Boone Dam Seepage Remediation

SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

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Boone Dam Seepage Remediation

Supplemental Environmental Assessment

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LIST OF ACRONYMS

Acronym	Definition
AADT	Average Annual Daily Traffic
APE	Area of Potential Effect
BMP	best management practices
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HUC	Hydrologic Unit Code
IRRM	Interim Risk Reduction Measure
mgd	million gallons per day
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PA	Programmatic Agreement
PCB	polychlorinated biphenyls
RLMP	Reservoir Land Management Plan
RM	river mile
ROS	Reservoir Operations Study
SHPO	State Historic Preservation Officer
SR	State Route
SWPPP	Stormwater Pollution Prevention Plan
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

CHAPTER 1 – PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

In January 2016, the Tennessee Valley Authority (TVA) completed an environmental assessment (EA) considering its proposal to address and remediate seepage occurring at TVA's Boone Dam, which is a multipurpose dam on the South Fork Holston River on the border between Sullivan and Washington Counties in upper East Tennessee. The 2016 EA concluded that TVA's proposal to construct a composite seepage barrier along the crest of the dam embankment and the associated construction activities on TVA's reservation and adjoining TVA lands would not result in significant environmental impacts.

Since 2016, TVA has made considerable progress in constructing the barrier and remediating seepage at the dam. Grouting along the embankment has been completed, and TVA is preparing to begin the final stages of the project, which entails constructing a concrete cutoff wall along and into the dam's earthen embankment.

In 2018, TVA hired a construction contractor to implement the final stages of the project, and the contractor has made recommendations related to construction actions and use of the construction area. These recommendations would require minor changes to TVA's original construction plan, reviewed in the 2016 EA. In addition, over the course of the project, several factors have arisen that have led TVA to reconsider certain actions planned for the final stages of construction. Based on these considerations, TVA proposes to change several actions described and analyzed in the 2016 EA, including changes to:

- Restoration of the dam's crest after construction of the cutoff wall is complete;
- Use of the Earl Light Tract as a construction support area; and
- Disposal of construction spoil and rock.

The contractor has provided additional information detailing how the construction zone at the dam would be utilized during cutoff wall construction, how wastes would be managed, and what facilities would be required during construction operations.

TVA has prepared this supplement to the 2016 EA to address both the changes to the original proposal as well as new information relating to the proposed action. TVA will consider the impacts associated with the changes within the project area and will review the new information to determine whether this information alters any of the 2016 EA's analysis.

1.1 BACKGROUND

TVA's Boone Dam is a multi-purpose dam on the South Fork Holston River, on the border between Sullivan and Washington Counties in Tennessee. Completed in 1952, the dam is 160 feet high and stretches 1,697 feet across the South Fork Holston River, impounding the 4,500-acre Boone Reservoir and providing a winter flood storage capacity of 81,580 acre-feet.

In October 2014, a small sinkhole and seepage was discovered at the base of the dam that indicates a potential risk to the integrity of a section of the dam's earthen embankment. TVA responded to the discovery by taking immediate interim risk reduction measures (IRRMs) for the protection of public safety. These measures included repairing the small sinkhole, constructing a tailrace filter to minimize further deterioration of the dam, closing the dam reservation (areas managed for the purpose of supporting operation and maintenance of the dam and associated infrastructure) to the public, installing a network of sensors to monitor the dam, and lowering the pool elevation to between 1,350 and 1,355 feet, which is roughly 10 feet below normal winter pool levels. As part of the IRRMs, TVA also began interim operations at Boone Dam that included lower reservoir levels, limited seasonal reservoir pool fluctuation, modified releases into the tailwater for hydropower generation, 24-hour inspection, and modified flood control operations. The change in operations was integral to the continued operation of the dam. TVA also promptly began a detailed study of the cause of the seepage and potential alternatives for remediation of Boone Dam.

In 2015, after extensive investigation, TVA initiated an environmental assessment (EA) to review its proposal to remediate the seepage of water at Boone Dam by constructing a composite seepage barrier descending from or near the crest of the dam embankment into the foundation soils, epikarst, and underlying bedrock beneath the dam. The composite seepage barrier would be constructed in stages and consist of extensive injected grout columns as well as an excavated and filled concrete diaphragm wall. The composite seepage barrier would reduce movement of water through the dam's foundation and underlying bedrock, and would make the reoccurrence of seepage connection from the reservoir unlikely. The EA also addressed the extended reservoir drawdown during the 5 to 7 year project timeframe. TVA issued the Final EA and Finding of No Significant Impact (FONSI) in January 2016; these documents are incorporated herein by reference.

As described in the 2016 EA, TVA planned to construct the barrier in a three stage process. In the first two stages, TVA would construct a grout curtain into the dam's soils, epikarst and underlying bedrock by drilling through the dam's earthen embankment deep into the foundation soils and bedrock to target the weathered rock and soil interface. Grout (composed of concrete with sand gravel and admix, and water) would be injected under controlled pressures and flow rates into numerous holes drilled in a line along the crest of the embankment. The linear grouting injections and columns were to form a vertical curtain beneath and within the dam's embankment.

TVA has completed this grouting program and, based on recent investigation, determined that the grouting has performed as desired. During these grouting activities, TVA conducted activities as initially planned on two nearby TVA parcels to support construction.

In stage 3, which TVA has yet to initiate, a concrete diaphragm wall would be constructed along the same alignment as the grouting by excavating deep trenches into the dam's embankment into which concrete would be poured. The wall would be constructed by excavating overlapping elements into the dam's embankment, wherein concrete would be placed. Ultimately, the wall would further reduce movement of water through the dam's foundation and epikarst. In the 2016

EA, TVA explained that a variety of construction activities would be implemented during the project.

TVA continues to maintain the current reservoir water levels of Boone Reservoir between 1350 and 1355 feet elevation; these water levels will be maintained for the remainder of the project, except under special conditions or extreme rain events or to conduct testing.

1.2 PURPOSE AND NEED FOR ACTION

The purpose and need for the proposed actions remains the same as those defined by TVA in its 2016 EA. The proposed changes to TVA's initial proposal are intended to maximize efficiencies, reduce impacts to the public and environment, and ensure future maintenance of the dam.

The project will address the risk to public safety and welfare posed by seepage flows occurring under the Boone Dam, as well as the instability of the dam's earthen embankment. In fulfillment of TVA's statutory mission, the proposal would allow TVA to return the Boone Dam and reservoir to normal operations. The need for the action arises from the ongoing seepage flows of water and sediment beneath the dam which undermine the foundation of the embankment dam. If left unaddressed, continued internal erosion may lead to an eventual breach of the dam. These measures would remediate the seepage and allow TVA to continue safe operation of the dam for flood control, water supply, hydroelectric power, and recreation both in the reservoir and in the dam's tailwaters. Although dam failure is unlikely given the measures taken by TVA, the continued safety of the communities downstream of Boone Dam is TVA's paramount concern.

1.3 RELATED ENVIRONMENTAL REVIEWS

In addition to the Final EA completed by TVA in 2016 that will be supplemented, two environmental reviews were identified in the 2016 EA as relevant to this supplemental EA:

- *TVA Reservoir Operations Study* (ROS) and associated Programmatic Environmental Impact Statement (EIS). This study was completed in 2004 to review the policy that guides the day-to-day management of the Tennessee River and reservoir system. (TVA 2004)
- *Northeastern Tributary Reservoirs Land Management Plan Final EIS.* The Boone Reservoir Land Management Plan (RLMP), included in this Final EIS, addresses TVA's management of approximately 880 acres of public lands around the reservoir, including approximately 84 acres of two tracts TVA is using as Construction Support Areas (the Earl Light Tract and Tract 22R). The RLMP EIS was a source of information in the 2016 Final EA on the affected environment and potential environmental impacts. (TVA 2010)

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Pursuant to the National Environmental Policy Act (NEPA) and implementing regulations promulgated by the Council on Environmental Quality (40 CFR 1500–1508), federal agencies are required to evaluate the potential environmental impacts of any proposals for major federal actions. TVA prepared this EA to supplement its previous assessment of the potential

consequences of TVA's actions on the environment and human health in accordance with NEPA and TVA's guidelines for implementing NEPA (TVA 1983).

This supplemental EA describes additional, relevant information relating to the existing environment at the project site, analyzes potential environmental impacts associated with changing the crest restoration to the historic character of Boone Dam, impacts relating to the revised plan for use of the Earl Light Tract (anticipated to be beneficial to the area, its environmental character, and to the general public), impacts relating to the disposal of construction spoils, and impacts associated with activities and infrastructure needed to manage slurry and concrete during cutoff wall construction.

While the impacts associated with the cutoff wall construction were analyzed in TVA's 2016 Final EA, additional information about these construction activities is now available and is incorporated into this Supplemental EA to ensure that the information is disclosed and available to the public. TVA seeks to minimize redundant or repetitive analysis and focuses the supplemental analysis only on issues or impacts associated with the project modifications that have potential to be significant.

The analysis in this Supplemental EA does not address the reservoir operations of Boone Reservoir, which was a focus of the 2016 Final EA. TVA is not proposing modifications to these operations.

1.5 CONSULTATION REQUIREMENTS AND NECESSARY PERMITS

As described in the 2016 Final EA, TVA must complete consultation and secure any necessary permits prior to undertaking the proposed actions. Because TVA's seepage remediation began in 2016, consultation and permits have been previously obtained.

Consultation with the Tennessee Historical Commission (THC) on the impact of federal actions on Tennessee historic and archaeological sites is required under Section 106 of the National Historic Preservation Act (NHPA). Consultation regarding the proposed project changes was completed with the Tennessee State Historic Preservation Office (SHPO). In 2015, TVA consulted with interested federally recognized Indian tribes on impacts of the seepage remediation project on areas that may be of religious and cultural significance to them. Because no additional areas would be impacted under TVA's new proposal, TVA did not consult again with tribes regarding its proposal.

TVA has concluded that the proposed action would not require additional consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act.

The following permits have been or would be obtained by TVA:

- *National Pollutant Discharge Elimination System (NPDES) Stormwater Construction Permit* - TVA has obtained a NPDES Stormwater Construction Permit for clearing, grading or excavating of the project area to ensure proper stormwater management and treatment throughout the project. TVA submitted a site-specific Stormwater Pollution Prevention Plan to the Tennessee Department of Environment and Conservation (TDEC).

No additional permissions would be needed for actions covered under the Proposed Action.

- *Individual Aquatic Resources Alteration Permit (ARAP) Section 401 Water Quality Certification* - TVA obtained an Individual ARAP Section 401 Water Quality Certification from TDEC's Division of Water Resources for the alteration of waters of the state, including streams and wetlands. No additional permissions would be needed for actions covered under the Proposed Action.
- *Section 10 / Section 404 Clean Water Act Permit* - TVA obtained a permit under Sections 10 and 404 of the Clean Water Act to implement dredge or fill activities in jurisdictional waters of the United States. TVA coordinated with the US Army Corps of Engineers (USACE) to obtain this permit. No additional permissions would be needed for actions covered under the Proposed Action.
- *Ready Mix Concrete Permit NPDES General Permit* - A RMCP is required for discharges of washwater, stormwater or a no-discharge recycle system associated with ready mix concrete facilities. A Ready Mix Concrete Facility RMCP Notice of Intent and site-specific Stormwater Pollution Prevention Plan would be developed and submitted to TDEC for approval.
- *Special Waste Approval* - A Special Waste Approval is required for disposal of special wastes in a permitted landfill. A Special Waste Application would be completed and submitted to TDEC for approval. This permit is required for the proposed disposal of slurry material once it has dried in the ponds and/or other excavated materials not meeting the TDEC definition for clean fill.
- *Non-Title V Operating Permit* – A Non-Title V Operating Permit is required for operation of an air contaminant source. A Non-Title V Permit application for Concrete Batch Plant Source would be completed and submitted to TDEC for approval. This permit is needed for the proposed concrete batch plant.

1.6 PUBLIC NOTIFICATION

TVA completed the supplemental EA on February 22, 2019, and posted the document for public viewing on TVA's webpage: www.tva.gov/nepa. TVA notified interested federally recognized Native American tribes, elected officials, organizations (e.g., Boone Lake Association, Boone Dam Repair Coalition, National Wild Turkey Federation), and government agencies, including TDEC, Tennessee Wildlife Resources Agency (TWRA), USACE, and the USFWS. See Chapter 5 for a list of those notified. A notice was sent to recipients of TVA's monthly project newsletter as well.

CHAPTER 2

2.0 DESCRIPTION OF ALTERNATIVES CONSIDERED

In this supplemental EA, TVA will evaluate changes to the Action Alternative that was analyzed in the 2016 EA, and will consider new information relating to this Alternative. The alternative incorporating these changes is the Proposed Action described below. TVA will also analyze the No Action Alternative, which is based on proceeding with the project as described in the 2016 EA.

2.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, TVA would continue to implement the proposal as described in the 2016 EA. The dam crest would be restored to its previous condition and the Earl Light Tract would be relied upon for construction support activities, including disposal of construction spoils. Because construction of the cutoff wall is addressed in the 2016 EA, activities associated with its construction would be the same as those described in Alternative B.

2.2 TVA'S PROPOSED ACTION – MODIFICATIONS TO CONSTRUCTION OF THE COMPOSITE SEEPAGE BARRIER

Under the Proposed Action alternative, preferred by TVA, TVA would continue to construct a composite seepage barrier at Boone Dam to address ongoing seepage of water and sediment. TVA, however, would make certain changes to the initial proposal analyzed in the 2016 EA. Most notably, TVA would not return the crest of the dam to its previous condition, and for the final phase of construction, would change how it uses the Construction Support Areas near the dam, as well as how it disposes of construction spoils.

The following is a description of the proposed changes to the scope of TVA's seepage remediation project at Boone Dam. See Figure 2-1 for the location of the Boone Dam project site, with the current Construction Zone and two Construction Support Areas identified.

2.2.1 Crest Restoration

In the 2016 EA, TVA proposed to restore the crest of the dam as the fourth and final stage of seepage remediation. Early in the project, TVA lowered the crest of the earthen embankment 10 feet to create a work platform.

Rather than removing the work platform and returning the crest of the dam to its previous height, TVA proposes to leave the work platform in place in its current condition and to install a permanent concrete flood wall, which would be approximately 9.6 feet in height and would create a minimum elevation of 1408.5 feet. The flood wall would be approximately 800 feet long, and each end would blend into existing grade at that same minimum elevation that corresponds with the concrete dam and right rim. The concrete wall would be either L-shaped or T-shaped. See Appendix A for renderings of the proposed flood wall.

