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Pickwick Landing Dam
SOUTH EMBANKMENT SEISMIC UPGRADE
FINAL SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
Hardin County, Tennessee

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List of Acronyms

APE	Area of Potential Effect
ARAP	Aquatic Resources Alteration Permit
BMPs	Best Management Practices
CFR	Code of Federal Regulation
EA	Environmental Assessment
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	USFWS National Wetlands Inventory
PCA	Packaging Corporation of America
SEA	Supplemental Environmental Assessment
TDEC	Tennessee Department of Environmental Conservation
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

CHAPTER 1 - PURPOSE AND NEED FOR ACTION

1.1 Introduction and Background

In September 2016, Tennessee Valley Authority (TVA) completed a final Environmental Assessment (EA) to document the potential effects of TVA's upgrades to the south embankment of Pickwick Landing Dam to improve performance of the dam during and following a large earthquake. Since the EA was completed, there have been changes to the design to reduce overall risks to the integrity of the dam during construction and to address construction challenges. TVA is proposing to implement the necessary design changes to complete its upgrades at Pickwick Landing Dam. This supplemental EA (SEA) evaluates the anticipated environmental impacts of the proposed design changes, which are necessary to upgrade the south embankment of Pickwick Landing Dam.

The Pickwick Landing Dam is a multi-purpose concrete and earthen embankment dam located on the Tennessee River (Mile 206.7) in Hardin County, Tennessee, near Tennessee's border with Mississippi and Alabama (Appendix A, Figures 1 and 3). The dam was completed in the 1930s and is a significant producer of hydroelectric power and a vital navigation link on the Tennessee River. In addition to the 3,300-foot-long dam which extends to the north and two large navigation locks, there is an earthen embankment which extends to the south approximately 4,380 feet. State Highway 128 crosses the entire length of the dam.

The Pickwick Landing Dam is approximately 100 miles from southern portions of New Madrid Seismic Zone along the Mississippi River. According to the U.S. Geological Survey (USGS 2009), the New Madrid is the most active seismic zone in the United States east of the Rocky Mountains, and there is a 7 to 10 percent chance or probability that a quake of magnitude 7 to 8 will occur in the New Madrid region within the next 50 years. A seismic stability evaluation of the dam's south embankment completed in 2014 indicated that under a "design earthquake" scenario, the loss of strength is likely to occur in portions of the embankment, leading to slope instability. The analysis indicated that the mean annual probability of an earthquake-induced breach is between 1 in 2,500 and 1 in 1,250 for reservoir elevations between 408 (winter pool) and 414 (summer pool) feet, respectively.

TVA considers these probabilities high enough that upgrades to the south embankment are warranted. Even if a breach were not to occur, a slope stability failure (especially one in the upstream direction) would likely require lowering the reservoir well below winter pool to ensure safety and make repairs. Making scheduled upgrades to the embankment will allow TVA to avoid the significant economic impacts that would result from having to lower the reservoir below winter pool levels for an extended period in the wake of an emergency.

Since the publication of the 2016 EA, design changes have been suggested which would improve worker safety, reduce construction traffic on local roads, and better ensure seismic stability of the dam during construction. This SEA addresses impacts to resources created by the design changes and incorporates by reference the 2016 EA and previously identified impacts as appropriate.

1.2 Other Environmental Reviews and Documentation

TVA previously prepared an EA for actions related to the proposed construction and seismic upgrades to the Pickwick Landing Dam in September 2016, *Pickwick Landing Dam South Embankment Seismic Upgrade* (TVA 2016a). The findings and analyses of this EA are incorporated by reference in Chapter 3 as appropriate. In addition, TVA prepared a white paper in February 2018 for an additional 0.58 acres of forest to be cleared adjacent to the previously proposed tree removal areas.

1.3 Scope of the Supplemental Environmental Assessment

Pursuant to the National Environmental Policy Act (NEPA) and the implementing regulations promulgated by the Council on Environmental Quality (40 Code of Federal Regulations [CFR] 1500–1508), federal agencies are required to evaluate the potential environmental impacts of any proposals for major federal actions. TVA prepared this SEA to assess the potential consequences of TVA's Proposed Action Alternative on the environment and human health in accordance with NEPA and TVA's guidelines for implementing NEPA (TVA 1983).

This SEA tiers from TVA's September 2016 Pickwick Landing Dam South Embankment Seismic Upgrade EA (referred to herein as the 2016 EA). Based on the specific activities proposed for this project, TVA was able to focus its environmental review on specific resources and eliminate others from further evaluation. This SEA does not contain detailed discussions on resources not found in the project area, or where site-specific conditions would not change the impact analysis presented in the 2016 EA.

This SEA describes the existing environment at the project site and analyzes potential environmental impacts associated with the changes of the Proposed Action Alternative. As noted earlier, previously detailed impacts for resources documented in the 2016 EA will not be reassessed in this document but rather incorporated by reference. In addition, the No Action Alternative was fully addressed in the 2016 EA and will not be reanalyzed in this SEA unless warranted by the design changes being recommended.

The original 2016 project Study Area included the areas along and adjacent to the dam's south embankment on both the upstream and downstream sides (Appendix A, Figure 2). On the downstream or west side of the embankment, potential actions would occur along the base of the entire embankment. An area to the west of the embankment would be used for laydown of equipment and materials in support of construction activities. Project activities would also be located upstream or east along the embankment and within the reservoir, with an extended fill area proposed along the embankment's upstream side near the dam's navigation locks.

The project area for this SEA includes the 152 acre[1] Study Area previously reviewed in the 2016 EA as well as four additional areas outside of the original Study Area. These areas include two 35-acre upstream staging/fleeting areas, additional downstream footprint near Station 40+00 (approximately 0.89 acres), upstream fill area between Station 40+00 and 43+00 (approximately 0.47 acres), and a turbidity curtain placed around the Packing

[1] The initial 2016 EA Study Area was 157 acres. However, after recalculating the boundary it was determined that the Study Area was approximately 152 acres.

Corporation of America (PCA) water intake (approximately 0.77 acres), for a total of 223.76 acres (Appendix A, Figure 2).

Within the SEA Study Area footprint, the proposed placement of fill footprint increased from approximately 46.34 acres to approximately 50.36 acres of direct impacts. An approximately 100-foot buffer is included around the fill and labeled as proposed impact area due to the need for an additional 50 feet to be cleared of vegetation beyond the proposed fill areas. Although most actions and environmental impacts associated with the proposed upgrades would occur within the Study Area, the area of potential impacts to certain environmental resources is broader than the Study Area's boundaries.

This SEA consists of six chapters discussing the project alternatives, environmental resources potentially affected, and analyses of impacts. The structure of the SEA is outlined below:

- **Chapter 1.0:** Describes the purpose and need for the project, the decision to be made, related environmental reviews and consultation requirements, necessary permits or licenses, and the SEA overview.
- **Chapter 2.0:** Describes the alternatives, provides a comparison of alternatives, and identifies the Preferred Alternative.
- **Chapter 3.0:** Discusses the affected environment within the Study Area and potential impacts on environmental resources. Mitigation measures also are proposed, as appropriate.
- **Chapters 4.0, 5.0, and 6.0:** Contain the list of preparers of this SEA, the SEA distribution list, and the literature cited in preparation of this SEA, respectively.In consideration of the nature and scope of the proposed action, TVA determined that the potential impacts of the alternatives under consideration on several environmental resources are bounded by the previous assessment and documented in the 2016 EA.

Based on TVA's experience with conducting environmental reviews of seismic upgrade projects, the nature of the Proposed Action Alternative, and other available information, the potential effects to the following resources have been considered in this supplemental environmental review:

- Floodplains
- Groundwater
- Surface water
- Wetlands
- Threatened and endangered species
- Natural areas, parks, and recreation
- Transportation
- Navigation
- Cultural resources

TVA expects that most of the resources listed above would only be nominally affected by TVA's proposed upgrades, and thus, the SEA analysis of these resources would be concise. The primary environmental issues related to these resources include:

- Clearing of wooded areas downstream of the dam (up to 0.78 acres);

- Impacts to wetlands, streams and floodplains from berm construction and new fill materials; and
- Impacts from construction traffic, including importing new fill material via road or barge.

Most actions associated with the proposed upgrades would occur on or adjacent to the dam's earthen embankment, which is a previously disturbed area; therefore, impacts to most resources are anticipated to be minimal.

1.4 Necessary Permits and Consultation

TVA would secure any permits necessary to undertake the Proposed Action Alternative. All permits would be held by TVA. TVA has obtained these permits for the activities evaluated in the 2016 EA, but would need to update/amend any existing permits to incorporate the newly proposed SEA activities.

1.4.1 National Pollutant Discharge Elimination System (NPDES) Stormwater Construction Permit

A NPDES Stormwater Construction Permit is required for clearing, grading or excavating of the project area. An updated Notice of Intent for Construction Activities and site-specific Stormwater Pollution Prevention Plan would be developed and submitted to the Tennessee Department of Environmental Conservation (TDEC) for approval.

1.4.2 Individual Aquatic Resources Alteration Permit (ARAP) Section 401 Water Quality Certification

In compliance with Section 401 of the Clean Water Act, an Individual ARAP Section 401 Water Quality Certification coordinated through the TDEC's Division of Water Resources would be required. TVA must update/amend its existing Section 401 Permit for the additional discharge of fill material and dredging in wetlands.

1.4.3 Section 10 / Section 404 Clean Water Act Permit

TVA must update/amend its existing Section 10 of the River and Harbors Act and Section 404 of the Clean Water Act permits to implement dredge or fill activities in jurisdictional waters of the United States. TVA would coordinate with the United States Army Corps of Engineers (USACE).

1.4.4 Consultation Requirements

1.4.4.1 Endangered Species Act

Consultation with the U.S. Fish and Wildlife Service (USFWS) on the potential impact of federal actions on federally listed threatened and endangered species is required under Section 7 of the Endangered Species Act.

1.4.4.2 National Historic Preservation Act

Consultation with the Tennessee Historical Commission as to the impact of federal actions on Tennessee historic and archaeological sites is required under Section 106 of the National Historic Preservation Act (NHPA). In addition, TVA must consult with interested federally recognized Indian tribes as to the impact on areas that may be of religious and cultural significance to those tribes.

