO barriers. After construction, these roads could be considered safer both due to the removal of the obstructions and due to a higher wall separating traffic from the water. Thus, in some areas, depending on which side of the road the floodwalls are constructed, there could be a positive direct impact to roads due to an increase in public road safety.

Under the Proposed Action, direct, adverse impacts to public roads could occur during the construction period. Many of the areas that require construction have access roads either immediately adjacent or atop the existing embankments. Additionally, at Fort Loudoun Dam, the construction would take place immediately adjacent to U.S. Highway 321. Roads would be returned to conditions that are compliant with all state and Federal regulations. Earthen berms take up considerably more space than floodwalls. In areas where berms would be constructed, large portions of existing roadways could experience temporary, adverse impacts during construction. Similarly, additional construction time may be necessary in order to allow each successive lift to settle in berm areas. Thus, roadways could be inaccessible for a longer period of time due to the lengthier construction duration under this alternative. It is expected that all public roads would be rebuilt after the construction. Indirect negative impacts could occur under the combined Floodwall/Berm Alternative due to road damage from heavy equipment. All land in the vicinity of the dams would still be designated TVA Project Operations and all work would be conducted within the existing TVA right-of-way. The size of the footprints required for the

berms is not currently decided. When the project specifications are complete, additional analysis may be completed if deemed necessary.

Undeveloped - Shrubs and trees

A small area of undisturbed shrubs and trees at Watts Bar Dam would be directly negatively impacted due to the need to tie the new berm in to a campground area located at a higher elevation. This impact would be relatively minor. It is not anticipated that any undeveloped or undisturbed areas would be directly or indirectly impacted at any of the other dam locations. Thus, a minor impact could occur to undeveloped land at Watts Bar Dam. These areas would continue to be designated TVA Project Operations areas; however, no direct or indirect impacts to land use designations would occur.

3.9.2.3. Alternative C – All Floodwalls

Alternative C would raise existing flood containment structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. The dams are currently part of the existing flood protection system and would continue to be designated as TVA Project Operations areas. No direct or indirect impacts to the existing land use on the dams, levees and embankments would occur under the Floodwall Alternative. The construction and operation of the permanent modifications would not result in changes in TVA's operation of the dams and reservoirs and would not affect land use or land rights, including flowage easements, on privately-owned and TVA-managed reservoir shorelands elsewhere on the reservoirs.

Recreation Areas

The Proposed Action would raise existing flood containment structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. The construction of these floodwalls could directly impact some recreation areas immediately adjacent and near the existing flood control structures.

At all four dams, due to the location of the recreational walkways and parking lots, a minor temporary negative direct impact to recreation areas could occur during construction of the floodwalls. During construction, access to these areas could be limited because of safety reasons. After construction, these areas would be returned to recreational use. Additional minor and temporary direct impacts could occur due to the need for staging areas in parking lots near the dams. These lots would also be returned to recreational use when construction is complete. Under Alternative C, minor and temporary direct negative impacts to recreation areas are anticipated at all four dams; these impacts would be smaller than those anticipated under Alternative B.

Roads

During construction, it is likely that public access to these roads would be restricted due to safety reasons. Therefore, a minor and temporary negative direct impact to roads could occur during construction. Potentially, some roads would require modification in order to accommodate the new floodwalls. Roads would be returned to conditions that are compliant with all state and federal regulations. Indirect minor adverse impacts to public roads could occur due to damage from heavy equipment; however, fewer impacts to roads would occur under Alternative C than compared to the Proposed Action, due to the increased number of trucks required during the construction of earthen berms.

Overall, minor temporary negative impacts to public roads could occur during construction, but overall minor positive impacts could occur due to increased public safety. These areas would continue to be designated TVA Project Operations areas; however, no direct or indirect impacts to land use designations would occur.

Undeveloped - Shrubs and trees

Under Alternative C, a small portion of the undeveloped area near Watts Bar Dam could be impacted. Impacts under this alternative are similar, but smaller than those under Alternative B. A small portion of undisturbed area may be lost; however, the land would still be designated TVA Project Operations area. Therefore, no direct or indirect impacts to land use designations would occur.

3.10. Socioeconomics and Environmental Justice

This section describes the socioeconomic resources in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, including the minority and poverty characteristics related to environmental justice and the impacts on social and economic resources and environmental justice from the Action and No Action alternatives. Components of socioeconomic resources that are analyzed include population, employment, and income; minority populations and poverty levels are analyzed in regard to environmental justice.

3.10.1. Affected Environment

The dams that would be affected by the proposed modifications are located along the Tennessee River and its tributaries in East Tennessee in Grainger, Jefferson, Loudon, Rhea, and Meigs Counties. These five counties are identified as the impact area for socioeconomic resources and environmental justice.

Socioeconomics

Population

The total population of the five-county impact area in 2010 was 166,182. As projected by the state of Tennessee, the total population of these counties would be about 199,407 by 2030. Population trends and projections are presented in Table 3.10-1.

Table 3.10-1.
Population, Impact Counties, 1990 – 2030

County	1990	2000	2010	Projection 2030	Percent Increase, 1990-2010	Percent Increase, 2010-2030
Grainger	17,095	20,659	22,657	25,922	32.5	14.4
Jefferson	33,016	44,294	51,407	65,990	55.7	28.4
Loudon	31,255	39,086	48,556	57,095	55.4	17.6
Meigs	8,033	11,086	11,753	13,148	46.3	11.9
Rhea	24,344	28,400	31,809	37,252	30.7	17.1
Total	113,743	143,525	166,182	199,407	46.1	20.0
Tennessee	4,877,185	5,689,283	6,346,105	7,451,677	30.1	17.4
U.S.	248,709,873	281,421,906	308,745,538	373,504,000	24.1	21.0

Source: Tennessee State Data Center (TSDC) 2012, U.S. Census Bureau (USCB) 1990, USCB 2000, USCB 2008, USCB 2010a.

Employment

Overall, the five impact counties have a total employment of about 64,360 jobs (Table 3.10-2). Approximately 6.3 percent are employed in farming, above both the national level of 0.6 percent and the state level of 2.2 percent. Manufacturing provides 16.0 percent of the jobs, more than

the national share of 8.5 percent and the state share of 8.9 percent. Retail trade is similar to the state and national shares, while government employment is above the state share but lower than the national share. However, there are major differences among the counties. Grainger County has 14.5 percent of its jobs in farming and 14.4 percent in manufacturing. At the other extreme, Rhea County has only 3.1 percent of its jobs in farming and 23.9 percent in manufacturing. Retail trade accounts for a similar proportion of employment in the five counties. Government ranges from 8.4 percent in Meigs County to 20.6 percent in Rhea County.

Table 3.10-2.
Employment, 2010, Impact Counties

County	Total Employment	Percent Farm	Percent Manufacturing	Percent Retail Trade	Percent Government
Grainger	6,932	14.5	14.4	9.3	15.0
Jefferson	18,834	6.2	12.1	12.2	14.2
Loudon	18,692	6.0	15.4	11.5	12.1
Meigs	6,128	5.5	14.0	9.6	8.4
Rhea	13,774	3.1	23.9	10.1	20.6
Total	64,360	6.3	16.0	11.0	14.5
Tennessee	3,541,421	2.2	8.9	10.9	12.9
U.S.	136,341,000	0.6	8.5	10.8	18.3

Source: Bureau of Economic Analysis (BEA) 2012a, BEA 2012b.

Income

Per capita personal income in the impact area in 2010 was $29,024, 72.7 percent of the national average of $39,937 and less than the state average of $34,921 (Table 3.10-3). All of the counties in which the dams are located, with the exception of Loudon County, had per capita personal incomes levels 70 percent or less of the national average. In Loudon County, per capita personal income was 89.8 percent of the national average and higher than the state average.

Table 3.10-3.
Per Capita Personal Income, 2010, Impact Counties

County	Per Capita Personal Income (dollars)	Percent of U.S.
Grainger	27,966	70.0
Jefferson	27,680	69.3
Loudon	35,875	89.8
Meigs	27,502	68.9
Rhea	26,096	65.3
Total	29,024	72.7
Tennessee	34,921	87.4
U.S.	39,937	100.0

Source: BEA 2012c.

Environmental Justice

Executive Order 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. This section provides demographic information that characterizes the distribution of minority populations and low-income populations in the five-county impact area.

In identifying minority and low-income populations, the following Council of Environmental Quality (CEQ) (1997) definitions of minority individuals and populations and low-income populations were used:

Minority individuals. Individuals who identify themselves as members of the following population groups: American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Black, Hispanic, or two or more races.

Minority populations. Minority populations are identified where (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Low-income populations. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P-60, on Income and Poverty.

According to CEQ guidance (CEQ 1997), U.S. Census data are typically used to determine minority and low-income population percentages in the affected area of a project in order to conduct a quantitative assessment of potential environmental justice impacts.

Minority Population

Minorities constitute less than 10 percent of the total population in each of the five counties in the impact area, as of the 2010 U.S. Census of Population. The block groups and census tracts in the immediate vicinity of the four dams have a total minority population of 10.2 and 8.9 percent, respectively. These levels are slightly greater than the average of 7.4 percent in the five-county impact area, but well below the state average of 24.4 percent and the national average of 36.3 percent (Table 3.10-4). Every census tract and most of the block groups in the immediate vicinity of the four dams have a smaller share of minorities than does the state as a whole.

Table 3.10-4.
Minority Population, Impact Counties, 2010

County		Total Population	Minority Population	Percent Minority Population
Grainger		22,657	904	4.0
CT5003		6,337	435	6.9
	BG3	1,281	111	8.7
	BG4	852	13	1.5
Jefferson		51,407	3,669	7.1
CT703		7,239	1,081	14.9
	BG1	1,589	146	9.2
	BG2	1,357	217	16.0
	BG3	1,473	398	27.0
	BG4	1,278	178	13.9
	BG5	1,542	142	9.2
CT704		3,723	208	5.6
	BG1	1,808	106	5.9
Loudon		48,556	4,780	9.8
CT602.02		7,604	1,697	22.3
	BG1	2,219	333	15.0
	BG2	764	221	28.9
	BG3	1,063	289	27.2
	BG4	978	273	27.9
CT603.01		3,332	329	9.9
	BG2	1,454	218	15.0
CT603.02		6,201	305	4.9
	BG2	1,419	73	5.1
	BG3	903	65	7.2
	BG4	2,271	101	4.4
CT604		4,719	123	2.6
	BG1	898	14	1.6
	BG2	1,333	19	1.4
CT605.01		8,664	323	3.7
	BG3	1,682	27	1.6
Meigs		11,753	492	4.2
CT9601		3,155	179	5.7
	BG2	1,647	105	6.4
Rhea		31,809	2,506	7.9
CT9751		4,594	250	5.4

Table 3.10-4.
Minority Population, Impact Counties, 2010

County		Total Population	Minority Population	Percent Minority Population
	BG1	1,899	107	5.6
	BG2	1,886	73	3.9
5-County Total		**166,182**	**12,351**	**7.4**
CT Total		**55,568**	**4,930**	**8.9**
BG Total		**31,596**	**3,229**	**10.2**
Tennessee		6,346,105	1,545,323	24.4
U.S.		308,745,538	111,927,986	36.3

CT = census tract; BG = block group
Source: USCB 2010b

Poverty

The portion of the population in the impact counties that had income below the poverty level varied greatly among the counties during the period 2006 to 2010, ranging from 13.8 percent in Loudon County to 25.2 percent in Meigs County (Table 3.10-5). Four of the five counties in which the dams are located had poverty levels greater than 18 percent, the exception being Loudon County, in which Fort Loudoun and Tellico dams are located. The census tracts and block groups in the immediate vicinity of the four dams had a total of 17.5 and 17.8 percent, respectively, of the population living below the poverty level. This level is above the state and national average of 16.5 percent and 13.8 percent, respectively, but virtually the same as the average of 17.7 percent in the five-county impact area. Therefore, the five-county impact area and the census tracts and block groups near the dams are not considered low-income communities.

Table 3.10-5.
Poverty Levels, Impact Counties, 2006-2010

County		Total Population*	Persons Below Poverty Level*	Percent of Persons Below Poverty Level*
Grainger		21,819	4,085	18.7
CT5003		5,899	1,313	22.3
	BG3	1,168	164	14.0
	BG4	697	199	28.6
Jefferson		48,532	8,852	18.2
CT703		6,346	1,609	25.4
	BG1	1,449	186	12.8
	BG2	1,016	597	58.8
	BG3	1,036	429	41.4
	BG4	900	107	11.9

Table 3.10-5.
Poverty Levels, Impact Counties, 2006-2010

County		Total Population*	Persons Below Poverty Level*	Percent of Persons Below Poverty Level*
	BG5	1,945	290	14.9
CT704		3,543	676	19.1
	BG1	1,707	392	23.0
Loudon		46,707	6,467	13.8
CT602.02		7,712	2,707	35.1
	BG1	2,153	797	37.0
	BG2	919	263	28.6
	BG3	1,148	90	7.8
	BG4	948	211	22.3
CT603.01		3,178	301	9.5
	BG2	1,452	285	19.6
CT603.02		5,951	253	4.3
	BG2	1,225	41	3.4
	BG3	800	0	0.0
	BG4	2,365	72	3.0
CT604		4,333	582	13.4
	BG1	728	63	8.7
	BG2	1,281	144	11.2
CT605.01		8,051	435	5.4
	BG3	1,699	20	1.2
Meigs		11,336	2,856	25.2
CT9601		3,556	792	22.3
	BG2	1,869	600	32.1
Rhea		30,261	5,794	19.1
CT9751		4,309	568	13.2
	BG1	2,045	376	18.4
	BG2	1,740	75	4.3
5-County Total		158,655	28,054	17.7
CT Total		52,878	9,236	17.5
BG Total		30,290	5,401	17.8
Tennessee		6,075,066	1,002,467	16.5
U.S.		296,141,149	40,917,513	13.8

* Population for whom poverty status is determined.
CT = census tract; BG = block group
Source: USCB 2010c; USCB 2010d

3.10.2. Environmental Consequences

The following sections discuss the potential socioeconomic and environmental justice impacts associated with implementing the project alternatives.

Social and economic issues considered for evaluation within the impact area include change to current and projected population levels, change in expenditures for goods and services, and short-term or long-term impacts on employment and income.

Executive Order 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. According to the CEQ, adverse health effects to be evaluated within the context of environmental justice impacts may include bodily impairment, infirmity, illness, or death. Environmental effects may include ecological, cultural, human health, economic, or social impacts. Disproportionately high and adverse human health or environmental effects occur when the risk or rate of exposure to an environmental hazard or an impact or risk of an impact on the natural or physical environment for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the impact level for the general population or for another appropriate comparison group (CEQ 1997).

3.10.2.1. Alternative A – No Action Alternative

<u>Socioeconomics</u>

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possibly dam failure. No construction would take place and no direct impacts to population levels, employment, or income would occur. However, the No Action Alternative could have adverse indirect impacts on the social and economic situation in downstream areas. The level of risk reduction under the No Action Alternative would be less than the level provided by the Action Alternatives. Downstream areas, including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants and other locations, could potentially experience a higher risk of flooding during a PMF along with a greater potential for associated property damage and personal injury.

<u>Environmental Justice</u>

Screening-level analyses of the census data from the project area were used to identify low-income and minority populations. If the affected area has a minority population and/or a low-income population meaningfully greater than those of the general population, it was identified as a potential concern for environmental justice issues. Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. As described for other resources in Chapter 3, the No Action Alternative would not result in negative health or other environmental effects that could affect EJ populations. Therefore, there would be no disproportionately high and adverse direct or indirect impacts on minority or low-income populations resulting from the No Action Alternative.

3.10.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Socioeconomics

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments or earthen berms at each of the four dam structures. Construction activities at the Cherokee, Fort Loudoun, Tellico, and Watts Bar dams would take approximately two years and an average crew of 15 to 20 workers would be employed. There would be short-term beneficial economic impacts from construction activities associated with this alternative, including the purchase of materials, equipment, and services and a temporary increase in employment and income. This increase would be local or regional, depending on where the goods, services, and workers were obtained. It is likely construction materials would be purchased locally in the five-county impact area, as well as some adjacent counties. Also, the relatively small construction workforce would likely be from local sources. The direct impact of Alternative B to the economy would be short-term and beneficial.

Implementation of Alternative B could have minor beneficial indirect impacts on population and long-term employment and income levels in the five-county impact area. The majority of the indirect employment and income impacts would be from expenditure of the wages earned by the workforce involved in construction activities, as well as the local workforce used to provide materials. Following completion of Alternative B, the potential for overtopping and failure of the four dams during a PMF event, with increased flooding at downstream locations, would be minimized. Downstream areas, including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants and other locations, would experience a lower risk of flooding along with a lower potential for associated property damage and personal injury. These indirect impacts of Alternative B to downstream socioeconomic resources would be beneficial.

Environmental Justice

Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. Also, based on the analysis of impacts for all resource areas presented in this EIS, it was determined that there would be no significant adverse health impacts on members of the public or significant adverse environmental impacts on the physical environment (water, air, aquatic, and terrestrial resources) and socioeconomic conditions. Therefore, there would be no disproportionately high or any adverse direct or indirect impacts on minority or low-income populations due to human health or environmental effects resulting from Alternative B.

3.10.2.3. Alternative C – All Floodwalls

Socioeconomics

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. This alternative varies from Alternative B only in the types of dam structure used to prevent the potential for failure of the dams during overtopping and to prevent increased flooding at downstream locations during those events. Therefore, the direct impacts to the economy from construction activities associated with this alternative would be the same as those discussed for Alternative B (i.e., short-term and beneficial).

Indirect impacts on population and long-term employment and income levels in the five-county impact area associated with Alternative C would be the same as those described for Alternative

B. The minimized potential for overtopping and failure of the four dams during a PMF event would result in lower risk of flooding in downstream areas and, therefore less potential for associated property damage and personal injury as described for Alternative B.

Environmental Justice

Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. Therefore, there would be no disproportionately high adverse direct or indirect impacts on minority or low-income populations because of negative health or environmental effects resulting from Alternative C.

3.11. Cultural and Historic Resources

Cultural resources include, but are not limited to, prehistoric and historic archaeological sites; historic structures; and historic sites that were the location of important events but that lack material remains. Cultural resources are finite, non-renewable, and often fragile. They are frequently threatened by industrial, commercial, and residential development as well as construction of roads, runways, and other infrastructure. They provide data on past environmental and cultural change that span millennia, unlike any kind of historical data. Hence Federal agencies are required to consider how their actions may affect cultural resources and to preserve significant cultural resources.

Regulatory Obligations

TVA is mandated under the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act of 1979 (ARPA) to preserve significant cultural resources (archaeological sites and historic structures) located on TVA lands or affected by TVA undertakings. Some cultural resources are identified as "historic properties." A historic property, as defined by NHPA regulations at 36 CFR § 800.16, is any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). The NRHP was established under the NHPA as a means to identify, evaluate and protect the historic properties of the nation. Properties that meet one or more of the following criteria in 36 CFR § 63 may be eligible for listing in the NRHP:

- Associated with events that have made a significant contribution to the broad patterns of our history;
- Associated with the lives of significant persons in our past;
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
- Have yielded or may be likely to yield, information important in history or prehistory.