TVA proposes this modification to its original proposal because the change would allow TVA to conduct future inspections and assessments of the performance of the seepage barrier on a safer and more usable crest surface. The restoration proposed in the 2016 EA involves reestablishing a steep earthen slope on the dam's crest; the steep slope (more than 2:1 in many places) would be less desirable because it is more difficult to traverse and maintain (e.g., it has been too steep to safely mow in the past). The change would also eliminate the need for removal of the work platform used during the cutoff wall installation. Leaving these structures in place would reduce the effort required to complete the project, including a reduction in both on-site and offsite traffic, a reduction in the use construction equipment on the crest, the elimination of the need to borrow approximately 20,000 cubic yards of fill, and the elimination of the disposal of approximately 7,000 cubic yards of concrete and crushed stone.

Drainage of the new platform during construction would convey runoff to a point beyond the downstream toe of the dam into a water treatment facility, and, post construction, this runoff would be conveyed into the existing stormwater infrastructure, as it was prior to the repair effort.

TVA has constructed stability berms on the upstream and downstream sides of the dam. Additional modifications of the berms may be implemented to facilitate construction of the cutoff wall, as part of the restoration of the crest after construction of the cutoff wall, and/or to support long term operations.

2.2.2 Construction Support Areas

TVA proposes to change how the two tracts of land that have been used to support construction activities would be utilized for the remainder of the project. See Figure 1. Generally, TVA would not use the Earl Light Tract as originally intended and would concentrate activities on Tract 22R, as described below:

2.2.2.1 Construction Support Area 1 (Earl Light Tract)

TVA has reviewed its initial proposal and determined that additional development of the Earl Light Tract is not necessary. Since 2016, TVA has used a small portion of the parcel for employee parking along Minga Road. TVA had also envisioned using the entire 71.2-acre parcel for laydown, storage, and placement and permanent disposal of construction spoils. However, TVA has determined the area is no longer needed for those actions.

Because the parcel would not be used to the extent previously planned, it would not be necessary to close a portion of Minga Road to the public to support activities on the Earl Light Tract. TVA previously anticipated an extended closure of the road during the project. Under this alternative, the road would remain open.

TVA proposes to remove the temporary parking area that was constructed at this location in 2016 and to consolidate parking into the construction area near the dam and in Construction Support Area 2 (Tract 22R).

At this time, TVA estimates that the Earl Light Tract would be reopened for public use in early 2021.

2.2.2.2 Construction Support Area 2 (Tract 22R)

TVA proposes some minor changes to the use of Tract 22R, which is east of the dam construction area. The proposed changes are expected to reduce the level of impacts to the public and environment that were disclosed in the 2016 EA, which are detailed below.

Temporary parking for construction employees would be located at the northeast end of Tract 22R and would be accessible from Minga Road. The new parking lot would consist of crushed stone on fabric and would have limited, secure access via an existing gravel access road that would also need additional stone topping. Egress to the drying ponds/temporary drying area from off-site would be via the existing service gate from Minga Road. Disposal haul trucks would use this road to carry/transport disposal material from the slurry treatment area for disposal off-site. A flagger or temporary portable traffic signal would be provided at the intersection of the access gate and Minga Road.

Ingress and egress to the drying ponds/temporary drying area from onsite would be via the main site road and the existing roadway on the southwest end of Tract 22R. The area below the existing road would be stripped and leveled, and fabric would be placed below the road gravel material. Culverts would be installed to maintain the existing drainage. This road would connect the slurry treatment area to the site.

Figure 2-1. Construction Areas at the Project Site

2.2.2.3 Management of Excess Rock and Soil

Under the modified proposal, TVA's construction contractor would transport all cutoff wall construction spoils to an off-site location for disposal. TVA would transport construction spoils to one of the following Class I disposal facilities: the Iris Glen Environmental Center (Iris Glen) in Johnson City, Tennessee; the Carter Valley Sanitary Landfill (Carter Valley) in Church Hill, Tennessee; or the EcoSafe Landfill located in Blountville, Tennessee. See Figure 2-2. Clean construction spoils may be transported to an appropriate alternative location, as described below.

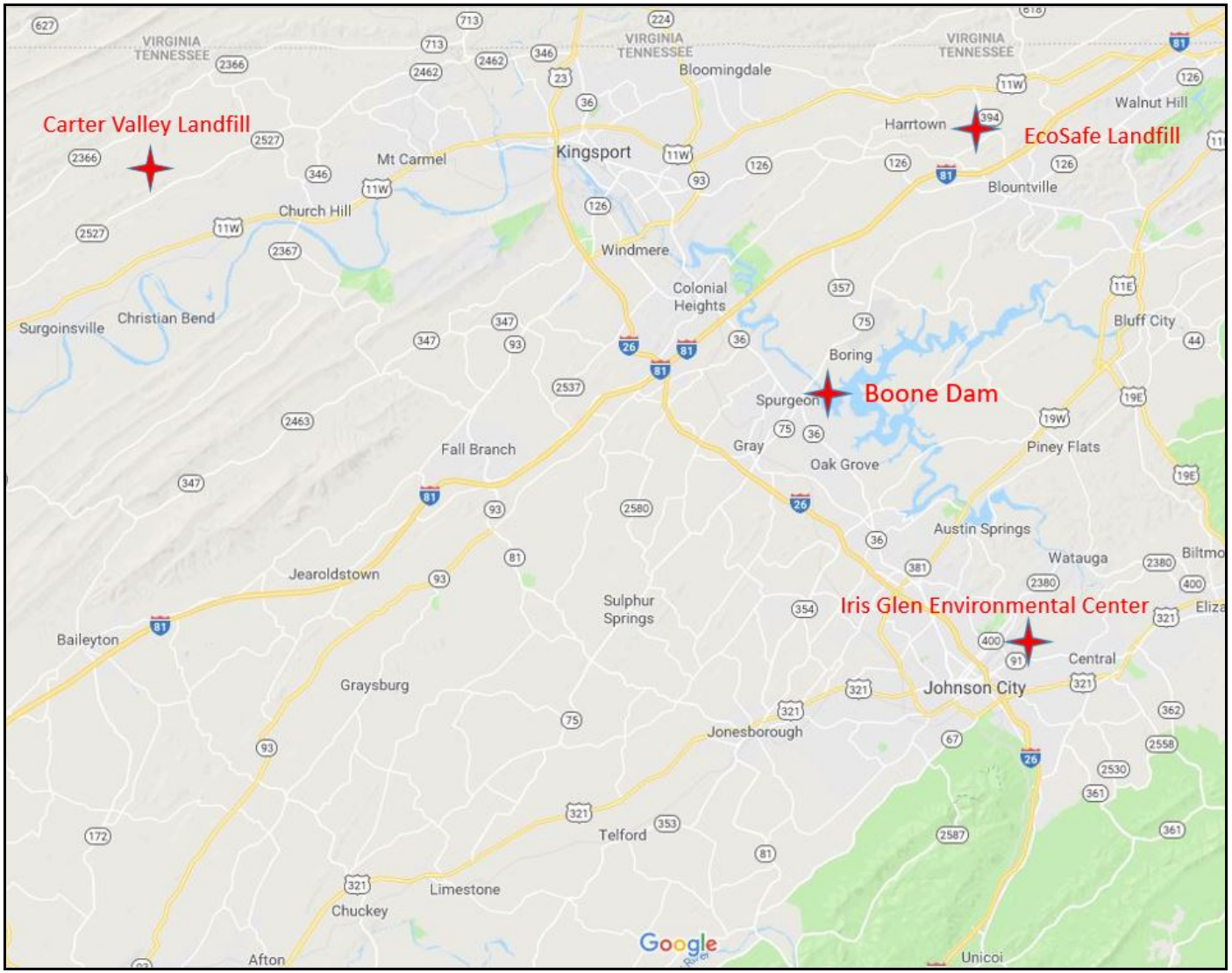
The transport of spoils off-site represents a change to the TVA proposal analyzed in the 2016 EA. In the 2016 Final EA, TVA stated all spoils generated during construction would be transferred to and placed at the two TVA Construction Support Areas near the dam for permanent disposal (2016 EA, p. 2-5). Most of these spoils were to be placed at the Earl Light Tract. The EA described TVA's consideration of travel to and the cost of disposal at Iris Glen and EcoSafe facilities and the conclusion that the costs would be prohibitive (the Carter Valley facility was not discussed in the 2016 EA).

Since 2016, TVA has reconsidered the option and determined that disposal at Iris Glen, Carter Valley, or EcoSafe would be at or near the same cost and effort as disposing of the spoils at the Earl Light Tract. TVA also considered that using an established landfill would be beneficial because TVA would minimize the physical disturbance of the Earl Light Tract, and the duration of its closure to the public for use and enjoyment would be reduced.

Under this alternative, construction spoils that include special waste (e.g., spoils that have come into contact with certain drilling fluids) would be transported to one of these three Class I landfills. TVA would obtain the necessary permits from TDEC for the disposal of any special waste at the landfills. Clean construction spoils (e.g., topsoil, gravel, concrete) would either be taken to one of these facilities or to an appropriate location that meets the following conditions:

- The property owner has contacted local or state officials and obtained verification that the spoils or fill can be placed in the designated area according to local or state regulations and environmental restrictions. Verification would be provided to TVA.
- No spoils or fill will be placed in the 100-year floodway.
- No spoils or fill will be placed in any wetland as defined by Section 404 of the Clean Water Act and the U.S. Army Corps of Engineers.
- Prior to placement of spoils, TVA Environmental Compliance and Operations staff will review the designated area and determine whether additional environmental review is needed.

Figure 2-2. Location of Iris Glen, Carter Valley and EcoSafe Landfills



2.2.3 Cutoff Wall Construction

In the 2016 EA, TVA proposed that, upon completion of an extensive grouting program, a cutoff wall would be constructed. Construction of the cutoff wall represents Stage 3 of TVA's seepage remediation project and is conceptually illustrated in Figure 2-3.

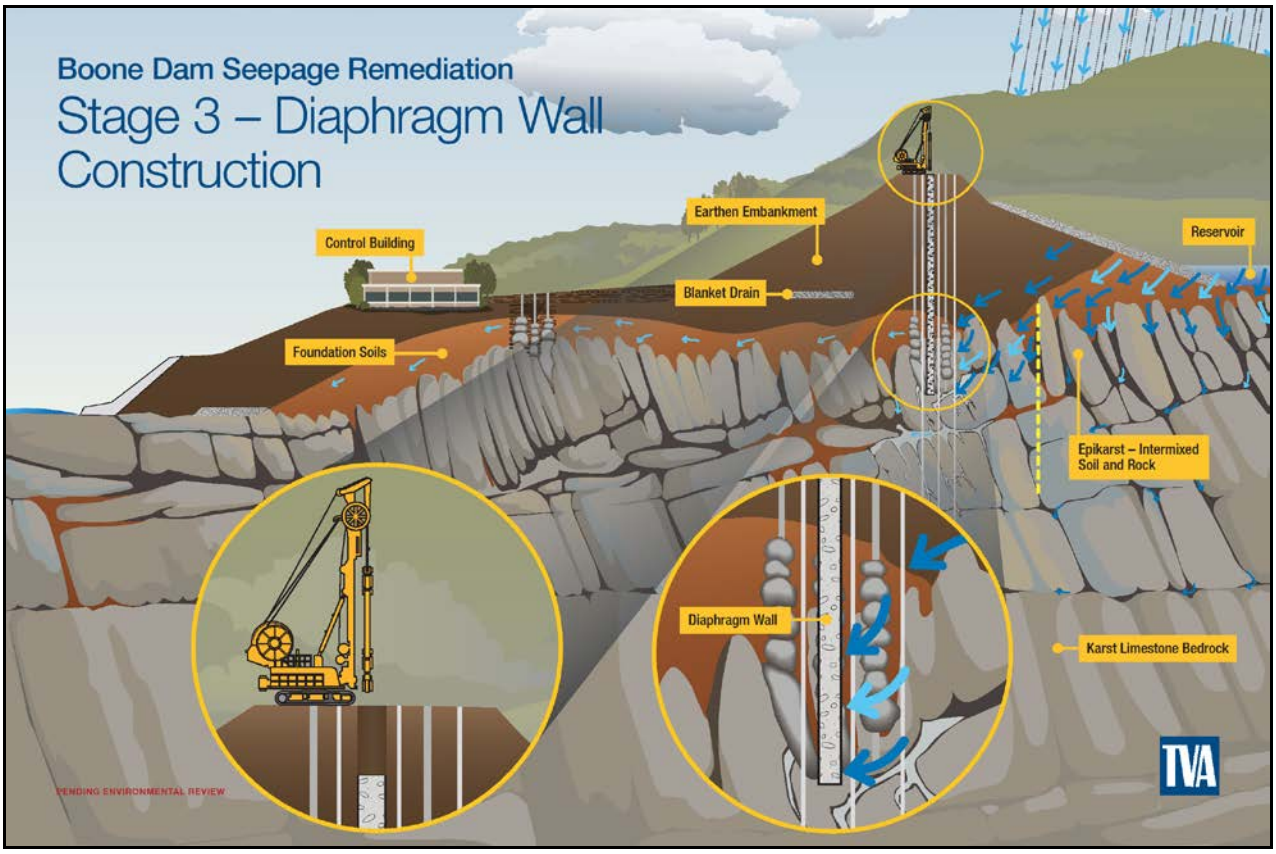


Figure 2-3. Conceptual Schematic of Construction of Seepage Barrier

In 2018, a preferred design for the cutoff wall was completed. The 2016 EA generally describes the activities required to construct the cutoff wall. More information on these activities is outlined here. TVA is not proposing to change these activities but addresses them in this supplemental EA to disclose this additional information and update the previous analysis.

2.2.3.1 Drilling

According to the proposal, the construction method would consist of the installation of over 300 secant piles distributed along the cutoff wall alignment, with the center to center spacing varying as needed to maintain the continuity of the required cutoff wall thickness and overlap of adjacent elements. The construction would be executed using a steel casing to the top of the epikarst. After the casing is installed on the top of the epikarst rock, a pile-top reverse circulation drilling (RCD) rig would be installed to drill until final depth. The RCD would be performed using polymer drilling fluid to facilitate removal of the excavated materials and provide support to excavation in the epikarst remains open.

