Tennessee Valley Authority, 1134 Swan Pond Road Trailer Park, Harriman, Tennessee 37748

April 22, 2015

Mr. Craig Zeller
U.S. Environmental Protection Agency
Region 4
61 Forsyth Street Southwest
Atlanta, Georgia 30303

Dear Mr. Zeller:

Please find enclosed the On-Scene Coordinator Report Addendum for the Non-Time Critical Removal Action for the Embayment/Dredge Cell. The enclosed report fulfills the requirements of Section XVI, paragraph 41 of the Administrative Order and Agreement on Consent. Please contact me if you have any questions.

Sincerely,

Carol Eimers
General Manager
Kingston Recovery Project

Enclosures

Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
On-Scene Coordinator Report for the Non-Time Critical Removal Action for the Embayment/Dredge Cell Addendum

EPA –AO-063A

Date Submitted:
04/22/2015

Submitted to whom
Craig Zeller

Concurrence

Received	Not Applicable	TVA
☒	☐	Carol Eimers
☒	☐	Michelle Cagley
☒	☐	Jodie Birdwell

Received	Not Applicable	Jacobs
☒	☐	Bruce Haas
☐	☐	_____
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Approvals

TVA Carol Eimers Date 4/21/2015

EPA Craig Zeller Date 9/15/2015

cc:

- ☒ Jonathon Burr, TDEC
- ☒ Brenda Brickhouse, TVA
- ☒ Susan Jacks, TVA
- ☒ Craig Zeller, EPA
- ☒ Carol Eimers, TVA
- ☒ EDMS
- ☒ Bruce Haas, Jacobs
- ☒ Michelle Cagley, TVA
- ☒ Greg Signer, TVA
- ☒ KIF Incident Document Control
- ☒ Jodie Birdwell, TVA
- ☒ Ryan Stubbs, EPA
- ☒ Document Control, Jacobs (Barbara Peratrovich)

Document No. EPA-AO-063A

Kingston Ash Recovery Project

On-Scene Coordinator Report Addendum for the Non-Time-Critical Removal Action for the Embayment/Dredge Cell

TVA Kingston Fossil Fuel Plant Release Site, Roane County, Tennessee

Tennessee Valley Authority

Revision	Description	Date
00	OSC Report Addendum for TVA Review	April 14, 2015
01	OSC Report Addendum for EPA Review	April 22, 2015
02	OSC Report Addendum Final	August 27, 2015

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List of Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cy	cubic yard
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ERM	Emory River Mile
FCN	Field Change Notice
ft	foot
Jacobs	Jacobs Engineering Group Inc.
Merit	Merit Construction, Inc.
msl	mean sea level
NRDA	Natural Resource Damage Assessment
OIG	Office of the Inspector General
OSC	On-Scene Coordinator
SCS	Site Construction Services
SWSHP	Site Wide Safety and Health Plan
TDEC	Tennessee Department of Environmental Conservation
TPM	Total Property Management
TVA	Tennessee Valley Authority
WBS	Work Breakdown Structure
Whaley	Whaley and Sons, Inc.

ACKNOWLEDGEMENT

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant parties involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Carol Eimers, TVA General Manager, Kingston Ash Recovery Project

Signature Carol Eimers Date 8/31/15

EXECUTIVE SUMMARY

On December 22, 2008, approximately 5.4 million cubic yards (cy) of ash material were released into the environment from the Tennessee Valley Authority (TVA) Kingston Fossil Plant (plant) in Harriman, Roane County, Tennessee. In response to this release, TVA undertook immediate response actions and worked in close coordination with the U.S. Environmental Protection Agency (EPA), the Tennessee Department of Environmental and Conservation (TDEC), and other agencies to provide for the safety of area residents, to contain released ash and minimize its downstream migration, and to monitor and assess air and water quality. On January 12, 2009, TDEC issued a Commissioner's Order to TVA requiring the comprehensive assessment, cleanup and restoration of areas impacted by the release. On May 11, 2009, an *Administrative Order and Agreement on Consent* (EPA Order) was signed between EPA and TVA providing the regulatory framework for the restoration efforts under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). TVA undertook response actions to achieve short-term strategic Site objectives defined in the EPA Order as time-critical removal actions. Those actions were summarized in an On-Scene Coordinator (OSC) Report. TVA subsequently undertook further response actions to achieve mid-term Site objectives as non-time-critical removal actions, which were summarized in a separate OSC Report submitted to EPA on March 20, 2015. This OSC Report Addendum summarizes the non-time-critical removal actions taken to restore the Swan Pond Embayment, including establishment of a complex mosaic of riparian and wetland habitat.

EFFECTIVENESS OF REMOVAL ACTIONS

Effectiveness of Embayment Grading. The western section of the Middle Embayment was graded to create a hummocky topography at the bottom of the reservoir, including depressions and piles of stones, to enhance the natural fish and macroinvertebrate habitat. The eastern section of the Middle Embayment was graded to re-create the islands and peninsulas that existed prior to the ash release and that provide an aquatic habitat feature important to fish and other aquatic species. Grading targeted an elevation of 743.0 ft mean sea level (msl) for tree planting in reforestation areas to avoid extensive submersion during high lake levels and improved survivability of the newly planted trees. In the northwestern corner of the North Embayment, the surface grades were lowered to create a transitional wetland area that will remain attractive to water birds for nesting and foraging. The transitional wetland area was graded with a steeper riparian shoreline bank and several low-lying closed depressions. Grading of the Clean Water Ditch consisted of filling in the ditches to restore pre-spill streamflow through the embayments and restore the riparian and/or terrestrial habitat at the embayment shoreline.

Effectiveness of Plantings. Plantings focused on the riparian edge of Watts Bar Reservoir. Reforestation areas were planted with hardwood, pine, and understory shrub species to promote natural successional growth of hardwood forest. Three native seed mixes were planted, corresponding to established hydrologic regimes: Subxeric/xeric seed mix in zones of higher topography, mesic/subxeric seed mix in intermediate zones, and hydric seed mix in low-lying areas on the shoreline. The transitional wetland area was planted using a mosaic of these three seed mixes, supplemented with wetland shrub mix. In the borrow area, a former sediment basin was planted using the hydric seed mix to promote natural successional wetland growth and transition to the adjacent existing wetlands. A vegetated retaining wall, constructed along the Emory River shoreline, was planted with live stakes of silky dogwood, and hydroseeded with subxeric/xeric seed mix for erosion protection. The borrow area was planted with a native seed mix together with lime, fertilizer, inoculant, and mulch.

Effectiveness of Habitat Structures. Fish habitat structures, consisting of submerged brush and woody debris and/or small piles of boulders, were placed within the embayment bottom prior to inundation to provide fish cover and habitat to enhance angling opportunities and fish populations. Simulated fallen trees, consisting of felled trees anchored in the embayment bottom, were installed to serve as fish

attractors. One osprey nesting platform, consisting of a raised nesting box set on a utility pole, was erected in the Middle Embayment. Two heron nesting platforms, consisting of a wooden support structure with 3 tiers of nesting boxes were placed on the riparian shoreline in the Middle Embayment. Simulated snags, consisting of large standing felled trees, were erected in the transitional wetland area to provide habitat for woodpeckers that feed on insects dwelling in the decomposing wood. Vernal pools, consisting of shallow ephemeral ponds, were created near the shoreline to provide habitat for amphibian and insect species to be safe from predation by fish.

MONITORING AND ANALYTICAL RESULTS

Monitoring conducted during the non-time-critical removal action is discussed in the OSC Report. No additional monitoring was performed specific to the ecological restoration activities.

SAFETY AND HEALTH

No safety and health incidents occurred during the ecological restoration activities. No reportable environmental events occurred during the ecological restoration activities either. Minor events that were under direct control of Site personnel and did not require immediate external reporting and did not threaten human health or the environment, were tracked as non-reportable environmental events.

PUBLIC INFORMATION AND COMMUNITY RELATIONS ACTIVITIES

Community relations activities were performed to promote open communication among citizens, TVA, EPA, and other agencies, and provide opportunities to the community for meaningful and active involvement in the cleanup process. Public information and community relations activities conducted both by EPA and TVA during the non-time-critical removal action are described in the OSC Report. There have been no community relations activities unique to the ecological restoration.