1.4.4.3 Executive Order 11988 – Floodplain Management

Consistent with Executive Order (EO) 11988, TVA analyzed the proposed project using the hydraulic model in the most recent official Flood Insurance Study to determine whether the Base Flood Elevation of the Tennessee River would increase greater than 0.00 foot as a result of the project. See Section 3.2 for the results of the hydraulic model.

1.5 Decision to be Made

The decision to be made is whether to approve or disapprove the proposed seismic upgrades to the south embankment of the Pickwick Landing Dam. The activities associated with the proposed upgrades include the following major items. Additional details of the proposed activities are provided in Section 2.1.2.

- Proposed Upstream or East Side of the Embankment – This area would include proposed placement of fill for the upstream berm and extended fill area. The proposed impact area for this portion of the project is approximately 22.30 acres, which is an increase of approximately 1.28 acres from the 2016 EA footprint. (Appendix A, Figure 2).
- Proposed Downstream or West Side of the Embankment – This area would include proposed placement of fill for the downstream berm and extended fill area. The proposed impact area for this portion of the project is approximately 28.06 acres, which is an increase of approximately 2.74 acres from the 2016 EA footprint. (Appendix A, Figure 2).
- Downstream Staging Area – This approximate 7.7-acre area would include utilizing a grassed, gently sloping embankment area, rather than the downstream fill area, as a staging area for fill stockpiles, construction materials, and construction equipment. This area also includes the area under the State Highway 128 bridge, which would connect the upstream and downstream work areas. This would reduce the need to use local roads to transfer materials and equipment between upstream and downstream work areas. (Appendix A, Figure 2).
- Proposed Barge Staging Areas – Two 35 acre temporary barge/fleeting areas would be placed at the north end of the upstream dam work area, where fill materials can be shipped to the site via barge, unloaded at the barge unloading site on the dam, and transported under the State Highway 128 bridge structure to the downstream work zone. (Appendix A, Figure 2).

1.6 Public Outreach

The draft SEA was released to the public for a 30-day comment period. The draft SEA was posted on the TVA website and notices of its availability and requests for comments were sent to government agencies, organizations, and interested individuals (See Section 5.0). TVA also announced its availability and requested comments in an ad in the local newspaper, The Courier, on October 18, 2018.

During the public review period, TVA received a total of 3 comment letters; 2 from TDEC and 1 from the National Park Service-Shiloh National Military Park. These comment letters and TVA's responses are included in Appendix B.

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CHAPTER 2 - ALTERNATIVES

2.1 Description of Alternatives

In this section, the Proposed Action Alternative is analyzed in detail. A synopsis of the potential environmental effects of adopting each alternative is provided in Table 1 provided below in Section 2.2.

2.1.1 No Action Alternative

Under the No Action Alternative, TVA would take no action to improve the condition of the embankment. TVA would continue to operate the dam and reservoir under normal operations. The risk of a dam breach and reservoir loss during or following a large seismic event would remain. This alternative is not considered reasonable because it does not address the risk to public health and safety or the region's economy. The No Action Alternative was detailed and analyzed in the 2016 EA.

2.1.2 Proposed Action Alternative

Under the Proposed Action Alternative, TVA would proceed with the seismic upgrades to the dam as discussed in the 2016 EA with the proposed design changes outlined in Sections 2.1.2.3 and 2.1.2.4 of this SEA. As proposed in the 2016 EA, TVA would construct berms along the toe of the upstream and downstream sides of the embankment to address potential shallow failures of the embankment and place extended fill in select locations on each side of the embankment to address deeper failure modes. TVA also plans to utilize the 7.5 acre laydown area located on the west side of North Carolina Landing Road that will be used for parking, equipment and material storage and staging, placement of a temporary office trailer(s), and other project management activities detailed in the 2016 EA. Sections 2.1.2.1 and 2.1.2.2 describe the actions proposed within the 2016 EA.

2.1.2.1 Proposed Downstream Activities per 2016 Environmental Assessment

The proposed berm along the downstream side would be located adjacent to the dam and would stabilize potential shallow downstream failures through the embankment. The extended fill would be placed only in select locations downstream and would reach a distance downstream of the toe to stabilize potential failures through the foundation's silty sand. The area to receive the most extended fill would be to the north, close to the dam's navigational lock. The fill areas would not need to be as high as the berm. Work elements on the downstream side would include:

- Site preparation: Prior to construction, trees and stumps in the project area would be removed and disposed of off-site, topsoil and riprap would be removed to a storage area, and erosion and sedimentation controls would be installed. Much of the site preparation activities for the 2016 EA actions have been completed.
- Materials and placement: The downstream berm would consist of sand and gravel imported from an off-site location, placed with bulldozers, and compacted with vibratory drum rollers.
- Cover: The existing riprap on the downstream slope would be stripped and stockpiled so it could be used to armor the face of the new berm. The flat portion of the berm would be covered with topsoil and seeded.

Because the weight of the berm could cause the existing clay tile toe drain pipes to collapse, the toe drain pipes would be replaced prior to construction, and new manholes passing through the berm would be constructed. At one location along the embankment, the existing drainage swale that collects flow would be filled as part of the fill area so it would be replaced with a buried pipe extending past the fill area. Additional work activities proposed since evaluation of the 2016 EA associated with the downstream portion of the project are detailed in Section 2.1.2.3.

2.1.2.2 Proposed Upstream Activities per 2016 Environmental Assessment

Similar to the proposed downstream berm, a berm and fill would be built on the upstream side of the dam. Construction of the berm on the upstream side would involve placing fill consisting of crushed stone, sand and/or gravel (which is easier to place underwater without compaction than sandy or clayey soils), or rip rap into the floodplain or waters along the embankment. If sand and gravel are used for the upstream berm, vibratory densification techniques would be used to compact the berm. The berm would have a riprap face and would be constructed either with a barge-mounted crane or placed from land starting at the south abutment.

Extended fill would also be placed in an area of the embankment adjacent to the dam's lock (see Exhibit 1). Because the extended fill would extend far beyond the upstream slope, the crushed stone would be placed using barge-mounted equipment.

TVA does not propose to alter reservoir operations at Pickwick Landing Dam during the construction period. Additional work activities proposed since evaluation of the 2016 EA associated with the upstream portion of the project are detailed in Section 2.1.2.3.

2.1.2.3 Changes to the Design Resulting in Additional Area of Impact Since the 2016 EA (Exhibit 1, reference by item number)

1. Downstream Site Access Improvements: The 2016 EA work area did not include a construction access road to the downstream work area from North Carolina Landing Road. The original plan was to send construction traffic along an existing driveway to a maintenance building east of North Carolina Landing Road. This path included several sharp turns, which may be difficult for construction vehicles to negotiate. Therefore, TVA is now proposing to route construction vehicles to the work area via a newly constructed gravel access road that ties into North Carolina Landing Road at the driveway entrance. TVA is also proposing to close North Carolina Landing Road to public traffic at the intersection with State Highway 128.

2. Additional Downstream Footprint near Station[2] (Sta.) 40+00: The large drainage area in the low-lying area downstream of the dam from about Sta. 40+00 to 48+00 requires the use of a stormwater sediment basin. The only feasible location for this stormwater sediment basin is in an area in the southwest corner of the low-lying area that is outside the 2016 EA Study Area. Therefore, TVA is proposing to utilize this additional 0.89-acre area for stormwater management.

[2] Station is a location along a line in distance from a reference point often used in engineering and surveying drawings. Stations are identified in Exhibit 1 in order to indicate the location of the proposed actions.

3. Downstream Staging Area: At the time of the 2016 EA, the design included a limited staging area on the downstream side of the dam. TVA is now proposing to utilize a grassed, gently sloping embankment area north of the downstream fill area as a staging area for fill stockpiles, construction materials, and construction equipment. This area also includes the area under the State Highway 128 bridge, which would connect the upstream and downstream work areas, reducing the need to use local roads to transfer materials and equipment between the two work areas. Routing equipment through this area would result in a safer work environment for the contractor and cause less disturbance to public traffic on State Highway 128.

4. Barge Activities: At the time of the 2016 EA, it was anticipated that all fill materials would be delivered to the site by truck on local roads. TVA is now proposing an option for the contractor to build a temporary barge unloading site at the north end of the upstream dam work area, where fill materials can be shipped to the site via barge, unloaded at the barge unloading site on the dam, and transported under the State Highway 128 bridge structure to the downstream work zone. The proposed unloading site is in an area where upstream fill was already planned to be placed.

To support the use of the barge unloading site and the filling operation upstream of the dam, TVA is proposing to use two 35-acre upstream staging/fleeting areas (Exhibit 2 and Appendix A, Figure 2). The areas would be used to temporarily store 8 to 12 fully loaded barges until they are needed at the fill placement work zone. Tug boats would be utilized for short term durations (a work shift) and a spud barge or temporary mooring would be utilized for longer term duration (several days).

If requested, the contractor could utilize the Hardin County Port Authority’s facility about one mile upstream of the dam, on the south (left descending) bank, at the end of Hardin Dock Road, to support its barge use (Exhibit 2). The facility is leased to the PCA. The facility includes a sheet pile bulkhead, a flat storage/operation area, and access to the end of Hardin Dock Road. The facility is currently being used by PCA and the facility would not require any upgrades.

5. Upstream Fill Area: After the 2016 EA, TVA performed additional bathymetric surveying and sediment thickness probing in the reservoir, which indicated that the riverbed was deeper than originally thought in some locations. Between Sta. 40+00 and 43+00, the deeper riverbed and thick sediment (14 feet thick) resulted in a wider footprint of extended fill, as the outer slope was continued outward to meet the deeper riverbed at the planned slope inclination, rather than steepening it to meet the 2016 EA Study Area footprint. Therefore, TVA is proposing to increase the limits of the upstream fill approximately 0.47 acres to provide a safe design of the Upstream Fill Area. TVA does not intend to require the contractor to re-grade the displaced sediment.

6. Upstream Site Access: Access to the upstream work area would require the use of the crest of the dam south of Sta. 13+00, where the State Highway 128 road embankment and the dam crest diverge. Construction vehicles would access the dam crest via the access road from State Park Road. TVA is proposing to close the access road to public traffic at the intersection with State Park Road. The dam crest would be fenced off and closed to the public during construction. The fencing would prevent access to this area of the dam, which is regularly used by the public for fishing.

