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October 16, 2018
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Revision 0

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

RE: Unstable Areas Demonstration
Active Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Johnsonville Fossil Plant
New Johnsonville, Tennessee

1.0 PURPOSE

As described in 40 CFR § 257.64(a), an owner or operator of an existing CCR surface impoundment is required to demonstrate that the unit is not located in unstable areas unless the unit meets certain requirements. This letter documents Stantec's certification that Active Ash Pond 2 at the TVA Johnsonville Fossil Plant (JOF) complies with the location restrictions for unstable areas in the EPA Final CCR Rule at 40 CFR § 257.64(a).

2.0 SUMMARY OF FINDINGS

The attached demonstration documents that Ash Pond 2 meets the requirements set forth 40 CFR § 257.64(a).

3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stephen H. Bickel, being a Professional Engineer in good standing in the State of Tennessee, 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 Johnsonville Active Ash Pond 2 meets the requirements specified in 40 CFR § 257.64(a).

Re: Unstable Areas Demonstration
Active Ash Pond 2
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Johnsonville Fossil Plant
New Johnsonville, Tennessee

SIGNATURE ______________________ DATE 10/16/2018

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ATTACHMENTS: Unstable Areas Demonstration

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AGRICULTURE
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STATE OF TENNESSEE

Unstable Areas Demonstration

Johnsonville Fossil Plant
Active Ash Pond 2
New Johnsonville, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:
Stantec Consulting Services Inc.
Lexington, Kentucky

October 16, 2018
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1.0 PROJECT BACKGROUND

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 the Active Ash Pond 2 (the Unit) at the Johnsonville Fossil Plant (JOF) regarding the requirements for the Unstable Areas Location Restriction as required by the EPA Final CCR Rule, 40 C.F.R. §257.64.

As required by §257.64 of the EPA Final CCR Rule, an owner or operator of an existing or new CCR landfill, existing or new CCR surface impoundment, or lateral expansion of a CCR unit is required by October 17, 2018 to demonstrate that the unit is not located in an unstable area unless the owner or operator demonstrates that generally accepted good engineering practices have been incorporated into the design of the CCR unit to promote the geotechnical integrity of the unit in such a manner that structural components of the CCR unit will not be disrupted.

The Unit has been identified as a CCR surface impoundment on the JOF site. As defined by §257.53 of the EPA Final CCR Rule, the Unit is characterized as a, "…diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR."

The following factors have been considered to determine whether the Unit at JOF is located in an unstable area:

- On-site or local soil conditions that may result in significant differential settling;
- On-site or local geologic or geomorphologic features; and
- On-site or local human-made features or events (both surface and subsurface).

2.0 UNIT DESCRIPTION

JOF is located on a 685-acre reservation located in New Johnsonville, Humphreys County, Tennessee. The plant resides on the east bank of the Kentucky Lake reservoir, approximately 12 miles west of Waverly, Tennessee, and approximately 70 miles west of Nashville, Tennessee.

Figure 1: Site Vicinity Map

Referring to **Figure 1**, the Unit is centered approximately 2,000 feet west from the plant's powerhouse. It was created by placing fill and then building an approximate two-mile-long perimeter dike, on an area within the former Tennessee River floodplain (now inundated by Kentucky Lake), to enclose approximately 90 acres. The perimeter dike varies from 25 to 35 feet in height.

The Unit has been in operation since 1970. It formerly received sluiced fly ash and bottom ash and plant process water. It also received stormwater runoff pumped from the Coal Yard Drainage Basin. The last coal fired generating units were shut down in December 2017, therefore the Unit no longer receives fly ash or bottom ash.

TVA has determined that the Unit is a CCR Surface Impoundment and therefore subject to the final rule.

3.0 SOIL CONDITIONS (§257.64(B)(1))

Per §257.64(b)(1), the unstable areas demonstration must consider on-site or local soil conditions that may result in significant differential settling when determining whether the area is unstable.

Assessment of the soil conditions was completed considering the following criteria related to the CCR Rule:

- Review inspection reports of the CCR unit for any documented deformations in the soils or movement of structural components indicating possible differential settlement of foundation soils.
- Review published soil surveys that indicate on-site or local presence of soft or compressible soil formation(s).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information that may indicate the foundation materials are soft or compressible.
- Review results of existing analyses to confirm that settlement of the unit would be negligible (within acceptable limits) and would not cause release of CCR into the environment.

3.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the CCR Rule.

The geologic description for the Active Ash Disposal area is taken from the John Kellberg's report "Geology of the New Johnsonville Steam Plant Site", 1948. Based on this information the general area of the JOF site is comprised of materials from a partially dissected river terrace. As the Tennessee River was lowered over time, the terrace was cut down to its present elevation and the drainage pattern developed on the terrace surface created a series of small valleys and gullies traversing the area. Near the river those small valleys have cut down 50 to 60 feet, while near their heads they are gullies 10 to 15 feet deep. This dissection has resulted in a gently rolling terrain with the tops of the low hills at elevations around 410 feet and valley floors ranging from elevation 350 to 390 (Kellberg, 1948).

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) maintains an online web soil survey tool that provides available data on local soils information for a user-specified Area of Interest. Appendix A includes the Web Soil Survey completed for the JOF site.

The soil survey (U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), 2018)indicates that the soils surrounding the JOF site are Silt-Loams, Silty Clay-Loams, or Gravelly Silt Loams of the Ennis, Humphreys, Huntington, Lindside, Melvin, and Wolftever Associations.

These soils formed from the weathering of interbedded sedimentary rock and generally range from silt loam to clay loam in texture.

Five geotechnical investigations have been conducted of the Unit in addition to multiple investigations on the JOF site. These investigations were conducted and reviewed for concurrence with the potential existence of soft soils and the published soil surveys. The perimeter dike foundation soils generally consist of Pleistocene age alluvial lean clay to sand with silt and gravel deposits that vary in thickness from 60 to 100 feet. The dike is underlain by fill materials that were placed hydraulically by dredging to raise the land above the level of Kentucky Lake. The fill is described as lean and sandy lean clay, to lean clay with gravel, silt and sand. The alluvium is described as lean clay with sand, to silty sand and sand with silt and gravel. The alluvial deposits are underlain by bedrock described as limestone and generally encountered approximately 100 feet below the top of the alluvium (Stantec Consulting Services Inc., 2010).

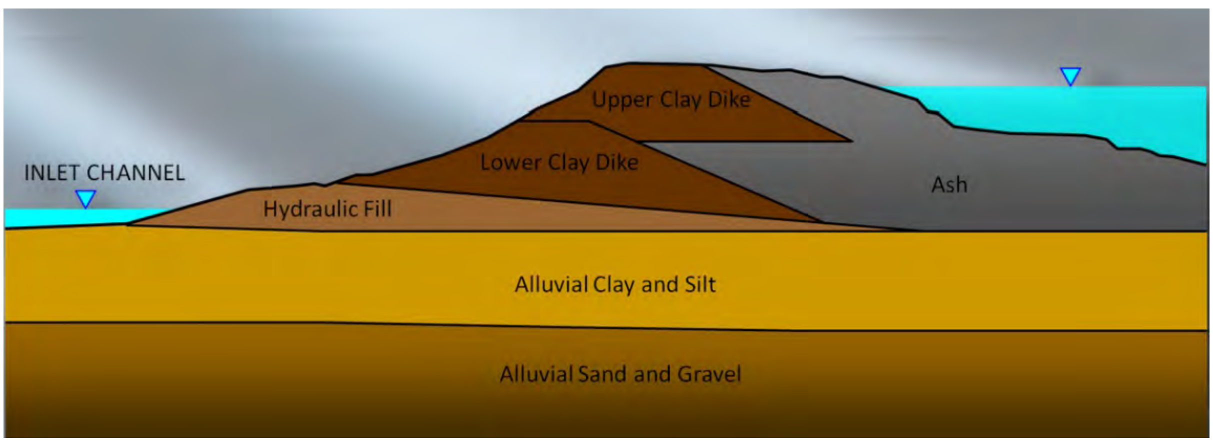

Figure 2: Typical Cross Section

As identified by the "Report of Geotechnical Exploration and Slope Stability Evaluation, Ash Pond, Johnsonville Fossil Plant" (Stantec Consulting Services Inc., 2010), and described within the History of Construction (Stantec Consulting Services Inc., 2016b), the perimeter dike was composed of 3 dike materials in addition to dense ash materials encountered that overlie the foundation materials. The original perimeter dike was made of "Fill" material that was mostly hydraulically placed during dredging of the boat harbor adjacent to the CCR Unit as well as placed by equipment and extends up to elevation 370 feet. The fill material has textural descriptions of lean clay, sandy lean clay, lean clay with gravel, silt, and silt with sand and is described as moist to wet in moisture content, and brown and gray in color.