2.2.3.2 Drilling Fluids, Use and Recirculation

Drilling fluid[1] provides a positive hydrostatic head above the groundwater level to assist in supporting and holding the bore open during pile excavation. The drilling fluid would utilize a mixture of polymer and water to create a slurry with additional admixtures in low dosages to promote efficiency and facilitate the ability to adapt to varying ground conditions.

This fluid would be displaced by the concrete during its placement and recirculated to the slurry treatment plant for treatment and re-use. To maintain the physical properties and make the drilling fluid more efficient and adaptable to varying ground conditions, it is likely that a long chain synthetic polymer would be used to enhance the cellulosic base material.

A slurry plant would be located within the Slurry Desanding Treatment Plant (discussed below), where mixing, storing, desanding, and decanting of the polymer slurry would occur.

The RCD rig would continuously re-circulate supporting drill fluid consisting of sand, water, and the polymers. As the drill excavates deeper, the displaced volume would be replaced by adding more drilling fluid. A steel tank, equipped with a scalper, would be used both as a buffer and to perform a first separation of solids and water. As the drilling progresses, the drilling fluid level would be topped up at the addition of each 10-foot long drill rod, which would be achieved by adding more drilling fluid into the pile to compensate for the volume of excavated concrete/rock.

This slurry would be produced at the Slurry Desanding Area and pumped to the drill rigs located on the work platform. Then, the slurry would be recirculated via two closed circuit systems; the first one would be constituted by tanks located on the work platform which would receive the spent slurry from the RCD drill. The second system would be the desanding plant, which would be located at the Slurry Desanding Area (see below); it would first receive and process the spent slurry from the tanks then recirculate it to the RCD drills. Thereafter, the slurry would continue to be recirculated until becoming no longer usable.

At that point, the slurry would be pumped to the Slurry Processing/Disposal Area (drying ponds/temporary drying area) for additional treatment. The slurry fluid would be displaced by the concrete during its placement and recirculated to the slurry treatment plant for treatment and re-use. Any drilling and grouting spoils would be collected at the hole location and placed in steel containers located on the platform. Solid spoils would be taken to the temporary drying area and later disposed off-site. Any wastewater generated at the platform would be initially handled with the stormwater on the platform.

[1] The terms drilling fluid, excavation support slurry, polymer slurry, and slurry are used interchangeably to refer to the fluid that would be utilized during RCD as a drilling enabling agent and an excavation support fluid until both drilling completion and before concrete placement.

Waste fluid would be evacuated throughout the piping network and directed to decantation tanks located at the desanding plant. The solids remaining at the decantation tanks of the mobile desanding units would be removed and sent to the temporary drying area for further treatment and stabilization before being transported off-site.

2.2.3.3 Excavation Support

After drilling is completed but before concrete could be placed in the excavation, the resulting hole would be maintained in an open condition using excavation support fluid. The excavation support fluid mixing plant would be located in the Slurry Desanding Area and would include storage tanks, a water supply tank, pumps, a polymer mixer and slurry desanding unit, and associated piping. After mixing, the slurry would be stored in storage tanks.

Sedimentation tanks for cuttings would be placed close to the point of drilling and would be used to separate sediment from drilling fluid. Fluid would be exchanged for fresh/treated polymer slurry prior to concreting. Drilling slurry would be sent back to the desanding facility after passing through the sedimentation tanks. At the facility, slurry would be screened to remove particles. Clean slurry would either be pumped into a bore under excavation or into storage tanks.

From the desanding facility, spoil material and debris would be transported to a temporary drying area before being transported by truck to an approved disposal facility, such as Iris Glen.

2.2.3.4 Concrete for Wall Construction

TVA proposes to construct a concrete batch plant to supply concrete to the pile locations after drilling and excavation stabilization. The plant site would include a storage area, silos for aggregate and concrete, scales, and electrical infrastructure. A back-up concrete facility would be in place as well to mitigate risk of breakdown; this facility would be at an existing off-site plant.

Concrete would be transported by truck from the batch plant to the placement location; each pile would be poured in approximately 4 to 6 hours. When each element is completed, any concrete mixed with slurry would be hauled to the temporary drying area, then transported to the off-site disposal facility.

2.2.3.5 Water Treatment Facility

The construction contractor would appropriately treat all wastewater used for either drilling, grouting, or cutoff wall construction on the work platform. All water from these activities would be sent to the water separation treatment area on the downstream of the dam (Figure 2-4). All stormwater would be collected in the platform's stormwater collection trench and piped to the same treatment facility. Both stormwater and wastewater used during construction would be combined at the water treatment facility where it would be treated for sediment in large tanks. An oil-water separator would be installed to remove oil prior to water being pumped to a second

series of tanks where the PH adjustment would take place by injecting carbon dioxide into the water. If the water meets the required quality standards, it would be discharged into the tailrace.

Water that requires further treatment for sediment would be pumped to the proposed Drying Pond Area. Wastewater from the Concrete Batching Plant Area would also be pumped to the Drying Ponds. Here, the wastewater would be handled in decantation ponds and treated to adjust for pH. The water treatment facility would be enlarged to handle additional stormwater capacity, if needed. Water would have sufficient time to settle out solids, and those solids would be hauled to the temporary drying area.

Because stormwater collected on the work platform may have suspended solids or oil, the water would be treated over time at settling tanks located on the downstream side of the dam. Total suspended solids and pH would also be treated in tanks.

2.2.3.6 Temporary Drying Area and Drying Ponds

Near the main entrance of the dam reservation, TVA proposes to grade and level an area (approximately 75 by 400 feet) for use as a temporary waste treatment area. Prior to disposal off-site, fluids and solids resulting from cutoff wall excavation and slurry treatment would be placed at the area for drying. See Figure 2-4.

Near the temporary drying area, the construction contractor would install three slurry settlement ponds to collect the waste slurry for further settlement, pH treatment, and drying, prior to disposal off-site. Additional ponds would be used to manage stormwater from the entire Slurry Desanding Area.

At the drying ponds, the construction contractor would finalize processing of wastewater and slurry processing would be done before waste material is disposed off-site. Six settlement ponds would be utilized to ensure treatment of wastewater is separate from treatment of spent slurry. TVA anticipates that most of the material delivered to these ponds would be spent slurry from the cutoff wall construction. The facility would be a redundant system and would likely only be used during large rain events where the volume of water would decrease treatment time at the dam’s Water Treatment Facility.

After completion of the cut-off wall, the drying area would be excavated and removed, liners would be removed and the ponds would be capped with clean soils, regraded for drainage, and seeded for restoration of vegetation.

2.2.3.7 Slurry Desanding Area

TVA also would install a slurry desanding/treatment plant at the existing paved parking area adjacent to the dam. Four 65-foot diameter slurry tanks would be constructed for the production, treatment, and collection of the slurry for cutoff wall construction operations (Figure 2-4). The plant area would be drained to collect and convey any runoff from the working surface, either to be discharged through a pipe to the tailrace waters of the dam or to the drying ponds.

2.2.3.8 Concrete Batch Plant and Workshop

As stated in the 2016 EA, a concrete batch plant would be constructed within the construction zone of the dam, and removed after completion of the project. TVA proposes to locate and construct this batch plant at the location indicated in Figure 2-4. The concrete plant area would be approximately 230 by 200 feet and consist of concrete pads and foundations, cement silos, covered storage for the aggregate and sand, a loading ramp, and a dedicated pit for the washout of waste concrete from trucks (following delivery of concrete to the work platform).

The waste concrete would be temporarily disposed at the concrete trucks washout area and later disposed off-site. The concrete trucks washout area would be lined to prevent seeping of the waste into the ground. A power supply will be brought on-site at both the batch plant and workshop locations.

In addition, TVA proposes to establish a workshop and storage area at the location of an existing laydown area (adjacent to the concrete batch plant and near the new office building) for equipment maintenance and fabrication personnel. The area would be approximately 175 by 140 feet in size. See Figure 2-4.

2.2.3.9 Water Supply and Discharge

TVA would install a large, floating pump on the upstream side of the dam to provide water supply for construction operations (similar to the pump used to take water during grouting operations). TVA would also install a temporary high-density polyethylene pipe to discharge treated water from the water treatment facility and water treatment ponds at the drying area. The slurry desanding stormwater would go to the ponds at the drying area, which in turn can be rerouted to either the water treatment area or the discharge point in the river below the dam, if the water is sufficiently clean to meet standards. See Figure 2-4.

2.2.3.10 Other Support Facilities

In the 2016 EA, TVA stated that there would be extensive infrastructure and facilities within the construction area to support the activities. These include construction of personnel parking, roads, and offices, and during the last phases of construction, an office complex near the main access location to the site (from Boone Dam Road) to support the construction contractor’s staff. See Figure 2-4 below.

Figure 2-4. Construction Site Plan and Water Flows.

2.2.4 Summary of TVA Commitments and Proposed Mitigation Measures

In addition to the requirements of any necessary permits, TVA would continue to implement the mitigation measures identified in its 2016 Final EA to ensure that adverse impacts on the environment are avoided, minimized or mitigated. All applicable permits would be acquired; therefore, associated permit-related mitigation measures and best management practices (BMPs) would be implemented to further minimize impacts.

In addition to the measures identified in the 2016 Final EA, TVA proposes to implement measures to minimize any impacts associated with the construction of an outfall within the 100-year floodplain of the South Fork Holston River, downstream of Boone Dam. Consistent with EO 11988, an outfall is considered to be a repetitive action in the 100-year floodplain that should result in minor impacts. To minimize adverse impacts, the outfall would be stabilized with the least amount of riprap practicable and no trees would be cut. TVA would implement Standard BMPs during construction of the outfall and would use the least amount of riprap materials to stabilize the outfall.

As discussed in Section 3.5.2 of this Supplemental EA, during consultation with the Tennessee SHPO, TVA and the SHPO concurred that the proposed installation of a flood wall at the dam's crest would adversely affect the Boone Hydroelectric Project, which is listed on the National Register of Historic Places. This adverse effect, however, was previously mitigated by TVA when TVA prepared and submitted Historic American Engineering Record documentation to the National Park Service, in accordance with a Programmatic Agreement between TVA and the Tennessee Historic Commission (Stipulation 11.B.1).

In addition, to address potential impacts to resources occurring at off-site waste disposal areas, TVA would apply the conditions for the approval of any placement of clean construction spoils at locations other the Iris Glen, Carter Valley and EcoSafe landfill facilities. These conditions are identified in Section 2.2.2.3. TVA staff must verify that these conditions are met prior to approval of the placement of spoils at these locations.

2.3 ENVIRONMENTAL RESOURCES CARRIED FORWARD

Chapter 3 describes the affected environment and examines the potential environmental impacts of the changes proposed by TVA to the Boone Dam Seepage Remediation project. The changes to TVA's original proposal are limited in scope, in comparison to the original scope of the project. Based on a review by TVA staff of the proposed action and analyses of the 2016 Final EA, TVA has identified a limited number of environmental resources or issues that will be addressed in the Supplemental EA:

- *Historic and Cultural Resources*
- *Surface Water Resources*
- *Waste Management*
- *Transportation*
- *Land Use*
- *Recreation*
- *Terrestrial and Aquatic Ecology*
- *Floodplains and Flood Risk*

As stated in section 2.4 above, the analysis in Chapter 3 focuses on those resources with the potential to be affected by the proposed action and is intended to supplement, to the extent necessary, the previous environmental analyses of the 2016 Final EA. TVA seeks to minimize redundant or repetitive analysis and focus the Supplemental EA only on potential impacts that were not previously disclosed and discussed.

TVA determined that there would be no impacts, or that potential impacts would be negligible or temporary, for numerous resource areas, or that the 2016 Final EA adequately addresses the potential impacts to these resource areas:

- *Geologic Resources*
- *Wetlands*
- *Threatened and Endangered Species*
- *Air Quality*
- *Socioeconomics*
- *Hazardous Materials*
- *Noise*
- *Public & Occupational Health & Safety*

2.4 COMPARISON OF ALTERNATIVES

Table 2-1 compares the impacts of the No Action Alternative and the Proposed Action. As noted above, impacts from implementing the No Action Alternative have been addressed by TVA in the 2016 Final EA analysis of its remediation proposal. The comparison of impacts is limited only to those resources and issues that would be potentially impacted by modifications proposed by TVA to the Boone Dam seepage remediation project.

Table 2-1: Comparison of Impacts of the No Action Alternative and the Proposed Action

Resource Area	Impacts from the No Action Alternative (*Proposed Action of the 2016 Final EA*)	Impacts from Proposed Action
Surface Water Resources	Surface water quality impacts would be minor. TVA will implement BMPs and adhere to permit requirements addressing water quality. TVA will monitor water quality near the construction and in reservoir releases to document temporary changes associated with construction.	Same as the No Action Alternative. TVA's wastewater infrastructure would be utilized during construction of the cutoff wall to treat waste generated during construction of the cutoff wall. TVA would monitor wastewater and stormwater generated during the construction of the cutoff wall and report the total iron, total suspended solids (TSS) and pH prior to discharge to surface waters per the RMCP Permit.
Floodplains and Flood Risk	Alteration of the crest of the dam would encroach on a short part of the 100-year floodplain, but this would not affect the ability of Boone Dam to contribute to the reduction of downstream flooding. A small amount of flood control storage would be permanently lost due to placement of fill within the Flood Control Storage Zone. There would be no permanent loss of power storage. Once the drawdown period is over, Normal Operations would resume and the probability of floodplain inundation conditions in the reservoir would return.	Similar to the No Action Alternative. TVA would install a flood wall at the crest of the dam. The installation of water supply intake and outfall, the use of two regional landfills, and other proposed actions would not result in impacts to floodplains. Cumulative impacts of the floating water intake and an outfall would be minor; most of the water withdrawn would be returned to the river.
Terrestrial Ecology	Wildlife species within the Earl Light Tract would be displaced and habitat on a large portion of the parcel would be disturbed. TVA would restore the area to its previous condition after the project.	TVA would not utilize the Earl Light Tract, which has habitat for a variety of vegetation and wildlife species, as a Construction Support Area through the life of the project. This habitat would not be altered, which would have beneficial impacts to these species.
Aquatic Ecology	An intermittent stream feature within the Earl Light Tract would be impacted; TVA would comply with Section 404 of the Clean Water Act to minimize impacts.	An intermittent stream feature within the Earl Light Tract would not be impacted.
Historic and Cultural Resources	No adverse impacts to historic buildings and structures.	The installation of a flood wall on the dam's crest would have an adverse effect on the historic dam. This impact has previously been mitigated by TVA.