7. Downstream Fill South of Station 15+00: The latest stability analyses indicate that fill would need to be placed to Sta. 12+00 and the downstream footprint would be slightly larger. Therefore, TVA is proposing to extend the downstream fill south of Sta. 15+00 to about Sta. 12+00 from 25.32 acres to approximately 28.06 acres to provide a safe design of the Downstream Fill South of Station 15+00.

2.1.2.4 Other Changes to the Design

The finalization of the design process included other changes that would take place within the 2016 EA Study Area and work area. The proposed activities discussed below were not addressed in the 2016 EA.

Construction Dewatering: Construction dewatering is necessary to install some of the planned improvements, and was not specifically addressed in the 2016 EA. Excavations for these structures are likely to extend below the groundwater surface or to potentially encounter perched groundwater, so dewatering would be needed to maintain stability of the excavation sidewalls, and to prevent upward water seepage from softening the foundation soils before placement of compacted fill. All of these locations are within the 2016 EA Study Area.

Control of Water in Stream Channels 7 and 8: The project includes modifications (partial or total encapsulation/culvert placement and backfilling on top of the encapsulation) at Stream Channels 7 and 8. While the stream channel modifications were addressed in the 2016 EA, the control of water during the modifications was not specifically addressed. The stream channel modifications would require the draining of Stream Channels 7 and 8. To accomplish this, the contractor would temporarily block the flow to the stream channel and install a bypass pumping system to convey the flow around the work area.

Blocking Tailwater in Stream Channels 7 and 8: The work in Stream Channels 7 and 8 may also require the contractor to block tailwater from backing up into the work area. At Stream Channel 8, this backwatering occurs at the culvert under North Carolina Landing Road. To prevent backflow, the contractor may use measures such as installation of a backflow preventer on the downstream side of the existing culvert or the installation of a temporary cofferdam (earth berms, sandbags, sheet piles, port-a-dam-type structure, or similar).

Temporary Excavation Support: Some of the excavations in the downstream work area identified in the 2016 EA would be deeper than 4 feet and would encounter wet soils. Therefore, TVA is proposing to install temporary sheet piling or trench box shoring to maintain stability and allow safe entry by workers. Excavation support methods may include steel plates, steel or timber sheet piles, and purpose-built trench shields. The sheeting or shoring would be installed before or during excavation, and removed as the excavation is backfilled.

Hardin County’s water intake structure is located within the 2016 EA Study Area. During final design review, TVA noted that its proposed work would be in close proximity to the water intake structure. To avoid impacting this structure, TVA is proposing to implement appropriate measures such as clearly delineating the location of the intake, installing additional turbidity curtains, and using more precise rock placement methods within 100 feet of the intake. In the future, TVA may evaluate if the water intake should be relocated. If it needs to be relocated, TVA will work with Hardin County and evaluate this action in a separate environmental review.

2.1.2.5 Proposed Schedule of Activities

TVA proposes to initiate construction in 2018 and conclude in late 2022 (dates are subject to change). Work would be conducted year round during this period. Construction and activities associated with implementing the proposed action would occur primarily during daylight hours of the work week; occasionally, activities may occur on weekend days. TVA does not anticipate the need for nighttime work activities or continuous, around-the-clock activities within the study area during the project. However, deliveries of barges may occur around the clock and be placed in the barge staging/fleeting area until needed during work hours.

2.1.2.6 Proposed Access

As discussed in the 2016 EA, construction activities would not necessitate closure of, or restrictions to, travel on State Highway 128 crossing the dam. TVA has identified several options for accessing the embankment and fill areas for construction activities. Three options exist on the upstream or east side of the embankment. The first option includes hauling materials on Hardin Dock Road and utilizing barges to bring in fill material as well as equipment for placement of the materials. The second option is to have an access road coming off either Playground Loop Road or State Highway 128 at the southern end of the embankment and then have locations where trucks could enter back on to State Highway 128 with the use of flagmen to avoid impacts to traffic. The last option would be to utilize a combination of both barges and hauling operations along State Highway 128. North Carolina Landing Road would be the access route to the downstream or west side of the embankment and the laydown area. The original plan was to send construction traffic along an existing driveway to a maintenance building east of North Carolina Landing Road. This path included several sharp turns, which may be difficult for construction vehicles to negotiate. Therefore, TVA is now proposing to route construction vehicles to the work area via a newly constructed gravel access road that ties into North Carolina Landing Road at the driveway entrance. TVA is also proposing to close North Carolina Landing Road to public traffic at the intersection with State Highway 128 during construction activities (See Section 2.1.2.3).

