Stantec Consulting Services Inc.
3052 Beaumont Circle, Lexington KY 40513

October 9, 2018
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Revision 0

Tennessee Valley Authority (TVA)
1101 Market Street
Chattanooga, Tennessee 37402

RE: Wetlands Demonstration
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

1.0 PURPOSE

As described in 40 CFR § 257.61(a), an owner or operator of an existing CCR surface impoundment is required to demonstrate that the unit is not located in wetlands unless the unit meets certain requirements. This letter documents Stantec's certification that Ash Pond 2 at the TVA Shawnee Fossil Plant (SHF) complies with the location restrictions for fault areas in the EPA Final CCR Rule at 40 CFR § 257.61(a)

2.0 SUMMARY OF FINDINGS

The attached demonstration documents that Ash Pond 2 meets the requirements set forth in 40 CFR § 257.61(a).

3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Don W. Fuller II, being a Professional Engineer in good standing in the State of Kentucky, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the TVA Shawnee Ash Pond 2 meets the requirements specified in 40 CFR 257.61(a).

Re: **Wetlands Demonstration**
Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Shawnee Fossil Plant
West Paducah, Kentucky

SIGNATURE _____ DATE 10/9/2018

ADDRESS: Stantec Consulting Services Inc.
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Lexington, Kentucky 40513-1703

TELEPHONE: (859) 422-3000

ATTACHMENTS: Wetlands Location Demonstration Report

Wetlands Demonstration

Ash Pond 2
Shawnee Fossil Plant
Paducah, McCracken County
Kentucky

Prepared for:
Tennessee Valley Authority

Prepared by:
Stantec Consulting Services Inc.

October 9, 2018
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List of Acronyms

CCR – coal combustion residuals
CWA – Clean Water Act
DMR – Discharge Monitoring Report
ECHO – Enforcement and Compliance History Online
EMAP – Environmental Monitoring and Assessment Program
EPA – US Environmental Protection Agency
FEMA – Federal Emergency Management Agency
GIS – Geographic Information System
GRE – Great Rivers Ecosystems
KAR – Kentucky Administrative Regulations
KDWM – Kentucky Division of Waste Management
KDOW – Kentucky Division of Water
KPDES – Kentucky Pollutant Discharge Elimination System
MGD – million gallons per day
NHD – National Hydrography Dataset
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resource Conservation Service
NWI – National Wetlands Inventory
ORM – Ohio River Miles
OHW – Ordinary High Water
OSRW – Outstanding State Resource Waters
PCB – polychlorinated biphenyl
PFO – Palustrine Forested Wetland
PSS – Palustrine Scrub Shrub Wetland
RCP – reinforced concrete pipe
RCRA – Resource Conservation and Recovery Act
SHF – Shawnee Fossil Plant
SWPPP – Storm Water Pollution Prevention Plan
SGLP– synthetic groundwater leaching procedure
TCDD - tetrachlorodibenzodioxin
TVA – Tennessee Valley Authority
TCLP – toxicity characteristic leaching procedure
USACE – US Army Corps of Engineers
USFWS – US Fish and Wildlife Service
USGS – US Geological Survey

Background
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1.0 BACKGROUND

1.1 PURPOSE

On April 17, 2015, EPA published the "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities" final rule in the Federal Register. The Tennessee Valley Authority (TVA) contracted Stantec Consulting Services Inc. (Stantec) to evaluate Ash Pond 2 at the Shawnee Fossil Plant (SHF) regarding the requirements for the Wetlands Location Restriction as required by the EPA Final CCR Rule, 40 C.F.R. §257.61.

1.2 OUTLINE OF RULE REQUIREMENTS

Section 257.61(a) of the EPA Final CCR Rule states that new landfills, existing and new surface impoundments, and lateral expansions of CCR units must not be located in wetlands unless the owner/operator can demonstrate that the CCR unit meets the requirements of § 257.61(a)(1) through (a)(5). For the purpose of this report, the existing CCR surface impoundment being assessed at SHF is referred to as the "CCR Unit" or "Ash Pond 2". The wetlands location restriction does not apply to existing CCR landfills.

Wetlands are defined under Section 404 of the Clean Water Act (CWA) as:

> *Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that 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.*

For purposes of existing CCR surface impoundments, the most reasonable interpretation of "located in wetlands" means adjacent to wetlands.

- *Adjacent wetlands include those that could be inundated by a breach of the CCR Unit.*
- *The definition of a wetland in 40 C.F.R. §232.2 includes both jurisdictional and non-jurisdictional wetlands.*

If the CCR Unit contributes to significant degradation of wetlands the facility can comply with the location criterion by compensatory steps that must be taken to achieve no net loss of wetlands. The demonstration should evaluate and address the following items to determine impacts for existing impoundments:

i. Applicable Water Quality Standards

ii. Clean Water Act

iii. Endangered Species Act

iv. Marine Protection Act

v. Erosion, Stability, and Migration Potential

vi. CCR Volume and Chemical Nature

vii. Wildlife Impacts

viii. Potential Effects from Catastrophic Release

ix. Additional factors, as necessary

1.3 SITE DESCRIPTION

SHF is located in Paducah, McCracken County, Kentucky. The facility lies on the south bank of the Ohio River at Ohio River Mile (ORM) 946. Figure 1 shows an overview map of SHF including its facilities and CCR disposal areas. SHF was constructed between 1951 and 1957 and began operations in the 1960s. The coal combustion process at SHF results in the production of by-products that include fly ash and bottom ash. The plant currently manages these CCRs in the Special Waste Landfill (in accordance with Kentucky Department of Waste Management (KDWM) Special Waste Landfill Permit No. 073-00041 and Ash Pond 2 (in accordance with Kentucky Division of Water (KDOW) Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0004219.

Ash Pond 2 is the only active CCR disposal impoundment at SHF and is referred to as the "CCR Unit". The current area of Ash Pond 2 is approximately 100 acres inside of the perimeter dikes with a dike height of about 25 feet (Stantec 2015b). Ash Pond 2 receives sluiced bottom ash (newly generated coal combustion residuals), plant effluent, and stormwater runoff. Ash Pond 2 discharges from Outfall 001 in the northwest corner of the pond through spillway structures to the Discharge Channel, and ultimately the Ohio River. About 25.75 million gallons per day (MGD) average are discharged from the Ash Pond 2 through Outfall 001. Estimated CCR storage as of 2009 was 4,712,407 cubic yards (Stantec 2009).

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Figure 1. Site Overview

1.4 DATA SOURCES

This section summarizes available data used to assess conditions at the site of the CCR Unit and determine the likelihood of the CCR Unit being located adjacent to a wetland. TVA has provided wetland delineations. Maps showing the available spatial data for the site inundation area are included in Appendix A.

1.4.1 Issued Permits

The CCR disposal facilities at SHF are currently operated under KPDES Permit KY0004219 and KDWM Special Waste Permit No. 073-00041. A summary of the identified permits is included in Table 1.

Table 1. Summary of Identified Permits

Permit Type and Issuing Agency	Permit Number	Date Issued	Unit(s) or Actions Permitted
KDWM Special Waste Permit	073-00041	6/20/2014	Operation of CCR dry stack and landfill facilities
KDOW KPDES	KY0004219	5/26/2018	Allows several industrial discharges from SHF, including the Ash Pond 2 discharge

1.4.2 TVA Documentation

In the development of this document, Stantec reviewed reports, data, tables, plans, maps, etc. that have been provided by TVA or prepared by Stantec regarding the Shawnee Facility, and especially pertaining to Ash Pond 2. Relevant resources are cited within the document and summarized in Appendix B.

1.4.3 Publicly Available Data

Data available to the public was collected and reviewed for information pertaining to site conditions at the SHF facility. Available data included the following:

- Kentucky Pollutant Discharge Elimination System (KDPES) Permit No. KY0004219 authorizes the discharge and effluent limitations for Outfall 001 (from the CCR Unit) for three different periods; before, during, and after the dewatering of the CCR Unit.

- National Wetlands Inventory (NWI) maps produced by the United States Fish and Wildlife Service (USFWS 2015a) were created in this area using photointerpretation of imagery from 1983. Spatial data showing the location and extent of mapped wetlands was reviewed for the area surrounding the SHF plant.

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- Ohio River Navigation Charts from the US Army Corps of Engineers (USACE 2014) show the ordinary high water (OHW) mark and pool elevations for the project site. Near ORM 950, the OHW elevation is 308.0 ft. The pool elevation is 290.0 ft.

- United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS 2018) soil survey data provides information on hydric soils adjacent to the CCR Unit.

- Federal Emergency Management Agency (FEMA 2011) floodplain information was reviewed to determine the annual percentage chance flood area in which the CCR Unit and surrounding areas fall.

- Historic US Geological Survey (USGS) Topographic Quadrangles were reviewed for surface water features and relevant structures (1983a, 1983b, 2016).

