

CLOSURE PLAN

CCR 257.102(b)

Bottom Ash Storage Pond

Welsh Power Plant
Pittsburg, Texas

Initial: October 2016
Revision 1: February 2021
Revision 2: December 2024

Prepared for : Southwest Electric Power Company - Welsh Plant

Pittsburg, Texas

Prepared by: American Electric Power Service Corporation

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Columbus, OH 43215



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CLOSURE PLAN
CCR 257.102(b)
WELSH POWER PLANT
BOTTOM ASH STORAGE POND

PREPARED BY: 
Shah S. Baig, P.E.

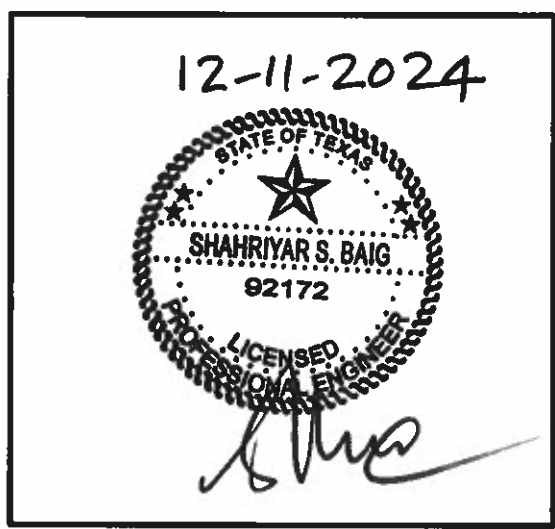
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DATE: 12/11/2024

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Bryan W. Brunton, P.E.
Section Manager – AEPSC Geotechnical Engineering

DATE: 12/11/2024



I certify to the best of my knowledge, information, and belief that the information contained in this closure plan meets the requirements of 40 CFR § 257.102

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1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CCR 257.102(b) for Closure Plans of Existing CCR Surface Impoundments

2.0 DESCRIPTION OF THE CCR UNIT

The AEP J. Robert Welsh Plant is located in southern Titus County, approximately 8 miles northeast of Pittsburg, Texas, and approximately two miles northwest of Cason, Texas. It is owned and operated by Southwest Electric Power Company (SWEPCO). The facility operates two surface impoundments for storing CCR materials called the Primary Bottom Ash pond (PBAP) and the Bottom Ash Storage pond. This report addresses the closure plan for the Bottom Ash Storage Pond (BASP). The Bottom Ash Storage pond CCR unit is located at the south end of the Plant and approximately 1,000 feet west of the Welsh Reservoir.

In 2000, the 22-acre Bottom Ash Storage Pond was constructed south of the landfill. The Bottom Ash Storage Pond receives bottom ash and economizer ash dredged from the primary bottom ash pond and non-CCR flows.

3.0 DESCRIPTION OF CLOSURE PLAN 257.102(b)(1)(i)

[A narrative description of how the CCR unit will be closed in accordance with this section]

The Welsh Bottom Ash Storage Pond will be closed by removal.

4.0 CLOSURE BY REMOVAL 257.102 (b)(1)(ii)

[If closure of the CCR unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.]

Closure will include removal of all CCR from the CCR unit. The removal of all CCR unit will be accomplished by mechanical means. The CCR material will be either hauled and placed at the onsite CCR landfill or hauled offsite for beneficial reuse.

The geomembrane liner in the pond will be removed and disposed at an approved off-site landfill. After the liner is removed, 12 inches of bottom soil will be removed as part of the closure of the CCR surface impoundment.

A 3rd party QAQC consultant will verify the removal of the CCR material and soil.

4.1 SOIL SAMPLING AND TESTING

In order to confirm and verify that the subsurface soils are free from any release or contamination due to the storage of the CCR materials in the pond, soil samples will be collected and laboratory tests performed.

Currently, all the CCR and additional 1-foot of native soils has been removed from the BASP. A detailed scope is provided in the Soil Sampling and Analysis Plan attached for reference.

4.2 CLOSURE PERFORMANCE STANDARDS 257.102 (c)

[An owner or operator may elect to close a CCR unit by removing and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to §257.95(h) for constituents listed in appendix IV to this part.]