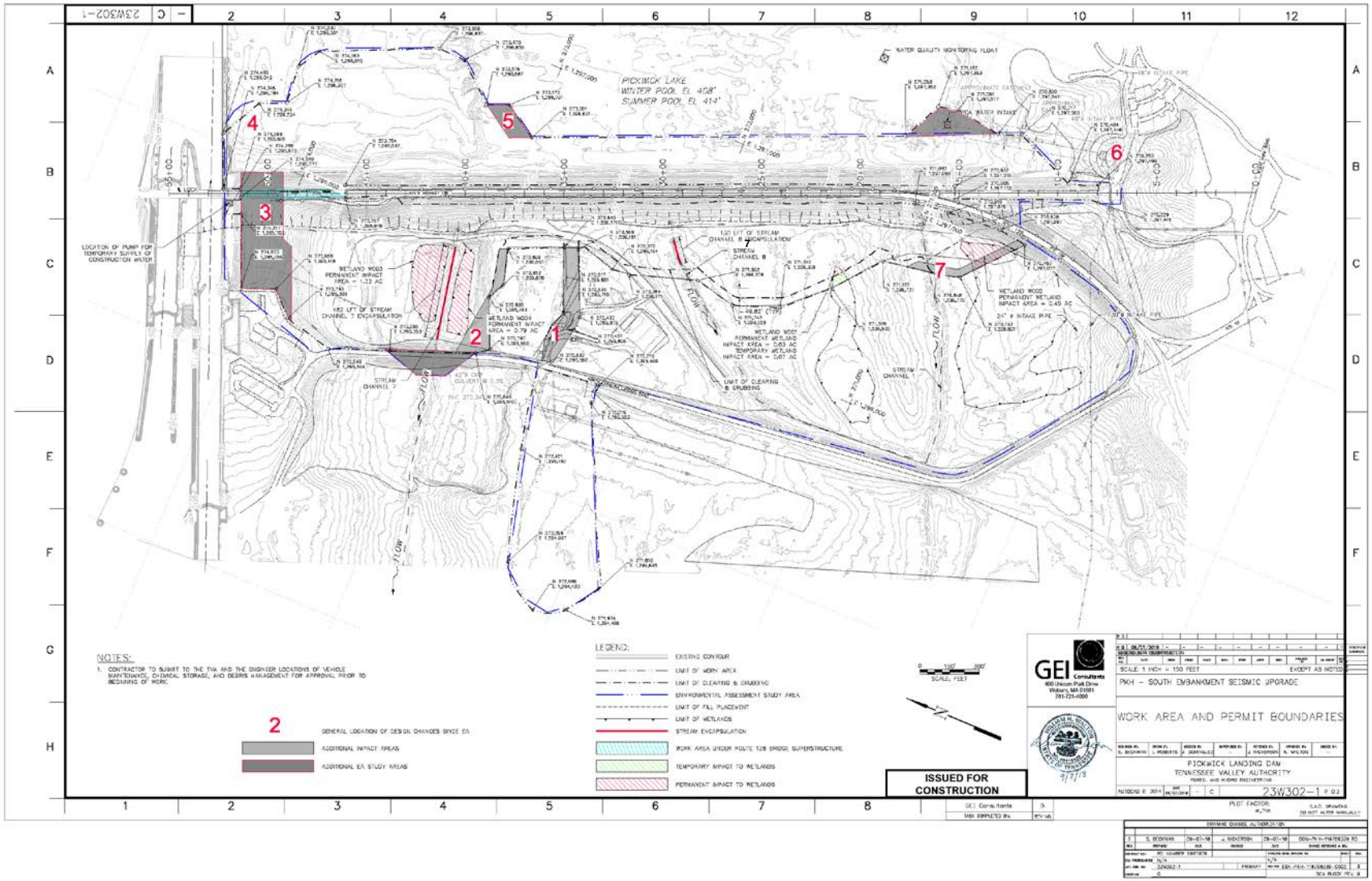

Exhibit 1 Proposed Upgrades to 2016 Design

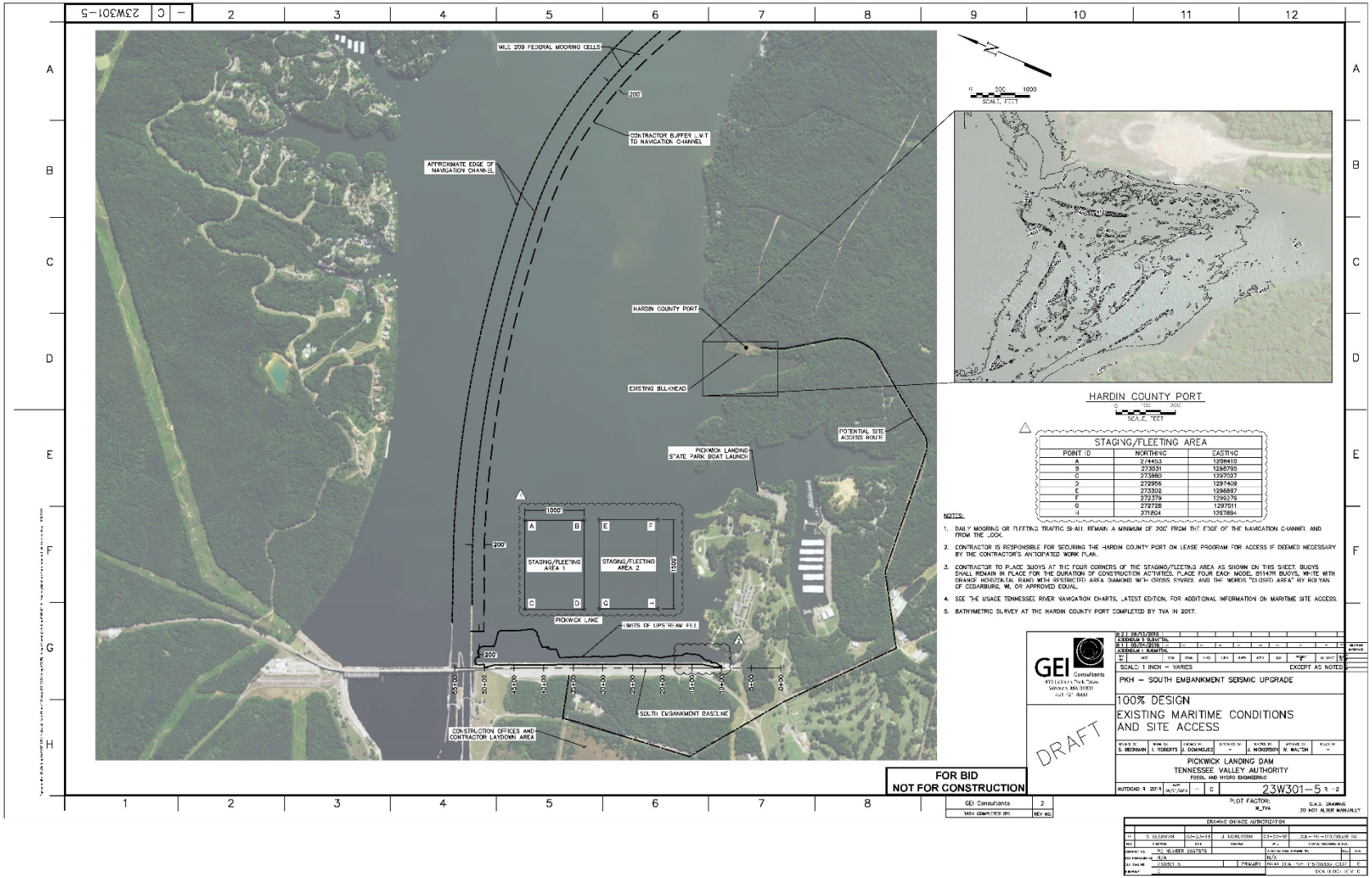

Exhibit 2 Proposed Site Access and Barge Activities

2.2 Comparison of Alternatives

A comparison of impacts associated with implementing the No Action Alternative and the Proposed Action Alternative is provided in Table 1. This comparison is based on current and potential future conditions at the Pickwick Landing Dam. Although the No Action Alternative would not result in the construction impacts associated with the Proposed Action Alternative, it does not address the underlying purpose and need of the project. Under the No Action Alternative, TVA would take no action to improve the condition of the embankment and the risk of a dam breach and reservoir loss following a large seismic event would remain. As stated in Section 2.1, although the risk of dam failure is low, TVA does not consider the No Action Alternative reasonable because it does not address the risk to public health and safety or the region's economy.

Table 1 Comparison of Impacts of the No Action Alternative and the Proposed Action Alternative

Resource Area	No Action Alternative	Proposed Action Alternative
Floodplains	Under the No Action Alternative there would be no changes within the 100-year floodplain. However, a seismic event could potentially result in failure of the dam resulting in downstream flooding.	The proposed berm and extended fill would occur within the 100-year floodplain and floodway of the Tennessee River. Approximately 641 acre-feet of fill would be placed in the 100-year floodplain. The final, detailed design of the project was evaluated in a hydraulic model and confirmed no rise in 100-year flood or floodway elevations as a result of implementing the Proposed Action Alternative.
Water Resources (Groundwater and Surface Water)	No direct or indirect impacts regarding groundwater. No direct impacts to surface waters; however, a seismic event leading to a breach in the dam could change the surface water pool and downstream water courses. A potential breach of the dam could also impact the existing intakes/local water supply if the dam were drained.	Minimal impacts to groundwater are anticipated because best management practices (BMPs) would be used to avoid hazardous materials reaching groundwater. Construction would directly impact approximately 612 linear feet of stream on the downstream side of the dam and 22.3 acres of fill material on the upstream surface water pool. Sediment and erosion control BMPs would be installed to minimize surface water impacts.
Wetlands	No direct or indirect impacts: however, a seismic event could potentially result in a breach of the dam resulting in impacts to wetlands through loss of vegetation, soils, or hydrology.	Permanent impacts on approximately 2.5 acres of wetlands would occur due to the placement of the extended fill and berm on the downstream side of the embankment. Approximately 0.03 acres of fill would be placed within a high-quality bald cypress forested wetland. TVA finds that there is no practicable alternative to avoiding these impacts and will coordinate with the USACE on mitigating these impacts.

Resource Area	No Action Alternative	Proposed Action Alternative
Terrestrial Ecology (Vegetation)	No direct or indirect impacts. However, a seismic event could potentially result in a breach of the dam resulting in impacts to terrestrial ecology. Wildlife may suffer mortality or be displaced by flooding. Vegetative communities may be changed due to flooding impacts, subsequent changes in hydrology, or opportunities for invasive species colonization.	Of the 35 acres of vegetative communities that would be impacted, approximately 23.45 acres of forest identified for the 2016 EA and February 2018 white paper would be cleared for construction of the project. The SEA will add approximately 0.78 acres of forested clearing impacts. Minor impact on populations of common wildlife species due to displacement to nearby areas.
Threatened and Endangered Species	No direct or indirect impacts; however, a seismic event could potentially result in a breach of the dam resulting in downstream impacts to both terrestrial and aquatic threatened and endangered species through habitat loss or alteration.	Actions with the potential to impact federally listed bats were addressed in TVA's programmatic biological assessment on routine actions and federally listed bats which was completed in April 2018. TVA has committed to appropriate avoidance and minimization measures including a tree clearing moratorium from April 1 to October 15 of any year and compensation for loss of suitable forest dwelling bat habitat. TVA has also committed to additional conservation measures identified in TVA's Bat Strategy Project Screening Form (Appendix C).
Natural Areas, Parks, and Recreation	No direct or indirect impacts. However, a seismic event could potentially result in a breach of the dam resulting in impacts to natural areas, parks, and recreation due to loss of the reservoir.	Minimal impacts from construction noise are anticipated to occur at Pickwick Landing State Park, and no impacts are expected at adjacent natural areas. No lake level related impacts to recreation are anticipated as lake levels would operate as they currently do and waters would not be drawn down. Fishing areas on the left bank below Pickwick Dam and fishing access to the southernmost crest of the dam would be temporarily closed to the public for the duration of the project.
Transportation	No direct impacts. A seismic event could potentially result in a breach of the dam resulting in loss of the road or instability in the roadway base.	Roadways would be impacted temporarily with increased truck traffic hauling materials and equipment to the site for construction. Flaggers would be utilized to avoid conflicts between construction traffic and local traffic.

Resource Area	No Action Alternative	Proposed Action Alternative
Navigation	No direct or indirect impacts.	No adverse impacts are anticipated to vessels. Care would be taken to avoid impacts to vessels navigating the lock and TVA would issue navigation notices concerning any construction activities adjacent to the lock.
Cultural Resources	No direct impacts; however, a seismic event leading to a breach in the dam could create impacts on the several resources which exist in the Pickwick Landing Dam tailwaters.	The entire archaeological Area of Potential Effects has been previously disturbed. No adverse effects to historic properties or cultural resources are anticipated.

2.3 Identification of Mitigation Measures

Mitigation measures were discussed in the 2016 EA Section 2.5 and by resource in Chapter 4. In addition to the requirements of any necessary permits, TVA would implement the mitigation measures previously detailed in the 2016 EA to avoid, minimize, or mitigate adverse impacts on the environment. In addition, the below mitigation measure were added during the SEA evaluation. All applicable permits would be acquired; therefore, associated permit-related mitigation measures and BMPs would be implemented to further minimize impacts.

- To avoid impacts to Hardin County's water supply intake structure, TVA will implement appropriate measures such as such as clearly delineating the location of the intake, installing additional turbidity curtains, and using precise rock placement methods within 100 feet of the intake.
- At project completion, TVA will restore public access to the two recreation areas located on the left bank below the Dam and at the southern end of the crest of the Dam. If needed, TVA will repair/refurbish North Carolina Landing Road to ensure no long-term impacts to public recreational access occur.
- In order to prevent the construction barge(s) from floating free during a flood, the barge(s) would be relocated outside the floodway and securely anchored.
- The evacuation plan listed as a mitigation measure in the 2016 EA would also apply to construction access roads in the floodplain, the sediment basin, the barge unloading site, the downstream staging area, manholes, dewatering wells, pumping equipment, and dewatering equipment.

2.4 Environmental Resources Not Carried Forward

The detailed analysis provided in Chapter 3 focuses on those environmental resources with the potential to be affected by the design changes of the Proposed Action Alternative. For the Proposed Action Alternative, TVA determined that there would be no impacts, or that potential impacts would be negligible or temporary, for certain resources. Therefore, TVA determined that detailed analysis was unnecessary for these resources, and information regarding these resources can be found in the 2016 EA.

2.5 Preferred Alternative

TVA's preferred alternative is the Proposed Action Alternative. Under the Proposed Action Alternative, TVA would proceed with stabilizing the Pickwick Landing Dam's south embankment as described in Section 2.1.2 and as discussed in the 2016 EA with the proposed changes outlined in sections 2.1.2.3 and 2.1.2.4. Table 1 compares the impacts of the No Action Alternative with the Proposed Action Alternative.

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CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the Study Area's existing physical, biological, and cultural resources. As stated in Chapter 1, the Study Area for the project encompasses approximately 224 acres to the east and west of the existing south embankment along Pickwick Landing Dam, in Hardin County, Tennessee. Within the Study Area footprint, approximately 50 acres is proposed to be impacted directly with placement of fill material. A 100-foot buffer has been included around the fill and labeled as proposed impact area due to the need for an additional 50 feet to be cleared of vegetation beyond the proposed fill.

Under the No Action Alternative, TVA would take no action to improve the condition of the south embankment. TVA would continue to operate the dam and reservoir under normal operations. The risk of a dam breach and reservoir loss during or following a large seismic event would remain. The anticipated potential effects of implementing the No Action Alternative were analyzed in the 2016 EA to establish a baseline for analyzing the environmental impacts of the Proposed Action Alternative in accordance with NEPA regulations. The impacts associated with the implementation of the No Action Alternative can be found in the 2016 EA and are not discussed further in this SEA.