Under Section 106 of the NHPA, before any Federal undertaking (i.e., Proposed Action), the lead agency must follow a formal process in which the agency fully considers the potential effects of the undertaking on historic properties and NRHP-eligible cultural resources as described in 36 CFR § 800. By carrying out the Section 106 process, an agency may simultaneously satisfy its obligations under Section 106 to fully consider the undertaking's potential effects on historic properties and its obligation under NEPA to determine whether historic resources will be adversely affected, and if so, whether measures can be implemented that will reduce adverse effects to a level that is found acceptable by all consulting parties.

Cultural resources are generally divided into two broad categories (independently of their eligibility status for the NRHP): archeological resources and historic architecture. By convention, an archaeological resource is defined as an area with a number of associated, non-modern historic (older than 50 years) or prehistoric artifacts that have the potential to provide scientific or humanistic understanding of past human behavior and cultural adaptation. In the state of Tennessee, an archaeological site is identified "based on several factors such as landform, physiographic region, size of site relative to the number and type of artifacts, level of

survey and conditions, and previous disturbance" (Tennessee Division of Archaeology 1999). Some examples are: earthworks; fortifications; shipwrecks; whole or broken tools, weapons and projectiles; containers made of ceramics, wood, or basketry; human remains; rock carvings and rock paintings; and remains of subsurface structures such as domestic fire pits. Historic architecture consists of standing structures that are 50 years old or older. Examples of historic architecture with potential for listing on the NRHP include: early farms, houses, and churches; historic cemeteries; and statues and monuments. In addition to meeting one or more of the criteria of Section 106 listed above, archaeological resources and historic architectural resources must retain their integrity in order to be eligible for the NRHP. Integrity can be related to any or all of the following: location, design, setting, materials, workmanship, feeling, and association (36 CFR 60.4).

Area of Potential Effect (APE)

NHPA requires the lead agency in an undertaking to identify an area of potential effect (APE) for resources that may be affected by the undertaking. The Advisory Council on Historic Preservation defines APE as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist". In any given federal undertaking the APE for cultural resources is defined by the lead federal agency in consultation with the appropriate consulting parties. In defining the APE the agency head must consider direct and indirect consequences of the undertaking that could affect historic properties, regardless of whether those historic properties are located within the area in which project activities will take place.

The APE for the proposed undertaking consists of existing HESCO barriers as described in Section 1.3 and the areas that would be affected by their continued maintenance or replacement with permanent barriers. For Alternative B, these modifications consist of the footprints of the floodwalls/embankments/berms and the construction borrow/staging areas as described in Section 2.1.1. For Alternative C, these consist of the footprints of the floodwalls and the construction staging areas as described in Section 2.1.2. Because access to these areas would be on existing paved and gravel roads, the access routes are not part of the APE.

3.11.1. Affected Environment

Cherokee Dam

An archaeological and historic structures survey was conducted adjacent to the APE along the shoreline and a three foot wide strip above the normal summer pool elevation (Gage and Herrmann 2009) at Cherokee Dam. The survey identified no cultural resources adjacent to the Cherokee Dam APE. The records of the Tennessee Division of Archaeology (TDOA) indicate no cultural resources are present in the APE at Cherokee Dam for Action Alternative A (including the borrow area and two staging areas).

An historic structures survey by TRC concluded that Cherokee Dam is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley, and in meeting the increased energy needs of the regional defense industry during World War II. In addition, the dam is a representative example of the Modernism style of architecture utilized by TVA in its early phase of dam construction (Karpynec 2011). Based on this finding TVA determined that Cherokee Dam is eligible for listing in the NRHP under criteria A and C for its historical and architectural significance, and the State Historic Preservation Officer (SHPO) agreed by letter dated September 29, 2011 (Appendix B).

Fort Loudoun Dam

TDOA records indicate no cultural resources have been recorded within the APE, including the staging areas at Fort Loudoun Dam. The shoreline and exposed lake bottom adjacent to the southern portion of the APE were included within an archaeological survey (Ahlman et al. 2000). No cultural resources were identified within the Fort Loudoun Dam APE. A second survey at the Lenoir City Marina (Windingstad 2008) included an area adjacent to the eastern portion of the Northern Saddle Dam part of the APE. The surveyors did not excavate shovel tests in that portion of their project area due to steep slope, and no cultural resources were identified within the Fort Loudoun Dam APE.

An historic structures survey by TRC concluded that Fort Loudoun Lock and Dam is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley, as well as a representative example of the modernism style of architecture utilized by TVA in its early phase of dam construction (Karpynec 2011). Based on this finding, TVA has determined that Fort Loudoun Lock and Dam is eligible for listing in the NRHP under Criteria A and C for its historical and architectural significance, and the SHPO agreed by letter dated September 29, 2011.

Tellico Dam

Archaeological surveys were conducted in all areas of the Tellico Dam APE during the Tellico Project (summarized in Kimball 1985), and an additional survey was conducted in the APE more recently (Frankenberg and Hermann 2000). No cultural resources were recorded within the Tellico APE. Site 40LD343, a former farm with barns, silos, and outbuildings, was recorded in close proximity to Saddle Dam No. 3, but TDOA records indicate that the site boundary falls outside of the APE and the entire site is inundated by Tellico Reservoir. The construction staging areas for Fort Loudoun Dam will also be used for the Proposed Action at Tellico Dam. No cultural resources have been recorded in these areas or in the Tellico borrow areas.

An historic structures survey by TRC concluded that no historic structures have been recorded within the APE. The Phase I architectural assessment of Tellico Dam found that it is a typical example of a late twentieth-century concrete gravity dam that lacks unique features of architecture or workmanship. Moreover, the dam was completed less than 50 years ago and has yet to gain historical significance. Therefore, TVA determined that Tellico Dam is ineligible for the NRHP, and the SHPO agreed by letter dated September 20, 2011.

Watts Bar Dam

At Watts Bar Dam, due to the extensive disturbance during dam construction, no modern archaeological surveys have been conducted within the corridor extending from the eastern end of the dam along the existing earthen embankment, or within the borrow area and the staging area north of State Route 68. The staging area south of State Route 68 was included within a survey conducted by Garrow & Associates (Fryman 1992). The survey (which included systematic shovel testing) failed to identify archaeological sites, and indicated that dredge or mining spoils were likely disposed of in this area at some time in the past. TDOA records indicate that one archaeological site (40MG1) has been recorded within the APE at Watts Bar Dam. However, the site, which was identified prior to dam construction, is located within the area investigated by Garrow & Associates. The results of that survey suggest the site was destroyed by activities associated with the construction of the lock and dam.

An historic structures survey by TRC concluded that no historic structures other than the dam have been recorded within the APE. The Phase I architectural assessment of Watts Bar Dam found that this structure is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley and as a representative example of the Stripped Classicism style of architecture utilized by TVA in its initial phase of dam construction (Karpynec 2011). Based on this finding TVA has determined that Watts Bar Dam is eligible for listing in the NRHP under criteria A and C for its historical and architectural significance, and the SHPO agreed by letter dated September 29, 2011.

3.11.2. Environmental Consequences

3.11.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers installed at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams would remain in place and be maintained as needed. Longer term use of the HESCO barriers as a solution would require some level of maintenance activities and/or replacement to continue their effectiveness. Access to the HESCO barriers for maintenance would be on existing paved routes and would not disturb native soil. There would be no potential for effects to archaeological resources or historic structures under the No Action Alternative.

3.11.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Cherokee Dam

No archaeological sites are recorded within the APE for Action Alternative B at Cherokee Dam. The majority of the APE consists of artificial ground. During dam construction, excavation to depths of up to 45 feet took place in the majority of the APE in order to provide a firm surface for the emplacement of rolled fill, including the area of the north and south embankments and Saddle Dam No. 1 (TVA 1946:168-169). Therefore, there is little or no potential for intact archaeological sites within the APE. The borrow area consists of an existing borrow area in which there is significant prior ground disturbance. Both staging areas are paved parking areas with little or no potential for cultural resources. Action Alternative B has no potential to affect archaeological resources in the APE for Action Alternative B at Cherokee Dam.

TVA has determined that Action Alternative B would have a visual effect on Cherokee Dam, but the effect would not be adverse. Considering the profile of the proposed floodwalls and berm, TVA finds that Alternative B would not compromise the integrity of Cherokee Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of Alternative B on Cherokee Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

Fort Loudoun Dam

No archaeological sites are recorded within the APE for Action Alternative B at Fort Loudoun Dam. The entire APE consists of road shoulders, which consist of pavement on artificial fill, and lacks undisturbed native soils. Therefore, Action Alternative B has no potential to affect archaeological resources within the Fort Loudoun Dam APE. The staging areas were likely subjected to significant ground disturbance during excavation of the canal connecting Fort Loudoun and Tellico reservoirs, and are unlikely to contain intact archaeological resources.

TVA has determined that Action Alternative B would have a visual effect on Fort Loudoun Dam, but the effect would not be adverse. The three project sites associated with Fort Loudoun Dam are not located on the main dam and are largely outside the visual-line-of-sight to the resource. Of the three project areas, Segment FTL-2 is the nearest to the main dam. Situated adjacent to the lock operations building, FTL-2 would be partially hidden by the presence of the Carmichael Greer Bridge. Considering the profile of the proposed floodwall, TVA finds that the floodwall would not compromise the integrity of Fort Loudoun Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of Alternative B on Fort Loudoun Lock and Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

Tellico Dam

No archaeological sites are recorded within the APE for Action Alternative B at Tellico Dam. The entire APE consists of constructed embankments, with the exception of the approximately 320-foot long corridor along the entrance drive to Tellico Recreation Area, which consists of the road shoulder. Options that include widening the existing embankment would impact strips of ground outside the existing embankment from 2.0 to 3.5 feet wide paralleling the existing Tellico Dam embankment, and up to 5.0 feet wide paralleling Saddle Dam Nos. 2 and 3. Those areas were disturbed (graded and/or covered with artificial fill) during the construction of the dam and access road and have little or no potential to contain intact buried cultural horizons. The staging areas were likely subjected to significant ground disturbance during excavation of the canal connecting Fort Loudoun and Tellico reservoirs, and are unlikely to contain intact archaeological resources. Action Alternative B has no potential to affect archaeological resources.

The Tellico Dam is a typical example of a late-twentieth century concrete gravity dam that fails to exhibit unique features of its architectural style or workmanship. In accordance with NRHP Criteria Consideration G, a property less than 50 years old is normally not eligible for the NRHP unless it is of exceptional importance. Completed on November 29, 1979, the Tellico Dam has been in operation for only 32 years and its role within local, state, and national events has yet to gain historical perspective. Based on these findings, TVA has determined that Tellico Dam is ineligible for listing in the NRHP and the SHPO agreed by letter dated September 20, 2011.

Watts Bar Dam

No archaeological sites are recorded within the APE for Action Alternative B at Watts Bar Dam. During dam construction, portions of the APE closest to Highway 68 were subject to very extensive cut and fill operations and the construction of the east dam embankment (TVA 1949:201 and Figures 68, 74, 83, 84). That portion of the APE adjacent to Watts Bar Dam Recreation area was most likely also affected by construction activities, although to a lesser extent; this is supported by photographs taking during construction (TVA 1949). Due to these severe ground disturbing activities the potential for historic properties in the APE is minimal. Therefore TVA considers that Action Alternative B has no potential to affect archaeological sites within the APE of Watts Bar Dam.

TVA has determined that Action Alternative B would have a visual effect on Watts Bar Dam, but the effect would not be adverse. The project site is located on the east embankment. Considering the profile of the proposed floodwall and/or berm, TVA finds that the Proposed Action would not compromise the integrity of Watts Bar Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. In addition, the

floodwall and/or berm would not stand out as a visual intrusion to the historic setting of the dam, which has been compromised by the construction of the Watts Bar Nuclear Plant. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of Alternative B on Watts Bar Lock and Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

3.11.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be removed from the dam structures and replaced with concrete floodwalls. The floodwalls would be in the same locations as the floodwalls and berms proposed under Alternative B, and their construction would not affect archaeological sites. The effects of the floodwalls on Cherokee, Fort Loudoun, and Watts Bar Dams, all of which have been recommended eligible for the NRHP, would be also be similar to those of Alternative B and would not adversely affect these historic properties.

3.12. Noise

3.12.1. Affected Environment

Noise is generally described as unwanted sound, which can be based either on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (such as community annoyance). Sound is usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Noise levels are computed over a 24-hour period and adjusted for nighttime annoyances to produce the day-night average sound level (DNL). DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974). A DNL of 65 A-weighted decibel (dBA) is the level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like construction (The A-weighted sound level, used extensively in this country for the measurement of community and transportation noise, represents the approximate frequency response characteristic of the average young human ear). Areas exposed to a DNL above 65 dBA are generally not considered suitable for residential use. A DNL of 55 dBA was identified by USEPA as a level below which there is no adverse impact. Additionally, to avoid potential long-term effects to hearing, USEPA established a 24-hour exposure level of 70 dBA (USEPA 1974).

Noise occurring at night generally results in a greater annoyance than do the same levels occurring during the day. It is generally agreed that people perceive intrusive noise at night as being 10 dBA louder than the same level of noise during the day. This perception is largely because background environmental sound levels at night in most areas are about 10 dBA lower than those during the day.

TVA contracted with EnSafe, Incorporated to conduct sound pressure level sampling at the Cherokee Dam to establish a baseline comparison for the proposed project activities. Samples were collected in May and June 2011. Sample collection locations were selected based on proximity to the proposed project area including areas used frequently by the general public. Noise levels throughout the project area are variable depending on the time of day and climatic conditions. Land uses in the project vicinity are primarily for TVA dam-related activities, recreation, and transportation. Some industrial noise may be generated in association with the dam activities. Additional transportation noise may be generated along the roadways. Other noise in the project area would be associated with the outdoor recreation activities. The sections below present the results of the baseline conditions survey at the four dam locations.

<u>Cherokee Dam</u>

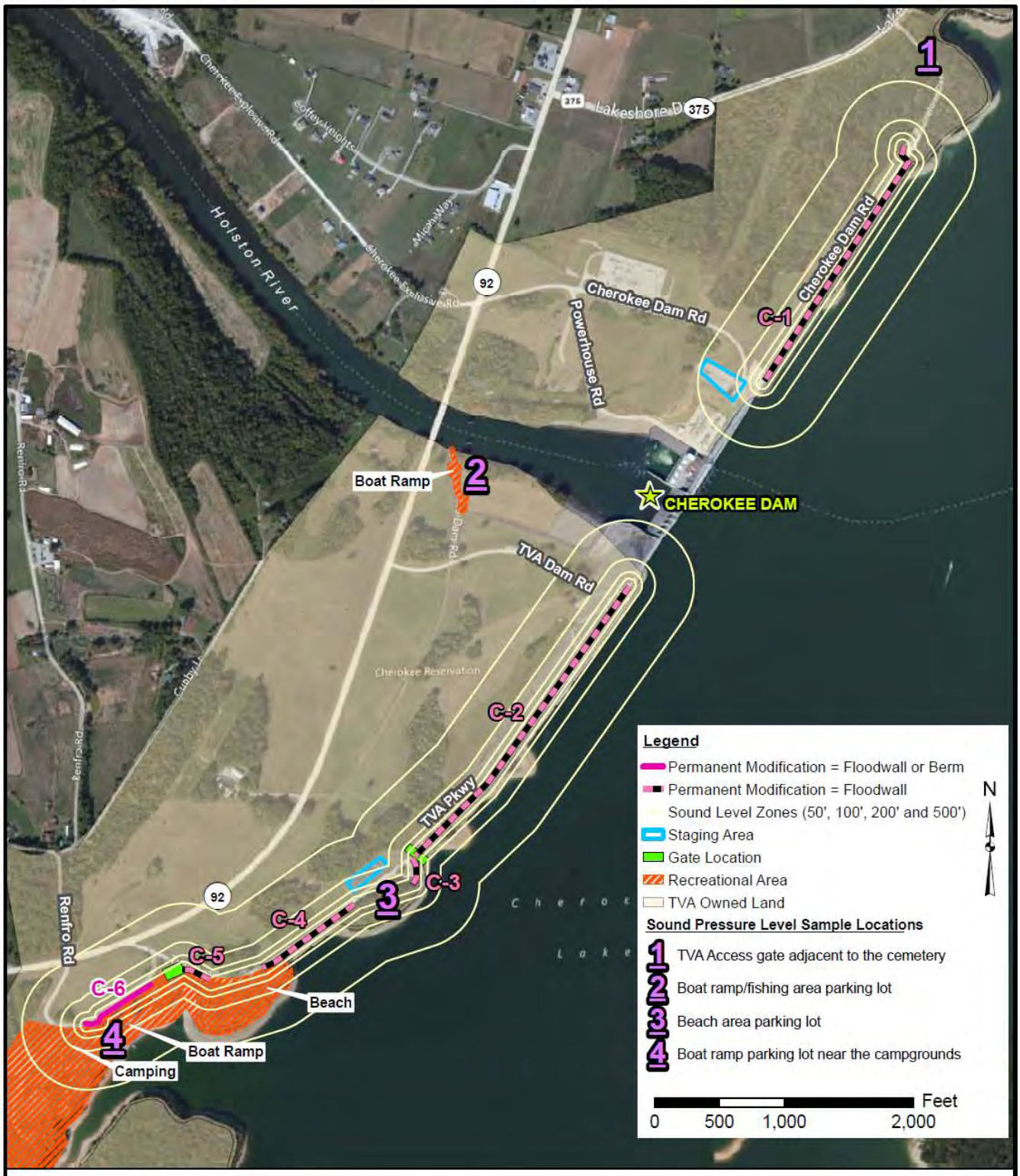
Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Cherokee Dam to determine baseline existing noise levels (Figure 3.12-1). Existing sound levels were not measured at the Cherokee Dam borrow area (Figure 3.12-2), but they are assumed to be above the 70 dBA criterion due to the proximity to U.S. Highway 25E. The measured results from the existing conditions surveys at these four locations are listed in Table 3.12-1.

Table 3.12-1.
Cherokee Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	58.2	56.3	63.3
2	61.7	54.8	63.3
3	63	63.8	70.3
4	68.6	61.9	70.2

Source: EnSafe 2011a

The noise samples from Location 3 (70.3 dBA) and Location 4 (70.2 dBA) currently exceed the 70 dBA criterion value established by USEPA to help prevent hearing-loss in the general population. However, this value is based on continuous, long-term exposure over a period of several years and, therefore not likely to pose problems for the individuals that would typically frequent this area (i.e., TVA workers and recreational users).