Closure of the CCR unit will be completed when all CCR materials in the unit and any soils affected by releases from the CCR unit have been removed, and groundwater monitoring demonstrates that all concentrations of constituents are below background values using the statistical procedures in §257.93(g) for two consecutive sampling events.

5.0 ESTIMATE OF MAXIMUM CCR VOLUME 257.102 (b)(1)(iv)

[An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.]

The estimated maximum CCR volume on-site is 500,000 cubic yards in the Bottom Ash Storage Pond.

6.0 ESTIMATE OF LARGEST AREA OF CCR REQUIRING COVER

257.102 (b)(1)(v)

[An estimate of the largest area of CCR unit ever requiring a final cover

This pond will be closed by removal of CCR materials as such this section is not applicable.

7.0 CLOSURE SCHEDULE 257.102(b)(1)(vi)

[A schedule for completing all activities necessary to satisfy the closure criteria in the section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of the CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of the CCR unit closure.

The following table presents milestone activities and schedule to complete the closure of the BASP.

Cease sluicing CCR from PBAP and miscellaneous non-CCR wastewater streams to BASP	April 11, 2021
Commence Closure by submitting the Request for proposal for closure design	No later than April 11, 2021
Engineering/design schedule based on proposals	November 2022 - Completed
Construction schedule based on proposals	August 2024 - Completed
Soil Sampling	December 2024
Completion of closure	No later than April 11, 2026

ATTACHMENTS

American Electric Power/Southwestern Electric Power
Company

Soil Sampling and Analysis Plan - Bottom Ash Storage Pond

**J. Robert Welsh Power Plant
1187 County Road 4865
Pittsburg, Titus County, Texas**

September 2024
Updated November 2024

Soil Sampling and Analysis Plan – Bottom Ash Storage Pond

J. Robert Welsh Power Plant
1187 County Road 4865
Pittsburg, Titus County, Texas

September 2024

Updated November 2024

Prepared By:

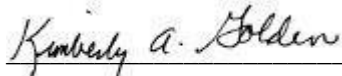
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Prepared For:

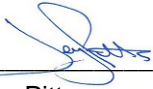
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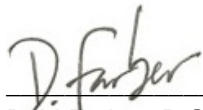
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Figure 1. Site Location Map

Figure 2. Coal Combustion Residual (CCR) Unit Location Map

Figure 3. Bottom Ash Storage Pond Sampling Grid

Acronyms and Abbreviations

AEP	American Electric Power Company
BASP	Bottom Ash Storage Pond
CCR	Coal Combustion Residue
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
DPT	Direct Push Technology
EPA	Environmental Protection Agency
Ft bgs	Feet Below Ground Surface
GPD	Gallons per Day
HASP	Health and Safety Plan
HDPE	High-density Polyethylene
JSA	Job Safety Analysis/Analyses
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
NELAP	National Environmental Laboratory Accreditation Program
NOR	Notice of Registration
PBAP	Primary Bottom Ash Pond
pCi/L	Picocuries/Liter
PCL	Protective Concentration Level
SIN	Self-Implementation Notice
SPLP	Synthetic Precipitation Leaching Procedure
SWEPCO	Southwestern Electric Power Company
TAC	Texas Administrative Code
TAT	Turnaround Time
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
USCS	Unified Soil Classification System

1 Introduction

Southwestern Electric Power Company (SWEPCO), a subsidiary of American Electric Power (AEP), owns and operates the coal-fired J. Robert Welsh Power Plant (the Plant), located at 1187 County Road 4865 in southern Titus County, approximately eight miles northeast of Pittsburg, Texas and approximately two miles northwest of Cason, Texas (**Figure 1**). The Welsh Plant, which occupies approximately 354 acres, began operations in 1977 with three coal-fired generating units (Units 1,2, and 3) (Arcadis, 2018).

Throughout the life of the generating Plant, coal combustion residuals (CCR) (fly ash, bottom ash, and economizer ash) have been generated. These CCR byproducts were stored in either the Primary Bottom Ash Pond (PBAP) or the adjacent landfill that was constructed in 1977. In 2000, the 22-acre Bottom Ash Storage Pond (BASP) was constructed south of the landfill and received CCR waste streams from the PBAP. A site plan showing the Plant and CCR units is provided as **Figure 2**.