RESOURCES COMMITTED

TVA has recorded an estimate in the amount of $1.2 billion for the total cost of cleanup related to the incident. Costs incurred during the non-time-critical removal action related to the Embayment/Dredge Cell, totaled $545 million, of which $16.5 million were associated with the Swan Pond Embayment Ecological Restoration. EPA costs incurred during the non-time-critical removal action have totaled $7 million.

DIFFICULTIES ENCOUNTERED AND CONCLUSIONS

- Tree survivability in reforestation areas was problematic due to topographic and weather-related impacts. Trees were planted on relatively flat terrain, planted just prior to prolonged hot, dry weather in the summer of 2014, and trees planted following severe cold weather in the winter of 2015 may have contributed to tree loss. Tree survivability was improved by raising the elevation of the islands and replanting of trees in damaged areas. Other plantings and ecological enhancements were successful in achieving objectives of the non-time-critical removal action.

1 SUMMARY OF EVENTS

1.1 SITE CONDITIONS AND BACKGROUND

On December 22, 2008, approximately 5.4 million cubic yards (cy) of ash material were released into the environment from the Tennessee Valley Authority (TVA) Kingston Fossil Plant (plant) in Harriman, Roane County, Tennessee. In response to this release, an Incident Command System (ICS) Unified Command structure was implemented consisting of the U.S. Environmental Protection Agency (EPA) Region 4 as the lead agency, the Tennessee Department of Environmental and Conservation (TDEC), and TVA. TVA undertook immediate response actions and worked in close coordination with the EPA, TDEC, and other agencies to provide for the safety of area residents, to contain released ash and minimize its downstream migration, and to monitor and assess air and water quality. Following initial response actions, EPA transferred lead agency authority from EPA to TVA on January 11, 2009. On January 12, 2009, TDEC issued a Commissioner's Order to TVA requiring, among other things, the comprehensive assessment, cleanup and restoration of areas impacted by the release (TDEC 2009a). On May 11, 2009, an *Administrative Order and Agreement on Consent* (EPA Order) was signed between EPA and TVA providing the regulatory framework for the restoration efforts under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA 2009b). TVA undertook response actions to achieve short-term strategic Site objectives defined in the EPA Order as time-critical removal actions. Those actions were summarized in an On-Scene Coordinator (OSC) Report (TVA 2011). TVA subsequently undertook further response actions to achieve mid-term Site objectives as non-time-critical removal actions. Those actions were summarized in an OSC Report for the non-time-critical removal actions (TVA 2015b).

This report is an addendum to that OSC Report for the non-time-critical removal actions that specifically addresses the ecological restoration activities within the Swan Pond Embayment. This report addendum has been prepared in conformance with the requirements of EPA's Office of Solid Waste and Emergency Response Directive No. 9360.3-03 (EPA 2007).

TVA's Kingston Fossil Plant is located on the Emory River close to the confluence of the Clinch and Tennessee Rivers. The Emory River at the plant site is impounded by Watts Bar Dam. The normal summer and winter pool levels of Watts Bar Reservoir in the vicinity of the plant are 741.0 and 735.0 ft mean sea level (msl), respectively. The Emory River originates on the Cumberland Plateau and its inflows to Watts Bar Reservoir are not controlled. Flows in the nearby Clinch River arm of Watts Bar Reservoir are controlled by Melton Hill Dam. The Swan Pond Embayment is a backwater inlet of Watts Bar Reservoir, and is fed by local streams comprising the former Swan Pond Creek.

1.1.1 Initial Situation

On Monday, December 22, 2008, a containment dike surrounding a portion of the Class II landfill collapsed, releasing about 5.4 million cy of fly ash and bottom ash. The wet ash material flowed into area waters, including the Emory River and most of Swan Pond Embayment. The initial situation is further described in the time-critical removal action EPA-approved OSC Report (TVA 2011).

1.1.2 Location of Hazardous Substance(s)

The ash material contains naturally-occurring metals and radionuclides that are hazardous substances as defined by CERCLA Section 101(14). The released ash extended through several miles of riverways. Initially, the ash may have traveled upstream as far as Emory River Mile 5.75 and as far downstream as Tennessee River Mile 564. Implementation of the time-critical removal action in 2009 and 2010 removed more than 3,500,000 cy of ash and associated sediment from the river system and disposed of those

materials at an offsite landfill. Volumes of ash remaining in the river system following the time-critical removal action were estimated at approximately 532,000 cy (TVA 2011). Implementation of the non-time-critical removal action in 2010 through 2014 removed an additional 1,300,000 cy of ash and associated sediment from Swan Pond Embayment and disposed of those materials onsite in a reconstructed Ash Landfill (TVA 2015b).

1.1.3 Cause of Release or Discharge

The cause of the release was described in the time-critical removal action EPA-approved OSC Report (TVA 2011). AECOM Technology Corporation (AECOM) published a Root Cause Analysis Report to identify the most probable mechanisms or factors that contributed to the failure (AECOM 2009). AECOM's conclusion was that rapid failure of the active Dredge Cell was progressive in nature due to four concurrent factors: (1) fill geometry, (2) increased fill rates, (3) soft foundation soils, and (4) loose wet ash.

The TVA Office of the Inspector General (OIG) also published an Inspection Report (TVA OIG 2009). The OIG Inspection Report included that TVA's management practices or policies and procedures contributed to the release by allowing conditions to advance to the critical stage. TVA has since acted to address its ash management program and to improve its organizational effectiveness, including: organizational changes to address management and accountability issues; changes designed to alter the corporate culture which had de-emphasized the importance of ash management; and steps to assess ash storage facilities against dam safety guidelines.

A TDEC Advisory Board also published a report of lessons learned from the TVA Dredge Cell failure (TDEC 2009b). Findings/recommendations of the TDEC Advisory Board included: (1) emphasis on improved life-cycle engineering design, monitoring, inspection, and follow-up maintenance; and (2) understanding of the evolutionary process of the cell construction and methods to manage that evolution.

1.1.4 Injury/Possible Injury to Natural Resources

Possible injury to natural resources were described in the time-critical removal action EPA-approved OSC Report (TVA 2011). The ash released into the Swan Pond Embayment and Emory River covered aquatic habitats in this portion of Watts Bar Reservoir. Bottom-dwelling animals (mussels, snails, insects, crayfish, etc.) in areas where large amounts (>6 inches) of ash were deposited were likely unable to escape the release and were smothered by ash deposits. Subsequent surveys indicate that the release appears to have had minimal long-term impacts on the numbers and species of aquatic and terrestrial organisms present. Long-term Monitored Natural Recovery is being implemented as a non-time-critical removal action to address residual ash in the river system in accordance with the approved Action Memorandum (TVA 2012). The long-term monitoring continues to assess impacts to natural resources in the river system.

1.1.5 Efforts to Obtain Response by Responsible Parties

Initial responses to the release are described in the time-critical removal action EPA-approved OSC Report (TVA 2011). Immediate actions included: (1) closing the Emory River to boat traffic; (2) managing of river flows by controlling releases from nearby dams; (3) controlling ash migration by constructing a Weir 1 across the Emory River and a Dike 2 across the Swan Pond Embayment; (4) repairing damaged railroads, roads, and utilities; (4) collecting cenospheres (floating ash residue) and floating debris from the river system; (5) installing storm water management systems (clean water diversion, ash water collection, and settling basin); (6) dust control systems; (7) dike stabilization; and (8) comprehensive community outreach activities.

On May 11, 2009, an EPA Order was signed between EPA and TVA providing the regulatory framework for the restoration efforts under CERCLA (TVA 2009).

Time-critical actions began following issuance of the EPA Order to address short-term strategic objectives for the Site. An Action Memorandum for the time-critical removal action was approved on August 4, 2009 (Jacobs 2009). Time-critical actions included dredging of ash from the Emory River and from the Swan Pond Embayment east of Dike 2; dredging was completed in June 2010. Recovered ash was dewatered, then loaded onto railcars for transport to the Arrowhead Landfill in Uniontown, Alabama; disposal was completed on December 1, 2010.

Non-time-critical actions began following approval of the Action Memorandum on May 18, 2010 (Jacobs 2010b). Non-time-critical actions included excavation of ash from the remainder of the Swan Pond Embayment west of Dike 2; excavation was completed by June 2014. Recovered ash was dewatered then disposed of in an onsite Ash Landfill; closure of the Ash Landfill was completed on January 21, 2015.

