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SUPPLEMENTAL ANALYSIS

REVISIONS TO DAM SAFETY MODIFICATIONS AT CHEROKEE, FORT LOUDOUN, TELLICO, AND WATTS BAR DAMS

Grainger, Jefferson, Loudon, Rhea, and Meigs Counties, Tennessee

Prepared by:
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Supplemental Analysis

Revisions to Dam Safety Modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams

Abstract:

On May 24, 2013, TVA issued the final environmental impact statement (FEIS) for the proposed permanent dam safety modifications at its Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams in Tennessee. The FEIS documented the analysis of a No Action Alternative (HESCO barriers remain in place), and two Action Alternatives (HESCO barriers removed and replaced by permanent flood protection structures). Under the No Action Alternative (Alternative A), TVA would continue to use HESCO barriers to minimize the potential for failure of the four dams and prevent an increase in flooding at downstream locations, including TVA's nuclear plants, during the Probable Maximum Flood (PMF). Under the first of two Action Alternatives (Alternative B), TVA would remove the HESCO barriers and install permanent dam modifications in the form of a combination of concrete floodwalls and raised earthen embankments. Under the second Action Alternative (Alternative C), TVA would remove the HESCO barriers and install permanent dam modifications consisting entirely of concrete floodwalls and gap closure barriers (no embankments or berms). The Record of Decision (ROD) to implement the preferred Alternative B: Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments/Berms was signed on July 2, 2013.

Recently TVA updated the approach to the preferred Alternative B for permanent modifications at Cherokee, Fort Loudoun, and Watts Bar dams, including the incorporation of roller-compacted concrete (RCC) as a new design feature and a minimal increase in the elevations of the permanent modifications at Fort Loudoun, Watts Bar, and Tellico (Segment T-1 only). Revised Alternative B would result in the same impacts compared to the previously selected Alternative B for the majority of resources analyzed in the FEIS. TVA identified four (4) resource areas that would experience impacts from Revised Alternative B that differ from the previously selected Alternative B. Under Revised Alternative B, construction of permanent modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams generally would result in short-term, minor, adverse impacts to Recreation, Transportation, Visual Resources, and Public Safety. These impacts would be similar to, or less than, the impacts described for these resources under the previously selected Alternative B. Potential short-term, beneficial impacts to Public Safety (Traffic Safety) and Visual Resources would occur at specific segments under the Revised Alternative B.

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SUMMARY

Purpose and Need for Action

The Tennessee Valley Authority (TVA) has prepared this Supplemental Analysis of Revisions to Permanent Dam Safety Modifications to Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams in order to evaluate the incorporation of roller-compacted concrete (RCC) into preferred Alternative B as a permanent measure to correct safety deficiencies previously identified at these four structures. The Supplemental Analysis also evaluates other revisions to Alternative B including increases in the elevations of the permanent modifications at Fort Loudoun and Watts Bar and changes to concrete floodwalls and training walls at Cherokee and Watts Bar.

The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. To minimize the potential effects of the PMF event determined based on revised flood modeling, temporary measures were implemented in 2009 at four dams (Cherokee, Fort Loudoun, Tellico, and Watts Bar) in Grainger, Jefferson, Loudon, Rhea, and Meigs Counties, Tennessee. These measures consisted of raising dam elevations approximately 3 to 8 feet by installing interconnected, fabric-lined, crushed stone-filled HESCO barriers in order to safely pass the simulated worst-case floodwaters, to avoid dam overtopping and possible impacts to the embankments, and to provide additional floodwater storage capacity. The downstream embankment of Watts Bar Dam was also strengthened using concrete matting.

The purpose and need of the permanent modification Proposed Action is to (1) minimize the potential for the failure from overtopping of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the PMF; and (2) prevent an increase in flooding during the PMF at downstream locations including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants.

Revised Alternative B

In the July 2013 Record of Decision, TVA selected Alternative B – Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments for implementation. TVA has subsequently updated the approach to permanent modifications at Cherokee, Fort Loudoun, and Watts Bar dams, including the use of roller-compacted concrete (RCC) instead of concrete floodwalls or earthen embankments in some locations and minor increases in flood barrier heights at Fort Loudoun, Tellico, and Watts Bar Dams. These changes constitute the Revised Alternative B – Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls, Earthen Embankments, and Roller-Compacted Concrete.

Affected Environment and Environmental Consequences

The baseline conditions of 17 specific resource areas and the environmental consequences of the alternatives on these resource areas were evaluated in the final environmental impact statement (FEIS) issued in May 2013. 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 and public comment processes; and,
- Typical National Environmental Policy Act (NEPA) review topics (e.g., Solid and Hazardous Waste).

The Affected Environment discussion for each resource area identified 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. Resources evaluated in the FEIS include: Geology and Soils, Water Resources, Air Quality and Greenhouse Gas Emissions, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural and Historic Resources, Noise, Transportation, Visual Resources, Recreation, Solid and Hazardous Waste, and Public Safety.

The Environmental Consequences of the alternatives were also discussed in the FEIS for the same 17 individual resource areas with borrow/staging areas, parking lots, roadway alterations, and gap closure barriers considered as appropriate. The Environmental Consequences discussions described the potential impacts of the proposed permanent dam safety modifications on each of the affected environment resource areas.

For the purposes of this Supplemental Analysis, TVA determined that the Revised Alternative B (combination of concrete floodwalls, earthen embankments, and RCC) would result in similar impacts to those evaluated under Action Alternative B in the FEIS (TVA 2013) for the following 13 resources areas: Geology and Soils, Water Resources, Air Quality and Greenhouse Gas Emissions, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Noise, Solid and Hazardous Waste, and Public Safety. Impacts unique to Revised Alternative B were identified and evaluated for the remaining four resources: Cultural and Historic Resources, Transportation, Recreation, Visual Resources, and Public Safety. A comparison of the impacts of Alternative B and Revised Alternative B is provided in Table ES-1 below.

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from Action Alternative B	Impacts from Revised Alternative B
Geology and Soils	Minor, temporary negative impacts at the dam sites during construction. Ongoing existing and new negative impacts to soils at the borrow areas.	Same as Alternative B
Water Resources	No direct, indirect or cumulative impacts anticipated, with the use of appropriate BMPs.	Same as Alternative B
Air Quality and Greenhouse Gas Emissions	Minor temporary negative impacts during construction, with use of BMPs.	Same as Alternative B
Flooding and Floodplains	No direct impacts. Positive indirect impacts due to downstream flood risk reduction.	Same as Alternative B
Wetlands	No direct, indirect or cumulative impacts anticipated.	Same as Alternative B
Aquatic Ecology	No direct, indirect or cumulative impacts anticipated, with use of BMPs.	Same as Alternative B

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from Action Alternative B	Impacts from Revised Alternative B
Terrestrial Ecology	Minor direct negative impacts to vegetation (tree clearing), as well as to marginal, already disturbed areas on the dam reservations. Minor temporary indirect impacts to wildlife due to noise and run-off during construction. Minor permanent indirect impacts to wildlife (habitat loss) due to clearing. Minor negative impacts at the borrow areas.	Same as Alternative B
Threatened and Endangered Species	Potential indirect impacts to Indiana bats due to the clearing of forested areas containing suitable habitat. TVA would mitigate these impacts. No direct, indirect, or cumulative impacts to any other listed species.	Same as Alternative B
Land Use	No direct, indirect or cumulative impacts anticipated as all construction would occur on the dam reservations.	Same as Alternative B
Socioeconomics and Environmental Justice	Short term beneficial impacts from construction, minor long term beneficial impacts to employment and minor indirect beneficial impacts due to reduced flood risk.	Same as Alternative B
Cultural and Historic Resources	No adverse direct, indirect or cumulative impacts to archeological or historic resources anticipated.	Same as Alternative B
Noise	Temporary negative impacts ranging from minor to significant depending on the segment.	Same as Alternative B
Transportation	Temporary minor to significant direct negative impacts during construction, depending on the segment. Possible cumulative impacts at Fort Loudoun and Tellico during construction.	Same as Alternative B for Watts Bar. Minor, short-term, adverse impacts to traffic would be expected to occur at Cherokee and Fort Loudoun dams; however, these impacts would be less significant than those described for the previously selected Alternative B.
Visual Resources	Negative direct impacts ranging from minor to significant, depending on the dam segment.	Same as Alternative B for Watts Bar and Tellico. Minor, short-term direct and indirect impacts to visual resources during construction; minor, beneficial impacts to aesthetics at Cherokee Dam and FTL-4 compared to Alternative B.

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from Action Alternative B	Impacts from Revised Alternative B
Recreation	Temporary negative impacts during construction ranging from minor to significant due to short-term closure of recreation access at Cherokee, Tellico, and Watts Bar.	Same as Alternative B for Watts Bar. Moderate to significant short-term adverse impacts to recreation at Cherokee, Fort Loudoun, and Tellico dams due to inaccessibility of some recreational areas and parking lots during construction; expected to be similar to Alternative B.
Solid and Hazardous Waste	Minor temporary increases during construction.	Same as Alternative B
Public Safety	Minor temporary negative impacts during construction. Minor indirect positive impacts due to flood risk reduction.	Same as Alternative B for Watts Bar and Cherokee. Minor beneficial impacts to traffic safety at Fort Loudoun in comparison to Alternative B.

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AADT	Average Annual Daily Traffic
ADA	Americans with Disabilities Act
APE	area of potential effect
ARPA	Archaeological Resources Protection Act of 1979
BMPs	best management practices
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
EIS	Environmental Impact Statement
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
GHG	greenhouse gas
HMTA	Hazardous Material Transportation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
No.	number
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PMF	Probable Maximum Flood
RCC	Roller-compacted concrete
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention Control and Countermeasures Plans
TDEC	Tennessee Department of Environment and Conservation
TDOA	Tennessee Division of Archaeology
TDOT	Tennessee Department of Transportation
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
U.S.	United States
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

CHAPTER 1 - PURPOSE AND NEED FOR ACTION

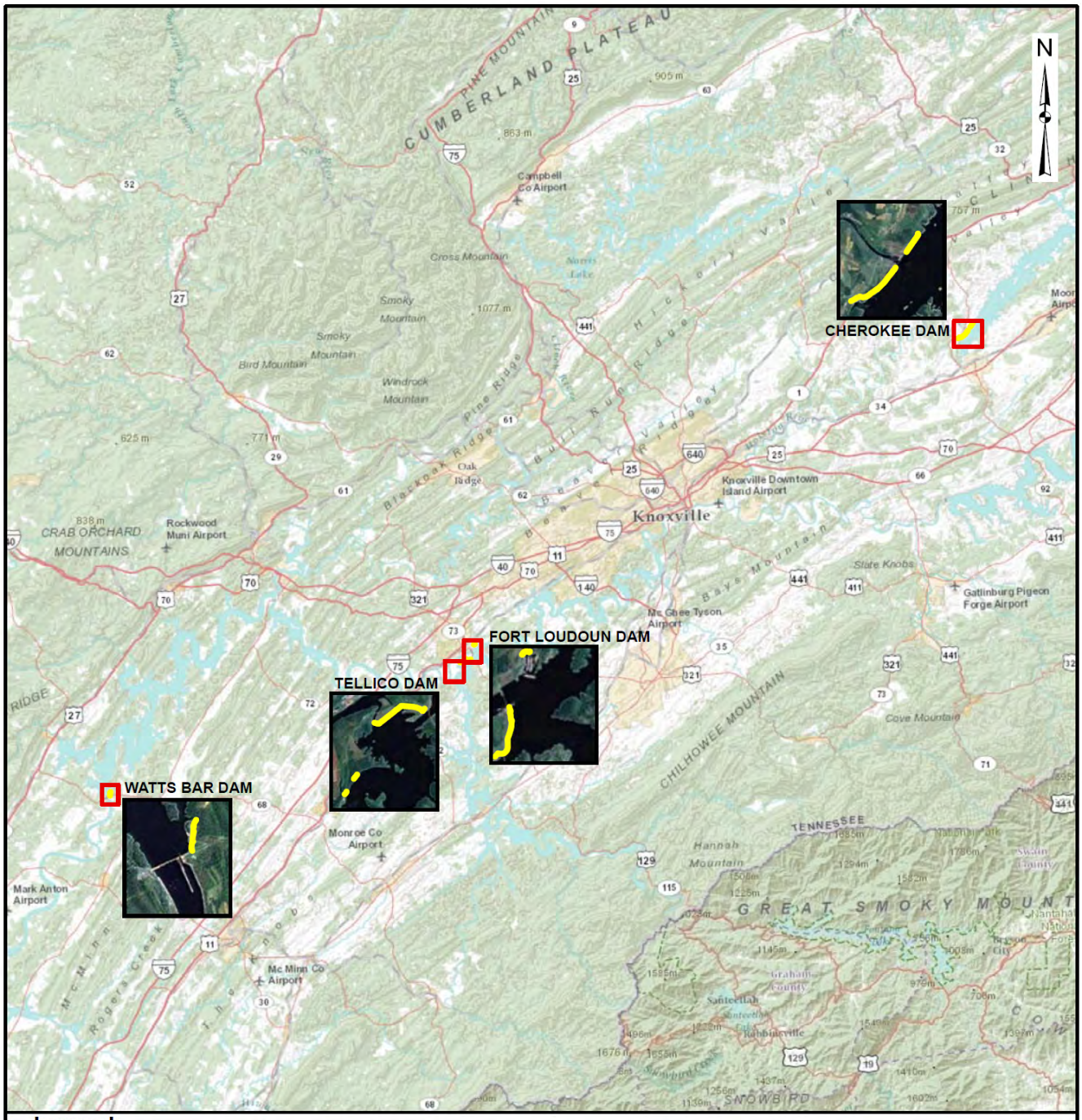
On May 24, 2013, Tennessee Valley Authority (TVA) issued the final environmental impact statement (FEIS) for the proposed permanent dam safety modifications at its Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams in Tennessee (TVA 2013). The purpose and need of the permanent modification Proposed Action was, and continues to be, to (1) minimize the potential for the failure from overtopping of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the probable maximum flood (PMF); and (2) prevent an increase in flooding during the PMF at downstream locations including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants. The Record of Decision (ROD) to implement the preferred Alternative B: Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments/Berms was signed on July 2, 2013. The FEIS and ROD can be viewed here: http://www.tva.com/environment/reports/dam_safety/index.htm. TVA subsequently began construction at several segments of the permanent modifications.

Recently TVA updated the approach to permanent modifications at Cherokee, Fort Loudoun, and Watts Bar dams (Figure 1-1), including the incorporation of roller-compacted concrete (RCC) as a new design feature and minor increases in barrier heights. These design updates were substantial enough to warrant the preparation of a Supplemental Analysis to evaluate the impacts of the new permanent modifications, referred to herein as Revised Alternative B (combination of concrete floodwalls, raised earthen embankments, and RCC). The updated designs will also require that TVA prepare a revised ROD.

This Supplemental Analysis incorporates the background information and findings of the 2013 FEIS and only presents and evaluates new and/or significant data made available since the publication of the FEIS that might impact the findings of the FEIS (particularly the relevant environmental and socioeconomic impacts of the use of RCC into the updated design plans).

1.1 Related Environmental Reviews and Consultation Requirements

TVA is the lead Federal agency in the preparation of this Supplemental Analysis and Revised ROD; there are no cooperating agencies. Federal, state, and local agencies and governmental entities were notified when the 2013 FEIS was released for review. These agencies included the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Tennessee Department of Environment and Conservation (TDEC), and the Tennessee State Historic Preservation Officer (SHPO). For this Supplemental Analysis, TVA re-initiated consultation with the Tennessee SHPO on the proposed Revised Alternative B work at Watts Bar Dam Segment WB-3, and at Cherokee and Fort Loudoun dams during March and May 2014. The SHPO responded to TVA in March 2014 and concurred with TVA's no effects determinations. No additional consultation has been initiated in association with this Supplemental Analysis.



Source: World Topographic Map is provided by ArcGIS Map Service, 2012

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Figure 1-1
Site Location Map

Tennessee Valley Authority

1.2 Decision to be Made

The Senior Vice President of River Operations will consider TVA staff recommendations, this Supplemental Analysis, public comments, and other factors, prior to issuing a revised ROD. The revised ROD and this Supplemental Analysis will be made available to the public.

1.3 Necessary Permits or Licenses

TVA thoroughly examined the project components and determined that no additional permits or licenses would be required based on the incorporation of RCC into the design plans. As indicated in the FEIS, construction stormwater permits are the only permits and/or licenses potentially necessary to complete the permanent dam modifications. Stormwater-related permits would be site-specific and their need is dictated by the total area of temporary and permanent disturbance at each dam (i.e., area of excavation at each dam). No Section 404(b) permits, state aquatic resource alteration permits, State 401 certification, Endangered Species Act (ESA) Section 7 incidental take permits, or any other similar, resource-specific permits would be required for implementing the Proposed Action.

1.4 Supplemental Analysis Overview

This Supplemental Analysis consists of seven chapters as outlined below. In addition, this document includes an appendix which contains consultation correspondence.

- **Chapter 1:** Describes the purpose and need for this Supplemental Analysis, scope, decision to be made, related environmental reviews and consultation requirements, necessary permits or licenses, and Supplemental Analysis overview.
- **Chapter 2:** Briefly summarizes the original preferred Alternative B presented in the FEIS and provides detailed information on Revised Alternative B.
- **Chapter 3:** Incorporates by reference the Affected Environment and Environmental Consequences of the alternatives presented in the FEIS and discusses the environmental consequences to resource areas that could potentially be affected by the incorporation of the proposed design changes. The affected resources include Cultural and Historic Resources, Transportation, Recreation, Visual Resources, and Public Safety. Direct and indirect impacts are evaluated for each resource in this chapter.
- **Chapter 4:** Incorporates by reference the Cumulative Impacts of the alternatives identified in the FEIS, in consideration of other major actions in the region of influence, and addresses any additional Cumulative Impacts that could be associated with the proposed design changes.
- **Chapters 5-7:** Contains the list of preparers, distribution list, and a list of literature cited.
- **Appendix A:** Contains Consultation Correspondence.

CHAPTER 2 - ALTERNATIVES

Since publication of the FEIS in May 2013, TVA has identified a new industry approach that could be implemented for the permanent modifications at Cherokee and Fort Loudoun dams. This approach (i.e., the use of roller-compacted concrete [RCC]) has been incorporated, along with a few additional design updates, into the Revised Alternative B. Similar to the preferred Alternative B that was evaluated in the FEIS (TVA 2013), Revised Alternative B has been developed to minimize the potential for the failure of Cherokee and Fort Loudoun dams during the PMF, with the same considerations: level of risk reduction to the public, constructability, potential environmental impacts, cost, and results of internal and public scoping. Flood modeling studies and consultations with Nuclear Regulatory Commission (NRC) conducted since early 2013 have also indicated the need for taller permanent modifications at Fort Loudoun and Watts Bar Dams. The PMF elevation has increased by 1.0 foot at Fort Loudoun and by 0.1 ft and 1.5 ft at Watts Bar. Consequently, the elevations of the permanent modifications under Revised Alternative B have increased from 836.0 to 837.0 ft at Fort Loudoun and from 769.4 ft to 769.5 ft (WB-1 and WB-2) and 767.0 ft to 768.5 ft (WB-3) at Watts Bar.