AEP will close the BASP and PBAP by removal. Arcadis U.S., Inc. (Arcadis), on behalf of AEP, has prepared this Soil Sampling and Analysis Plan (SAP) to support closure of the BASP. As part of closure, SWEPCO must demonstrate that the unit has been adequately decontaminated for the list of constituents in 40 CFR 257 Appendix IV. This SAP covers the collection and analysis of soil samples which will be performed after removal activities at the BASP to make this demonstration. The determination of 'adequate decontamination' for the unit will be made by comparing the soil sample results first to the lower value of the soil-to-groundwater residential assessment levels (RALs; under the Texas Risk Reduction Program [TRRP], 30 Texas Administrative Code [TAC] Chapter 350) or the Texas Specific Background values for 40 CFR 257 Appendix IV constituents. For constituents that do not have a soil-to-groundwater RAL, the Synthetic Precipitation Leaching Procedure (SPLP) test method will be utilized, and the results will be compared to the site-specific groundwater protection standard (GWPS) developed in accordance with 30 TAC Chapter 352.

This SAP will be provided to the Texas Commission on Environmental Quality (TCEQ) for review and approval. After receiving TCEQ's approval, the SAP will be implemented and a report summarizing the sampling results will be prepared and submitted to the TCEQ as part of the BASP closure package.

The soil SAP for the PBAP is provided under separate cover.

2 Unit Description

The BASP (Notice of Registration [NOR] No. 014) was constructed in 2000 (Central and South West Services, Inc., 2000) with a 60-mil high-density polyethylene (HDPE) liner, a capacity of 555,000 cubic yards, an area of 22 acres, and it measured 985 feet long by 923 feet wide by 20 feet deep. The BASP received bottom ash and economizer ash dredged and sluiced from the PBAP as well as stormwater runoff from a small watershed area of the Plant property and an adjacent ash storage area. Decant water from the BASP flowed back into the PBAP. The BASP received CCR and non-CCR Class 2 non-hazardous waste streams, including: fly ash/removal of fine particulates from flue gas, bottom ash, ecology pit sediment - dewatered, and aqueduct sediment - cleanout of water supply pipeline.

The BASP is now in the process of being closed by removal of CCR. The unit is under a groundwater monitoring program that includes semi-annual groundwater sampling (AEP, 2022).

3 Summary of Closure Activities

In a letter dated October 23, 2020, AEP requested an extension from the TCEQ to cease receipt of CCR waste and initiation of closure activities at the BASP until April 11, 2021. The TCEQ granted the extension in a letter dated October 30, 2020 (TCEQ, 2020). AEP submitted the initial Intent to Initiate Closure Notification for the BASP to the TCEQ on April 6, 2021, and submitted a revised notice on June 1, 2021. A Closure Plan for the BASP was prepared in accordance with 40 Code of Federal Regulations (CFR) §257.102(b) in October 2016 and revised in February 2021. As stated in the Closure Plan, the BASP is undergoing closure by CCR removal.

AEP ceased sluicing CCR from the PBAP and sending miscellaneous non-CCR wastewater streams to the BASP on April 6, 2021. Per 40 CFR §257.102(c) and 30 TAC §352.1221, part of the closure by removal process involves removing and decontaminating all areas affected by releases from the CCR unit. In order to achieve this goal, AEP determined that, in addition to removal of the CCR, an additional 12 inches (minimum) of existing soil beneath the pond would be excavated.

AEP completed removal of 334,344 cubic yards CCR from the BASP in August 2024. The additional one foot of soil is currently being removed from the BASP. A construction as-built drawing showing the contours of the bottom of the pond after CCR and soil were removed from the BASP was prepared by the Construction Quality Assurance (CQA) contractor. The contractor placed approximately five feet of backfill in approximately 9.6 acres of the southern portion of the BASP. However, backfilling was terminated after the TCEQ informed AEP in an email that soil sampling for the 40 CFR 257 Appendix IV constituents is required to demonstrate that the unit was adequately decontaminated (TCEQ, 2024). The objective of the proposed soil sampling strategy in Section 4 is to provide this demonstration.

