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AMERICAN ELECTRIC POWER

ALTERNATIVE SOURCE DEMONSTRATION - LITHIUM PRIMARY BOTTOM ASH POND

J. Robert Welsh Power Plant

1187 County Road 4865

Pittsburg, Titus County, Texas

October 28, 2020

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Prepared for:

American Electric Power Corporation

Prepared by:

Arcadis U.S., Inc.
100 E Campus View Boulevard
Suite 230
Columbus
Ohio 43235-1447
Tel 614 985 9100
Fax 614 985 9170
Texas Geoscience Firm Reg. No. 50158
Texas Board of Professional Engineers
Firm Reg. No. F-533

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Kenneth J. Brandner, P.E., P.G.
Geological Engineer

Everett H. Fortner III, PG
Senior Geologist

Michael Hay, PhD
Principal Geochemist

Matthew J. Lamb
Project Manager

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
Arcadis	Arcadis U.S., Inc.
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
ft	feet
GWPS	groundwater protection standard
MCL	maximum contaminant limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
PBAP	Primary Bottom Ash Pond
SPLP	Synthetic Precipitation Leaching Procedure
SSI	statistically significant increase
SSL	statistically significant level
USDA	United States Department of Agriculture
USGS	United States Geologic Survey

1 INTRODUCTION

This Alternate Source Demonstration (ASD) report has been prepared on behalf of American Electric Power Corporation for lithium detected in groundwater at hydraulically downgradient monitoring well AD-9 at the Primary Bottom Ash Pond (PBAP) at the J. Robert Welsh Plant site located in Titus County, Texas. This ASD report was prepared in accordance with the Coal Combustion Residual (CCR) Rule (the Rule) specified in 40 Code of Federal Regulations (CFR) §257 and based on recommendations provided in the Electric Power Research Institute “Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites” (Electric Power Research Institute [EPRI] 2017). As part of the Rule, CCR facility owners are required to conduct detection and assessment monitoring of “Appendix III” and “Appendix IV” constituents, respectively, to ensure compliance with applicable groundwater standards (described further below). Because the monitored constituents also have natural sources and can be influenced by sampling methodology implementation, the Rule allows owners or operators to evaluate and demonstrate whether a source other than the CCR unit caused a statistically significant increase (SSI) over background levels for an Appendix III constituent or at statistically significant levels (SSLs) over groundwater protection standards for an Appendix IV constituent, such as natural variation in groundwater quality or sampling methodology error.

The owner or operator must complete the written ASD within 90 days of identifying the SSI or SSL and include the certification from a qualified professional engineer to verify the accuracy of the information in the report. An SSL was identified for lithium at monitoring well AD-9 as detailed in the September 1, 2020 report entitled “Statistical Analysis Summary, Primary Bottom Ash Pond” (Geosyntec 2020). Therefore, this ASD report was prepared by Arcadis U.S., Inc. (Arcadis) on behalf of American Electric Power Corporation within the 90-day period and has been certified by a qualified professional engineer.

1.1 Facility History

The J. Robert Welsh Plant is located within southern Titus County, approximately eight miles northeast of Pittsburg, Texas, and approximately two miles northwest of Cason, Texas (**Figure 1-1**). The Plant began operations in 1977 with three coal-fired generating units (Units 1, 2, and 3). Currently, only Units 1 and 3 are operational. Throughout the life of the Plant, CCR materials (fly ash, bottom ash, economizer ash) have been generated. These byproducts were stored in the PBAP and in the adjacent Landfill that were constructed in the late 1970s. In 2000, the 22-acre Bottom Ash Storage Pond was installed south of the Landfill. The Bottom Ash Storage Pond was constructed with a 60-mil high-density polyethylene liner (**Figure 1-2**).

Presently bottom ash and economizer ash from the Plant are sluiced to the PBAP. Solids settle as the clear liquids flow through a drainage canal into the clear water pond (a non-CCR unit). Solids (bottom ash and economizer ash) in the PBAP are dredged and sluiced into the Bottom Ash Storage Pond. Marketable ash material from the PBAP is also temporarily stored in the western two thirds of the Landfill for processing, then loaded into trucks and sold for beneficial reuse (highway road base, etc.).