The use of RCC was not originally proposed in the FEIS because at that time, TVA had not determined that the use of RCC was a feasible option in terms of constructability and potential impacts to traffic at Fort Loudoun dam. RCC is a relatively new construction technique and additional information on its use, including in situations similar to TVA's proposed dam modifications, has recently become available. RCC is a special blend of concrete with a low water content that is applied in layers in a manner similar to paving. It is delivered by dump trucks, spread by modified asphalt pavers, and then compacted by vibratory rollers. For constructing the dam modifications, it would be applied in successive horizontal layers ("lifts") 8 to 10" thick resulting in a stair-step appearance on the upstream and downstream faces. Compared to the traditional modification approaches that were evaluated in the FEIS (concrete floodwalls and earthen embankments), the application of RCC would be expected to result in fewer impacts to public safety, transportation, and aesthetics, specifically in and around Fort Loudoun Dam. Its use would also likely result in shorter construction times and lower costs.

2.1 Description of Alternatives

The major difference between the previously selected Alternative B and Revised Alternative B consists of changes to the design of modifications at Cherokee and Fort Loudoun dams. Under Revised Alternative B, the modifications at Watts Bar dam that were proposed in Alternative B of the FEIS would be increased by approximately 0.1 ft at Segments WB-1 and WB-2, and approximately 1.5 ft at Segment WB-3. At Tellico Dam, the alignment of Segment T-1 would shift slightly to tie into the new alignment of the FTL-4 embankment, and the final elevation of T-1 would increase by approximately 1.1 ft.

Section 2.1.1 provides the description of permanent modifications at the four dams under the previously selected Alternative B (TVA 2013). Section 2.1.2 introduces Revised Alternative B and provides details on design updates to the safety modifications.

2.1.1 Alternative B – Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments

Under Action Alternative B, the HESCO barriers would be removed and permanent dam modifications in the form of a combination of concrete floodwalls, raised earthen embankments,

and roadway alterations would be made to each of the four dam structures. The concrete mat structure would remain in place at Watts Bar Dam. Concrete floodwalls would be constructed from reinforced concrete designed to withstand the hydrostatic forces resulting from the PMF. In several locations, the HESCO barriers would be replaced with raised earthen embankments instead of concrete floodwalls.

The HESCO barriers installed as temporary modifications in 2009, which are currently in place at each dam, would be replaced by the permanent dam modifications. With implementation of Alternative B (as well as for Revised Alternative B), the HESCO barriers at all project area dam segments would be removed and the crushed stone reused at other TVA locations for roadbed materials or other purposes, resold for use in non-TVA projects, or disposed of at a municipal landfill. The removal and potential environmental effects associated with the disposition of the HESCO barriers would be the same for Revised Alternative B and are discussed in detail in the FEIS and not addressed further in this Supplemental Analysis.

The remainder of this section provides summarized descriptions of the Alternative B permanent modifications at the four dams. More detailed descriptions, including illustrations of cross-sections, are provided in Section 2.1.2 of the FEIS. For the purpose of an analysis in this Supplemental Analysis, Alternative B, the preferred action in the FEIS, serves as the baseline conditions against which the effects of Revised Alternative B are evaluated.

Cherokee Dam

The Alternative B permanent modifications at Cherokee Dam are illustrated in Figure 2-1. Under Alternative B, floodwalls were selected as the permanent modification type for the Cherokee Dam main embankment segments (totaling approximately 5,200 feet).

Floodwalls would be installed to replace the 2,150-feet and 2,650-foot-long rows of HESCO barriers currently in place on the north and south embankments (Segments C-1 and C-2), respectively (Figure 1-2 of FEIS). Concrete floodwalls would be installed on the west (downstream) side of the access road/walkway that runs along crest of the main embankments, and would be built to a height of 6.6 feet. In an effort to help maintain the downstream viewshed of Cherokee Dam for the many visitors who frequent the recreation area, the paved walkway located on top of Segment C-2 would be raised by approximately 3 feet; essentially making the finished floodwall height from the walkway, 3.6 feet.

Under Alternative B, two small steel doors would be installed at the south end of Segment C-1 and the north end of Segment C-2, respectively. These doors would be required in order to provide uninterrupted flood protection along the north and south main embankments at Cherokee Dam, while allowing for continued use of the pedestrian staircases that lead from the downstream toe of the embankments to the crests (Figure 2-1).

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Figure 2-1
Cherokee Dam Alternative B

Tennessee Valley Authority

The final proposed segment (C-3) would be a continuous, downstream earthen embankment, approximately 3,150 ft long, beginning near the south end of Segment C-2, wrapping around the back side of the visitor's building, and eventually tying into the existing grade near the RV park and campgrounds (Figure 2-1). The alignment of Segment C-3, which would be constructed to a height of 6.6 feet, would require the permanent closure of the downstream parking lot south of Segment C-2, as well as the existing main access road into the Cherokee Dam Recreation Area (Figure 2-1). The current south access road (Renfro Road) into the recreation area near the boat ramp would become the new main access road. The existing parking lot and roundabout, located slightly north of the boat ramp parking lot would be widened to accommodate the additional traffic resulting from the closure of the existing main entrance road. Segment C-3 would be grassed and TVA would allow public use (walking, running, biking, etc.).

During construction, access to the Cherokee Dam boat ramp would remain available, but the access road and parking lot would be shared with construction/delivery traffic and material staging.

Additional dam safety modifications would be made to the central concrete portion of Cherokee Dam. About 40 post-tensioned anchors would be installed in two sections of the concrete portion of the dam - a 372-foot long section of the northern end and the spillway section. The concrete floodwalls installed in 1985 on the north and south non-overflow portions of the concrete portions of the dam would be raised about 6 feet to an elevation of 1095.6 feet. Each of the floodwall sections is approximately 326 feet long. A new 13.6-foot tall floodwall would be built on the 93-foot wide section of the dam immediately south of the northern floodwall. A new 5-foot wide concrete training wall would be built on the downstream face of the dam at the southern end of this new 13.6-foot tall floodwall. Finally, TVA would raise the height of an approximately 400-foot long section of the concrete south spillway training wall by 40 feet and backfill much of the area behind the training wall (on the side opposite the river channel) with rock riprap to increase erosion protection.

Construction staging areas at Cherokee Dam are illustrated in Figure 2-1. The estimated quantities of construction materials for the floodwall and embankment work at Cherokee Dam are provided in the FEIS. The necessary fill material for Segment C-3 would be obtained from an existing borrow area located to the northwest of the intersection of I-81 and US 25E, a few miles south of Morristown and in Hamblen County - a short distance from the Hamblen-Jefferson county line (Figure 2-2 in FEIS). Concrete would be delivered to the project area by truck from existing commercial concrete plants or produced at an onsite batch plant.

Fort Loudoun Dam

At Fort Loudoun Dam, the temporary HESCO barriers would be permanently replaced by two embankment segments and two floodwall segments. Permanent modifications at Fort Loudoun Dam and the potential construction areas are illustrated in Figure 2-2.

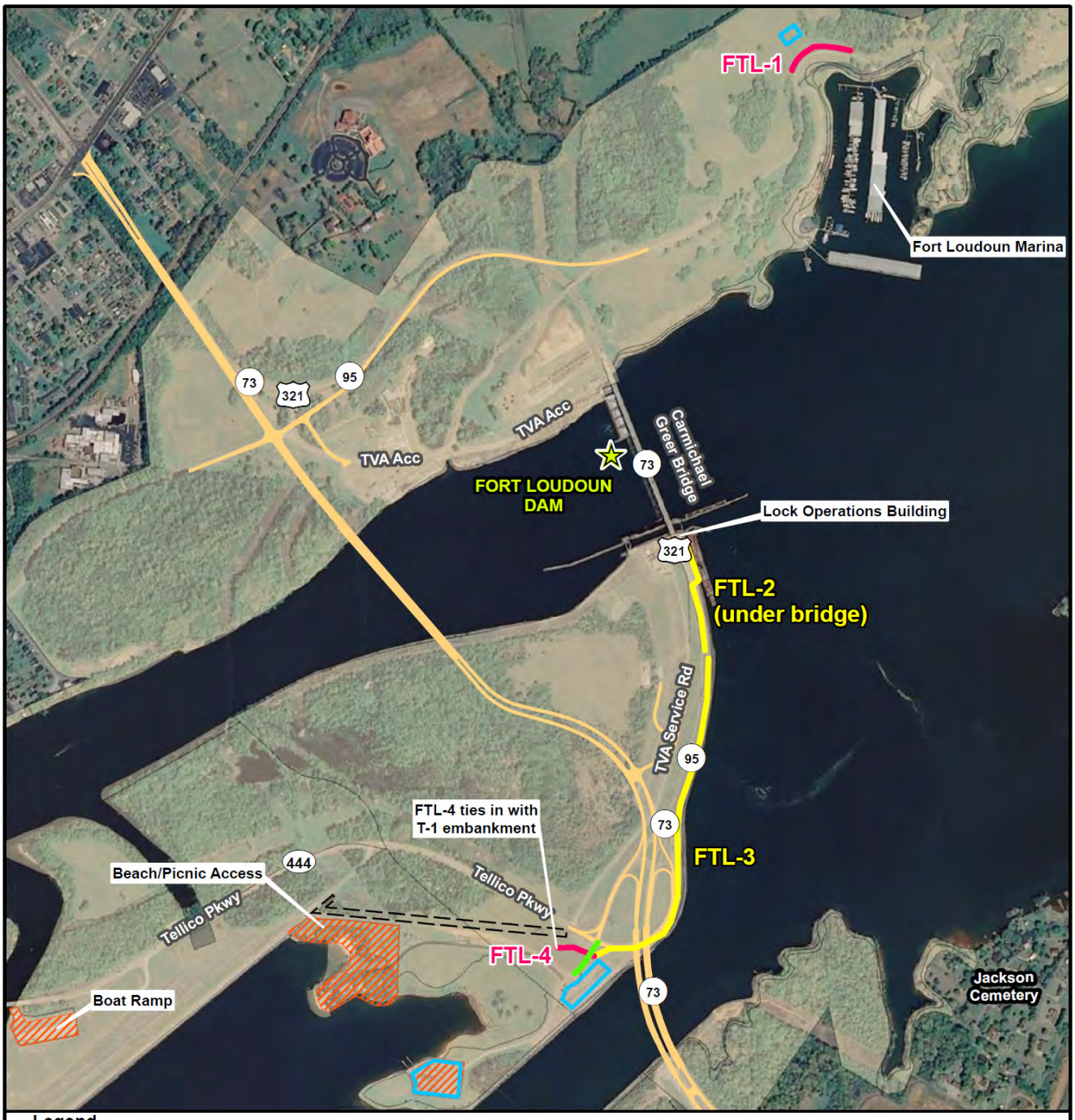

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Figure 2-2
Fort Loudoun Dam Alternative B

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The first segment (FTL-1) is located at the north saddle dam near Fort Loudon Marina. The existing floodwall is approximately 400 feet in length, terminates at elevation at both ends, and will need to be modified or completely rebuilt to accommodate the calculated PMF elevations. The proposed permanent modification for FTL-1 is an earthen embankment built to a height of 6 feet. Although construction access for Segment FTL-1 would occur from the downstream side of the existing embankment, this permanent modification would require temporary closure of City Park Drive (across from the marina) for a period of approximately 12 days for piping work and HESCO basket removal.

The second segment at Fort Loudoun Dam (FTL-2) is located immediately south of the concrete portion of Fort Loudoun Dam and extends from the USACE Lock Operations Building southward for 800 feet to the U.S. Highway 321 Carmichael Greer Bridge (Figure 2-2). The northern 390 feet of this floodwall would be built under the bridge on the upstream (east) side of the crest of the dam. The southern 470 feet of the floodwall would be built under the bridge on the downstream (west) side of the dam and would tie into the bridge abutment with grade beam closure. The proposed permanent modification for Segment FTL-2 would be a concrete floodwall built to a height of 5.8 feet.

The third segment at Fort Loudoun Dam (FTL-3) would be built along the shoulder of U.S. Highway 321 from the south end of the U.S. Highway 321 Bridge approximately 2,600 feet south to the entrance to the Tellico Recreation Area (Figure 2-2). This segment of concrete floodwall would be built on the upstream (east) side of U.S. Highway 321 and would be constructed to a height of 4.8 feet.

The fourth segment at Fort Loudoun Dam (FTL-4) would be aligned across the existing entrance road to the Tellico Recreation Area, connecting Segments FTL-3 and T-1 (Figure 2-2). The proposed permanent modification for this segment would be an embankment, built to a height of 4.8 feet using borrow material.

Under Alternative B at Fort Loudoun Dam, an approximately 250-foot long portion of the Tellico Recreation Area entrance road would be rebuilt across the top of the Segment FTL-4 earthen embankment. The construction of Segment FTL-4 and the raised roadway would require the Tellico Recreation Area, including the bathrooms, boat ramp and boat ramp parking lot, walking trail parking lot, picnic area, and beach area to be temporarily closed to vehicle traffic for a period of approximately 2 weeks during construction. During this time, all facilities within the recreation area would remain open to public foot traffic. Following construction of the raised roadway, the north access entrance to the canal parking area for the Tellico Recreation Area bathrooms would be permanently closed; the existing south access entrance would become the main entrance to this parking area.

Three existing parking lots would be used as temporary construction staging areas during the construction of permanent modifications at Fort Loudoun Dam (Figure 2-2); The estimated quantities of construction materials for the floodwall and embankment work at Fort Loudoun are provided in the FEIS.

Tellico Dam

Under Alternative B, permanent modifications at Tellico Dam are proposed for a total of four segments. A single borrow area was identified in the FEIS to provide required fill material for construction of embankments at Tellico and Fort Loudoun dams, as well as for the neighboring Tennessee Department of Transportation (TDOT) U.S. Highway 321 Bridge reroute project. The availability of fill material at this site has since been partially depleted and TVA will obtain

the necessary fill material for the work at Fort Loudoun and Tellico dams from it or a commercially-available, pre-existing borrow area.

The proposed modification for Tellico segments under Alternative B are as follows:

- Segment T-1: an approximately 1,800-foot long earthen embankment built on the downstream side of the existing embankment to a height of 4.8 feet; the existing walkway on this canal saddle dam would be rebuilt atop the raised embankment.
- Segment T-2: a 4.8-foot-tall concrete floodwall constructed on the upstream side of the main Tellico embankment, and a 2-ft increase in height of the paved walkway located on top, making the finished floodwall height from the walkway 2.8 feet.
- Segment T-2a: construction of a 250-ft long, 5.2-ft tall concrete parapet wall on the upstream face of the right non-overflow portion (monoliths 1 through 6) at the Tellico concrete dam.
- Segments T-3 and T-4: a 650-foot-long raised earthen embankment at T-3 and a 400-foot-long concrete floodwall at T-4. The proposed embankment and floodwall would raise the current height of T-3 and T-4 by 5.0 feet and 4.8 feet, respectively.

Watts Bar Dam

Under Alternative B, permanent modifications at Watts Bar Dam are proposed for a total of three segments and a raised roadway. These proposed modifications are as follows:

- Segment WB-1: an approximately 1,100-ft long embankment built on the east side of existing Watts Bar Lane to a height of 3.5 ft.
- Segment WB-2: an approximately 550-ft long embankment built on the east side of existing Watts Bar Lane to a height of 3.5 ft.
- Segment WB-3: the existing concrete floodwall beneath the bridge would be strengthened or modified to maintain stability under new debris/impact loads.
- An approximately 575-foot long portion of the Watts Bar Recreation Area entrance road would be raised 5 feet and a new parking lot would be constructed.

2.1.2 Revised Alternative B – Permanent Modification of Dam Structures: Concrete floodwalls, Raised Earthen Embankments, and Roller-Compacted Concrete (RCC)

Under Revised Alternative B, the HESCO barriers would be removed, and permanent dam modifications consisting of concrete floodwalls, raised earthen embankments, and/or RCC would be constructed at each dam.

For work at Watts Bar Dam, TVA proposes to use the same borrow area identified for Alternative B or an existing borrow area near Wolf Creek Road about 7 miles west-southwest of the Dam. The concrete would either be provided by commercial concrete suppliers or by onsite concrete batch plants. The permanent concrete mat structure in the downstream embankment of Watts Bar Dam would remain in place. At Fort Loudoun and Tellico dams, TVA would use the borrow area identified in the FEIS (FEIS Figure 2-7) and/or a commercial borrow area. TVA has issued a Request for Information to local vendors of earthen fill with the required engineering properties. The selected vendor(s) could provide the fill from existing or newly opened commercial borrow areas, and will be responsible for obtaining and complying with all

applicable permits. In the event that the previously identified borrow area at Cherokee Dam is no longer available, TVA would use a similar process to obtain fill from a local vendor.

Cherokee Dam

The Revised Alternative B permanent modifications at Cherokee Dam are illustrated in Figure 2-3.

RCC would be used to raise Segments C-1 and C-2 (approximately 2,550 and 2,750 ft long, respectively) to a final elevation of 1095.6 ft (approximate final height of 6.6 ft) (Figure 2-4). At the south end of Segment C-1 and the north end of Segment C-2, 100-ft long transition flood walls would be constructed of traditional concrete and RCC to join Segments C-1 and C-2 to the central concrete portion of the dam. Riprap shouldering would be placed on both the upstream and downstream sides to fill in the transition between the RCC and the existing riprap and/or fill. It is anticipated that final design would include Americans with Disabilities Act (ADA) access to the park and parking lot areas at Cherokee Dam.

Segment C-3, which is approximately 1,600 ft in length (Figure 2-3), would be raised using RCC. The top of the RCC would have a final elevation between 1094 ft and 1095.6 ft. If the top of the RCC is less than the minimum elevation of 1095.6, then a concrete curb would be used to raise the effective barrier height to 1095.6. Where required for traffic and pedestrian safety, an approximately 2.5-ft tall concrete rail with a handrail on top or a guardrail would be constructed on top of the RCC on both the upstream and downstream sides, and the 4-ft wide pedestrian lane would likely be identified by striping on the upstream side or constructed as a concrete sidewalk (Figure 2-5). Should TVA opt to install concrete rails or guardrails at this segment, the purpose would be solely related to traffic safety. The RCC would be left exposed on the downstream side. The side facing of the RCC in exposed areas could be left as is, or could be conventional or grout-enriched. If required, rip rap shouldering would be placed on the upstream side to fill in the transition between the RCC and the existing riprap and/or fill. As under Alternative B, the parking area downslope from the northern end of Segment C-3 would be used for a construction staging area and permanently closed once construction is completed.