The CCR and soil removed from the BASP during closure were disposed of in the onsite landfill. Inspections were performed and documented throughout the closure activities by the CQA contractor. A closure certification report summarizing the closure activities will be submitted to the TCEQ after final closure is completed.

4 Soil Sampling Strategy and Methodology

As stated previously, the BASP has an area of approximately 22 acres. The objective of the soil sampling is to collect samples from the exposed native soil where no fill has been placed and from native soil underlying the fill in the southern portion of the pond to demonstrate that CCR and soil removal activities performed during the BASP closure were adequate to decontaminate the pond area.

4.1 Pre-Sampling Activities

A site-specific Health and Safety Plan (HASP) and relevant task-specific Job Safety Analyses (JSA) will be prepared for the project, prior to mobilizing personnel to the site. Arcadis will work with AEP to incorporate any AEP-specific health and safety requirements into the plan. The HASP will be reviewed and signed off on by the onsite Arcadis field scientist/geologist, who will then review it during an initial health and safety meeting with subcontractors (utility locator, driller, surveyor). Daily tailgate safety meetings will be conducted and documented in the field notes.

Arcadis will mobilize to the site to measure out a one-acre grid on the BASP (**Figure 3**). Each grid block will be assigned an identifier (e.g., A1, B1, etc.). A sample location will be selected randomly in each grid block and

marked in the field with a stake or a flag. Therefore, it is estimated that 21 soil borings will be advanced within the BASP. Arcadis will work with a surveyor from AEP's CQA contractor, Akron Consulting Company, LLC (Akron), to establish the grid, survey the sample locations, and determine the depth at which native soil will be encountered in the backfilled portion of the BASP. The sample number and depth to native soil at each location will be marked on the sample location marker.

Prior to initiating any intrusive work, the presence of subsurface and overhead utilities will be investigated. In accordance with the Arcadis Utility Location and Clearance Standard, the following will be completed:

- Plant excavation/digging permit prior to any sampling activities.
- After sample locations have been marked in the field, Arcadis or its drilling contractor will notify Texas 811 a minimum of 48 hours in advance of commencing intrusive activities at the site and identify any potential subsurface utility conflicts with proposed sampling locations.
- In addition, Arcadis will review any prior utility clearance for the unit or available drawings showing underground utilities in the sampling areas.
- If the prior utility clearance information or drawings showing underground utilities in the sampling area are not available, the soil boring locations will be cleared for subsurface utilities to a minimum depth of 5 feet below ground surface (ft bgs) utilizing a hand auger as a soft-dig utility clearance technique. If any obstruction is identified, the soil boring location will be field adjusted.

4.2 Sampling Methodology

Drilling will be performed by a Texas licensed drilling company with oversight by a field scientist or field geologist.

Soil sampling can be performed using a track-mounted Direct-Push Technology (DPT) rig. In the area where there is fill, the DPT rig will be positioned over the proposed sampling location in the approximate center of the grid block to advance the soil sampler through the fill material to the top of the native soil. The soil will be continuously logged by a field scientist or geologist for lithologic characteristics according to the Unified Soil Classification System (USCS). The field scientist/geologist will note general visual and olfactory observations, soil types and horizons, and depth to native soil.

Once native soil is reached beneath the fill material, a discrete grab sample will be collected from the upper one foot of native soil by the field scientist/geologist. Where there is no fill, the DPT rig will advance the sampler into the upper one foot of native soil for sample collection. The field scientist/geologist will ensure that adequate sample volume is collected for analysis of total 40 CFR 257 Appendix IV constituents and possible analysis using the Synthetic Precipitation Leaching Procedure (SPLP) (if needed for data evaluation purposes). In addition to the initial sample collected from the upper foot of native soil, two additional samples will be collected from estimated depths of 1-2 and 2-3 feet below the initial sample. The additional samples will be placed on hold and analyzed only if needed.

Soil samples will be placed in clean sampling jars provided by the laboratory and labeled with the sample number (Grid Designation-Sample Depth-Date), sampler's initials, sample time, and requested analyses. The field scientist/geologist will wear a new pair of nitrile gloves for each sample collected. The samples will be placed in a cooler with ice and sent to the laboratory by overnight courier each day under proper chain of custody.