1.2 ORGANIZATION OF THE RESPONSE

The organization of the non-time-critical removal action was via the ICS under a Unified Command. While TVA retained responsibility as the lead federal agency, EPA retained approval authority over the actions taken to clean up the Site, in consultation with TDEC. TDEC also retained authority in specific areas, such as final closure of the Dredge Cell and Ash Pond. In addition, other agencies were involved such as the U.S. Coast Guard, Bureau of Reclamation, the Agency for Toxic Substances and Disease Registry, U.S. Army Corps of Engineers, and the Tennessee Department of Health.

1.3 CHRONOLOGICAL NARRATIVE OF RESPONSE ACTIONS

- Restoration of the ecosystem in the Swan Pond Embayment began concurrent with the completion of ash removal from the embayment. Ecosystem restoration included establishment of a complex mosaic of forested, scrub-shrub, and emergent wetland plant communities. This included the restoration of floodplain microtopography and wetland hydrology (i.e., constructed vernal pools) that historically provided important off-channel, seasonal, aquatic habitat for amphibians, birds, and other semi-aquatic species. Enhancements included constructing weirs to control water levels in the North Embayment and constructing additional wetlands in the former borrow area.

- Initial construction of a vegetative retaining wall along the Emory River began on March 3, 2014. Planting of reforestation areas and hydroseeding of riparian habitat areas began on the Lakeshore peninsula on April 9, 2014. Grading for a transitional wetland habitat in the North Embayment and erection of fish and bird habitat structures was conducted in June and July 2014. Weir 1 was constructed in July 2014; weir 2 was constructed in August 2014. Final restoration was completed on June 12, 2015, when the final area of reforestation was planted.

1.3.1 Alternative Technology Approaches Pursued

Several technologies were evaluated for restoring the ecosystem within the embayment, as described in the *Engineering Evaluation and Cost Analysis (EE/CA) for the Embayment/Dredge Cell* (Jacobs 2010a). Technologies were evaluated as to their effectiveness, implementability, and cost. The technologies included the following enhancements to the ecosystem beyond those required to satisfy the EPA Order.

- Riparian zones in much of the East, Middle, and North Embayments were converted from pasture and/or lawn vegetation to riparian zone plantings and reforestation areas. Vernal pools and simulated fallen trees were constructed in these zones to add to the complexity of the riparian habitat.

- New wetland areas were created to enhance the wetland acreage beyond those present in the existing wetlands north of the North Embayment. A transitional wetland area was constructed in the northern end of the North Embayment. Pond 1, used as a sediment basin during operation of the borrow area, is being established as a wetland area at the far north side of the borrow area.

- Weirs were installed in the North Embayment to allow control of water levels for management of the existing wetlands north of the embayment and to maintain a relatively constant pool in the northern half of the North Embayment. This enhances the ecological resources by providing for active management of the riparian zone.

- Concurrent with the ecological restoration of the embayment, TVA developed recreational facilities on lands surrounding the embayment. The recreation area development included both passive and active recreational uses that enhance both public access to and enjoyment of the natural resources in the embayment. Passive recreation is enhanced by more than 3.8 miles of multipurpose walking trails, canoe/kayak launches, a boat ramp with parking and restroom facilities, a pedestrian bridge over the East Embayment, and fishing piers. Active recreation, will be enhanced by future development of a multi-use sports complex; TVA will license additional acreage to Roane County for the development and maintenance of a multi-use sports complex that will include a festival field, soccer fields, baseball fields, parking, and other amenities.

2 EFFECTIVENESS OF REMOVAL ACTIONS

2.1 ACTIONS TAKEN BY TVA

Operations conducted under the non-time-critical removal action are summarized in the OSC Report (TVA 2015b). The following sections describe the effectiveness of the actions taken to restore the ecosystem in the Swan Pond Embayment. Photographs of the progress of the ecological restoration actions are presented in Appendix A. Figures 1 through 4 show the areas that were restored.

Restoration of the Swan Pond Embayment was specified in a single EPA-approved design package: *Swan Pond Embayment Ecological Restoration, Kingston Fossil Plant* (Removal Design Package, Document No. RDP-0112-D). Initial designs were approved by EPA on December 6, 2012. Supplemental design revisions were made to eliminate a third weir in the North Embayment and to move a proposed boat ramp to the Lakeshore Drive peninsula. A revised design (Rev. 01) was prepared and issued for construction on July 31, 2013. That final design package was approved by EPA on September 4, 2013.

Restoration focused on increasing areas of diverse natural habitats and ecological complexity. Topographic variation and native vegetative species coupled with established hydrologic regimes worked in concert to achieve this diversity. Restoration focused on shorebird habitat enhancement and wetland restoration to increase wildlife habitat and develop native riparian vegetation along the more denuded shorelines around the Lakeshore peninsula and North and Middle Embayments. Efforts were taken to connect each of the restored areas to provide a contiguous ecological system that increases wildlife use and recreational activities.

Merit Construction, Inc. (Merit) was the contractor procured for construction of the Swan Pond Embayment Ecological Restoration. Total Property Management (TPM) was a subcontractor to Merit for the installation of the plant materials and vegetative slope stabilization. Whaley and Sons, Inc. (Whaley) was a subcontractor to Merit for embayment grading. TVA's Site Construction Services (SCS) was also involved in embayment grading activities.

2.1.1 Embayment Grading

Embayment grading included building up of islands and peninsulas in the Middle Embayment to reflect pre-spill topography, regrading of the northwestern corner of the North Embayment to create a transitional wetland, and filling of the Clean Water Ditch in both embayments to re-establish the embayment shoreline.

2.1.1.1 Middle Embayment Grading

Grading of the Middle Embayment was conducted throughout the ash removal activities as areas were demonstrated to be clean of ash. The western section of the Middle Embayment (west of the Swan Pond Circle Road underpass) was graded to create a hummocky topography at the bottom of the reservoir, including depressions and piles of stones, to enhance the natural fish and macroinvertebrate habitat. SCS completed that grading in late spring of 2012.

The eastern section of the Middle Embayment was graded to re-create the islands and peninsulas that existed prior to the ash release. The islands provide an aquatic habitat feature important to fish and other aquatic species. Native sediment on the bottom of Watts Bar Reservoir had either been displaced by the ash during the release or removed together with the ash during ash removal operations. Grades within the embayment were therefore lower than existed prior to the release. The pre-spill terrestrial and riparian

grades were restored to an elevation that would support native plant communities. Restoration included filling the islands to elevations and general shapes to reflect pre-spill topography.

The approved design would have raised grades in the island areas to elevations as high as 750.0 ft msl (about 9 ft above normal summer pool), whereas pre-spill grades averaged only about 743.0 ft msl. To reduce the quantity of borrow fill needed to recreate the islands, the grades were lowered a few feet. The periphery of the islands was held at normal summer pool elevation (741.0 ft msl) with gentle, relatively flat slopes toward interior upland areas.

Field Change Notice (FCN) 080 raised the minimum elevation required for designated reforestation areas. Grading targeted an elevation of 743.0 ft msl for tree planting to avoid extensive submersion during high lake levels. This improved the survivability of the newly planted trees.

SCS completed grading of the islands in the Middle Embayment in June and July 2014. A total of approximately 25,000 cy of borrow fill were hauled into the embayment to recreate the islands. In addition, Whaley hauled approximately 3,000 cy of topsoil to the islands for supplementing the soils in the reforestation areas.

2.1.1.2 North Embayment Grading

Grading in the North Embayment was limited because the embayment became flooded during a rain event in 2011. In the northwestern corner of the embayment, the surface grades were lowered to create a transitional wetland area. Due to TVA concerns over potential bird collisions with transmission lines traversing this upper portion of the North Embayment, the area was converted to a wetland mosaic instead of optimized shorebird impoundment system. The wetland mosaic will still remain attractive to water birds and is anticipated to be used for nesting and foraging. The wetland mosaic will closely resemble the existing borrow area wetland complex, exhibiting emergent and scrub/shrub habitat with varying substrate topography and associated water depths.

Whereas former grades sloped gradually between elevations 750.0 and 740.0 ft msl to the embayment, the transitional wetland grades were modified to create a steeper riparian shoreline bank, and several low-lying closed depressions between elevations 740.0 and 744.0 ft msl. Whaley completed grading of the transitional wetlands in the North Embayment in July 2014. A total of approximately 10,000 cy of soil were removed to create the transitional wetlands.

During the excavation of ash from the North Embayment, a berm had been constructed across the embayment to facilitate dewatering. During the ecological restoration design, a decision was made to retain the berm and install a weir (Weir 2) in that berm to allow for managed control of water levels in the northern half of the embayment. FCN-085 provided for riprap armoring of the berm so as to comply with requirements of the Dam Safety Governance. That armoring work was completed on August 19, 2014.