As presented in Chapter 2, TVA has evaluated the Proposed Action Alternative and determined that certain environmental resources would not be affected due to the proposed activities or the resources and the associated impacts were fully address in the 2016 EA. Resources that could potentially be affected by the changes to the Proposed Action Alternative are considered further in this SEA and include: floodplains, groundwater, surface water, wetlands, threatened and endangered species, natural areas, transportation, and cultural resources. TVA expects that most of the resources listed above would only be nominally/minimally affected by TVA's proposal, and thus, the SEA analyses of these resources are concise. Landscape viewshed impacts were previously detailed in the 2016 EA; however, should the proposed marine staging areas be utilized, then usage of these areas may slightly change the view shed while construction activities occur. These would be temporary and minimal impacts.

Most activities associated with the Proposed Action Alternative would occur on or adjacent to the earthen embankment, which is a previously disturbed area; therefore, impacts to most resources are anticipated to be minimal. The anticipated potential effects of implementing the Proposed Action Alternative are described below for each resource type.

3.1 Geology and Soils

3.1.1 Affected Environment

The Geologic Map of Tennessee indicates that the Study Area is located in the Gulf Coastal Plain physiographic providence. Surficial deposits and bedrock consists of Quaternary alluvial deposits including ferruginous sand, clayey fine sand, and massive clay decomposition residuum; chert-pebble gravel and sand; some colluvial and alluvial loess; Tertiary sand, clay, silty clay, and lignite. Cretaceous sand in this region is typically located in floodplains more than 100 feet thick; in small streams generally less that 20 feet thick (Hardeman et al. 1966).

The Natural Resources Conservation Service's (NRCS) Soil Survey of Hardin County, Tennessee, indicates that primary soil series consist of Beason silt loam, Captina silt loam, Lindside silt loam, Melvin and newark silt loams (melvins), Sequatchie loams, Waynesboro loams, and Wolftever loams (USDA 2015). These soils are generally formed in silt/fine textured alluvium and located on low stream terraces and floodplains. The NRCS's Hydric Soils List classified Beason silt loam and Melvin and newark silt loams (melvins) as hydric. NRCS soils located within the Study Area are illustrated on Figure 4 (Appendix A).

3.1.2 Environmental Consequences

3.1.2.1 Proposed Action Alternative

Implementation of the Proposed Action Alternative would result in a direct impact on soil resources within the project footprint. Approximately 23.6 acres of land would be disturbed as clearing and grubbing of the forest occurs prior to placement of the rip rap fill to create the berm on the west side of the south embankment. In order to mitigate impacts due to the soil disturbance, TVA would employ appropriate sediment and erosion control devices, as required by the TDEC, during the construction operation to limit soil loss, erosion, and the possibility of sedimentation or turbidity to receiving streams. To prevent future erosion, disturbed soils would also be stabilized with seed mixes appropriate for the existing conditions after construction is completed.

Minimal impacts to soil resources to the east side of the Pickwick Landing Dam would occur as a result of the seismic upgrades, as this portion is under water. The soils in this area have been previously disturbed from construction of the existing dam. Fill would be placed along the existing dam and proposed berms. No dredging activities would be required and minimal sedimentation is expected to result from the placement of the rip rap fill.

No impacts on geologic resources are anticipated because these resources would be covered but not made permanently unavailable.

3.2 Floodplains

3.2.1 Affected Environment

Floodplains are the relatively level land areas along streams and rivers that are subject to periodic flooding. The area subject to a one percent chance of flooding in any given year is normally called the 100-year floodplain. The area subject to a 0.2 percent chance of flooding in any given year is normally called the 500-year floodplain.

With the exception of an existing dock and barge terminal at Tennessee River Mile 207.7 that would be used in its current form, the proposed project would take place between Tennessee River miles 206.3 and 206.8, left descending bank, in Hardin County, Tennessee, adjacent to Pickwick and Kentucky Reservoirs. Nearly the entire Study Area lies within FEMA Zone AE or the Floodway (Appendix A, Figure 5) and Table 2 below lists the flood elevations at specific project activity areas.

Table 2 Project Activities - Tennessee River Miles and Flood Elevations

Project Activities	River Miles	100-year Flood Elevation (ft msl)	500-year Flood elevation (ft msl)
Laydown Area	206.3-206.5	401.2-401.3	403.4-403.5
Downstream Impact Area	206.6-206.7	401.4	403.6
Crest of Dam	206.72	419.0	419.0
Upstream Impact Area	206.72-206.8	419.0	419.0

[1] ft msl = feet above mean sea level

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action Alternative

As a federal agency, TVA adheres 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 (U.S. Water Resources Council 1978). The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

The analyses of temporary relocation of topsoil and riprap; tree and stump removal; replacement of toe drain pipes; establishment and use of a laydown area (including placing gravel); and installation of instrumentation support structures remain valid from the 2016 EA; however, some aspects of the facilities have changed, and new facilities have been proposed.

The quantities of fill within the floodplain have changed due to changes in the design of the seismic upgrade project. The changes are presented in Table 3.

Table 3 Fill Quantities Associated with the Proposed Action

Location of Fill	Original Proposed Quantity (2016 EA) (acre-feet)	Updated Proposed Quantity (2018 SEA) (acre-feet)
Fill in Pickwick 100-year floodplain	260	396
Fill in Kentucky 100-year floodplain	263	245
Fill in Pickwick flood control storage zone	71	95
Fill in Pickwick power storage zone	53	67
Fill in Kentucky flood control storage zone	240	271
Fill in Kentucky power storage zone	0	0

As discussed in the 2016 EA, the proposed seismic upgrade project, including the additional fill upstream and downstream of the dam, was to be modeled. In 2018, the project was modeled in the current hydraulic models of Pickwick and Kentucky reservoirs in the Hardin County Flood Insurance Study of the Tennessee River. The model encompassed the Tennessee River several thousand feet upstream and downstream of the extent of the seismic upgrade project, and a summary report of the No Rise analysis is provided in Appendix D. The results of the model effort indicated that the proposed project

would not result in any increase in flood elevations in the community upstream and downstream of the proposed project; therefore, the fill for the seismic upgrade would comply with the National Flood Insurance Program and be consistent with EO 11988.

A new temporary construction access road, barge unloading site, and sediment basin would be constructed within the footprint of the proposed fill for the seismic upgrade downstream of Pickwick Landing Dam; therefore, during construction, the road, barge unloading site, and sediment basin would eventually be overlain with fill for the seismic upgrade. These temporary facilities and activities are allowable because they would not only be removed prior to the end of construction, but are also within the fill area for the seismic upgrade.

The crest elevation of the sediment basin would be located at about 380 feet msl, and would therefore be inundated during the 100-year flood. The evacuation plan described in Section 2.5 of the 2016 EA (Mitigation Measures) would apply for activities involving the access road, barge unloading site, and sediment basin.

A staging area is also proposed to be located on the downstream face of Pickwick Landing Dam, north of the downstream fill area. The evacuation plan described in Section 2.5 of the 2016 EA (Mitigation Measures) would apply for activities involving the additional downstream staging area.

The access road on the south end of the crest of Pickwick Landing Dam would be modified for construction. The access road is located outside the 100-year floodplain and above the 500-year flood elevation, which would be consistent with EO 11988 and TVA Flood Control Storage Loss Guideline.

Manholes, installation of dewatering wells and pumping equipment, and excavation to install these facilities may be necessary during construction. These facilities would be considered a functionally-dependent use of the floodplain because Pickwick Landing Dam is located within the floodplain. The manholes and spoil from excavation would result in an infinitesimal increase in flood elevations; and would therefore comply with the National Flood Insurance Program. Backflow preventers, bypass pumping equipment, and temporary cofferdams may be necessary for work in Stream Channels 7 and 8 (Appendix A, Figure 6). To minimize adverse impacts, floodproof pumping equipment would be used. Alternatively, the evacuation plan described in Section 2.5 of the 2016 EA (Mitigation Measures) would apply for activities involving the manholes, dewatering wells, pumping equipment, backflow preventers, bypass pumping equipment, and temporary cofferdams.

Fill on the upstream face of Pickwick Landing Dam would be placed using barge-mounted mechanical equipment. To minimize adverse impacts and prevent construction barge(s) from flowing free during a flood, TVA would relocate the barges outside the floodway and securely anchor them.

Based on the mitigation measures listed in Section 2.5 of the 2016 EA and the additional measures presented above, the proposed changes to the Pickwick Seismic Upgrade project would have no significant impact on floodplains and their natural and beneficial values.

3.3 Wetlands

3.3.1 Affected Environment

As defined in the Section 404 of the Clean Water Act, wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands and wetland fringe areas can also be found along the edges of many watercourses and impounded waters (both natural and man-made). Wetlands also form the transitional boundary between terrestrial and aquatic ecosystems; as such, they tend to be highly productive and biologically diverse ecosystems. They provide a multitude of ecological and public benefits, including flood control, erosion control, reservoir shoreline stabilization, water quality improvement, recreation opportunities, and habitat for fish and wildlife resources.

Activities in wetlands are regulated by state and federal agencies to ensure no net loss of wetland resources. As noted in Section 1.4 of this SEA, under Section 404 of the Clean Water Act, activities resulting in the discharge of dredge or fill into waters of the U. S. must be authorized by the USACE through a Nationwide, Regional, or Individual Permit. Section 401 of the Clean Water Act requires state water quality certification for projects requiring USACE approval. In Tennessee, TDEC is responsible for issuance of water quality certifications pursuant to Section 401 of the Federal Water Pollution Control Act (33 U.S.C 1251, 1341) regarding regulated waters of the State. Lastly, EO 11990 requires federal agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities.

The USFWS's National Wetlands Inventory (NWI) Geographic Information System (GIS) data was used to estimate the extent of wetlands and deepwater habitats in the Study Area. The NWI data indicated that there are approximately 29.7 acres of Pickwick Reservoir classified as lacustrine, limnetic, unconsolidated bottom, permanently flooded, dike/impounded deepwater habitat within the Study Area (USFWS 2016).

As discussed in the 2016 EA, TVA biologists surveyed the Study Area for jurisdictional wetlands and identified four wetlands. As shown in Figure 6 of Appendix A, four palustrine forested wetlands not indicated on the NWI were identified in the Study Area and totaled approximately 12.72 acres.