- Historic Topographic Maps from the SHF facility and surrounding areas (USGS 1932, 1949, 1954, 1961, 1967, 1982, 1984, 1987, 2012) were reviewed and provide supporting information for wetland conclusions.

- Historic Aerial Maps (provided by TVA) from 1965, 1975, 1998, and 2012 were reviewed and provide supporting information for wetland conclusions.

- The EPA's Enforcement and Compliance History Online (USEPA 2018) database was consulted to provide background information regarding water quality discharge compliance with issued NPDES/KPDES permits.

- KDOW Section 305(b), 303(d) CWA) Report (KDOW 2018) provides an assessment of water quality of surface waters in the State. Waters receiving discharge from the SHF have several impairments based on this report.

- USFWS's website (Information for Planning and Conservation (IPAC) data and county lists) was accessed to determine federally threatened and endangered species that may be impacted by the CCR Unit (USFWS 2015b). The lists provided by this information are not considered "official". Additional coordination with USFWS, outside the scope of this document, would be required to obtain official lists of species that may be impacted by the CCR Unit.

2.0 ASSESSMENT OF SITE WETLANDS

Areas on and adjacent to SHF were first assessed for the presence of wetlands by desktop review, using aerial photography, USFWS National Wetland Inventory (USFWS 2015a), publicly available geospatial data (USDA-NRCS 2017), and FEMA floodplain data (2011). Confirmation of remote findings was conducted during onsite reconnaissance.

The 1987 USACE Delineation Manual defines wetlands as areas with the following general environmental characteristics: 1. Hydric soils; 2. Wetland Hydrology; and 3. Hydrophytic Vegetation.

Initially, Stantec reviewed available data for the presence or absence of wetlands adjacent to Ash Pond 2. No information was discovered during the review to suggest that wetlands have been delineated within the area adjacent to the CCR Unit. In the absence of on-site delineations, the desktop analysis used other historic and current data to determine the potential for wetlands. After desktop analysis, a site reconnaissance was conducted to help determine if wetland indicators were in fact located within the study area as suggested by the desktop analysis. The data review and subsequent site reconnaissance indicated the likely presence of wetlands adjacent to Ash Pond 2. The evidence supporting the presence and estimated extent of wetlands is outlined in the following sections.

2.1 LOCATION AND CONDITION OF WETLANDS

2.1.1 Desktop Assessment

For a preliminary assessment of existing wetlands that could potentially be inundated by a breach of Ash Pond 2, the potential breach inundation area associated with Ash Pond 2 was investigated. These wetlands were identified through review of National Wetlands Inventory (NWI) data and the presence of wetland indicators were confirmed through site reconnaissance. The wetlands described do not include obvious non-wetland waterbodies identified in NWI data such as the ash impoundment itself, other engineered impoundments on site, or the impounded Ohio River (variously identified as *Lake* or *Freshwater Pond).*

The NWI identified five probable wetlands located adjacent to the CCR Unit and within the potential breach inundation area, totaling 163.98 acres. These are mostly described as *Freshwater Forested/Shrub Wetland* type wetlands, with some, along the west-southwest boundary of the CCR Unit, clearly open water, and designated as *Freshwater Pond*. Additional methods used to identify potential wetlands adjacent the CCR Unit, as well as greater detail on the NWI-identified wetlands, are discussed below.

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A review of current aerial photography clearly shows an existing oxbow wetland immediately west of Ash Pond 2. A review of publicly available geospatial data provides supporting data for this wetland identification. The soils in this oxbow were identified from the NRCS soil survey (USDA-NRCS 2017) as *Melvin silty clay loam, ponded* which is considered hydric. NRCS soil survey data is more descriptive for areas outside of the CCR pond and disposal area. Within the potential breach extents for Ash Pond 2, 38.1% of the soils are classified as hydric or partially hydric. Other areas within the potential breach boundary are described as *Water, Miscellaneous Water, or Dumps, Coal, and Waste disposal areas.* Thus, undisturbed soils within the breach extents of the pond are potentially hydric. While this alone does not indicate the presence of wetlands, it does indicate that the hydrology for development of wetlands may exist in areas surrounding the active ash pond. FEMA floodplain information (2011) indicates that the facility is leveed such that it is excluded from the 1% annual chance floodplain. Ash Pond 2 is included in the 0.2% annual chance floodplain. Areas immediately adjacent to the Ohio River and Little Bayou Creek outside of the facility levees are included in the 1% annual chance floodplain which indicates that hydrology may be sufficient to support wetlands.

NWI wetlands and areas adjacent to Ash Pond 2 were examined to determine the proximity of potential wetlands to the current CCR Unit. The area containing Ash Pond 2 is shown as a "Lake" on the NWI map. Ash Pond 2 abuts the relocated Little Bayou Creek, which is immediately adjacent to an area identified in the USFWS National Wetland Inventory (USFWS 2015a) as *Freshwater Forested/Shrub Wetland*. See Figure 2 below for mapped NWI wetlands within the Potential Inundation Area as defined by the breach analysis (Appendix A).

Total NWI identified wetlands within the potential breach inundation area encompassed 163.98 acres, roughly 50% of the potential inundation area. Hydric soils were identified using the Soil Survey Geographic Database (SSURGO) and encompassed 124.84 acres, roughly 38% of the inundation area (USDA-NRCS 2016).

Likely wetlands within potential inundation area as defined within the TVA Shawnee Fossil Plant Ash Pond 2 Breach Analysis for Wetland Determination (Stantec 2017c) are shown in Figure 2 below and are described in the following bulleted list.

- Wetland A: Wetland A is located immediately west-southwest of the existing Ash Pond 2. It was identified from inundation visible in current aerial photography, wetland hatching on the 1982 USGS topographic map, and from the current NWI data. It is a conglomerate of seven individual, but contiguous wetland boundaries identified from NWI data and is described in the dataset as *Freshwater Forested/Shrub Wetland* and *Freshwater Pond*. It appears to be a mosaic of open water, forested, shrub/scrub, and emergent wetlands. This area covers 62.26 acres.

- Wetland B: Wetland B is located northwest of Ash Pond 2, and includes areas surrounding Little Bayou Creek, and Bayou Creek. This wetland also wraps north around Ash Pond 2 for the extent of the area between the CCR Unit and the Ohio River. It is a conglomerate of five (5) individual but contiguous wetland boundaries identified from NWI data described as entirely *Freshwater Forested/Shrub Wetland*. This wetland was identified through NWI data, and wetland indicators were found on-site during field reconnaissance by Stantec staff. Landscape position (upstream and at the convergence of two streams in the Ohio River floodplain) also indicates the likelihood of a wetland. This likely-contiguous NWI wetland, within the potential inundation area, is mapped as 98.88 acres.

- Wetland C: Similar to Wetland B, but much smaller in size, Wetland C was identified from NWI data just northeast of Ash Pond 2 and bordered by the Ohio River, the Ash Pond Discharge Channel, and the main plant discharge channel. Wetland C consists of 0.66 acre of *Freshwater Forested/Shrub Wetland* within the potential breach inundation area.

- Wetland D: Wetland D was identified from NWI data and is also within the floodplain of the Ohio River. It falls between the main plant discharge channel and the main plant intake channel, just west of the intake channel dredge cell. It is identified as *Freshwater Forested/Shrub Wetland* in the NWI. Wetland indicators were noted during the field reconnaissance at this location. It is mapped at 0.60 acre within the potential breach inundation area.

- Wetland E: Wetland E was identified from NWI data and it encompasses a small area upstream of the plant (south) approximately a mile upstream on Little Bayou Creek from the confluence of Bayou and Little Bayou. It is identified as *Freshwater Forested/Shrub Wetland* in the NWI. It is mapped at 1.59 acres within the potential breach inundation area.