2.1.1.3 Clean Water Ditch Grading

A series of clean water ditches had been installed in the Swan Pond Embayment west of Dike 2 during the emergency response actions in early 2009 to bypass upgradient surface water around the ash. Nearly 5,900 linear ft of ditches, 4 ft deep and 16 to 20 ft across were constructed and lined with rock to reduce bank erosion. Grading of the Clean Water Ditch consisted of filling in the ditches to restore pre-spill streamflow through the embayments and restore the riparian and/or terrestrial habitat.

The section of the Clean Water Ditch traversing the eastern side of the North Embayment was filled beginning in July 2014. Whaley filled the ditch from north to south, completing the grading work to the

fishing pier in July 2014. SCS completed filling the remainder of the Clean Water Ditch in September and October 2014, at which time flow was routed through Weir 2 and the lower half of the North Embayment, discharging to a set of culverts beneath Swan Pond Circle Road. The culverts beneath Swan Pond Circle Road continued to carry flow from the North Embayment until January 26, when the culverts were filled with flowable fill (grout).

The section of the Clean Water Ditch traversing the northeastern side of the Middle Embayment was filled in October and November 2014. That grading work began by excavating a notch in Dike 3 on September 24, 2014, which opened the Middle Embayment up to the Emory River. Flow was then diverted from the Clean Water Ditch into the Middle Embayment by excavating a second notch in the Clean Water Ditch berm near the culverts beneath Swan Pond Circle Road. Each end of the Clean Water Ditch was then plugged with earthen fill, the water was pumped out of the ditch, and the ditch filled with rocky materials excavated from the removal of Dike 3. The berm was then graded over the rocky fill to provide final contours for planting. Grading was completed on November 11, 2014.

The section of the Clean Water Ditch traversing the northwestern side of the Middle Embayment was removed in December 2014 and January 2015. That grading work began on December 10, 2014, by excavating a notch in the former haul road, which also served as a berm forming the Clean Water Ditch. The former haul road was excavated to below an elevation of 738.0 ft msl, near low winter pool elevation in Watts Bar Reservoir.

The section of the haul road that passed through the bridge underpass beneath Swan Pond Circle Road was removed immediately following removal of the Clean Water Ditch. Materials were pushed with a dozer to the northern side of the underpass, then removed with an excavator. Once final grades were reached in the area of the underpass, the berm holding back water in the North Embayment was breached, allowing water to pool beneath the bridge. The final remnants of the haul road consisted of a berm separating the North and Middle Embayment waters; that berm was breached on January 27, 2015, allowing waters to flow directly from the North Embayment into the Middle Embayment through the bridge underpass. The former Clean Water Ditch pipe culverts beneath Swan Pond Circle Road were then filled with flowable fill. Final grading of the areas north and south of the culverts was completed in mid-April, 2015.

2.1.2 Planting

Planting included reforestation, restoration of riparian habitat, and reclamation of disturbed borrow areas. Planting of trees, shrubs, and seed mixes was restricted to seasons that promoted survivability; namely, spring of 2014, fall of 2014, and spring of 2015. TPM performed the planting.

2.1.2.1 Reforestation Areas Planting

Reforestation areas were targeted for the re-establishment of hardwood forest along the riparian edge of Watts Bar Reservoir. Along with hardwood tree species, pine seedlings and understory shrub species were planted to promote natural successional growth of hardwood forest. Tree species were modified depending on availability at regional nurseries. Trees plantings were typically 1 to 2 inch in size and up to 8 ft in height. Approximately 15.1 acres of reforestation areas were planted.

A screening reforestation area was targeted for the re-establishment of forest habitat south of the boat ramp parking on the Lakeshore peninsula. The screening area was intended to provide a visual barrier to limit views of the power plant from the boat parking area. Approximately 1.0 acres of screening reforestation area were planted.

Reforestation areas were prepared by either placing topsoil or amending the soil with organic mulch. Holes were augered in which to set rootballs and/or container-grown plants. Once planted, the areas were hydroseeded with subxeric/xeric seed mix.

Reforestation around the Lakeshore peninsula and the East Embayment began in January 2014, and was completed in late May 2014. Reforestation around the Middle Embayment began in early May and June 2014, then was discontinued until fall, resuming in November and December 2014. Final planting of reforestation areas in the North Embayment was completed on June 12, 2015.

2.1.2.2 Riparian Zone and Wetland Habitat Planting

Revegetation of the riparian zone habitat targeted areas less than 200 ft from the shoreline. In addition to the riparian zone reforestation areas, revegetation included the planting of special native seed mixes by hydroseeding and the planting of container-grown wetland shrubs.

Three native seed mixes were planted, corresponding to established hydrologic regimes. Subxeric/xeric seed mix, also referred to as the "deer and turkey mix", was planted in zones of higher topography. Approximately 19.0 acres of subxeric/xeric seed mix were planted (including reforestation areas that were also seeded with subxeric/xeric seed mix). Mesic/subxeric seed mix, also referred to as the "waterfowl mix", was planted in intermediate zones. Approximately 9.4 acres of mesic/subxeric seed mix were planted. Hydric seed mix, also referred to as the "wildlife mix", was planted in low-lying areas on the shoreline. Approximately 3.7 acres of hydric seed mix were planted.

In the northern corner of the North Embayment, the transitional wetland area was planted using a mosaic of these three seed mixes, supplemented with approximately 0.5 acres of wetland shrub mix.

In the far northern edge of the borrow area, Pond 1 was constructed initially as a sediment basin for treatment of storm water during active borrow area operations. Once vegetative cover has become sufficiently established within the former borrow area, Pond 1 will be dismantled by removing the outlet piping and breaching the containment berm. The former basin will then be planted using the hydric seed mix to promote natural successional wetland growth and transition to the adjacent existing wetlands. This work will be conducted as part of ongoing operation and maintenance activities.

By the summer of 2014, approximately 3.5 acres of riparian zone areas had already naturally self-seeded with no invasive species noted. A decision was made, therefore, not to disturb these naturalized areas for replanting of seed mix, but allow them to remain self-seeded.

2.1.2.3 Other Planting

Areas on the eastern shore of the Lakeshore peninsula that experience excessive wave action were stabilized with a combination of hard and natural armoring techniques to reduce erosion and ensure sustainable protection. A vegetated retaining wall, described below, was planted with live stakes of silky dogwood, and hydroseeded with subxeric/xeric seed mix.

Reclamation of the borrow area north and east of the North Embayment was initially attempted in the fall of 2013 using a "steep slope" seed mix. However, due to poor grass establishment and rill erosion on the steeper slopes, the borrow area was reseeded in summer and fall of 2014 using a native seed mix and several admixtures. Admixtures included ProPlus® "NeutraLime™ Dry" applied at a rate of 300 pounds per acre, Pennington® "All Purpose Fertilizer 19-19-19" at a rate of 400 pounds per acre, and ProPlus® "JumpStart™" at a rate of 2.5 gallons per acre. The area was hydromulched using "MulchPro™ Blend", a 70:30 blend of wood fiber:paper. On steeper slopes, the surface was prepared by tracking the area with

a dozer to break up the surface, then hydroseeding. In flatter areas, the surface was prepared by breaking up the area with a disk, then distributing the native seed mix using a seed drill.

2.1.2.4 Operation and Maintenance Plan

Long-term maintenance of the plantings will be conducted in accordance with the *Monitoring, Maintenance, and Reporting Plan* (TVA 2015a). This plan establishes minimum criteria for success of the plantings and sets requirements for preserving the ecological enhancements TVA has made to the Swan Pond Embayment ecosystem. The plan is part of a Natural Resources Damages Assessment for the December 22, 2008 ash release.

The restoration success criteria are to achieve the following:

- In reforestation areas, achieve a survival rate (i.e., stem density) of trees and shrubs at least 75% of the baseline condition (i.e., 363 stems per acre) at each planting site (i.e., shoreline, constructed wetland, reforestation, vegetative wall, etc.) for the first 10 years. In subsequent monitoring years (i.e., years 11 thru 30), restoration will achieve a tree and shrub cover of at least 75%.

- In herbaceous and open meadow areas, achieve at least 75% vegetative cover.