3.3.2 Environmental Consequences

3.3.2.1 Proposed Action Alternative

Implementation of the Proposed Action Alternative would result in approximately 0.07 acres[3] of additional impacts to wetlands within the Study Area than those identified in the 2016 EA. Due to the location of the wetlands and the necessary placement of the proposed fill for the seismic upgrades, there is no practicable alternative that would avoid impacts to wetlands.) Approximately 2.5 acres of forested wetlands would be permanently impacted and 0.07 acre of wetlands would be temporarily impacted by implementation of the

[3] The proposed design changes in the SEA changed how Wetland W002 would be impacted. Instead of the 0.5 acre temporary impacts described in the 2016 EA, there would be 0.45 acre of permanent impacts to the wetland associated with the implementation of the Proposed Action.

Proposed Action Alternative. Of the 2.5 acres of forested impacts, 0.03 acre is within the high-quality forested cypress wetland (Wetland W001 in Appendix A, Figure 6).

Direct impacts to wetlands and streams would be regulated under an USACE Clean Water Act Section 404 permit. TVA does not anticipate that the proposed fill would have drainage impacts to the hydrology of the wetlands that would remain following construction. TVA staff would monitor hydrology by weirs monthly during construction to ensure that this is the case and would coordinate with the USACE should unforeseen drainage impacts occur.

3.4 Surface Water

3.4.1 Affected Environment

Surface water is described as water flowing through a defined watercourse (e.g., rivers, streams, or creeks), or stored within a reservoir, pond, or lake. The Tennessee River, which is impounded by the Pickwick Landing Dam, is the only named stream within the Study Area. In addition to the upstream reservoir waters and the four wetlands noted above, TVA biologists delineated approximately 164 linear feet of wet weather conveyance (ephemeral channel), 1,228 linear feet of intermittent streams, and 3,439 linear feet of the perennial streams within the Study Area.

TVA biologists identified one wet weather conveyance as a small incised channel approximately 2 feet in width and depth ranging from 1 to 5 feet, two intermittent channels with widths ranging from 2 to 3 feet, and three perennial channels ranging from 3 to 10 feet in width and depths ranging from 1 to 6 feet. The substrate of the perennial streams appeared mostly comprised of silt and clay. In this area, the source of the perennial streams which originate at the base of the embankment is the dam's toe drainage system. Identified surface waters generally flow east towards Robinson Creek, which flows into the Tennessee River just downstream from Pickwick Landing Dam (Appendix A, Figure 6).

3.4.2 Environmental Consequences

3.4.2.1 Proposed Action Alternative

Under the Action Alternative, TVA would implement proposed seismic upgrades at Pickwick Landing Dam, resulting in additional impacts to surface waters within the Study Area. Approximately 612 linear feet of perennial stream would be directly impacted by the proposed placement of the berm/fill area on the downstream/west side of the dam. As noted above, the source of these perennial streams is the dam's toe drainage system. Under the proposal, the toe drain pipes would be replaced prior to construction and fill in the area, and new manholes passing through the berm would be constructed. At one location along the downstream side of the embankment, because the existing drainage swale that collects flow would be filled as part of the fill area, TVA would replace the swale with a buried pipe extending past the fill area. In total, approximately 612 linear feet of perennial streams in the Study Area would be encapsulated by the new toe drain system prior to being covered by the berm or fill.

On the upstream side of the dam, approximately 22.3 acres of fill material would be placed in the surface waters of the Pickwick Reservoir. This is an increase of 1.28 acres from the 2016 EA impact area of 21.02 acres. The lake surface would be minimally impacted by the placement of the fill as it would be less than 1 percent of the total surface area of the lake.

Direct impacts to the impacted streams would be regulated and mitigated under a USACE Clean Water Act Section 404 permit and TDEC ARAP. It is not anticipated that the proposed placement of fill would alter or create drainage impacts to the streams following construction. TVA staff would monitor the streams' hydrology by weirs monthly during construction to ensure impacts do not occur and would coordinate with the USACE should unforeseen drainage impacts occur.

Sediment loading increases would be minor and would occur only during initial construction activities while sediment and surface water BMP systems are installed pursuant to the NPDES permit. This change in sediment contribution would be insignificant and would be substantially reduced by sediment control methods. No other impacts to water quality for waters of the U.S. are anticipated.

3.5 Threatened and Endangered Species

3.5.1 Affected Environment

The Endangered Species Act (ESA) provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered in the United States or elsewhere. The ESA outlines procedures for federal agencies to follow when taking actions that may affect federally listed species or their designated critical habitat. In addition, the state of Tennessee provides protection for species considered threatened, endangered or deemed in need of management within the State other than those already federally listed under the ESA. Plant species are protected in Tennessee through the Rare Plant Protection and Conservation Act of 1985. The listing of species is managed by the TDEC. Additionally, the Tennessee Natural Heritage Program and TVA both maintain databases of aquatic and terrestrial plant and animal species that are considered threatened, endangered, special concern, or are otherwise tracked in Tennessee because the species is rare and/or vulnerable within the state.

Data provided in the 2016 EA remains valid for Endangered and Threatened species; however, some changes have occurred as a result of TVA's ESA programmatic consultation with the USFWS on routine actions and federally listed bats completed April 2018 as detailed in the information below. Figure 7 in Appendix A also illustrates potential roosting and foraging habitat for bats.

3.5.1.1 Northern Long-Eared Bat

The northern long-eared bat predominantly overwinters in large hibernacula such as caves, abandoned mines, and cave-like structures. During the fall and spring they utilize entrances of caves and the surrounding forested areas for swarming and staging. In the summer, northern long-eared bats roost individually or in colonies beneath exfoliating bark or in crevices of both live and dead trees (Lacki and Schwierjohann 2001, USFWS 2014).

Roost selection by the northern long-eared bat is similar to the Indiana bat, however it is thought that northern long-eared bats are more opportunistic in roost site selection. This species also is known to roost in abandoned buildings and under bridges. Northern long-eared bats emerge at dusk to forage below the canopy of mature forests on hillsides and roads, and occasionally over forest clearings and along riparian areas (USFWS 2014).

No caves or other suitable winter roosting structures for this species occur within a 3-mile radius of the Study Area. Northern long-eared bat summer captures have been

documented approximately 14.7 miles away in Hardin County, Tennessee. The reservoir, forested wetlands, riparian corridors along streams, and forested uplands within the Study Area offer suitable summer foraging habitat. TVA biologist observed approximately 30.4 acres of suitable summer roosting habitat including at least 14 snags, 10 shagbark hickories, and 4 live trees with crevices and hollows scattered throughout the Study Area along streams and wetlands.

3.5.1.2 Indiana Bat

Indiana bats occupy caves during winter months. During summer months, they use areas of mature deciduous forest that have open mid-stories with an abundance of trees with exfoliating (i.e., loose or peeling) bark. Suitable roost trees include dead trees of several species and live trees such as shagbark hickory and white oak. The greatest threats to Indiana bats posed by forestry activities are disturbance of hibernating colonies in caves and destruction of summer roosting and foraging habitat (Hammond and Sweeney 1997).

Known Indiana bat maternity roosting sites occur approximately 9.9 miles away from the Study Area in McNairy County, Tennessee. No caves or other suitable winter roosting structures for Indiana bat occur within the Study Area. No caves are known within a three-mile-radius of the Study Area. The reservoir, forested wetlands, riparian corridors along streams, and the forested uplands within the Study Area offer suitable summer foraging habitat. TVA biologists observed approximately 30.4 acres of suitable summer roosting habitat including at least 14 snags, 10 shagbark hickories, and 4 live trees with crevices and hollows scattered throughout the Study Area along streams and wetlands.

3.5.1.3 Gray Bat

The gray bat is widely distributed throughout cave systems of the southeastern United States; however, 90 percent of their known population occurs in fewer than a dozen cave systems. Gray bats are insectivores and forage primarily over water and along lake and reservoir shorelines. Banding studies have indicated that gray bats prefer summer caves within a mile of a feeding area (river or other reservoir of water), although they have been known to fly as far as 12 miles from their colony to feed (Kentucky Bat Working Group 1999).

Gray bat summer captures have occurred approximately 10.6 miles from the Study Area in Hardin County, Tennessee. No caves or other suitable roosting structures for gray bats occur within the Study Area. Forested wetlands, streams, and the reservoir offer suitable foraging habitat for this species.

3.5.2 Environmental Consequences

3.5.2.1 Proposed Action Alternative

Both the state and federal lists of protected terrestrial animal species were reviewed and habitats were evaluated through field surveys conducted within the Study Area for the 2016 EA. Information documented in the 2016 EA for terrestrial Endangered and Threatened species remains valid with the exception of the proposed impacts to bat habitat and finalization of TVA's programmatic consultation with the USFWS on routine actions and federally listed bats in accordance with ESA Section 7(a)(2) and completed in April 2018.

In addition to the removal of 22.87 acres previously consulted on for the 2016 EA and 0.58 acre addressed in the 2018 white paper, the proposed action includes the removal of 0.78

acres of forest associated with the proposed increase in fill placement. As part of TVA's ESA programmatic biological assessment for bats, TVA programmatically quantified and minimized removal of potentially suitable summer roosting habitat during time of potential occupancy by Indiana bat and northern long-eared bat (TVA 2017). The project area does not occur in any known habitat for either Indiana bat or northern long-eared bat. Accordingly, TVA will track and document removal of potentially suitable summer roost trees and include that data in annual reporting in accordance with Section 7(a)(2) consultation. Additionally, if suitable bat roost tree habitat needs to be removed when bats may be present on the landscape, TVA would set aside funding to be applied towards future bat-specific conservation projects. TVA currently plans to conduct the tree removal between October 15 and March 31, when Indiana and northern long-eared bats are not on the landscape.

Forested wetlands, streams, and the Pickwick Reservoir offer suitable foraging habitat for the gray bat. However, no gray bat roosting habitat would be impacted by the Proposed Action Alternative.

A number of activities associated with the proposed action, including tree clearing, were addressed in TVA's programmatic biological assessment on routine actions and federally listed bats in accordance with ESA Section 7(a)(2) (TVA 2017). For those activities with potential to affect bats, TVA committed to implementing specific conservation measures. Therefore, direct and indirect impacts to federally-listed bat species are expected to be minor. These activities and associated conservation measures are identified in TVA's Bat Strategy Project Screening Form (Appendix C).