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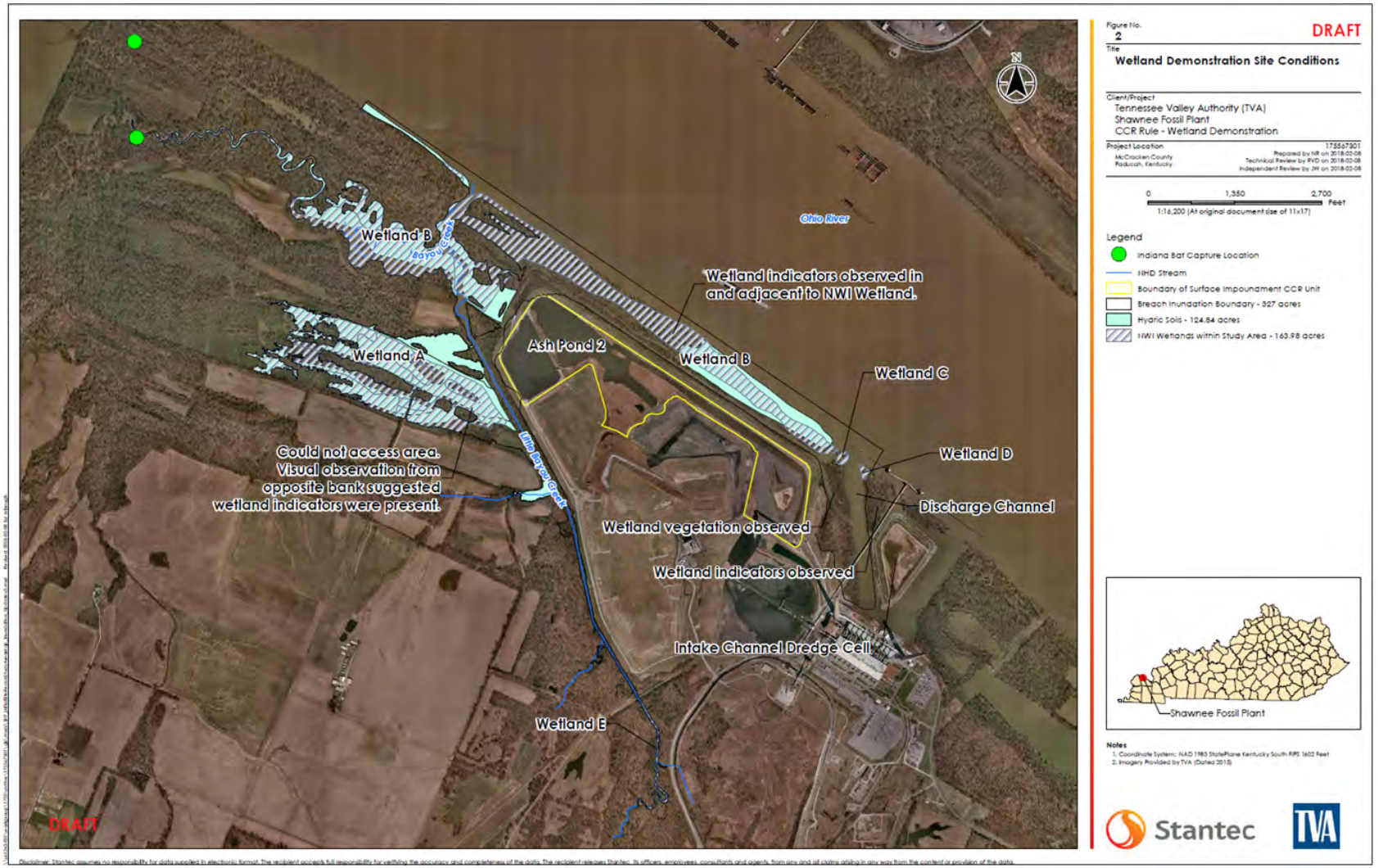

Figure 2. CCR Wetlands Demonstration Desktop Assessment

2.1.2 Field Reconnaissance

A preliminary site assessment of the potential wetlands in a quarter mile buffer surrounding the CCR Unit was conducted by Stantec staff on July 12-13, 2017, to identify if indicators of wetlands are present adjacent to the CCR Unit. This investigation did not include a formal wetland delineation.

According to the field reconnaissance summary memo (Stantec 2017b), saturated conditions were encountered at some locations within the study area. Buttressed trees were also observed, which indicates that they have grown under inundated conditions; however, this is not officially recognized as a wetland hydrology indicator under the applicable regional supplement. Mussel shells and cracked soil were also observed in some locations.

Several soil samples were taken within the study area to view the upper six inches of the soil. Additional depth would need to be analyzed to adequately classify the soil. Observed loamy soils within the study area consisted of dark low chroma matrix. Some of these areas would likely constitute hydric soils; however, others require additional study to determine if they would be classified as hydric.

The National Wetland Plant List published by the USACE in partnership with other federal agencies classifies vegetation species based on how likely each plant is to be found in a wetland environment within a particular region. The classification system ranges from upland (UPL) to obligate (OBL- wetland) with three facultative categories in between ranging from facultative upland (FACU) to facultative (FAC) to facultative wetland (FACW).

Much of the area near the Ohio River was characteristic of mixed hardwood floodplain forest habitat with little to no herbaceous ground cover. Dominant tree species within the study area included black willow (*Salix nigra* - OBL), silver maple (*Acer saccharinum* - FAC), eastern cottonwood (*Populus deltoides* - FAC), green ash (*Fraxinus pennsylvanica* - FACW), sycamore (*Platanus occidentalis* - FACW), and hickory species. Where herbaceous vegetation was observed, species included giant cane (*Arundinaria gigantea* - FACW) and stinging nettle (*Urtica dioica* - FAC). Common reed (*Phragmites australis* - FACW) was observed adjacent to the Discharge Channel near the access road crossing of the Discharge Channel. For the most part, vegetation trended toward being collectively hydrophytic, but depending on area observed, this forest community could represent a borderline remnant wetland condition. Further investigation is warranted to determine presence and extent of current wetlands.

A formal wetland delineation in accordance with USACE and TVA protocols would be needed to verify wetlands on the property. The field reconnaissance confirmed that wetlands likely exist in areas that would be impacted by a breach/failure of the CCR Unit. Thus, the requirements of § 257.61(a)(1) through (a)(5) of the EPA Final CCR Rule must be addressed.

3.0 IMPACTS

The following sections summarize the requirements of the EPA Final CCR Rule regarding the wetlands demonstration for Ash Pond 2 at SHF. As part of the wetland location restriction, the operator must show that the operation of the CCR Unit does not violate applicable laws or standards, as well as ensure that the unit does not cause or contribute to significant wetland degradation. A qualified, independent professional engineer must be able to verify these location restrictions. To evaluate potential impacts of the CCR Unit on wetlands, each of the following subsections was considered for the identified wetlands.

3.1 §257.61(a)(1) LOCATION ALTERNATIVES

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in § 232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section. (1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.

The EPA Final CCR Rule states that the party must make "clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands".

The criterion is not applicable under Section 404 because the CCR Unit was built before Section 404 of the Clean Water Act was promulgated, and before the regulations for jurisdictional wetlands were promulgated in 1972. Additionally, the surface impoundment itself is not a wetland because surface impoundments are wastewater treatment systems and are exempted as such from the definition of a jurisdictional wetland.

3.2 §257.61(a)(2)(i&ii) APPLICABLE WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

(2) The construction and operation of the CCR unit will not cause or contribute to any of the following: (i) A violation of any applicable state or federal water quality standard; (ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act.

The EPA Final CCR Rule states that the operation of the CCR unit must not violate any applicable state or federal water quality standard. The issued permits for the pond discharge require regular discharge monitoring reports (DMRs). As part of this analysis, a subset of the DMRs was reviewed for compliance with the issued NPDES permit, and it was determined that discharges from Outfall 001are currently within the acceptable limits of the permit.

3.2.1 Kentucky Administrative Regulations (KAR)

Surface water quality in the State of Kentucky is regulated, in part, by 401 KAR 10:031. These standards set the surface water quality criterion and list the maximum allowable concentrations for specific pollutants. These regulations will supersede the federal standards where more stringent. Kentucky also has an antidegradation policy (401 KAR 10.030) for surface waters of notable quality (i.e., categorized as an outstanding national resource water (ONRW), exceptional water). At SHF, water from the CCR Unit is discharged to the Ash Pond 2 discharge channel which flows up-gradient and parallel to the northeastern dike before discharging into the Ohio River, which does not qualify as one of these waters. The Ohio River is not designated an ONRW at the point which Outfall 001 discharges; however, it holds this designation approximately 3.4 miles downstream of Outfall 001, due to supporting federally listed threatened or endangered aquatic species. State regulations are incorporated as conditions of the issued NPDES/KPDES permit for the facility.

Historically, the issued Kentucky Division of Waste Management permit for the landfill requires groundwater monitoring in accordance with 401 KAR 45:160 with site specific monitoring limits set for pollutants of concern as part of the issued permit. In addition, the CCR Rule requires stringent monitoring of groundwater to determine if wells around the CCR Unit have significantly elevated concentrations of several parameters, as compared with background concentrations.

3.2.2 Clean Water Act

Section 307 of the Clean Water Act, entitled Toxic and Pretreatment Effluent Standards, states that toxic pollutants named by the EPA (126 pollutants total) shall be subject to effluent limitations based on the application of best available technology for point sources. Other federal laws may be applicable to maintaining water quality standards. These include Sections 401, 402, and 404 of the CWA. In addition, the operation of the CCR unit must not violate applicable toxic effluent standard or prohibition under Section 307 of the CWA (U.S. Congress 1972b).