The fill material has strength consistencies ranging from very soft to medium stiff with isolated zones of stiff and very stiff consistencies which correlates the site history indicating multiple borrow sources and methods were used to place the material. The second dike horizon, "Lower Clay Dike" extends from elevation 370 feet to 378 feet. The lower dike has textural descriptions of lean clay, lean clay with sand, lean clay with gravel and silt.

The soil was described as mostly moist in moisture content with some isolated dry and wet zones encountered, and brown and gray in color. The lower dike has strength consistencies ranging mostly from medium stiff to very stiff, with isolated zones of soft and very soft consistencies being encountered. The upper soil horizon, known as the "Upper Clay Dike", extends from Elevation 390 feet to Elevation 378 feet and consists of the final dike raising which occurred in 1978. The upper dike soils have textural descriptions of lean clay, lean clay with sand, and lean clay with gravel. The soil was described as moist in moisture content and mostly brown in color. The upper dike has strength consistencies ranging from medium stiff to very stiff.

Ongoing environmental assessments of the site have been conducted at the Unit as a part of the Environmental Investigation Plan (EIP) in compliance with the Tennessee Department of Environment and Conservation (TDEC) Order, Section VII.A.d which requires TVA to develop an EIP for each site that, when implemented, will provide the information necessary to "fully identify the extent of soil, surface water, and ground water contamination by CCR." As a part of these assessments, a recovered historical USGS map from 1936 indicated that Indian Creek meandered within the footprint of what is now the northeast dike. Prior to the impoundment of Kentucky Lake, the 1936 map indicated that the Unit was previously in an area of historic floodplain and farmland. Additional geotechnical drilling confirmed soft soils within the northeast perimeter dike. The geometry of the northeast perimeter dike with encountered soil parameters was analyzed further for structural stability to determine whether a failure would result in potential loss of containment.

As the result of raising the water level elevation within the unit to elevation 370 feet in 1976, TVA personnel reported seepage on the northeast and southeast dikes in the annual inspection. Additional seep areas were identified on the bench elevations 365 and below the water level of Kentucky Lake. The areas were noted and monitored periodically to evaluate changes in size or condition that would indicate a potential structural deficiency within the perimeter dike soils. In 2008 a previously identified seep area on the southeast perimeter dike was documented as having increased in size due to the raising of the water level within the Unit by 2 feet. In February 2009, TVA installed a system of perforated pipes enclosed in crushed stone and geotextile fabric to control and monitor the seepage which reduced the potential for failure and increased the structural stability of the southeast perimeter dike. In addition to lowering the pool elevation of the pond with the installation of multiple spillways, perimeter dike stabilization measures have been constructed and implemented in the areas identified by the previous inspection reports. There have been no additional reported seeps or changes to the perimeter dikes since the stabilization improvement structures were installed. (Stantec Consulting Services Inc., 2010).

Annual site inspections of the Unit have been conducted and documented regularly from 1968 to 2018. These inspections were reviewed to identify observations of potential signs of deformations in the soil or movement of structural components, which would indicate differential settlement of the foundation soils. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

3.2 ASSESSMENT

Historic soil reports and geotechnical exploration reports, discussed in Section 3.1, were reviewed for evidence of soft and compressible soils that may have been on site prior to the development of the Unit. For the purposes of this report, soft and compressible soils are fat clays, elastic silts, organic silts and clays, or highly organic soils (peat). The information available from published soil surveys, borings, and the local soils described in Section 3.1 indicates the presence of soft or compressible soils within the Unit foundation soils. The geotechnical explorations of the Unit and subsequent testing and analyses also show that the on-site dike soils did contain portions of soft or compressible soils at the interface of the foundation, located on the interior portions of the perimeter dike. These areas were small and problem areas were removed as a part of the improvements associated with the creation of the Unit.

While annual site inspections have reported erosion/deformations at the crest, no signs of tension cracking or significant settlement of the perimeter dike have been observed. The areas of reported erosion/deformation have been repaired and are monitored through annual inspections of the perimeter dikes. Annual site inspections had also reported seepage on the perimeter dike slope, which indicated possible implications of reduced structural integrity. It was determined that the seeps were caused by inadequate seepage control measures combined with rising pool level elevations. These seepage areas have been mitigated by the implementation of the Northeast and Southeast Dike Slope Stability Projects in 2010 and 2011, respectively. The Northeast Dike project included flattening embankment slopes, the installation of a rip rap buttress along the toe of the dike, and seepage filters to further improve factors of safety. The Southeast Dike Improvement work involved installation of a rip rap buttress along the toe of the dike and seepage filters to further improve factors of safety against slope failure along this side of the pond (Tennessee Valley Authority (TVA), 2011a).

A historic meandering stream was identified to be located below a portion of the northeast dike. Soft soils are characteristic of a historic stream bed and, once identified within the Unit footprint, were analyzed as a part of the Stacking Plan (2015) developed to determine structural stability of the perimeter dikes for stacking CCR operations within the Unit. Results of the analysis indicated that failure is unlikely. The ash stacking had been documented to have been stacked at historically higher elevations than the Unit configuration was operating at during the analyses development. Although this was the case historically, the Stacking Plan designated the ash stack be offset from the perimeter dike to further increase the structural stability of the dikes. Structural stability improvements of the northeast perimeter dikes included flattening of the slopes, construction of a rock buttress, water diversion from the northeast dike, and instrumentation installation. The instrumentation readings are reviewed monthly, and no movement has been observed in 5 years.

As part of the improvements to the Unit dikes with the raising of the perimeter dikes in 1978, any soft or compressible soils were removed, and seepage control measures were installed and monitored in compliance with USWAG (Tennessee Valley Authority (TVA), 2011b).

Small settlements may occur in spots due to the placement of the Unit over top of the original hydraulically sluiced materials; however, because of the uniform loading method for which the Unit was constructed, significant differential settlement is highly unlikely to occur and does not constitute a condition of an unstable area.

Based on this assessment of the soil conditions, the CCR Rule-related criteria listed above for soil conditions have been met.

4.0 GEOLOGIC OR GEOMORPHOLOGIC FEATURES (§257.64(B)(2))

Per §257.64(b)(2), the unstable areas demonstration must consider on-site or local geologic or geomorphologic features when determining whether the area is unstable.

Assessment of the geologic or geomorphologic features was completed considering the following criteria related to the CCR Rule:

- Review of published geologic maps that indicate on-site or local geomorphologic features such as:
  - Karst potential;
  - Known sinkhole outlines;
  - Known spring locations; and,
  - Known landslide locations.
- Review of inspection reports of the CCR unit for any documented characteristic features of karstic formation (e.g. sinkholes, vertical shafts, sinking streams, caves, seeps, large springs, or blind valleys).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information regarding the on-site or local geology and geomorphology.
- Review of 5-foot and 10-meter Digital Elevation Models (DEMs) derived from 10-meter LiDAR data obtained by the United States Geological Survey (USGS) to identify areas susceptible to mass movement.

4.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the CCR Rule. Appendix B contains a map presenting the geology of the area, a map displaying nearby sinkholes, landslide locations, and springs, and two maps showing 5-foot and 10-meter DEMs that show topography highlighting areas of shallow and steep slopes.

Prior to construction, in an effort to determinate the typical lithology of the JOF site, foundation drilling for the railroad bridge to the south indicated that alluvial deposits ranged up to 67 feet in depth and averaged 60 feet deep beneath the floodplain (now submerged by Kentucky Lake) of the Tennessee River. Near the surface the alluvium consisted of fine grained silt and silty clay that grade into sand and river gravel with increasing depth.

A groundwater monitoring well drilled at the Unit in 1986 encountered bedrock at approximate Elevation 290 feet, or about 100 feet below the dike. The sand and gravel alluvium were logged as being about 40 feet thick.