2 PHYSICAL SETTING

2.1 Regional Topography

The elevation at the Site ranges from approximately 300 feet (ft) above mean sea level (amsl) at Swauano Creek downstream of the Welsh Reservoir, to 360 ft amsl at a topographically high ridge at the west end of the Landfill. The PBAP is in a topographically low area that had been an un-named intermittent tributary of Swauano Creek prior to development of the Site. The Landfill is approximately 40 acres in size and is located in a topographically higher area directly south of the PBAP. The Bottom Ash Storage Pond is approximately 22 acres in size and in a topographically higher area directly south of the Landfill.

A topographically high ridge is present directly northwest of the Site where offsite monitoring wells AD-22 and AD-23 were installed along the FM 1735 right-of-way during June 2019. Ground surface elevation at these offsite monitoring wells ranges from approximately 361 ft amsl at AD-22 to 369 ft amsl at AD-23.

2.2 Geology and Soils

2.2.1 Regional and Local Geology

The Site area is located within the West Gulf Coastal Plain. Cretaceous formations crop out in belts that extend in a northeasterly direction parallel to the Gulf of Mexico, and dip gently to the southeast. The Site, including all three CCR Units (PBAP, Landfill, Bottom Ash Storage Pond), is located along the outcrop of the Eocene-age Reklaw Formation, which consists of very fine to fine grained sand and clay (Flawn 1966). The Reklaw Formation attains a thickness of approximately 110 ft in Titus County, and is underlain by the Eocene-age Carrizo Sand which consists of fine to coarse sand, silt, and clay (United States Geologic Survey [USGS] 1965). In the topographically low areas underlying the Welsh Reservoir to the east of the PBAP, Quaternary alluvial sediments associated with Swauano Creek are present (Flawn 1966).

All of the CCR monitoring wells at the Site are completed in the Reklaw Formation. The two offsite monitoring wells (AD-22, AD-23) west of the Site are completed in the overlying Queen City Formation. Monitoring well locations are shown on **Figure 2-1**.

As shown on the regional geologic map and legend (**Figure 2-2A** and **Figure 2-2B**), the Reklaw Formation outcrop (Er) at the Site is relatively narrow (less than 1 mile in width). The Reklaw Formation is overlain by the Eocene-age Queen City Formation, which outcrops in topographically higher areas west of the Site, including the area where monitoring wells AD-22 and AD-23 are located. The Queen City Formation consists of fine to medium grained sand, shale, silt, and impure lignite, and attains a thickness of approximately 210 ft in Titus County (USGS 1965). The Queen City Formation also contains ironstone concretions (Flawn 1966).

2.2.2 Regional and Local Soil Composition

Information gathered from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Services soil data provides a detailed inventory of the regional soils and their characteristics, including the widespread distribution of clay-bearing soils, that support data collected at the Site from soil borings and groundwater monitoring well locations. Two main named soil layers are present in the Pittsburgh, TX, area in the vicinity of the Site:

- Norfolk sandy loam
- Susquehanna fine sandy loam

Both soils are similar in the uppermost 1.5 ft of material, generally grayish in color and containing fine sand, silt, and clay. However, the subsoils of both units have subtle differences from one another and are described herein. Observations from soil borings at the Site are consistent with the characteristics of one or both of these soil units, as described in the USDA Natural Resources Conservation Services document.

The Norfolk sandy loam is a widely distributed soil unit that is uniformly developed in the lowland areas and is derived from weathering Eocene-aged deposits. It is a generally porous soil, allowing infiltrating water to migrate downward toward the water table. The soil layer is generally yellowish-gray in color, however the subsoil at greater depths is characterized by increased clay content and a mottled red and yellow appearance. As noted in the USDA soil descriptions, the soil and subsoils of the Norfolk sandy loam may be broken down into the grain size distributions presented in **Table 2-1**.

The Susquehanna fine sandy loam is also widely distributed and generally resembles the Norfolk sandy loam at the surface. Subsoils of the Susquehanna contain a greater component of clay, and likely contain increased iron content, as evidenced by observed iron concretions and iron crust formation within the subsoil. This soil is often mottled in appearance, ranging from red and yellow to a reddish brown or gray. Despite the greater clay content, the soil and subsoil is not impervious to infiltrating water that migrates toward the water table. As noted in the USDA soil descriptions, the soil and subsoils of the Susquehanna fine sandy loam may be broken down into the grain size distributions presented in **Table 2-2**.