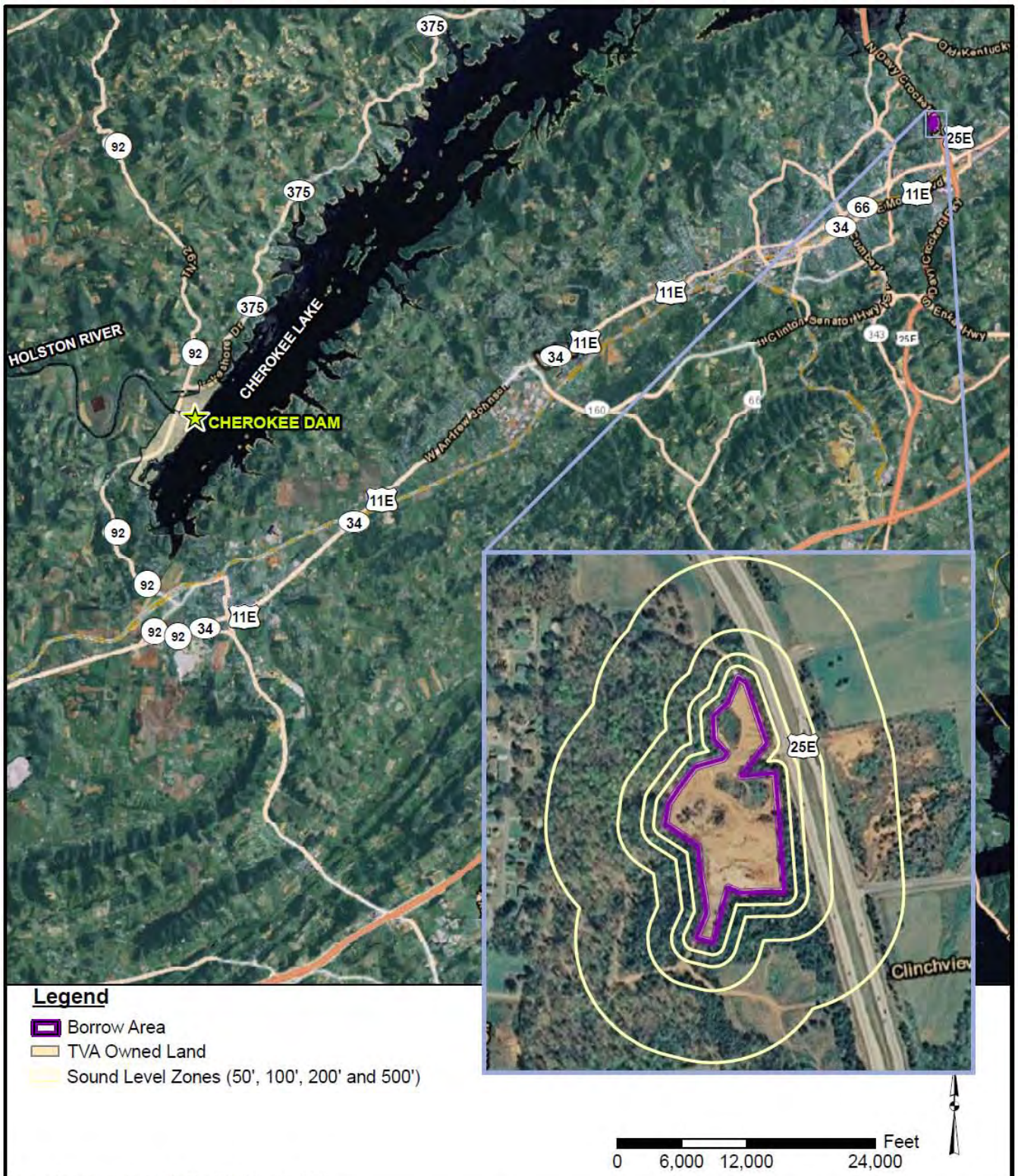


Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-1
Sound Level Zones
Cherokee Dam

Tennessee Valley Authority



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-2
Sound Level Zones
Cherokee Dam Borrow Area

Tennessee Valley Authority

Fort Loudoun Dam

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Fort Loudoun Dam to determine baseline existing noise levels (Figure 3.12-3). The measured results from the existing conditions survey at these four locations are listed in Table 3.12-2.

Table 3.12-2.
Fort Loudoun Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	62.6	72.3	68.7
2	59.5	63.3	61.3
3	66.6	70.9	68.7
4	57.0	63.0	60.2

Source: EnSafe 2011b

Legend

- Staging Area
- Gate Location
- Permanent Modification = Floodwall
- Recreation Area
- TVA Owned Land
- Sound Level Zones (50', 100', 200' and 500')

Sound Pressure Level Sample Locations

1 Fort Loudoun Dam overlook area, near welcome sign
2 In the marina parking lot, near the restaurant
3 Near the lock entrance and Army Corp of Engineers mailbox
4 In the fishing boom area near the stop sign

N

0 500 1,000 2,000 Feet

Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-3
Sound Level Zones
Fort Loudoun Dam

Tennessee Valley Authority

Tellico Dam

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Tellico Dam to determine baseline existing noise levels (Figure 3.12-4). Existing sound pressure levels were not measured at the Tellico Dam borrow areas (Figure 3.12-5). Existing levels are anticipated to be above the 70 dBA criterion at the northern most borrow area due to the proximity to Interstate 40. Levels at the southernmost borrow area are anticipated to be similar along U.S. Highway 321 but are estimated be lower than the 70 dBA criterion in the portions of the borrow area away from the highway and closer to the residential areas. The measured results from the existing conditions survey at these four locations are listed in Table 3.12-3. Fort Loudoun noise survey sample location 4 (Table 3.12-2 and Figure 3.12-3), which had a DNL of 60.2, is also relevant to Tellico Dam.

Table 3.12-3.
Tellico Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	63.2	46.8	61.7
2	68.4	50.4	66.8
3	63.3	54.7	63.8
4	70.0	59.7	69.9

Source: EnSafe 2011c

Legend

- Gate Location
- Permanent Modification = Floodwall or Berm
- Permanent Modification = Floodwall
- Staging Area
- Recreational Area
- TVA Owned Land
- Sound Level Zones (50', 100', 200' and 500')

Sound Pressure Level Sample Locations

1. In the fishing boom area near the stop sign
2. Beach recreation near the parking lot
3. Dam entrance, in the boat dock parking lot
4. Washout area on warning sign

N

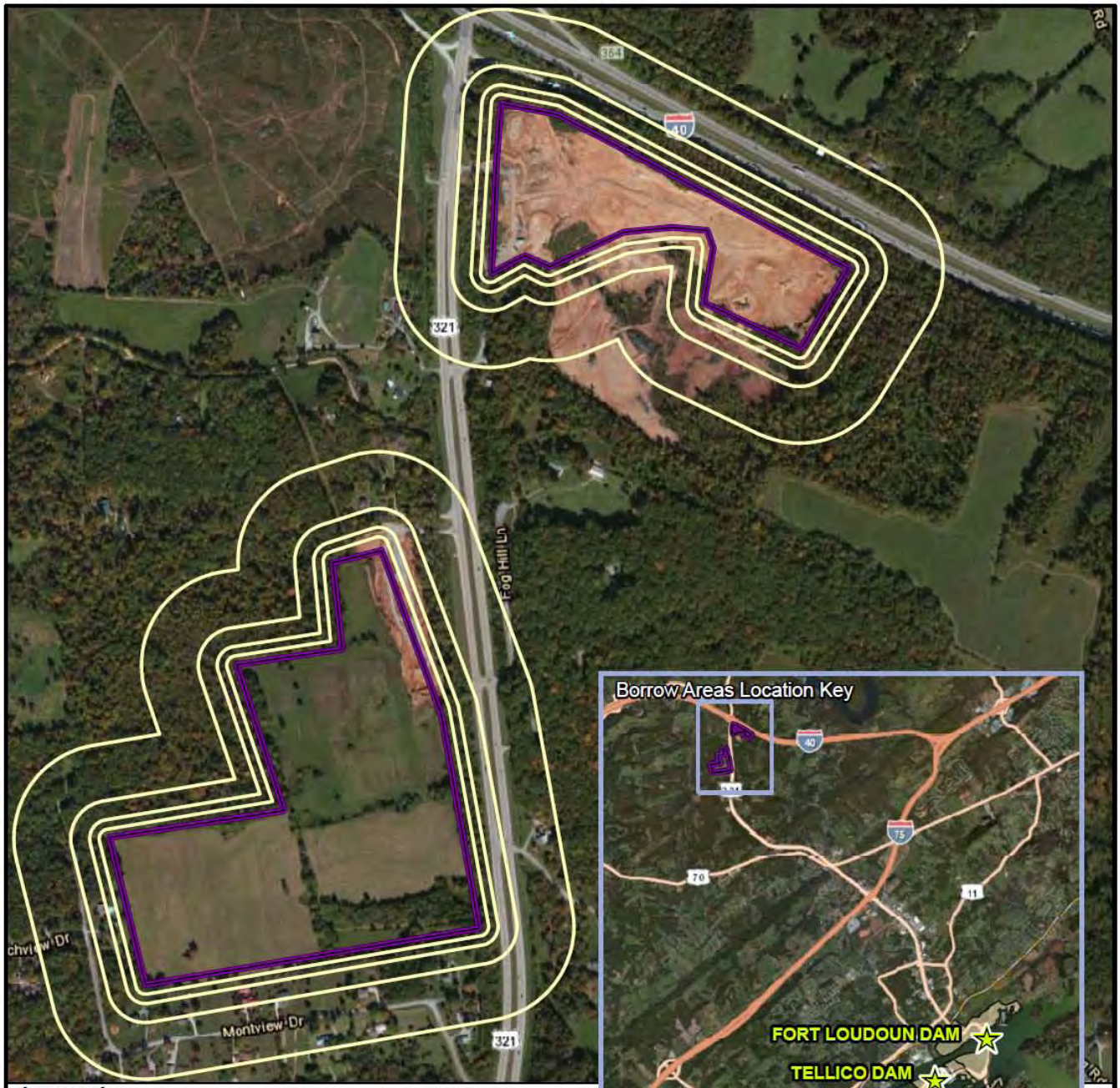
0 1,000 2,000 4,000 Feet

Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-4
Sound Level Zones
Tellico Dam

Tennessee Valley Authority



Source: Aerial is provided by ArcMap Bing Maps, 2012.

AECOM

Figure 3.12-5
Sound Level Zones
Tellico Dam Borrow Area

Tennessee Valley Authority

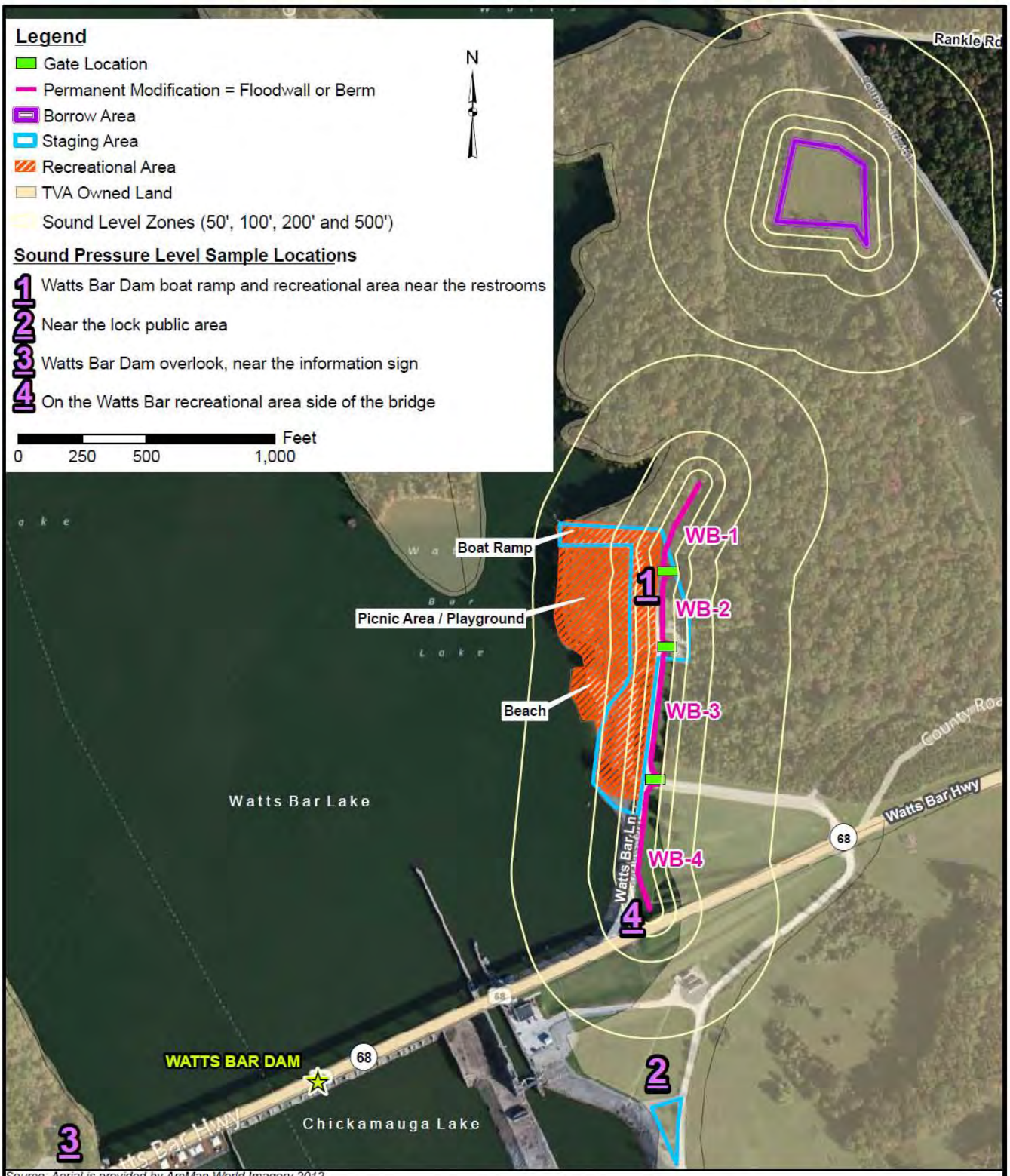
Watts Bar Dam

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Watts Bar Dam to determine baseline existing noise levels (Figure 3.12-6). The measured results from the existing conditions survey at these four locations are listed in Table 3.12-4.

Table 3.12-4.
Watts Bar Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	73.9	74.6	80.9
2	60.0	65.0	71.1
3	74.3	64.7	72.5
4	63.3	65.2	64.2

Source: EnSafe 2011d



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-6
Sound Level Zones
Watts Bar Dam

Tennessee Valley Authority

3.12.2. Environmental Consequences

The following sections discuss the potential noise impacts associated with the project alternatives.

3.12.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, noise receptors in the vicinity would continue to experience ambient noise from traffic and recreational activities and normal operational noise levels from dam operations at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. Sound pressure levels as described in the existing conditions above would be expected to continue. Some of these levels are above the 55 and 65 dBA USEPA criterion; however, impacts would not be anticipated unless a person was exposed to these levels on a continuous basis over a period of several years. There are no permanent residents in these areas, only recreational visitors, campers, and TVA workers; therefore, these noise levels would not be anticipated to impact visitors or workers in these areas. Overall, noise related impacts would not be expected to occur at any of the four dam sites in association with implementation of the No Action Alternative.

3.12.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Table 3.12-5 describes noise emission levels for construction equipment expected to be used during the proposed construction activities. As can be seen from this table, the anticipated noise levels at 50 feet range from 76 dBA to 101 dBA based on data from the Federal Highway Administration (FHWA 2006).

Table 3.12-5.
A-weighted (dBA) Sound Levels of Construction Equipment and Modeled Attenuation at Various Distances[1]

Noise Source	50 feet	100 feet	200 feet	500 feet	1000 feet
Backhoe	78	72	68	58	52
Compactor	83	77	71	63	57
Concrete Mixer Truck	79	73	67	59	53
Crane	81	75	69	61	55
Dozer	82	76	70	62	56
Dump Truck	76	70	64	56	50
Excavator	81	75	69	61	55
Front End Loader	79	73	67	59	53
Sweeper	82	76	70	62	56

***Source**:* FHWA 2006. "Highway Construction Noise Handbook."
The dBA at 50 feet is a measured noise emission. The 100-to 1,000-feet results are modeled estimates.

Assuming the worst case scenario of 83 dBA, as would be the case during the construction of a floodwall or berm along the project corridor, all areas within 200 feet of the project corridor could experience construction noise levels exceeding 65 dBA. Construction noise levels could attenuate to less than 65 dBA at a distance of 500 feet from construction activities.

During the approximately 21-month construction period, construction activities would be expected to create temporary noise impacts above 65 dBA to sensitive receptors within 200 feet of the project corridor, including in the recreation areas closest to the construction areas. Construction activities would take place a minimum of 12 hours per day, and possibly up to 18 hours per day and would occur during daylight hours. Night-time construction is not anticipated under this alternative. Similarly, no construction would take place on weekends or holidays. In addition to noise created by construction equipment, there would also be impacts from noise generated by construction vehicles and personal vehicles for laborers that could use public roads and highways for access to constructions sites. The noise impacts associated with the construction activities would be temporary; following construction, noise levels would return to existing conditions. Throughout construction BMPs would be utilized to minimize noise; these BMPs would include properly maintaining construction equipment, restricting compression release engine breaking by trucks, and supplying employees with hearing protection when appropriate.

For all four dams, the construction noise associated with Alternative B would not be anticipated to impact individuals in water craft on the reservoir/canal side of the dam segments. First, the water craft will likely remain far enough from the construction area on shore that any associated construction noise would be attenuated prior to reaching the passengers. Additionally, for water craft operating with an engine, the immediate noise from the craft itself would likely mask any construction noise from shore. Therefore, the noise environment impact evaluation is concentrated on areas on shore located in close proximity to the construction areas at all four dams.

Cherokee Dam

The noise samples from Location 3 (70.3 dBA) and Location 4 (70.2 dBA) currently exceed the 70 dBA criterion value established by the USEPA to help prevent hearing-loss in the general population (as discussed above). As this value is based on continuous, long-term exposure over a period of several years it does not pose a current risk to individuals working or recreating in the area.

Dam segment C-1 (Figure 3.12-1) is located within restricted TVA access areas and construction noise would only have the potential to impact TVA employees or individuals in recreational water craft in Cherokee Lake. The existing noise levels in this area were measured at 63.3 dBA at Location 1. The construction noise would result in noise elevations above the existing conditions (Table 3.12-5). These elevations would be noticeable to TVA workers in this area. However, application of BMPs such as properly maintaining construction equipment, restricting compression release engine breaking by trucks, and supplying employees with hearing protection when appropriate would minimize potential impacts. Overall, adverse noise impacts within restricted TVA access areas would be minor and temporary.

The northernmost point of dam segment C-2 is located approximately 1,573 feet from the boat ramp on the Holston River off of TVA Dam Road (Figure 3.12-1). This area is located outside of the zone of potential impact from all construction activities. The only potential noise impacts experienced at this boat ramp would be short-term noise from construction traffic along TVA Dam Road. This would be negligible as there would already be traffic noise along this road in association with the boat ramp activities. Overall adverse noise impacts at this boat ramp would be minor and temporary.