According to the Geologic Map of the Johnsonville Quadrangle (United States Geological Survey (USGS), 1995), the site is predominantly underlain by bedrock belonging to the Fort Payne Chert, Ridgetop Formation, Decatur, Brownsport, and Dixon Limestones Chattanooga Shale, and Camden Chert formations, in general order of descending geology. (Stantec Consulting Services Inc., 2010). The majority of these formations are of Mississippian age, with the exception of the Camden Chert of Devonian age and is comprised of limestones that may be described as thin to thick bedded, light-gray to brownish-gray, coarse to crystalline grained, hard, dense, and brittle. (Kellberg, 1948) (Geocomp, 2016)

The Chattanooga Shale is a fissile, bituminous, carbonaceous shale that overlies the Camden Formation. It is likely thin to nonexistent beneath the Unit. The Camden formation consists of thin (from one to three inches thick) beds of cherty limestone and contains hard, dense, brittle, white chert pieces, separated by softer gritty clay layers. (Stantec Consulting Services Inc., 2010)

Historical investigations into the existence of karsts and sinkholes in the area indicates that there is a potential risk of karstic formation because of underlying soluble rocks. No exposed surface faults could be identified in the vicinity of the impoundments at the JOF site. The change of water level after construction of the Kentucky Dam may have altered the historical pattern of chemical weathering of the carbonate rocks of the bedrock. However, no reports or references were identified to verify karst development in the area after the construction of the Kentucky Dam. (Geocomp, 2016).

Four shallow depressions were observed during the Phase 1 site reconnaissance on the southeast dike exterior slope and were investigated by Stantec in 2010. Clay material was encountered and identified at each of the excavation. The clay was found to be medium to soft in consistency and very moist to saturated in natural moisture content. The material showed inconsistent placement and compaction compared with the results of split spoon sample recovery tests and the rest of the soils encountered along the dike crest. Inorganic material including black, carbonaceous vegetative debris, buried tree parts, and/or decayed root systems were encountered in each of the inspection pits.

Annual site inspections of the Unit have been conducted and documented regularly from 1968 to 2018. These inspections were reviewed to identify observations of potential deficiencies within the surface impoundment or along the perimeter dikes that indicate characteristic features of karstic formations. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

4.2 ASSESSMENT

The original topographic mapping developed by the USGS for development of the Unit 1 did not contain any contours, or mapped call-outs, that suggest sinks, sinkholes or springs were present beneath the area that would ultimately become the Unit (United States Geological Survey (USGS), 1995).

An investigation into the existence of karst in this region indicates that the JOF site and surrounding area do not have a significant risk of sinkholes occurring according to historical documentation relating to the systematic study of karst across the United States (United States Geological Survey, 1984) and the EPA Seismic Assessment of the JOF Unit (Geocomp, 2016).

The Karst Potential Map included in Appendix B shows the location of sinkholes and areas to have mapped Karstic Potential. The JOF site is located approximately 2 miles outside of the Karstic Potential zone to the east (see Digital Engineering Aspects of Karst Map, located in Appendix B). The closest reported sinkhole is 0.5 miles from the Unit, on the southwest edge of the JOF Plant property. The rock encountered in geotechnical explorations of the Unit indicated that there was limestone encountered below the alluvial soils with rock core recovery quality ranging from fair to excellent.

A sinkhole had developed and was reportedly repaired on the southwest slope directly above a spillway outlet pipe during the 1990s. Annual inspections have not observed, and historical topography does not indicate natural spring formation at or within the vicinity of the JOF site. Paleosinks, sinkholes, or other characteristic features of karstic formation have not been documented in the available inspection reports of the Unit.

The depressions were concluded to have been the result of voids created when trees were removed from the dike, when buried tree parts rotted or when loosely placed clay was used to backfill and grade the bench at the former crest of the dike. The loose material to grade the bench may have been placed to repair access routes for installation of a groundwater monitoring well during 1986. It may also have been placed as an erosion control riprap measure at the toe of the west dike in 1996. The combination of these situations could have been the cause of the depressions. Ultimately, conclusions of the testing indicate that the depressions were caused by internal erosion in the dike and were not created by sinkhole formation (Stantec Consulting Services Inc., 2010).

The digital elevations models (DEMs), provided in Appendix C, show no indication of areas susceptible to mass movement within the vicinity of the Unit. The nearest area having moderate to steep slopes is approximately 1.25 miles northeast of the site, separated by the Boat Harbor Channel and a mile of property of the JOF site. This separation by way of the land and waterway gives relief to potential landslides that would occur and would not contribute to a potential release of CCR from the Unit.

A local landslide in 2002 occurred on the west side exterior slopes due to the steepness of these slopes. Earlier TVA Annual Dike Inspection Reports had noted a “bulge” in this area and attributed its formation to rock trucks hauling riprap for erosion repairs on the west side in the mid-1990’s. Records and photos taken by TVA staff after the occurrence indicated that the 2002 slide was probably shallow, and it was repaired that same year using geotextile fabric, crushed stone, and riprap. This area has been reported in annual inspections to be stable since being repaired. (Stantec Consulting Services Inc., 2010)

Although these potential karstic conditions have been identified within the Unit, there is sufficient evidence to demonstrate that the Unit is not located in an area of unstable karstic conditions. Topographical maps generated over time do not indicate the characteristics associated with unstable karstic formations. The JOF site history does not show any physical evidence of pre-treatment of karst. The Unit has documented incidents of deficiencies within the perimeter dike as discussed above; however, the incidents were analyzed and identified to have been caused by localized deficiencies within the perimeter dikes that were subsequently repaired and do not constitute that the Unit is unstable.

Accordingly, the CCR Rule-related criteria listed above for geologic and geomorphologic features have been met.

5.0 HUMAN-MADE FEATURES OR EVENTS (§257.64(B)(3))

Per §257.64(b)(3), the unstable areas demonstration must consider on-site or local human-made features or events when determining whether the area is unstable.

Assessment of the human-made features or events was completed considering the following criteria related to the CCR Rule:

- Review inspection reports of the CCR unit for any documented indications of tension cracking, settlement, depressions, or deformation of the unit's structural components (embankments, spillways, outlets, liners, leachate collection systems, or final covers).
- Review of routine operations and inspections of the surface impoundment to maintain precaution from human-induced events or forces that might impair the integrity of some or all the structural components responsible for preventing unpermitted release of CCR into the environment.
- Review instrumentation installed to monitor the CCR unit to ensure readings are maintained within documented tolerances.
- Review of maps and other resources to confirm that the CCR unit is not located:
  - On previously mined or quarried areas;
  - On areas that have undergone excessive drawdown of groundwater; or,
  - On an old landfill.

5.1 BACKGROUND

This section describes the reports, investigations, and records that were reviewed as a part of the determination as it pertains to this portion of the final rule.

Annual site inspections of the Unit have been conducted and documented regularly from 1967 to 2018. These inspections were reviewed to identify any observations of potential indications of human-induced events or forces that could have impaired the integrity of structural components, which are responsible for preventing the release of CCR to the environment. TVA will continue to comply with inspection requirements pursuant to the EPA Final CCR Rule and other regulatory requirements.

Historical geological surveys and topographic maps were reviewed to determine the historic land use of the site as it pertains to human-made features. The USGS topographic map from 1938 indicates that the Unit was a floodplain area. In the mid-1940's Kentucky Dam on the Tennessee River was constructed resulting in the impoundment of Kentucky Lake. The original site was noted as farmland and floodplain area prior to the creation of the Kentucky River.

As stated in Section 3.0, a portion of the perimeter dikes on the northeast corner is situated over top of a historic meandering stream. The potential structural deficiencies within this area have been identified and structural improvement measures have been incorporated into the perimeter dikes. These improvements addressed the problem soils within the area of concern on the Unit and additional human activities on the perimeter dikes are not likely to cause an unstable condition.

The surface impoundment is being operated in accordance with approved quality control and operational procedures in the approved Operations and Maintenance Manual developed in accordance with the EPA Emergency Action Plan and is subject to periodic inspection by the Tennessee Department of Conservation (TDEC). The surface impoundment has been operating under the National Pollutant Discharge Elimination System (NPDES) Permit No. TN0005444 (Tennessee Valley Authority (TVA), 2011b).

TVA inspects and maintains the Unit in accordance with TVA's GCP&S Standard Programs and Processes criteria for Coal Combustion Products Inspection of CCP Storage Facilities (GCP&S-SPP-27.4.1). This program is in accordance with the 'Federal Guidelines for Dam Safety' developed by the Federal Emergency Management Agency (FEMA 93). These documents direct TVA to perform inspections scheduled on specific intervals and with qualified personnel. The dikes are also visually inspected daily during operations by site personnel or designee.