Based on Kentucky's 2016 CWA Section 305(b) report (KDOW 2016), the adjacent Little Bayou Creek is impaired for polychlorinated biphenyl (PCB) in fish tissue, beta particles and photon emitters, copper, gross alpha, and lead. Suspected sources of impairments to the watershed include inappropriate waste disposal and industrial point source

discharge. The Ohio River from ORM 317.1-981.0 is impaired for Clordane and the entire reach of the Ohio River in Kentucky is impaired for dioxin (including 2, 3, 7, 8-TCDD), and PCB in water column. Sources are unknown. The Ohio River watershed is extremely large. At the SHF facility (ORM 946), the waterbody is categorized as impaired both upstream and downstream of the SHF discharges (KDOW 2016).

Designated uses of the Ohio River at the discharge of Outfall 001 are warm water habitat, fish consumption, primary contact recreation, secondary contact recreation, and domestic water supply. The previously mentioned contamination by PCB and dioxin, originating from unknown sources, impair the designation for fish consumption, but all other designated uses are maintained.

One current NPDES/KPDES discharge permit issued in accordance with Section 402 of the CWA has been identified as being associated with SHF (KY0004219). This permit approves several process water and stormwater discharges, including the discharge from Ash Pond 2/Outfall 001 (Stantec 2010b). The section 307 toxic pollutant list is often used as a basis for developing permitted discharge standards for NPDES permits.

The EPA's Enforcement and Compliance History Online Database (USEPA 2018) was reviewed. Additionally, Stantec reviewed a subset of DMR data from the past decade. Based on this review, DMR data was within the permitted limits of their current KPDES issued permit.

Because available information indicates that SHF CCR Unit Outfall 001 is compliant with the current KPDES permitted standards allowed for the facility, applicable water quality standards are being met.

A KPDES Permit No. KY0004219 and corresponding Fact Sheet, released May 2018, authorizes the discharge and effluent limitations for Outfall 001 (from the CCR Unit) for three different periods; before, during, and after the dewatering of the CCR Unit.

The permit authorizes the discharge of leachate from Outfall 001. It also outlines an action plan to address inspections and maintenance of current impoundments to minimize leachate, as well as corrective measures for any future discovery of leachate which is associated with an outfall not currently permitted for discharge of leachate (an outfall other than 001) (KDOW 2018).

If new surface seep/leachate areas are discovered, KDOW is to be notified within 10 days of the discovery and presented with a plan of corrective measures. Examples of potential approved corrective/mitigative measures are:

(1) plans to reduce or eliminate the leachate seep to the surface;

> *(2) actions to route the surface leachate seep (via a conveyance designed to contain the flow or eliminate the possibility of infiltration) to an outfall permitted to discharge leachate; and*
>
> *(3) combinations of actions to eliminate or, if elimination is not feasible, reduce and control a surface leachate seep and ensure any discharge to a receiving stream is authorized by the permit (KDOW 2018).*

A Seep Action Plan has been developed for SHF, detailing the above measures that will be taken in the event of a new seep discovery (Stantec 2018).

Whole Effluent Toxicity (WET) biomonitoring tests have been performed with fathead minnows and daphnia (*P. promelas* and *C. dubia*) in accordance with SHF NPDES permit requirements for outflow from Outfall 001 since 1997. No violations of WET standards for Outfall 001 were found during a review of SHF documentation (2018).

Historic surface water samples from Little Bayou Creek during 1978 and 1988 indicated increased pH, temperature, DO, TDS, alkalinity downstream of SHF compared with upstream sample sites. These increases were attributed to seepage from the CCR Unit to Little Bayou Creek (TVA 2005). Comparable information concerning these elevated concentrations was not found in recent TVA or publicly available documentation. The February 2010 wastewater flow schematic for KPDES Permit Number KY0004219 permit renewal printed in the Shawnee Fossil Plant Units 1 and 4 Final Environmental Assessment indicated that approximately 0.017 MGD was being lost from the ash pond due to permitted seepage (TVA 2014).

Leachate from SHF into Little Bayou Creek has been monitored on site for over 30 years. While past reports have indicated release of ammoniated leachate via groundwater into Little Bayou Creek, ammonia is not listed as a 307 CWA toxic pollutant and chronic criterion concentration (CCC) limits for ammonia, as specified in KPDES Permit Number KY0004219 permit, are not exceeded by input from SHF. Per the KPDES Permit, intake water to the plant and Outfall 001 effluent for total ammonia (as N) is monitored monthly. No known state or federal water quality standards are violated as a result of ongoing monitoring and maintenance to the CCR Unit structures.

The use of groundwater for any purpose is prohibited surrounding SHF and the Paducah Gaseous Diffusion Plant, located upstream/upgradient of SHF. SHF is currently following reporting and action procedures for groundwater monitoring, as outlined in the CCR Rule. Data and results of this sampling will be addressed in separate reports as required by the CCR Rule.

Seepage along the northeast dike has been identified and addressed (Stantec 2009). Based on the 2015 Inspection Report (Stantec 2015a), "Improvements have been constructed to bring Ash Pond 2 into compliance with accepted slope stability, seepage, and hydrologic/hydraulic design criteria.

These projects included Ash Pond 2 Southeast Dike Seepage Improvements Project and Ash Disposal Area No. 2 Spillway Replacement Project."

No known federal or state water quality standards are being violated as a result of construction and operation of the CCR Unit.

3.3 §257.61(a)(2)(iii) ENDANGERED SPECIES ACT

(2) The construction and operation of the CCR unit will not cause or contribute to any of the following: (iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973

The operation of the CCR unit must not jeopardize the continued existence of endangered or threatened species or critical habitats, as protected under the Endangered Species Act of 1973. The following species are identified by USFWS as threatened or endangered and have potential to occur in McCracken County, Kentucky.

- Bald Eagle (*Haliaeetus leucocephalus*) – while not currently listed as threatened or endangered, the Bald Eagle is protected under the Bald and Golden Eagle Protection Act. No designated critical habitat is located in the vicinity of the CCR unit.
- Least Tern (*Sterna antillarum*) – Endangered
- Orangefoot Pimpleback (*Plethobasus cooperianus*) – Endangered
- Fat Pocketbook (*Potamilus capax*) – Endangered
- Clubshell (*Pleurobema clava*) – Endangered
- Fanshell (*Cyprogenia stegaria*) – Endangered
- Northern Riffleshell (*Epioblasma torulosa rangiana*) – Endangered – Extirpated
- Purple Cat's Paw (*Epioblasma. o. obliquata*) – Endangered - Extirpated
- Ring Pink (*Obovaria retusa*) – Endangered
- Rough Pigtoe (*Pleurobema plenum*) - Endangered
- Sheepnose (*Plethobasus cyphyus*) – Endangered
- Spectaclecase (*Cumberlandia monodonta*) – Endangered
- Pink Mucket (*Lampsilis abrupta*) - Endangered

- Rabbitsfoot (*Quadrula c. cylindrica*) – Threatened: not known to occur within McCracken County, Kentucky, however, USFWS designated Critical Habitat occurs within the Ohio River adjacent to SHF.
- Indiana Bat (*Myotis sodalis*) – Endangered: two records from West Kentucky State Wildlife Management Area immediately to the west of SHF.
- Northern Long-Eared Bat (*Myotis septentrionalis*) – Threatened
- Gray Bat – (*Myotis grisescens*) – Endangered

According to the Shawnee Fossil Plant's Coal Combustion Residual Management Environmental Impact Statement (TVA 2017b), "The least tern utilizes shoreline habitat of the Ohio River in summer, and it potentially could nest on areas of exposed gravel in Ash Impoundment 2. The two small ponds in the area of disturbance for the proposed CCR Landfill are unlikely to provide suitable foraging habitat. No use of these habitats at SHF by this species has been reported, and no terns were observed during site surveys."

Indiana bat and northern long-eared bat habitat occurs within the inundation area of the CCR Unit and was documented by TVA in a letter concerning vegetation removal to USFWS dated October 26, 2011. The inundation area west and north of the CCR Unit is described as "A seasonally flooded, mature bottomland hardwood, characterized by a heavy canopy cover, an open midstory and understory. The site is ideal for woodland species of bats. Many trees within the stand are substantial in size (>49 in. dbh) and have physical characteristics (substantial cavities, crevices) used by bats." Additionally, two records of Indiana bats occur to the west of SHF, one of which may be within the inundation area for a catastrophic release of CCR. Bat records are shown in Figure 2 and were georeferenced based on a map included in the 2011 letter.

The area owned by TVA immediately to the southwest of the CCR Unit, along Little Bayou Creek is described as, "An alluvial forested site dominated by a mixture of bottomland hardwood and upland species, characterized by a variable canopy cover, damaged by storms. Trees varied in size, with several specimens >50 in. dbh." (TVA 2011).