3.6 Natural Areas, Parks and Recreation

3.6.1 Affected Environment

TVA developed a Natural Areas land-use designation system to manage publicly owned land in and around its facilities and reservations. These sites are identified as Habitat Protection Areas, Small Wild Areas, Ecological Study Areas, or Wildlife Observation Areas. Their management includes restrictions on activities that might endanger significant natural features (TVA 2016b). TVA identifies 12 Natural Areas within a 5-mile radius of the Study Area, as shown on Figure 8 (Appendix A). Managed natural areas include agricultural conservation easements, Rabbitsfoot Designated Critical Habitat, Kentucky Reservoir No. 2 State Mussel Sanctuary, Factory Hollow Registered State Natural Area, Kentucky Reservoir Reservation, Pickwick Landing State Park, Tishomingo County Game Refuge, Chambers Creek Wetland Wildlife Management Area, Dry Creek Wildlife Management Area, Lauderdale Wildlife Management Area, Bruton Branch Recreation Area, and Mississippi Wildlife and Recreation Land. Pickwick Landing State Park is adjacent to the Study Area to the south; a small area of State Park is located in the Study Area. At the park, there are two swimming beaches, picnic areas, and the park's inn and conference center located within 300 to 1000 feet of the project area. Other public or commercial recreation areas within 5 miles of the Study Area are also shown on Figure 8. These include recreation areas on both the north and south banks below Pickwick Landing Dam, State Line Boat Ramp, Aqua Yacht Harbor, and Grand Harbor Marina.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action Alternative

Approximately 3.5 acres of Pickwick Landing State Park is located within the Study Area. Impacts to the State Park would be minimal as construction activities may require use of

existing access routes through the Park, but will not take place within the State Park. Some of the facilities at Pickwick Landing State Park including two swimming beaches, picnic areas, and the park's inn and conference center are located within 300 – 1000 feet of the project area. However, the proposed activities would not impact the use of or access to the park facilities. Because of this proximity and the multi-year duration of the proposed project, the presence of construction activities near the park (particularly those along the upstream side of the dam's embankment) may adversely affect the aesthetic quality of the visitor experience in portions of the park, especially those nearest the embankment. Construction activities on the upstream side of the dam may diminish the quality of the park's viewshed, although such impacts would be minor because the current view of the embankment and dam can be characterized as an unnatural and man-made. Temporary and minor noise from vehicles or equipment may be audible from the park, including from trucks entering the southwestern corner of the park to access the dam's embankment (along the park's Playground Loop Road). The waters around Pickwick Landing State Park receive heavy recreational boating use. Boating related facilities within the park include two large boat launching ramps and a marina with a storage capacity of approximately 380 boats. These facilities are located in the Sulphur Creek embayment and there is a large volume of recreational boating traffic in the Sulphur Creek marked secondary channel located just upstream from the proposed barge staging/fleeting area. Barge traffic associated with the staging/fleeting areas could have some temporary impact on recreational boating patterns in and around this secondary channel.

The Rabbitsfoot Designated Critical Habitat and the Kentucky Reservoir No. 2 State Mussel Sanctuary are also located adjacent to the Study Area. Potential direct impacts to these resources are not anticipated as they are beyond the clearing and fill areas for the project. North Carolina Landing Road was previously assessed and assumed that it would remain open to the public in the 2016 EA; however, it has been determined that this road would be closed during construction for safety reasons. This would temporarily impact access to the tailwater fishing area on the left bank below Pickwick Landing Dam. Although the road would be closed for the duration on construction, it should not create adverse long term impact recreational use of this area. The recreation areas on the north bank below the dam should not be significantly impacted by the project. Likewise, the temporary closure of the southern crest of the dam to bank fishing should not have a long-term negative impact.

The other natural areas detailed in Section 3.6.1 will not be impacted by the Proposed Action as they are located 2 miles beyond the Study Area and impact area footprint. Recreation impacts would occur as a result of construction of the project but be temporary in nature and would not create a long term adverse impact.

3.7 Transportation

3.7.1 Affected Environment

There are approximately 2.3 miles of roads located within the Study Area (Table 4). The only route within the Study Area with a Functional Classification is State Highway 128, which is classified as a Minor Arterial. The construction contractor may utilize either the Hardin County Port, local quarry facilities, or a mixture of both options to obtain fill material necessary for the project. Haul trucks would transport materials from the Hardin County Port to the project site via Hardin Dock Road and North Carolina Landing Road.

Table 4 Roads within the Study Area

Road Name	Length with the Study Area	
	Feet	Miles
Tennessee State Highway 128	5,115	0.97
North Carolina Landing Road	4,332	0.82
Playground Loop	64	0.01
Unnamed Roads	2,653	0.51
Hardin Dock Road*	7,465*	1.41*
North Carolina Landing Road*	6,350*	1.20*
Total	**12,164 25,979***	**2.31 4.92***

*Potential transportation routes that may be used for material delivery. These routes are outside of the defined Study Area; however, may be utilized for haul routes. The totals illustrated above are with and without utilizing Hardin Dock Road and North Carolina Landing Road.

The other roadways in the project vicinity that may be utilized for material delivery include U.S. Highway 64 which is a Principal Arterial; State Route 57 which is a Minor Arterial; Major Collector Routes of State Route 226 (Airport Road), State Route 142, State Route 22, and State Route 117; and Dennie Barber Road, Hinton Road, and Red Sulphur Road which are all local routes.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action Alternative

Approximately 2.3 miles of roads are within the Study Area and could be temporarily impacted by a minor increase in traffic volume from construction vehicles or employees commuting to and from the project area. Construction traffic may impact Playground Loop and the State Park if necessary to access the southern portion and upstream toe of the embankment. State Highway 128 is a through route within the project area and an adjacent haul/access road may be necessary for construction. TVA has committed to having a flagger available to avoid impeding traffic on this road with hauling activities should on-road trucks be used to deliver materials. TVA's flagger would let truck and equipment operators know when they can access the highway without endangering motorists or causing a stop condition. Signage would also be placed to alert drivers that they are entering the construction area.

North Carolina Landing Road, which receives less traffic than the State Highway 128, would also be impacted by the hauling of materials and equipment to the laydown and project area on the downstream side of the dam. In the 2016 EA analysis, it was assumed that this roadway would remain open during construction and flaggers and signage would be used to minimize any impacts; however, subsequent evaluation revealed that it would be best for this road to be closed during construction. This would result in a temporary change in access during construction; however, it provides a safer environment for both the public and construction staff. The temporary closing of North Carolina Landing Road would also impact access to the tailwater fishing area on the left bank below the dam (See Section 3.6). The tailwater fishing area on the right bank would remain open. Following construction, the tailwater fishing area on the left bank would reopen.

In addition, the construction contractor may utilize either the Hardin County Port, local quarry facilities, or a mixture of both options to obtain fill material necessary for the project.

Quad axel dump trucks or semi tractors with trailers would be used to haul fill materials for both options. For use of the Hardin County Port, the contractor would unload material from barges into trucks and travel on Hardin Dock Road and then north along North Carolina Landing Road to the project site. If the contractor utilizes Hardin County Port to unload material from barges to the eastern side of the dam, transportation impacts would decrease as a haul route adjacent to State Highway 128 may not be necessary. The proposed option of bringing downstream fill materials to the site via barge has the potential to reduce the use of local roads.

For use of the local quarry facilities, the contractor would use facilities within 35 miles of the project site and would utilize various main roadways including State Route 128, State Route 226, State Route 57, State Route 142, State Route 22, and U.S. Highway 64 to transport the materials to the project site. It is estimated that 25 trucks would be onsite and complete 400 to 1,650 trips per day (1.5 to 6.5 trips per hour, 10-hour work days) to complete the necessary deliveries of fill material. This would be a total of 104,000-429,000 trips over a 12 month period assuming a 5 day work week and depending on material source location.

The annual average daily traffic counts, a measure of how busy a roadway is, along the roadways within the project vicinity that are most likely to be used for hauling materials range from 1,030 (along State Route 142 in Hardin County) to 6,821 (along State Route 128 just north of Pickwick Dam). It is unknown at this time which method of delivery the contractor would use, Hardin County Port, local quarry facilities, or a mixture of both. The most conservative scenario, hauling exclusively on roadways, was used to analyze the potential impacts on transportation. Under this scenario, the maximum number of trips per day (550) generated along the roadway with the lowest annual average daily traffic (along State Route 142) would result in a 53 percent increase in traffic. This scenario likely produces a larger increase in daily traffic than would actually occur as it assumes hauling from only one source that has the least existing traffic. The contractor would likely utilize various quarry facilities during the construction period, which would spread out the truck traffic along multiple roadways.

Although the increase in daily traffic due to trucks appears to be high, review of the number of trucks per hour on each haul route was assessed to determine how the roadways would function. The analysis determined that between 40 and 165 trucks would be added to existing traffic per hour. This increase is minimal and should not impact the level of service of the existing roadways. Therefore, the proposed action would have temporary minor impact on traffic flows within the project vicinity during construction activities.

3.8 Navigation

3.8.1 Affected Environment

Pickwick Reservoir was impounded by the construction of the Pickwick Landing Lock and Dam, and was opened to commercial navigation in 1938. Additional improvements, completed in 1948, provided a commercially navigable waterway up to Wilson Dam. Today, Pickwick Reservoir is an important link in the Tennessee River System which provides 800 miles of slack-water navigation from Paducah, Kentucky to Knoxville, Tennessee, and includes several navigable tributaries such as the Hiwassee and Clinch Rivers. The Tennessee-Tombigbee Waterway enters Pickwick Reservoir at mile 415.0. The Tennessee River Waterway is in turn linked to the 12,000 mile National Inland Waterway in several places, and supports local, national, and international commerce. Approximately 35 to 40 million tons of commodities move on the Tennessee River System annually. On average,

nearly 17.5 million tons of that traffic locks through Pickwick Lock each year (USACE 2013). Approximately 8 miles upstream on the Tennessee River and 2 miles downstream on the Tennessee-Tombigbee Waterway lies Yellow Creek State Inland Port Authority near Iuka, Mississippi, which handles between 0.5 and 1 million tons of cargo each year, primarily iron and steel products.