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Figure 2-3
Cherokee Dam Revised Alternative B

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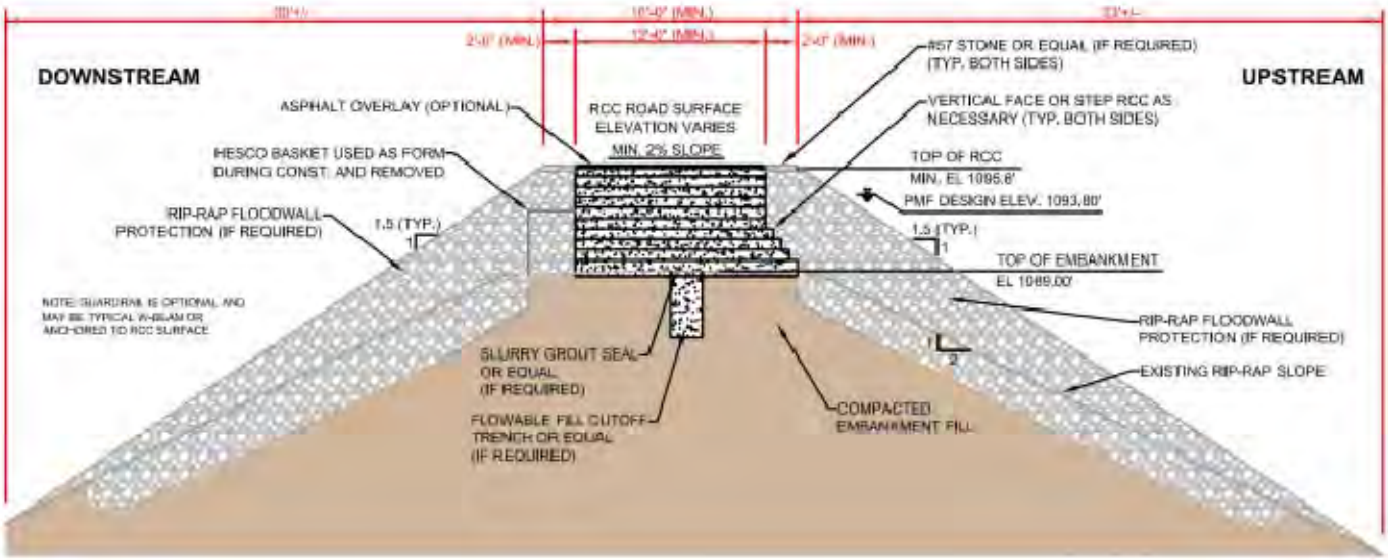

Figure 2-4. Cherokee Dam Main Embankment Segments C-1 and C-2 – 606-ft RCC Concept

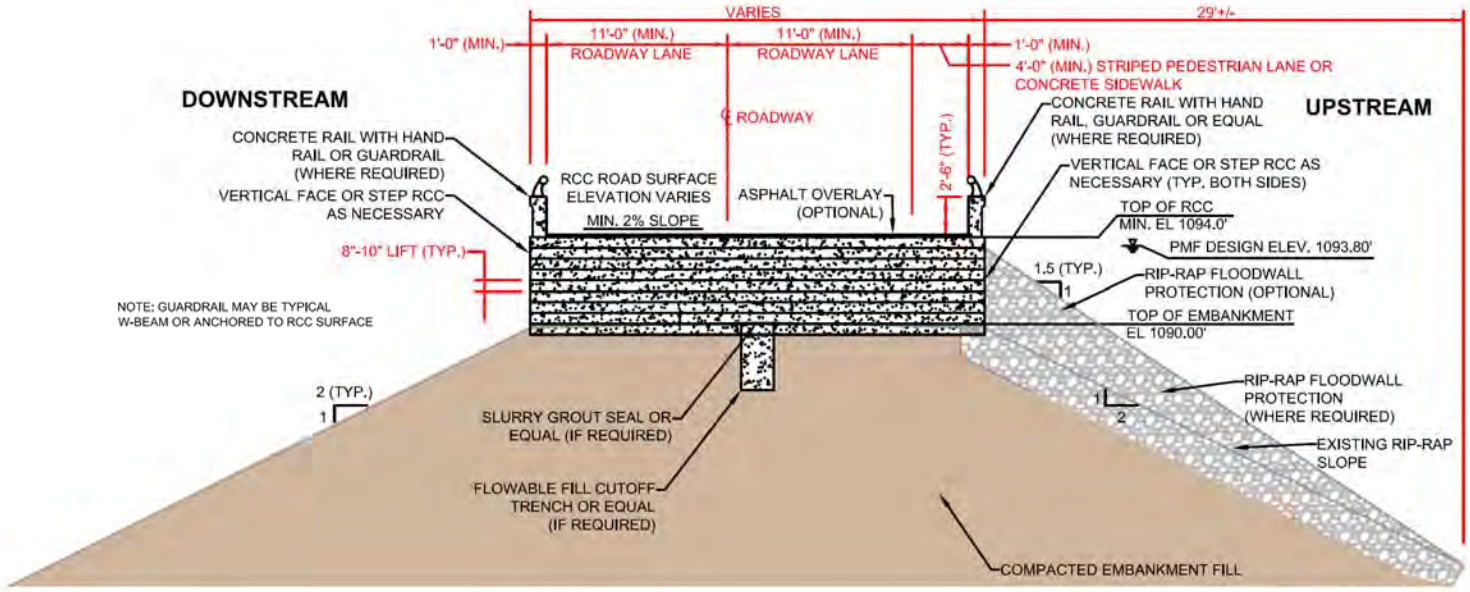

Figure 2-5. Cherokee Dam Saddle Dam #1 Segment C-3 – 6.6-ft RCC (optional concrete curb) Concept

Segment C-4, which is approximately 600 ft in length (Figure 2-3), would be raised using RCC. The top of the RCC would have a final elevation between 1094 ft and 1095.6 ft. If the top of the RCC is less than the minimum elevation of 1095.6, then a concrete curb would be used to raise the effective barrier height to 1095.6. An approximately 2.5-ft tall concrete rail with a handrail on top or guardrail may be constructed on top of the RCC on both the upstream and downstream sides (Figure 2-6). Should TVA opt to install concrete rails or guardrails at this segment, the purpose would be solely related to traffic safety. If required, earthen fill or rip rap protection

would be placed on both the upstream and downstream sides to fill in the transition between the RCC and the existing earthen fill.

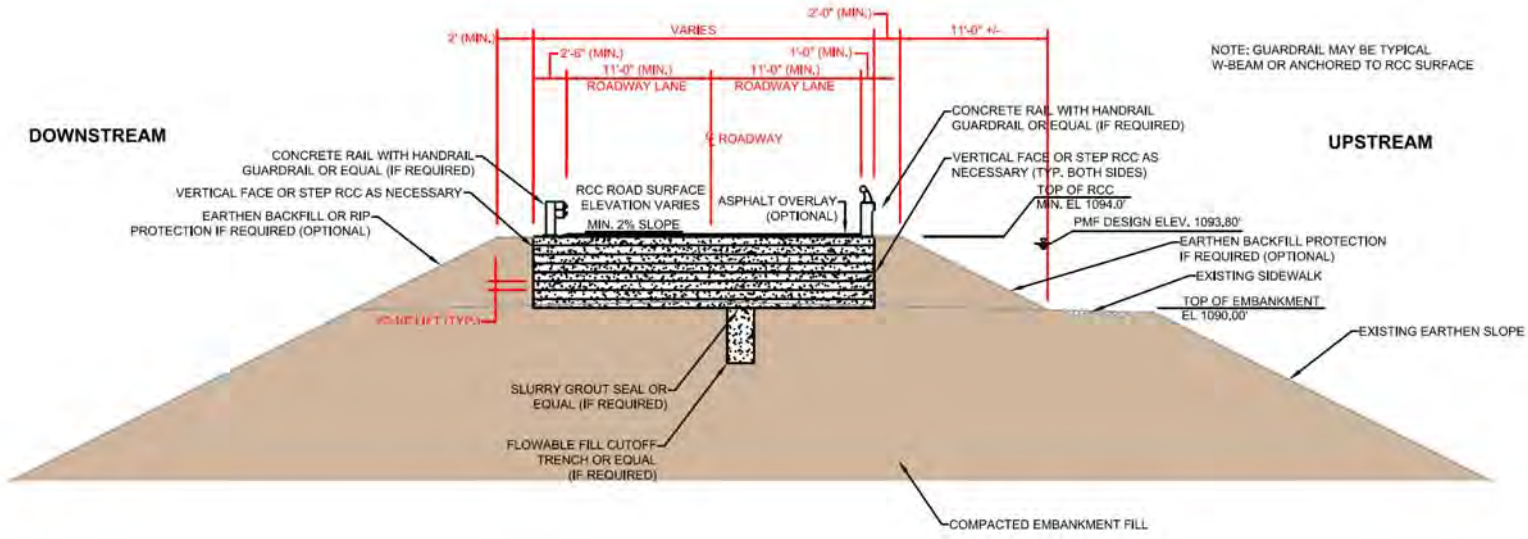

Figure 2-6. Cherokee Dam Saddle Dam #2 Segment C-4 – 6.6-ft RCC (optional concrete curb) Concept

Under Revised Alternative B, an earthen embankment-RCC combination built to a height up to 6.6 ft would be used to permanently modify Segment C-5, which is approximately 600 ft in length (Figure 2-3). Beginning near the Visitor/Restroom Building and transitioning into the existing grade at Renfro Road (near the RV park and campground), Segment C-5 would be modified by constructing an earthen embankment flanked on the downstream side by an approximately 24-ft wide section of RCC, and flanked on the upstream side by a 5-ft wide sidewalk (Figure 2-7). The top of the RCC would have a final elevation between 1094 ft and 1095.6 ft. If the top of the RCC is less than the minimum elevation of 1095.6, then an extruded concrete curb would be used to raise the effective barrier height to 1095.6. The two-lane roadway would be relocated onto the RCC portion. The riding surface will be either RCC or an overlay of 1.5-inch surface asphalt. The parking area would be relocated onto the adjacent upstream earthen embankment area, which would be capped with a 6-inch (minimum) base stone, 2.5-inch binder and 1.5-inch surface asphalt (Figure 2-7). If required, earthen backfill would be placed on both the upstream and downstream sides to tie into the existing grade.

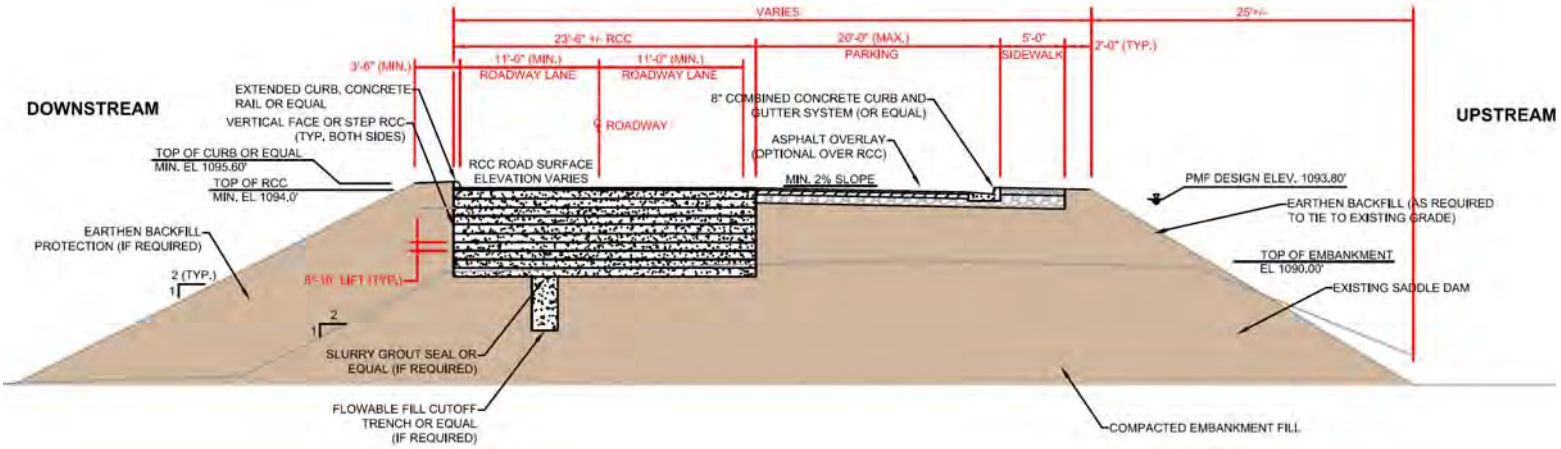

Figure 2-7. Cherokee Dam Saddle Dam #3 Segment C-5 – 6.6-ft Earthen Embankment and RCC Combination Concept

Revised Alternative B would not require the permanent closure of the existing main access road into the Cherokee Dam Recreation Area; however, the main entrance road would be closed for the duration of construction. The Cherokee Dam Recreation Area main entrance roadway and entrances to all parking lots located along Segments C-3 and C-4 would also be raised using RCC and earthen fill, as needed, in order to reduce any excessive grade/slope that would result from the permanent modifications. During construction, access to the Cherokee Dam boat ramp and the adjacent campground would remain available, but the access road and parking lot would be shared with construction/delivery traffic and material staging. As under Alternative B, the parking lot located downstream (and downslope) of the northern end of Segment C-3 would be permanently closed.

Additional dam safety modifications would be made to the central concrete portion of Cherokee dam, as described for Alternative B, with the exception of the proposal to raise the 400-foot section of the concrete south spillway training wall by 40 feet and backfill behind the wall. Additional engineering studies have shown this to be unnecessary. Also, final design at Cherokee Dam could result in the loss of approximately 2 parking spaces each from the parking lots located along Segments C-3 and C-4. This results from the need to make the transition between the elevated roadway on the RCC and the lower existing parking lot grade.

Construction staging areas at Cherokee Dam are illustrated in Figure 2-3. The estimated quantities of construction materials for the RCC and embankment work at Cherokee Dam are provided in Table 2-1. Concrete would be delivered to the project area by truck from existing commercial concrete plants or produced at an onsite batch plant. Construction at Cherokee Dam under Revised Alternative B would last at about 4.5 months.

Table 2-1.
Cherokee Dam Construction Material Quantities* for Revised Alternative B

Item Description	Quantity	Units
Site Preparation		
Construction Survey	1	LS
Saw Cut Asphalt (Full Depth)	1500	LF
Asphalt Removal	24840	SY
Asphalt Disposal	4140	CY
Curb and Gutter/Sidewalk Removal	4347	LF
Sidewalk Removal	800	SY
Concrete Disposal	133	CY
Traffic Control	1	LS
HESCO Unit Removal/Relocation	6756	LF
Chain Link Fence Removal	1450	LF
Chain Link Fence Installation	1450	LF
PMF Wall Removal	0	LF
Portable Concrete Barrier	0	LF
Utility Relocation	1	LS
Floodwall Construction		
Excavation	1200	CY
Concrete	964	CY

Table 2-1.
Cherokee Dam Construction Material Quantities* for Revised Alternative B

Item Description	Quantity	Units
Steel	43740	LB
Expansion Joint Filler	546	LF
Embankment Construction		
Rip Rap Rock for shoulders	60000	CY
Fill Placement and Compaction	33400	CY
Temporary Road Construction	6000	CY
Demo of Temporary Road After Construction	6000	CY
Erosion Prevention and Sediment Control Measures		
Silt Fence with Wire Backing	6500	LF
Curb Inlet Protection	14	EA.
Rock Check Dam	30	EA.
Catch Basin Protection	4	EA.
Erosion Control Blanket	46000	SY
Riprap Placement	60	CY
Geotextile Fabric	133	SY
Sediment Tubes (Waddles)	22000	LF
Seeding and Fertilizing	19	AC.
Traffic Control		
Guardrail	13500	LF
Pavement Markings	1	LS
Handrails	0	LF
Paving		
8-10" Lifts of RCC Paving	40000	CY
2" Asphalt Pavement Surface (TDOT 411-D)	505	TON
Concrete Sidewalk	92	SF

* Based on 30% design and subject to change

Fort Loudoun Dam

The Revised Alternative B permanent modifications at Fort Loudoun Dam are illustrated in Figure 2-8. All modifications at Fort Loudoun Dam would be constructed to a final elevation of 837.0 ft; this is 1.0 ft taller than the modifications proposed under Alternative B.

The first segment (Segment FTL-1) would be modified by the construction of an earthen embankment, same as that described under Alternative B; however, under the revised alternative, the embankment would be built to a final height of approximately 7.0 ft (final elevation of 837.0 ft; 1.0 ft taller than Alternative B) (Figure 2-9). In addition to the height increase, the downstream side of the bench would need to be widened by about 2 ft. The

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Figure 2-8
Fort Loudoun Dam Revised Alternative B

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construction limits, or work area outlined in the preliminary design plans, would be the same as for Alternative B (i.e., no additional clearing, cutting, etc. would be necessary).

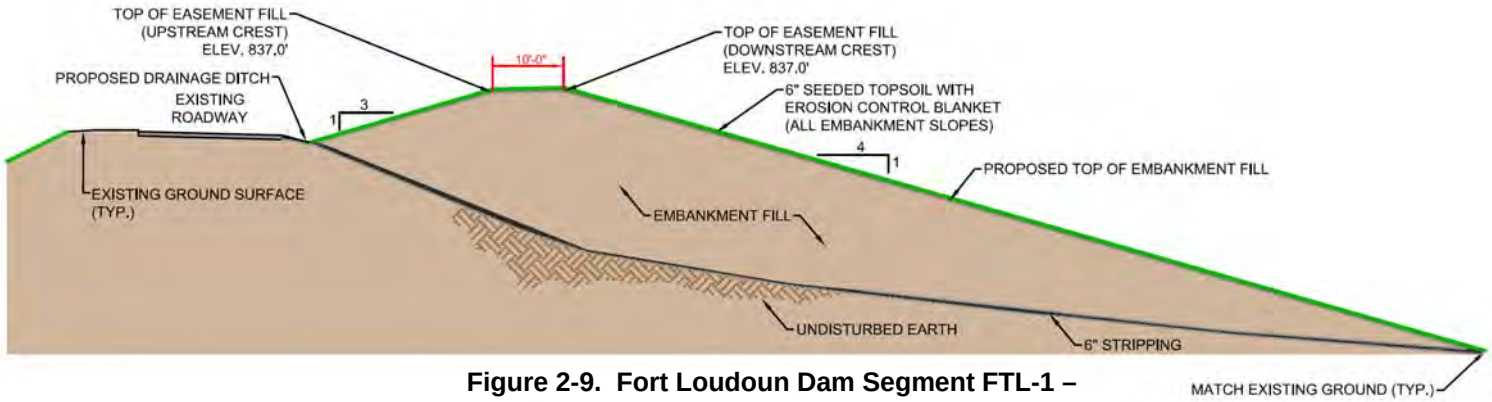

Figure 2-9. Fort Loudoun Dam Segment FTL-1 – 7.0-ft Earthen Embankment Concept for Saddle Dam

Segment FTL-2, which is an approximately 860-ft long, double-stacked row of HESCO barriers located under the US-321 Bridge, would be permanently modified by the addition of a concrete floodwall built to a final height of approximately 6.8 ft (final elevation of 837.0 ft; Figure 2-10). This modification is similar to that described for Segment FTL-2 under Alternative B, but would be approximately 1.0 ft taller and likely require a slightly larger foundation. Final designs for this segment have not yet been developed, but TVA anticipates this segment to be constructed in roughly the same alignment as that described under Alternative B. TVA determined that due to limited work area, the use of RCC under the bridge is not feasible.