4.3 Investigation-Derived Waste Management

Soil cuttings generated during drilling will be placed back in the borehole, and the boreholes will be filled with bentonite. A decontamination pad will be constructed within the footprint of the BASP. The soil sample tubes will be decontaminated between collection of soil samples and downhole equipment in contact with soil will be decontaminated between soil sample locations. The drillers will use the onsite potable water source to decontaminate the downhole equipment and samplers using a high-pressure water washer. No soap will be used, and the pad will be constructed to prevent erosion and run-off from the pad. Accumulated water will be allowed to evaporate or will be drummed and disposed of offsite. General trash (e.g., used gloves, plastic liners, paper products, disposable sampling equipment, etc.) will be collected, containerized, and managed with general facility trash.

5 Sample Analysis

All 21 soil samples collected from the BASP will be submitted to a National Environmental Laboratory Accreditation Program [NELAP] accredited laboratory for analysis of the Appendix IV to 40 CFR 257 constituents, as follows:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Fluoride
- Lead
- Lithium
- Mercury
- Molybdenum
- Selenium
- Thallium
- Radium 226 and 228 combined

Each of the 21 initial soil samples collected at the BASP will be analyzed for the metal constituents listed above. Arcadis will work with the laboratory to ensure that the detection limits are below the comparative criteria (i.e., the residential soil-to-groundwater Tier 1 PCLs and/or Texas-Specific Background concentration for metals). Fluoride and lithium do not have Tier 1 PCLs for the soil-to-groundwater pathway; therefore, they will only be analyzed using SPLP.

Radium also does not have a Tier 1 PCL for soil, however, EPA has established a radium level of 5 picoCuries per gram (pCi/g) above background as a protective health-based level for cleanup of soil in the top 15 centimeters (6 inches) (EPA, 2014). If there are exceedances of the EPA established radium level, select samples will be run for SPLP. During a teleconference on June 10, 2024 between AEP and the TCEQ regarding soil sampling for closure, TCEQ agreed that fewer samples could be collected for radium 226/228; therefore, 50% of the soil samples will be analyzed for radium 226/228 combined. If there are metal exceedances of ^{GW}Soil_{Ing} PCL, Tier 2 PCLs may be calculated using the site-specific pH value of 7.5 as calculated in the Affected Property Assessment Report for the Boiler Cleaning Pond Closure dated December 18, 2013 (Arcadis, 2013).

Arcadis will complete data evaluation immediately upon receipt of the sample results to allow time for SPLP analysis or analysis of delineation samples, as needed. SPLP analysis will be performed if the total concentration

results for a constituent exceeds the respective Residential PCL for the soil to groundwater protection standard (^{GW}Soil_{ing} PCL). The SPLP results will be compared to the site-specific CCR groundwater standards.

6 Data Evaluation

Arcadis will implement the general procedures for data evaluation and usability assessment as defined in the TCEQ Regulatory Guidance for Review and Reporting of COC Concentration Data RG-366/TRRP-13 to validate data received from the analytical laboratory. Validated data will then be compared to assessment levels to determine whether the unit has been adequately decontaminated. The procedure for evaluation of the results are discussed in the following sections.

6.1 Evaluation of Results

Total metal concentrations will be evaluated to determine if the Appendix IV COC concentrations exceed the soil-to-groundwater PCLs. If the Texas-Specific Background concentration for a metal is greater than the soil-to-groundwater PCL, the background concentration is substituted and becomes the PCL. Determination of successful decontamination will be as follows:

- If any metals exceed the respective Tier 1 ^{GW}Soil_{ing} PCLs, a Tier 2 PCL will be calculated and the analytical results will be compared to the Tier 2 PCLs.
- If a COC exceeds the respective Tier 2 PCL, it will be analyzed using SPLP. The SPLP results will be compared to the site-specific Groundwater Protection Standard (GWPS). If the SPLP results are equal to or less than the GWPS, decontamination has been confirmed.
- After the above evaluation sequence, if it is decided that one or more metal exceedances of a comparative criterion cannot be resolved, Arcadis will request that the laboratory analyze the next shallowest vertical delineation sample from the location where the exceedance(s) occurred for that COC(s) to perform vertical delineation.
- Horizontal delineation will be completed as needed.