The Pickwick Navigation Lock (Exhibit 3) is part of the dam structure and is located adjacent to the Study Area. Located approximately 12 miles south of Savannah, Tennessee, at Tennessee River mile 206.7 (see Exhibit 2), the dam has two locks: one measures 110 feet by 600 feet and the other measures 110 feet by 1,000 feet. The first lock was completed in 1937 by TVA and the second, larger lock was put into operation in 1984 to augment the first lock. The locks are capable of handling large commercial tows and have an approximate lift of 63 feet. Two Federal Mooring Cells are located just upstream of the lock at Tennessee River Mile 207.0 for securing barges, particularly during times of inclement weather or during periods of traffic delay. Additionally, two more Federal Mooring Cells are located nearby at Tennessee River Mile 209.0.

Exhibit 3 Pickwick Navigation Lock (Source: USACE 2016)

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action Alternative

As discussed in the 2016 EA, although the project impact area is in close proximity to the navigational lock, the project would not impede navigational traffic through the lock. Construction activities would occur outside of the area necessary for navigation and care would be taken to ensure no obstructions to vessels navigating the lock occur. Barges and construction equipment would be clearly marked and avoid the navigational lock.

The extended fill on the upstream berm located along the embankment adjacent to the dam's lock (see Exhibit 2) has the potential to create a boating hazard because it extends into the reservoir far beyond the upstream slope and would lie just below the water surface during summer and transitional pool levels. Therefore as identified in the 2016 EA, navigation markers, including lighting, would be placed on all sides of the extended fill to alert boaters of its presence. Additionally, TVA would submit a Notice to Navigation to the USACE, Nashville District, Navigation Branch, at least 2 weeks prior to commencing work activities.

There is a potential for contractors completing the seismic upgrades to utilize the lake for material delivery. This should not impede navigation traffic on the lake. Two 35-acre marine staging areas are being proposed for construction activities; however, they are to the southeast of the navigational lock and should not pose a navigation hazard. These areas would be clearly marked and as noted above, TVA would submit a Notice to Navigation to the USACE 2 weeks prior to commencing work.

3.9 Cultural Resources

3.9.1 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. Cultural resources become historic properties when they 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. The Pickwick Landing Dam is classified as an NRHP-eligible architectural resource.

Section 106 of the 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.) Section 106 of the NHPA also requires federal agencies to consult with the respective State Historic Preservation Officer (SHPO) 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. With regards to cultural resources, the APE is taken as the affected

environment for purposes of this SEA. APE is defined at 36 CFR § 800.16(d) (a section of the federal regulations implementing Section 106 of the NHPA) as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.” TVA defines the archaeological APE for the Proposed Action Alternative as the area in which the undertaking would result in ground-disturbing activities. TVA defined the architectural APE as to be the direct line of sight from the project area.

Archaeological Resources

As part of the 2016 EA, TVA’s Cultural Compliance staff conducted a desktop review of available documents pertaining to the APE’s potential to contain archaeological sites. The topography of the APE has been heavily disturbed and terraformed during construction of the embankment. For those location which did not have adequate documentation regarding prior disturbance, archeologists from TVA and the University Of Alabama Office Of Archaeological Research conducted field surveys. Both surveys concluded that these areas have also been heavily disturbed and no archaeological resources were identified.

The majority of the proposed actions associated with this SEA are located within the previously reviewed APE, and were previously determined in consultation, to contain no historic properties. However, some areas affected by the proposed actions were not a part of the previous APE. These areas include the proposed 0.89-acre sediment basin, upstream staging/fleeting area and the barge unloading site. The proposed sediment basin is located within a previously modified drainage ditch. Shovel testing of the adjacent laydown area further demonstrated that this location was previously disturbed as the result of construction of Pickwick Landing Dam with shallow and disturbed subsurface soils samples (Thompson 2016). The historic photographic and construction documentation is not adequate to determine if the entire footprint of the proposed barge staging/fleeting area would be located within previously disturbed areas associated with the construction of Pickwick Landing Dam. As a precaution, the proposed barge staging/fleeting area was redesigned to avoid the mapped boundaries of known previously inundated sites.

Historic Structures

One previously recorded architectural resource, the NRHP listed Pickwick Landing Hydroelectric Project, is located within the architectural APE.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action Alternative

Adoption of TVA’s proposed action would result in ground disturbance and would have similar visual impacts to historic properties, should they be present. However, based on a combination of archaeological surveys and photo and historical documentation, the entire archaeological APE was determined to be previously disturbed and unlikely to contain intact archaeological deposits (See Section 4.13.2 in 2016 EA). Furthermore, no historical structures associated with the Dam villages were identified. The historic photographic and construction documentation is not adequate to determine if the entire footprint of the proposed barge staging\fleeting area would be located within previously disturbed areas associated with the construction of Pickwick Landing Dam. As a precaution, the proposed barge staging\fleeting area was redesigned to avoid the mapped boundaries of known previously inundated sites. The only proposed redesign that would introduce a new visual element from the previous design that could have the potential to affect the NRHP-listed

Pickwick Landing dam is the new upstream barge staging\fleeting area. However, the barge staging\fleeting area is temporary in nature and would not cause a long term visual effect.

In a letter dated May 3, 2018, TVA provided the Tennessee SHPO with notification of the changes in design associated with the project and our finding of no effect to historic properties. In a letter dated May 15, 2018, the Tennessee SHPO concurred with our finding of no effect (Appendix E). Pursuant to 36 CFR § 800.3(f)(2), TVA consulted with federally recognized Indian tribes regarding historic properties within the proposed project's APE that may be of religious and cultural significance and are eligible for the NRHP. TVA received comments from the Absentee Shawnee Tribe of Oklahoma with no objections (Appendix E).

3.10 Cumulative and Unavoidable Adverse Impacts, Relationship of Short-term Uses and Long-Term Productivity, and Irreversible and Irretrievable Commitments of Resources

Cumulative effects, unavoidable adverse impacts, relationship of short-term uses and long term productivity, and irreversible and irretrievable commitments of resources were detailed in the 2016 EA. No additional projects or other information which would alter the previous discussion have occurred since the 2016 analysis; therefore, the 2016 EA discussion remains valid for this SEA.

CHAPTER 4 - LIST OF PREPARERS

Table 5 summarizes the expertise and contribution made to the SEA by the Project Team.

Table 5 Environmental Assessment Project Team

Name/Education	Experience	Project Role
TVA		
Bernie Auld *M.S. Civil/Environmental Engineering; B.S. Civil Engineering*	30 years in civil engineering, water resources	Dam safety and regulatory compliance
Nicole Berger *M.S., Engineering Management; B.S., Civil/Environmental*	14 years in river forecasting; 1 year in navigation	Navigation
Adam J. Dattilo *M.S., Forestry; B.S., Natural Resource Conservation Management*	15 years in ecological restoration and plant ecology; 8 years in botany	Vegetation
Elizabeth B. Hamrick *M.S., Wildlife, B.S. Biology*	8 years in biological surveys and environmental reviews	Threatened and Endangered Species (terrestrial animals), ecological resources (wildlife)
Michaelyn Harle *Ph.D. Anthropology*	16 years in archaeology and cultural resource management	Archaeology and Cultural Resources
Robert Marker *B.S. Recreation Resources Management*	45 years in recreation planning and management	Recreation
Loretta A. McNamee *B.S. Environmental Biology*	11 years in Project Management and NEPA Compliance	NEPA compliance and project management
Craig Phillips *M.S. and B.S Wildlife and Fisheries Science*	10 years in stream sampling and hydrological determinations; 9 years in environmental reviews	Aquatic Ecology
Kim Pilarski-Hall *M.S., Geography, Minor Ecology*	20 years in wetlands assessment and delineation	Wetlands, Natural Areas
Amos Smith *B.S., Geology*	32 years in solid and hazardous waste management	Solid and Hazardous Waste
Lori A. Whitehorse *B.S., Plant and Soil Science*	15 years environmental regulatory compliance; 2 years NEPA experience	Environmental Program Manager
Chevales Williams *B.S., Environmental Engineering*	14 years in water quality monitoring and compliance; 12 years in NEPA planning and environmental services	Surface Water and Water Quality
Carrie Williamson, PE, CFM *M.S. and B.S., Civil Engineering*	5 years in Floodplains and Flood Risk; 3 years in river forecasting; 11 years in compliance monitoring	Floodplains and Flood Risk
HDR		
Shane Womack, PE *B.S. Civil Engineering*	25+ Years in project management and engineering services	Project management and coordination

Name/Education	Experience	Project Role
Vickie Miller, AICP, PWS *B.S. Environmental Science, M.S. Natural Resources*	20+ years in NEPA planning and environmental services	NEPA compliance and document preparation
Eric Mularski, PWS *B.S. Biology*	17+ years in environmental services and planning	NEPA compliance and document preparation

CHAPTER 5 - ENVIRONMENTAL ASSESSMENT RECIPIENTS

5.1 Federal Agencies

- U.S. Army Corps of Engineers, Nashville District
- U.S. Army Corps of Engineers, Nashville Regulatory Branch
- U.S Coast Guard
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Fish and Wildlife Service, Cookeville, Tennessee
- U.S. National Park Service, Shiloh National Military Park

5.2 State Agencies

- Southwest Tennessee Development District
- Tennessee Department of Agriculture
- Tennessee Department of Economic and Community Development
- Tennessee Department of Environment and Conservation
  - Bureau of Parks and Conservation
  - Division of Environment
  - Division of Natural Areas
  - Division of Natural Heritage
  - Pickwick Landing State Park
  - State Parks
- Tennessee Department of Transportation
- Tennessee Emergency Management Agency
- Tennessee Historical Commission
- Tennessee Wildlife Resources Agency

5.3 Local Governments and Organizations

- City of Crump, Tennessee
- City of Saltillo, Tennessee
- City of Savannah, Tennessee
- Government of Hardin County, Tennessee
- Director, Hardin County Emergency Management Agency

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CHAPTER 6 - LITERATURE CITED

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Appendix A – Figures

Appendix B – Responses to Comments Received on the Draft Supplemental Environmental Assessment

Appendix C – TVA's Bat Strategy Project Screening Form and U.S Fish and Wildlife Service Notification

Appendix D – Pickwick Landing Dam Seismic Upgrade Project No-Rise Study Memorandum

Appendix E – Cultural Resource Consultation Documentation

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