Dam segment C-2 is located immediately adjacent to the lakeside portion of the jogging/walking recreation path on the south side of Cherokee Dam (Figure 3.12-1). The construction activities associated with this segment would be immediately discernible to individuals in this area. It is likely that during construction, the portion of segment under construction would be closed and restricted to construction workers only for safety and access reasons. Therefore, the nearest walkers/joggers would likely be located along the side of the trail running along the base of the dam segment, through the field. At its closest distance, this trail is located approximately 300 feet from the construction area, at this range, the noise generated by the construction activities may be heard by visitors on the path below, however it would not likely be above 65 dBA and thus not be loud enough to cause potential significant impacts. At most it could cause an annoyance to visitors on the path. Therefore, noise impacts along most of the walking/jogging path would be minor and temporary.

Cherokee Dam Segment C-3 and its associated gap closure barrier are located adjacent to one parking area and across the TVA Parkway from another (Figure 3.12-1). The parking area across the TVA Parkway would be used as a staging area. It is unclear whether the parking area immediately adjacent to dam segment C-3 would remain accessible during the construction activities but it is likely that for public safety reasons it would be closed for the duration of the construction on that segment and while the parking area across the parkway is used for construction purposes. Should the parking area adjacent to segment C-3 be closed during construction, there would be no noise impacts to visitors in this area as it is probable that the lakeside portion of the walking/jogging trail in this area would be closed for safety reasons. Should the parking area remain open, construction noises would be readily apparent to visitors in the lot.

Dam segments C-4, C-5, and C-6 and the gap closure barrier between segments C-5 and C-6 are all located immediately adjacent to the beach, boat ramp, and camping recreation areas (Figure 3.12-1). Segment C-4 is located far enough from these recreational areas that noise impacts associated with construction on this segment would be minor. However, segments C-5 and C-6 and the connecting gap closure barrier between these segments are located immediately adjacent to the most heavily used areas. The existing noise levels measured at Station 4 were 70.2 dBA. Within 200 feet of the construction areas, noise levels would exceed 71 dBA, resulting in potential adverse impacts in these areas. Beyond 200 feet from the construction the construction noise would be at levels similar to the existing conditions and, therefore would not have significant adverse impacts. Large portions of the boat ramp and beach are located within 200 feet of the construction zones. The elevated noise levels in these areas would be highly apparent and there would be a potential for significant adverse impacts. Most of the camping area is located beyond 200 feet from the construction area; therefore, while the construction noise may be evident from certain areas of the campground, the potential for significant impacts would be limited to a small area.

Overall, noise impacts associated with the construction of these dam segments and this gap closure barrier could be minor to significant depending on the types of construction equipment in use and whether the recreation areas are left open during the construction activities.

In the vicinity of the Cherokee Dam borrow areas (Figure 3.12-2), noise associated with the excavation of borrow materials would be audible at levels around the 70 dBA criterion up to 200 feet from the excavation area. This 200 foot zone includes portions of U.S. Highway 25E. Though existing sound level measurements are not available, noise levels along this highway are likely already elevated above this criterion from the steady flow of traffic along this corridor. As this borrow area is already being used for similar purposes by other projects, the excavation

associated with the collection of borrow materials would not significantly increase noise above the existing levels. Impacts on drivers along U.S. Highway 25E would be minor and temporary. There are no structures or other ongoing activities in the area that would potentially be impacted by the borrow excavation.

Overall, noise impacts in the Cherokee Dam area associated with implementation of Alternative B would range from negligible to significant and adverse depending on the dam segment location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). These would be mitigated in part by the timing of construction, which would likely not occur on weekends and holidays when recreational use of the dam reservation is greatest. With implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be minimized to a certain extent. Following completion of construction, adverse noise impacts would cease.

Fort Loudoun Dam

The noise samples collected at all four locations at Fort Loudoun Dam were below the 70 dBA criterion value established by USEPA to help prevent hearing-loss in the general population (as discussed above). This value is based on continuous, long-term exposure over a period of several years. The existing levels below 70 dBA do not pose a current risk to individuals working or recreating in the area.

Dam Segment FTL-1 (Figure 3.12-3) is located immediately adjacent to City Park Drive and is across from the Fort Loudoun Marina. Existing noise levels in this area measure 61.3 dBA on average. Nighttime levels are slightly higher at 63.3 dBA. The construction noise associated with implementation of Alternative B would exceed these levels to a distance of at least 200 feet and possibly up to 500 feet depending on the construction equipment in use. Therefore, the construction activities would have impacts on drivers along this section of roadway and would also potentially be noticeable at the northernmost parts of the marina. The construction noise would have a lower potential impact on the marina at night as the existing nighttime noise levels are approximately the same as the estimated highest construction noise emissions at 500 feet. However, night-time construction is not anticipated under this alternative. Along the roadway, the construction noise would still exceed existing levels and would exceed the 70 dBA USEPA recommended levels of hearing protection for human health. Though these USEPA levels were established based on long-term exposure, these elevated levels would be a noticeable annoyance to anyone in the immediate vicinity. If this road is closed during the construction activities these impacts would be mitigated. Thus potential noise impacts associated with construction of the floodwall at FTL-1 could range from minor to significant adverse impacts depending on the time of day of construction and on whether the road is left open or is closed during the construction activities.

On the south side of Fort Loudoun Dam, dam segments FTL-2 and FTL-3 are immediately adjacent to U.S. Highway 321 and the entrance/exit ramps from this highway to the Tellico Parkway and TVA recreation areas. Existing noise levels measured at Stations 3 and 4 are 68.7 and 60.2 dBA respectively. The highway itself is located within 50 feet of the construction areas and, therefore drivers along this roadway would experience the elevated noise levels associated with this construction if the construction occurs prior to the rerouting of U.S. Highway 321. Traffic flow would be slowed from normal speeds and reduced to one lane to accommodate the construction. Drivers would experience the elevated noise levels while within the construction zone, however once outside of the zone the sound environment would return to normal road noise levels. The time of exposure for drivers would be short-term and though the elevated noise levels could be an annoyance during the time of exposure constituting adverse

impacts. Significant impacts to human health would not be anticipated given the short length of exposure and the estimated sounds levels.

A gap closure barrier and the southernmost portion of dam segment FTL-3 extend into the Tellico Dam Recreation Area. A parking area is located immediately south of the gap closure barrier. This parking area is designated to be used as a staging area; therefore it would be closed to visitors. Noise impacts for visitors on Tellico Parkway entering the recreation area or merging onto U.S. Highway 321 would be similar to the noise levels experienced by drivers on the highway. These impacts would be adverse but short-term.

Overall, noise impacts in the Fort Loudoun Dam area associated with implementation of Alternative B would range from minor to significant and adverse depending on the dam segment location and time of day of construction. With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease.

Tellico Dam

Noise sample data collected at all four Tellico Dam stations were below the 70 dBA USEPA criterion protective of hearing (as discussed above).

The majority of the Tellico Recreation Area is located within the project construction area (Figure 3.12-4), either along the proposed dam segments or in the potential staging areas. Dam segments T-1 and T-2 are immediately adjacent to the beach area and the walking/jogging trail. Portions of both the beach and the trail are within 50 feet of the construction area for these two dam segments, therefore these areas would experience elevated noise levels above the 70 dBA criterion. It is likely that for public safety purposes, visitor access would be restricted in the immediate vicinity of the construction zone. Within 50 feet of the construction zone, visitors would experience elevated noise levels between 76 and 83 dBA. This would constitute an adverse impact and would be a significant disturbance to for individuals recreating in these areas. At a distance of 100 feet noise levels would be reduced to range between 70 and 77 dBA, still constituting an adverse impact and disturbing visitors in the area. At 200 feet distance from the construction zone, noise levels would still be elevated above the existing conditions which range from 68.7 to 61.3 dBA. Noise levels from the construction activities at 200 feet would range from 64 to 71 dBA constituting an adverse impact. The construction noise would be audible and have the potential to impact visitors within 200 feet from the construction zones. This would include portions of the walking/jogging path and the northernmost part of the beach area. At a distance of 500 feet the majority of the construction noise would be below existing sound levels in the area. It is possible that the construction noise may be heard on occasion at this distance, but it would not constitute a significant adverse impact to visitors at this range. In summary, noise related impacts in the vicinity of dam segments T-1 and T-2 would be adverse at the beach and along the walking/jogging trail. These impacts would be temporary; once the construction was concluded the sound environment would return to existing levels.

In the vicinity of dam segments T-3 and T-4 existing noise levels average 60.2 dBA. Construction noise levels out to a distance of 500 feet could exceed these existing noise levels. Within 200 feet of the construction area, noise levels could exceed the 70 dBA USEPA criterion. These two dam segments are immediately adjacent to the Tellico Parkway and the construction noise would constitute adverse impacts on drivers passing through the area, the noise would be distinctly audible while the vehicles were in range of the construction zones. The exposure

times would be short term. Though traffic would likely be slowed through the area as a result of lane closures to complete the construction on dam segment T-4, the traffic would still move through in a short time frame resulting only in short-term impacts. The elevated noise levels would cease once the construction was completed.

Noise levels would also be elevated in the vicinity of the Tellico Dam staging areas (Figure 3.12-4), noise in these areas would primarily be restricted to the movement of construction vehicles and supplies. As the Tellico Dam staging areas are located in existing parking lots, the noise increase would likely not be significantly higher than existing vehicle traffic, though construction vehicle engine noises would likely be somewhat louder than passenger vehicle noises. Impacts to the sound environment would be anticipated to be minor and temporary.

In the vicinity of the Tellico Dam borrow areas (Figure 3.12-5), noise associated with the excavation of borrow materials would be audible at levels around the 70 dBA criterion up to 200 feet from the excavation area. This 200 foot zone includes portions of Interstate 40 and U.S. Highway 321. Though existing sound level measurements are not available in the borrow area, noise levels along these highways are likely already elevated above this criterion from the steady flow of traffic along these corridors. As the borrow area adjacent to Interstate 40 is already being used for similar purposes by other projects, the excavation associated with the collection of borrow materials for the Tellico Dam Proposed Action would not significantly increase noise above the existing levels. The second borrow area along U.S. Highway 321 currently appears to be empty grass fields, these fields are bordered on the north and south/southwest by residential structures. These residential structures are located inside 200 feet from the outer edges of the borrow field boundaries. If the excavation were occurring along the boundaries, these residences may experience elevated noise levels, an adverse impact. It is impossible to predict the exact locations where excavation activities would occur within the borrow areas; however, it is likely that TVA would concentrate excavation to the areas closest to U.S. Highway 321 in the center of the fields, thereby lessening potential adverse impacts. Impacts on drivers along Interstate 40 and U.S. Highway 321 would be minor and temporary.

Overall, noise impacts in the Tellico Dam area associated with implementation of the Proposed Action would range from negligible to significant and adverse depending on the dam segment location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease.

Watts Bar Dam

Existing noise levels in the Watts Bar Dam area (Figure 3.12-6) vary across the project area; the highest levels, 80.9 dBA, were recorded at Station 1 in the vicinity of dam segments WB-1 and WB-2. The lowest existing sound levels were recorded at Station 4 on the south side of dam segment WB-4 at 64.2 dBA. The existing noise levels measured at Stations 1, 2, and 3 all measured above the 70 dBA USEPA criterion. As this value is based on continuous, long-term exposure over a period of several years it does not pose a current risk to individuals working or recreating in the area.

All four dam segments proposed for modification under the Proposed Action are immediately adjacent to recreation areas including a beach, picnic area and playground, and boat launch. In the vicinity of all four Watts Bar Dam segments, construction noise levels would exceed existing

noise levels at a distance of 50 feet from the construction area near Station 1 and at a distance of 200 feet near Station 4. These elevated noise levels would constitute an adverse impact on visitors in the area. It is likely that visitor access would be restricted in the immediate construction zone. As the parking areas would be utilized for construction staging, the noise levels would also be elevated in these regions. The elevated noise levels from the construction activities would be distinctly audible and would disturb visitors in the area, most especially utilizing the picnic area, playground, and upper areas of the beach. The adverse noise impacts would, however, be short-term.

Near the Watts Bar staging area located south of Highway 68 (Figure 3.12-6), the existing noise levels were measured at 71.1 dBA, a level that exceeds the USEPA criterion. Construction related noise at this staging area would consist primarily of vehicle traffic as vehicles and equipment were shuttled between the staging area and the construction zone. Therefore, noise levels would not be anticipated to be elevated significantly above the existing levels.

Existing noise levels were not measured in the vicinity of the Watts Bar borrow area (Figure 3.12-6). Because of the more remote location of this borrow area, located away from any major structures, recreation, or other human activity areas, it is assumed that existing noise levels in this area are less than the 70 dBA criterion. County Road 461 is located within 200 feet of the northeastern most portion of the borrow area. Any elevated noise levels associated with the construction activity would be inconsequential and temporary for drivers along this road. Therefore, noise levels associated with Watts Bar borrow excavation would not be anticipated to have adverse impacts.

Overall, noise impacts in the Watts Bar Dam area associated with implementation of the Proposed Action would range from negligible to significant and adverse depending on the dam segment / staging area location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease.

3.12.2.3. Alternative C – All Floodwalls

Potential noise-related impacts associated with implementation of Alternative C would be similar to those described above for Alternative B at all four dams. Under Alternative C, the overall construction duration would likely be shorter given that the construction timeframe for concrete floodwalls is slightly shorter than that of earthen embankments or berms. This would result in a shorter potential period of increased noise from construction equipment and activities in the project areas than compared to Alternative B.

3.13. Transportation

This section describes the transportation network, the traffic counts on this network, and the potential impacts to the transportation network as a result of the project actions.

3.13.1. Affected Environment

The project area at each dam is adjacent to or in the immediate vicinity of a number of public thoroughfares, minor recreation roads, and restricted access maintenance roads. These roadways are discussed in the following sections for each dam respectively.

Cherokee Dam

At Cherokee Dam, approximately 6,685 feet of the existing embankment has a road either on top of it, or immediately adjacent (Figure 2-2).

State Highway 92 / Murrell Road

Highway 92 / Murrell Road is an undivided two-lane major roadway running approximately northeast-southwest where it crosses the Holston River approximately 2000 feet from the western / downstream side of Cherokee Dam. The most recent Average Annual Daily Traffic (AADT) available from the Tennessee Department of Transportation (TDOT) is from the 2011 calendar year. Along Highway 92 the AADT is between 4,870 and 4,966 vehicles per day at the Cherokee Dam (TDOT 2011a and b). Near the junction with U.S. Highway 11E to the south, the AADT on Highway 92 is 6,998 (TDOT 2012a).

Cherokee Dam Road / Powerhouse Road

Cherokee Dam Road / Powerhouse Road is a restricted access, undivided two-lane minor rural arterial that branches out south from Lake Shore Drive toward a TVA electric facility and maintenance area. The roadway runs northeast-southwest roughly parallel to Highway 92 along a portion of the western shore of Cherokee Reservoir. Cherokee Dam Road terminates at Cherokee Dam. A restricted access maintenance access road extends across the dam from Cherokee Dam Road and connects with TVA Parkway on the south. No AADT data is available for this restricted access road.

TVA Parkway

TVA Parkway is an undivided two-lane minor rural arterial that branches out east from Highway 92 toward two recreation areas. The roadway runs northeast-southwest roughly parallel to the highway along a portion of the western shore of Cherokee Reservoir. TVA Parkway terminates at Cherokee Dam. A restricted access maintenance access road extends across the dam from TVA Parkway and connects with Cherokee Dam Road on the north. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data was available.

TVA Dam Road

TVA Dam Road is an undivided two-lane minor rural arterial that exits U.S. Highway 92 approximately 1,000 feet south of the Holston River. This roadway runs east toward Cherokee

Lake and provides access to two recreation areas. This roadway is not heavily traveled as it is used primarily for recreation and not through traffic; no AADT data was available.

U.S. Highway 25E / State Highway 32 / Davy Crockett Parkway

The borrow area for the proposed Cherokee Dam berm is located approximately 23 miles away from the project site in Morristown, TN on U.S. Highway 25E / State Highway 32 / Davy Crockett Parkway (Figure 2-3). U.S. Highway 25E is a divided, four-lane highway that runs northwest-southeast and intersects with U.S. Highway 11E in Morristown. Along U.S. Highway 25E near the borrow area the AADT is 18,251 vehicles per day (TDOT 2012b).

U.S. Highway 11E / Andrew Johnson Highway

To reach the project area at Cherokee Dam from the borrow area on U.S. Highway 25E, the construction traffic would travel south along U.S. Highway 11E / Andrew Johnson Highway (Figure 2-3). There would be an increase in construction traffic along U.S. Highway 11E through Morristown and Jefferson City and then along U.S. Highway 92 to the project site at Cherokee Dam. Along U.S. Highway 11E south of the junction with U.S. Highway 25E the AADT is 15,781 vehicles per day (TDOT 2012c). In Jefferson County, near the junction with U.S. Highway 92, the AADT on U.S. Highway 11E is 17,956 vehicles per day (TDOT 2012d).

Fort Loudoun Dam

At Fort Loudoun Dam (Figure 2-7), approximately 3,800 feet of embankment have a road either on or adjacent to it. Of that 3,800 feet, approximately 3,300 feet of embankment is adjacent to U.S. Highway 321 and approximately 500 feet of embankment is adjacent to Tellico Parkway.

U.S. Highway 321 / State Highway 95 / State Highway 73

U.S. Highway 321 / State Highway 95 / Highway 73 is a divided two-lane highway that currently crosses the Fort Loudoun Dam at the elevated J. Carmichael Greer Bridge. The AADT along U.S. Highway 321 at the J. Carmichael Greer Bridge is 18,816 vehicles per day (TDOT 2012e). The Knoxville News Sentinel reported that TDOT estimates show an average of 21,200 vehicles a day travel over the J. Carmichael Greer Bridge (Jacobs 2012). By May 13, 2015, U.S. Highway 321 is to be widened to four lanes and rerouted from the dam to a new bridge downstream of the dam.

City Park Drive

City Park Drive is an undivided two-lane major rural roadway that crosses U.S. Highway 321 northwest of the J. Carmichael Greer Bridge. The northern segment of this road travels northeast along Fort Loudoun Lake. A number of recreation facilities including the Fort Loudoun Marina are located along City Park Drive approximately 3,000 feet from the U.S. Highway 321 overpass. The roadway continues on toward residential areas to the north. The AADT along City Park Road / Elm Hill Road south of the U.S. Highway 321 overpass is 1,105 vehicles per day (TDOT 2012f). No AADT information was available for the northern section of City Park Drive. Under the U.S. Highway 321 widening and rerouting project described above, the existing City Park Drive overpass will be removed and traffic rerouted to connect directly with the existing U.S. Highway 321 roadway.

Tellico Parkway

The Tellico Parkway is an undivided two-lane highway that runs roughly northeast-southwest and intersects U.S. Highway 321 on the east side of the Tellico Canal. This roadway continues to the south. The AADT along the Tellico Parkway is 8,792 vehicles per day at the dam (TDOT 2011d).