Restoration planting sites will be monitored and maintained for a period of 30 years. The baseline for monitoring is assumed to be the 10-ft by 12-ft planting scheme (363 per acre) at each planting site. It is anticipated that new native/pioneer species seedlings will colonize through time at each planting site and natural successional processes (i.e., competition) will lead to a lower density (than baseline condition) over time that is more characteristic of a typical climax hardwood forest.

Monitoring will occur during the growing season, between mid-April and late July. During the first year following planting, trees and shrubs will be inspected at approximately 6 months and other plants will be inspected monthly. Dead or diseased plants will be replaced as necessary to meet success criteria. Monitoring will include an evaluation of the presence of invasive plant species; if present, plans will be developed for mechanical removal or application of approved herbicide so that they do not represent more than 15% of the vegetative cover in the restored areas.

In reforestation areas, survival monitoring of planted trees and shrubs will be based on live vegetation in early years (i.e., Years 1 thru 10); and on percent cover in subsequent years (i.e., Years 11 thru 30) as the vegetation matures. In open or meadow area (grasses and forbs) survival monitoring will be based on percent cover.

Weirs will be inspected annually; their condition will be recorded and any debris interfering with their function will be removed.

2.1.3 Habitat Structures

Several types of habitat structures were constructed to enhance the ecological restoration of the embayment. Fish habitat structures included submerged brush and simulated fallen trees. Bird habitat structures included an osprey nesting platform, heron nesting platforms, and simulated snags. Vernal pools were constructed to promote development of natal amphibian and insect species. Created wetlands were constructed in both a transitional wetland area and a former storm water retention pond.

2.1.3.1 Fish Habitat Structures

Fish habitat structures consisted of submerged brush and woody debris placed within the embayment bottom prior to inundation to provide fish cover and habitat to enhance angling opportunities and fish populations. Small piles of boulders were also placed in the embayment bottom to serve as additional fish habitat structures and to create complex habitats. Approximately 12 fish habitat structures were installed.

Fish lunkers had originally been planned as fish habitat areas. Lunkers are open box structures buried under the edge of stream banks to provide undercut bank habitat for fish and other aquatic organisms. During construction, water levels remained high in the North Embayment, which would have impeded construction of the fish lunkers. Fish lunkers are more commonly used in streambank applications and attract larger fish. Because simulated fallen trees will increase the diversity and number of fish and benthic species, FCN-087 replaced the two fish lunkers with simulated fallen trees / sunken brush piles. Since there is a fishing pier in the general vicinity, this diversity will enhance the localized fishing experience and improve the aquatic habitat benefit for the type and size of fish expected to be present in the North Embayment.

Felled trees were installed in the embayments as simulated fallen trees to serve as fish attractors. The trees were placed in such a manner as to simulate a tree having fallen into the embayment, with its rootwad partially exposed and its top branches partially submerged in the embayment. A slight hole was excavated near the rootwad to serve as a vernal pool. A total of 8 simulated fallen trees were installed.

A large white pine tree was blown over during inclement weather and fell along the East Embayment shoreline upstream of the pedestrian bridge. FCN-079 replaced the felled tree (with vernal pool) in lieu of an instream fish attractor. The tree was repositioned at the base of a runoff swale from the shoreline, extending approximately 50 ft perpendicular to the shoreline. In this way, the tree serves not only as a fish attractor, but also disperses the energy of the swale runoff during rain events.

2.1.3.2 Osprey/Heron Nesting Platforms

One osprey nesting platform was erected in the Middle Embayment. FCN-084 removed the installation of a second osprey nesting platform from the North Embayment. There are several nearby locations that ospreys are using as nesting sites. Because the North Embayment became flooded during a storm event in 2011, access to place a new platform in the North Embayment would have required either draining of the embayment or mobilization of a shallow-draft barge.

The osprey nesting platform consisted of utility poles driven at least 10 ft into the sediment and extending at least 15 ft above the typical highest water level in Watts Bar Reservoir. A square nesting box was then fabricated on top of the utility pole.

Two heron nesting platforms were also erected in the riparian zone in the Middle Embayment. The heron nesting platforms consisted of a wooden support structure with three tiers of welded wire mesh platforms: one at a height of 3 ft, one at 5 ft, and one at 7 ft above ground surface.

2.1.3.3 Simulated Snags

Felled trees were erected in the transitional wetland area as simulated snags. Large standing snags provide habitat for woodpeckers that feed on insects dwelling in the decomposing wood. The felled trees were approximately 12 inches in diameter and 15 to 25 ft long. To create the simulated snag, the trees

were erected with approximately 1/3 the length of the tree trunk buried for vertical stability. A total of 11 simulated snags were erected.

2.1.3.4 Vernal Pools

Vernal pools are shallow ephemeral ponds that provide habitat for wetland plants and animals. The vernal pools collect water from local surface runoff, followed by desiccation from evapotranspiration. They are usually devoid of fish, and thus allow the safe development of natal amphibian and insect species unable to withstand competition or predation by fish.

The vernal pools were constructed by excavating shallow depressions in close proximity to embayment shorelines. The pools varied in size from 20 to 75 ft in length and approximately 10 ft wide. The pools were between 10 and 24 inches deep. Woody debris, such as logs and branches, were placed in the vernal pools to provide habitat structure for wildlife. A total of 1.1 acres of vernal pools were constructed in the riparian zone.

2.1.4 Vegetative Slope Stabilization

Historical bank erosion in two areas along the Emory River shoreline had created unstable conditions. To stabilize the slope and provide for a natural-appearing bank, a vegetative retaining wall system was constructed. The retaining wall system consisted of modular units with mechanically-stabilized reinforced backfill. AMEC Environment and Infrastructure completed the wall design per Submittal 0173.

The wall was constructed in two parts: Wall A at the southern end of the Lakeshore peninsula was approximately 430 ft long and Wall B at the northern end was approximately 490 ft long. Initial construction, beginning on February 27, 2014, consisted of excavating to a firm, level foundation while water levels in Watts Bar Reservoir were relatively low. Although the original design called for two rows of gabions to be placed, one above the other, due to rising lake levels in early spring, an 18-inch layer of rock was placed first. The rock layer was placed between elevations 739.5 and 741.0 ft msl. A single row of gabions was then placed as foundation platform on top of the rock foundation. The gabions consisted of woven wire baskets 3 ft high and 3 ft thick that were filled with cobble-sized rock. Riprap was placed for scour protection outboard of the gabion and rock foundation, between elevations 735.0 and 744.0 ft msl.

The facing of the vegetative retaining wall consisted of Envirolok™ geotextile bags filled with topsoil that were stacked in layers to form a 1:2 slope. Backfill behind the facing material consisted of compacted sandy earth fill with geogrid reinforcement. The geogrid product was Mirafi® Miragrid 3XT, as fabricated by TenCate Geosynthetics Americas. The geogrid was embedded approximately 10 ft behind the wall facing in Wall A and 7 ft behind the wall facing in Wall B. The geogrid was placed in layers between every third row of Envirolok™ bags, or approximately 18 inches apart. The bag facing and geogrid reinforcement were connected together to form the wall using Envirolok™ connector pins. Backfilling of vegetative Wall A was completed on April 1, 2014 and Wall B on April 9, 2014.

2.1.5 Weir Construction

Two weirs were constructed in July and August 2014 to control water levels for enhanced ecological habitat. Weir 1, located in a small berm at the far northern end of the North Embayment, controlled water levels in the existing wetland area to the north of the borrow area. The weir was a precast concrete structure about 2 ft square with a drop inlet and culvert pipe outlet discharging into the North Embayment. The top of Weir 1 was set at elevation 744.5 ft msl, although two wooden stop logs allow

for potential dropping of water levels to elevation 742.5 ft msl for wetland maintenance. Riprap was placed upstream of the weir as inlet protection, and flex-a-mat tied concrete revetment blocks were placed downstream of the weir berm for erosion protection in case of overtopping of the small berm.

Weir 2, located in a berm through the North Embayment, controlled water levels in the northern half of the embayment to avoid seasonal shoreline fluctuations associated with Watts Bar Reservoir. The weir was also a precast concrete structure about 8 ft by 14 ft, with a drop inlet and dual culvert pipes discharging to the lower half of the North Embayment. The top of Weir 2 was set at elevation 743.0 ft msl, although fiberglass stop logs allow for potential dropping of water levels to elevation 739.0 ft msl for shoreline maintenance.