7 Report Preparation and Certification

Arcadis will prepare a report summarizing the results of the soil sampling at the BASP. The report will be certified by a Texas-licensed Professional Engineer and will include:

- A summary of the soil sampling activities performed to support the closure of each CCR unit and how these activities were performed in accordance with the TCEQ-approved SAP.
- Discussion of any deviations from the TCEQ-approved SAP and rationale for those deviations.
- Figures depicting sampling locations, and sample results.
- Data summary tables for metals and radium-226/228, including comparative criteria and SPLP results (as applicable).
- Calculations for Tier 2 PCLs (as applicable).
- Comparison of the analytical results to the site-specific GWPS.

Soil Sampling and Analysis Plan - Bottom Ash Storage Pond and Primary Bottom Ash Pond

- Appendices containing laboratory reports, data usability evaluations/data validation reports, any other reports or correspondence that support the BASP closure.

8 References

AEP. 2020. Closure Plan, Primary Bottom Ash Pond, Welsh Power Plant, Pittsburg, Texas. November.

AEP. 2022. Application for CCR Unit Registration. January 19, 2022.

Arcadis. 2013. Affected Property Assessment Report, Welsh Power Plant – Boiler Cleaning Pond Closure. December 18.

Arcadis. 2016. Bottom Ash Storage Pond – CCR Location Restriction Evaluation. May 2.

Arcadis. 2018. Primary Bottom Ash Pond – CCR Location Restriction Evaluation. October 3.

Central and South West Services, Inc. 2000. Letter to the Texas Natural Conservation Commission Executive Director, Notification of Construction of the new Welsh Bottom Ash Storage Pond. January 31.

Environmental Protection Agency (EPA). 40 CFR 257. Criteria for Classification of Solid Waste Disposal Facilities and Practices.

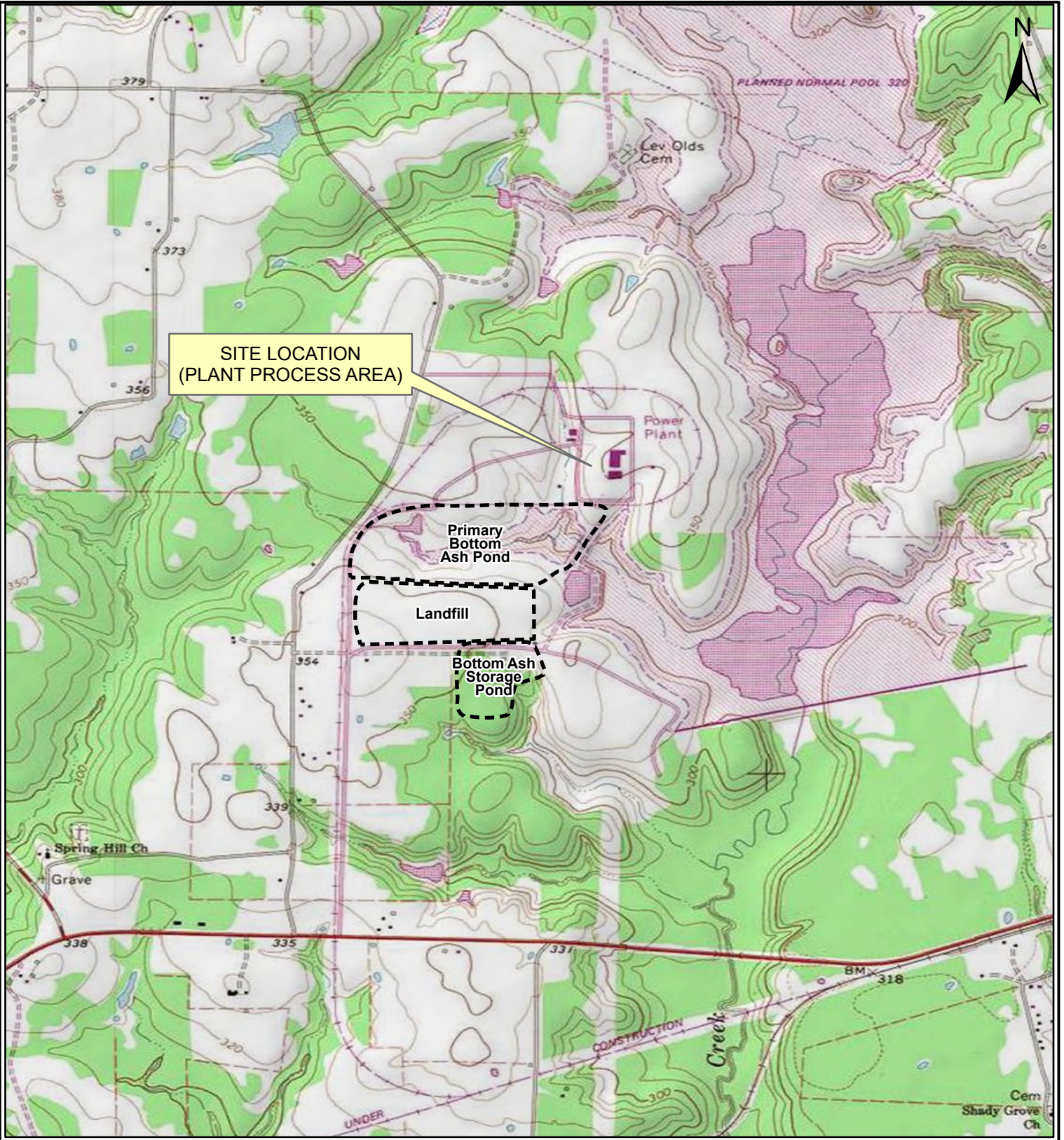
Texas Commission on Environmental Quality (TCEQ). 2020. Letter on New Cease Receipt of Waste and Initiation of Closure Deadline for Coal Combustion Residual Unit, AEP Southwestern Electric Power Company – Pittsburg, Titus County. October 30.