TVA Service Road

The TVA Service Road is an undivided two-lane minor rural arterial located west of U.S. Highway 321 runs from the south side of the Fort Loudoun Dam to the Tellico Parkway roughly parallel to the highway's current route. The TVA Service Road is gated with restricted access. This roadway is not heavily traveled as it is a restricted access road used primarily for maintenance and not through traffic; no AADT data was available. Under the U.S. Highway 321 widening and rerouting project described above, this TVA service road would also be modified to ensure continued access for TVA maintenance activities.

Unnamed Road

An unnamed, undivided two-lane minor rural arterial travels north toward the Tennessee River from the TVA Service Road approximately 1,200 feet from the intersection with the Tellico Parkway. This road leads to storage tank facilities and a recreation area. This roadway is not heavily traveled as it is used primarily for recreation and maintenance purposes; no AADT data was available. Under the U.S. Highway 321 widening and rerouting project described above, this road would also be modified to ensure continued access for recreation and maintenance activities.

Tellico Dam

At Tellico Dam (Figure 2-11), approximately 4,625 feet of embankment have a road either on top of or immediately adjacent.

Tellico Parkway

The Tellico Parkway is an undivided two-lane highway that runs roughly northeast-southwest and crosses the canal that connects the Tennessee River and Tellico Lake approximately 1000 feet north of the Tellico Dam. The AADT along the Tellico Parkway is 8,792 vehicles per day at the dam (TDOT 2011c).

Unnamed Road South

Unnamed Road South is an undivided two-lane rural arterial that branches out south from Tellico Parkway and runs west toward the bridge over the canal that connects the Tennessee River and Tellico Lake. This road leads to a parking area and small boat ramp. This roadway is not heavily traveled as it is used primarily for recreation purposes; no AADT data was available.

Unnamed Road West

Unnamed Road West is an undivided two-land rural arterial that branches out south from Tellico Parkway and runs roughly northeast-southwest providing maintenance access to the east side

of Tellico Dam. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data was available.

Unnamed Road East

Unnamed Road East is an undivided two-lane rural roadway that branches out south from the Tellico Parkway at the exit ramp from U.S. Highway 321. Unnamed Road East provides access to several recreation areas including a boat ramp. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data was available.

Maintenance Access Road – Saddle Dam No. 2

An unpaved gated maintenance access road travels east from Tellico Parkway approximately 3,500 feet south of the emergency spillway. This road is restricted access leading to the dam segment designated T-3 on Figure 1-3. This maintenance access road is not heavily traveled; no AADT data was available.

Maintenance Access Road – Saddle Dam No. 3

A gravel maintenance access road exits east from Tellico Parkway 1,600 feet south of the Saddle Dam No. 2 maintenance access road. This access road is not heavily traveled as it is used only for TVA maintenance and not for through traffic; no AADT data was available.

Watts Bar Dam

At Watts Bar Dam (Figure 2-17), approximately 1,600 feet of embankment have a road on or immediately adjacent.

State Highway 68 / Watts Bar Highway

U.S. Highway 68 / Watts Bar Highway is an undivided two-lane major roadway that runs roughly east-west across Watts Bar Dam on the south side of Watts Bar Lake at the outlet to the Tennessee River. The AADT along Highway 68 is 5,826 vehicles per day at Watts Bar Dam (TDOT 2011e).

Unnamed Road

An unnamed road crosses U.S. Highway 68 approximately 600 feet east of Watts Bar Dam. This unnamed road is an undivided two-lane rural arterial that provides access to a recreation and boat ramp area located approximately 600 and 1200 feet (respectively) north of Watts Bar dam in addition to providing access to the TVA facilities located on the northeast side of the dam. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data was available.

3.13.2. Environmental Consequences

This section presents a discussion of the potential environmental impacts that could occur associated with each of the project alternatives.

3.13.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place and no additional construction would occur in association with the embankments in the project areas at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. Short-term lane closures along the roadways within the project areas may be required from time to time during inspection or repairs of the existing HESCO barriers, but these would be temporary and result in only minor impacts to transportation. At Fort Loudoun, similar short-term lane closures may be required along U.S. Highway 321 for dam segment repairs in the event of major damage to the segment, however as will be discussed in the cumulative impacts section, this highway is being rerouted, therefore the potential for such lane closures will end once the reroute construction is completed. Given the traffic volume along U.S. Highway 321 at present (18,000 to 22,000 vehicles per day) such lane closures would have the potential to create significant impacts to transportation, but it is unlikely that such closures would be required between 2012 and 2015 when the U.S. Highway 321 reroute is completed.

No impacts to the other major roadways in the project areas are anticipated; therefore, potential impacts to transportation at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams under the No Action Alternative would be minor to significant (Fort Loudoun only), though the potential for significant impacts is considered unlikely. All potential impacts to transportation would be short-term (for the duration of the maintenance work).

3.13.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments/berms. Under this alternative, overtopping of each dam during a PMF event would be prevented by construction of a floodwall on the earthen embankments and/or raising the earthen embankments to the same height or higher than the existing HESCO barriers.

Cherokee Dam

Under the Proposed Action, there may be minor traffic congestion or lane closures on the TVA Parkway during construction of the concrete floodwalls. This could limit access or increase the time required to enter and exit the recreational areas from this roadway. Complete road closure during construction is not currently anticipated. Traffic impacts on the TVA Parkway would be short-term and minor. Concrete would be trucked in to the project area using primarily major highways; therefore, significant impacts related to concrete truck traffic would not be anticipated to occur.

The borrow area for the proposed Cherokee Dam berm is located approximately 23 miles away from the project site in Morristown, Tennessee on U.S. Highway 25E. U.S. Highway 11E connects U.S. Highway 25E (borrow site location) with U.S. Highway 92 (project site location). Construction equipment transporting borrow material would travel these roadways several times a day for a period of up to a few weeks. As the existing traffic volume exceeds 18,000 vehicles per day on U.S. Highway 25E, 15,000 vehicles per day on U.S. Highway 11E, and 5,000 vehicles per day on U.S. Highway 92, the construction traffic associated with implementation of Alternative B would have no significant impact on the traffic volume along these roadways. Therefore, no significant impacts to transportation are anticipated in association with the implementation of Alternative B at Cherokee Dam.

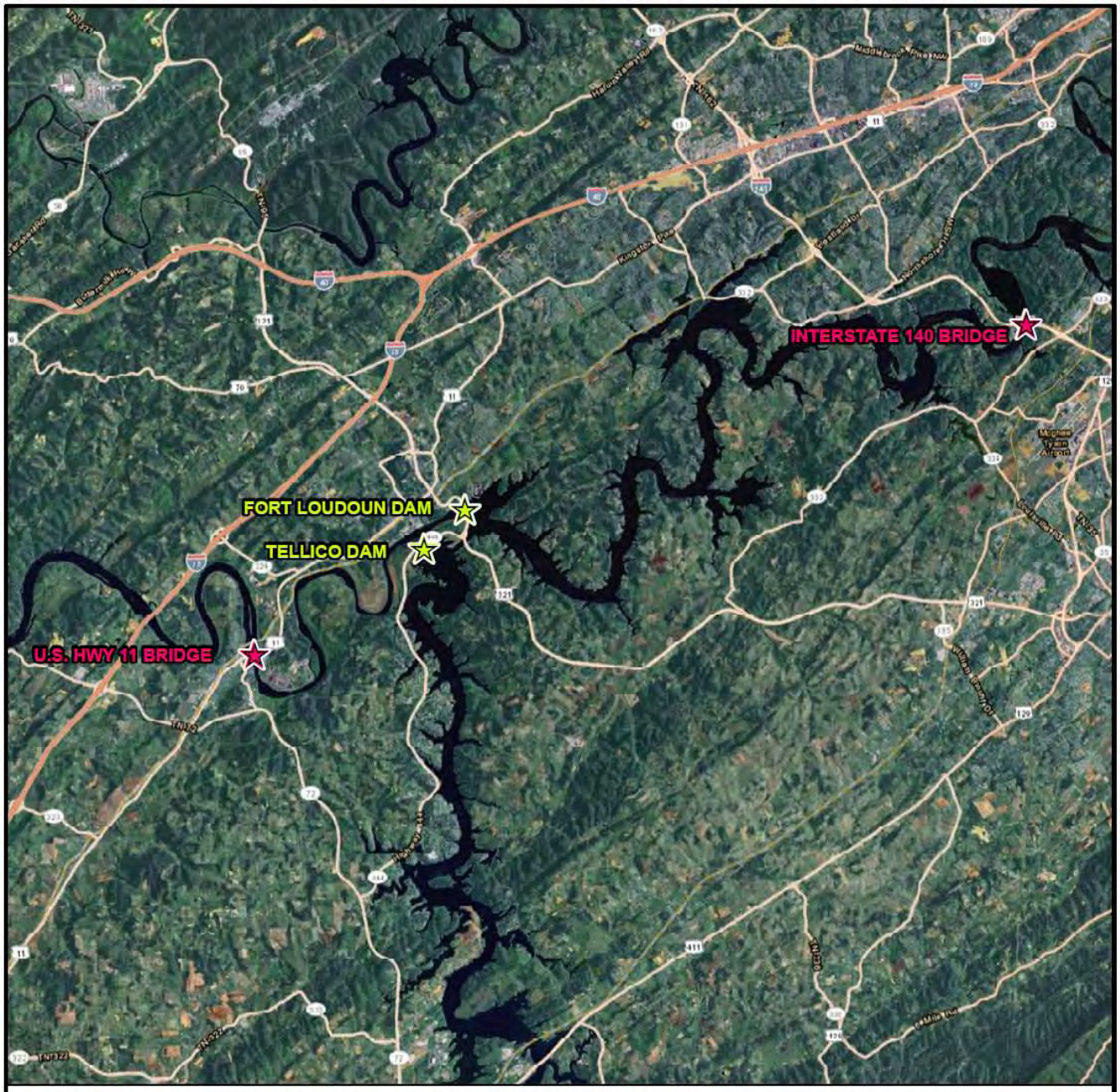
Fort Loudoun Dam

Under the Proposed Action, potential short-term impacts would likely occur to transportation in association on U.S. Highway 321 and City Park Drive with the implementation of Alternative B at Fort Loudoun Dam. Construction activities along these dam segments would necessitate temporary lane closures increasing traffic congestion along these sections of these two roadways.

U.S. Highway 321

The dam segments FTL-2 and FTL-3 are immediately adjacent to the heavily traveled U.S. Highway 321. Complete road closure will not be feasible due to the distances drivers would be required to detour should the J. Carmichael Greer Bridge be closed completely. The nearest upstream bridge over the Tennessee River is the Pellissippi Parkway bridge on Interstate 140 / Pellissippi Parkway. The Pellissippi Parkway bridge is approximately 50 miles round trip from either side of the J. Carmichael Greer Bridge – this would require drivers to detour an hour out of their way to cross the river. The Mulberry Street bridge on U.S. Highway 11 / State Highway 2 / Mulberry Street located downstream of the J. Carmichael Greer Bridge. The Mulberry Street Bridge is approximately 10 miles from the north side and 12 miles from the south side of the J. Carmichael Greer Bridge (Figure 3.13-1). Drivers would require an approximately 40 minute detour to utilize this closest route. Given the large volume of traffic that utilizes the J. Carmichael Greer Bridge on a daily basis (approximately 18,000 to 22,000 vehicles per day), closing this bridge completely and diverting traffic either to the north or the south would constitute a significant impact on transportation.

Single lane closures would be required along U.S. Highway 321 south of the J. Carmichael Greer Bridge and would result in significant increases in traffic congestion along this roadway. The lane closures would require traffic controls in which the traffic flow in one direction is completely stopped while the other is allowed to pass for a time after which point the traffic flow would be switched. For traffic volumes at 18,000 to 22,000 vehicles per day, this would result in a significant impact to transportation; there could also potentially be impacts to human health and safety as a result of the increased congestion and the impatience drivers could experience as result of significant delays should the construction and lane closures occur during daylight or weekend hours. TVA will coordinate the schedule for the floodwall work at Fort Loudoun with the schedule for the U.S. Highway 321 relocation project and, if possible, remove the HESCO barriers and construct the floodwalls after traffic has been rerouted on to the relocated highway.



N

Feet
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Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.13-1
Alternate River Crossings

Tennessee Valley Authority

City Park Drive

Similar impacts would be anticipated along City Park Drive as a result of implementation of Alternative B. Here again the dam segment is immediately adjacent to a two-lane, fairly heavily traveled roadway. At FTL-1 the dam segment is immediately adjacent to the roadway, the opposite side of the dam segment is a hill slope, therefore, construction equipment would be required to be staged in the roadway, thus requiring at a minimum single lane closures. To minimize potential impacts, TVA would conduct a traffic analysis to determine the average daily traffic volume along this section of City Park Drive as that information was not available from the established TDOT measuring stations prior to scheduling the construction activities. Using the new traffic volume information, TVA could determine whether complete road closures were necessary or whether single-lane closures could be implemented during construction. Should it be necessary to close this portion of City Park Drive completely during construction, traffic could be detoured around the area via an approximately five-mile route utilizing Martel, Lakeview, and Easter Ridge Roads. This detour would include a travel time of approximately 15 minutes under normal traffic conditions. Most likely the traffic volume along City Park Drive is lowest at night, therefore construction along FTL-1 would likely have the least impact if conducted during weekday nights should the single-lane closure method be implemented. However, night-time construction is not anticipated under this alternative. Similarly, no construction would take place on weekends or holidays. Concrete for construction of the floodwalls would be trucked in to the project area using primarily major highways; therefore, significant impacts related to concrete truck traffic would not be expected to occur.

In summary, there could be significant impacts to transportation as a result of implementation of Alternative B at Fort Loudoun Dam. These impacts would be minimized to an extent through implementation of BMPs with regard to lane closures. TVA will coordinate the schedule for the floodwall work at Fort Loudoun with the schedule for the U.S. Highway 321 relocation project and, if possible, remove the HESCO barriers and construct the floodwalls after traffic has been rerouted on to the relocated highway. Additionally, these impacts would be temporary lasting only the duration of the proposed construction. Following completion of the construction activities, unrestricted traffic flow would resume.

Tellico Dam

Under Alternative B, potential short-term impacts could occur to transportation on the northern-most leg of the unnamed road that exits the Tellico Parkway and provides access to the boat ramp and recreational facilities along Tellico Lake if construction of the floodwalls and berms necessitates lane closures. These impacts would be anticipated to be temporary and minor. Short-term impacts may also occur along the Tellico Parkway adjacent to the southern-most floodwall section in the project area. Construction activities along this portion of the floodwall could result in temporary lane closures. These impacts would be anticipated to be temporary and minor. No impacts to the other roadways in the project area would be anticipated.

There will be an increase in the amount of traffic moving from the borrow areas located near Interstate 40 overpass to the berm locations near Tellico Dam. Concrete for construction of the floodwalls would be trucked to the project site from local suppliers. The trucks would primarily rely on major highways to reach the dams; therefore, significant impacts to transportation would not result from concrete delivery. Transportation of berm material between the borrow sites and the project site would require multiple truck loads over a duration of several weeks to a few months (depending on the number of berms potentially constructed and the amount of material).

The current traffic load on this roadway is between 18,000 and 22,000 vehicles per day, therefore the increase in construction related traffic would be insignificant along this roadway as a result of the Proposed Action. Therefore, only minor impacts to transportation would be anticipated in this project area as a result of the implementation of the No Action Alternative at Tellico Dam.

Watts Bar Dam

Under the Proposed Action, there may be minor traffic congestion or lane closures in the recreation area adjacent to the project area during construction of the concrete floodwalls or earthen berms. This could potentially limit access or increase the time required to enter and exit the recreation area. Complete road closure during construction is not currently anticipated. Traffic impacts in the recreation area would be temporary and minor. Concrete for construction of floodwalls would be trucked to the project site from local suppliers. The trucks would primarily rely on major highways to reach the dams; therefore, significant impacts to transportation would not result from concrete delivery. Transportation of berm material between the borrow site and the project site would require multiple truck loads over a duration of several weeks (depending on the number of berms potentially constructed and the amount of material). Overall, only minor impacts to transportation are anticipated in association with the implementation of the Proposed Action at Watts Bar Dam.

3.13.2.3. Alternative C – All Floodwalls

Potential impacts to transportation in association with the implementation of Alternative C would be similar to those described above for all dams. Under Alternative C, the overall construction duration would likely be shorter given that the construction timeframe for concrete floodwalls is slightly shorter than that of earthen embankments or berms. This would result in a shorter potential period of increased traffic congestion and lane closures in the project areas than compared to Alternative B. Under Alternative C, there would be no construction traffic associated with the transfer of fill material from the borrow areas because no earthen embankments or berms would be built. However, due to the increased number of floodwalls under this alternative compared to Alternative B, there would be a need for larger amounts of concrete, and thereby an increased amount of concrete construction traffic.

3.14. Visual Resources

Visual resources can have a large influence on aesthetics. Aesthetics is a measure of sentiment or taste that an environment can induce in an observer. This involves the appearance of a view, and its interaction with surrounding views and their individual components. Visual resources would include details such as the shape and color of visual elements, relative placement of visual items with respect to roads, green space and structures, light characteristics, and other factors which could affect a person's experience of the area. Individual items, scale, color, texture and lighting are all visual characteristics of the environment.

3.14.1. Affected Environment

Visual Resources in the project area are highly variable. Land uses include dam and reservoir operations, recreation (public and private), wildlife reserves, rural, urban, commercial and industrial categories. These land uses each have their own unique visual aspect, ranging from the emotionally relaxing and refreshing natural areas to the high energy and powerful industrial areas. This section focuses on the visual resources in the immediate vicinity of the four project areas as these will be the only visual environments potentially impacted.

Cherokee Dam

Visual resources at Cherokee Dam are quite variable, with an almost industrial setting near Segment C-1 and a highly natural setting near Segments C-5 and C-6 (Figure 2-2). Segment C-1, which is accessible to public foot traffic only but receives relatively little public use, visually includes the dam and an associated power plant and switchyard and an expanse of levee with riprap and mowed lawn (Appendix A, Photos 1 through 3). This area combines industrial elements with natural ones, creating a disjointed experience. The soft rolling hills and trees sit in direct opposition to the massive dam and power plant. The transmission lines scattered throughout the natural areas add to this disjointed experience. The large levee with concrete and riprap also breaks up the visual flow in the area which would have created a harmonious and pleasant visual experience, flowing from forested hills to open water. The view from the water is much less impacted by the industrial structures. From the reservoir, the area appears much more natural and peaceful. The levee; however, creates an artificial separation of the calming aspects of water and distant nature, appearing as a disquieting line across the horizon, infringing upon the unrefined aspects of the view.

Visual resources at the western end of the Cherokee Dam reservation are dominated by views of natural areas. This area is accessible to the public and is a popular recreation area. Water, forested areas, mowed and landscaped grassy areas, rolling hills and a distinct lack of structures are the main visual elements. Structures and other human constructed items are generally hidden from most viewing spots, heightening the experience of being engulfed in nature (Appendix A, Photos 12 through 15). This area elicits feelings of well-being and enjoyment due to opportunities to experience the natural setting with friends and family and the appearance of a surrounding open and inviting wilderness. The views from the picnic areas and the walkways of the reservoir are especially pleasant as large expanses of calm water with forested hills in the distance are dominant. The parking lots and camping areas are secluded in trees, making these human-made items almost invisible, especially from the water.