Table 2-1: Comparison of Impacts of the No Action Alternative and the Proposed Action

Resource Area	Impacts from the No Action Alternative (*Proposed Action of the 2016 Final EA*)	Impacts from Proposed Action
Recreation	Direct and indirect adverse impacts on recreation would continue through the life of the project, mitigated in part by TVA's plans to improve access. Recreation opportunities would be lost at the construction areas during construction but would be restored after project's completion. After the dam remediation period recreational visits are expected to return to normal.	TVA would not utilize the Earl Light Tract, which has previously provided dispersed recreational opportunities, as a Construction Support Area through the life of the project. TVA would reopen the tract for public use in 2021, which would result in beneficial impacts to recreational opportunities in the area.
Transportation	Minor direct adverse impacts related to construction traffic and the temporary closure of a portion of Minga Road near the dam. Closure of Minga Road would result in a minor increase in travel time/distance for some residents along Minga Road and would also affect current school bus routes for the duration of the closure.	Minga Road would remain open and no impacts to residents or drivers would result. The transport of waste from the construction site to the three landfills would result in negligible additions to the traffic volumes along the route.
Waste Management	Placement at the Earl Light Tract would impact the area but would be isolated and would not result in any cumulative impacts.	Because of the volume of construction spoils estimated (about 38,000 cubic yards), minor cumulative impacts to the capacity of the three local landfill facilities are expected. Potential impacts associated with placing clean spoils on other locations would be addressed through conditions of approval for use of those locations. In addition, there would be fewer impacts associated with borrow and placement of fill to restore the dam's crest and disposal of work platform structures at the crest.
Land Use	Temporary changes in activities within the Boone Dam Reservation during construction. Portions of two TVA tracts would be used temporarily inconsistently with the Boone RLMP. No long-term change in land use allocations or designation as a result of construction or the drawdown.	The Earl Light Tract would not be used as originally planned, resulting in minimal alteration of the parcel's land use, which is beneficial compared to the No Action alternative.

CHAPTER 3

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing environmental conditions of the environmental resources that may be affected if the Proposed Action or the No Action Alternative is implemented. The chapter also describes the potential environmental effects (direct, indirect or cumulative) that could result from implementing the No Action Alternative and Proposed Action. As noted above, the analyses of impacts focuses on resources affected by the changes proposed by TVA and is intended to supplement the environmental analyses of the 2016 Final EA.

3.1 SURFACE WATER RESOURCES

Since TVA issued the 2016 Final EA, TVA and its construction contractor have developed more specific information relating to the management of water during construction of the cutoff wall. Impacts to surface water quality were addressed in the Final EA, Section 3.3.2.

3.1.1 Affected Environment

As stated in the January 2016 EA, the Boone Project is located within two 8-digit Hydrologic Unit Code (HUC) watersheds: HUC 06010102 (South Fork Holston) and HUC 06010103 (Watauga). Boone Dam impounds portions of the South Fork Holston and Watauga Rivers. TVA operates two dams upstream of Boone Reservoir on the Watauga River. Boone Dam is approximately 30 miles downstream from South Holston Dam, 25 miles downstream from Wilbur Dam (Watauga River), and 10 miles upstream from Ft. Patrick Henry Dam.

Boone Reservoir is operated by TVA to meet a variety of purposes, including power production, flood control, recreation, water supply management, water quality, and aquatic habitat. These purposes are consistent with the designated uses assigned by the State of Tennessee for this portion of the South Fork Holston River, including domestic water supply, industrial water supply, fish and aquatic life, trout stream, recreation, livestock watering and wildlife, and irrigation. (TDEC 2013).

Surface Water Quality

The TDEC has established water quality standards and designated uses for streams and lakes across the state, and issues periodic reports on waterbodies not meeting these standards and uses. Generally, characteristics considered during the assessments are temperature, dissolved oxygen (DO), pH, nutrients, sedimentation, siltation, loss of habitat and contaminants. TDEC classifications for South Fork Holston and Watauga Rivers in Boone Reservoir have not changed since the 2016 EA. TDEC still classifies these rivers in Boone Reservoir for domestic water supply, industrial water supply, fish and aquatic life, livestock watering and wildlife, and irrigation. Parts of each river are also designated for trout stream recreation. (TDEC 2013).

As part of this program, TDEC also issues a list of impaired waters called the “303d list,” referring to Section 303d of the federal Clean Water Act. Waterbodies are added to this list when they do not support all designated uses because of water quality issues. As in the 2012 303d list referenced in the original EA, TDEC’s 2018 303d lists most of the South Fork Holston

watershed as impaired. The tailwaters below the dam are listed as impaired for low flow alterations, temperature, and dissolved oxygen. These are attributed to the TVA reservoir. (TDEC 2018)

TVA maintains a program to examine contaminants in fish fillets from TVA reservoirs and their major tributary streams on a rotational basis. The data collected from this program are distributed to the state officials who are responsible for placing or removing fish tissue consumption advisories on those bodies of water. The entirety (4,400 acres) of Boone Reservoir has a precautionary advisory for carp and catfish because of elevated concentrations of polychlorinated biphenyls (PCBs) and chlordane in the sediments. (TWRA 2018).

TVA Vital Signs Monitoring Ecological Health Ratings

The ecological health of Boone Reservoir rated “fair” in 2016. Ecological conditions in Boone Reservoir were assessed a “poor” rating in all previous years except 2015, when it also rated “fair”. The most notable results for 2015 and 2016 were improved dissolved oxygen concentrations at the South Fork Holston mid-reservoir monitoring location. Throughout the years, each indicator at all sampling locations has exhibited some stress: high concentrations of chlorophyll, low dissolved oxygen concentrations, “fair” fish assemblage, “poor” bottom life and elevated concentrations of metals and/or the presence of organic contaminants in the sediments. (Baker, 2018)

TVA monitors three locations on Boone Reservoir — the deep, still water near the dam, called the forebay (South Fork Holston River Mile 19.0), and two mid-reservoir locations (South Fork Holston River Mile 27.0 and Watauga River Mile 6.5). For this Supplemental EA, the most relevant is the forebay location, so the following discussion is focused on that information.

Dissolved oxygen

Dissolved oxygen rated “fair” at the forebay. Dissolved oxygen conditions have varied considerably from year to year and from site to site but generally rate “poor” at the forebay. Prevailing weather patterns and the related changes in reservoir flows are a major factor in differing dissolved oxygen conditions from year to year. During 2015 and 2016, however, the improved dissolved oxygen conditions in Boone Reservoir were likely due to the lower pool elevations which reduced reservoir volume and shortened the length of time water remained in this reach of the reservoir.

Chlorophyll

Chlorophyll concentrations were elevated, resulting in a “poor” rating. High chlorophyll a concentrations indicate excessive algal growth, which often signals nutrient enrichment from anthropogenic sources. High chlorophyll concentrations are a common problem on Boone, typically rating “poor” or at the low end of the “fair” range.

Fish

As in previous years, the fish community rated “fair” at all three monitoring locations. Characteristics of the fish communities (e.g., fish abundance, species richness and composition) were similar to long-term averages for the respective sampling locations.

Bottom Life
Bottom life rated “fair” at all three monitoring locations. Benthic organisms consisted mostly of midges, worms, and small mollusks known as fingernail clams. Bottom life generally rates “poor” or at the low end of the “fair” range due to the limited variety of organisms collected. This is most likely a factor of the anoxic conditions that develop and persist each summer during thermal stratification.

Sediment
Sediment quality rated “good” at the forebay monitoring location because no PCBs or pesticides were detected, and concentrations of metals were within expected background levels. Problems with organic contaminants have persisted over the years as chlordane and PCBs are sometimes detected in the sediment samples from each monitoring location.

3.1.2 Environmental Consequences

In this section, TVA is addressing new information regarding its construction activities and the potential impacts to surface water quality.

3.1.2.1 No Action Alternative

Under the No Action alternative, TVA would continue to implement the proposal as described in the 2016 EA. The dam crest would be restored to its previous condition and up to 71.2 acres of the Earl Light Tract would be relied upon for construction support activities, including disposal of construction spoils, access road construction, grading, and laydown areas.

In the 2016 Final EA, section 3.3.2.2, TVA stated the seepage remediation proposal has the potential to impact surface water supply. As noted therein, TVA would obtain National Pollutant Discharge Elimination System (NPDES) permits to address stormwater management and treatment throughout the entire project area. TVA would also implement a range of BMPs to mitigate any effects of surface water runoff from the construction area. These BMPs would include silt fences, erosion eels, straw waddles, rock check dams, and concrete washout areas. TVA concluded that, in general, the impacts to water quality would be minor because of these BMPs and adherence to commitments in the permits.

Under this alternative, minor localized impacts from construction activities are possible. Activities on the Earl Light Tract would result in ground disturbance and soil removal with potential to result in surface water impacts, especially during rain storms. However, TVA would adhere to the requirements of NPDES permits and implement a range of BMPs to ensure that the activities would not result in any major impacts to surface water quality.

Additional information about specific activities and infrastructure needed to manage slurry and concrete during cutoff wall construction, such as water and wastewater treatment systems, is addressed under the Proposed Action Alternative as supplemental information.

3.1.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under TVA's Proposed Action, TVA would continue to construct a composite seepage barrier at Boone Dam to address ongoing seepage of water and sediment. However, TVA would make certain changes to its initial proposal analyzed in the 2016 Final EA. Most notably, TVA would not return the crest of the dam to its previous condition, and for the final phase of construction, would change how it uses the Construction Support Areas near the dam and how it disposes of construction spoils. The proposed changes and new information as they relate to surface water quality are discussed in greater detail below.

Crest Restoration

In the 2016 EA, TVA proposed to restore the crest of the dam as the fourth and final stage of seepage remediation. Instead, TVA proposes to leave the work platform that has been in place during construction and install a permanent concrete flood wall. The restoration would require reestablishing a steep earthen slope (more than 2:1 in many places) on the dam's crest, which is less desirable and more difficult to maintain. The change would also eliminate the need for removal of the work platform that would be constructed to complete the cutoff wall installation.

This proposed change would reduce the use of construction equipment on the crest, eliminate the need to borrow approximately 20,000 cubic yards of fill, and eliminate the disposal of approximately 7,000 cubic yards of concrete and crushed stone. Drainage of the new platform during construction would convey runoff to a point beyond the downstream toe of the dam into a water treatment facility, and, post-construction, this runoff would be conveyed into the existing stormwater infrastructure, as it was prior to the repair effort.

These proposed actions would reduce the potential for surface water quality impacts from erosion, possible spills, and the need to dispose of thousands of cubic yards of demolition materials. Therefore, the actions described in Proposed Action Alternative would be beneficial to surface water quality compared to the No Action Alternative.

Construction Support Areas

TVA proposes to change how the two tracts of land that have been used to support construction activities would be utilized for the remainder of the project. Generally, TVA would not use the Earl Light Tract as originally intended, and would concentrate activities on Tract 22R. TVA had originally proposed to use the Earl Light Tract for laydown, storage, and disposal of construction spoils. TVA now proposes to take the construction spoils to landfill facilities, as discussed below.

Management of Excess Rock and Soil

TVA proposes to move the spoils from construction of the cut-off wall to an off-site landfill disposal facility. Using a disposal facility would be beneficial because the physical disturbance of the Earl Light Tract would be minimized and the duration of its closure to the public for use and enjoyment would be reduced (2016 EA, pp. 2-15 and 2-16).

TVA estimates that about 23,000 cubic yards of solids/spoils would result from construction of the cutoff wall and an additional 15,000 cubic yards would result from associated construction activities. In addition, TVA estimates that more than 400,000 gallons of fluids would be treated on site with the separated sediment and solids transported offsite for disposal. These initial estimates are subject to change and are dependent upon several factors (including the actual depth of overburden and rock and the actual reutilization of slurry and stormwater volumes).

The proposed actions reduce the potential for surface water quality impacts from erosion and possible spills from equipment that could occur from disposing of the construction spoils on the Earl Light Tract. Disposing of these materials at a permitted facility, designed to handle such material, would lessen the potential impacts to surface water quality. Therefore, the proposed actions in this alternative would have beneficial impacts to surface water quality compared to the No Action Alternative.

The remediation activities associated with the proposed action, considered together with other projects, would result in beneficial cumulative impacts on water resources in the area.

As explained above, since the completion of the 2016 EA, additional information is available about water and wastewater management actions that would be implemented during construction of the cutoff wall, as described in the following overview.

Water and Wastewater Management System Overview

TVA's seepage remediation project will require drilling for the construction of the primary cutoff wall. Drilling would require generation and use of drilling fluid (or slurry) consisting of water and additives to support drilling operations. Additives would be utilized to adjust the following slurry properties:

- Reduces viscosity and assist in treating cement contamination of slurry.
- Thin the fluid to reduce viscosity.
- Disperse solids in the drilling fluids.
- Adjust pH.

As described in chapter 2, TVA would construct and operate a wastewater processing infrastructure. Spent slurry water would be treated and recirculated until no longer usable. When no longer usable, spent slurry water would be pumped to a slurry processing and disposal area (drying ponds and temporary drying area). Treated stormwater runoff from the working platform and unevaporated wastewater from drying ponds would be discharged to the South Fork Holston River from a single outfall downstream of the Boone Dam tailrace. Solids from the drying area would be disposed of offsite.

Process water, stormwater, and wastewater would be generated from the Work Platform, Concrete Batch Plant, and Slurry Desanding Area within the construction zone. Stormwater from the Work Platform would be routed to the proposed Water Treatment Area, whereas wastewater and stormwater from the Slurry Desanding Area would be routed to the Slurry Ponds in the Slurry Treatment Area. Wastewater generated at the Concrete Batch Plant and stormwater from the Temporary Drying Area would be routed to the Slurry Settlement tanks.

Because the Concrete Batch Plant would be covered, minimal amounts of stormwater runoff would be generated.