Additionally, in accordance with TVA's GC-SPP-27.4.1, TVA inspects and maintains the Unit instrumentation. Furthermore, TVA monitors and maintains instrumentation data within the Unit that includes piezometers and slope inclinometers. Threshold exceedance levels have been analyzed and established to be monitored on a quarterly basis (Stantec & AECOM, 2016). There have been no documented exceedances of threshold, action, or notification levels at the piezometers since the previous intermediate inspection. No significant movement has been observed in the slope inclinometer readings (Stantec Consulting Services Inc., 2018a).

Appendix C contains maps presenting the locations of permitted hazardous waste sites, water wells, nearby quarries, oil and gas wells and lines, and gas fields.

5.2 ASSESSMENT

The inspection reports, that were available for review, contained no documentation of disposal activities resulting in failure of a structural component. Operations and inspection manuals were verified to include satisfactory measures to maintain precaution from human-induced events or forces that might impair structural components. In addition, the historical land use of the site does not indicate the site was pre-disposed to human activities indicating the Unit is in an unstable area.

Local and on-site "human-made features or events" or activities both surface and subsurface were considered in the assessment of the stability of the CCR unit. Facilities within the vicinity of the CCR unit, such as active mining operation facilities, industrial wastes and well sites, and oil and gas fields, were reviewed for their potential to cause unstable conditions at the Unit by their regular production activities. There were no records available for review of the site having been constructed on previous landfills, previously mined or quarried areas. An active sand and gravel quarry is located approximately 0.5 miles southeast of the site in the closed south railroad loop disposal area. There are no industrial wells or waste sites within 1 mile of the site. Based on the maps provided in the Appendix, the site is not located within oil or gas fields. There are 4 oil or gas wells, lines, or other related infrastructure within 1 mile of the site. It is not expected that human events related to these industries or their operations pose a negative impact to the structural components of the Unit or that would cause the unit to become unstable.

Based on this assessment of the human-made features or events, the CCR Rule-related criteria listed above for human-made features and events have been met.

6.0 CONCLUSIONS

Based on the assessment given herein, the Active Ash Pond 2 at JOF meets the requirements in §257.64 of the EPA Final CCR Rule for unstable areas.

7.0 REFERENCES

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APPENDIX A
SOIL CONDITIONS

United States Department of Agriculture

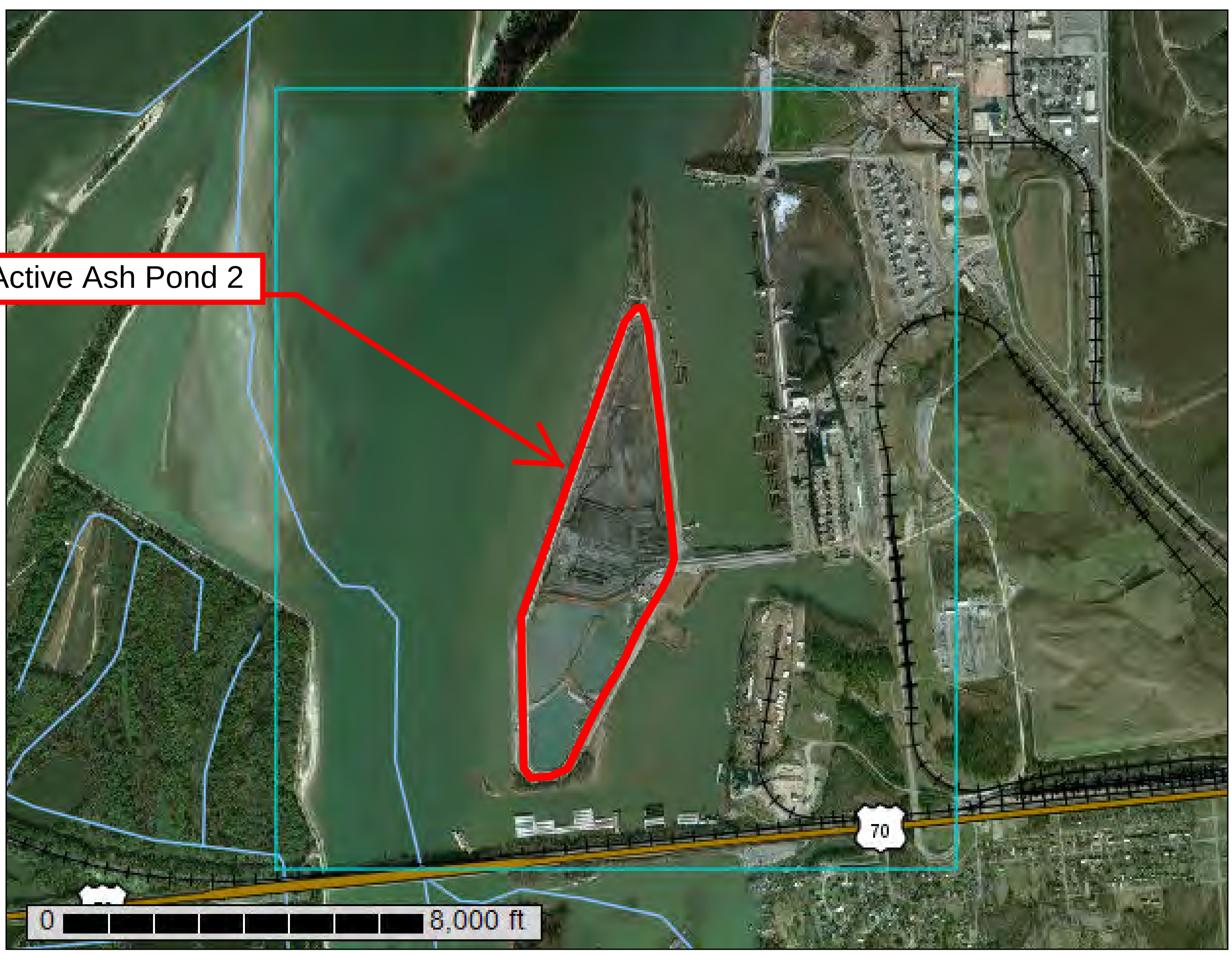
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Benton County, Tennessee, and Humphreys County, Tennessee

Johnsonville Fossil Plant



May 29, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

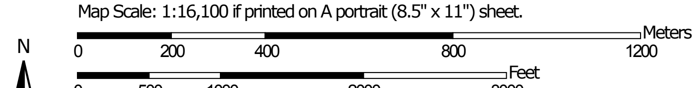
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:16,100 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Benton County, Tennessee
Survey Area Data: Version 11, Sep 19, 2017

Soil Survey Area: Humphreys County, Tennessee
Survey Area Data: Version 11, Sep 25, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 11, 2012—Jan 27, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AE	Aquents, clayey, 0 to 1 percent slopes, ponded	2.9	0.2%
BC	Beason and Chenneby soils, 0 to 3 percent slopes, frequently flooded	10.6	0.9%
Ua	Udorthents, loamy	7.8	0.6%
Ud	Udorthents-Urban land complex	0.5	0.0%
W	Water	297.7	24.2%
WoA	Wolftever silt loam, 0 to 3 percent slopes, frequently flooded	2.9	0.2%
Subtotals for Soil Survey Area		**322.3**	**26.2%**
Totals for Area of Interest		**1,230.8**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
En	Ennis silt loam	3.9	0.3%
Hg	Humphreys gravelly silt loam, 2 to 5 percent slopes	6.8	0.6%
Hl	Huntington silt loam	2.9	0.2%
Hs	Huntington silty clay loam	7.6	0.6%
Lc	Lindside silty clay loam	4.7	0.4%
Lcb	Lindside silty clay loam, high-bottom	29.0	2.4%
Mc	Melvin silty clay loam	26.9	2.2%
Ml	Melvin silt loam	16.0	1.3%
Ps	Paden silt loam	92.4	7.5%
Psr	Paden silt loam, eroded	131.9	10.7%
Psx	Paden silt loam, slope	87.0	7.1%
Ts	Taft silt loam, 0 to 2 percent slopes	0.8	0.1%
W	Water	464.9	37.8%
Wcc	Wolftever silty clay loam, compact	33.8	2.7%
Subtotals for Soil Survey Area		**908.5**	**73.8%**
Totals for Area of Interest		**1,230.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Benton County, Tennessee