An assessment of endangered bat critical habitat was completed as part of the KDWM solid waste permit application for the special waste landfill horizontal expansion (FMSM 2007). The assessment indicated that, "No caves used by the Indiana bat occur in the county, but mature forest exists approximately one mile from the current settling ponds, and foraging habitat exists over the adjacent Ohio River, as well as the current settling ponds. There are no records of caves or other unique or important terrestrial habitats within three miles of the proposed project area."

Although unlikely due to adequate slope stability factors of safety, aquatic species existing within the Ohio River, including freshwater mussels, may be impacted by a catastrophic release of CCR. Kentucky Water Quality Standards (401 KAR 10:031 Section 4) seek to protect aquatic life in warm water aquatic habitats. Parameters and associated criteria are set for the protection of productive warm water aquatic communities, fowl, animal wildlife, arboreous growth, agricultural, and industrial uses. The SHF KPDES permit follows these parameters, with certain exceptions as granted by law, under the discharge permit.

The portion of the Ohio River between Olmstead, Illinois and Paducah, Kentucky, which includes the area adjacent to SHF, is currently designated as critical habitat for the rabbitsfoot mussel. The TVA document "Certification of Shawnee Fossil Plant CCR Unit Operation Compliance with the Endangered Species Act" (Appendix C) describes the constituent elements for the rabbitsfoot critical habitat and concludes, "Suitable habitat for federally listed aquatic species does not occur within the SHF CCR area."

Third Rock Consultants completed a mussel survey for TVA in 2014, examining the Ohio River in transects upstream, downstream, and at the site of the SHF outfalls as well as within 27 barge mooring cells adjacent to SHF. No live federally listed species were observed; however, remnants of two federally endangered fat pocketbook were collected during the survey. Nineteen mussel species were recorded during the survey.

TVA Environmental Compliance and Operations has determined that the current operation of the SHF CCR Unit would have no direct, indirect or cumulative effects on federally listed species, and therefore is not likely to jeopardize the existence of listed species or result in the destruction or adverse modification of designated critical habitat (Appendix C).

3.4 §257.61(A)(2)(iv) MARINE PROTECTION ACT

(2) The construction and operation of the CCR unit will not cause or contribute to any of the following: (iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

The Marine Protection, Research, and Sanctuaries Act of 1972 (U.S. Congress 1988) does not apply to any TVA sites, does not apply to federal facilities and also does not apply to TVA existing surface impoundments because the CCR Unit is not classified as "marine" as per 15 C.F.R. § 922.3.

3.5 §257.61(a)(3)(i&ii) EROSION, STABILITY, AND MIGRATION POTENTIAL

3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors: (i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit; (ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;

TVA monitors for potential erosion and stability issues, pursuant to 40 CFR 257.83, and addresses them when/if identified. Inspection requirements of 40 CFR 257.83 are as follows:

- Weekly visual inspections must be performed to identify any potential structural issues that could negatively affect the function or safety of the CCR Unit.
- Weekly inspections of all hydraulic discharges are also required weekly, observing for any indication of abnormal coloration of discharge, as well as any debris or sediment in discharge.
- Monthly inspections are required of all CCR Unit instrumentation.

Seepage along the northeast dike has been previously identified and addressed (Stantec 2009). Based on the 2015 Inspection Report (Stantec 2015a), "Improvements have been constructed to bring Ash Pond 2 into compliance with accepted slope stability, seepage, and hydrologic/hydraulic design criteria. These projects included Ash Pond 2 Southeast Dike Seepage Improvements Project and Ash Disposal Area No. 2 Spillway Replacement Project".

After reviewing the FY2017 annual inspection, conducted during December 2016, no known critical deficiencies or potential structural weaknesses currently exist around Ash Pond 2. The following are current site conditions of the CCR Unit noted in the annual inspection report.

- A good stand of grass is generally maintained on the slopes of the perimeter dikes and slopes of all the facilities.
- Adequate freeboard was observed at Ash Pond 2 (Main Ash Pond/Stilling Pond).
- No instabilities were observed in the dike or stack slopes.

- Various maintenance activities at the facilities have been performed since the previous annual inspection, including repairing erosion features and maintaining vegetation.
- No evidence of sinkholes or depressions was observed.
- Outlet structures and drainage pipes were generally in good condition.
- No evidence of unsafe or unreliable operations was observed.
- Erosion previously noted in the access road and discharge channel near the southeast corner of Ash Pond 2 was repaired (2015 Formal Inspection Item No. 1 and 2016 Intermediate Inspection Item No. 1 [Maximo Work Order 117862576]).

"Areas of Interest" documented in this report include:

- The wet area of interest previously noted on the drainage channel bank near the access road crossing at the southeast corner of Ash Pond 2 was observed during this inspection (2015 Formal Inspection Item No. 3). It is recommended to continue to monitor the area.

Based on the FY2017 Intermediate Inspection report, no critical concerns were noted, and areas of interest will be monitored and addressed as needed, including the repair of two (of 34) malfunctioning piezometers.

TVA will continue to monitor the perimeter dikes of the CCR Unit as part of the operations and maintenance plan to proactively address future erosion and stability issues that may occur. With rigorous stability inspections and maintenance, it is unlikely that wetlands are being impacted because of erosion and soil migration. It is unlikely that the CCR Unit is contributing to significant degradation of wetlands due to erosion, instability, or migration of soils, muds, or deposits from or used to support the CCR Unit.

3.6 §257.61(a)(3)(iii) CCR VOLUME AND CHEMICAL NATURE

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors: (iii) The volume and chemical nature of the CCR

Ecological resources in wetlands must be sufficiently protected, including consideration of the volume and chemistry of the CCR managed in the unit.

According to the 2015 Formal Inspection of CCR Facilities and Ponds (Stantec 2015), Ash Pond 2 currently impounds 492,000 cubic yards of water with 944,000 cubic yards of storage remaining. Ash Pond 2 receives approximately 40,000 tons of wet-sluiced bottom ash a year. Approximately 25.8 MGD of water are discharged into the Ash Pond 2 discharge channel. During the 2010 Stantec Geotechnical Exploration of SHF, ash was

typically encountered below 340 feet elevation and extended to an average depth of approximately 15 feet below the upper dike. Classification testing performed on selected fly ash samples resulted in a USCS classification of ML with a textural description of silt with sand. The ash materials are black in color and moist to wet in moisture content. The borings typically encountered sluiced bottom ash overlying sluiced fly ash.

In 2013 and 2016, TVA collected analytical data for SHF CCR. Samples were analyzed for physical and inorganic constituents using a variety of methods.

The volume and chemical nature of CCR is not likely to cause or contribute to significant degradation of wetlands because no evidence of the CCR Unit discharging directly to a wetland at any point was found in the available information, nor were discharges observed during the field reconnaissance.

3.7 §257.61(A)(3)(IV) FISH AND WILDLIFE IMPACTS

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors: (iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR

According to §257.61(a)(3)(iv), the design and operation of the CCR unit must not cause or contribute to significant degradation of wetlands by addressing impacts on fish, wildlife, and other aquatic resources and their habitat from routine release of CCR.

The Electric Power Research Institute (EPRI) conducted biomonitoring of fishes at Ohio River fossil plants via the Ohio River Ecological Research Program (2017). Monitoring results from the 2015 sampling season show fish populations in the Ohio River upstream and downstream of the SHF plant. Two Kentucky State Listed species were found during their sampling events, a black buffalo (1) and Mississippi silverside (437). A total of 57 species and 3 hybrids were caught during the 2015 year.

The Ohio River Valley Water Sanitation Commission (ORSANCO) also surveyed the River adjacent to SHF for water quality and fish community assemblages (2014). Biological survey results for Olmsted pool, 2014 show a "good rating" for sample sites around SHF and also documented black buffalo occurring in the pool along with 46 fish species total.

Water released from Outfall 001 of the CCR Unit meets the required KPDES permitted discharge limits. Should a catastrophic release of CCR occur, the plant also maintains emergency response procedures that would be implemented. The emergency response to a release would limit and minimize the amount and duration of an unauthorized discharge to waterbodies as much as possible, thus minimizing the impact to aquatic habitat and organisms.

Although past studies have indicated potential seeps into Little Bayou Creek, (TVA 2005), no data reviewed from more recent monitoring indicates this is still the case, and numerous improvements have been made to dike structures to bring the Unit into compliance with acceptable design criteria (Stantec 2015a). EPA aquatic life ambient water quality criteria (CCC) for ammonia is not exceeded, therefore freshwater ecosystems are not being significantly impacted by ammonia input.

In general, the routine stability inspections and maintenance of the CCR Unit are intended to minimize the likelihood of an accidental release, thereby minimizing risk to wildlife and aquatic habitats. No direct discharges of CCR to wetlands have been discovered; therefore, it is unlikely that the CCR Unit is impacting fish, wildlife, or other aquatic resources as a result of routine CCR releases.