Some of the drilling and process water would likely be recirculated after treatment. Before treatment and recirculation, the process areas could generate the following approximate quantities of process water and wastewater:

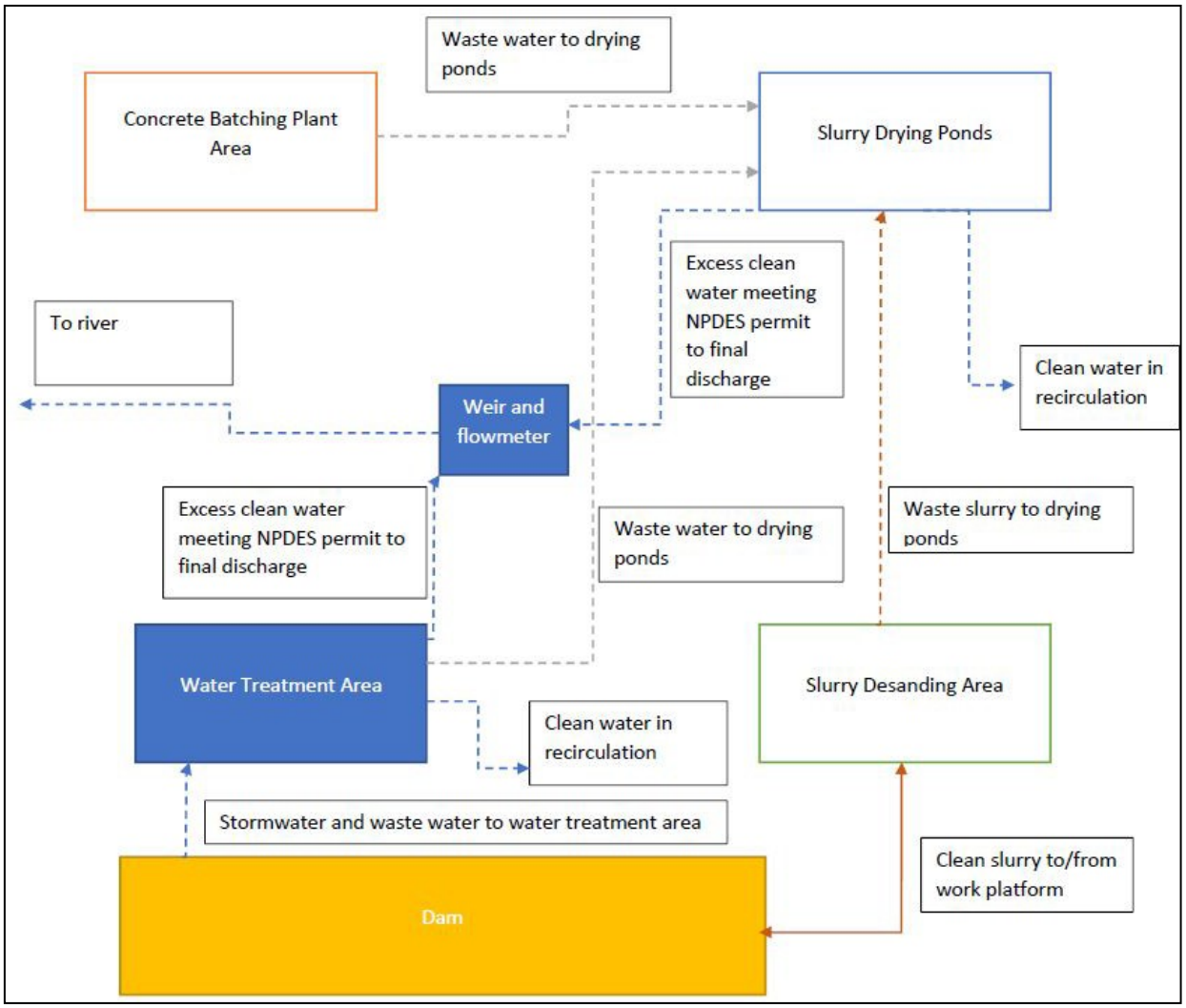
- Work Platform - 3.3 Million Gallons per Day (MGD),
- Slurry Desanding Area - 0.0132 MGD, and
- Concrete Batch Plant - 0.0027 MGD.

These quantities, however, do not account for quantities treated and recirculated, which would depend on operational conditions. For additional details see the “Construction of Boone Dam Cutoff Wall, Boone Dam Embankment Seepage Mitigation Project NPDES Permit Engineering Report” prepared by Barr Engineering Company, December 2018. (Barr Engineering, 2018)

Effluent from the two Treatment Areas would be combined for pH adjustment and flow monitoring for TSS and iron in the Effluent Monitoring Area prior to discharge to the South Fork Holston River in accordance with its NPDES Ready Mix Concrete Permit. (Barr Engineering, 2018)

A wastewater treatment system flow schematic is shown in Figure 3-1.

Figure 3-1. Wastewater Treatment System – Flow Schematic



Surface water quality and monitoring requirements include:

- Meet permit effluent limits of RMCP general permit
- Neither cause nor contribute to exceedance of water quality criteria

Consistent with TVA's conclusions in the 2016 EA, the actions proposed to manage water and wastewater would only have minor, temporary impacts on surface water quality.

3.2 FLOODPLAINS AND FLOOD RISK

3.2.1 Affected Environment

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a one-percent annual chance of flooding (100-year flood) in any given year is normally called the 100-year floodplain.

TVA evaluates proposed development activities that would occur in the 100-year floodplain to ensure the proposal is consistent with the requirements of Executive Order (E.O.) 11988, Floodplain Management. For certain “Critical Actions”, the minimum floodplain of concern is the area subject to inundation from a 500-year (0.2 percent annual chance) flood. “Critical Actions” are those for which even a slight chance of flooding would be too great.

As stated in the 2016 Final EA, TVA’s Boone Dam Seepage Remediation project is located adjacent to the South Fork Holston River at Boone Dam, in Sullivan County, Tennessee. The 100- and 500-year flood elevations at the upstream face of Boone Dam would both be 1385.0 feet. The 100- and 500-year flood elevations at the downstream face of Boone Dam would be 1271.8 and 1275.0 feet, respectively. All elevations are referenced to National Geodetic Vertical Datum 1929.

Portions of the Construction Zone just upstream of the dam are located within the 100-year floodplain of the South Fork Holston River. The current Construction Zone is located between South Fork Holston River miles 18.3 and 19.5. The dam’s crest and the two Construction Support Areas are located outside the 100-year floodplain and above the 100-year flood elevation of South Fork Holston River, which would be consistent with EO 11988.

3.2.2 Environmental Consequences

As a federal agency, TVA is subject to the requirements of EO 11988, Floodplain Management. The objective of EO 11988 is “…to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative” (EO 11988, Floodplain Management). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances (United States Water Resources Council 1978). The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

3.2.2.1 No Action Alternative

Under the No Action Alternative, the proposed project changes would not take place. Therefore, there would be no direct, indirect, or cumulative impacts to floodplains in addition to the impacts discussed in the 2016 Final EA.

3.2.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

The proposed project involves avoiding the Earl Light Tract, allowing the work platform on the upstream side of the earthen embankment to remain to facilitate future inspections and assessments of the seepage barrier, constructing a flood wall along the top of the earthen embankment dam, disposing of construction spoils at the Iris Glen, Carter Valley and EcoSafe disposal facilities, and constructing a slurry plant, concrete batch plant and workshop, water treatment facility, temporary drying area, drying ponds, slurry de-sanding area, main office complex, parking lots, roads, a floating water intake, and an outfall for the water treatment facility and slurry drying ponds. Avoiding the Earl Light Tract would have no impact to a slight beneficial impact on floodplains. TVA has reviewed floodplain information in the vicinity of the three disposal facilities and verified that the facilities are located outside 100-year floodplains; therefore, their use for disposal of spoil material would have no impact on floodplains.

In addition, of the proposed facilities listed above, only the floating water intake and outfall would be located within the 100-year floodplain of the South Fork Holston River, as shown in Figure 3-3 below. Consistent with EO 11988, a water intake and outfall are considered to be repetitive actions in the floodplain that should result in minor impacts.

If, during the life of the project, the reservoir falls below the elevation of the floating water intake, TVA would be responsible for finding another source of raw water. This mitigation measure would minimize any adverse impacts to natural and beneficial floodplain values.

Figure 3-2. Floodplains associated with Boone Hydro Plant, as shown in the National Flood Hazard Layer (FEMA, 2018).

The cumulative impacts of the floating water intake and an outfall would be minor and insignificant, because most of the water withdrawn would be returned to the river. Instead of the withdrawal water going through the turbines, spillway, or sluices at Boone Dam, the water would instead pass through the slurry desanding facility, the slurry drying pond, and/or the water treatment facility. There would be no indirect impacts due to the intake and outfall, because they would be used solely for work related to the seepage project. As stated above, most of the water withdrawn would return to the South Fork Holston River downstream of Boone Dam.

Additional modifications to the stability berms that are on the upstream and downstream sides of the dam have potential to result in a negligible loss of flood control storage and would have a negligible impact on flooding and floodplain values and functions.

3.3 TERRESTRIAL ECOLOGY

3.3.1 Affected Environment

In the 2016 Final EA, TVA provided information about the vegetative communities of the Ridge and Valley ecoregion and grouped its discussion of these communities into two broad categories: lowland and upland. As noted in Chapter 3.6 of the 2016 Final EA, incorporated herein by reference, the Earl Light Tract is one of the largest TVA parcels on Boone Reservoir and contains a mix of upland and lowland forested areas, a gravel parking area, a recreational walking trail, native warm season grass stands, and open land maintained by a cooperative agriculture license. Until seepage remediation began, the parcel provided public opportunities for hiking and wildlife/bird viewing and is utilized by hunters. Vegetative buffers have been established along the major drains throughout the lowland areas to enhance wildlife cover. The tract provides a variety of ecological communities for terrestrial species. In addition to the agricultural use, it is currently managed for dispersed recreation and natural resources.

The Earl Light Tract is habitat to numerous upland wildlife species. Notably, the Earl Light Tract is well-known for the presence of wild turkey. Other common mammal species present at Boone Reservoir include white-tailed deer (Odocoileus virginianus), raccoon, beaver, eastern chipmunk (Tamias striatus), striped skunk (Mephitis mephitis), white-footed mouse (Peromyscus leucopus), southern flying squirrel (Glaucomys volans), and gray squirrel (Sciurus carolinensis) (TVA 2002, TVA 2010). TVA identified several stands of potential bat roosting trees in the forest areas near the areas in the Earl Light Tract that TVA had proposed for construction support activities. No other sensitive resources were identified.

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

Under the No Action Alternative, TVA's seepage remediation actions would be as described in the 2016 Final EA and would include use of large portions of the 71.2-acre Earl Light Tract for construction support activities. The impacts associated with the No Action Alternative would be the same as those analyzed in Chapter 3.6.2.2 of the 2016 Final EA for the original proposal. Generally, minor to moderate indirect adverse effects to wildlife in the Earl Light Tract (and Tract 22R) would occur during use of these areas from displacement or disturbance. Impacts would extend through the life of the project (5 to 7 years), after which TVA would restore and revegetate the area. It is expected that any displaced wildlife would return to the project area upon completion of actions.

3.3.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under the Proposed Action Alternative, TVA anticipates that impacts of construction activities within the Boone Dam reservation would be the same as described in the 2016 Final EA, as seepage remediation actions continue. However, fewer impacts to terrestrial vegetation and wildlife species would occur at the Earl Light Tract under the Proposed Action because no additional activities would occur on the tract under this alternative. TVA would return the land to

its previous use as a conservation area sooner than initially planned. Returning the property to its previous use and condition would be more beneficial to wildlife species than the No Action Alternative. Fewer areas within the parcel would be disturbed and the period of disturbance would be shorter.

Changes proposed by TVA to other aspects of the seepage remediation project would not result in additional or differing impacts to terrestrial ecology than those described in the 2016 Final EA.

3.4 AQUATIC ECOLOGY

In the 2016 Final EA, TVA described the presence of one stream feature on the Earl Light Tract that would be potentially impacted by the seepage remediation project. The stream feature is approximately 1,080 feet long, 2 to 4 feet wide, 1 to 3 feet deep, and appears to function as a wet weather conveyance. To date, only a small portion of the Earl Light Tract has been used for construction support activities, as initially planned, and the stream feature has not been impacted.

3.4.1 Environmental Consequences

3.4.1.1 No Action Alternative

Under this alternative, impacts to the intermittent stream would be the same as discussed in the 2016 Final EA. Because the intermittent stream feature would be impacted while TVA uses this area, TVA would acquire a Section 404 of the Clean Water Act permit and minimize impacts to the stream by installing a culvert, bridge or other engineered measure. After completion of the project, TVA would restore and revegetate the area and reestablish the area's current use for natural resource conservation.

3.4.1.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under TVA's Proposed Action, the Earl Light Tract would not be used as foreseen and the intermittent stream feature would not be impacted. The avoidance of impacts to the stream feature is beneficial when compared to TVA's initial plan for the parcel.

3.5 HISTORIC AND CULTURAL RESOURCES

3.5.1 Affected Environment

Cultural resources include prehistoric and historic archaeological sites, districts, buildings, structures, and objects, as well as locations of important historic events that lack material evidence of those events. Cultural resources that are listed, or considered eligible for listing, on the National Register of Historic Places (NRHP) are called historic properties. To be considered a historic property, a cultural resource must possess both integrity and significance. A historic property's integrity is based on its location, design, setting, materials, workmanship, feeling, and association. The significance is established when historic properties meet at least one of the following criteria: (a) are associated with important historical events or are associated with the lives of significant historic persons; (b) embody distinctive characteristics of a type, period, or

method of construction; (c) represent the work of a master, or have high artistic value; or (d) have yielded or may yield information important in history or prehistory (36 CFR Part 60.4).

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their proposed undertakings on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment on those effects. TVA determined that the Proposed Action Alternative is an “undertaking” as defined by the regulations under NHPA. Once an action is determined to be an undertaking, the regulations require agencies to consider whether the proposed activity has the potential to impact historic properties. If the undertaking is such an activity, then the agency must follow the following steps: (1) involve the appropriate consulting parties; (2) define the area of potential effects (APE); (3) identify historic properties in the APE; (4) evaluate possible effects of the undertaking on historic properties in the APE; and (5) resolve adverse effects (36 CFR § 800.4 through 800.13.). An APE is defined as the “geographic area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist” (36 CFR § 800.16.).

Concerning cultural resources, the APE is defined as the affected environment for purposes of this EA. TVA defined the APE to be the following: the entire boundary of the NRHP-listed Boone Hydroelectric Project, including the dam, powerhouse, and adjacent dam reservation where laydown, parking, and access is proposed. This APE accounts for direct and indirect effects.