AE—Aquents, clayey, 0 to 1 percent slopes, ponded

Map Unit Setting

National map unit symbol: 2qsb2
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 224 days
Farmland classification: Not prime farmland

Map Unit Composition

Aquents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aquents

Setting

Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey alluvium

Typical profile

A - 0 to 4 inches: silty clay loam
Cg - 4 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Hydric soil rating: Yes

BC—Beason and Chenneby soils, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2qsb8
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 224 days
Farmland classification: Not prime farmland

Map Unit Composition

Beason and similar soils: 53 percent
Chenneby and similar soils: 42 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beason

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Clayey alluvium

Typical profile

A - 0 to 7 inches: silty clay loam
Bt1 - 7 to 49 inches: silty clay loam
Bt2 - 49 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Chenneby

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over loamy alluvium

Typical profile

A - 0 to 8 inches: silt loam
Bw, Cg - 8 to 57 inches: silt loam
Cg - 57 to 79 inches: stratified loamy sand to fine sandy loam to loam to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Aquents

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ua—Udorthents, loamy

Map Unit Setting

National map unit symbol: 2qshv
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F

Frost-free period: 196 to 224 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy human transported material

Typical profile

C - 0 to 79 inches: loam

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Ud—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 2qshw
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 224 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 55 percent
Urban land: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy human transported material

Typical profile

C - 0 to 79 inches: loam

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 2qshy
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WoA—Wolftever silt loam, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2qshs
Elevation: 350 to 650 feet
Mean annual precipitation: 47 to 58 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 196 to 224 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wolftever and similar soils: 95 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wolftever

Setting

Landform: Stream terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1 - 8 to 32 inches: silty clay loam
Bt2 - 32 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Humphreys County, Tennessee

En—Ennis silt loam

Map Unit Setting

National map unit symbol: kpz8
Elevation: 380 to 850 feet
Mean annual precipitation: 35 to 63 inches
Mean annual air temperature: 45 to 70 degrees F
Frost-free period: 183 to 232 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Ellisville and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellisville

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Parent material: Loamy alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Hg—Humphreys gravelly silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qh70
Elevation: 360 to 800 feet

Mean annual precipitation: 48 to 58 inches
Mean annual air temperature: 57 to 59 degrees F
Frost-free period: 190 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Humphreys and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Humphreys

Setting

Landform: Stream terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, convex
Across-slope shape: Linear, convex
Parent material: Gravelly slope alluvium derived from cherty limestone

Typical profile

Ap - 0 to 10 inches: gravelly silt loam
Bt - 10 to 27 inches: gravelly silt loam
BC, C - 27 to 42 inches: extremely gravelly coarse sandy loam
2Bt - 42 to 80 inches: gravelly silt loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 60 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Hl—Huntington silt loam

Map Unit Setting

National map unit symbol: kpzd
Mean annual precipitation: 48 to 54 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 180 to 200 days

Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Huntington and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huntington

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Parent material: Loamy alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 64 inches: silt loam
H3 - 64 to 74 inches: stratified fine sand to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Hydric soil rating: No

Hs—Huntington silty clay loam

Map Unit Setting

National map unit symbol: kpzh
Elevation: 800 to 1,300 feet
Mean annual precipitation: 49 to 58 inches
Mean annual air temperature: 45 to 72 degrees F
Frost-free period: 170 to 215 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Egam and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Egam

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 65 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 36 to 48 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Hydric soil rating: No

Lc—Lindside silty clay loam

Map Unit Setting

National map unit symbol: kpzk
Elevation: 300 to 1,500 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Lindside and similar soils: 92 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lindside

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Parent material: Loamy alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 44 inches: silty clay loam
H3 - 44 to 60 inches: stratified silty clay loam to gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Lcb—Lindside silty clay loam, high-bottom

Map Unit Setting

National map unit symbol: kpzl
Elevation: 380 to 850 feet
Mean annual precipitation: 35 to 63 inches
Mean annual air temperature: 45 to 70 degrees F
Frost-free period: 183 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Beason and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beason

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 18 inches: silty clay loam
H3 - 18 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained

Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Mc—Melvin silty clay loam

Map Unit Setting

National map unit symbol: kpzp
Elevation: 300 to 600 feet
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 54 to 55 degrees F
Frost-free period: 165 to 205 days
Farmland classification: Not prime farmland

Map Unit Composition

Melvin and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melvin

Setting

Landform: Depressions
Landform position (three-dimensional): Dip
Parent material: Loamy alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 9 inches: silty clay loam
H2 - 9 to 30 inches: silty clay loam
H3 - 30 to 62 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Ml—Melvin silt loam

Map Unit Setting

National map unit symbol: kpzq
Elevation: 380 to 850 feet
Mean annual precipitation: 35 to 63 inches
Mean annual air temperature: 45 to 70 degrees F
Frost-free period: 183 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Minter and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Minter

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Parent material: Clayey alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 11 inches: silty clay loam
H2 - 11 to 60 inches: clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Ps—Paden silt loam

Map Unit Setting

National map unit symbol: kpzs
Elevation: 350 to 550 feet
Mean annual precipitation: 48 to 55 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 180 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Paden and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paden

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Parent material: Loess or silty alluvium over loamy alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 34 inches: silt loam
H3 - 34 to 46 inches: silty clay loam
H4 - 46 to 90 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: About 34 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 16 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Psr—Paden silt loam, eroded

Map Unit Setting

National map unit symbol: kpzt
Elevation: 350 to 550 feet
Mean annual precipitation: 48 to 55 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Paden and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paden

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Parent material: Loess or silty alluvium over loamy alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 34 inches: silt loam
H3 - 34 to 46 inches: silty clay loam
H4 - 46 to 90 inches: silty clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: About 34 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 16 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Psx—Paden silt loam, slope

Map Unit Setting

National map unit symbol: kpzv
Elevation: 350 to 550 feet
Mean annual precipitation: 48 to 55 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Paden and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paden

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Parent material: Loess or silty alluvium over loamy alluvium derived from interbedded sedimentary rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 34 inches: silt loam
H3 - 34 to 46 inches: silty clay loam
H4 - 46 to 90 inches: silty clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: About 34 inches to fragipan
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 16 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Ts—Taft silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2v59m
Elevation: 350 to 1,400 feet
Mean annual precipitation: 48 to 58 inches
Mean annual air temperature: 57 to 59 degrees F
Frost-free period: 190 to 230 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Taft and similar soils: 90 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Taft

Setting

Landform: Alluvial flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Silty alluvium over residuum weathered from cherty limestone

Typical profile

A - 0 to 1 inches: silt loam
E - 1 to 9 inches: silt loam
Bw - 9 to 24 inches: silt loam
E/Bx - 24 to 28 inches: silt loam
Btx - 28 to 64 inches: silt loam
2Bt - 64 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 26 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 6 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Guthrie

Percent of map unit: 4 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Wcc—Wolftever silty clay loam, compact

Map Unit Setting

National map unit symbol: kq02
Elevation: 380 to 850 feet
Mean annual precipitation: 35 to 63 inches
Mean annual air temperature: 45 to 70 degrees F
Frost-free period: 183 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Beason and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beason

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 18 inches: silty clay loam
H3 - 18 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