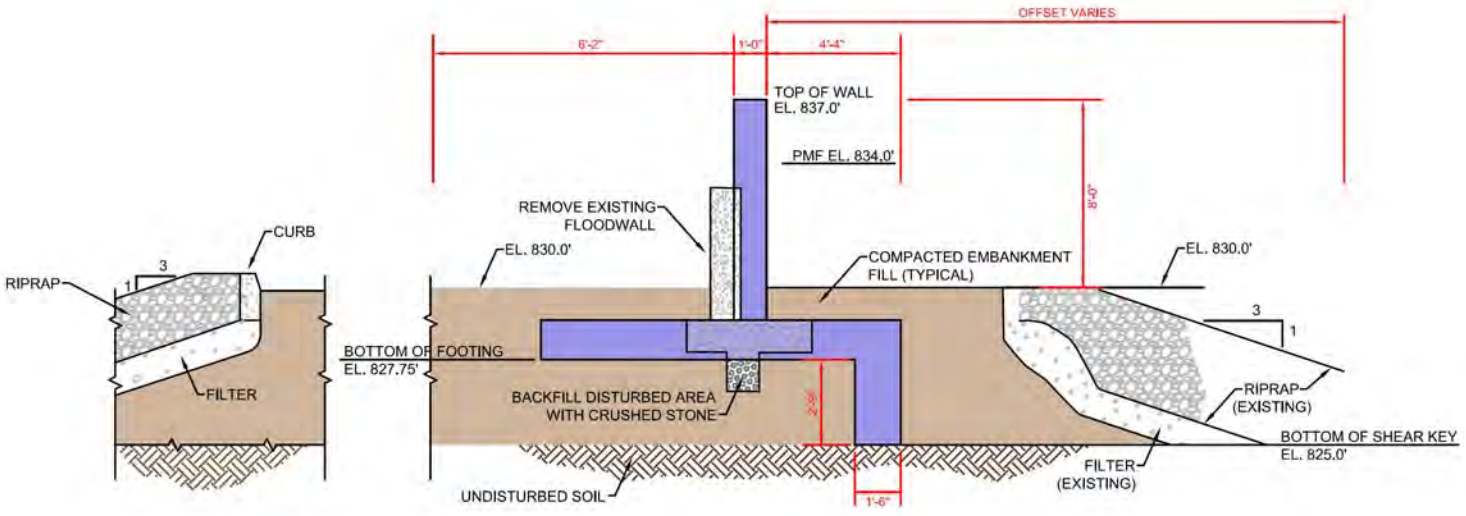

Figure 2-10. Fort Loudoun Dam Segment FTL-2 – 6.8-ft Concrete Floodwall Concept

Under Revised Alternative B, Segment FTL-3, which runs along the shoulder of US-321 from the south end of the bridge to near the SR 444 (Tellico Parkway) off ramp, would be upgraded using an approximately 1,400-ft long section of RCC with a maximum height of approximately 6.1 ft (final elevation of 837.0 ft; Figures 2-8, 2-11). The use of RCC for this segment is only considered feasible if the adjacent TDOT new bridge project has been completed and the US-321 traffic has been re-routed onto the new bridge, as it would otherwise require a lengthy total closure of the current US-321. It would also require NRC to grant TVA an extension to the 2015 completion deadline for the replacement of the HESCO barriers. NRC has indicated to TVA that it will grant this extension and the construction of this segment would likely occur after June 2016 based on TDOT's current schedule for completing the new bridge project. This RCC segment of roadway would be closed to the public and accessible only to authorized personnel during and following construction. Because of the limited traffic on the elevated RCC roadway, the roadway width may be reduced from that depicted in Figure 2-11. Guardrails would be installed if necessary for traffic safety. Until Segment FTL-3 is completed, TVA would conduct any necessary maintenance on the HESCO barriers; this maintenance is described in the description of Alternative A in Section 2.1.1 of the FEIS. Maintenance would likely require the short-term closure of the adjacent lane of U.S. Highway 321.

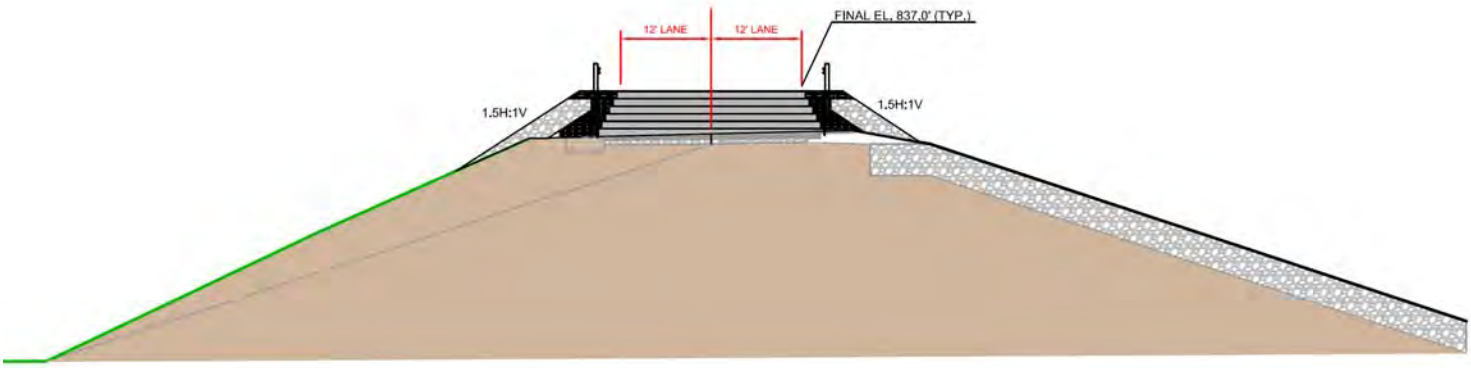

Figure 2-11. Fort Loudoun Dam Segment FTL-3 – 5.8-ft RCC Concept

Under Revised Alternative B, Segment FTL-4 would consist of an approximately 250-ft long earthen embankment between the U.S. Highway 321 roadbed and the junction of SR 444 and the entrance road to the Tellico recreation area (Figure 2-8). This embankment would have a final height of approximately 5.8 ft (final elevation of 837.0 ft; 1.0 ft taller than Alternative B) (Figure 2-12). This embankment would tie-in to the elevated US 321 roadbed on its east end and to the elevated SR 444 roadbed on its west end. PMF protection for the area located between Segments FTL-3 and FTL-4 would be provided by the elevated US 321 roadbed.

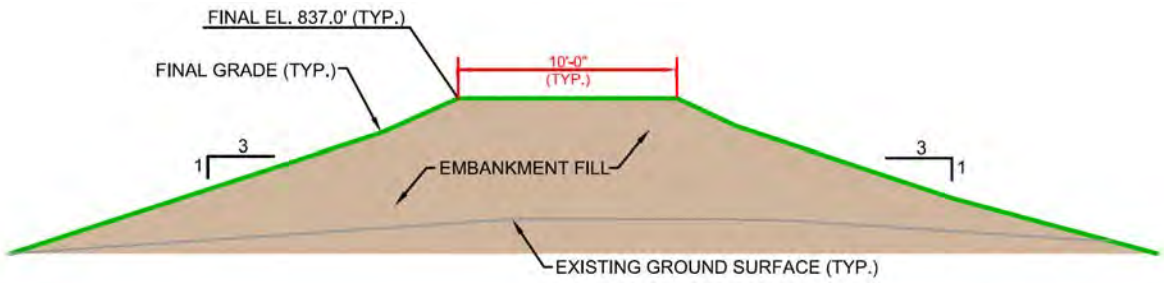

Figure 2-12. Fort Loudoun Dam Segment FTL-4 – 5.8-ft Tall Earthen Embankment Concept

Additionally, an approximately 150-ft long portion of the Tellico Recreation Area entrance road would be raised to meet the new grade of SR 444, which as part of the bridge replacement project would be raised to at least 837.0 ft. This portion of raised roadway would begin at the intersection with SR 444 at the same elevation, and then the entrance to the Tellico Recreation Area would slope/ramp downward and eventually meet existing grade. The entire recreation area would be temporarily closed to vehicle traffic for a period of approximately 2 weeks during construction. During this time, all facilities within the recreation area would remain open to public foot traffic. Following construction of the raised roadway, the north entry to the canal parking area for the Tellico Recreation Area bathrooms would be permanently closed; the existing canal parking area entry to the south would become the only ingress/egress to this parking area.

Three existing parking lots would be used as temporary construction staging areas during the construction of permanent modifications at Fort Loudoun Dam (Figure 2-8). The estimated quantities of construction materials for the floodwall and embankment work at Fort Loudoun are provided in Table 2-2. Concrete would be delivered by truck from existing commercial concrete plants.

During construction of embankment FTL-4, the elevated access roadway, and embankment T-1 at the Tellico Recreation Area, access to the boat ramp and recreational facilities would be closed for approximately 30 to 45 days, most likely during the late summer or early fall. Construction at Fort Loudoun Dam under Revised Alternative B would take approximately 6 months to complete.

Table 2-2.
Fort Loudoun Dam Construction Material Quantities* for Revised Alternative B

Item Description	Quantity	Units
Site Preparation		
Construction Survey	1	LS
Saw Cut Asphalt (Full Depth)	1500	LF
Asphalt Removal	1750	SY
Asphalt Disposal	250	CY
Curb and Gutter/Sidewalk Removal	2000	LF
Sidewalk Removal	1000	SY
Concrete Disposal	900	CY
Traffic Control	1	LS
HESCO Unit Removal/Relocation	3245	LF
Chain Link Fence Removal	1600	LF
Chain Link Fence Installation	100	LF
PMF Wall Removal	2000	LF
Portable Concrete Barrier	6700	LF
Utility Relocation	1	LS
Wall Construction (Concrete T-wall SR 444 Ramp)		
Excavation	6500	CY
Fill Placement	2530	CY

Table 2-2.
Fort Loudoun Dam Construction Material Quantities* for Revised Alternative B

Item Description	Quantity	Units
Riprap Placement	770	LB
Concrete	1170	LF
Steel	201390	LB
PMF Wall Construction (Under Bridge)		
Disposal of material	300	CY
Excavation	1664	CY
Fill Placement	448	CY
Riprap Placement	119	LB
Concrete	1060	EA.
Steel	598862	LF
Gap Closure System	3	LF
Embankment Construction		
Borrow Material	1500	CY
Fill Placement and Compaction	3000	CY
Temporary Road Construction	13481	CY
Demo of Temporary Road After Construction	13481	CY
Erosion Prevention and Sediment Control Measures		
Silt Fence with Wire Backing	6600	LF
Curb Inlet Protection	5	EA.
Rock Check Dam	5	EA.
Catch Basin Protection	3	EA.
Erosion Control Blanket	400	SY
Seeding	1	AC.
Riprap Placement	2950	CY
Geotextile Fabric	5900	SY
Traffic Control		
Guardrail	3000	LF
Pavement Markings	1	LS
Paving		
8 - 10” Lifts of RCC Paving (Asphalt Paving Method)	6436	CY
2' Extruded Concrete Curb Dowelled Into RCC	1700	TON
2" Asphalt Pavement Surface (TDOT 411-D)	715	SF

* Based on 30% design

Tellico Dam

The Revised Alternative B permanent modifications at Tellico Dam are illustrated in Figure 2-13.

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Figure 2-13
Tellico Dam Revised Alternative B

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Under Revised Alternative B, all modifications at Tellico Dam would be the same as those described for Alternative B, with the exception of Segment T-1 (ties into intersection of SR 444 and Segment FTL-4 and the elevated roadway at the entrance of the Tellico Recreation Area). Segment T-1 would be constructed to a final elevation of 836.0 ft and includes a slight shift in the alignment compared to the alignment proposed under Alternative B (Figure 2-13); this is 1.1 ft taller than the modifications proposed for all segments under Alternative B (Figure 2-14).

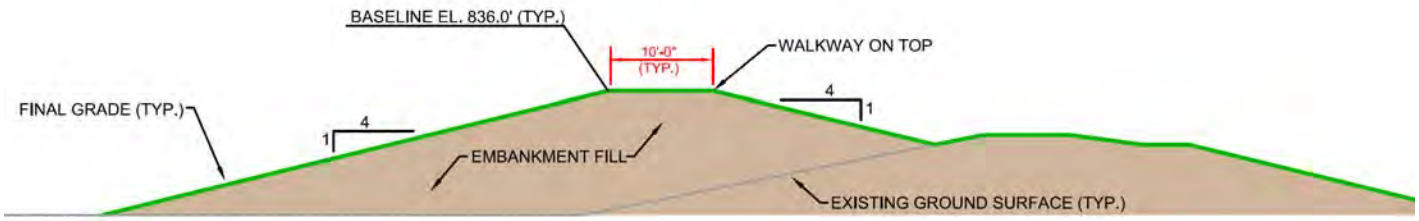

Figure 2-14. Tellico Dam Segment T-1 – 5.9-ft Earthen Embankment with Walkway Concept

Watts Bar Dam

The Revised Alternative B permanent modifications at Watts Bar Dam are illustrated in Figure 2-15. Under this alternative, construction details of permanent modifications at Watts Bar Segments WB-1 and WB-2 would be the same as those described for Alternative B, with the exception of a small height increase of 0.1 ft. In addition, floodwall Segment WB-3, which was set to be strengthened under Alternative B, would now have its height increased by 1.5 ft. The minor design changes to the height of the proposed embankments at WB-1 and WB-2 (and associated raised roadway), as well as the 1.5-ft height increase at WB-3, would result in a minimal increases in both the amount of fill dirt needed for the embankments at WB-1 and WB-2 and the amount of additional concrete needed at WB-3, as compared to Alternative B. Given the negligible impacts that would result from raising the Watts Bar modifications by an additional 0.1 ft to 1.5 ft (increasing the height from approximately 3.5 ft to 3.6 ft and 3.8 ft, respectively), construction details for this dam are not discussed further in this Supplemental Analysis.

TVA is also considering increasing the height of the earthen embankments by an additional 1.5 to 2.5 feet, and increasing the height of the WB-3 concrete floodwall by 0.5 to 3.5 feet. These proposed actions are not addressed further in this Supplemental Analysis and will be the subject of a separate environmental analysis.

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Figure 2-15
Watts Bar Dam Revised Alternative B

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2.2 Comparison of Alternatives

Table ES-1 provides a comparison of impacts associated with the No Action Alternative and the action alternatives, Alternative B, Alternative C, and Revised Alternative B.

2.3 Identification of Mitigation Measures

Revised Alternative B would not result in significant impacts to any resource that would require mitigation; therefore, no required mitigation measures have been identified at this time. However, best management practices (BMPs) and probable mitigation activities are identified and discussed in the appropriate resource area discussions.

2.4 The Preferred Alternative

Throughout the duration of this project, TVA has continued to improve the engineering design plans at each of the four dams. In October 2013, new information became available and the design plans for Cherokee, Fort Loudoun, and Watts Bar dams were modified.

TVA has identified Alternative B (Combination of Concrete Floodwalls and Earthen Embankments) as the Preferred Alternative at Tellico Dam (although with a slight change in alignment and total height at Segment T-1) and Revised Alternative B (Combination of RCC, Concrete Floodwalls, and Earthen Embankments) as the Preferred Alternative at Cherokee, Fort Loudoun, and Watts Bar dams. Revised Alternative B would result in fewer transportation and public safety impacts at Fort Loudoun Dam than would Alternative B. Revised Alternative B would also result in minor beneficial impacts to Visual Resources at Cherokee, Fort Loudoun and Tellico dam recreation areas in comparison to Alternative B.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter 3 - Affected Environment and Environmental Consequences – of the FEIS consisted of 17 individual resource areas that were evaluated to describe the baseline conditions and environmental consequences of the original Alternatives A, B, and C (TVA 2013). 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 National Environmental Policy Act (NEPA) review topics (e.g., solid and hazardous waste).

Information contained in that chapter of the FEIS established the baseline conditions against which TVA evaluated the proposed alternatives and ultimately selected Alternative B as the preferred action. The Affected Environment discussion for each resource area identified the existing conditions and 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 future trends for the resource area.

The 17 resource areas addressed in the FEIS were Geology and Soils, Water Resources, Air Quality and Greenhouse Gas Emissions, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural and Historic Resources, Noise, Transportation, Visual Resources, Recreation, Solid and Hazardous Waste, and Public Safety.

No new or significant information has been made available that would change the conclusions of the FEIS with respect to the Affected Environment and/or Environmental Consequences associated with Action Alternative B. Therefore, the Affected Environment and Environmental Consequences discussions in the FEIS associated with Action Alternative B are incorporated by reference into this Supplemental Analysis and are not discussed further.

Based on the fact that the only design change proposed at Watts Bar Segments WB-1 and WB-2 is a minimal increase in height (0.1 ft), TVA determined that the Environmental Consequences associated with implementation of Revised Alternative B at Watts Bar embankment Segments WB-1 and WB-2 would be the same as Alternative B for all 17 resource areas and are not discussed further in this Supplemental Analysis. TVA determined that the 1.5-ft floodwall height increase proposed for Segment WB-3 under Revised Alternative B would be evaluated for potential impacts to cultural resources and visual resources only, given that Watts Bar Dam is eligible for listing in the National Register of Historic Places (NRHP); therefore, Segment WB-3 is not included in this analysis for any other environmental resources. Additionally, due to the minimal changes in design at Tellico Segment T-1, TVA determined that specific analysis of this dam area was not necessary. However, due to the proximity of the Fort Loudoun Dam Segment FTL-4 and the Tellico recreation area, potential impacts to the Tellico recreation area are discussed concurrently with those associated with Segment FTL-4.

Based on the proposed design changes at Fort Loudoun Dam and Cherokee Dam, TVA determined that the Environmental Consequences associated with implementation of Revised Alternative B would remain the same as Action Alternative B for 12 of the original 17 resource areas. TVA also determined that five resource areas (Cultural and Historic Resources,

Transportation, Visual Resources, Recreation, and Public Safety) have the potential to be affected by the proposed design changes at Fort Loudoun and Cherokee dams, Watts Bar Segment WB-3, and Tellico Segment T-1. Table 3-1 presents the 17 resource areas and TVA's assessment of the need for further evaluation of environmental consequences.

Table 3-1.
Environmental Consequence Analysis by Resource Area

Resource Area	Revised Alternative B Environmental Consequence Analysis	FEIS Conclusion
Geology and Soils	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Minor, temporary negative impacts at the dam sites during construction. Ongoing existing and new negative impacts to soils at the borrow areas.
Water Resources	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	No direct, indirect or cumulative impacts anticipated, with the use of appropriate BMPs.
Air Quality and Greenhouse Gas Emissions	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Minor temporary negative impacts during construction, with use of BMPs.
Flooding and Floodplains	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	No direct impacts. Positive indirect impacts due to downstream flood risk reduction.
Wetlands	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	No direct, indirect or cumulative impacts anticipated.
Aquatic Ecology	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	No direct, indirect or cumulative impacts anticipated, with use of BMPs.
Terrestrial Ecology	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Minor direct negative impacts to vegetation (tree clearing), as well as to marginal, already disturbed areas on the dam reservations. Minor temporary indirect impacts to wildlife due to noise and run-off during construction. Minor permanent indirect impacts to wildlife (habitat loss) due to clearing. Minor negative impacts at the borrow areas.
Threatened and Endangered Species	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Potential indirect impacts to Indiana bats due to the clearing of forested areas containing suitable habitat. TVA would mitigate these impacts. No direct, indirect, or cumulative impacts to any other listed species.
Land Use	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	No direct, indirect or cumulative impacts anticipated as all construction would occur on the dam reservations.
Socioeconomics and Environmental Justice	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Short term beneficial impacts from construction, minor long term beneficial impacts to employment and minor indirect beneficial impacts due to reduced flood risk.
Cultural and Historic Resources	Discussed in detail in this Supplemental Analysis	No direct, indirect, or cumulative impacts to archaeological or historic resources anticipated.