The APE has been subjected to multiple cultural resources surveys and historic architectural assessments (Prybylski 2015; Bradley et al. 2015; Martens et al. 2017). The only historic resource within direct line of sight to the proposed project is Boone Hydroelectric Facility, listed in the NRHP in 2017. Previous archaeological surveys and consultation have cleared the entire APE for direct effects for archaeology (Bradley et al. 2015, Pietak and Holland 1998, Wells 2015).

TVA considers effects to historic properties pursuant to Section 106 of the NHPA. As a key component of the historic function and operation of the facility, the dam is a contributing resource of the NRHP-listed Boone Hydroelectric Facility.

3.5.2 Environmental Consequences

Section 106 of the NHPA requires federal agencies to consult with the respective State Historic Preservation Officer (SHPO) and Indian tribes when proposed federal actions could affect historic and cultural resources, including archaeological resources, which are also protected under the Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act, in addition to the NHPA.

Under both alternatives, due to the complexity of the undertaking, and pursuant to 36 CFR Part 800.14(b), TVA would continue to execute a Programmatic Agreement (PA) established in December 2015 with the Tennessee SHPO that stipulates how the anticipated adverse effects of the alternative would be resolved and establishes a process for phased identification, evaluation, and treatment of historic properties for unanticipated adverse effects.

3.5.2.1 No Action Alternative

As the No Action Alternative does not include changes to the proposal described in the 2016 Final EA, this alternative would have no adverse direct, indirect or cumulative effect to historic properties.

3.5.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under the Proposed Action Alternative, TVA would not return the crest of the dam to its previous condition. TVA proposes to leave the work platform that has been in place during construction and install a permanent concrete flood wall at the dam's crest, which would be approximately 9.6 feet in height and would create a minimum elevation of 1408.5 feet. The flood wall would be approximately 800 feet long, and each end would blend into existing grade at that same minimum elevation that corresponds with the concrete dam and right rim. In addition, TVA would change how it uses the two Construction Support Areas near the dam and how it disposes of construction spoils. See Appendix A for renderings of the proposed flood wall at the dam's crest.

The change to the treatment of the dam's crest would have a direct visual effect on the earthen embankment, a portion of a contributing structure of the NRHP-listed Boone Hydroelectric Project. The earthen embankment, originally constructed between 1950 and 1953, was altered post-1979 to add an additional 8.5 feet of height after Federal Guidelines for Dam Safety required protection against a probable maximum flood (PMF) (FEMA 2004). The change in the design to feature a concrete floodwall instead of the steep slope of the earthen embankment design, as modified after 1979, would adversely affect the design of the Boone Hydroelectric Project. Therefore, the Proposed Action would have an adverse effect to historic properties.

TVA has consulted with the Tennessee SHPO regarding this impact. The Tennessee SHPO concurred with TVA that the project, as currently proposed, would adversely affect the NRHP-listed Boone Hydroelectric Project. However, adverse effects caused by the changes to the treatment of the dam's crest, involving the construction of a floodwall instead of restoring the earthen embankment have been mitigated, as per the Programmatic Agreement (PA), through the preparation and submittal of Historic American Engineering Record documentation (Stipulation 11.B.1) (TVA 2015). The correspondence between TVA and the Tennessee SHPO is included in Appendix A.

TVA also notified the Advisory Council on Historic Preservation, via the Electronic Section 106 Documentation Submittal System (e106), regarding the finding of Adverse Effects and the mitigation of the adverse effects through Stipulation 11.b.1 of the PA.

Under this alternative, TVA would transport construction spoils off-site. Prior to approval from TVA for placement of spoils at a location other than the three landfill facilities, TVA Cultural Resources staff would review the designated area and determine whether placement of spoils or fill has potential to affect historic or archaeological resources, in compliance with NHPA. Additional consultation under the NHPA may be required.

3.6 RECREATION

3.6.1 Affected Environment

As described in the 2016 Final EA, the Earl Light Tract is allocated as Zone 4 (Natural Resource Conservation) in the Boone RLMP. This parcel has historically been available for public use, but access has been restricted since 2016 when TVA began seepage remediation actions. The parcel has historically been used for dispersed recreation uses, including walking/hiking along a constructed footpath (which allows access through various successional stages of forest community), hunting, and wildlife/bird viewing.

3.6.2 Environmental Consequences

3.6.2.1 No Action Alternative

Under the No Action Alternative, the Earl Light Tract would remain closed to the public through the life of the project. Up to 71.2 acres of the 118-acre parcel would be used by TVA for construction support actions and existing recreational opportunities would be lost. After completion of the project, TVA would restore the disturbed areas to a natural condition, to reconstruct the existing recreation facilities, and reopen the tract for public use. Impacts, thus, are anticipated to extend through the life of the project until those recreational opportunities are restored by TVA. Other impacts to recreation, including cumulative effects, would be the same as those described by TVA in the 2016 Final EA.

3.6.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under the Proposed Action Alternative, TVA would not utilize the Earl Light Tract as a Construction Support Area. The area would be reopened to the public and the recreational opportunities provided in the past would be returned before TVA completes seepage remediation activities at the dam. The reopening of this parcel for public use would be a minor beneficial recreation impact of the proposed action. There would be no cumulative impact associated with the reopening of the parcel and other modifications proposed by TVA.

3.7 TRANSPORTATION

This section describes an overview of the regional transportation infrastructure (i.e., the roadway network) at Boone Dam and Reservoir and supplements analysis of the potential impacts on these transportation resources addressed in the 2016 Final EA.

3.7.1 Affected Environment

TVA addressed the area's transportation network in Chapter 3.17 of the 2016 Final EA. In that document, TVA described access routes to Boone Dam and the two Construction Support Areas and provided existing traffic volumes in the area for numerous roadways. This information is incorporated herein by reference.

As described in the 2016 Final EA, the primary route to access Boone Dam is from the intersection of Boone Dam Road, a two-lane road, and State Route (SR) 75 (known as the Bristol Highway). This route, approximately 0.6 miles from SR 75 to Boone Dam, is located approximately 1.1 miles northeast of the intersection of SR 75 and SR 36. SR 75 is a four-lane road with a continuous center turn lane that is oriented in a southwest-to-northeast direction; SR 75 provides access to Interstate 26 at an intersection approximately 3.7 miles from its intersection with Boone Dam Road. SR 36 is a four-lane road that is oriented in a northwest-to-southeast direction and provides access to Interstate-81 at an intersection approximately 4.6 miles from the intersection of Boone Dam Road and SR 75.

Traffic volumes disclosed in the 2016 Final EA were based on average annual daily traffic (AADT) counts in 2013 and 2014 measured at existing Tennessee Department of Transportation (TDOT) stations on SR 75, SR 36, and Interstates 26 and 81 in the vicinity of Boone Dam. This information indicated that average daily traffic along SR 75 near Boone Dam Road was 9,062 in 2014. In 2017, the average increased slightly to 9,214. At the intersection of SR 75 and SR 36 just southwest of Boone Dam, the average in 2014 was 11,698; in 2017, this average increased slightly to 12,042.

The AADT counts for the route from Boone Dam to the Iris Glen Environmental Center in Johnson City (approximately 14 to 16 miles driving distance) indicate that the route receives moderate levels of traffic daily (from 7,100 to over 60,000 daily trips). In 2014, the average annual daily traffic count along Interstate 26 in Washington County (counted at a location just west of I-26 and Boones Creek Road interchange) was 54,136 vehicles, and in 2017, it was 60,486 vehicles. The average annual daily traffic along E. Main Street in Johnson City, near the location of the Iris Glen Environmental Center was 7,100 in 2017. (TDOT 2019)

The AADT counts for the route from Boone Dam to the Carter Valley landfill in Church Hill (approximately 32 miles driving distance) indicates similar traffic volumes. In 2017, the AADT along SR 36 near Interstate 81 was 14,570. The AADT along Interstate 81 just north of Interstate 26 was 37,304 in 2017. The AADT in 2017 for the stretch of Interstate 26 between Interstate 81 and Kingsport ranged from 47,572 (north of Rock Springs Road) to 26,556 (in Kingsport near the bridge over the South Fork Holston River). The AADT for US Highway 11W near the Carter Valley landfill was 16,689 in 2017. (TDOT 2019). No traffic count was available for the relatively small Bradley Creek Road.

The AADT counts for the route from Boone Dam to the EcoSafe landfill in Blountville, Tennessee (approximately 13 to 14 miles driving distance) indicates similar traffic volumes, although the route to this landfill would not require travel on an Interstate segment, which has higher traffic volumes. In 2017, the AADT along SR 75 north just west of Blountville was 5,010, and was 7,840 along SR 394 north of Blountville and near Harr Lane. No AADT is available for Harr Lane, the location of the landfill; the small road is used primarily for access to the landfill.

3.7.2 Environmental Consequences

3.7.2.1 No Action

Under the No Action Alternative, TVA would continue seepage remediation activities as described in the 2016 Final EA, with construction activity contributing to local transportation impacts over the lifespan of the project. Worker trips to and from the site could result in localized congestion at the intersection of Boone Dam Road and SR 75 and could adversely affect traffic at times when workers are entering and leaving the Boone Dam project site. Generally, the additional traffic associated with workers on the site would constitute only a minor adverse impact on local traffic conditions.

Under this alternative, TVA would close a small segment of Minga Road to the public for an estimated 2 to 4 years during construction to allow TVA to access the Construction Support Areas. TVA would dispose of cutoff wall construction spoils in these areas (primarily the Earl Light Tract).

The closure on Minga Road would not result in any residential driveway access closures. The proposed closure of Minga Road would eliminate the use of construction vehicles on the residential portion of the road and would result in minor impacts on residential traffic using Minga Road. Residents along Minga Road that would be most affected by closure of the portion of the road currently have an approximately 1.5-mile drive from their residences to the intersection of Boone Dam Road and SR 75. When the road closure is in effect, these same residents would have an approximately 2.4-mile drive (via Minga Drive to Hamilton Road) to the same intersection along SR 75. This small detour would result in only minor impacts on residential traffic in the immediate area. The closure would also affect current school bus routes along Minga Road for the duration of the closure.

The cumulative impacts associated with the No Action Alternative are addressed in TVA's 2016 Final EA.

3.7.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under the Proposed Action Alternative, TVA would change how it disposes of cutoff wall construction spoils. TVA would not utilize the Earl Light Tract for spoils disposal and would transport the materials to either the Iris Glen Environmental Center in Johnson City, Tennessee, the Carter Valley Sanitary Landfill in Church Hill, Tennessee, or the EcoSafe Systems Landfill in Blountville, Tennessee. Some clean spoils may be transported elsewhere, if the location meets criteria described above. TVA would not close a portion of Minga Road to the public during the project.

TVA estimates that disposal of an estimated 23,000 cubic yards of soil material from cutoff wall construction would require approximately 1,950 trucks to move the spoils to one of three landfill facilities from Boone Dam. TVA estimates that no more than 6 trucks per day, 40 per week and 160 per month would travel with cutoff wall spoils off-site from Boone Dam. These are estimates associated only with cutoff wall excavation and construction.

Additional spoils would be generated in spring and summer 2019, when TVA would be conducting activities to install support infrastructure (e.g., water systems, parking). TVA estimates that these actions would result in an additional 15,000 cubic yards of soil material. The transport of these 15,000 cubic yards of materials would require an additional 1,500 trucks to move the spoils off-site (approximately 22 per day, 150 per week, and 600 per month for approximately 3 months). Because of the sequence of construction actions (with infrastructure construction occurring prior to cutoff wall construction), it is unlikely that these spoils would be transported at the same time. Thus, the period in spring and summer 2019 during which daily traffic would be up to 22 trucks would be the most active.

Once the infrastructure is in place to support cutoff wall construction, TVA estimates that the number of trucks per day is reduced to no more than 6 per day, 40 per week, and 160 per month.

Combined, approximately 3,500 trucks would be required over the life of the project to transport approximately 38,000 cubic yards of spoils off-site. Note, these estimates are conservative and are subject to change. The estimates may vary based on several factors, including the actual depth of overburden and rock and the realized reutilization of slurry and stormwater volumes.

For travel to Iris Glen, the local roadways that are most likely to be impacted include the Boone Dam Road, SR 75, Interstate 26, and Main Street in Johnson City, although some variation in the route of these trucks would be likely. These roadways are moderately traveled during the day and the increase in daily traffic would be negligible.

For travel to Carter Valley, the local roadways that are most likely to be impacted include the Boone Dam Road, SR 75, SR 36, Interstates 81 and 26, US Highway 11W, and Bradley Creek Road. Some variation in the route would be likely. These roadways are also moderately traveled during the day and the increased in daily traffic would be negligible.

For travel to the EcoSafe facility, the local roadways that are most likely to be impacted include the Boone Dam Road, SR 75, SR 127, SR 394, and Harr Lane. Some variation in the travel route would be likely. The route serves fewer vehicles than the routes to Carter Valley and Iris Glen but are along well-established, moderately traveled highways. The increase in daily traffic would be negligible.

While these impacts do not represent major impacts to the area's transportation system, the transportation impacts are greater under this alternative than under the No Action Alternative due to the use of area highways for travel and the greater distance of travel (compared to transporting the materials to the nearby Earl Light Tract). Notably, however, residents and travelers along Minga Road would benefit under this alternative compared to TVA's original proposal outlined in the 2016 Final EA, because a portion of this road would remain open during the project.

Cumulative impacts on transportation associated with the Proposed Action are similar to those addressed in the 2016 Final EA for TVA's initial proposal. While the proposal would result in

minor, adverse impacts on transportation in the vicinity of the project, when combined with TDOT projects nearby, the impacts would be localized and temporary and would not appreciably add to traffic volumes across the area's roadway network.

3.8 WASTE MANAGEMENT

This section supplements Section 3.16 of the 2016 Final EA, which describes existing solid waste management at the proposed Boone Dam project site and the potential impacts on solid waste management associated with the TVA's seepage remediation project.

Solid waste may include a variety of components normally generated from construction activities, including biodegradable waste (i.e., food and kitchen waste), recyclable materials (i.e., paper, glass, metals, certain plastics), and inert materials (e.g., construction waste, dirt, rocks). Sources of solid waste include construction activities, construction equipment and maintenance, commercial and industrial facilities, and households and the generation of discarded items such as scrap metal, appliances, and furniture. Generally, solid waste is managed by reduction, reuse, recycling, and disposal in landfills.