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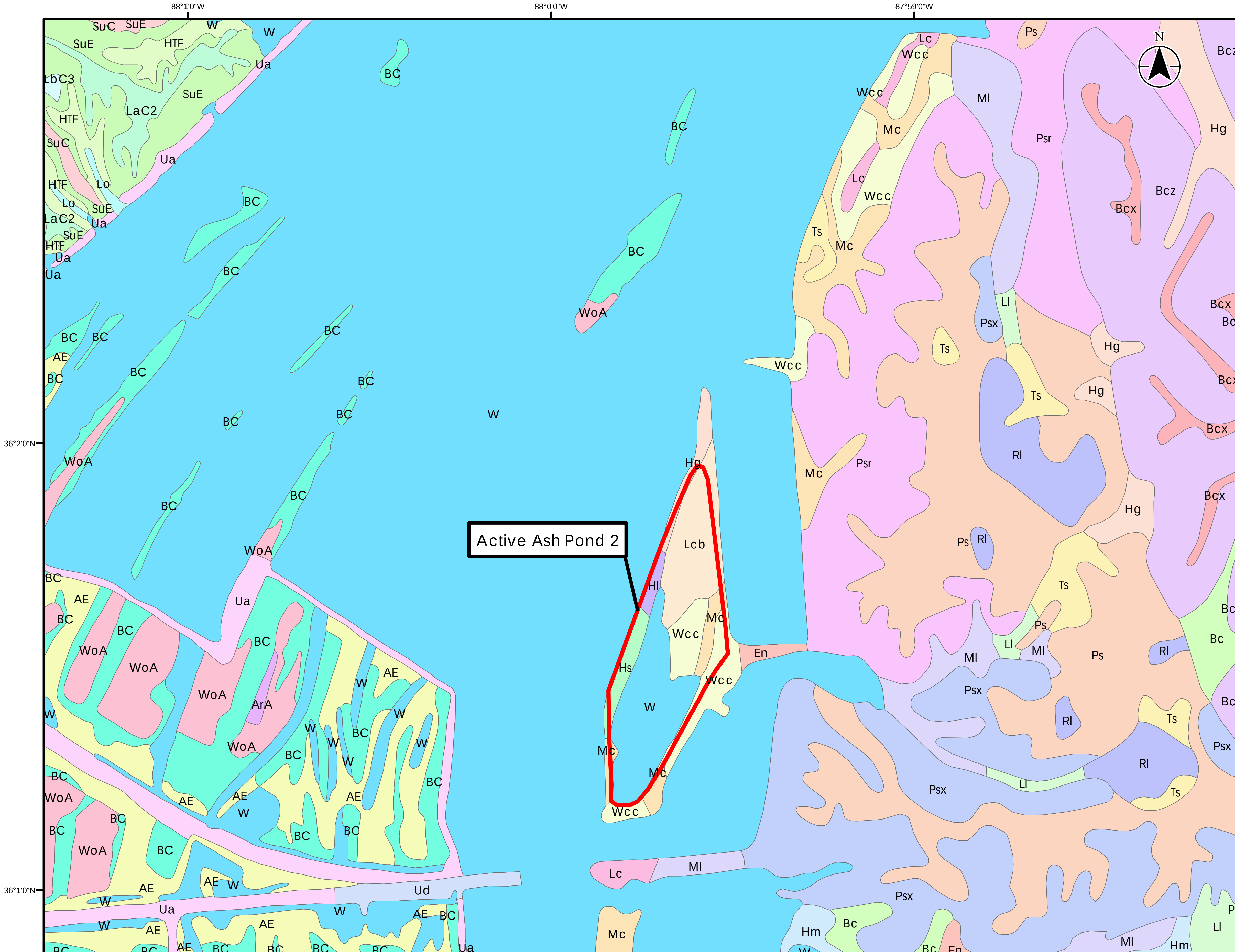


Geological Formation Map

Site
Johnsonville Fossil Plant
Active Ash Pond 2

Client/Project
Tennessee Valley Authority (TVA)
Chattanooga, Tennessee

Project Location
Humphreys County, Tennessee

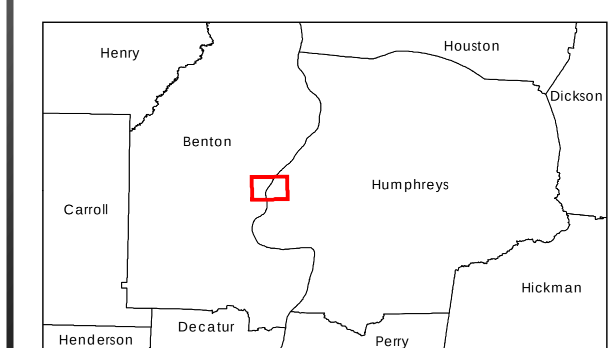
Prepared by RRR on 2018-6-27

0 0.25 0.5 Miles
1:16,000 (At original document size of 11x17)

Legend

Unit Limits

AE, ArA, BC, Bc, Bcx, Bcz, En, HTF, Hg, Hl, Hm, Hs, LaC2, LbC3, Lc, Lcb, Ll, Lo, Mc, Ml, Ps, Psr, Psx, Rl, SuC, SuE, Ts, Ua, Ud, W, Wcc, WoA, WoB2



Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Geological Formatiuon data provided by National Resources Conservation Service (NRCS) via Tennessee GIS

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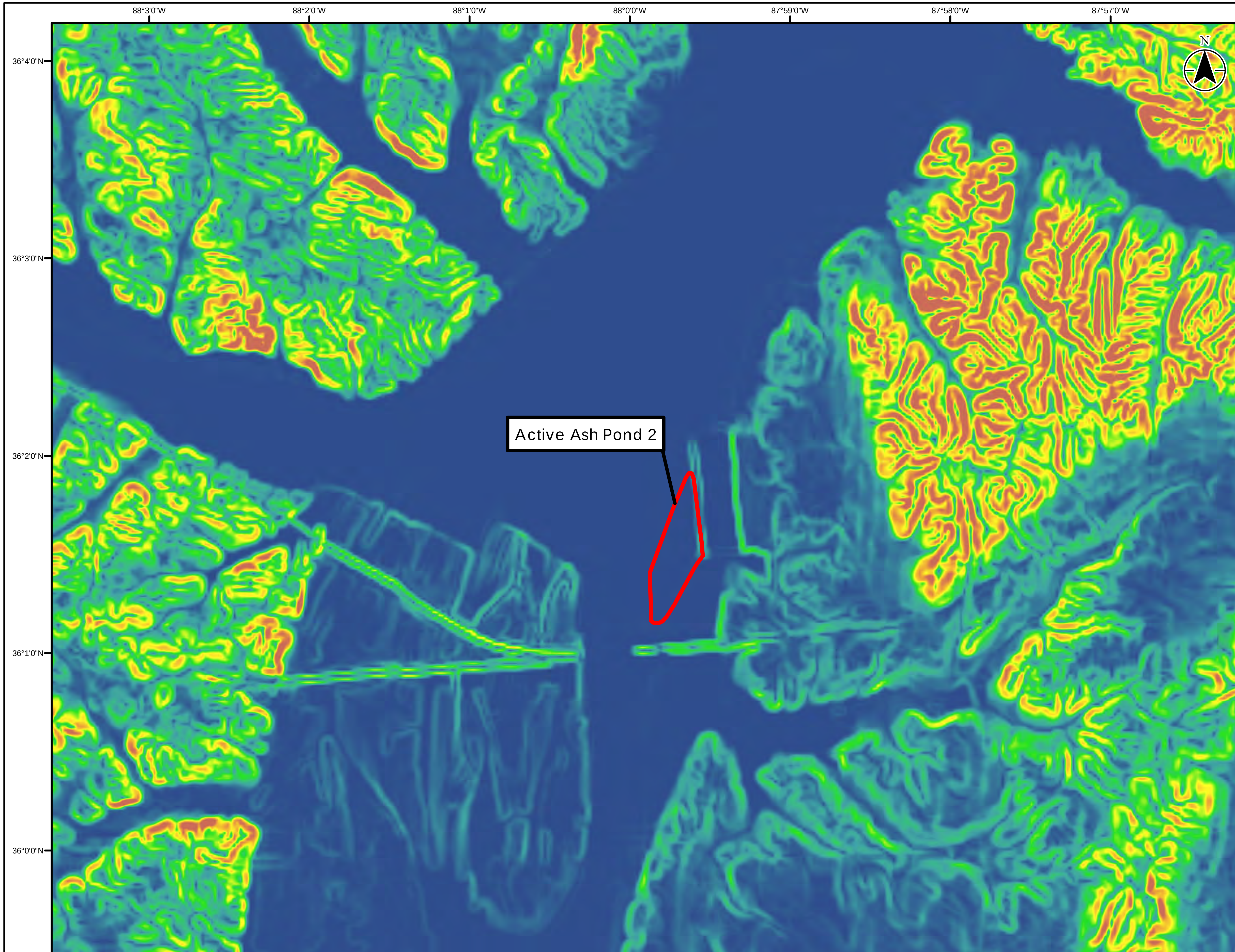
APPENDIX B
GEOLOGIC OR GEOMORPHOLOGIC CONDITIONS