The berm traversing the North Embayment had been installed in 2010 as a temporary storm water control berm during ash removal from the North Embayment. In cooperation with the Natural Resource Damage Assessment (NRDA) trustees, it was agreed that the berm would remain permanently so as to establish optimum riparian habitat under a stable (fixed) shoreline in the upper half of the North Embayment. The TVA Dam Safety Governance organization classified the berm as a low risk dam that could be overtopped during significant storm events. As a result, riprap armoring was placed on the berm for erosion protection. The riprap extended partially down the upstream face of the berm, across the top of the berm, and full depth of the downstream face of the berm. The riprap armoring extended from abutment to abutment, approximately 670 ft. The riprap armoring was constructed by SCS in July and August 2014.

2.1.6 Hugelkultur

Hugelkultur, translated from German as ‘mound culture’, is the use of rotted wood and other organic materials to create raised beds that are water retentive and self-fertilizing due to the decomposition of the wood. The wood holds water that falls on the bed and moisture that is drawn up from the ground. As the wood decomposes, its nutrients are fed directly into the soil of the bed while simultaneously providing food for microbes and nematodes. They are therefore well suited to dry climates and areas where fertilizers are not desired or accessible.

Hugelkultur beds differ from other raised beds in that they are built on top of a stockpile of rotting wood and other composting biomass. Typically built to a height of 4 to 6 ft, much of this height is lost in the first couple of years as the organic materials break down. The shrinking that occurs as the wood breaks down creates air pockets that promote root growth and loosen the soil.

In the northern portion of the borrow area, a series of hugelkultur mounds were created by stacking wood debris (logs, branches, stumps, and wood chips) in steep piles 8 to 10 ft high, covered with 2 ft of topsoil. The hugelkultur mounds were used as a natural means of disposing of wood debris from clearing operations in the borrow area, as a means of covering or obscuring rock outcroppings in the borrow area, and as an aid in minimizing sediment transport due to rill erosion and sheetflow. Although hugelkultur is normally used to create gardening beds, in this application they will support native seed plantings and successional vegetation.

2.2 LISTING OF QUANTITIES AND TYPES OF MATERIALS ADDRESSED

The quantities of ash removed during the non-time-critical removal action and ultimate destinations of materials disposed are presented in the OSC Report (TVA 2015b). No additional volumes of ash-related materials were removed during the ecological restoration activities. The ecological restoration addressed several areas of ecological habitat that were created or restored. These areas, and their respective acreage, are summarized in Table 2-1.

Table 2-1. Listing of the Habitat Areas Addressed

Ecological Habitat Area	Plant Materials Installed	Habitat size (acres)
Reforestation	Pignut Hickory, shagbark hickory, silver maple, red maple, American beech, black walnut, tulip poplar, cucumber tree, black gum, American sycamore, white oak, southern red oak, northern red oak, overcup oak, water oak, willow oak, shumard oak, post oak, black oak, swamp chestnut oak, basswood. Understory trees: serviceberry, false indigo bush, red chokeberry, redbud, pawpaw, American beauty berry, sweetshrub, hornbeam, sugarberry, silky dogwood, flowering dogwood, Washington hawthorn, arrowwood, persimmon, Carolina silverbell, witch hazel, American holly, spicebush, sweetspire, hophornbeam, sourwood, ninebark, American plum, winged sumac, staghorn sumac, elderberry, sassafras, possumhaw viburnum, blackhaw viburnum. Evergreens: Virginia pine, eastern white pine, loblolly pine.	15.1
Screening Reforestation	Plant materials same as reforestation plant materials.	1.0
Wetland Shrub	Sweet shrub, buttonbush, sweetspire, tag alder, American beauty berry, winterberry, red chokeberry	0.5
Subxeric / Xeric	Partridge pea, false sunflower, little bluestem, roundhead lespedeza, Virginia wildrye, Illinois bundleflower, Maximilian sunflower, big bluestem, indiangrass, switchgrass, tall dropseed, purple prairie clover, bluejacket spiderwort; browneyed susan, blackeyed susan, indian woodoats.	19.0
Mesic / Subxeric	Virginia wild rye, bushy bluestem, wild senna, yellow wingstem, blue flay iris, showy tickseed, switchgrass, iron weed, fox sedge, lurid sedge, bluejacket spiderwort, swamp milkweed, broom sedge, fringed sedge, fowl mannagrass, green bulrush, woolgrass, mistflower, swamp verbena, smooth beardtongue, joe-pye weed, common sneezeweed, seed box, path rush, soft rush, Allegheny monkey flower.	9.4
Hydric/wetland	Virginia wild rye, bushy bluestem,Virginia iris, common boneset, common buttonbush, cardinal flower, creeping spike rush, eastern gamagrass, fowl manna grass, fox sedge, Frank's sedge, fringed sedge, nodding sedge, bluejacket spiderwort, great blue lobelia, green bulrush, joe-pye weed, common sneezeweed, seed box, soft rush, Allegheny monkey flower, rice cut grass, rosemallow, swamp milkweed, wingstem.	3.7
Borrow Area	Native seed mix: Indian grass, big bluestem, little blue stem, side oats grama Virginia wild rye, fall panicum, deer tongue grass, broomsedge, Canada wild rye, switchgrass, ladino clover, tall dropseed, blackeyed susan, partridge pea, false sunflower, lance leaved coreopsis, Maximillan sunflower, showy tickseed, perplexed tick trefoil, Illinois bundleflower, purple prairie clover, iron week, gray goldenrod, hairy mountain mint, lupine, ragweed, butterfly milkweed, New England aster, yellow wingstem, narrow-leaved sunflower, wild senna, rigid goldenrod.	21.0
Naturalized	Riparian zone areas allowed to naturally self-seed.	3.5
Live Stakes	Silky dogwood with Subxeric / Xeric seed mix	1.4
	Total all Habitat Types	74.6

2.3 ACTIONS TAKEN BY STATE AND LOCAL FORCES

The TDEC has been actively engaged in the actions associated with remedying the release since it occurred. During the ecological restoration, TDEC was involved in establishing habitat types, assessing ecological damages, and evaluating restoration credits in conjunction with NRDA. Actions taken by TDEC during the non-time-critical removal action are presented in detail on their website, available at http://tennessee.gov/environment/kingston/index.shtml.

2.4 ACTIONS TAKEN BY FEDERAL AGENCIES AND SPECIAL TEAMS

The OSC Report (TVA 2015b) describes actions taken by EPA and other federal agencies. In addition, the U.S. Fish and Wildlife Service was involved in establishing habitat types, assessing ecological damages, and evaluating restoration credits in conjunction with NRDA.

3 MONITORING AND ANALYTICAL RESULTS

Monitoring conducted during the non-time-critical removal action is discussed in the OSC Report (TVA 2015b). No additional monitoring was performed specific to the ecological restoration activities.

4 SAFETY AND HEALTH

The Kingston Ash Recovery Project developed a comprehensive Site Wide Safety and Health Plan (SWSHP), *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (Jacobs 2010c, 2013, 2014), which governed the overall health and safety program. The SWSHP was prepared and controlled by the Site Safety Officer and approved by EPA in consultation with TDEC. The SWSHP was updated periodically during the non-time-critical removal action to apply to operations at the Site, being revised five times during this period. No safety and health incidents occurred during the ecological restoration activities.

No reportable environmental events occurred during the ecological restoration activities either. Minor events that were under direct control of Site personnel and did not require immediate external reporting and did not threaten human health or the environment, were tracked as non-reportable environmental events.

5 PUBLIC INFORMATION AND COMMUNITY RELATIONS ACTIVITIES

Community relations activities were performed to promote open communication among citizens, TVA, EPA, and other agencies, and provide opportunities to the community for meaningful and active involvement in the cleanup process.

Public information and community relations activities conducted both by EPA and TVA during the non-time-critical removal action are described in the OSC Report (TVA 2015b). There have been no community relations activities unique to the ecological restoration.

6 RESOURCES COMMITTED

6.1 TENNESSEE VALLEY AUTHORITY COSTS

Costs incurred during the non-time-critical removal action for the Embayment/Dredge Cell totaled $545 million, as reported in the time-critical removal action EPA-approved OSC Report (TVA 2011). Costs for the Embayment Restoration portion (WBS 01.16) were approximately $16.5 million.

6.2 U.S. ENVIRONMENTAL PROTECTION AGENCY COSTS

EPA costs incurred during the non-time-critical removal action were $7.2 million, as reported in the OSC Report (TVA 2015b).