3.8.1 Affected Environment

As described in the 2016 Final EA, there are several landfills within the geographic region of Boone Reservoir, including the Iris Glen Environmental Center located in Johnson City southeast of Boone Dam, and the EcoSafe Systems Landfill located in Blountville, Tennessee, northeast of Boone Dam. These facilities, as well as the Carter Valley landfill in Church Hill, Tennessee, are relevant to TVA's proposed modifications to the Boone Dam Seepage Remediation project.

The Iris Glen facility is a Class I disposal facility that opened in 1994 and is operated by Waste Management Inc. The facility accepts waste including asbestos-friable, asbestos-non-friable, construction and demolition debris, drum management-solids, industrial and special waste, and municipal solid waste (Waste Management 2015). In 2016, officials estimated the facility received 696 tons of waste daily, transported by up to 200 trucks daily, and had enough capacity to operate until 2037 (Vance, 2017).

The EcoSafe Systems Landfill, also a Class I facility, is located on Harr Lane in Blountville and began operations in 2012. The facility is approved to accept a variety of waste streams, including domestic, commercial and institutional wastes, municipal solid wastes, bulky wastes, landscaping and land clearing wastes, industrial wastes, construction/demolition wastes, faring wastes, shredded automobile tires, dead animals and approved special wastes (TDEC 2019). The facility is approximately 85 acres in size and has a capacity of approximately 10.4 million cubic yards in five cells (2011 Mclean).

An additional facility not addressed in the 2016 Final EA that is relevant to TVA's proposed action is the Carter Valley facility, a Class I facility located in Church Hill, Tennessee. Carter Valley, managed by BFI Waste Systems, accepts domestic, commercial and industrial wastes, municipal solid wastes, landscaping and land clearing wastes, construction/demolition wastes,

farming wastes, and special wastes (TDEC 2019) The 347-acre facility has approximately 25 years of capacity remaining and, in 2013, accepted approximately 900 tons of waste daily (Proffitt, 2013).

One additional location under consideration by TVA as a site for placement of clean spoils is located on Centenary Road and is also adjacent to Airport Highway in Sullivan County, approximately 5 miles from Boone Dam. The privately owned parcel has previously been used for agricultural purposes. The owners received an NPDES permit from TDEC in September 2018 for industrial activity, including the potential disposal of clean fill and other clean construction waste.

3.8.2 Environmental Consequences

3.8.2.1 No Action

As described in the analysis in the 2016 Final EA, incorporated herein, construction associated with the cutoff wall would generate several nonhazardous solid waste streams. Soils, rock, concrete, and other clean fill materials would be removed from the construction site and placed at the two Construction Support Areas. Upon completion of the cutoff wall, TVA would also restore the crest of the dam to its previous condition, removing the work platform and placing approximately 20,000 cubic yards of fill material to recreate the crest.

Overall, adverse direct and indirect impacts on solid waste management would be minor and temporary because of the nonhazardous nature of materials (i.e., rock and soil) and construction material waste streams (i.e., cement and grouting materials) associated with the Proposed Action. TVA's actions would not contribute to cumulative impacts related to waste generation or management in the vicinity of the project; the waste associated with the dam remediation would not affect the waste disposal capacity of the other projects considered in the cumulative impacts analysis in the 2016 Final EA.

3.8.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under the Proposed Action, TVA proposes to move the cutoff wall construction spoils to the Iris Glen, Carter Valley, or EcoSafe landfill facilities; clean spoils would either be transported to these facilities or to an appropriate site for placement. This proposal modifies TVA's initial plan to transfer spoils to the Earl Light Tract for permanent disposal. The 2016 Final EA included a discussion of both the travel to and cost of disposal at an area landfill(s), concluding that the costs would be prohibitive (the Carter Valley facility was not addressed in the 2016 Final EA). However, TVA reconsidered the option and determined that disposal off-site would be at or near the same cost and effort as disposing of the spoils at the Earl Light Tract. TVA also considered that using Iris Glen, Carter Valley, and EcoSafe, or another appropriate site for clean spoils, would be beneficial because TVA would minimize the physical disturbance of the Earl Light Tract, and the duration of its closure to the public for use and enjoyment would be reduced.

In addition, under the Proposed Action, TVA would install a concrete flood wall at the crest of the dam, rather than restore the dam's crest with fill material. The change would eliminate the

need for removal of the work platform used during the cutoff wall installation. TVA estimates that leaving the structures in place would eliminate the need to borrow approximately 20,000 cubic yards of fill, and would eliminate the need to dispose of approximately 7,000 cubic yards of concrete and crushed stone.

As noted above, at this time, TVA anticipates that approximately 23,000 cubic yards of solids/spoils would result from construction of the cutoff wall and approximately 15,000 cubic yards would result from related infrastructure improvement actions. Thus, a total of 38,000 cubic yards are estimated to be generated from the final phase of the remediation project. In addition, TVA estimates that more than 400,000 gallons of fluids would be treated on-site, with the separated sediment and solids transported offsite for disposal. Note, these estimates are subject to change and may vary based on several factors, which may include the actual depth of overburden and rock, as well as the actual reutilization of slurry and stormwater volumes.

Under this alternative, TVA would obtain necessary permits from TDEC for the disposal of the special waste and dispose of spoils that have come in contact with some drilling fluids to one of the three Class I landfills. Under this alternative, clean spoils (e.g., topsoil, gravel, broken concrete) may be placed at another location by TVA or the construction contractor if the location meets the following conditions:

- The property owner has contacted local or state officials and obtained verification that the spoils or fill can be placed in the designated area according to local or state regulations and environmental restrictions. Verification would be provided to TVA.
- No spoils or fill will be placed in the 100-year floodway.
- No spoils or fill will be placed in any wetland as defined by Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers and TDEC's Aquatic Resources Alteration Permit program.
- Prior to placement of spoils or fill, TVA Environmental Compliance and Operations staff will review the designated area and determine whether additional environmental review is needed.

By ensuring that special wastes are disposed of at the Class I landfills and that clean spoils are placed at locations meeting these conditions, no significant direct or indirect impacts associated with management of the construction waste would occur.

The amount of waste that would be transported to and stored at Iris Glen, Carter Valley or EcoSafe would contribute to cumulative impacts related to waste management in the vicinity of the project. Given the estimated volume that would be generated under this alternative (about 38,000 cubic yards), the proposed action would have a minor effect on the waste disposal capacities of these landfills, given their capacities and when considering other projects considered by TVA in the cumulative impact analysis section of the 2016 Final EA and other activities in the area generating waste. Because TVA may send waste to up to three facilities, the effects to the capacity of any one of the facilities may be reduced marginally.

3.9 LAND USE

This section provides an overview of the existing land use in the vicinity of the Boone Dam project and lands adjacent to Boone Reservoir, and the potential impacts on land use associated with the No Action Alternative and the Proposed Action.

3.9.1 Affected Environment

The Earl Light Tract is allocated as Zone 4 (Natural Resource Conservation). TVA proposed in 2016 to utilize 71.2 acres of the 118-acre parcel as a Construction Support Area. The tract is currently managed by TVA for dispersed public recreation and natural resources. A 54-acre portion of this parcel also is licensed for agricultural use as hay land. The parcel has been allocated by TVA to Zone 4 (Natural Resource Conservation) to reflect its capability to provide a diversity of ecological communities and recreation opportunities. The majority of the 71.2-acre Construction Support Area have historically been maintained primarily as open fields; a small area was previously used as a borrow pit during construction of Boone Dam.

Tract 22R is allocated as Zone 6 (Developed Recreation) and occupies 12.8 acres of the 53-acre parcel. The larger parcel that this site is a part of consists primarily of forested areas, and a small area is mowed grass. The parcel was allocated to Zone 6 (Developed Recreation) to reflect current recreation uses, including a paved boat ramp and parking lot, courtesy pier, and fishing access. The majority of the activities at Tract 22R would be located within an area of this parcel that is primarily an existing utility right-of-way with a transmission line.

3.9.2 Environmental Consequences

3.9.2.1 No Action Alternative

Under the No Action Alternative, activities within the Boone Dam reservation and the two Construction Support Areas would change during the dam remediation process. However, land use allocations or designation would not change as a result of the construction. Land use at TVA's proposed two Construction Support Areas would be directly affected during the project, as portions of these tracts would be managed in a manner that is not consistent with their

current zone allocations. However, after the completion of the project, Construction Support Area 1, currently allocated as Zone 4 (Natural Resource Conservation), would again be managed for natural resource conservation and Construction Support Area 2, currently allocated as Zone 6 (Developed Recreational), would be managed for developed recreation. Implementing the Proposed Action does not change TVA's zone designations for these areas because the proposed uses are temporary. TVA would return disturbed areas at the dam location and at the two Construction Support Areas to their previous uses. Disturbed areas would be revegetated with native or noninvasive plant species, and TVA would regrade and restore areas that were previously disturbed (e.g., borrow pit areas) to an improved condition. Cumulative impacts associated with the No Action Alternative are adequately addressed in the 2016 Final EA.

3.9.2.2 Proposed Action – Modifications to Construction of the Composite Seepage Barrier

Under this alternative, TVA would continue to implement remediation activities at Boone Dam and on the adjacent Tract 22R. Although Tract 22R would be used for additional activities (e.g., employee parking), the use would be similar to those described in the 2016 Final EA and no additional areas within Tract 22R would be disturbed. Under this alternative, the anticipated impacts to the use of most of the Earl Light Tract would not occur. Except for a small area where TVA has built a parking and storage area, TVA would not use the parcel for construction support activities and current resources on the parcel would not be impacted as anticipated. TVA would return the property, including the temporary parking and storage area, to its intended use and would begin managing it for Natural Resource Conservation sooner than originally planned.

CHAPTER 4

4.0 LIST OF PREPARERS

The following individuals contributed to the completion of the Supplemental EA.

Name/Education	Experience	Project Role
Hallie Hearnes *M.A., Public History* *B.S., Historic Preservation*	11 years in historic preservation, cultural resource management, historic architectural recordation and assessment, and public outreach.	Historic and Cultural Resources
Matthew Higdon *M.S., Environmental Planning* *B.A., History*	16 years in natural resources planning and NEPA compliance	NEPA Compliance, Recreation, Land Use, Transportation
Charles McEntyre *M.S., Environmental Engineering* *B.A., Biology, Minor Chemistry*	41 years in water and wastewater engineering	Surface Water Quality
Lori Whitehorse *B.S., Plant and Soil Science*	15 years in environmental regulatory compliance	NEPA Compliance, Waste
Carrie C. Williamson, PE, CFM *M.S. and B.S., Civil Engineering; Professional Engineer*	6 years in Floodplains and Flood Risk; 3 years in River Forecasting; 11 years in Compliance Monitoring	Floodplains and Flood Risk

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CHAPTER 5

5.0 ENVIRONMENTAL ASSESSMENT DISTRIBUTION

Following is a list of the agencies, organizations, and persons who have received notices of availability with instructions on how to access the EA on the TVA webpage.

Federal Agencies and Offices

- U.S. Department of Army, Corps of Engineers
- U.S. Fish and Wildlife Service

State Agencies

- Tennessee Wildlife Resources Agency
- Tennessee Department of Environment and Conservation
- Tennessee Historical Commission

Organizations

- Boone Lake Association
- Boone Watershed Partnership
- Ducks Unlimited
- First Tennessee Development District
- National Wild Turkey Federation
- Sierra Club (Watauga Group)
- Sullivan County Soil Conservation District
- Tennessee Wildlife Federation
- Tennessee Ornithological Society (Elizabethton, Lee and Lois Herndon Chapter)
- Trout Unlimited
- Washington County Soil Conservation District

Individuals

TVA notified over 1,200 individuals who have requested to receive regular email updates regarding the remediation of the dam.

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CHAPTER 6

6.0 REFERENCES

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APPENDIX A – CORRESPONDENCE

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

November 8, 2018

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

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), BOONE DAM REMEDIATION AND RESERVOIR DRAWDOWN SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT, SULLIVAN COUNTY,

On December 22, 2015, TVA and the State Historic Preservation Officer executed a Programmatic Agreement (PA) regarding the Boone Dam Remediation and Reservoir Drawdown Project. Since 2016, TVA has made considerable progress in constructing the barrier and remediating seepage at the dam. Grouting along the embankment has been completed and TVA is preparing to begin the final stages of the project, which entails constructing a concrete cutoff wall along the dam's earthen embankment.

In the 2016 consultation and EA, TVA proposed to restore the crest of the dam as the fourth and final stage of seepage remediation. Early in the project, TVA lowered the crest of the earthen embankment 10 feet to create a work platform. Rather than removing the work platform and returning the crest of the dam to its previous height, TVA proposes to leave the work platform that has been in place during construction (Figures 1-4). TVA proposes to install a permanent concrete flood wall with "L-shaped" or "T-shaped" footings (not visible below the surface) approximately 9.6 ft in height, to create a minimum elevation of 1408.5 ft. The L-wall would be approximately 8000 ft long with each end blending into existing grade at that same minimum elevation, where appropriate, at the concrete dam and right rim.

While the original design for this project called for the earthen embankment to be returned to its original height and appearance, it is no longer the preferred design. Leaving the work platform in place and the addition of a concrete floodwall as proposed would allow regular access to conduct future inspections and assessments of the performance of the seepage barrier on a safer and more usable crest surface. The proposed design change would allow TVA to continue safe operation of the dam for flood control, water supply, hydroelectric power, and recreation both in the reservoir and in the dam's tailwaters.

TVA finds the area of potential effects (APE) for the design change to the earthen dam to be the entire boundary of the NRHP-listed Boone Hydroelectric Project (Figure 5). The APE has been subjected to multiple surveys and assessments (Prybylski 2015; Bradley et al. 2015; Martens et al. 2017). The only historic resource within direct line of sight to the proposed project is Boone

Hydroelectric Facility, listed in the NRHP in 2017. Previous survey and consultation has cleared the entire project area for archaeology (Bradley et al. 2015, Pietak and Holland 1998, Wells 2015) (see Figure 5).

The change to the treatment of the dam's crest is anticipated to have a direct visual effect on the earthen embankment, a portion of a contributing structure of the NRHP-listed Boone Hydroelectric Project. The earthen embankment, originally constructed between 1950 and 1953, was altered post-1979 to add an additional 8.5 ft of height after *Federal Guidelines for Dam Safety* required protection against a probable maximum flood (PMF) (FEMA 2004). The change in the design to feature a concrete floodwall instead of the steep slope of the earthen embankment design, as modified after 1979, will adversely affect the design of the Boone Hydroelectric Project.