3.8 §257.61(a)(3)(v) POTENTIAL EFFECTS FROM A CATASTROPHIC RELEASE (ENVIRONMENTAL IMPACTS)

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors: (v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment

The CCR Rule requires that the CCR Unit will not cause or contribute to significant degradation of wetlands and the environment due to the potential effects from a catastrophic release of CCR. A breach analysis to determine the extents of a catastrophic release was conducted. In the unlikely but hypothetical event of a failure, the potential inundation area identified in the Breach Analysis (Appendix A) and wetlands therein could be flooded in water and CCR material. Additionally, CCR material could be carried downstream in the Ohio River. Trees and other vegetation as well as any existing wildlife in the area inundated by the breach would be impacted. Approximately, 164 acres of NWI wetlands are located within the 327-acre potential breach inundation zone.

While there are potential wetlands within the footprint of the breach extents that would likely be affected by a catastrophic release, there is little to no risk of a catastrophic failure. Thus, the threat to wetlands from such a release is minimal. The likelihood of a release is minimal for the following reasons.

The SHF inflow design flood control system plan was analyzed by Stantec for TVA (2016b) and found to adequately manage flow into and from the CCR Unit during the 1,000-year inflow design flood, with a water surface elevation of 348.8 feet; the lowest embankment elevation being 351.1 feet. The plan and results show that the impoundment meets the requirements set forth in 40 CFR 257.82(a) and (b).

Stantec conducted a structural stability assessment based on the sudden drawdown for the Ash Pond 2 western, northern, and eastern perimeter dikes (2016d). Results showed calculated factors of safety for critical cross sections were 1.6 and 1.9, surpassing the EPA required factor of safety of 1.1.

In a seismic safety factor assessment for Ash Pond 2 conducted by Geocomp (2016), an evaluation was conducted for seismic loading for the seismic factor of safety (FOS) and liquefaction factor for safety. The seismic FOS (pseudo-static stability) was found to be 1.11, exceeding the EPA's required FOS of 1.0 for the EPA Final CCR Rule. The Liquefaction factor of safety (post-earthquake stability) was 1.98, exceeding the EPA's required FOS of 1.2.

Stantec assessed the static safety factor of Ash Pond 2 regarding long-term, maximum storage pool loading condition as well as maximum surcharge pool loading condition at critical cross sections (2016c). Long-term maximum storage FOS was 2.09 at cross section E-E and 1.74 at cross section P-P, exceeding EPA's CCR required FOS of 1.5. The maximum surcharge pool loading FOS was 1.56 at cross section E-E and 1.46 at cross section P-P, exceeding EPA's required FOS of 1.4.

There are 32 piezometers and six slope inclinometers currently being monitored at Ash Pond 2. There were no exceedances of threshold, action, or notification levels at the piezometers during the most recent Facilities Inspection (2017a) with the exception of SHF_N_2A_PZ5 and SHF_N_2B_PZ3. The water level exceedances recorded at these instruments are above the ground surface, therefore, the readings are likely errors based on visual inspection of the area and the absence of water at the surface of the piezometers.

A Hazard Potential Classification Assessment for Ash Pond 2 at SHF was performed by Stantec in 2013 and updated in 2016 (2016a) as required per the EPA Final CCR Rule. Based on the applicable hazard classifications defined in the EPA Final CCR Rule, Ash Pond 2 is classified as a "significant hazard potential" CCR surface impoundment, which is defined below:

> *Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.*

TVA has an Emergency Action Plan (EAP) in the unlikely event of a catastrophic failure of the CCR Unit (2017a). As per the EAP, the Plant Shift Operations Supervisor (SOS) will coordinate with the Civil Construction Field Supervisor/Construction Manager in the event of a safety emergency to (among other duties) "Assess the possible hazards to human health and the environment due to the release."

3.9 §257.61(a)(4) WETLAND MITIGATION

(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands);

Because Section 404 of the CWA and state wetlands laws were not found to be violated due to the day-to-day operation of the CCR Unit, and because the unit was built prior to the implementation of regulations governing fill in wetlands, no known net loss of wetlands is occurring and therefore, it is anticipated that no mitigation would be required as per §257.61(a)(4) of the EPA Final CCR Rule.

4.0 CONCLUSIONS

Based on the assessment outlined herein, Ash Pond 2 located at SHF meets the requirements of §257.61 of the EPA Final CCR Rule for the wetlands location restriction.

5.0 REFERENCES

Electric Power Research Institute (EPRI). 2017. Ohio River Ecological Research Program (OREP) 2015 Ohio River Monitoring Results. Final Report, September 2017.

Federal Emergency Management Agency. 2011. National Flood Hazard Layer, McCracken County, Kentucky, Map Number 21145C0045F. Available at: http://fema.gov/.

Fuller, Mossbarger, Scott & May Engineers, Inc. (FMSM). 2007. Critical Habitats Information. Attachment 17 of the permit application for the in the Consolidated Waste Stack Disposal Area, Shawnee Fossil Plant. Environmental Review by Resource, Realty, and Environmental Services dated February 14, 2007. Prepared for TVA.

Geocomp. 2016. Initial Seismic Safety Factor Assessment for SHF Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, West Paducah, Kentucky. Prepared for TVA.

Kentucky Energy and Environment Cabinet Division of Waste Management (KYDWM). Special Waste Landfill-Coal/07300041. Permit. Shawnee Fossil Plant. Tennessee Valley Authority. Issued June 20, 2014.

KDOW. 2018. Kentucky Pollution Discharge Elimination System Permit No. KY0004219 and accompanying Fact Sheet. 300 Sower Blvd, Frankfort KY 40601.

Kentucky Energy and Environment Cabinet Division of Water (KDOW). 2018. Integrated Report to Congress on the Condition of Water Resources in Kentucky, 2016 Assessment Results with Emphasis on the Big Sandy, Little Sandy, Tygarts River and Kentucky River Basin Management Units and a Statewide Update. Issued February 28, 2018.

Ohio River Valley Water Sanitation Commission (ORSANCO). 2014. Biological Survey – Pool Results – Olmsted Pool 2014. Accessed via http://www.orsanco.org/programs/biological-programs/pool-results/ on January 31, 2018.

Stantec. 2018. Seep Action Plan, TVA Shawnee Fossil Plant, Paducah, McCracken County, Kentucky. Prepared for TVA.

Stantec. 2017a. FY2017 Intermediate Inspection of CCR Facilities Shawnee Fossil Plant Paducah, McCracken County, Kentucky. Prepared for TVA.

Stantec. 2017b. SHF Ash Pond 2 - CCR Rule, Wetlands Demonstration - Initial Site Conditions Field Reconnaissance. Memo to TVA. August 11, 2017.

Stantec. 2017c. TVA Shawnee Fossil Plant Ash Pond 2 Breach Analysis for Wetland Determination. Memo to Michelle Meehan. November 13, 2017.

Stantec. 2016a. Initial Hazard Potential Classification Assessment for SHF Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, West Paducah, Kentucky. Prepared for TVA.

Stantec. 2016b. Initial Inflow Design Flood Control System Plan, Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, West Paducah, Kentucky. Prepared for TVA.

Stantec. 2016c. Initial Static Safety Factor Assessment for SHF Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, West Paducah, Kentucky. Prepared for TVA.

Stantec. 2016d. Initial Structural Stability Assessment for SHF Ash Pond 2, EPA Final Coal Combustion Residuals (CCR) Rule, TVA Shawnee Fossil Plant, West Paducah, Kentucky. Prepared for TVA.

Stantec. 2015a. 2015 Formal (5 Year) Inspection of CCR Facilities and Ponds Shawnee Fossil Plant Paducah, McCracken County, Kentucky. Prepared for TVA.

Stantec. 2015b. Outfall 008 Relocation. Prepared for TVA.

Stantec. 2013. Review of Automated Piezometer Data for ALF, BRF, CUF, JOF, JSF, PAF and SHF, Coal Combustion Byproduct Storage Facilities, Various Plants. Prepared for TVA.

Stantec. 2011. Dam Safety Hazard Classification Review Shawnee Ash Pond 2, Tennessee, Chattanooga. Prepared for TVA.

Stantec. 2010a. Spillway Replacement Project Ash Disposal Area No. 2 Pond B (Ash Stilling Pond) Work Plan 5. Prepared for TVA.

Stantec. 2010b. Stormwater Pollution Prevention Plan. Spillway Replacement Project Ash Disposal Area No. 2. Prepared for TVA.

Stantec. 2009. Report of Phase 1 Facility Assessment. Tennessee Valley Authority. KY CCP-RT-090624. Prepared for TVA.

Tennessee Valley Authority (TVA). 2018. SHF Documentation: Summary of Outfall 001 WET Biomonitoring Results. October 1997 - November 2017.