Slope Raster Map

Site
Johnsonville Fossil Plant
Active Ash Pond 2

Client/Project
Tennessee Valley Authority (TVA)
Chattanooga, Tennessee

Project Location
Humphreys County,
Tennessee

Prepared by RRR on 2018-6-27

0 0.5 1 Miles
1:36,000 (At original document size of 11x17)

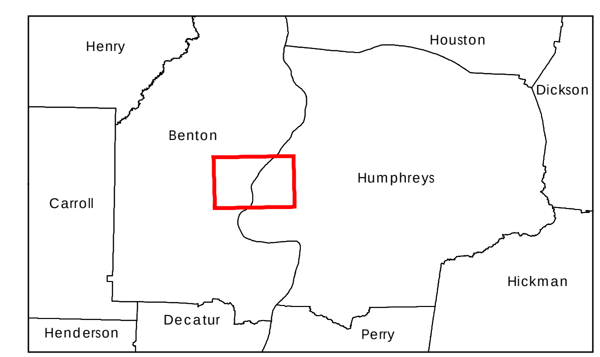
Legend

Unit Limits

Slope:

High : 21.6737

Low : 0



Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Slope Data derived from 30m National Elevation Dataset (NED) Digital Elevation Model (DEM) from the United States Geologic Survey (USGS)

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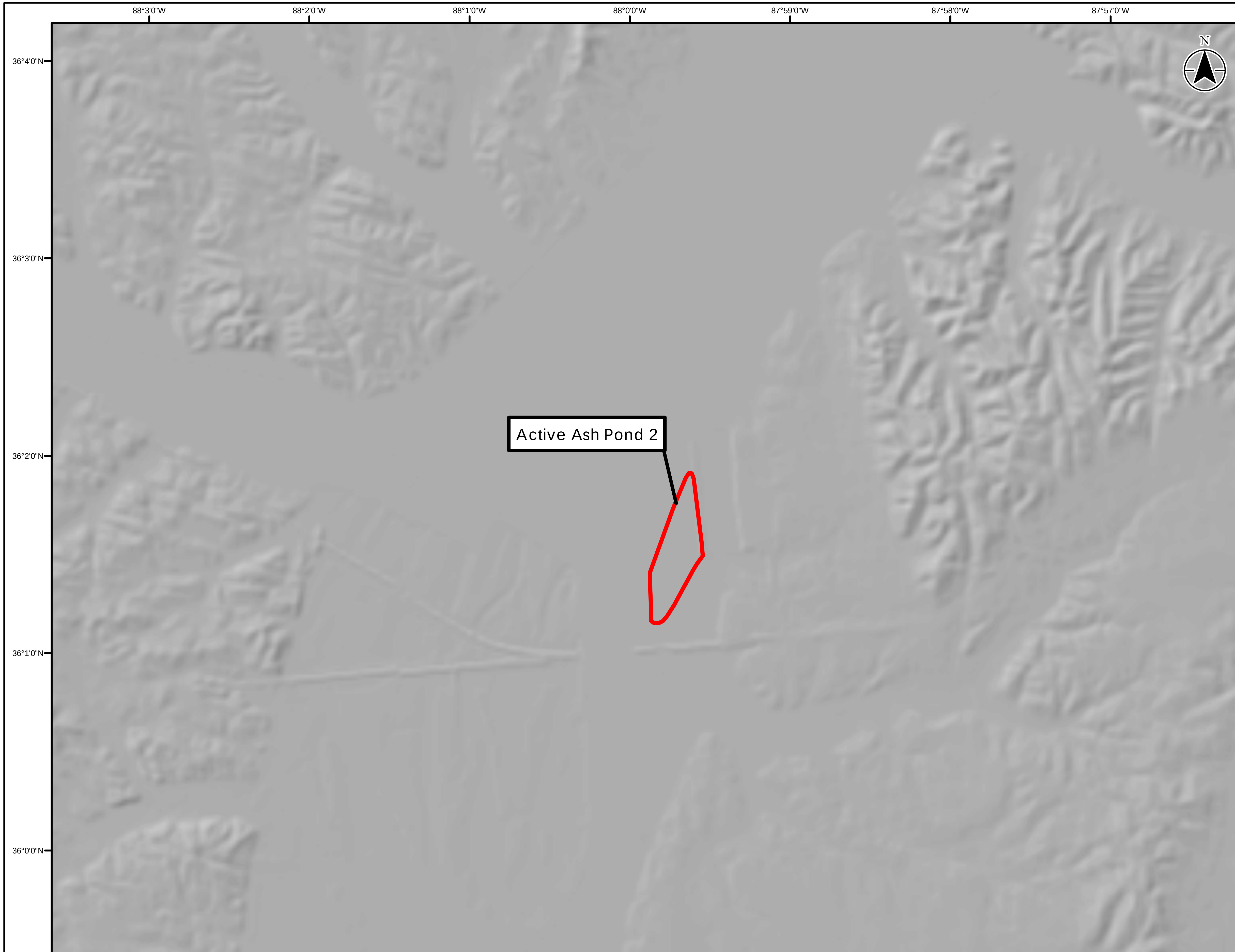


Hillshade Raster Map

Site

Johnsonville Fossil Plant
Active Ash Pond 2

Client/Project

Tennessee Valley Authority (TVA)
Chattanooga, Tennessee

Project Location

Prepared by RRR on 2018-6-27

Humphreys County,
Tennessee

0 0.5 1 Miles
1:36,000 (At original document size of 11x17)

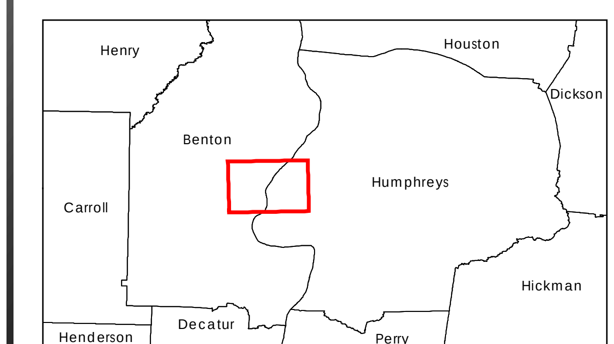
Legend

Unit Limits

Hillshade:

High : 232

Low : 109



Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Hillshade Data derived from 30m National Elevation Dataset (NED) Digital Elevation Model (DEM) from the United States Geologic Survey (USGS)

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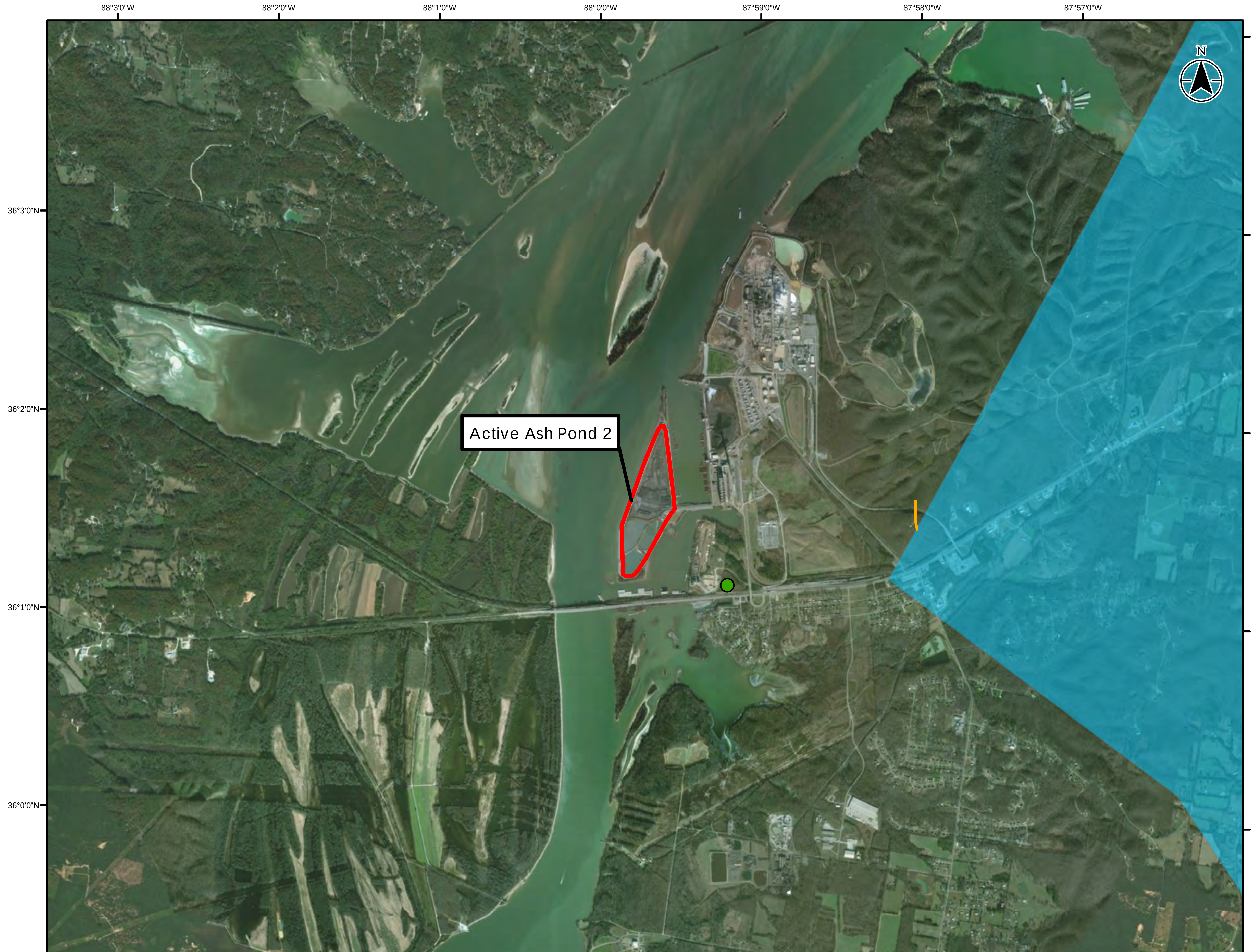