Segments C-2, C-3 and C-4 represent a middle ground between the two very different visual areas (Appendix A, Photos 4 through 8). This area is visually appealing, but the levee, riprap,

HESCO barriers and road interfere with the experience of a natural setting. Views from the walkway towards the water and opposite side of the reservoir are very appealing, making this a popular walking trial, especially for those who are physically limited. Views of this area from the water would be similar to those around segment C-1, with the levee breaking up the visual appreciation of an undisturbed area. Overall, this area is visually appealing due to the surrounding natural areas.

At Cherokee Dam, the typical summer pool elevation is 1064 to1069 feet and the typical winter pool elevation is 1040 to 1045 feet. This can result in a maximum water level difference of 29 feet. This seasonal change can have large visual impacts. Some of these impacts can be dramatic, as evidenced from visual resources analyses in the 2004 River Operations Study EIS (TVA 2004, Photo 3.14-1). Impacts from water drawdown would be most apparent in the winter season. There are no year round residents in the immediate vicinity of Cherokee Dam; therefore, only temporary recreation enthusiasts would experience low water levels. The visual effect of the drawdown would serve to exacerbate the disturbance of the visual flow from hillsides to water due to the levees in the area.

Fort Loudoun Dam

The Fort Loudoun Dam project area has a similar combination of visual resources as at Cherokee Dam, ranging from industrial to nature landscapes. The most industrial views are near the dam, and the most naturally appealing views are near segment FLT-1 (Figure 2-7).

Segment FLT-1 is adjacent to a commercial marina, immediately next to a boat ramp parking lot (Appendix A, Photos 17 through 19). This area is somewhat recessed from the general viewing spots in the area. The access road to the parking lot separates the untamed forested portion of the view from the structured human-made area adjacent. Except for the taller trees, the natural area is usually blocked from view by the road and the HESCO barriers. The addition of visual interruptions such as electrical poles and the riprap along the levee increase the discordant experience of the scenery. More pleasant views of the marina and its surroundings are available further from this segment. Although this portion of the project area also has human-made structures, they are more harmonious with the surrounding view. The boat docks are organized and low in stature, allowing the trees across the reservoir to be seen. The boat house and parking lot are also partially hidden in trees or behind grassy swales, reducing the impact of these structures on the surrounding wilderness. Overall, this area is pleasant visually, but constitutes more of an entry into a scenic and nourishing experience than an area where one would travel to in order to experience an appealing view.

Segments FTL-2 and FTL-3 are far more industrial in appearance. The concrete portion of the dam itself is located near FTL-2 (Appendix A, Photos 20 and 21). This area is highly organized and views are dominated by the dam itself. As at the marina, but at a more extreme level, this access point to the reservoir serves as purely that – an access point. It is unlikely that visitors would linger here for the view after the initial curiosity of the powerful dam structure was satisfied. This portion of the Fort Loudoun reservoir area is not visually appealing due to the large industrial structures, the levee with riprap and the almost complete obstruction of any of the natural areas surrounding it.

August reservoir level in 2002 - 1,382 feet

January reservoir level in 2003 - 1,361 feet (21 feet lower than August level)

Photo 3.14-1. Example of the Visual Impacts from Seasonal Water Level Difference (TVA 2004)

Segment FLT-3 is also relatively industrial in character. It runs from the dam along U.S. Highway 321 towards Tellico Dam (Appendix A, Photo 22). This area is not accessible by pedestrians; therefore, it would only be visible from a distance, either from the water or from a distant land based spot. From the water, views would be dominated by the levee, the highway and the bridge. This would be in opposition to the scenic areas across the reservoir, constituting an interruption in the visual experience. This interruption is reduced towards the southern end of the segment as the bridge is less intrusive and the highway is at ground level. However, the human-made structures still dominate the view. The view of the water from the road is effectively blocked by the HESCO barriers, also creating a disjointed visual experience for drivers. On one side, a pleasant view of forested hills appears; on the other a tall visual barrier prevents any appreciation of the reservoir.

At Fort Loudoun the normal summer pool elevation range is between 812 and 813 feet and the normal minimum winter pool elevation is between 807 and 809 feet. Thus, the maximum elevation difference in the water level would be 6 feet. Visually, in this area, this difference would not constitute a major change in visual resources over the course of the year.

Tellico Dam

The visual resources at Tellico Dam effectively represent a middle ground between Cherokee and Fort Loudoun dams. Segments T-1 and T-2 run from the Fort Loudoun Segment FLT-3 to the Tellico Dam itself (Figure 2-11). This area continues the visual appearance of Segment FLT-3, but the levee and the HESCO barriers are somewhat less intrusive (Appendix A, Photo 25). Appreciation of the natural environment is more effortless here than at the Fort Loudoun segments. The levee and riprap appear smaller in stature and the highway is further from the shoreline and is mostly visually obstructed in this area. The walking trail on the reservoir side of the levee would allow generous opportunities for the appreciation of the natural environment as the view of the reservoir and the landscape across the water are completely unhindered by dam reservation structures.

Segment T-2 is very similar to T-1 at its beginning, but becomes much more industrial at its southern end (Appendix A, Photos 30 through 36). Tellico Dam is much smaller than the other dams in the project area and is nestled into a forested hillside. It is much less industrial in appearance, mostly because if it's close relationship with the adjacent hill. The walking trail along the levee is located opposite the HESCO barriers from the water. Views from the trail are mostly of the adjacent forested hillsides, as the water is partially blocked from view by the HESCO barriers. The experience, however, would still be pleasant and relaxing as the natural areas are appealing and framed by a foreground of softly undulating mowed lawn areas with small stands of trees. Additionally, unless the observer is very small in stature, some visual appreciation of the reservoir is still possible.

In between Segments T-1 and T-2 is a small recreation area which contains a swimming area, a picnic area and a boat ramp (Appendix A, Photos 26 through 28). There are also some walking trails in this area which lead in both directions – towards Tellico Dam and towards Fort Loudoun Dam. This area has an abundance of visual resources as the levees and the other industrial structures are mostly hidden from view by the trees. From this area views are exceptionally pleasant as it is one of the few areas along the reservoir shorelines where the forested areas are immediately adjacent to the water. There are no obstructions between these two natural settings and the effect is relaxing and enjoyable.

Segments T-3 and T-4 are in completely natural settings offering considerable opportunities to appreciate nature (Appendix A, Photos 37 through 39). This area is also adjacent to the Hall Bend Nature Reserve, which has several walking trails. Walking in this area, a visitor is completely immersed in nature, with only very minor visual interruptions. The view consists generally of forested areas, with intermittent glimpses of the reservoir through the trees. These segments represent one of the most appealing and harmonious visual experiences in the entire project area. The only disturbances are the HESCO barriers, which interrupt the appreciation of the water. The barriers are less obtrusive, however, than the larger levee structures in the other portions of the dam area. Overall, these segments represent a significant visual resource eliciting agreeable and calming feeling due to the immediate and almost absolute envelopment of the viewer in a natural setting.

Tellico Village is a large residential area is located just to the south of Segment T-4 (Appendix A, Photos 40 and 41). This area is located in an almost idyllic setting. Homes are nestled in amongst trees and small hills. The water front area is also harmonious with the surroundings as the homes are partially hidden by trees. The view of the reservoir from this residential area would be very pleasant due to the lack of industrial structures within the view. Small sections of levee topped with the HESCO barriers are visible from the village, but these are mostly blocked by trees along the shoreline.

At Tellico Dam, normal reservoir pool elevations are similar to Fort Loudoun, between 812 and 813 feet during the summer and between 807and 809 feet during the winter. This would result in a maximum water level change of 6 feet. Although Tellico Village is a year round residential area located at the edge of the water, this change in water level should not result in an extreme visual impact over the course of the year.

Watts Bar Dam

All four segments at Watts Bar Dam are immediately adjacent and in the same general area (Figure 2-17). Watts Bar Dam and the recreation area nearby present a compelling aesthetic juxtaposition due to the visual dominance of the nuclear power plant (Appendix A. Photo 50). The decisively industrial appearance of the plant's cooling towers and the bridge provide a severely disjointed experience at portions of the recreation area. The plant does not visually fit in with the surrounding area although it is often partially screened by trees. It detracts significantly from the recreational experience which visitors seek when coming to the reservoir. Additional views in the area, even when not including the plant are disquieting due to other industrial and structural aspects (Appendix A, Photo 52). These areas are much less interrupted by the human-made structures, but they often play a large visual role, detracting from the surrounding serenity and natural setting.

Views from the access road to the recreation area are more pleasant, although the industrial nature of the adjacent plant is still visible and causes minor visual disharmony (Appendix A, Photo 48). In contrast, the view from some portions of the recreation area of the reservoir is breathtaking (Appendix A, Photo 56). These variable views highlight the disjointed visual experience at the Watts Bar Dam recreation area; providing some appealing views, some mostly appealing views and some views which are not appealing at all.

To the north of the recreation area, there is a former campground and hiking trails which provide a much more attractive visual experience (Appendix A, Photos 45 and 47). This area is highly visually pleasant as the trails wind through forested areas and the former campsites are for the

most part hidden from immediate view. Ironically, the most alluring visual resource in the area is the farthest from the water.

At Watts Bar Dam, the typical pool elevations are between 740 and 741 feet during the summer and 735 to 737 feet during the winter. This results in a maximum 6 foot change in water elevation. Considering the industrial and severely disjointed visual nature of the recreation area, this difference would be insignificant over the course of a year.

3.14.2. Environmental Consequences

This section contains a discussion of the potential impacts to visual resources should any of the alternatives be implemented. A series of graphic renderings using photographs of the existing conditions was prepared in order to illustrate possible impacts to visual resources at the four dam areas.

Under Alternatives B and C, at all four dam areas, temporary moderate negative direct impacts to visual resources are anticipated during construction activities. These would include the appearance of large construction equipment in a variety of natural settings, additional traffic on the roads and in parking lots, and other barricades and signage related to safety in the construction areas. Similar temporary moderate indirect impacts to visual resources are also anticipated during construction along access roads and at areas distant from the immediate dam areas such as from the water or locations across the reservoir. Additional minor temporary impacts are anticipated during construction if the Floodwall/Berm option (Alternative B) is selected as the constructed berms will have to settle for a period of time prior to being seeded with grasses. This would result in large expanses of soil, contrasting to the usual greenery associated with the reservoir areas.

Moderate to severe impacts to visual resources at two dam locations could occur due to potential altered traffic flow.

3.14.2.1. Alternative A – No Action Alternative

Under Alternative A, the HESCO barriers would remain in place, maintained as necessary by TVA. Minor, temporary visual impacts during maintenance would occur due to the presence of construction equipment along the dam reservations. Public comments during the scoping revealed that many responders wanted the HESCO barriers removed, due to their negative visual impact. The barriers appear temporary and industrial, and block the view of the water in many places, influencing the aesthetics of the dam environments. Although the No Action Alternative was intended to be the baseline from which the other alternatives were evaluated, in this case the HESCO barriers constitute an ongoing negative impact to visual resources.

3.14.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

<u>Cherokee Dam</u>

Under Alternative B, the HESCO barriers would be replaced with combination of floodwalls and berms at Cherokee Dam. Segments C-1 through C-5 would be raised with floodwalls and Segment C-6 would be raised with an earthen embankment (Figure 2-2 and 2-6).

A reinforced concrete floodwall would be constructed on the downstream side of Segments C-1 through C-5. Photo 3.14-2a shows a portion of the embankment at Cherokee Dam, photos

3.14-2b and 3.14-2c show renderings of the area if a wall were built along Segment C-2. A 3-foot-high floodwall would not have a significant negative impact on visual resources in the area, as the wall would simply replace the existing HESCO barriers. To the contrary, this height may have a positive impact to visual resources as the wall would blend in with the road better than the existing HESCO barriers. Alternatively, a 7-foot wall would have major negative impacts to visual resources in the area. The proposed height of this floodwall is 6.6 feet, closer to the rendering of the taller wall. A tall wall would block the view of both a pedestrian and a boater on the water of the rolling hills and forested areas on the downstream side of the embankment. This visual obstruction would significantly alter the appearance of the area and the experience of walking or boating due to the loss of view of the downstream hillsides. Additionally, even while looking from the walkway out over the water the presence of the high wall nearby would have a disquieting effect, contrasting the tranquility generated by the presence of the water and the distant hills. This effect would be slightly less intense at Segment C-1, where there is much less public use and slightly more intense at Segment C-5, adjacent to the recreation areas.

Photo 3.14-2a. Cherokee South Main Embankment

Photo 3.14-2b. Visual Rendering of a 3-foot-tall floodwall on the downstream side of Segment C-2 at Cherokee Dam

Photo 3.14-2c. Rendering of a 7-foot-tall floodwall on the downstream side of Segment C-2 at Cherokee Dam

Photo 3.14-3a represents Segment C-2 as seen from the parking lot at the bottom of the stairs at the end of Powerhouse Road. Photo 3.14-3b shows a rendering of a 7-foot floodwall atop this segment. This area is already highly visually impacted by the large existing saddle dam and the parking lot. Under Alternative B, a 6.6-foot tall concrete floodwall would be built at Segment C-2. Addition of this floodwall would merely appear as a larger levee to visitors viewing this segment from the Powerhouse Road parking lots and/or the reservoir itself. A 6.6-foot-tall permanent floodwall would block pedestrian's views of the rolling hills and forested areas on the downstream side of this embankment. This visual obstruction would greatly alter the appearance of the area and the experience of walking due to the loss of view of the downstream hillsides. Because pedestrians utilizing the top of the Segment C-2 embankment for recreation purposes likely do so primarily for the view of the reservoir and not the view of the downstream hillsides, minor impacts to visual resources would be anticipated under Alternative B.

Photo 3.14-3a. View of Cherokee South Main Embankment (Segment C-2) from the TVA Dam Road Parking Area

Photo 3.14-3b. Rendering of a 7-foot-tall Floodwall atop Segment C-2

Fort Loudoun Dam

At Fort Loudoun Dam, all raises would be accomplished using floodwalls due to site and access limitations. Photo 3.14-4a shows the Fort Loudoun Bridge and U.S. Highway 321. Photo 3.14-4b presents a rendering of a 7-foot floodwall near the Fort Loudoun Dam, Segment FTL-2. This setting is already highly industrial and a floodwall would have only minor negative impacts to visual resources. All segments at Fort Loudoun Dam, with the exception of FTL-1 are adjacent to roads, bridges or dams and are not readily accessible by foot. From the water, the addition of the floodwall would not impose additional industrial themes to the view. At Segment FTL-1, adjacent to the parking area by the marina, the floodwall would also result in a minor visual impact. This area is not centrally located, nor is it an attraction. As in the parking area at Cherokee Dam (C-6), it is merely a backdrop which is already dominated by a large embankment covered with riprap. The addition of a wall on top of this embankment is not anticipated to have significant visual impacts. Segments FTL-2 and FTL-3 are dominated visually by the road and bridge; however, the current U.S. Highway 321 bridge is scheduled to be removed and the road relocated by May 2015. The HESCO barriers along the road are currently stacked two-high, resulting in a 7- to 8-foot-tall wall. The height of the proposed permanent floodwall segments would be 5.8 feet, shorter than the wall simulated in the visual rendering (Photo 3.14-4b). Therefore, along this road, the floodwalls would not be anticipated to result in any significant impacts to visual resources as the barriers and the proposed walls are approximately the same height.

Photo 3.14-4a. Photo used for rendering of floodwall at Fort Loudoun Dam

Photo 3.14-4b. Rendering of a 7-foot Floodwall atop the Existing Embankment at Fort Loudoun Dam

Tellico Dam

At Tellico Dam, most of the embankments would be raised with floodwalls, with the exception of a 1,900-foot section of Segment T-1. Photo 3.14-5a, which was captured (facing north) from the boat ramp peninsula located within the Tellico Recreation Area, shows a portion of Segment T1 at Tellico Dam. Photo 3.14-5b presents a rendering of a 7-foot floodwall along the downstream side of segment T-1. The proposed height of this floodwall-embankment/berm combination is 4.8 feet, considerably shorter than the wall in the visual rendering. A portion of this wall would be an embankment/berm under this alternative, but the wall could be used as an example of what the area might look like with an embankment/berm. From the water, the raised height of the embankment would serve as a larger visual interruption between forested hillsides and shoreline. It is not particularly disquieting from this angle however. Larger impacts to visual resources would be experienced from the pathway along the embankment.

The construction of an embankment/berm at this location, however, could result in a positive impact to visual resources in the area as it would allow a walkway to be constructed atop the berm. Therefore, pedestrians on the walkway would have an unobstructed view of both the forested areas to the downstream side and the reservoir on the upstream side. This would only hold for the 1900 feet of embankment/berm however, and depends on the possibility of the construction of a walkway atop the embankment/berm. The areas where walls would be constructed along segment T-1 could experience major impacts to visual resources, similar to those at Cherokee Dam. The wall to the downstream side would present a partial barrier to the observer of the forested hillsides, while allowing generous views of the reservoir. Most adults would be able to see over a 4.8 foot wall, but it would still represent a visual obstruction and aesthetic disturbance. The wall itself could create an unsettling experience due to its height and proximity to the observer.

Photo 3.14-5a. Photo used for Visual Rendering of a 7-foot floodwall at Segment T-1

Photo 3.14-5b. Rendering of a 7-foot-tall Floodwall atop Existing Embankment at Segment T-1 at Tellico Dam

Photo 3.14-6a shows the south embankment at Tellico Dam. Photos 3.14-6b and 3.14-6c present renderings of Segment T-2 with a 3-foot and a 7-foot floodwall, respectively. The proposed height for the permanent modifications at Tellico is 4.8 feet, a height which falls in between the heights simulated in the two visual renderings. Of all the proposed construction areas, this segment would likely experience the most severe adverse impacts to visual resources if the 7-foot option were selected. The view of the reservoir would be completely obstructed and recreationalists would be completely cut off from the tranquility of the water and the distant shoreline. Although the adjacent, forested hillside would still be enjoyable, the loss of the sight of the water would be dramatic. Under Alternative B, a 4.8-foot-tall floodwall would not be expected to completely obscure the public's view of Tellico Reservoir from the south embankment because the majority of adults would be able to see over the floodwall. A 3-foot wall would be much less intrusive visually. Under this alternative, at segment T-2, severe negative impacts to visual resources are anticipated. The view from land towards the dam would not be as dramatically affected (Photos 3.14-7a and 3.14-7b). Observers walking in the downstream areas of the reservation would not experience an extremely jolting visual change. From this perspective, the reservoir is already not visible, and the wall blends with the existing embankment.