TCEQ. 2024. Email from Fabienne Rambaud, P.G. to Rebecca Jones (AEP). July 12.

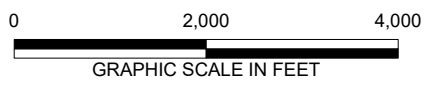
TCEQ. 30 TAC 350. Texas Risk Reduction Program.

Figures

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J. ROBERT WELSH POWER COMPANY
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS
SOIL SAMPLING AND ANALYSIS PLAN – BOTTOM ASH STORAGE POND

SITE LOCATION MAP



FIGURE
1

NOTE:
1. BASEMAP SOURCE: 7.5 MINUTE TOPOGRAPHIC QUADRANGLE FOR CASON, TEXAS, 2011

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WELSH RESERVOIR

WELSH PLANT

PRIMARY BOTTOM ASH POND

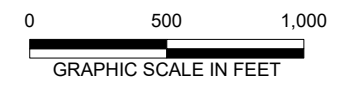
LANDFILL

BOTTOM ASH STORAGE POND

HWY 1735

LEGEND

 COAL COMBUSTION RESIDUAL (CCR) UNIT



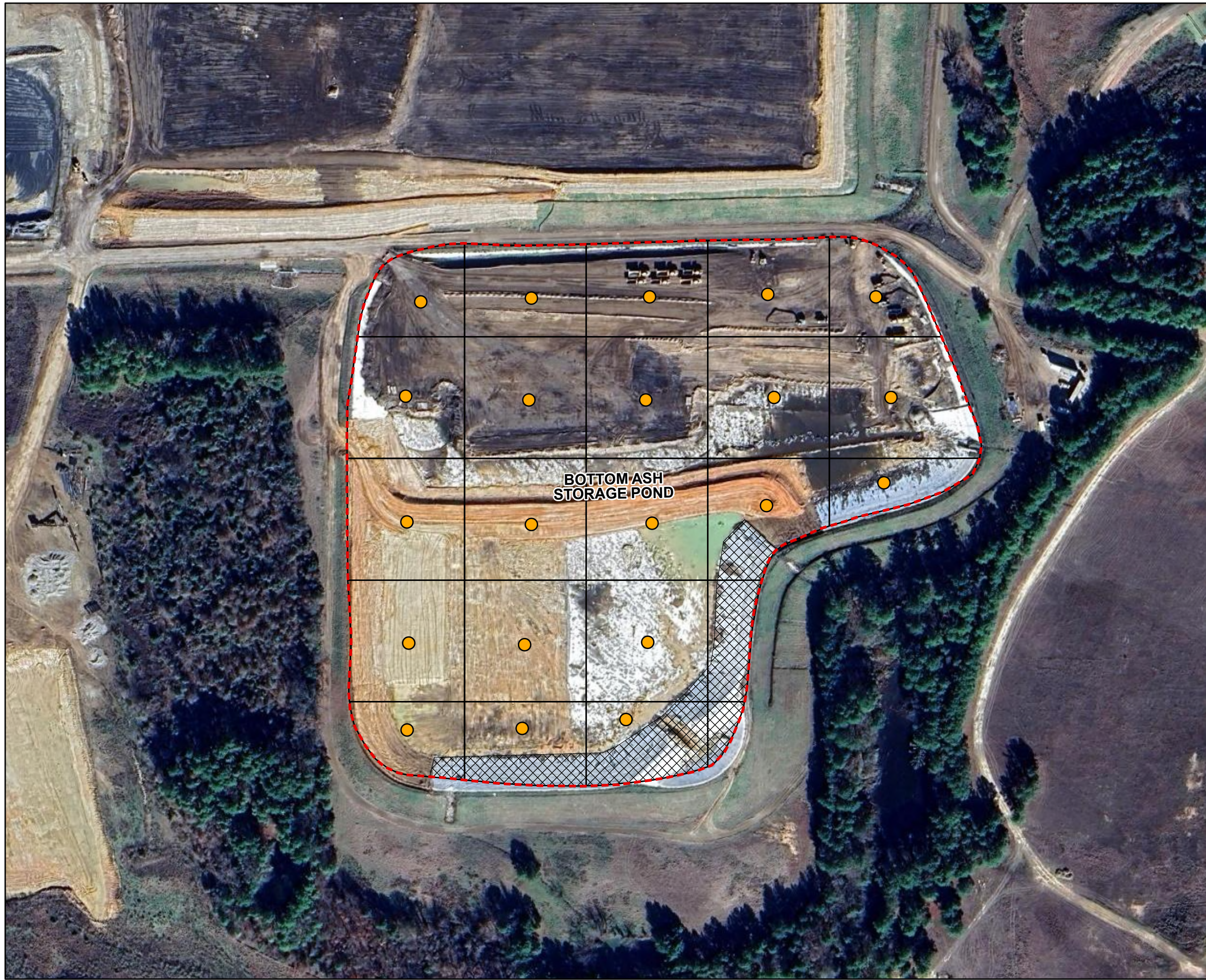
NOTE:
1. BASEMAP SOURCE: GOOGLE EARTH PRO, DECEMBER 2023