Table 3-1.
Environmental Consequence Analysis by Resource Area

Resource Area	Revised Alternative B Environmental Consequence Analysis	FEIS Conclusion
Noise	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Temporary negative impacts ranging from minor to significant depending on the segment.
Transportation	Discussed in detail in this Supplemental Analysis	Temporary minor to significant direct negative impacts during construction, depending on the segment. Possible cumulative impacts at Fort Loudoun and Tellico during construction.
Visual Resources	Discussed in detail in this Supplemental Analysis	Negative direct impacts ranging from minor to significant, depending on the dam segment.
Recreation	Discussed in detail in this Supplemental Analysis	Temporary negative impacts during construction ranging from minor to significant due to short-term closure of recreation access at Cherokee, Tellico, and Watts Bar.
Solid and Hazardous Waste	Same as Action Alternative B. Not discussed further in this Supplemental Analysis	Minor temporary increases during construction.
Public Safety	Discussed in detail in this Supplemental Analysis	Minor temporary negative impacts during construction. Minor indirect positive impacts due to flood risk reduction.

3.1 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 changes 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 (NHPA) of 1966 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 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; and
- 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 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 Revised Alternative B, these modifications consist of the footprints of the floodwalls/embankments and the construction borrow/staging areas as described in Section 2.1.4. Since access to these areas would be provided by existing paved and gravel roads, the access routes are not part of the APE.

This section describes the existing cultural resources and the potential impacts to cultural resources as a result of the project actions at Cherokee, Fort Loudoun, and Watts Bar dams. Tellico Dam cultural resources were addressed in the FEIS and no additional impacts would be expected to occur under Revised Alternative B.

3.1.1 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 the action alternatives (including the borrow area and two staging areas). Because of the extensive disturbance to the vicinity of the dam during its construction, there is little or no potential for intact archaeological sites. No cultural resources were identified in the APE for the borrow area.

Historic structures surveys 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 and Holland 2011, Karpynec and Weaver 2014a). Based on these findings, 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 SHPO agreed by letter dated September 29, 2011 (Appendix C of the FEIS).

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 saddle dam APE. Due to the extensive modification of the Fort Loudoun Dam APE during construction of both Fort Loudoun and Tellico Dams, there is little to no potential for intact archaeological resources within the APE.

Historic structure surveys 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 and Holland 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 (FEIS Appendix C). A subsequent survey in association with the Revised Alternative B modifications was conducted in 2014; this survey found that Fort Loudoun retains sufficient integrity to remain eligible for listing in the NRHP (Karpynec and Weaver 2014b).

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 identified borrow area and the staging area north of Highway 68. The staging area south of Highway 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.

Historic structure surveys 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 and Holland 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.

A cultural resources survey of the proposed borrow area in Rhea County was conducted by TRC. No archaeological resources were found on the site and no historic structures were present on or in the immediate vicinity of the site.

3.1.2 Environmental Consequences: Revised Alternative B – Combination Floodwalls, Embankments, and RCC

Cherokee Dam

No archaeological sites are recorded within the APE for Revised 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 recent ground disturbance. Both staging areas are paved parking areas with little or no potential for cultural resources. Action Revised Alternative B has no potential to affect archaeological resources in the APE at Cherokee Dam.

TVA has determined that Revised 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 Revised 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 would have no adverse impacts on cultural resources. TVA has consulted with the SHPO on its determination that Revised Alternative B would not adversely affect Cherokee Dam.

Fort Loudoun Dam

No archaeological sites are recorded within the APE for Revised Alternative B at Fort Loudoun Dam. The entire APE consists of road shoulders which consist of pavement on artificial fill and other areas extensively disturbed during dam and highway construction, and lacks undisturbed native soils. Therefore, Revised 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 Alternative B would have a visual effect on Fort Loudoun Dam, but the effect would not be adverse. The four segments associated with Fort Loudoun Dam are not located on the main dam and are largely outside the visual-line-of-sight to the dam. Of the four segments, the proposed Segment FTL-2 floodwall is the nearest to the main dam. Situated adjacent to the lock operations building underneath the bridge, FTL-2 is 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 would have no adverse impacts on cultural resources (FEIS Appendix C). Based on the results of the subsequent 2014 survey (Karpynec and Weaver 2014b), TVA determined that the effects of Revised Alternative B would also not be adverse. TVA consulted with the SHPO on this finding in May 2014 (Appendix A).

Watts Bar Dam

No archaeological sites are recorded within the APE for 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 Alternative B has no potential to affect archaeological sites within the APE of Watts Bar Dam.

In a letter dated May 21, 2013, TVA contacted the SHPO regarding the potential excavation work required at the previously undisturbed Watts Bar borrow area (Figure 2-19). In April 2013, TVA contracted a Phase I cultural resources survey of the approximately 7.25-acre pasture, including a 0.5-mile radius. Results of the archaeological survey of the proposed borrow area APE indicated that no architectural resources or historic properties were present; therefore, use of the proposed borrow area in Rhea County would have no potential to affect cultural resources.

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 profiles of the proposed embankments, TVA finds that Alternative B 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 embankments and floodwall 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.

TVA contracted with Tennessee Valley Archaeological Research to conduct a Phase I architectural survey of the 1.5 ft increase in the height of the WB-3 concrete floodwall proposed under Revised Alternative B. This study determined that the modification of the floodwall would not compromise the integrity of Watts Bar Dam or diminish its architectural and historic significance. The modification of the floodwall would therefore have no adverse effect to historic properties. TVA consulted with the SHPO on this determination in March 2014; in a letter dated March 26, 2014, the SHPO concurred with TVA's determination (Appendix A).

3.2 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 at Cherokee and Fort Loudoun dams.

3.2.1 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 Cherokee and Fort Loudoun dams. Watts Bar and Tellico dam transportation resources were addressed in the FEIS and no additional impacts would be expected to occur under Revised Alternative B.

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 2-3).

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) data available from the TDOT are from the 2012 calendar year. Along Highway 92 the AADT is approximately 5,411 vehicles per day at the Cherokee Dam (TDOT 2012a). Near the junction with Highway 11E to the south, the AADT on Highway 92 is 7,194 (TDOT 2012b).

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 electrical substation 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 are 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 is located entirely on the Cherokee Dam reservation and terminates at the dam. A restricted access maintenance access road extends across the dam from TVA Parkway and connects with Cherokee Dam Road on the north. TVA Parkway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data are available.

Renfro Road

Renfro Road is an undivided two-lane minor rural arterial that exits Highway 92 1 mile south of the Holston River and 0.1 mile west of the intersection of Highway 92 and TVA Parkway. It runs south from Highway 92 to the TVA campground and boat launch ramp. Traffic on this section of Renfro Road is primarily for recreation and maintenance; no AADT data are available.

TVA Dam Road

TVA Dam Road is an undivided two-lane minor rural arterial that exits 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 are available.

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

The borrow area that would provide earthen fill for work at proposed Cherokee Dam Segment C-5 is located approximately 11 miles away from the project site, approximately 2.5 miles northwest of the town of White Pine, Tennessee near the intersection of I-81 and U.S. Highway 25E. Interstate 81 is a divided, four-lane highway that runs northeast-southwest. U.S. Highway 25E is a divided, four-lane highway that runs northwest-southeast and intersects with Highway 11E in Morristown and with I-81 in White Pine to the south.

This existing borrow area is located a few miles south of Morristown, in Hamblen County, Tennessee. Interstate 81 connects U.S. Highway 25E (borrow site location) with 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. The 2012 AADT on Sublett

Road, immediately adjacent to the borrow areas is 435 vehicles per day, and exceeds 18,000 vehicles per day on Highway 25E (TDOT 2012a). The construction vehicles would most likely travel from U.S. Highway 25E to I-81 and then Highway 92, through Jefferson City and eventually to the project site. The 2012 AADT for Interstate 81 ranged from over 45,000 to over 63,000 vehicles per day (TDOT 2012b). The 2012 AADT on Highway 92 south of Jefferson City ranges from approximately 13,000 to over 15,000 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 could also travel along Highway 11E/Andrew Johnson Highway. There could be an increase in construction traffic along Highway 11E through Morristown and Jefferson City and then along Highway 92 to the project site at Cherokee Dam. Along Highway 11E south of the junction with Highway 25E the AADT is over 14,000 vehicles per day (TDOT 2012a). In Jefferson County, near the junction with Highway 92, the AADT on U.S. Highway 11E is over 18,000 vehicles per day (TDOT 2012b).

Fort Loudoun Dam

At Fort Loudoun Dam, 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 20,553 vehicles per day (TDOT 2012c). In late 2012, TDOT began construction on a project to widen U.S. Highway 321 to four lanes and reroute it from the dam to a new bridge downstream of the dam. This project is scheduled to be completed in June 2016. North of the project area, in the vicinity of the borrow areas, the 2012 AADT for Highway 321 is 25,033 vehicles per day (TDOT 2012c).

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 Loudon Marina, approximately 3,000 feet from the U.S. Highway 321 overpass, are located along City Park Drive. 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 1,172 vehicles per day (TDOT 2012c). No AADT information is 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 (State Highway 444) 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 8,166 vehicles per day at the dam (TDOT 2012c).

TVA Service Road

The TVA Service Road is an undivided two-lane minor rural arterial located west of U.S. Highway 321 that 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 dam and lock operations and maintenance by TVA and the Corps of Engineers; no AADT data are 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 operations and 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 parking area for tailwater fishers. This roadway is not heavily traveled as it is used primarily for recreation and maintenance purposes; no AADT data are 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.

3.2.2 Environmental Consequences: Revised Alternative B – Combination Floodwalls, Embankments, and RCC

This section presents a discussion of the potential environmental impacts to transportation that could occur associated with Revised Alternative B in comparison to the previously selected Alternative B. Under Revised Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls, raised earthen embankments, and RCC. Under this alternative, overtopping of each dam during a PMF event would be prevented by construction of a floodwall, earthen embankment, and/or RCC to the same height or higher than the existing HESCO barriers.

TVA has carefully considered the impacts to safety and transportation during the planning of the proposed permanent dam safety modifications. The potential for impacts to safety and transportation is greatest in the vicinity of Fort Loudoun Segment FTL-3 (Figure 2-8). Since NRC has indicated to TVA that it will grant an extension for the work at this segment, thereby allowing the construction at FTL-3 to take place after the TDOT bridge project is completed, TVA would be able to raise the existing flood protection to a final height of 5.8 ft using RCC because traffic will already have been re-routed to the new bridge. Separating the two projects would significantly decrease both potential traffic impacts and safety concerns as there would no longer be any traffic along Segment FTL-3. This would also eliminate the need to close part of the ramp between Highway 444 and U.S. Highway 321 during construction of the permanent modification.

Cherokee Dam

Construction along segments C-1 and C-2 would not directly impact traffic as these segments are not along publically accessible roads. However, construction traffic related to work at Segment C-2 would access the project area via TVA Parkway, which could have minor adverse impacts to traffic within the Cherokee Recreation Area.

Under Revised Alternative B, the segment of TVA Parkway between Highway 92 and the visitor/restroom building would not be permanently closed in order to construct the Segments

C-3, C-4, and C-5 RCC sections; however, the main entrance would be closed for up to 4.5 months during construction activities at these segments. Access to the campground, boat ramp and picnic area would continue to be available from Renfro Road and Highway 92, although Highway 92 would also be used by construction traffic and only one lane of Renfro Road would be open during construction activities at Segment C-5. Overall, impacts to traffic during construction at Cherokee Dam would be temporary and adverse.

Concrete would either be trucked into the project area using primarily major highways or be produced onsite in a batch plant. The batch plant would be located in an existing proposed staging area (Figure 2-3). There would be a greater number of concrete trucks traversing the area in comparison to Alternative B, as more concrete would be required for the RCC segments. However, all of the RCC work would occur within the Cherokee Recreation Area, and would not be expected to adversely affect Highway 92 traffic. Currently, an estimated 5,411 vehicles travel per day on Highway 92; therefore, significant impacts related to concrete truck traffic would not be anticipated. The borrow area for the proposed Cherokee Dam berm is located approximately 11 miles away from the project site, approximately 2.5 miles northwest of the town of White Pine, Tennessee near the intersection of I-81 and Highway 25E. In comparison to Alternative B, only Segment C-5 would require fill material from the borrow area, so fewer dump trucks would be travelling the local roads to and from the borrow area; therefore, construction traffic associated with implementation of Revised Alternative B would have no significant impact on traffic along these roadways.

Despite the short-term Recreation Area road closures, temporary decrease in available parking, and minor temporary increases in traffic due to construction vehicles, no significant adverse impacts to transportation would be expected to result from implementation of Revised Alternative B at Cherokee Dam. Indirect impacts due to additional vehicles on the surroundings roads would not be anticipated.

Fort Loudoun Dam

Under Revised Alternative B, potential short-term impacts would likely occur to transportation along U.S. Highway 321, City Park Drive and Tellico Parkway (SR 444) at Fort Loudoun Dam.

U.S. Highway 321

Segment FTL-2 is located beneath the U.S. Highway 321 Bridge and would be modified with a floodwall constructed to a final elevation of 837.0 ft. Construction of FTL-2 would not have significant traffic impacts as it is under the bridge and access would be from the TVA access road along the existing embankment. There would be minor additional traffic along local roads due to concrete trucks. Segment FTL-3 is immediately adjacent to the heavily traveled U.S. Highway 321. Under Revised Alternative B, FTL-3 would be modified using RCC. TVA is currently proposing to postpone the upgrading of the flood protection at Fort Loudoun Dam until after the re-routing of U.S. Highway 321 is complete; this would require both an extension from the NRC, as well as completion of the TDOT replacement bridge project. If this is accomplished, there would no longer be any traffic along Segment FTL-3, and therefore, minimal impacts to traffic or transportation due to the construction of this segment. For the duration of the Highway 321 re-routing, there could be short-term single-lane closures of US-321 during necessary maintenance work on the HESCO barriers along this segment. This work would be conducted in a manner that would minimize effects on traffic. Overall impacts to traffic on US-321 under Revised Alternative B would be less than under Alternative B.

City Park Drive

Impacts to transportation along City Park Drive (Segment FTL-1) under Revised Alternative B would be almost identical to those under Alternative B. Due to the higher elevation, construction may take slightly longer, but the additional width of the embankment would be on the downstream side (north of the road) and the construction limits would be the same as for Alternative B. Most of the construction access would be from the east end of FTL-1, traveling west on City Park Drive. The west-bound lane of City Park Drive would be closed during some of the construction, and construction warning and reduced speed limit signs would be posted. The section of City Park Drive adjacent to FTL-1 and just east of the entrance to Fort Loudon Marina would be closed to all traffic for up to two weeks to allow construction of components of the embankment and removal of the HESCO barriers. Access to Fort Loudon Marina from U.S. Highway 321 would not be impeded by this road closure. To access areas along City Park Drive east of Segment FTL-1, including Lenoir City Park, traffic from the west and south could be detoured around the area via an approximately 5-mile route utilizing Martel, Lakeview, and Easter Ridge Roads. This detour would include a travel time of approximately 15 minutes under normal traffic conditions. This would result in a moderately adverse short-term impact. Fill material for construction of the embankment would likely be trucked into the project area using U.S. Highway 321 and then on City Park Drive to the work site. Given the small amount of earthen fill that would be required for the FTL-1 and FTL-4 embankments, adverse impacts related to truck traffic delivering fill material from the yet-to-be-identified borrow area would not be expected to occur.

Tellico Parkway

Under Revised Alternative B, both ends of Segment FTL-4 would tie into the new raised roadways/ramps near the intersection of U.S. Highway 321, SR 444, and the Tellico Recreation Area entrance (part of the TDOT bridge project). The recreation area would be closed for approximately 30 to 45 days during the construction associated with FTL-4 and Tellico Segment T-1. This road closure should not, however, impact traffic along Tellico Parkway.

Due to the alignment shift of Segment FTL-4 under Revised Alternative B, fewer lane closures (if any) may be required during the construction of this segment. If construction of the FTL-4 embankment and the new U.S. Highway 321 on/off ramp are not concurrent, no significant impacts to traffic and traffic safety are anticipated for this segment as it would be constructed outside the U.S. Highway 321 right-of-way. If construction is concurrent, very minor impacts to traffic are possible due to potential lane closures along the existing roads associated with the construction of the on/off ramps. The potential short-term lane closures associated with Revised Alternative B 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. There could also be potential impacts to human health and safety as a result of the increased congestion and impatience drivers could experience as a result of significant delays should the construction and lane closures occur during daylight or weekend hours. TVA would coordinate the schedule for the embankment work at FTL-4 with the schedule for the U.S. Highway 321 relocation project to minimize traffic impacts to the extent possible.

Given that construction of the FTL-3 segment of Revised Alternative B would not occur until after the Highway 321 project was complete, impacts to transportation and traffic safety during construction at Fort Loudoun Dam would not be significant and would be less than those described under the previously selected Alternative B. Indirect impacts due to increased vehicles on the surrounding road would not be anticipated.

Overall Potential Impacts

Under Revised Alternative B, concrete for construction of the floodwalls and RCC would either be trucked to the project site from local suppliers or be produced onsite in a batch plant. The plant would be located in a proposed staging area (Figure 2-8). The trucks would primarily rely on major highways to reach the dam; therefore, significant impacts to transportation would not result solely from concrete delivery and would be similar to those under Alternative B. Transportation of fill material between the borrow site and the project sites would require multiple truck loads over a duration of several weeks to a few months for Segments FTL-1 and FTL-4. The current traffic load on U.S. Highway 321 is approximately 25,000 vehicles per day; therefore, the increase in construction related traffic would be insignificant along this roadway as a result of implementation of Revised Alternative B; therefore, only minor adverse, direct impacts to transportation would be anticipated in this project area due to increased construction vehicle traffic and materials delivery at Fort Loudoun Dam. Relative to Alternative B, Revised Alternative B would result in reduced overall impacts to transportation.

3.3 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 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. The changes at Watts Bar Segments WB-1 and WB-2 and Tellico Dam under Revised Alternative B would result in negligible visual impacts and are not analyzed further in this section. The potentially greater visual impacts to Cherokee and Fort Loudoun Dams, and to Watts Bar Segment WB-3 are addressed below.

3.3.1 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 Cherokee and Fort Loudoun dams, as well as Segment WB-3, as these would be the primary visual environments potentially impacted.

Cherokee Dam

Visual resources at Cherokee Dam are quite variable, with an almost industrial setting at Segments C-1 and C-2, and a more natural setting near Segments C-3, C-4, and C-5 (Figure 2-3). Segment C-1, which is accessible to the public by foot, but receives relatively little public use, visually includes the dam and an associated power plant, switchyard, and an expanse of levee with riprap and mowed lawn. 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. Cherokee Dam main embankment that dominates Segments C-1 and C-2 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 and appears much more natural and peaceful.