Photo 3.14-6a. Tellico Dam Main Embankment (Segment T-2)

Photo 3.14-6b. Rendering of a 3-foot-tall Floodwall atop Segment T-2 at Tellico Dam

Photo 3.14-6c. Rendering of a 7-foot-tall Floodwall atop Segment T-2 at Tellico Dam

Photo 3.14-7a. View of Tellico Dam (Concrete Portion of Dam)

Photo 3.14-7b. Rendering of a 7-foot-tall Floodwall atop Segment T-2 at Tellico Dam

Photo 3.14-8a shows Segment T-4 (Saddle Dam No. 3) as seen from the closest part of Tellico Village. Photo 3.14-8b presents a rendering of the view of a 7-foot-tall floodwall at Segment T-4 from Tellico Village. Again, the wall rendering serves as an example of the height of a proposed embankment/berm. The embankment/berm would more closely resemble the existing embankment, and would present a less obvious visual change than the rendered wall. From this perspective, impacts to visual resources are anticipated to be minor. The view from the trails along in the Hall Bend Preserve could be slightly more impacted than this perspective. The existing HESCO barriers currently present a disjointed experience of the wilderness and reservoir. The construction of an embankment/berm to replace them may constitute a positive visual impact for observers from this area.

Photo 3.14-8a. Segment T-4 (Saddle Dam No. 3) at Tellico Dam, as seen from the closest part of Tellico Village

Photo 3.14-8b. Rendering of a 7-foot Floodwall at Segment T-4 from Tellico Village

Overall, impacts to visual resources range from severe to slightly positive, depending on the segment and the situation of the observer. At segment T-2, impacts would be severe for observers walking along the embankment trail, but less so for those walking further from the embankment. Observers from Tellico Village would experience a very minor negative impact, while those on the backwoods trails may experience a minor positive impact. Walkers on segment T-1 would potentially be able to travel atop the embankment/berm, resulting in a partial positive impact along the length of the berm.

Watts Bar Dam

Under Alternative B, all existing embankments at Watts Bar Dam would be raised by constructing a 2.3-foot-tall embankment/berm. Photo 3.14-9a shows a view of the existing embankment at Watts Bar Dam. Photo 3.14-9b presents a rendering of a 7-foot wall along the downstream side of the existing embankment. Although the photo depicts a floodwall, the image can be used to estimate the vertical appearance of a berm of the same height. Additionally, the segment is simulated at 7 feet in the rendering; the proposed embankment/berm would actually 4.7-feet shorter than this under Alternative B. The HESCO barriers in this area are relatively set back from the reservoir and the recreation areas, constituting a very minor visual disturbance. The area is also already highly industrial in appearance due to the power plant contrasting with the natural scenery. The construction of berms to replace the HESCO barriers is not anticipated to have a significant impact to visual resources in this area.

Photo 3.14-9a. View of Existing Watts Bar Dam Embankment from Recreation Area

The area by the former campground and trails is likely to be the most visually impacted by the construction. This area is surrounded by trees and natural areas and the construction of the berm may necessitate the removal of some of the immediately adjacent vegetation. Overall, the berms could have a minor negative direct impact to visual resources at Watts Bar Dam.

Photo 3.14-19b. Rendering of a 7-foot-tall Floodwall along the Watts Bar Dam Embankment

Overall, construction of earthen embankments/berms as the permanent modification type at selected dam segments would blend in with the surroundings and be virtually unnoticeable from the key observation points (KOPs) within the project areas. If floodwalls are selected for some dam segments, then they would be built using a natural-colored concrete in order to blend in with the character of the surrounding environment, particularly with the riprap slopes of existing embankments that face most of the KOPs for the project areas.

3.14.2.1. Alternative C – Floodwalls

Under Alternative C, all segments at each of the four dams would be raised using floodwalls as the permanent modification type. Visual renderings of these proposed floodwalls at Cherokee Dam are shown in Photos 3.14-2b, 3.14-2c, and 3.14-3b. Impacts to visual resources under Alternative C would be similar to those under Alternative B. The only difference would be at Segment C-2. The rendering in Photo 3.14-3b reveals that here, visual impacts will be very minor. Under this alternative, Fort Loudoun Segments FTL-1 through FTL-3 would be permanently modified using floodwalls. This is the same option as in Alternative B, due to site and access restraints. Therefore, impacts to visual resources at Fort Loudoun under this

alternative would be the same. At Tellico Dam, the 1,900-foot portion of segment T-1 would be a floodwall instead of a berm. As a result, impacts to visual resources would be greater than those described for Alternative B. The possibility of constructing a walkway on top of the berm would no longer be an option and the 4.8-foot-tall floodwall would have moderate to major visual impacts to pedestrians on Segment T-1 (Photo 3.14-5b). The wall would obscure the downstream scenery. Although the reservoir would still be visible and present enjoyable views, the disquieting aspect of a nearby 4.8-foot concrete wall would be immediately adjacent. Therefore, under Alternative C, impacts to visual resources at Tellico Dam would be greater than those described for Tellico under Alternative B. Similarly, all segments at Watts Bar Dam would be raised using floodwalls. At Segments W-2 through W-4, impacts to visual resources would be similar to those under Alternative B. At Segment WB-1, however, impacts could be less significant if a floodwall was built. It is possible that less vegetation would have to be removed from the immediate area due to the smaller size of the floodwall footprint.

3.15. Recreation

3.15.1. Affected Environment

TVA has developed recreation facilities on all four dam reservations. These facilities include parking areas, visitor overlooks, restrooms, picnic areas, a campground, and boat launching ramps above and below the dams. Except for the campground, these facilities are normally open and used by the public year-round. The heaviest use occurs during the peak summer recreation period between late May and early September. Following is a more detailed description of the recreation facilities and visitor use at each of the four dams.

Cherokee Dam

Recreation facilities on Cherokee Dam Reservation are concentrated on the south side of the dam. A paved sidewalk extends from the south end of the south main dam embankment for approximately 2,275 feet. Because of the construction of the HESCO barriers on a portion of this trail, a 700-foot section does not presently meet ADA guidelines. This trail is accessible from the south overlook and day use area parking lots. A second trail crosses meadows and woodlands between the embankment and U.S. Highway 92. This trail is accessible from the day use area parking lot and a tailwater parking lot.

The day use area contains a visitor center with restrooms, picnic area (Photo 3.15-1), swimming area with sand beach, a picnic pavilion, playground, and an all-season boat launching ramp (Photo 3.15-2) and parking lot. To the southwest of the boat ramp is a campground open from mid-March through mid-November. The campground contains 42 sites with water and electric hookups, dump station, and restrooms with heated showers.

Recreation facilities on the south bank below the dam include a tailwater boat launching ramp that provides access to the Holston River, parking lots at the base of the dam, open space areas with a trail as described above, and a concrete stairway that provides pedestrian access to the top of Cherokee dam. The tailwater boat launching ramp is popular with float fishermen and other boaters.

Based on surveys conducted between 2006 and 2009, TVA estimates that the Cherokee Dam Reservation recreation facilities, excluding the campground, receive 20,000 to 25,000 annual visits. Recreation uses include fishing, boating, picnicking, sightseeing, walking, wildlife observation, swimming, and sunbathing.

The National Park Service has listed the Holston River from Cherokee Dam to its confluence with the Tennessee River on the Nationwide Rivers Inventory. This listing is in recognition of the high scenic, recreational, and other values of this river segment and its potential for qualifying as a national wild, scenic, or recreational river.

Several other recreation areas occur in the surrounding area. The closest of these is Black Oak Park, located about 0.9 miles southeast of the dam and across the reservoir in Jefferson County.

Photo 3.15-1. Cherokee Dam Recreation Area between Segments C-4 and C-5

Photo 3.15-2. Cherokee Dam Boat Ramp Parking Lot and Camping Area near Segment C-6

Fort Loudoun Dam

Recreation facilities on Fort Loudoun Dam Reservation include a parking area and tailwater fishing berm on the south bank below the dam. Parking areas, restrooms, tailwater fishing berms, and a boat ramp are located on the north bank below the dam. On the north bank, downstream of the dam, are parking areas. TVA also maintains a parking area, visitor overlook, and picnic area on the north bank upstream of the dam. Based on 2006-2009 surveys, TVA estimates that these facilities receive between 30,000 and 35,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, sunbathing, boating, and wildlife observation.

City Park Road, which intersects with U.S. Highway 321/State Route 95 on the dam reservation, is the main access road to Fort Loudoun Marina and Lenoir City Park. Fort Loudoun Marina, one of the largest marina operations on the Tennessee River system, is located in a cove immediately east of the dam reservation. Facilities include boat ramps, covered and uncovered boat slips, dry boat storage, fuel pumps, boat rentals, and restaurants. Lenoir City Park is located immediately east of the marina, about 0.4 miles north east of Segment FTL-1. This park is managed by the Lenoir City Parks and Recreation Department. Facilities include tennis courts, picnic shelters, restrooms, a fishing pier, a boat ramp and courtesy dock, playground area and walking trail.

Tellico Dam

TVA maintains several recreation facilities on the Tellico Dam Reservation. Immediately south of the junction of Tellico Parkway and U.S. Highway 321/State Route 95 are a parking area, restroom building, and ADA accessible fishing area along the canal connecting Fort Loudoun and Tellico reservoirs. To the west of this are a large boat ramp and parking area, and a separate day use area with swim beaches, restrooms, picnic area, and a paved, ADA accessible walking trail (Photo 3.15-3). A separate boat launch ramp and parking area is located on the east bank below the dam. A parking area adjacent to Tellico Parkway on the side of the dam provides access to a five-mile-long trail system that runs through the Hall Bend Habitat Protection Area.

Based on 2006-2009 survey results, TVA estimates that the Tellico Dam Reservation recreation facilities receive between 30,000 and 35,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, hiking, sunbathing, boating, and wildlife observation.

Photo 3.15-3. ADA Accessible Walking Trail at Tellico Dam Segment T-1

Watts Bar Dam

The TVA day use area on the east bank of the reservoir above the dam is one of the most heavily used recreation areas on the reservoir. Facilities include parking areas, a swimming beach with ADA access, playground, picnic area with group pavilion, restrooms with showers, and a boat ramp. An existing road network through an adjacent former campground is regularly used by joggers, walkers and bicyclists (Photo 3.15-4). These roads are ADA accessible. An overlook and parking area are located on the west bank immediately upstream of the dam. TVA maintains parking lots, fishing berms, and a boat launching ramp on the east bank downstream of the dam.

Based on 2006 to 2009 survey results, TVA estimated that the Watts Bar Dam Reservation recreation facilities receive between 10,000 and 15,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, bicycling, sunbathing, boating, and wildlife observation.

Photo 3.15-4. Example of the Walking Trail with Adjacent HESCO Barriers near the Watts Bar Recreation Area Boat Ramp

Borrow and Staging Areas

Several parking areas in the vicinity of recreational facilities have been designated as potential staging areas. At Cherokee Dam, two existing parking lots would be used for construction staging areas. One of these is just west of the southern end of the north embankment. The other is on the northwest side of TVA Parkway, just west of the southern end of the south embankment. These areas would be used as construction staging areas during the construction period for work at Cherokee Dam (Figure 2-2). At Fort Loudoun and Tellico dams, three existing parking lots could be used for construction staging areas. One of these is adjacent to the north saddle dam near Fort Loudoun Marina, just west of the southern end of the north embankment. The other two are adjacent to the canal near the entrance to the area and at the boat ramps at the west end of the canal. These areas would be used as construction staging areas during the construction period for activities at Fort Loudoun and Tellico dams (Figure 2-7 and 2-11). At Watts Bar Dam, potential construction staging areas include the two large parking lots in the recreation area adjacent to the proposed floodwalls and an area downstream of the dam adjacent to the lock channel. These areas would be used as construction staging areas for period of construction activities at Watts Bar Dam (Figure 2-17). At Watts Bar Dam, an additional borrow area is located to the north of Segment WB-1 (Figure 2-17).

3.15.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts on recreation that could occur if any of the alternatives were implemented.

3.15.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place and no additional construction would occur in association with the embankments in the project areas at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. The HESCO barriers would be maintained by TVA as necessary. No direct or indirect impacts to recreation at any of the four dams (or any impacts associated with borrow or staging areas) would be anticipated under the No Action Alternative.

3.15.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments/berms. Under this alternative, failure due to overtopping of each dam during a PMF event would be prevented by construction of a floodwall on the earthen embankments and/or raising the earthen embankments to the same height or higher than the existing HESCO barriers.

Cherokee Dam

HESCO barriers would be replaced with floodwalls and a single berm at the boat launch area of Cherokee Dam. The north embankment has no recreational facilities and relatively little public use; therefore, limited direct or indirect impacts to recreation in this area would be anticipated on the north bank. On the south embankment, several recreational facilities and activities could be negatively impacted by Alternative B. There is a trail which follows the embankment on the upstream side of Segment C-2. Construction at all four dams will be sequential, with the entire project taking up to two years total to complete; the exact length of time necessary at any one dam location has not been estimated at this time. The time period when accessibility may be denied or restricted would likely be considerably shorter than two years. The trail would be returned to use after construction is complete. There are two additional trails further downstream of the embankment; these trails are likely to remain accessible, but as described in Section 3.12 and 3.14, there could be noise and visual impacts during construction. One of the parking areas used to access these trails could also be inaccessible during construction due to its use as a staging area. The embankment adjacent to the boat dock parking lot would also be under construction; this is not likely to directly negatively impact the boat ramp or the parking area, but would contribute to noise and visual disturbance during construction activities. During construction, additional indirect impacts could occur due to heavy equipment and truck traffic on the access roads in the area. The campground to the southwest of the boat ramp would experience similar indirect negative impacts.

Overall, moderate temporary negative direct impacts to recreation would occur at Cherokee Dam due to inaccessibility of some recreational areas and parking lots during construction. Additionally, minor permanent visual impacts would occur to some of the facilities due to the addition of the 6.6-foot-high floodwall, impairing views of the reservoir while recreating (see Section 3.14, Visual Resources). Minor indirect negative impacts to recreation would include noise and visual disturbance and the presence of heavy equipment on roads during

construction. A potential positive direct impact would be the return of the entire Cherokee Dam recreational area to ADA accessible status after the completion of the floodwalls.

Fort Loudoun Dam

At Fort Loudoun Dam, impacts similar to those at Cherokee Dam are anticipated. All segments at Fort Loudoun Dam would be floodwalls. The temporary loss of access to some of the facilities at the marina could cause minor temporary negative impacts to recreation. The use of part of the marina parking lot as a staging area could impact recreation both directly and indirectly. If the remaining lot becomes overcrowded on a regular basis, it would be a direct impact. Indirectly, negative impacts would be due to noise and visual disturbance. Lenoir City Park (immediately adjacent to the marina) could also be both directly and indirectly negatively impacted due to loss of parking, and noise and visual disturbances. Additionally, the construction of a floodwall along U.S. Highway 321 could impact traffic access to the marina and other facilities near Fort Loudoun Dam.

Overall, temporary moderate direct and indirect impacts to recreation could occur under this alternative. Possible permanent impacts could occur due to visual blockage of the reservoir by the floodwalls and berms. Indirect minor impacts would include access problems, noise and visual disturbance as at Cherokee Dam.

Tellico Dam

At Tellico Dam, all segments would be berms. Impacts to recreation would be similar to those at Cherokee and Fort Loudoun dams. The trail which runs atop the embankment from the TVA highway to Tellico Dam would be inaccessible during construction of the Tellico segments. This path would be reopened once construction is complete. The ADA accessible fishing areas would also be inaccessible for the duration of the construction. Additionally, the parking area to the west of the embankment and the parking area to the south of the swimming area would be staging areas. The loss of this parking area could cause additional negative direct and indirect impacts to recreation. The swimming area to the east of Saddle Dam No. 1 should remain accessible, although travel to and from the area could constitute a minor indirect negative impact. A potential moderate impact at this dam includes the walking trails through the Hall Bend Habitat Protection Area. Access to this area could be limited during construction. Overall, impacts would be temporary and similar at Tellico Dam as at the other dams.

Watts Bar Dam

At Watts Bar Dam, the permanent modification type under Alternative B would be earthen embankments/berms for all four segments (Figure 2-17). Segments WB-1 through WB-4 are all relatively small segments, but they would be located immediately adjacent to two large parking lots and a former campground; both parking lots are proposed as staging areas. Major temporary impacts to recreation could occur at Watts Bar Dam due to the use of all of the recreational parking as a staging area. Additionally, under this alternative, a borrow area to the north of the campground would be necessary to acquire earthen fill material for the berms. This would also necessitate the use of dump trucks and heavy equipment on the roads in the area. Indirect impacts would also be greater at Watts Bar Dam than at the other dams due to the proximity of the construction and the recreational facilities.

Borrow and Staging Areas

The staging areas proposed for the construction are mostly parking lots which are used by people recreating at the dams. There would be a major direct negative impact to recreation if parking at other lots nearby is not sufficient. This impact would be temporary, but likely parking would only be disrupted during construction at Watts Bar Dam. The impact at Watts Bar Dam would be most severe as all access to the reservoir on the east embankment could be lost due to the construction and staging areas. Indirect negative impacts to recreation due to the use of the parking lots as staging areas would include noise and visual disturbance during construction. Additionally, heavy equipment traffic in the area could cause minor temporary direct and indirect negative impacts to recreation because of noise and visual disturbance.

3.15.2.3. Alternative C – All Floodwalls

Cherokee Dam

Under Alternative C, all the segments would be floodwalls. Direct and indirect impacts would be similar to those under Alternative B. A slightly smaller negative impact to recreation may occur due to the floodwall construction, which would require fewer trucks and take less time than the berm construction.

Fort Loudoun Dam

Due to site access restrictions, no earthen dams would be constructed at Fort Loudoun Dam under Alternative B. Therefore, direct and indirect impacts to recreation would be the same as under Alternative C.

Tellico Dam

At Tellico Dam, the berms proposed under Alternative B would be replaced with floodwalls under Alternative C. Fewer impacts to recreation during construction would be expected under this alternative compared to Alternative B; however floodwalls would be expected to have slightly greater long-term impact than earthen embankments/berms (Alternative B). The walking trails which run atop the existing embankment would likely be inaccessible for a shorter time during construction. However, visual impacts would be greater since trails would be located adjacent to the floodwalls, not on top of the berms. The fishing areas would be inaccessible for a shorter time as well. Additionally, less equipment would be needed to import material for floodwalls than for berms, resulting in a smaller indirect negative impact due to traffic and parking access. Temporary and permanent visual impacts would be larger as the proposed floodwalls would interfere more with the views from the recreation areas.

Watts Bar Dam

As at Tellico Dam, potential impacts to recreation at Watts Bar Dam are likely to be smaller than those under Alternative B. Floodwalls have a smaller footprint and are constructed more quickly than berms. Therefore, the recreational areas that would be inaccessible during construction would be so for a shorter time. If this alternative were selected, there would not be a need for a borrow area to the north of the campground. This would eliminate any impacts associated with the borrow area and the equipment needed for transporting fill material. Additionally, indirect noise and visual impacts would also be smaller due to the decreased size of the construction.