7 DIFFICULTIES ENCOUNTERED AND CONCLUSIONS

This section of the OSC Report Addendum records the problems encountered in implementing the time-critical removal action. Items that affected the response, issues of intergovernmental coordination, and difficulties in complying with policies and regulations are discussed.

7.1 DIFFICULTIES ENCOUNTERED AND MEASURES TAKEN

Tree survivability in reforestation areas was problematic due to topographic and weather-related impacts. In the Middle Embayment, trees were planted on relatively flat terrain that retained water in depressions, which may have contributed to tree loss. In addition, prolonged hot, dry weather in the summer of 2014 may have contributed to tree loss. In the North Embayment, grading near the underpass at Swan Pond Circle Road delayed planting of trees that had been delivered in November 2014 until the spring of 2015. Severely cold weather in the winter of 2015 may have contributed to tree loss. Tree survivability was improved by raising the elevation of the islands in the Middle Embayment and by replanting of trees in damaged areas.

8 REFERENCES

AECOM 2009. June 25, 2009. *Root Cause Analysis of TVA Kingston Dredge Pond Failure on December 22, 2008, Kingston Fossil Plant, Harriman, Tennessee*.

U.S. Environmental Protection Agency (EPA) 2007. December 2007. *Guidance for Preparing POLREPs/SITREPs*, Office of Solid Waste and Emergency Response (OSWER) Directive No. 9360.3-03.

EPA 2009a. January 10, 2009. Memorandum *re: Transfer of Lead Federal Agency Authority*. From Steve Spurlin, EPA Federal On-Scene Coordinator, to Tim Hope, TVA Incident Commander.

EPA 2009b. May 11, 2009. *Administrative Order and Agreement on Consent*, Docket No. CERCLA-04-2009-3766, Region 4.

Jacobs 2009. August 4, 2009 (EPA approval). *Action Memorandum; Request for Removal Action at the TVA Kinston Fossil Fuel Plan Release Site, Roane County, Tennessee*. Document No. EPA-AO-005.

Jacobs 2010a. January 15, 2010. *Kingston Ash Recovery Project Non-Time-Critical Removal Action, Embayment/Dredge Cell Engineering Evaluation/Cost Analysis* (EE/CA). Document No. EPA-AO-008.

Jacobs 2010b. May 18, 2010 (EPA approval). *Kingston Ash Recovery Project, Non-Time-Critical Removal Action, Embayment/Dredge Cell Action Memorandum*. Document No. EPA-AO-024.

Jacobs 2010c. October 21, 2010. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response.* Revision 05. Document No. EPA-AO-003.

Jacobs 2013. January 24, 2013 (EPA approval). *Site Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response.* Revision 06. Document NO. EPA-AO-003.

Jacobs 2014. February 6, 2014 (EPA approval). S*ite Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response.* Revision 07. Document No. EPA-AO-003.

Tennessee Department of Environment and Conservation (TDEC) 2009a. January 12, 2009. *Commissioner's Order*, Case No. OGC09-0001 In the Matter of: Tennessee Valley Authority.

TDEC 2009b. November 30, 2009. *Lessons Learned from the TVA Kingston Dredge Cell Containment Facility Failure TDEC Advisory Board Recommendations for Safe Performance*.

TVA 2009. February 2009. *Environmental Assessment, Initial Emergency Response Actions for the Kingston Fossil Plant Ash Dike Failure, Roane County, Tennessee*.

TVA 2011. March 31, 2011 (EPA approval). *TVA Kingston Fossil Fuel Plant Release Site On-Scene Coordinator Report for the Time-Critical Removal Action May 11, 2009 through December 2011*. Document No. EPA-AO-030.

TVA 2012. November 7, 2012 (EPA approval). *Kingston Ash Recovery Project Non-Time-Critical Removal Action River System Action Memorandum*. Document No. EPA-AO-054.

TVA 2015a. March 20, 2015 . *Kingston Ash Recovery Project, Natural Resources Damages Assessment Monitoring, Maintenance, and Reporting Plan*. Document No. EPA-AO-062.

TVA 2015b. August 27, 2015 (submitted for EPA approval). *Kingston Ash Recovery Project, On-Scene Coordinator Report for the Non-Time-Critical Removal Action for the Embayment/Dredge Cell*. Document No. EPA-AO-063.

TVA Office of Inspector General (OIG). July 23, 2009. *Inspection Report: Review of the Kingston Fossil Plant Ash Spill Root Cause Study and Observations About Ash Management.* 2009-12283-02.

Figures

BORROW AREA
SEE INSET RIGHT

WEIR #1

NORTH
EMBAYMENT
SEE FIGURE 2

WEIR #2

NORTH
EMBAYMENT

SWAN POND CIRCLE RD

SWAN POND RD

MIDDLE
EMBAYMENT
SEE FIGURE 3

EAST
EMBAYMENT

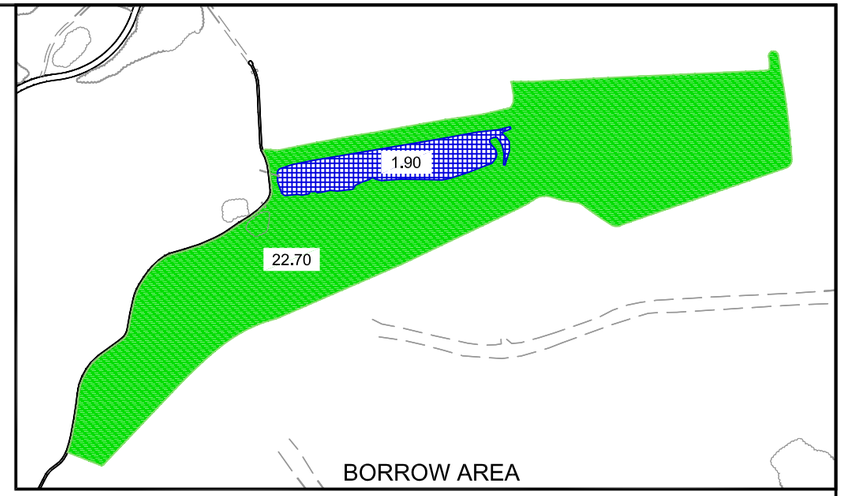
LAKESHORE DR

LAKESHORE
PENINSULA
SEE FIGURE 4

LEGEND

SYMBOL	DESCRIPTION
	WETLAND SHRUB MIX
	SUBXERIC / XERIC
	MESIC / SUBXERIC
	HYDRIC
	SCREEN
	REFOREST
	STEEP SLOPE SEED MIX
	LIVE STAKES
	VERNAL POOL (HYDRIC PLANT)
	NATURALIZED

SYMBOL	DESCRIPTION
	FISH HABITAT STRUCTURE (BRUSH PILE)
	OSPREY NESTING PLATFORM
	HERON PLATFORM
	SIMULATED SNAG
	SIMULATED FALLEN TREE



NOTE: AREAS ARE IN ACRES.

0 250 500 1000
SCALE IN FEET

FIGURE 1
ECOSYSTEM RESTORATION OVERALL PLAN
KINGSTON ASH RECOVERY PROJECT

DATE: 22 April 2015
PHASE: OSC Report Addendum

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LEGEND	
SYMBOL	DESCRIPTION
	WETLAND SHRUB MIX
	SUBXERIC / XERIC
	MESIC / SUBXERIC
	HYDRIC
	REFOREST
	VERNAL POOL (HYDRIC PLANT)

SYMBOL	DESCRIPTION
	FISH HABITAT STRUCTURE (BRUSH PILE)
⊗	SIMULATED SNAG
	SIMULATED FALLEN TREE

0.13
0.43
1.34
0.79
1.55
0.55
0.05
VERNAL POOL,
HYDRIC PLANT, TYP.
0.11
0.19
0.36
0.05
0.06
SUMMER POOL
ELEV=741
WINTER POOL
ELEV=737
0.32
SWAN POND CIRCLE RD
NORTH EMBAYMENT
2.46
0.40
RIP-RAP, TYP.
0.47
SWAN POND RD
1.24
0.14
0.29
0.16
SWAN POND CIRCLE RD

NOTE: AREAS ARE IN ACRES.