The main dam embankment 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. Views from Segment C-2 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.

Visual resources within the southwestern portion of the Cherokee Dam reservation (south of Segment C-2) are dominated by views of more 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. 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 and shoreline.

At Cherokee Dam, the target June 1 pool elevation is 1,071 feet and the target January 1 pool elevation is 1,045 feet, a maximum water level difference of 26 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 Environmental Impact Study (EIS) (TVA 2004, Photo 3.3-1). Impacts from water drawdown are 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.

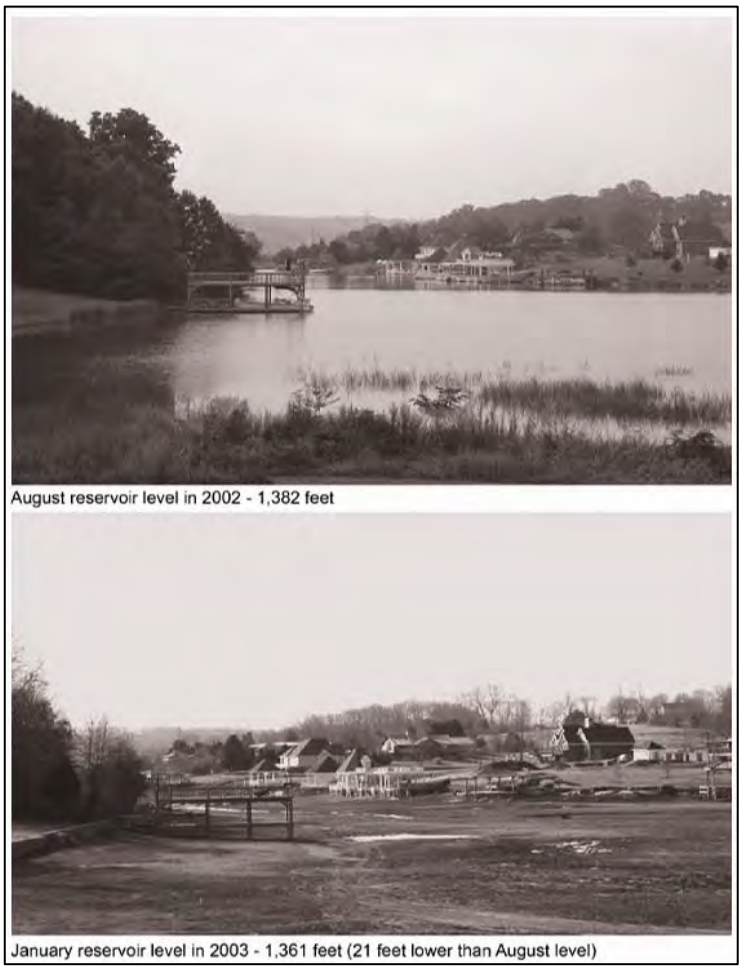

Photo 3.3-1. Example of the Visual Impacts from Seasonal Water Level Difference, (TVA 2004)

Fort Loudoun Dam

The Fort Loudoun Dam project area has a combination of visual resources similar to those at Cherokee Dam, ranging from industrial to natural landscapes. The most industrial views are

those nearest to the dam, and the most naturally-appealing views are those nearest to Segment FTL-1 (Figure 2-8).

Segment FTL-1 is adjacent to a commercial marina, immediately next to a boat ramp parking lot. This area is somewhat recessed from the general viewing spots in the area. The access road to the parking lot separates the 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 farther 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 landscape. Overall, this area is attractive, but constitutes more of an intrusion 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 more industrial in appearance, compared to Segments FTL-1 and FTL-4. The concrete portion of the dam itself is located near FTL-2. 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.

Segment FTL-3 is also relatively industrial in character. It runs from the south end of the J. Carmichael Bridge along U.S. Highway 321 towards Tellico Dam for approximately 1,400 ft. FTL-3 also includes views from the elevated portion of U.S. Highway 321 leading to a bridge. 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 Segment FTL-4 as the bridge is less intrusive and the highway is at ground level. However, the human-made transportation structures associated with bridge and on/off ramps dominate the view.

Segment FTL-4 would be aligned in a small grassy area located in between the new on- and the off-ramps for the U.S. Highway 321 replacement bridge. 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 target June 1 pool elevation range is 813 feet and the target January 1 pool elevation is 807 feet, a maximum elevation difference of 6 feet. Visually, in this area, this difference would not constitute a major change in visual resources over the course of the year.

Watts Bar Dam

All three segments at Watts Bar Dam are immediately adjacent and in the same general area (Figure 2-15). Watts Bar Dam and the nearby recreation area present a compelling aesthetic juxtaposition due to the visual dominance of the nearby nuclear power plant. The decisively industrial appearance of the plant's cooling towers and the dam/bridge provide a rather

disjointed experience at portions of the recreation area. The plant does not visually fit in with the surrounding area although it is partially screened by trees in many areas. It detracts significantly from the recreational experience that visitors seek when visiting the reservoir. Additional views in the area, even when not including the plant, can be disquieting due to other industrial and structural aspects. 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.

Segment WB-3 is located adjacent to the dam and under State Highway 68 and is the most industrial in appearance of the three Watts Bar segments. This segment, however, is not visually dominant, due to the proximity of the highway and the large cooling towers. From the recreation area, an observer can hardly see this segment at all. It is completely over-shadowed by the surrounding larger industrial elements in the viewscape.

At Watts Bar Dam, the target pool elevations are 741 feet on June 1 and 735 feet on January 1. 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.

3.3.2 Environmental Consequences: Revised Alternative B – Combination Floodwalls, Embankments, and RCC

Under Revised Alternative B, at all three dam areas, short-term, moderate, adverse, direct impacts to visual resources would be 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, minor indirect adverse 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. These indirect impacts would apply to every project site.

Cherokee Dam

Under Revised Alternative B, the HESCO barriers would be modified using RCC and a RCC-embankment combination at Cherokee Dam. Segments C-1 through C-4 would be raised using RCC and Segment C-5 would be raised with a RCC-embankment design (Figure 2-3).

RCC would be used to raise the Cherokee Dam segments to a final height of approximately 6.6 ft along the entire alignment, which runs through the recreation area from the main dam embankment to the boat ramp parking area. Photo 3.3-2a shows a portion of the main embankment at Segment C-2 (facing northeast); Segment C-1 appears very similar. Photo 3.3-2b shows the same area of Segment C-2 (with raised walkway) under Alternative B. The appearance of Segment C-1 would be similar, except that without the raised walkway, the 6.6-foot floodwall would be more visually intrusive. Photo 3.3-2c shows a rendering of Segment C-2 under Revised Alternative B; Segment C-1 would appear very similar. The absence of concrete

Photo 3.3-2a. Cherokee South Main Embankment with Temporary Measures

Photo 3.3-2b. Visual Rendering of Segment C-2 under Alternative B (6.6-foot-tall floodwall on the downstream side with a 3-foot-tall raised walkway)

Photo 3.3-2c. Visual Rendering of Segment C-2 under Revised Alternative B (6.6-foot-tall RCC) Proposed for Segments C-1 and C-2

walls at C-1 and C-2 under Revised Alternative B would continue to provide pleasant recreational views for visitors of these areas and would be more in keeping with the existing setting of the recreation area.

Even including the optional handrails or concrete curb, which are not pictured in Photo 3.3-2c, Revised Alternative B would be a visual improvement over the Alternative B floodwall and raised walkway option. The floodwall under Alternative B causes a visual interruption which is not present under Revised Alternative B. This alternative would also allow better views of the surrounding natural areas – both on the upstream and downstream sides of the main embankment. The experience would not be hindered by the visual intrusion of a wall adjacent to the walkway; therefore, the use of RCC under Revised Alternative B at Cherokee Dam Segments C-1 and C-2 would constitute a beneficial visual impact in comparison to Alternative B.

Photo 3.3-3a represents Segment C-2 as seen from the parking lot at the bottom of the stairs at the end of TVA Dam Road. Photos 3.3-3b and Photo 3.3-3c show renderings of the Alternative B and the Revised Alternative B designs, respectively. This area is already highly visually impacted by the large concrete dam, associated embankment, and the parking lot. Under Revised Alternative B, RCC would be added to the existing concrete at Segment C-2 to bring the final elevation to 1095.6 ft. The addition of RCC in this area would merely appear as a larger levee to visitors viewing this segment from the TVA Dam Road parking lot and/or the reservoir itself. From the perspective of C-2 walkway recreationalists, RCC and optional handrails or concrete curbs would not block most pedestrians' views of the rolling hills and forested areas on the downstream side of this embankment; therefore, this updated design

would not greatly alter the appearance of the area since most visitors would continue to be able to experience existing views. Under Revised Alternative B, due to the lack of visual intrusion which would be caused by the floodwall of Alternative B, RCC at C-3 would represent a beneficial visual impact.

The installation of the post-tensioning on the north side of the concrete portion of the dam would result in negligible long-term changes to the appearance of the dam. The construction of the larger training wall on the south side of the concrete portion of the dam would slightly alter the appearance of the dam from the vicinity of TVA Dam Road and a short stretch of Highway 92. Under Alternative B, the training wall would blend with other concrete elements of the dam and not adversely affect its appearance. Under Revised Alternative B, this previously proposed training wall has been eliminated following additional engineering studies; therefore, there would be no impact to visual resources.

Photo 3.3-3a. View of Cherokee South Main Embankment (Segment C-2 with Temporary Measures) from the TVA Dam Road Parking Area

Photo 3.3-3b. Rendering of a 6.6-foot-tall Floodwall atop Segment C-2 Under Alternative B

Photo 3.3-3c. Rendering of RCC (6.6-feet-tall) atop Segment C-2 under Revised Alternative B

Segment C-3 runs for approximately 1,600 ft from the south end of Segment C-2 to the curve in the access road near the picnic area (Figure 2-3 and Photo 3.3-4a). Under Revised Alternative B, Cherokee Segment C-3 would be raised by approximately 6.6 ft using RCC with an optional guardrail (Photo 3.3-4b). This proposed design would be in keeping with the existing natural setting following construction. Photo 3.3-5a shows the existing conditions at Segment C-3, and Photo 3.3-5b shows a rendering of the Segment under Revised Alternative B. The RCC with the optional guard rail are more pleasant and harmonious with the surrounding environment than the temporary HESCO barriers and the proposed embankment under Alternative B. This alternative would likely include a new pedestrian path along the access roadway, which would reduce visual clutter associated with the intersection of the existing pathway and the roadway. The Alternative B embankment would be much larger than the RCC construction and would constitute more of a visual disturbance in the area. Overall, in this portion of Segment C-3, Revised Alternative B would result in beneficial impacts in comparison to the current conditions and in comparison to Alternative B due to the smaller size of dense physical objects in the immediate viewscape.

Photo 3.3-4a. View of Temporary Measures at Cherokee Segment C-3 (Facing Northeast)

Photo 3.3-4b. Rendering of RCC (6.6-feet-tall) atop Segment C-3 showing optional guardrail under Revised Alternative B

Photo 3.3-5a. View of Temporary Measures at Cherokee Segment C-3 (Facing North-Northeast)

Photo 3.3-5b. Rendering of RCC along Segment C-3 under Revised Alternative B

Revised Alternative B at Segment C-4 would have similar aesthetic consequences as those described for Segment C-3. Photo 3.3-6a shows the existing HESCO barriers at Segment C-4 and Photo 3.3-6b shows a rendering of the Revised Alternative B updated RCC design with optional guard rail, Alternative B proposes an embankment at this location. The viewscape under Revised Alternative B is also less cluttered and has fewer visual obstacles due to the transparency of the guard rail in comparison with the HESCO barriers, and the proposed embankment. Overall, at Segment C-4, the impacts to aesthetics under Revised Alternative B would be minor and beneficial.

Under Revised Alternative B, at Segment C-5, the proposed construction of the RCC/embankment combination would not represent a major change to the visual resources in the area. Realignment of the access road and existing parking area should not adversely impact the aesthetics of the area. The additional earthen embankment on the downstream side would blend in with the current slope of the land. The removal of the HESCO barriers would represent a beneficial impact to the aesthetics of the area in comparison to a new RCC/embankment combination. The RCC/embankment combination would not represent a significant visual difference from the embankment proposed under Alternative B. Although a small amount of the downstream view from the recreation area and the parking lot would likely be obscured, it would represent an insignificant overall impact.

Indirect impacts to visual resources during construction would involve construction vehicles and heavy equipment both staged and in use at the Cherokee Dam recreation area. Increased noise during construction could also impact aesthetics. These impacts would be temporary and short term, however, and would therefore be minor.

Photo 3.3-6a. View of Temporary Measures at South End of Cherokee Segment C-4 (Facing East-Northeast)

Photo 3.3-6b. Rendering of RCC (6.6-feet-tall) at Segment C-4 (near Visitor's Center) under Revised Alternative B

Fort Loudoun Dam

At Fort Loudoun Dam, permanent modifications to Segments FTL-1 and FTL-4 would be in the form of earthen embankments, and Segments FTL-2 and FTL-3 would be modified using a concrete floodwall and RCC, respectively. At Segment FTL-1, adjacent to the parking area by the marina, the proposed 7-ft-tall embankment would result in a minor visual impact during construction. This area is not centrally located, nor is it an attraction. The existing HESCO barriers currently block the view to the north for motorists on City Park Drive. This view would remain blocked by the new embankment under Alternative B; however, an earthen embankment would be much more in keeping with the natural surroundings, much more visually appealing than the existing HESCO barriers. During and immediately following construction, before this embankment has been re-seeded, it would stand out from its surroundings as a large mound of earthen fill material. Once the vegetation has had time to regrow, this embankment would no longer adversely impact visual resources. Although the embankment would be slightly larger under Revised Alternative B, it would not reduce the visual quality of the area relative to Alternative B.

Floodwall segments FTL-2 and RCC segment FTL-3 are dominated visually by the road and bridge and are located in a highly industrial setting that is not readily accessible by foot. Photo 3.3-7a shows the Fort Loudoun Bridge and U.S. Highway 321. Photo 3.3-7b presents a rendering of a 6.8-foot floodwall near the Fort Loudoun Dam, Segment FTL-2. The HESCO barriers under the bridge (portion of FTL-2) are currently stacked two-high, resulting in a 7- to 8-foot-tall wall (Figure 3.3-7a). The height of the proposed permanent floodwall for Segment FTL-2 would be 6.8 feet, the same approximate height as the temporary barriers (Photo 3.3-7b). From the water, the addition of the floodwall would not impose additional industrial characteristics to the view. There would be no significant visual differences between Alternative B and Revised Alternative B.

Under Revised Alternative B, Segment FTL-3 would be modified using approximately 5.8 ft of RCC. Under Alternative B, a floodwall would be constructed at FTL-3. Unlike the floodwall option, which would partially block views of the reservoir for motorists heading east on Tellico Parkway, the RCC option requires that the new bridge be open and traffic re-routed; therefore, under the RCC Revised Alternative B option, Segment FTL-3 would be completely closed to the public. Similarly, following completion of the U.S. Highway 321/SR 95 bridge relocation project (slated for June 2016), both the floodwall and the RCC option would have little effect on visual resources, as this area would be closed to the public. Overall, regardless of the option, the proposed permanent modifications at Segment FTL-3 would have no impact on views of Tellico Reservoir from Highway 444; therefore, the proposed floodwalls/RCC at FTL-2 and FTL-3 would not be expected to result in any significant adverse impacts to visual resources.

Photo 3.3-7a. Photo of Existing Temporary Measures at Segment FTL-2 (Under Bridge)

Photo 3.3-7b. Rendering of a 6.8-foot Floodwall at Fort Loudoun Dam Segment FTL-2

Under Revised Alternative B, embankment Segment FTL-4 (located in a small grassy area located between the new on- and the off-ramps for the U.S. Highway 321 replacement bridge) would be a short section of raised earthen berm built to a height of 5.8 ft and would tie-in to the elevated US 321 roadbed on its east end and to the elevated SR 444 roadbed on its west end. Because the SR 444 roadbed would be elevated during TDOT construction, the access road at the entrance to the Tellico Recreation Area would have to be raised to meet the new grade; this work is considered part of Segment FTL-4. Photo 3.3-8a shows the existing visual attributes of the entrance to the Tellico Recreation Area (directly across from Segment FTL-4). Photo 3.3-8b shows a rendering of the embankment and raised roadway that were previously selected under Alternative B. Photo 3.3-8c shows the Revised Alternative B elevated entrance road as it slopes down to meet existing the existing grade within the recreation area. Under Revised Alternative B, there would be minimal visual disturbance to this area as the portion of new, elevated road would offer better views of the reservoir as visitors enter the recreation area. As opposed to the Alternative B raised roadway which would hamper motorists' downstream views, Revised Alternative B would maintain the view of Tellico Reservoir for motorists traveling on Tellico Parkway near the entrance, and for visitors entering the recreation area as they approach the parking area. Following construction of Revised Alternative B, the trees in the background would also remain visible from the road. This would be considered minor, direct beneficial impact to visual resources because the view of the reservoir from these areas under Alternative B would be more limited.

The removal of the HESCO baskets would be an improvement to the visual experience of this area. Additionally, the RCC/floodwall/embankment combination under Revised Alternative B would represent either no significant visual differences or a minor beneficial impact to visual resources in comparison to Alternative B. As described for FTL-1, there would be minor, temporary adverse impacts to aesthetics during and immediately after construction, before vegetation has regrown. Once this embankment has been re-seeded, it will blend in with the existing surroundings and no longer adversely impact visual resources. Therefore, at FTL-4, the proposed embankment would constitute minor, short-term direct and indirect adverse impacts to visual resources, but long term beneficial impacts.

Photo 3.3-8a. Entrance to Tellico Recreation Area

Photo 3.3-8b. Alternative B Rendering of FTL-4 Embankment and Raised Roadway

Photo 3.3-8c. Revised Alternative B Rendering of FTL-4 Elevated Entrance Road

Watts Bar Dam

Under Revised Alternative B, the Segment WB-3 floodwall (current elevation of 767.0 ft) at Watts Bar Dam would be raised by 1.5 feet in comparison to Alternative B (Figure 2-15). Photo 3.3-9a shows a view of the existing floodwall and HESCO barriers under the bridge at Watts Bar Dam. Photo 3.3-9b presents a rendering of the floodwall raised by 1.5 feet. Alternative B proposes a strengthening of the existing floodwall which would result in no significant visual changes, but would be an improvement over the HESCO barriers. As can be seen in the rendering, there is very little difference visually between the two photos. Although not illustrated, a rendering of Alternative B would be similar to both photos. This floodwall is located underneath the bridge, 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 cooling towers in the background contrasting with the natural scenery. The proposed modification at WB-3 would result in very little change in the appearance of the dam and therefore, would not result in any direct, adverse impacts to visual resources. Indirect impacts to aesthetics during construction due to equipment, vehicles and noise are possible. However, these adverse impacts would be minor and temporary.