Karst Potential Map

Site
Johnsonville Fossil Plant
Active Ash Pond 2

Client/Project
Tennessee Valley Authority (TVA)
Chattanooga, Tennessee

Project Location
Humphreys County, Tennessee

Prepared by RRR on 2018-6-27

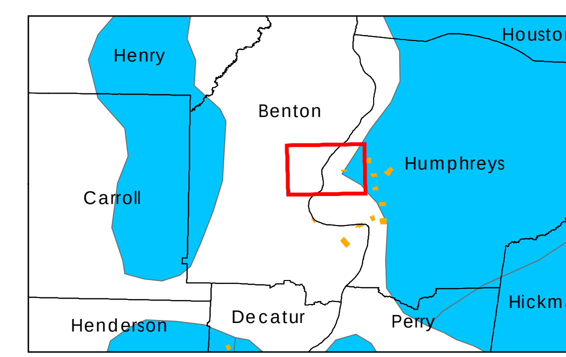
0 0.5 1 Miles
1:36,016 (At original document size of 11x17)

Legend

- Active Ash Pond 2 Unit Limits
- Fault Lines
- Karstic Soil Conditions

Reported Sinkhole Depth (m)

- 3 - 5
- 6 - 8
- 9 - 13
- 14 - 21
- 22 - 50



Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Base Map provided by ESRI
3. Tennessee Fault Line data provide by United States Geologic Survey (USGS)
4. Sinkhole data provided by TN Landforms

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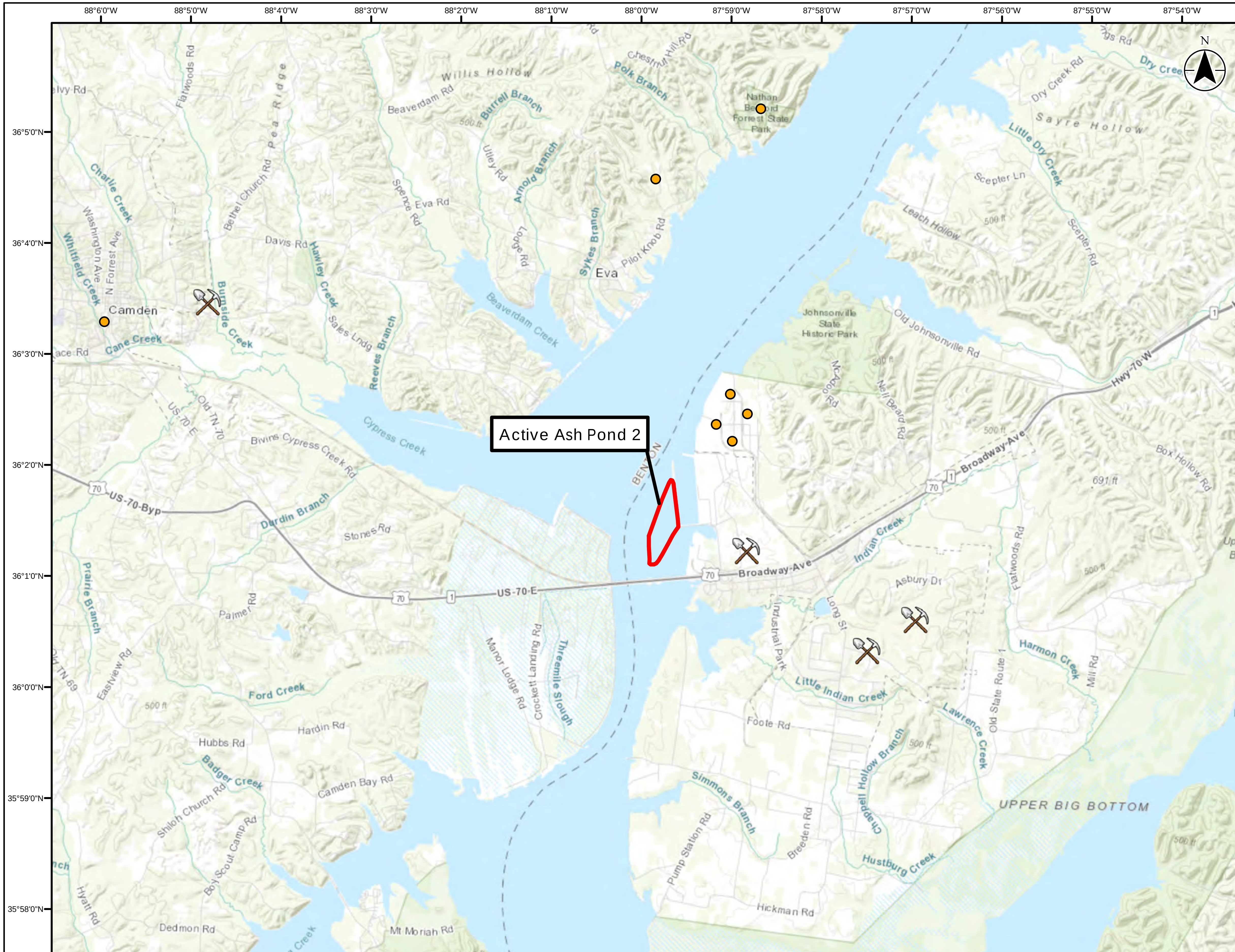
APPENDIX C
HUMAN-MADE FEATURES OR EVENTS



Human-Made Features Map

Site

Johnsonville Fossil Plant
Active Ash Pond 2

Client/Project

Tennessee Valley Authority (TVA)
Chattanooga, Tennessee

Project Location

Prepared by RRR on 2018-6-27

Humphreys County,
Tennessee

0 1 2 Miles

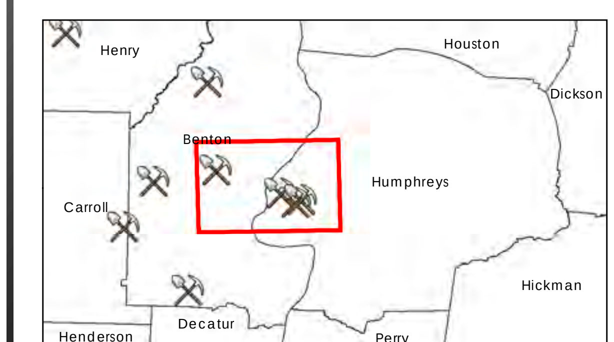
1:64,000 (At original document size of 11x17)

Legend

Unit Limits

Oil and Gas Wells

Active Mines and Mineral Plants



Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Slope Data Derived from 30m National Elevation Dataset (NED) Digital Elevation Model (DEM) from the United States Geologic Survey (USGS)

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