0 100 200 400
SCALE IN FEET

FIGURE 2
ECOSYSTEM RESTORATION
NORTH EMBAYMENT
KINGSTON ASH RECOVERY PROJECT

DATE:	PHASE:
22 April 2015	OSC Report Addendum

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NORTH
EMBAYMENT
SEE FIGURE 2

SWAN POND CIRCLE RD

SWAN POND CIRCLE RD

LAKESHORE
PENINSULA
SEE FIGURE 4

0.18

0.44

1.32

4.84

0.80

0.38

0.30

0.05

SUMMER POOL
ELEV=741

WINTER POOL
ELEV=737

1.81

VERNAL POOL,
HYDRIC PLANT, TYP.

0.02 (ALL 3)

3.45

0.63

2.61

0.02

0.03

0.17

0.87

EMORY RIVER

LEGEND

SYMBOL	DESCRIPTION
	SUBXERIC / XERIC
	MESIC / SUBXERIC
	REFOREST
	VERNAL POOL (HYDRIC PLANT)
	NATURALIZED

SYMBOL	DESCRIPTION
	FISH HABITAT STRUCTURE (BRUSH PILE)
	OSPREY NESTING PLATFORM
	HERON PLATFORM
	SIMULATED SNAG
	SIMULATED FALLEN TREE

NOTE: AREAS ARE IN ACRES.

0 100 200 400
SCALE IN FEET

FIGURE 3
ECOSYSTEM RESTORATION
MIDDLE EMBAYMENT
KINGSTON ASH RECOVERY PROJECT

DATE: 22 Apr 2015

PHASE: OSC Report Addendum

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LEGEND	
SYMBOL	**DESCRIPTION**
	MESIC / SUBXERIC
	SCREEN
	REFOREST
	LIVE STAKES

SYMBOL	DESCRIPTION
	FISH HABITAT STRUCTURE (BRUSH PILE)
	HERON PLATFORM
	SIMULATED FALLEN TREE

SWAN POND CIRCLE RD

EAST EMBAYMENT

LAKESHORE DR

EMORY RIVER

1.40

0.96

0.09

0.15

0.56

0.31

0.65

WINTER POOL
ELEV=741

0.24

1.00

0.90

0.05

NOTE: AREAS ARE IN ACRES.

0 100 200 400

SCALE IN FEET

FIGURE 4
ECOSYSTEM RESTORATION
LAKESHORE PENINSULA

KINGSTON ASH RECOVERY PROJECT

DATE: 22 April 2015

PHASE: OSC Report Addendum

I:\0002 ENGINEERING\Civil\Report Graphics\NTC OSC Final Report\SPEER Addendum\Fig 2-4_Planting Asbuilt-Detailed.dwg Apr 22,2015 - bperatro

APPENDIX A

Photo Log

APPENDIX A: PHOTO LOG
Non-Time-Critical Removal Action

1A – Oblique of the Middle Embayment after release (viewing from the east). January 8, 2009.

1B – Oblique of the Middle Embayment following SPEER Non-Time-Critical Removal Action. November 18, 2014.

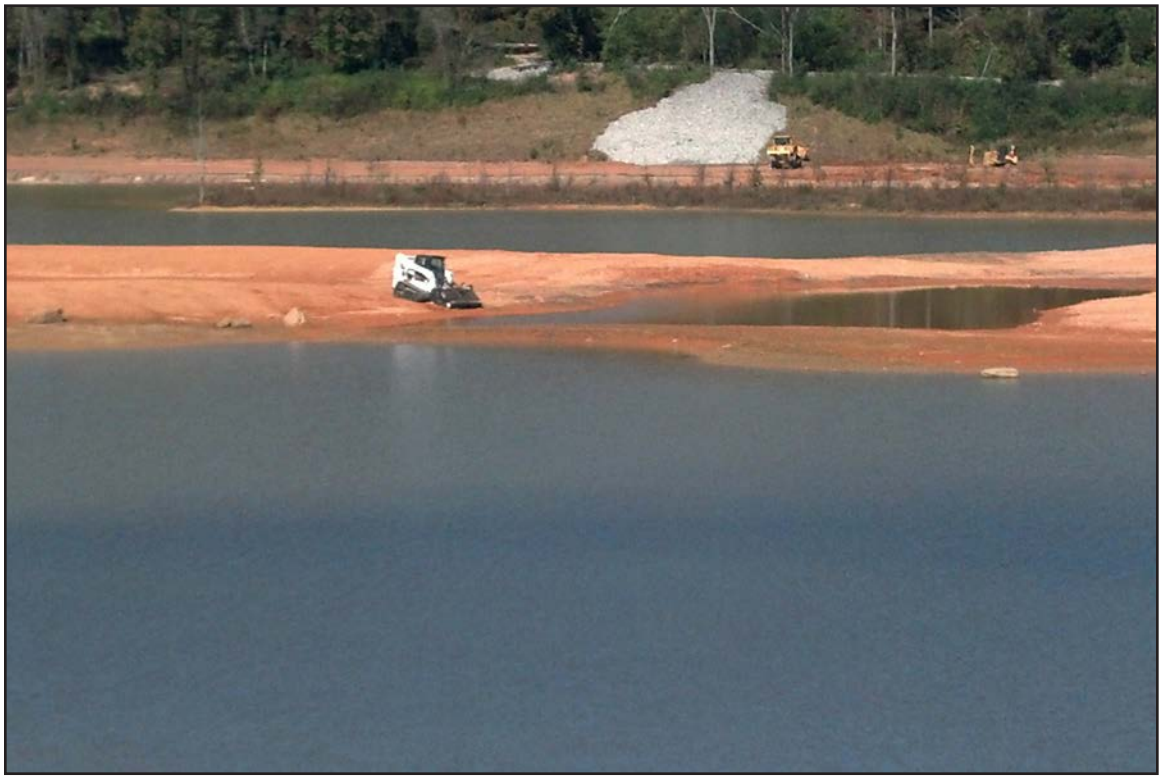
1C – Middle Embayment after release. December 27, 2008.

1D – Middle Embayment following SPEER Non-Time-Critical Removal Action. July 29, 2014.

1E – East Embayment following SPEER Non-Time-Critical Removal Action. July 29, 2014.

1F – East Embayment following SPEER Non-Time-Critical Removal Action. July 29, 2014.

2A – Middle Embayment before inundation with rock piles as fish habitat. May 24, 2014.



2B – Middle Embayment final grading by Merit to remove rocks. October 22, 2014.

3A – North Embayment grading of transitional wetlands area. July 29, 2014.

3B – North Embayment riprap armoring of the North Berm dike. July 7, 2014.

4A – Grading of clean water ditch - Filling in North Embayment. October 20, 2014.

4B – Grading of clean water ditch - Filling in Middle Embayment. October 20, 2014.

5A – Plantings - Augering holes for trees. April 23, 2014.

5B – Plantings - Placing balled and burlapped trees in reforestation areas. April 16, 2014.

6A – Plantings - Reforestation area in the North Embayment. April 10, 2015.

6B – Plantings - Reforestation area in the Middle Embayment. July 29, 2014.

7A – Fish habitat structures - Fish attractor. July 29, 2014.

7B – Simulated tree snag in the Middle Embayment. July 29, 2014.

8A – Osprey platform erected in the Middle Embayment. July 29, 2014.

8B – Heron platform erected in the Middle Embayment. July 29, 2014.

9A – Vernal pools in the North Embayment with plantings of wetland shrubs. October 20, 2014.

9B – Vernal pools in the Middle Embayment. October 20, 2014.

10A – Wetlands construction - Grading for wetland in the North Embayment. June 10, 2014.

10B – Wetland construction - Completed wetland in the North Embayment. September 18, 2014.

11A – Vegetative slope stabilization - Placing gabions. March 8, 2014.

11B – Vegetative slope stabilization - Placing geogrid tiebacks. April 2, 2014.

12A – Vegetative slope stabilization - Emory River shoreline. May 24, 2014.

12B – Vegetative slope stabilization - Established wall vegetation. October 2, 2014.

13A – Weir 1 at the transitional wetlands in the North Embayment. July 29, 2014.

13B – Weir 2 at the North Berm dike in the North Embayment. October 20, 2014.

14A – Wildlife - Osprey using simulated snag in the Middle Embayment. July 21, 2014.

14B – Wildlife - Blue Heron on simulated fallen tree in the Middle Embayment. August 25, 2014.

15A – Wildlife - Mallards in the North Embayment. August 24, 2011.

15B – Wildlife - Canadian Geese in the North Embayment. September 18, 2011.

16A – Wildlife - Geese, mallard, and wood duck in a vernal pool in the North Embayment. April 13, 2015.

16B – Wildlife - Deer in the East Embayment. April 13, 2015.