Photo 3.3-9a. Existing View of Segment WB-3 Floodwall and HESCO Barriers

Photo 3.3-9b. Rendering of 1.5-ft Height Increase at Segment WB-3 Floodwall

3.4 Recreation

3.4.1 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 Cherokee and Fort Loudoun 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 3.4-1), swimming area with sand beach, a picnic pavilion, playground, and an all-season two-lane boat launching ramp (Photo 3.4-2) and parking lot with space for 86 vehicles with trailers. To the southwest of the boat ramp is a campground open from mid-March through mid-November. The campground contains approximately 42 sites with water and electric hookups, dump stations, 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 3.4-1. Cherokee Dam Recreation Area between Segments C-4 and C-5

Photo 3.4-2. 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. 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 Loudon Marina and Lenoir City Park. Fort Loudon 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.

3.4.2 Environmental Consequences: Revised Alternative B – Combination Floodwalls, Embankments, and RCC

This section contains an analysis of potential direct and indirect impacts on recreation that could occur under Revised Alternative B in comparison to those under the preferred Alternative B previously selected. Under Revised Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls, earthen embankments, and RCC.

Cherokee Dam

HESCO barriers would be replaced with RCC at Segments C-1 through C-4, and a RCC-embankment combination would be used to permanently modify Segment C-5. The north portion of the main embankment (Segment C-1) has no recreational facilities and relatively little public use; therefore, negligible direct and indirect impacts to recreation in the area of Segment C-1 would be anticipated.

At Segments C-2, C-3, and C-4 several recreational facilities and activities would be temporarily adversely impacted by Revised Alternative B. As described in Section 3.2.2.1, road access to these areas from TVA Parkway would be closed for about 45 days in late summer/early fall. These areas include the visitors/restroom building, swimming beach, picnic area, and overlook areas. Some of these areas, such as the beach and picnic area, would likely be accessible during some of the closure period by visitors entering the reservation on Renfro Road and walking from the boat ramp parking lot or the large gravel area on the northwest side of the campground. The boat ramp and campground would remain open and accessible, although construction traffic would travel on Renfro Road during part of the construction period. Additionally, due to the use of the parking lots as staging areas during this time, parking for both boat ramp visitors and other recreational users could be limited.

The parking area on the downstream side near the northern end of Segment C-3 would be permanently closed. This parking area contains spaces for 60 vehicles. It is, however, lightly used, even on summer weekends, and its closure is not anticipated to adversely affect general recreation use of the area. Due to the loss of other parking during the construction period, the closure of this lot could constitute a moderate temporary adverse direct impact to recreation at

Cherokee Dam. However, as this lot is generally lightly used, when construction is complete there should be no permanent impacts to parking due to the closure of this lot. Similarly, the parking area at the south end of Segment C-3 would be temporarily closed during construction, and would permanently lose approximately two parking spaces due to the need for the RCC to be sloped to meet the existing grade of the parking lot.

The walking trail along the main south embankment would likely be closed for several months for the construction of Segment C-2. Other trails on the reservation are likely to remain accessible, but as described in Section 3.12 and 3.14 of the FEIS (TVA 2013), there would 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. Therefore, although potentially accessible by foot, lack of parking may temporarily directly impact all of the trails near Segment C-2.

The area in and around the boat ramp parking lot would also be impacted by construction; this is not likely to directly negatively impact the boat ramp, but would limit the availability of parking spaces and contribute to noise and visual disturbance during construction activities. During construction, additional indirect impacts would 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 to significant short-term adverse impacts to recreation would occur at Cherokee Dam due to inaccessibility of some recreational areas and parking lots during construction. Minor indirect negative impacts to recreation would include noise and visual disturbance and the presence of heavy equipment on roads during construction. A positive direct impact would be the return of the entire Cherokee Dam recreational area to ADA-accessible status after the completion of the updated permanent modifications. Additionally, the raised RCC and walkway proposed under Revised Alternative B along Segment C-2 would improve the recreational experience in comparison to the floodwall proposed under the previously selected Alternative B.

Fort Loudoun Dam

Construction of the Segment FTL-1 earthen embankment would result in the total closure of City Park Drive for approximately 12 days and the closure of the west-bound lane for a longer time period. This closure would not affect traffic to Fort Loudon Marina. As described in Section 3.3.2.1, it would inconvenience traffic travelling on City Park Drive from the west to Lenoir City Park; however, Martel Road runs parallel to City Park Drive, approximately 0.5 miles to the northwest, and would remain open and available to accommodate detour traffic. Recreation users of Fort Loudon Marina and, to a lesser degree, Lenoir City Park could be indirectly impacted by noise and visual disturbances from construction. These impacts are expected to be minor and short-term.

Construction of the FTL-2 floodwall and FTL-3 RCC segment would have little impact on recreation users aside from the small potential for increased traffic congestion described in Section 3.2.2.1. The construction of the FTL-4-related raised roadway at the entrance to the Tellico Recreation Area near the Tellico canal, including the canal fishing access, restrooms, large boat ramp, walking trail, swimming beach, and day use area, would be closed to all vehicle traffic for a 30-45 day period. This closure would likely occur during the heavily used late summer-early fall period. The resulting impacts would be significant and adverse for the duration of the area closure. Once the area is reopened, recreation users would continue to be inconvenienced by construction traffic, noise, and visual disturbance for the remainder of the

construction period. Additionally, although the boat ramp would be reopened, the boat ramp parking area is a proposed staging area, so parking may be limited with respect to boat ramp use. The permanent closure of the northern entry to the Tellico restroom building and fishing access parking area would have little long-term impact on recreation users as the southwest entrance road to the parking would be reopened as soon as construction is completed.

Other public recreation facilities in the vicinity that offer free boat launching are illustrated in Figure 3.4-1. The distance by road from the Tellico canal ramp to these other facilities ranges from about 1 mile for the boat ramp downstream of Tellico Dam to 8.4 miles for the Millers Landing Ramp. Note that the boat ramp downstream of Tellico Dam provides access to the upper end of Watts Bar Reservoir and the Fort Loudoun tailwater; to access Fort Loudoun and/or Tellico reservoirs after launching from this ramp, a boater would have to pass through the Fort Loudoun lock. These boat ramps could provide alternative launch sites for boaters displaced by the closure of the Tellico recreation area. The closure of the boat ramp and the necessity of using another in the area would represent a minor temporary direct adverse impact to recreation at the Tellico Dam reservoir.

Overall, although direct and indirect adverse impacts to recreation are likely at Fort Loudoun Dam, they would be similar under both Alternative B and Revised Alternative B.

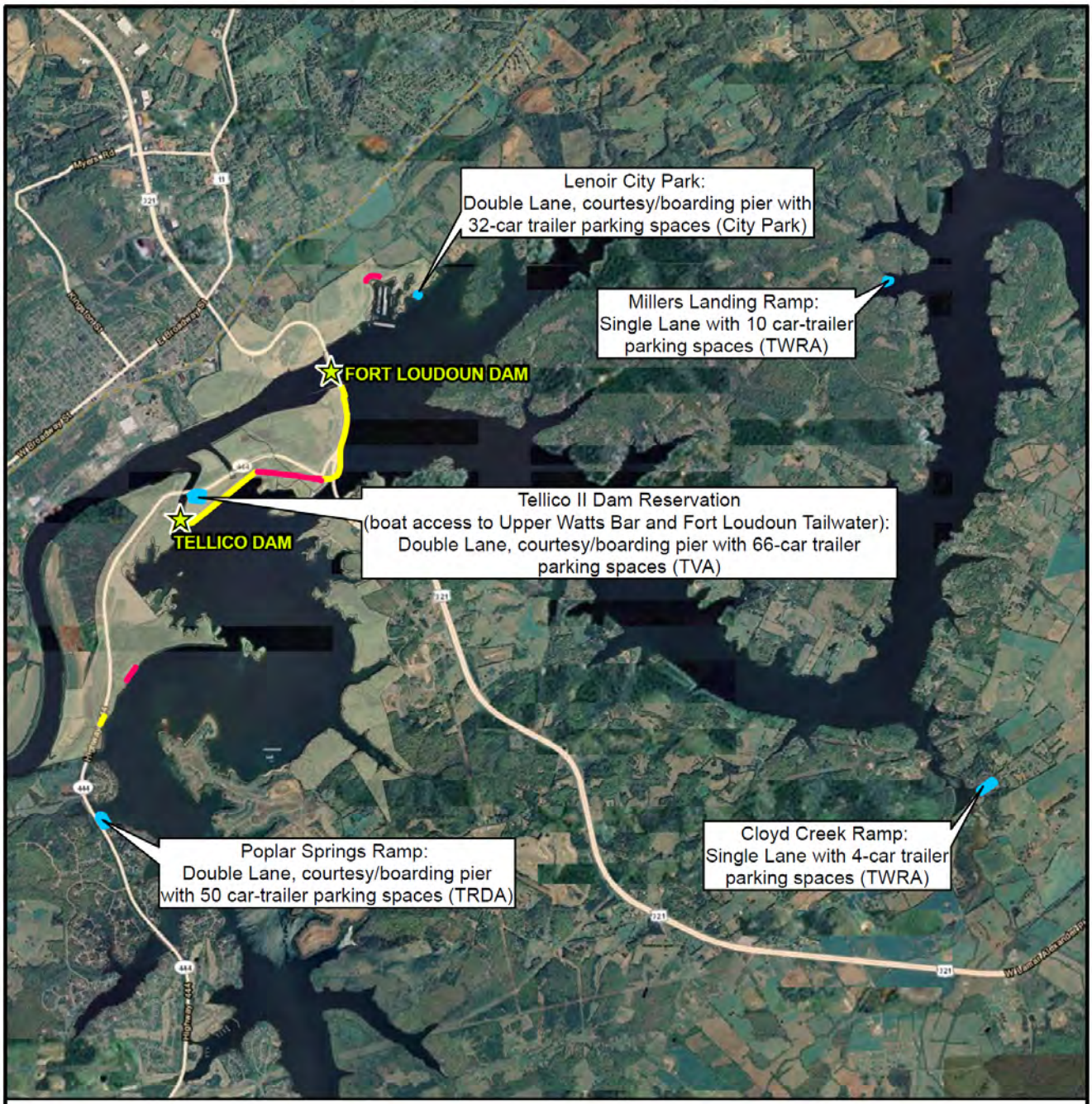

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Figure 3.4-1
Fort Loudoun and Tellico Dams
Public Boat Ramp Locations

Tennessee Valley Authority

3.5 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.

3.5.1 Affected Environment

Flood Risk

As the Federal agency responsible for the operation of numerous dams, and consistent with the Federal Guidelines for Dam Safety (FEMA 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. 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 of the FEIS, 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 of the FEIS.

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 plants would be catastrophic (Figure 3.5-1).

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. As discussed in the FEIS, TVA must develop and implement permanent dam safety modifications to replace the temporary measures at the four dams.

Traffic/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.

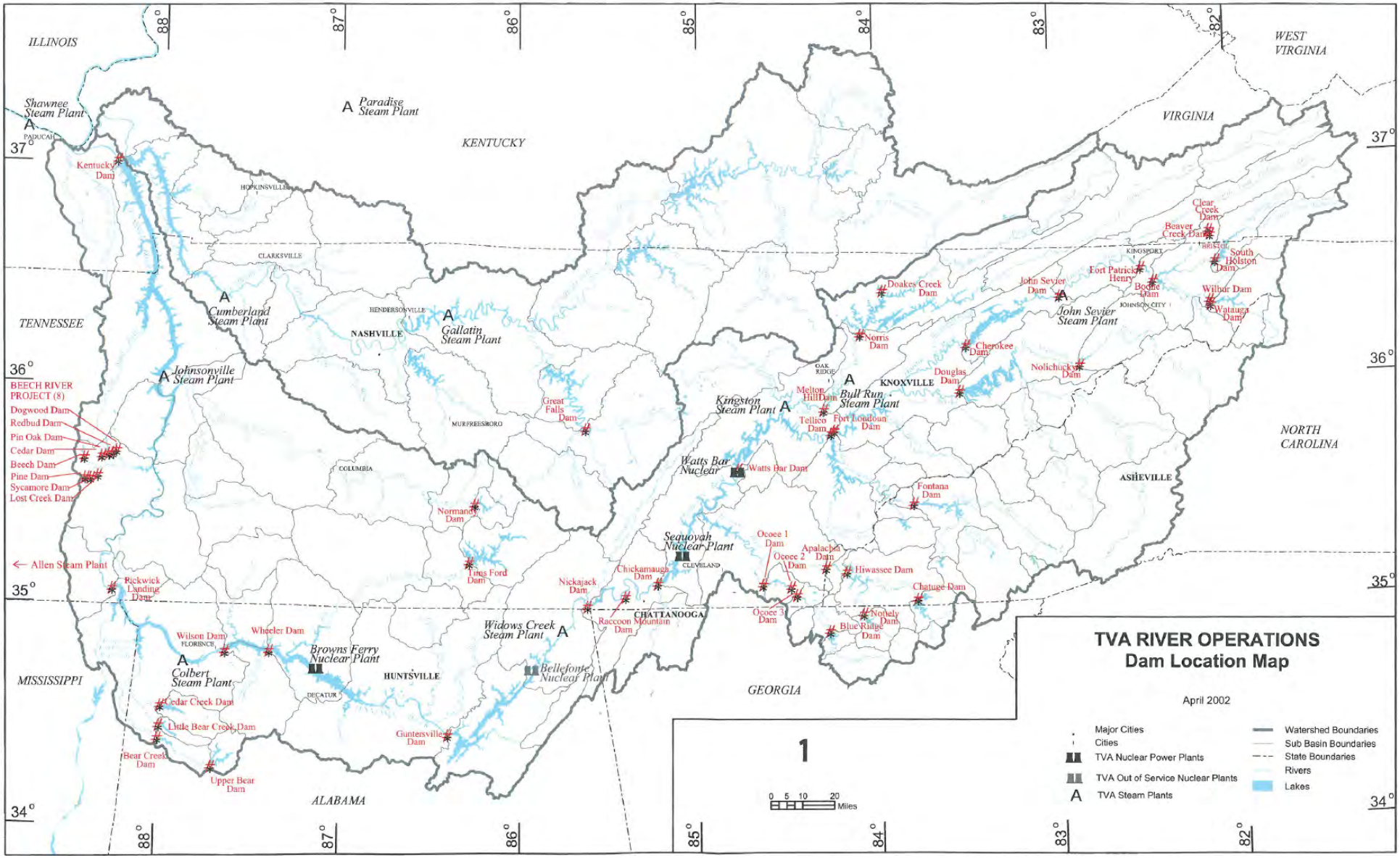

Figure 3.5-1. Locations of the Four Dams and Three Nuclear Plants in the Tennessee Valley

3.5.2 Environmental Consequences: Revised Alternative B – Combination Floodwalls, Embankments, and RCC

This section contains and analysis of potential impacts to public safety under Revised Alternative B.

Flood Risk

Under Revised Alternative B, the HESCO barriers would be replaced with either floodwalls, embankments, or RCC. These permanent structures are far more stable and durable than the existing, temporary barriers. Debris that would likely be associated with a PMF event would not be expected to breach any of these permanent modification types. The likelihood of the dams being overtopped 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 Revised Alternative B, construction activities at Cherokee and Fort Loudoun dams could contribute to impacts to public safety on roads in or near the project areas. Construction equipment would be traveling to and from the sites on a daily basis during the construction period. As described above in Section 3.2, lane closures and other disruptions could occur. Although TVA would follow all traffic regulations and have safety procedures in place, Revised Alternative B could result in a moderate temporary impact to public safety on roads in the project areas at Cherokee and Fort Loudoun dams; due to the delay in construction of Fort Loudoun Segment FTL-3 until traffic is relocated to the new US 321 bridge, these impacts would be somewhat less those described for the previously selected Alternative B.

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 the Cherokee and Fort Loudoun 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 workplace 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 of the FEIS. 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 activities 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 at Cherokee and Fort Loudoun Dams under Revised Alternative B and similar to those under Alternative B.

3.6 Relationship of Short-Term Uses and Long-Term Productivity

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 Revised Alternative B. 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: transportation, visual resources, recreation, and public safety. However, these impacts would be short-term, lasting only the duration of the construction activities.

Implementation of either Alternative B or Revised Alternative B would result in beneficial long-term impacts. However, based on the revised dam heights at Fort Loudoun and Watts Bar, only Revised Alternative B 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.

3.7 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.

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 Revised Alternative B as fewer (if any) berms would be constructed under this alternative; however, additional building materials (including concrete for floodwalls and RCC) would be utilized instead.

CHAPTER 4 - CUMULATIVE IMPACTS

4.1 Introduction

Cumulative impacts are defined as the effects of the proposed permanent dam safety modifications when considered together with other past, present, and reasonably foreseeable future actions. Chapter 3, Affected Environment and Environmental Consequences, presents information about past and present environmental conditions, as well as future trends where appropriate. This chapter addresses the cumulative impacts of the proposed permanent dam safety modifications and other reasonably foreseeable actions in the vicinity.

One ongoing project has been identified in the project area that would have the potential of causing cumulative impacts in conjunction with the construction of Alternative B (combination of floodwalls and embankments) or Revised Alternative B (combination of floodwalls, embankments, and RCC) – this project is the TDOT U.S. Highway 321 rerouting and widening project.

A project to widen and divert traffic along an approximately 1.2-mile stretch of U.S. Highway 321 between Lenoir City (beginning approximately 0.2 miles west of the U.S. Highway 11 intersection) and the Tellico Canal began in July 2012. The highway is being widened from two lanes to four lanes to relieve traffic congestion and improve safety. As part of the highway project, the J. Carmichael Greer Bridge over Fort Loudoun Dam is scheduled to be replaced by a new, 1,400-foot-long, four-lane bridge over the Tennessee River located about 2,000 feet downstream (west) of Fort Loudoun Dam (Figure 4-1). The current bridge over the dam will be permanently closed to the public once the replacement bridge is completed. In association with the U.S. Highway 321 construction, the roadway between the J. Carmichael Greer Bridge and the bridge over the Tellico Canal to the southeast is being reconfigured. Water, sewer, gas, electric, phone, and cable lines are also being relocated within the construction area. A new two-lane bridge is scheduled to be constructed over the Tellico Canal adjacent to the current bridge. The existing two-lane bridge over the Tellico Canal will service traffic flow in one direction along U.S. Highway 321 while the new bridge over the canal will service traffic flow in the opposite direction. Significant long-term lane closures are not anticipated with this project as most construction is occurring in areas where no roadways are currently present and would ultimately connect with existing roadways. Short-term disruptions, including short-term lane closures, may occur when the new and existing roadways are joined. As a result of the rerouting process, increased traffic congestion is possible at the time of connection. The widening and diversion of U.S. Highway 321 is scheduled to be completed in June 2016.