The PA for this project was designed to address potential changes to the design and to include mitigation of any potential adverse effects as a result of the project. Mitigation outlined in the PA included the preparation of Historic American Engineering Record (HAER) documentation (Stipulation II.B. 1). This documentation (HAER-50) was completed by Amec Foster Wheeler (now Wood) and submitted to the National Park Service (NPS) Southeast Regional Office in February 2018. TVA finds that this documentation fulfills mitigation requirements outlined by the PA.

Pursuant to 36 CFR 800.5(a), we are seeking your concurrence with TVA's findings that changes to the treatment of the dam's crest, involving the construction of a floodwall instead of restoring the earthen embankment will have a direct visual effect to a historic property.

Should you have any questions or comments, please contact Hallie Hearnes in Knoxville by email, hahearnes @t va.gov or by phone, (865) 632-3463.

Sincerely,

Michaelyn S. Harle on Behalf of Clinton E. Jones
Manager
Cultural Compliance

HAH:ABM
Enclosures

REFERENCES CITED

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Figure 1. Plan view depicting the location of the proposed floodwall at the crest of the dam.

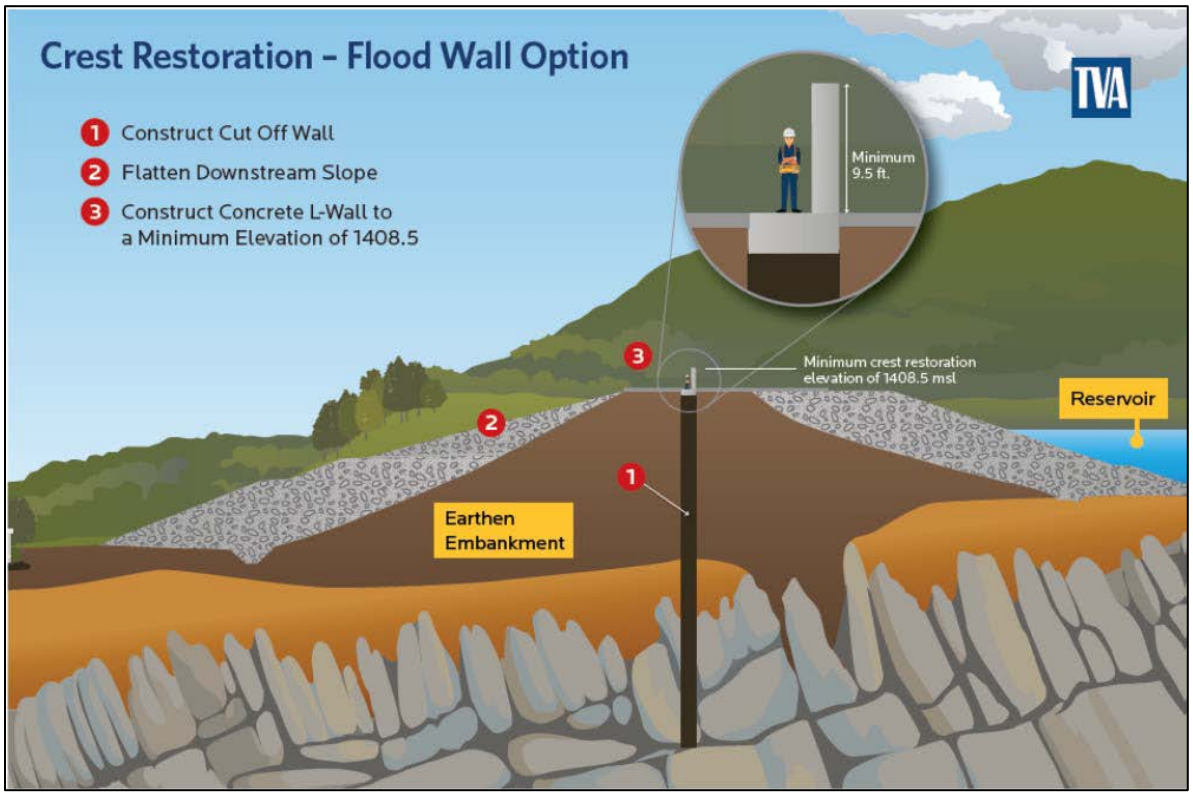

Figure 2. Section view of the proposed flood wall.

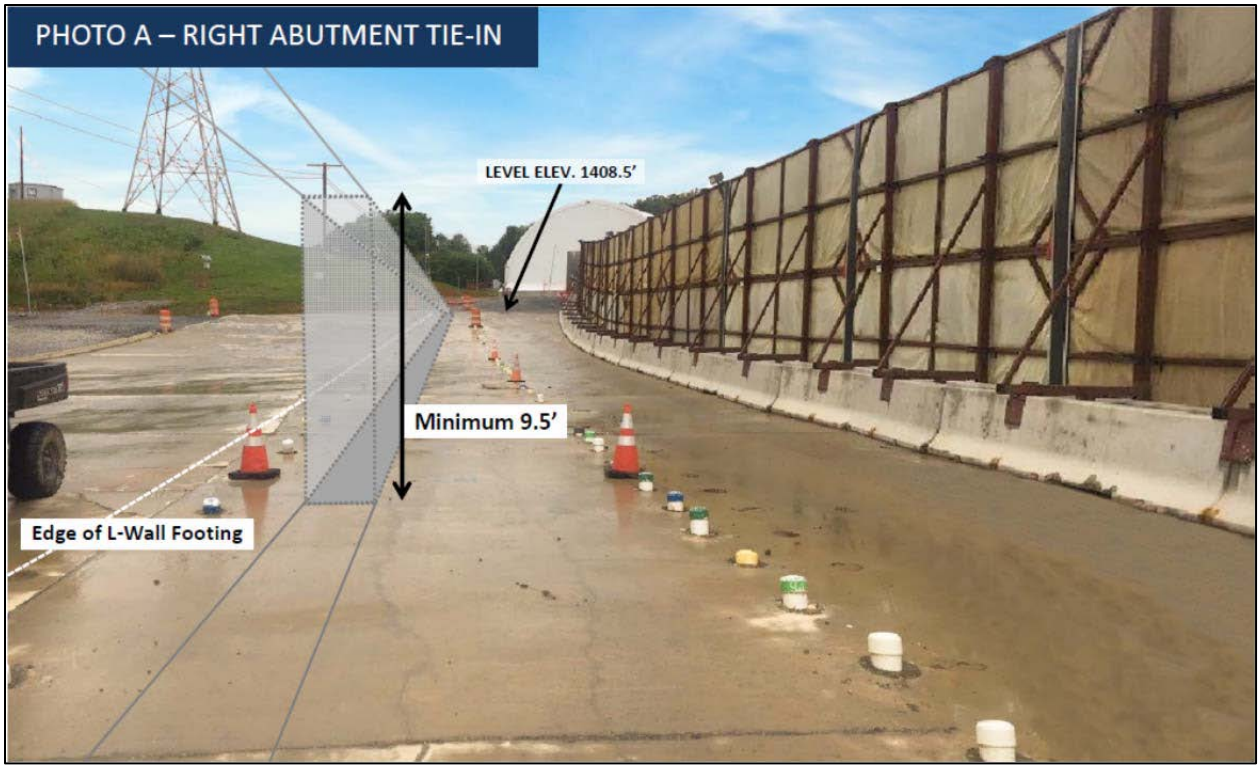

Figure 3. Photo illustration of the existing construction wall (right) and the proposed floodwall height (left).

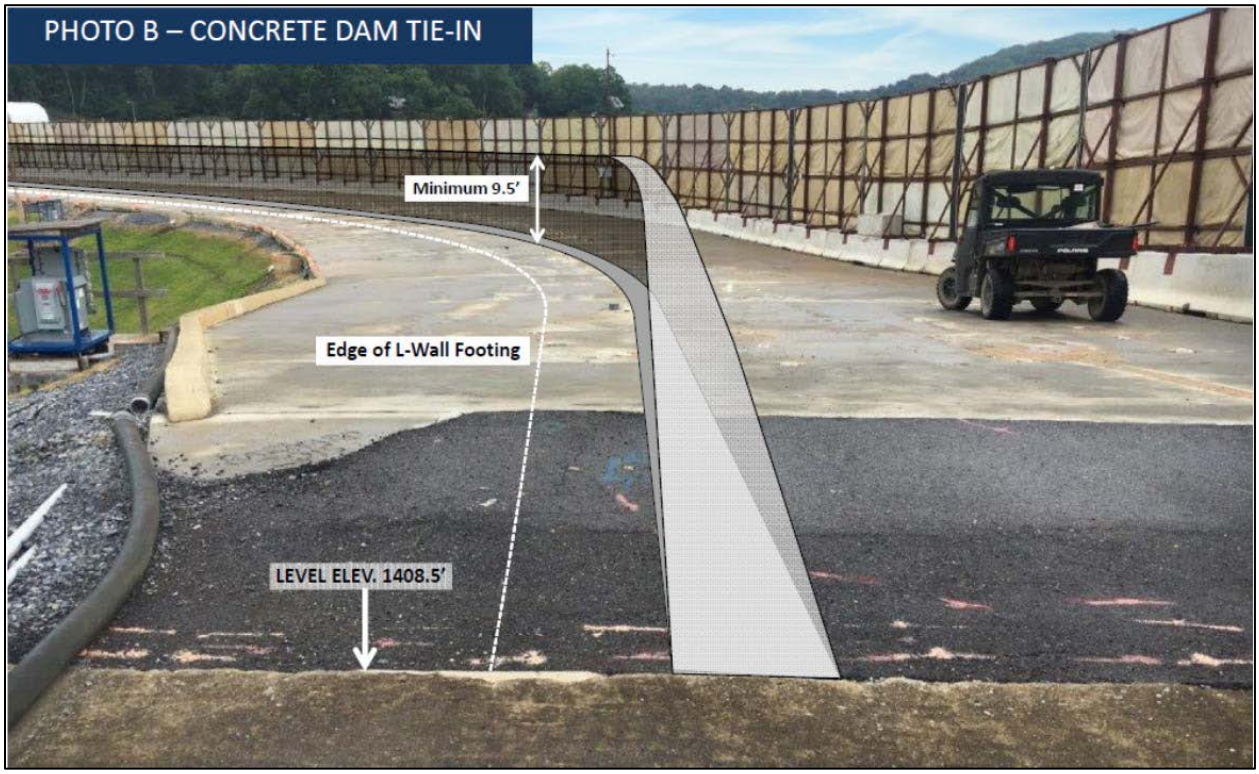

Figure 4. Photo illustration of the proposed floodwall height (left) and the existing construction wall (right) at the point where it will tie in with the concrete dam.

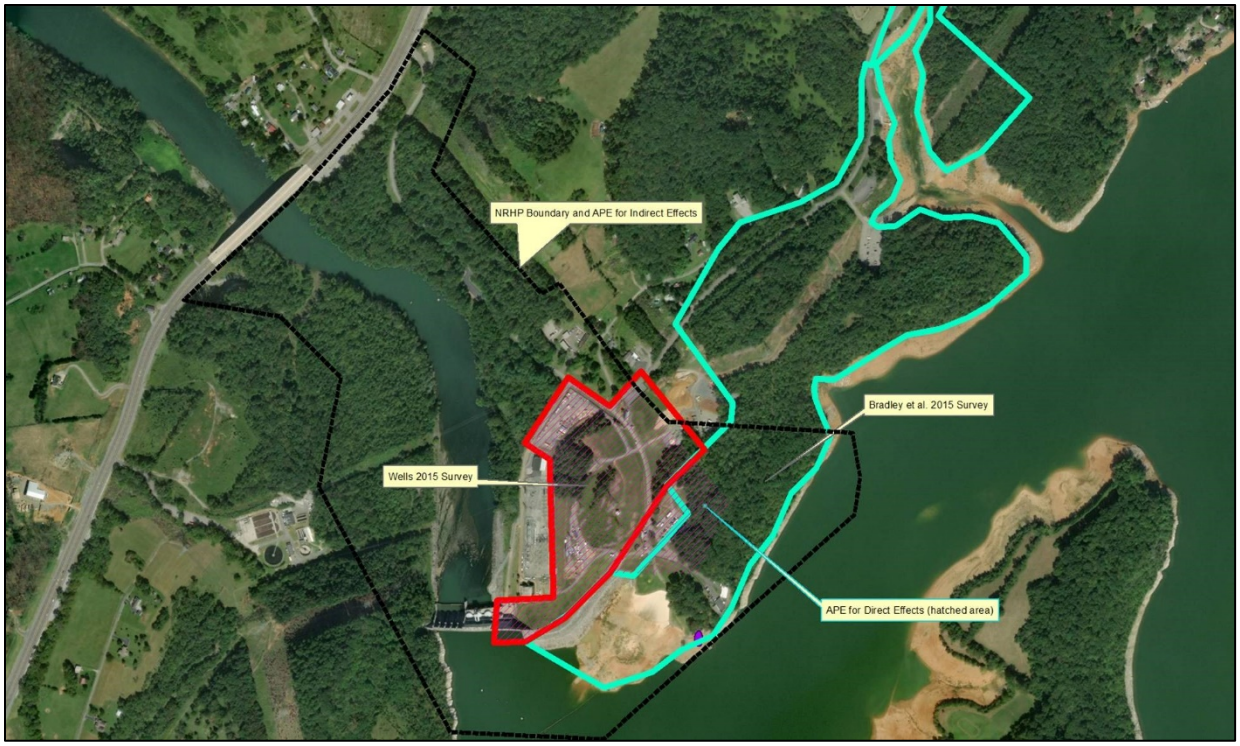

Figure 5. Aerial photograph depicting the NRHP boundary of Boone Hydroelectric Project.

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON PIKE
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

December 18, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Boone Dam Remediation and Reservoir Drawdown Supplemental Environmental Assessment, Sullivan County, TN

Dear Mr. Jones:

In response to your request, we have reviewed the information you submitted regarding the change in floodwall design as part of the above referenced undertaking and concur that Adverse Effects caused by the changes to the treatment of the dam's crest, involving the construction of a floodwall instead of restoring the earthen embankment have been mitigated, as per the PA, through the preparation and submittal of Historic American Engineering Record (HAER) documentation (Stipulation II.B.1).

Questions and comments may be directed to Justin Heskew at (615) 770-1092. Your cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

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

EPM/jsh