Borrow and Staging Areas

Under Alternative C, impacts to recreation due to the use of the staging areas would be similar to those under Alternative B. They would be smaller; however, as it would take less time and less materials to construct the floodwalls, and no space and equipment would be necessary to accommodate the fill material.

3.16. Solid and Hazardous Waste

Wastes are generally classified into two categories, solid waste, and hazardous waste. Both types would likely be generated under any of the alternatives.

3.16.1. Affected Environment

Solid Waste

Solid waste is more commonly referred to as trash or garbage and is generated by normal, day-to-day operations. It is generally managed in a variety of ways including reduction, recycling and disposal in landfills. Reduction considers the design, production, and use of materials to reduce the amount of waste; recyclables are those items diverted from the solid waste stream such as paper, glass, plastic, and metals; and disposal refers to the placement of solid waste in engineered areas designed to protect the environment from contaminants. Solid waste is generally considered low risk and may be disposed of in dumpsters pending removal from site by the contracted municipal waste hauler for disposal in a licensed landfill. Most construction debris, such as cleared trees, packing materials, and scrap lumber and metals would also fall into this category.

Currently, there is little solid waste generated at the four dam locations. Most of this waste would consist of general trash that is left by visitors and employees.

Hazardous Waste

Hazardous materials are solids, liquids, or gases that have properties that pose the potential to harm people, other living organisms, property, or the environment. Hazardous materials have the potential to become or to create hazardous waste. Hazardous materials include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic, pathogenic, or allergenic as defined by U.S. Department of Transportation (DOT) regulations. These materials pose a risk to health, safety, and property when transported in commerce (49 CFR 172.101, Hazardous Materials Table). The National Fire Protection Association (NFPA), in Section 704 of the National Fire Code, uses a different system for identifying the hazards associated with materials developed primarily with the needs of fire protection agencies in mind.

Hazardous waste refers to a class of wastes specifically defined in the Resource Conservation and Recovery Act (RCRA). These wastes contain certain toxic chemicals or have certain characteristics that cause them to be a significant risk to the environment and/or human health with respect to storage, transportation, or disposal. Hazardous waste may be classified as hazardous because of toxicity, reactivity, ignitability, or corrosivity. Certain types of wastes are “listed” or identified as hazardous by the USEPA in 40 CFR 263.

Currently there are little or no hazardous wastes at the four dam locations. Any possible hazardous materials and wastes would be associated with routine maintenance of the existing facilities and landscaping. Fort Loudoun Dam Marina has facilities for refueling boats, and most boats would contain gas and oil. Petroleum products are considered a hazardous material. The gas station and individual vessels are not anticipated to be impacted by any of the alternatives.

3.16.2. Environmental Consequences

This section contains a discussion on the potential impacts to existing levels of solid and hazardous waste should any of the alternatives be implemented.

3.16.2.1. Alternative A – No Action Alternative

Under Alternative A, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam downstream embankments and possibly dam failure.

Small amounts of solid waste may be generated by the HESCO barriers inspection and maintenance process. This could include general trash brought in by the inspection team and general office waste. Every five years, the liners would have to be replaced, which would result in a minor increase in solid waste. The crushed stone would be removed from the HESCO barriers, the liners replaced and then the stone would be returned to the barriers. The old liners would be disposed of at a municipal waste landfill. This would constitute a very minor increase in solid waste.

During the liner replacement process, a minor increase of hazardous waste and materials could occur due to the need for construction equipment, fuel, and maintenance materials. This would constitute a very minor temporary increase in hazardous waste.

3.16.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with a combination of floodwalls and earthen embankments/berms.

The crushed stone in the HESCO barriers would be considered solid waste. The stone will either be reused at another TVA project site, stockpiled on TVA land for use on future TVA projects, returned or resold to the supplier, or disposed of at a municipal landfill. Depending on what TVA elects to do with the stone, this could amount to a moderate increase in solid waste. If the stone is reused or resold, it would not represent an increase in waste. TVA would attempt to recycle the HESCO barrier metal frameworks and liners by reusing them for other TVA purposes or selling them for use by others. If this effort is not successful, TVA would, to the extent feasible, recycle their components. Otherwise, the HESCO barriers would also contribute to solid waste, representing a minor increase in solid waste. During construction of both berms and floodwalls, general construction debris would be generated. Waste would consist of packaging materials, general trash, cleared brush and trees, fill, extra lumber and other materials. This would represent a temporary moderate increase in solid waste.

During construction, a minor temporary increase in hazardous waste would occur due to the use of heavy equipment and other machinery. Potential hazardous waste items could include petroleum fuels, hydraulic fluids, testing supplies, car batteries and paints. Upon completion of the construction project, the amount of hazardous materials at the four dams would return to the current condition. BMPs such as secondary containment and silt fencing would be used to assure that hazardous substances would not be released to the environment.

3.16.2.3. Alternative C – All Floodwalls

Under Alternative C, the temporary HESCO barriers currently in place at each dam would be removed and replaced with permanent concrete floodwalls. Increases in solid and hazardous wastes during construction would be temporary and similar to those described under Alternative B.

3.17. Public Safety

There are several Federal safety regulations and requirements which apply to all TVA projects. These include:

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA) 42 USC, 9601 et seq.);
- Superfund Amendments and Reauthorization Act (SARA) Public Law 99-499 (100 Stats. 1613);
- Resource Conservation and Recovery Act (RCRA; 42 USC, 6901 et seq.).
- Clean Water Act (CWA) (33 USC, 1251 et seq.);
- Hazardous Material Transportation Act (HMTA);
- Toxic Substances Control Act (TSCA) (15 USC, 2601 et seq.);
- Federal Regulations on Hazardous Waste Management (40 CFR, 260-279);
- Chemical Accident Prevention Provisions;
- Emergency Planning and Community Right-to-Know Act (EPCRA);
- Occupational Safety and Health Standards;
- Spill Prevention Control and Countermeasures Plans (SPCC); and an
- Emergency Evacuation Plan

TVA ensures that all regulations are followed and requirements are met during the course of its construction activities.

3.17.1. Affected Environment

Flood risk

During an NRC audit following efforts by TVA to license the proposed Bellafonte Nuclear Plant in Alabama, it was discovered that the PMF calculations were not accurate using current data. This prompted TVA to re-evaluate the PMF calculations at all of its dams.

As described in Section 1.1, the updated PMF elevations at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams were higher than the previously calculated PMF elevations as well as those at TVA's Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants. These differences are due to changes in river operating assumptions, higher initial reservoir levels under the current reservoir operating policy (see the River Operations Study ([TVA 2004]), and revised data from a reanalysis of spillway water flow rates. The previous and revised PMF elevations are shown in Table 1-1.

As the Federal agency responsible for the operation of numerous dams, and consistent with the Federal Guidelines for Dam Safety (Interagency Committee on Dam Safety 2004), TVA prepares for the worst case flooding event in order to protect against dam failure, loss of life, major property damage and impacts to critical facilities. This worst case flooding event is known

as the PMF. NRC nuclear plant operating regulations also require that nuclear plants be protected from the PMF.

The differences in PMF elevations are sufficient to indicate that a PMF event could cause water to flow over the top of the four dams, even with the floodgates wide open, possibly resulting in dam failure. Failure of one or more of these dams would result in extensive damage to buildings, infrastructure, property, and natural resources, and potential personal injury and loss of life. Many communities, agricultural and industrial areas lie downstream from the dams, and the failure of any safety systems at the nuclear plant would be catastrophic (Figure 3.17-1).

To minimize the potential effects of the PMF, TVA implemented temporary measures to avoid floodwaters overtopping the four dams. These measures consisted of placing interconnected, fabric-lined, stone-filled metal containers ("HESCO barriers") on top of the earthen embankments of each dam. These HESCO barriers raise the elevation of each dam by 3 to 8 feet and provide additional floodwater storage capacity. TVA also installed permanent ArmorFlex concrete mats on an approximately two-acre area on the downstream earthen embankment of Watts Bar Dam just east of the Lock Operations Building. TVA must now develop and implement permanent dam safety modifications to replace the temporary measures at the four dams.

Traffic/Transportation

Almost all of the segments proposed for modification are either adjacent to a road, or have a road on top of them (see Section 3.13, Transportation). The current condition of the HESCO barriers could be affecting road safety at some of the sites. At Fort Loudoun Dam, the HESCO barriers are located on the upstream side of U.S. Highway 321 due to identified traffic hazards associated with locating the barriers on the downstream side of U.S. Highway 321, adjacent to the existing floodwall.

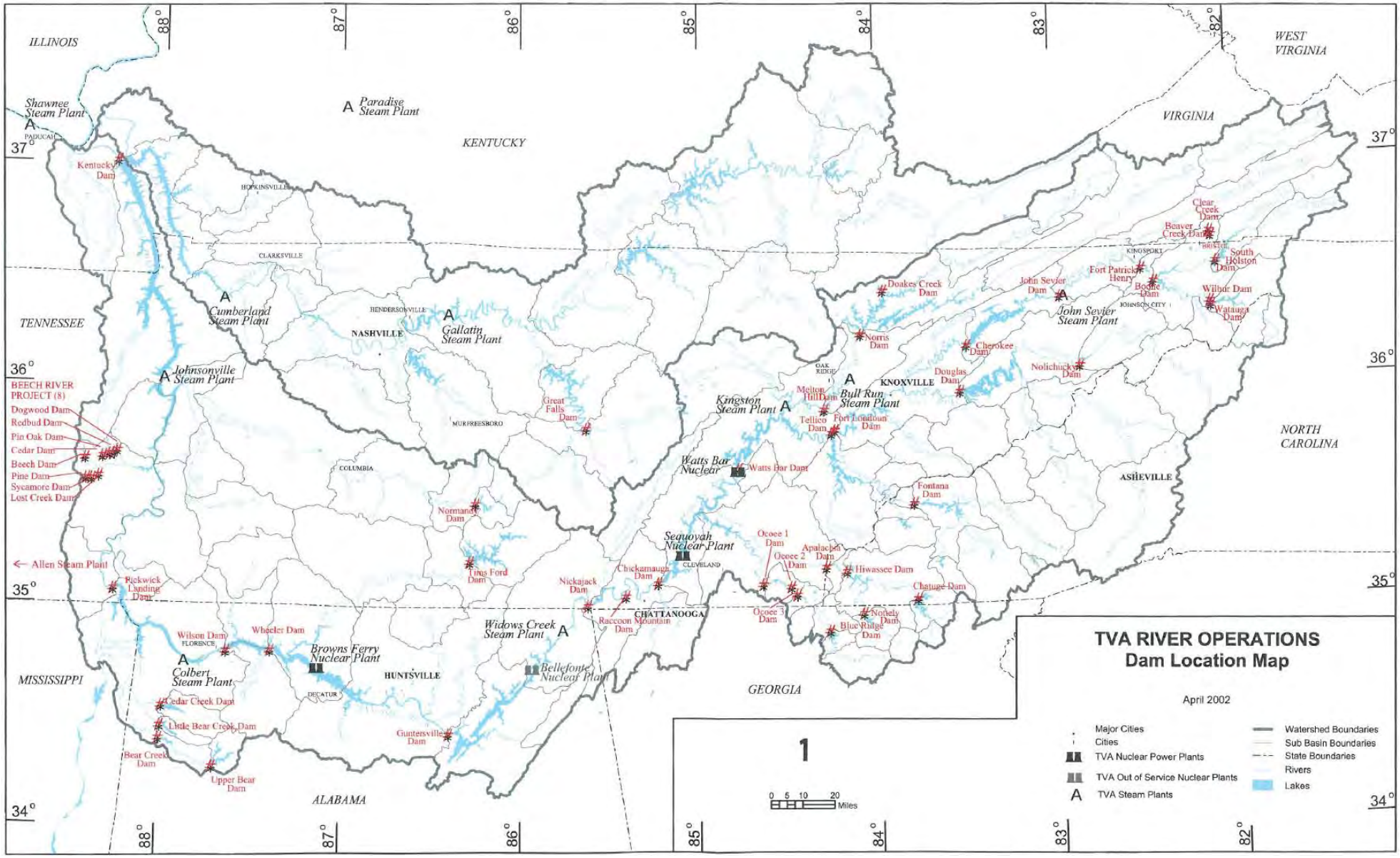

Figure 3.17-1. Locations of the Four Dams and Three Nuclear Plants in the Tennessee Valley

3.17.2. Environmental Consequences

This section contains and analysis of potential impacts to public safety should any of the proposed alternatives be implemented.

3.17.2.1. Alternative A – No Action Alternative

Flood risk

Under the No Action alternative, the HESCO barriers would continue to minimize the potential for failure of the four dams and prevent an increase in flooding at the downstream nuclear plants during the PMF. However, in a letter to TVA dated January 25, 2012, the NRC stated: " the NRC staff finds that the sand baskets are not capable of resisting debris impact... if a design flood were to occur, there is a high likelihood that significant debris would accompany flood waters which could impact the baskets. There is the potential for this debris to damage the baskets or push the individual baskets apart causing a breach... Therefore, sand baskets that are not designed and constructed to withstand impacts from large debris are not acceptable as a long-term solution." Therefore, implementation of the No Action Alternative would increase the risk of flooding and potentially impact public safety due to possible dam failure and nuclear plant flooding.

Traffic/Transportation

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. Any public safety issues along roads would continue to exist, such as those along U.S. Highway 321 at Fort Loudoun. Additionally, TVA would have to replace the liners in the barriers every five years, which could necessitate lane closures during this process. This could result in an increase in public safety concerns due to road congestion, single lane areas where traffic may need to be halted in one direction periodically, and reduced maneuverability. TVA would follow all traffic laws and safety regulations in order to minimize this potential direct impact. Indirect impacts are also possible as people delayed in the project area could drive at unsafe speeds once out of the area in order to make up lost time. Overall, minor and temporary direct and indirect impacts to public safety due to traffic and transportation could occur under the No Action Alternative.

Construction

No major construction would occur under the No Action Alternative; therefore, no direct or indirect impacts related to construction safety are anticipated.

3.17.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Flood risk

Under Alternative B, the HESCO barriers would be replaced with either floodwalls or berms. These structures are far more stable than the existing barriers. Debris that would likely accompany a PMF, should not dislodge or break a floodwall or earthen berm. The likelihood of the dams being over topped or the nuclear plants being flooded is greatly reduced under this option. Therefore, positive direct impacts to public safety under this alternative are anticipated.

Traffic/Transportation

Under Alternative B, greater construction and impacts to traffic and transportation would be expected to occur (see Section 3.13). This could contribute to impacts to public safety on roads in or near the project area. More construction equipment would be necessary and lane closures and other disruptions are likely to be in place for much longer than under the No Action Alternative. Although TVA would follow all traffic regulations and have safety procedures in place, this alternative could result in a moderate temporary impact to public safety on roads in the project area. Indirect impacts would be similar, but larger than under the No Action Alternative, as lane closures would be in place for a longer time and could impact longer stretches of road.

Construction

Construction activities would expose on-site workers to hazards associated with most large construction projects. According to the Occupational Safety and Health Administration (OSHA), the top four causes of construction fatalities are falls, heavy equipment accidents, trenching accidents, and electrocutions. These potential hazards would be expected at all of the dam sites. In general, the sites requiring the greatest amount of construction would statistically present the greatest occupational risk. Environmental hazards of construction projects would include working in extreme temperatures (primarily heat stress) and potential exposures to biological hazards such as mosquitoes, ticks, poisonous spiders and venomous snakes. Additional work place hazards would include exposure to hazardous materials such as petroleum, hydraulic fluid or paint, slips, trips and falls, vehicular accidents and drowning. Hazardous materials are discussed in more detail in Section 3.16. TVA would require the construction contractors to emphasize safety and follow all OSHA and other Federal and state regulations with respect to worker safety, minimizing the risk to workers. However, due to the construction and the likelihood of accidents, potential temporary minor negative impacts to public safety are anticipated. Indirect impacts due to the construction could include increased traffic accidents due to workers leaving the project area, accidents involving equipment travelling to and from the site, such as loads of materials, spills of hazardous materials on travelled roads, and other possible off-site accidents. These indirect impacts would be considered to be temporary and minor.

3.17.2.3. Alternative C – All Floodwalls

Direct and indirect impacts to public safety related to a reduction in flood risk, traffic and transportation, and/or construction would be similar to those described under Alternative B.

3.18. Relationship of Short-Term Uses and Long-Term Productivity

The NEPA requires consideration of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR §1502.16). For implementation of the Proposed Action, short-term uses generally are those that are expected to occur within the construction period, while long-term uses refer to the post-construction period lasting for several decades.

Implementation of the action alternatives would have various short- and long-term consequences. Short-term (construction related) impacts caused by the project would be similar for either Alternative B or Alternative C. These impacts would occur during and immediately after construction and would generally result in adverse effects. However, the long-term impacts that would occur over the life of the project would result in overall beneficial effects with regard to human health and the environment.

Temporarily adversely affected resources include: socioeconomics and environmental justice, noise, transportation, visual resources, recreation, solid and hazardous waste, and public safety. However, most of these impacts would be temporary, lasting only the duration of the construction activities.

Implementation of either Alternative B or Alternative C would result in beneficial long-term impacts. Either project alternative would address the need for TVA to prepare for the PMF, the worst case flooding event, in order to protect against dam failure, loss of life, major property damage, and impacts to critical facilities (including the downstream nuclear plants). Failure of any of these dams in a PMF could result in water flowing over the top of the four dams, even when the floodgates are fully open, possibly resulting in dam failure. Failure of one or more of these dams would result in extensive damage to buildings, infrastructure, property, and natural resources, as well as potential personal injury and loss of life. Not taking action would continue to place human safety and the environment at risk from a PMF.

3.19. Irreversible and Irretrievable Commitments of Resources

A commitment of resources is irreversible when options are lost to future generations. An irreversible commitment of resources suggests that a permanent or long-term – over 50 years – commitment of environmental resources would result from implementing the action alternatives. Irreversible commitments of resources also generally occur from the use of nonrenewable resources, such as minerals, cultural resources, and fossil fuels, which have few or no alternative uses following completion of construction. Other factors are also considered such as resources like soils where productivity is renewable only over long time spans. Conversely, an irretrievable commitment of resources suggests that a short-term – less than 50-year – commitment of resources would result in the lost production of elimination of renewable resources such as timber, agricultural land, or wildlife habitat. Opportunities for use of these resources are foregone for the period of the action alternatives, but these decisions are reversible. The use of opportunities foregone is irretrievable.

Implementation of the action alternatives and construction of the floodwalls and/or berms would result in direct impacts to the environment. Construction activities would result in an irretrievable and irreversible commitment of natural, physical, and cultural resources.
Under the No Action Alternative, there would be no foreseeable changes of land use within the project area. Thus, adoption of Alternative A would preclude any irreversible or irretrievable commitments of resources. Implementation of Alternative B would involve irreversible commitment of fuel energy, and building materials including irreversible excavation of borrow materials. Irreversible and irretrievable commitment of the borrow materials would be less under Alternative C as berms would not be constructed under this alternative however, additional building materials (including concrete for floodwalls) would be utilized instead.