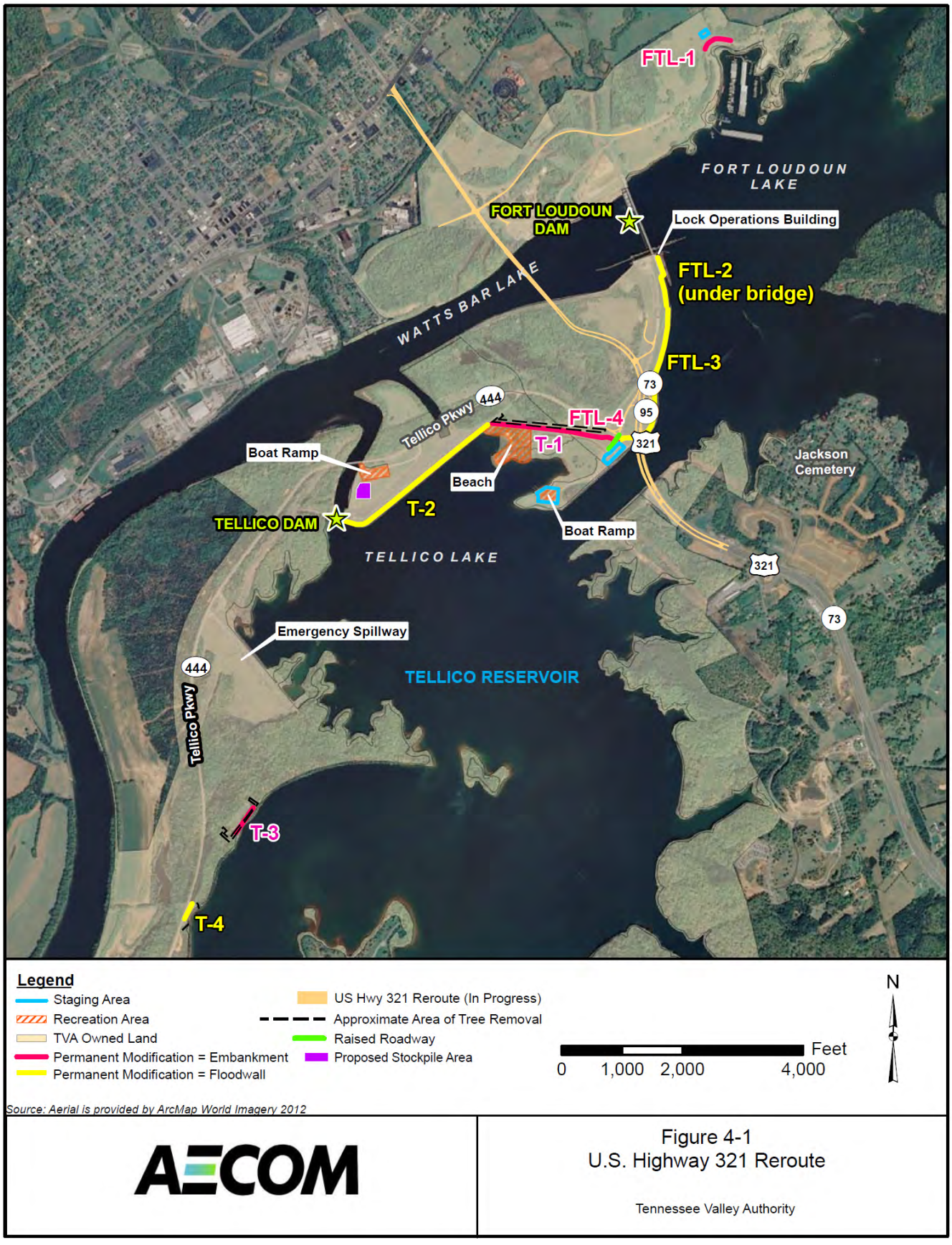

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Figure 4-1
U.S. Highway 321 Reroute

Tennessee Valley Authority

There would be very minor (if any) direct and indirect cumulative impacts as a result of the construction of the U.S. Highway 321 rerouting and widening project and the proposed permanent dam safety modifications (either Alternative B or Revised Alternative B) for the following resource areas at Fort Loudoun and Tellico dams: geology and soils, water resources, flooding and floodplains, wetlands, aquatic ecology, terrestrial ecology, threatened and endangered species, land use, environmental justice, socioeconomics, cultural resources, and air quality and greenhouse gas (GHG) emissions. Because of the absence or insignificance of potential cumulative impacts, those resource areas are not addressed further under the cumulative impacts analysis discussion. However, cumulative impacts are possible for transportation and public safety, which are discussed below.

Because of the location of the U.S. Highway 321 project (Figure 4-1), there would be no potential cumulative impacts in association with that project and the construction of the proposed permanent dam safety modifications at either Cherokee or Watts Bar Dams, and there are no other actions in the vicinity of these two dams that potentially would result in cumulative impacts.

4.2 Transportation

Short-term, adverse cumulative impacts to transportation along U.S. Highway 321, Tellico Parkway, the TVA Service Road, and the unnamed recreation area roads would occur as a result of the simultaneous nature of the U.S. Highway 321 rerouting and widening project (currently ongoing) and the construction of the proposed permanent dam safety modifications at Fort Loudoun Dam. The majority of the U.S. Highway 321 project construction is taking place in areas where there are no existing roads. As the construction nears completion, a new road will connect the existing highway and minor roads. At the time of connection, increased traffic congestion is possible as a result of the rerouting process, including possible lane closures. Segments FTL-2, FTL-3, FTL-4 and T-1, and the elevated portion of the Tellico Recreation Area access road would fall within the construction area for the U.S. Highway 321 rerouting project (Figure 4-1). This could result in potential cumulative impacts; however, the Bridge Replacement Project began two years ago and as a result, reduced speed limits have already been posted within construction work zones along the potentially affected roadways. In addition, construction signs have been posted to caution drivers of the construction activities and potential impacts to traffic; therefore, the cumulative effects of the permanent dam safety work at Fort Loudoun Dam could include short-term lane closures and increases in traffic congestion, but these impacts would be minimal since motorists in the project area have already been subjected to the similar impacts from the Bridge Replacement project. These impacts would be temporary, but potentially significant, given the current high traffic volume along U.S. Highway 321.

TVA proposes to begin construction of Fort Loudoun Segment FTL-3 after the Highway 321 project is complete, pending a deadline extension from NRC. If this were to occur, no cumulative impacts to traffic or traffic safety would occur as the two projects would no longer be happening concurrently. If the extension is granted, it is expected that potential dam segment repairs could proceed with fewer impediments following the conclusion of the U.S. Highway 321 rerouting project. Segments FTL-2 and FTL-3 are located under and on top of the existing bridge, respectively, and since the work at FTL-3 would not occur until the existing bridge is permanently closed, no lane closures would be required along the highway. However, the necessity for maintenance of the HESCO barriers during the Highway 321 project could require short term lane closures. Therefore, cumulative impacts to transportation in association with the U.S. Highway 321 project would be short-term, localized, and unlikely to reach significant levels. If the extension is not granted, in order to avoid the potential for significant cumulative impacts

to transportation, TVA could coordinate with TDOT during this rerouting process and schedule work to minimize or avoid cumulative impacts. Over the longer term, following the completion of construction, the U.S. Highway 321 project should improve traffic conditions in the project area, resulting in beneficial long-term impacts. Overall, direct and indirect cumulative impacts under Alternative B and Revised Alternative B would be similar.

4.3 Public Safety

Potential adverse impacts to public safety are possible as a result of construction of either Alternative B or Revised Alternative B and the U.S. Highway 321 project. These impacts would be associated primarily with the increased risk of traffic accidents as a result of greater congestion and altered road conditions in the construction zones. Lane closures, detours, and traffic hazards associated with proximity to construction equipment could contribute to driver distractions, increased stress, and corresponding increases in traffic accidents. Safety risks, including potentially significant impacts such as serious injury or loss of life, could also occur if access to construction areas and equipment is not properly restricted. However, BMPs would be utilized by construction crews to minimize potential risks to public safety, and construction-related risks to public safety would be temporary. Overall, the potential for cumulative impacts to public safety from the proposed permanent dam safety modifications, in conjunction with the U.S. Highway 321 project, would be limited by established safety procedures and planning, and impacts on public safety during the construction period are not expected to be significant.

TVA proposes to begin construction of Fort Loudoun Segment FTL-3 after the Highway 321 project is complete, pending a deadline extension from NRC. If this were to occur, no cumulative impacts to public safety due to traffic hazards are anticipated, as traffic would not be present on the highway adjacent to FTL-3 after the highway is re-routed.

Following completion of both the proposed permanent dam safety modifications and the U.S. Highway 321 project, there would be a cumulative beneficial impact to public safety. Completion of the permanent dam modifications would result in increased safety for individuals living in the vicinity and downstream of the dams as a result of the reduction in flood risk and corresponding reduction in risk to the nuclear facilities, and in conjunction with this beneficial impact on the safety of the public in the vicinity, the completion of the U.S. Highway 321 project would result in increased traffic safety as a result of the widened road. These beneficial impacts would be both significant and long-term. Overall, direct and indirect cumulative impacts under Alternative B and Revised Alternative B would be similar.

CHAPTER 5 - LIST OF PREPARERS

This chapter lists only those individuals who contributed to the preparation of this Supplemental Analysis. A list of preparers of the Draft and Final EIS can be found in the FEIS (TVA 2013).

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Involvement:	Visual Resources (renderings)

CHAPTER 6 - SUPPLEMENTAL ANALYSIS RECIPIENTS

6.1 Federal Agencies

Army Corps of Engineers, Nashville District

Army Corps of Engineers, Nashville Regulatory Branch

Department of Agriculture, Natural Resource Conservation Service

Nuclear Regulatory Commission

Department of the Interior

Environmental Protection Agency, Region 4

Fish and Wildlife Service, Cookeville, Tennessee

Forest Service, Cherokee National Forest

6.2 Federally Recognized Tribes

Cherokee Nation

Eastern Band of Cherokee Indians

United Keetoowah Band of Cherokee Indians in Oklahoma

The Chickasaw Nation

Muscogee (Creek) Nation of Oklahoma

Alabama-Coushatta Tribe of Texas

Alabama-Quassarte Tribal Town

Kialegee Tribal Town

Thlopthlocco Tribal Town

Seminole Tribe of Florida

Absentee Shawnee Tribe of Oklahoma

Eastern Shawnee Tribe of Oklahoma

Shawnee Tribe

6.3 State Agencies

Tennessee Department of Environment and Conservation

- Division of Water Pollution Control
- Division of Air Pollution Control
- Division of Natural Heritage
- Division of Ground Water Protection
- Division of Water Supply
- Division of Solid Water Management

Department of Economic and Community Development

Department of Transportation

Tennessee Historical Commission

Tennessee Wildlife Resources Agency

Tennessee Emergency Management Agency

East Tennessee Development District

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Pettit, Susan
Popovich, Steve, Loudon, TN
Prince, Janet, Louisville, TN
Proaps, Byron, Lenoir City, TN
Proud, James, Loudon, TN
Provart, Patricaa, Loudon, TN
Purvis, Clarence, Loudon, TN
Rafferty, Mary Ann, Homeowners Association of Tellico Village, TN
Raft, Peter, Loudon, TN
Ranaudo, Richard, Loudon, TN
Reller, William, Loudon, TN
Richards, Rosalie, Loudon, TN
Riggleman, Martha, Loudon, TN
Roberts, Al, President, Tellico Village Townhouse Association, Loudon, TN
Roberts, Jack, Loudon, TN
Roberts, Linda, Loudon, TN
Roberts, Sue, Loudon, TN
Rueth, David, Loudon, TN
Russell, Dennis, Loudon, TN
Russell, Warren and Carole, Loudon, TN
Sawinski, Richard, Homeowners Association of Tellico Village, Loudon, TN
Schiller, Ceree, Loudon, TN
Schins, Guillaume, Loudon, TN
Schmidt, H., Loudon, TN
Schmidt, Janet, Loudon, TN
Sciarretta, Debra, Loudon, TN
Sciarretta, Richard, Loudon, TN
Sech, Stan, Loudon, TN
Shanahan, Edith, Lenoir City, TN
Sheffer, Julie, Loudon, TN
Sheldon, Kay, Loudon, TN
Silvis, Ann, Loudon, TN
Sinner, Ronald, Loudon, TN
Smith, Brad, Jackson Bend Homeowners Association, Louisville, TN
Smith, DJ, Loudon, TN
Smith, ME, Loudon, TN
Spaeth, Jeanne and Don, Loudon, TN
Sponholz, Liz, Loudon, TN
Sprich, Dan, Loudon, TN
Staas, George, Loudon, TN
Stanczuk, Dennis, Homeowners Association of Tellico Village, Loudon, TN
Strasser, Betsy, Loudon, TN
Stridiron, Karen, Loudon, TN
Struttmann, Larry, Loudon, TN
Swicegood, Tom, Town of Louisville, Town Engineer, Louisville, TN
Tarr, Mr. and Mrs. Henry, Loudon, TN
Tinder, Sue
Tingle, Rob, Louisville, TN
Tomasko, Ronald, Loudon, TN
Treece, Ken, Loudon, TN
Tuck, John, Tellico Realty and Auction Company, Lenoir City, TN
Twesme, David, Loudon, TN
Valenzo, Tom, Loudon, TN
Vasicek, Ronald, Loudon, TN
Vietor, Gene, Loudon, TN
Visconti, Gerald, Loudon, TN
Visconti, Penny, Loudon, TN

Vreeland, James, Loudon, TN
Vreeland, Pandora, Loudon, TN
Wager, James, Loudon, TN
Wainwright, John, Loudon, TN
Waldrop, W. R., Loudon, TN
Waldrop, William, Loudon, TN
Walker, Charles, Loudon, TN
Weaver, John, Loudon, TN
Webb, Linda, Louisville
Weber, Gene, Loudon, TN
Wendoloski, Ronald, Loudon TN
Werner, Mark, Homeowners Association of Tellico Village, Loudon, TN
Wielgos, Dennis, Tellico Village Property Owners Association, Loudon, TN
Wiggins, Robert, Loudon, TN
Willer, Elizabeth, Loudon, TN
Williams, Alden, Loudon, TN
Willis, Helen, Loudon, TN
Wilson, Jean, Loudon, TN
Wood, Ken, Loudon, TN
Wright, Will, Tellico Village, TN

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APPENDIX A
CONSULTATION CORRESPONDENCE

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

March 17, 2014

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Pike
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), WATTS BAR DAM MODIFICATIONS, MEIGS AND RHEA COUNTY, TENNESSEE

In a letter dated September 29, 2011, your office concurred with TVA's finding of no adverse effect for proposed permanent dam safety modifications at Cherokee, Fort Loudoun, Tellico and Watts Bar Dams. TVA determined, in consultation with your office, Watts Bar Dam eligible for the National Register of Historic Places (NRHP) under Criterion A for its 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 and Criterion C as a representative example of TVA's interpretation of early Modern architecture. TVA is now proposing to increase the height of the ca. 1985 eastern floodwall by 1.5'. This extension will consist of steel reinforced concrete that will be connected to the existing floodwall with steel dowels.

Because the proposed actions are limited to the existing dam, the undertaking has no potential of affect archaeological resources. TVA identified the area of potential effects to be the area within the Watts Bar National Register boundary and those areas that have a direct line of sight to the project. TVA contracted with Tennessee Valley Archaeological Research (TVAR) to assess the modifications to the dam. Please find enclosed a copy of TVAR's draft report titled, *Phase I Architectural Assessment of the Proposed Improvements to the TVA Watts Bar Dam, Meigs and Rhea Counties, Tennessee.*

TVA has reviewed the report and agrees with the following findings and recommendations:

- The survey identified no previously unrecorded architectural resources.
- Watts Bar Dam retains sufficient integrity to remain eligible for the NRHP.
- The proposed 1.5' increase to the eastern floodwall will not compromise the integrity of Watts Bar Dam or diminish its architectural and historical significance.

Therefore TVA finds the additional modifications will have no adverse effect to historic properties. Pursuant to 36 CFR 800, TVA is seeking your concurrence with TVA's finding of no adverse effect for the proposed undertaking.

Mr. E. Patrick McIntyre, Jr.
Page Two
March 17, 2014

Should you have any questions or comments, please contact Marianne Shuler in Knoxville, Tennessee, at (865) 632-2464 or mmshuler@tva.gov.

Sincerely,

Clinton E. Jones
Manager
Biological and Cultural Compliance, Environment

Enclosures
cc (Enclosures):
Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, TN 37210

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37214
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

March 26, 2014

Mr. Clinton E. Jones
Tennessee Valley Authority
400 W. Summet Hill Dr.
Knoxville, Tennessee, 37902-1499

RE: TVA, WATTS BAR DAM MODIFICATIONS, RHEA, MEIGS COUNTY

Dear Mr. Jones:

In response to your request, received on Tuesday, March 18, 2014, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at http://www.tennessee.gov/environment/hist/federal/sect106.shtml

Considering available information, we find that the project as currently proposed will NOT ADVERSELY AFFECT ANY PROPERTY THAT IS ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES. Therefore, this office has no objection to the implementation of this project. Please direct questions and comments to Joe Garrison (615) 532-1550-103.

We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

May 29, 2014

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Pike
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), FORT LOUDOUN DAM MODIFICATIONS, LOUDON COUNTY, TENNESSEE

In a letter dated September 29, 2011, your office concurred with TVA's finding of no adverse effect for proposed permanent dam safety modifications at Cherokee, Fort Loudoun, Tellico and Watts Bar Dams. TVA determined, in consultation with your office, Fort Loudoun Dam is eligible for the National Register of Historic Places (NRHP) under Criterion A for its 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 and Criterion C as a representative example of TVA's interpretation of early modern architecture.

In 2011, the undertaking involved three proposed flood wall modifications at Fort Loudoun Dam. Your office concurred with our findings that the modifications would be largely outside of the visual line-of-sight to the dam and that the low profile of the proposed floodwalls (4 feet tall) would not compromise the integrity of the dam or diminish its architectural or historical significance. TVA is currently proposing to increase the height of the three originally proposed floodwalls. Floodwall 1 would be approximately 7 feet tall and floodwall #2 and #3 would be approximately 6.8 feet tall. In addition, one new floodwall is proposed (Figure 4) that would be approximately 5.8 feet tall and approximately 205 feet long.

TVA finds that the proposed undertaking would have no potential to affect archaeological resources due to the fact that the proposed modifications would be installed on ground previously disturbed by dam and road construction.

TVA identified the area of potential effects (APE) for direct effects to historic structures to be the area within the Fort Loudoun Dam National Register boundary. TVA contracted with Tennessee Valley Archaeological Research (TVAR) to evaluate the eligibility of and assess the effects to Fort Loudoun Dam. Please find enclosed a copy of TVAR's draft report titled, *Phase I Architectural Assessment For Proposed Flood Control Improvements to Fort Loudoun Dam, Loudon County, Tennessee*. The four segments are not located on Fort Loudoun Dam proper and are largely outside the visual line-of-sight to the structure. Considering the profile of the proposed floodwall, TVA finds that the floodwall would not compromise the integrity of Fort

Mr. E. Patrick McIntyre, Jr.
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May 29, 2014

Loudoun Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP.

TVA has reviewed the enclosed report and has determined that:

- Fort Loudoun Dam retains sufficient integrity to remain eligible for the NRHP.
- The proposed undertaking would not adversely affect Fort Loudoun Dam.

Pursuant to 36 CFR 800, we are seeking your concurrence with TVA's findings and recommendations that no historic properties would be adversely affected by the proposed undertaking.

Should you have any questions or comments, please contact Marianne Shuler in Knoxville, Tennessee, at (865) 632-2464 or mmshuler@tva.gov.

Sincerely,

Clinton E. Jones, Manager
Biological and Cultural Compliance
Environment

Enclosures
cc: Ms. Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210