TVA. 2017a. CCR Unit Emergency Action Plan (Rev. 0) Shawnee Fossil Plant, West Paducah, Kentucky. Tennessee Valley Authority, 1191 Market Street, Chattanooga TN 37402, April 17, 2017.

TVA. June 2017b. Shawnee Fossil Plant's Coal Combustion Residual Management Environmental Impact Statement. Knoxville, Tennessee.

TVA. 2014. Shawnee Fossil Plant Units 1 and 4 Final Environmental Assessment. Knoxville, Tennessee.

TVA. 2005. Shawnee Fossil Plant Waste Disposal Permit and Ash Stacking Plan. Volume 2 of 2. December 2, 2005.

TVA. 2011. Correspondence with the USFWS – Kentucky Office: Vegetation Removal Adjacent to Bayou Creek – Proposal. To: Mr. Virgil Lee Andrews, From John "Bo" Baxter. Dated October 26, 2011.

TVA. 1969. Plan Ash Disposal Area No. 2. Tennessee Valley Authority.

Third Rock Consultants, LLC. 2014. Mussel Survey – Shawnee Fossil Plant, Ohio River (ORM 946), McCracken County, Kentucky. Prepared for TVA. Issued October 14, 2014.

United States Army Corps of Engineers (USACE). 2014. Ohio River navigation charts: Cairo, Illinois to Foster, Kentucky. Available online at: http://cdm16021.contentdm.oclc.org/cdm/ref/collection/p16021coll10/id/158United States Congress. 1988. Marine Protection, Research and Sanctuaries Act of 1988. 16 U.S.C. § 1431 et seq. and 33 U.S.C. § 1401 et seq. http://www2.epa.gov/laws-regulations/summary-marine-protection-research-and-sanctuaries-act.

United States Congress. 1973. Endangered Species Act of 1973. 16 U.S.C. § 1531 et seq. http://www2.epa.gov/laws-regulations/summary-endangered-species-act.

United States Congress. 1972a. Clean Water Act of 1972. 33 U.S.C § 1251 et seq. http://www2.epa.gov/laws-regulations/summary-clean-water-act.

United States Congress. 1972b. Clean Water Act of 1972. 33 U.S.C § 1317 (a)(1). http://www2.epa.gov/eg/toxic-and-priority-pollutants-under-clean-water-act.

United States Department of Agriculture (USDA-NRCS). 2017. Web Soil Survey. Soil Data Explorer, Soil Reports, Land Classifications, Prime and other Important Farmlands. Version 11, Oct 3, 2017. https://websoilsurvey.sc.egov.usda.gov

USDA-NRCS. 2016. Soil Survey Geographic (SSURGO) Database for Kentucky. Accessed November 2018. Website: https://websoilsurvey.sc.egov.usda.gov

United States Environmental Protection Agency (USEPA). Enforcement and Compliance History Online (ECHO). 2018. http://echo.epa.gov/detailed-facility-report?fid=110000493305#pane3110000493305.

USEPA. 2013. STORET Data Warehouse. http://www3.epa.gov/storet/dw_home.html. Last updated on September 20, 2013.

U.S. Fish and Wildlife Service (USFWS). 2015a. National Wetlands Inventory. Washington (D.C.) United States Department of the Interior, Fish and Wildlife Service. http://www.fws.gov/wetlands/. Accessed May 28, 2015.

USFWS. 2015b. Threatened or Endangered Species by County Report. Washington (D.C.) United States Department of the Interior, Fish and Wildlife Service.http://ecos.fws.gov/tess_public/reports/species-by-current-range-county?fips=47157.

USFWS. 2011. Correspondence with Louisville Gas & Electric Company: Cane Run Biological Assessment – Letter of Concurrence. To: Mr. Paul Puckett, From Mr. Virgil Lee Andrews. Dated June 1, 2011

United States Geological Survey (USGS). 1932 - 2012. Historical Map Archives of the National Mapping Division Reference Collection. Reston (VA). United States Department of the Interior, Earth Science Information Center.

USGS. 2016. La Center, Kentucky-Illinois. 7.5' Series Quadrangle. U.S. Department of the Interior. Reston, Virginia.

USGS. 1983a. Joppa, Kentucky-Illinois. 7.5' Series Quadrangle. U.S. Department of the Interior. Reston, Virginia.

USGS. 1983b. Paducah West, Kentucky-Illinois. 7.5' Series Quadrangle. U.S. Department of the Interior. Reston, Virginia.

APPENDIX A
TVA SHAWNEE FOSSIL PLANT ASH POND 2 BREACH ANALYSIS FOR WETLAND DETERMINATIONS

Stantec

Memo

To:	Michelle Meehan Stantec 3052 Beaumont Centre Circle Lexington, KY 40513	From:	Brad Allgeier Stantec 10509 Timberwood Circle Louisville, KY 40223
File:	Mem_SHF_AP2_breach_wetland.docx	Date:	November 13, 2017

Reference: TVA Shawnee Fossil Plant Ash Pond 2 Breach Analysis for Wetland Determination

This memo documents modeling methodology and the data used to generate breach extents for Ash Pond 2 at Shawnee Fossil Plant (SHF).

Three locations (north corner, west corner and southwest corner) were selected to determine areas that could be impacted by a piping breach of Ash Pond 2. Any piping breach location on the northeast side, along the Ohio River, would result in release of ash and water directly into the river. No breach analysis was completed along this side but the potential impacted area is included.

Stage-storage tables were developed using contour data provided in CAD drawing 175555025_01_sitex_eg01_current. Hydrographic contour data was included in this drawing. To determine the volume of ash in the pond, the 351.0 feet elevation contour on the inside of the pond was offset at a 3:1 slope to generate areas and volumes down to elevation 326.0 feet. An assumption was made that 35% of the ash volume would leave with the water during a breach. Volume calculations can be found in SHF_stage_storage_20171109.xlsx spreadsheet.

Bottom of breach elevations were determined using terrain data and identifying where the slope on the downstream side of the pond flattens out. At the north corner that elevation was determined to be 326.0 feet and for the west and southwest corners the elevation was 335.0 feet. A piping breach was simulated assuming the water in the pond reaches the lowest non-clogging spillway for the "Sunny Day" analysis. . For Ash Pond 2, the spillway system consists of pipes and there is no open channel spillway. Therefore, the initial starting water elevation was set at elevation 351.0 feet which corresponds to the top of dike elevation.

Manning's n values for the terrain were populated using the National Land Cover Database. Values were assigned to each landuse as shown in Table 1.

Reference: TVA Shawnee Fossil Plant Ash Pond 2 Breach Analysis for Wetland Determination

Table 1. Manning's n values

Value	Name	Default Manning's n
0	nodata	
11	barren land rock/sand/clay	0.04
21	cultivated crops	0.05
22	deciduous forest	0.1
23	developed, high intensity	0.06
24	developed, low intensity	0.06
31	developed, medium intensity	0.06
41	developed, open space	0.04
42	emergent herbaceous wetla...	0.08
82	evergreen forest	0.1
90	open water	0.013
95	woody wetlands	0.08

Piping breach parameters were calculated using Froehlich 2008 equations. Those parameters and the stage-storage data were entered into HEC-HMS v.3.5 to generate an outflow hydrograph.

The generated hydrographs were transferred into HEC-RAS v5.0.3 (utilizing 2D capabilities) as an inflow hydrograph boundary condition. Normal depth with a slope of 0.005 was used for the downstream boundary condition along the Ohio River. Terrain data for the potential impacted areas outside of Ash Pond 2 was pulled from KYGeoNet. The terrain data was collected in 2013.

The potential impacted area from three independent piping breaches is shown on the attached Figure 1.

Stantec Consulting Services, Inc

Brad Allgeier, PE
Senior Project Engineering
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Attachment: Fig_1_SHF_AP2_breach_wetland.pdf

c. file: \\us1243-f01\workgroup\1755\active\175567301\technical_production\analysis\Dam Breach\background\H&H

Figure No.
1

DRAFT

Title

Piping Breach Impact Area
Ash Pond 2 - Shawnee Fossil Plant

Client/Project

Tennessee Valley Authority (TVA)
Shawnee Fossil Plant

Project Location

West Paducah
McCraken County, Kentucky

175567301
Prepared by BTA on 2017-11-13
Technical Review by DH on 2017-11-13

0 1,500 3,000 Feet

1:15,600 (At original document size of 11x17)

Legend

- Piping Breach Inundation Area
- Ash Pond 2 Bounday

Notes

1. Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet
2. Service Layer Credits:

Stantec

TVA

Z:\SHP\Fig_1_SHF_AP2_breach_wetland.mxd Revised: 2017-11-13 By: baltgener

APPENDIX B
TVA DOCUMENTATION

Summary of TVA provided documentation reviewed and used to compile SHF wetland demonstration

- Report of Phase 1 Facility Assessment (Stantec 2009) provided general site configuration and operation procedures for SHF. Information pulled from this report was cross-referenced with more recent, less comprehensive reports to prevent outdated information from being used.