J. ROBERT WELSH POWER COMPANY
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS
SOIL SAMPLING AND ANALYSIS PLAN – BOTTOM ASH STORAGE





**COAL COMBUSTION RESIDUAL (CCR) UNIT
LOCATION MAP**

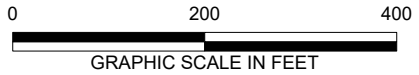


FIGURE
2



LEGEND

-  APPROXIMATE SAMPLE LOCATION
-  COAL COMBUSTION RESIDUAL (CCR) UNIT
-  AREA NOT ACCESSIBLE FOR SAMPLING
-  1-ACRE GRID



- NOTES:**
1. BASEMAP SOURCE: GOOGLE EARTH PRO, DECEMBER 2023
 2. SAMPLE LOCATIONS WILL BE SELECTED RANDOMLY USING A RANDOM NUMBER GENERATOR WITHIN EACH GRID.

J. ROBERT WELSH POWER COMPANY
 1187 COUNTY ROAD 4865
 PITTSBURG, TITUS COUNTY, TEXAS
SOIL SAMPLING AND ANALYSIS PLAN – BOTTOM ASH STORAGE POND

**BOTTOM ASH STORAGE POND
 SAMPLING GRID**

	<p align="center">FIGURE 3</p>
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