- TVA Shawnee Fossil Plant Ash Pond 2 Breach Analysis for Wetland Determination (Appendix A). This memo documents modeling methodology and the data used to generate breach extents for Ash Pond 2 at Shawnee Fossil Plant.

- CCR Unit Emergency Action Plan (TVA 2017a) provides information on potential breach pathways along the perimeter of Ash Pond 2 in the case of an emergency.

- Electric Power Research Institute (EPRI) Ohio River Ecological Research Program 2015 Ohio River Monitoring Results (2017) – Monitoring of fish populations in the Ohio River upstream and downstream of the SHF.

- Ohio River Valley Water Sanitation Commission (ORSANCO) Biological Survey Pool Results Olmsted Pool, 2014, show a "good rating" for sample sites around SHF and documents black buffalo (fish) occurring in the pool.

- Outfall 001 Whole Effluent Toxicity (WET) Biomonitoring Results Summary for SHF (TVA 2018) – No WET violations for *P. promelas* or *C. dubia* since toxicity tests began in 1997.

- TVA Letter to USFWS, dated October 2011, Shawnee Fossil Plant's Coal Combustion Residual Management Environmental Impact Statement (TVA 2017b) provides supplemental information regarding various endangered species that may reside in the vicinity of SHF.

- A critical habitat assessment (FMSM 2007) conducted for the Kentucky Division of Waste Management solid waste permit application for the existing landfill provides Indiana bat habitat information in the vicinity of SHF.

- 2015 Formal (5 Year) Inspection of CCR Facilities and Ponds (Stantec) and FY2017 Intermediate Inspection of CCR Facilities (Stantec 2017a) were used as a source of current information regarding the site operations.

- Dam Safety Hazard Classification Review for Shawnee Ash Pond 2 (Stantec 2011) provided supporting information of potential impacts should a catastrophic release occur.

- Storm Water Pollution Prevention Plan (SWPPP) Spillway Replacement Project Ash Disposal Area No. 2 (Stantec 2010b).

- Inflow Design Flood Control System Plan for SHF Ash Pond 2 (Stantec 2016b) provides information on how the inflow flood control system has been designed

and constructed to manage the design storm required by its hazard classification (significant hazard potential). Therefore, the 1,000-year flood event was the design control baseline criteria.

- Initial Structural Stability Assessment for SHF Ash Pond 2 (Stantec 2016d) shows that the Ash Pond 2 impoundment meets the structural stability requirements set forth in 40 CFR 257.73(d)1-2.

- Initial Seismic Safety Factor Assessment for SHF Ash Pond 2 (Geocomp 2016) confirms that the seismic and liquefaction factors of safety both exceed EPA required values.

- Initial Static Safety Factor Assessment for SHF Ash Pond 2 (Stantec 2016c) confirms that the initial static safety factors exceed EPA required values.

- Initial Hazard Potential Classification Assessment for SHF Ash Pond 2 (Stantec 2016a) classifies Ash Pond 2 with a "significant" hazard classification because a failure or mis-operation could cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

APPENDIX C
CERTIFICATION OF SHAWNEE FOSSIL PLANT CCR UNIT OPERATION COMPLIANCE WITH THE ENDANGERED SPECIES ACT

Certification of Shawnee Fossil Plant CCR Unit Operation compliance with the

Endangered Species Act – 9/28/2018

The operation of the Shawnee Fossil Plant (SHF) CCR Unit must not jeopardize the continued existence of endangered or threatened species or critical habitats, as protected under the Endangered Species Act of 1973 (ESA). The 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.

TVA has examined information contained in the State of Kentucky Natural Heritage Program database, the TVA Regional Natural Heritage database, and the U.S. Fish and Wildlife Service on-line Information for Planning and Consultation (iPaC) database to determine which federally listed species and/or designated critical habitats are potentially present on or adjacent to (within a 5-mile radius of) the SHF CCR Unit.

Nine federally listed endangered freshwater mussel species; Spectaclecase (*Cumberlandia monodonta*, Fanshell (*Cyprogenia stegaria*), Pink Mucket (*Lampsilis abrupta*), Ring Pink (*Obovaria retusa*), Orange-foot pimpleback (*Plethobasus cooperianus*), Sheepnose (*Plethobasus cyphyus*), Clubshell (*Pleurobema clava*), Rough Pigtoe (Pleurobema plenum), Fat Pocketbook (*Potamilus capax*) and one federally listed threatened freshwater mussel species; Rabbitsfoot (*Quadrula c. cylindrica*) are known to occur within McCracken County. Two additional federally listed endangered freshwater mussel species; Northern Riffleshell (*Epioblasma torulosa rangiana*) and Purple Cat's Paw (*Epioblasma o. obliquata*) are historically reported from the area, but are assumed to be extirpated from this portion of the Ohio River system.

Three of these mussel species (Orange-foot Pimpleback, Sheepnose, and Rabbitsfoot) are recorded in the Ohio River within a 5-mile radius of SHF. The reach of the Ohio River between Olmstead, Illinois and Paducah, Kentucky, which includes the portion of the river adjacent to SHF, is designated critical habitat for the Rabbitsfoot mussel. Critical habitat includes specific areas (occupied or unoccupied by the species) in which are found physical or biological features essential to the conservation of the species (constituent elements) and may require special management. The constituent elements for the rabbitsfoot critical habitat include: geomorphically stable river channels and banks; a hydrologic flow regime necessary to maintain benthic habitats where the species is found; water and sediment quality necessary to sustain natural physiological processes; the presence and abundance of fish hosts; and either little or no competitive or predaceous invasive species.

Suitable habitat for federally listed aquatic species does not occur within the SHF CCR area; therefore, direct, indirect, or cumulative impacts to state- or federally listed threatened and endangered aquatic species do not occur. Because the SHF CCR Unit does not include any freshwater stream habitat, these species do not occur on-site. All water discharges are through the permitted outfall and would meet existing KPDES permit requirements. Because KPDES requirements are protective of aquatic life (including federally listed species) in receiving waters, effects to federally listed freshwater mussel species near SHF are avoided. Similarly, existing water discharges do not adversely modify the critical habitat for rabbitsfoot.

The Interior Least Tern is federally listed as endangered. The interior least tern nests on open shorelines, riverine sandbars and mudflats throughout the Mississippi, Missouri, Arkansas, and Red River drainages. Small numbers of this species are reported from the lower Ohio River. The majority of records of this

species in Kentucky are along the Mississippi River. Least Terns have been documented using inland sites such as dredge, spoil, and stilling ponds associated with coal plants. However, there is no recorded use of these habitats by Interior Least Tern at the SHF CCR Unit or on the Ohio River near SHF. No impacts to Interior Least Tern occur from operation of the SHF CCR Unit.

Bald Eagle (*Haliaeetus leucocephalus*), while not currently listed under the ESA, is protected under the Bald and Golden Eagle Protection Act. No bald eagles have been observed within or adjacent to the SHF CCR Unit. No impacts to this species occur from operation of the SHF CCR Unit.

Two bat species federally listed as endangered; Gray Bat (*Myotis grisescens*), and Indiana Bat (*Myotis sodalis*) and one bat species federally listed as Threatened; Northern long-eared bat (*Myotis septentrionalis*) are known to be present in McCracken County, KY. Two of these species (Indiana bat and Northern Long-eared Bat) roost in trees and forage in upland and riparian areas during the summer. Gray Bats roost in caves year-round and forage over open water and in riparian areas along the Ohio River.

The terrestrial habitat on the SHF site has been largely converted from forest and agricultural use, and is currently maintained as developed industrial land or mowed fields except for small forested areas. There are no records of caves within 5 miles of the SHF CCR Unit. No suitable roosting habitat for forest-dwelling bats exists within the SHF CCR Unit. However, high quality roosting and foraging habitat for the two forest-dwelling bat species, and foraging habitat for gray bat exists immediately adjacent to the SHF plant site in wetlands and streams, and along the Ohio River. Lack of suitable roosting habitat within the SHF CCR Unit for these three species ensures that these species are not present within the SHF CCR Unit. Potential foraging habitat within the SHF CCR Unit is of extremely poor quality as the SHF CCR Unit does not support a diverse aquatic insect community. None of the three federally listed bat species has been documented using the SHF CCR Unit for roosting or foraging purposes. Therefore, no impacts to threatened and endangered bats result from operation of the SHF CCR Unit.

TVA Environmental Compliance and Operations has determined that the current operation of the SHF CCR Unit would have no direct, indirect or cumulative effects on federally listed species, and therefore is not likely to jeopardize the existence of listed species, or result in the destruction or adverse modification of designated critical habitat for the Rabbitsfoot mussel.

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