These soil descriptions are important for the understanding of contributing sources of key constituents, such as lithium to the groundwater system. Lithium can occur in soils through natural weathering processes and the development of clay minerals. In particular, lithium can be incorporated into the structure of clays in the smectite group through cation substitution, which is further influenced by the presence of iron within the clay structure (Drever 2002; Stucki 2005). The widespread distribution of clay deposits in the native soils in and near the Site and the propensity for clays to contain trace constituents of potential concern supports the potential for natural sources of lithium.

Geologic cross-sections were generated to evaluate the stratigraphy in the area of the PBAP. The lines of geologic cross-section are shown on **Figure 2-3** and the cross-section details for cross-sections A-A’ through E-E’ are shown on **Figures 2-4** through **2-8**, respectively. As shown on **Figure 2-4**, an unsaturated brown to gray clay and sandy clay stratum is present in the area of the PBAP from the surface to a depth of approximately 20 ft below ground surface. The clay stratum is underlain by a saturated fine to medium grained clayey and silty sand stratum with an average thickness of approximately 10 ft and is consistent with the soils of the Susquehanna fine sandy loam deposits. As discussed below in Section 2.3.2, this saturated sand stratum is the uppermost water-bearing unit in the area of the PBAP. This sand stratum is underlain by an unsaturated gray to black silty clay stratum that locally serves as a lower confining layer (aquitard) for the uppermost water-bearing unit.

As shown on **Figures 2-2A** and **2-4**, the Queen City Formation outcrops in the topographically high area to the northwest of the Site. The geologic contact between the Queen City Formation, in which offsite monitoring wells AD-22 and AD-23 are completed, and the Reklaw Formation, in which the CCR monitoring wells are completed, is located near an elevation of 340 ft amsl as shown on **Figure 2-4**. The Queen City Formation directly west of the Site consists predominantly of clayey sand, and the underlying Reklaw Formation consists of interbedded sand, silt, and clay strata.

2.3 Hydrology and Water Quality

2.3.1 Regional Hydrology and Water Quality

The Reklaw Formation, which outcrops at the Site, and the overlying Queen City Formation, which outcrops west of the Site, are part of the Cypress Aquifer, which also includes the underlying Carrizo Sand and Wilcox Formation (USGS 1965). As shown on **Figure 2-9**, the Cypress Aquifer is approximately 900 ft thick in the Site area, and the base of fresh water in the Cypress Aquifer is approximately 800 ft below ground surface.

Regional groundwater characteristics are presented in Texas Water Commission Bulletin 6517 "*Ground-Water Resources of Camp, Franklin, Morris, and Titus Counties, Texas, Texas*" (USGS 1965). All of the regional aquifer units are combined in this document, and considered as one interconnected unit, referred to as the "Cypress aquifer". This singular aquifer unit, composed of all water bearing units of similar character, was divided into three zones based on water quality characteristics of each zone rather than lithology. The following three zones were identified, in order of increasing relative depth:

- Zone A: characterized by minimal iron content and low pH, ranging from 4.5 to 6.5.
- Zone B: characterized by increased dissolved iron content and pH ranging from 5.0 to 7.0
- Zone C: characterized by iron concentrations of less than 0.3 milligrams per liter (mg/L) and neutral to alkaline pH (7.0 to 8.0)

Groundwater at the Site is generally assumed to be influenced by groundwater from Zones A and B. As described in USGS, 1965, Zones A and B can be more simply described as:

- Zone A: zone of oxidation and acidic groundwater
- Zone B: intermediate zone

The dissolved iron content in the A and B zones (ranging from non-detect to greater than 10 mg/L; USGS 1965) is likely influenced by iron present in the soils and sediments, which are described in Section 2.2. Slow recharge rates and transmissive properties of these zones contributes to longer residence times whereby the infiltrating groundwater may react with soil and sediments, allowing for the oxidation of sulfides to generate sulfate and mobilizing ferrous iron into solution. In addition, groundwater from several wells completed in shallow (less than 60 ft in depth) sediments contained sulfate concentrations above

1,000 mg/L. Sulfate concentrations observed at the Site are consistent with the range of data for other similar depth wells in the four-county area (USGS 1965).

Additional regional groundwater information is provided in the 107th Annual Meeting of the Texas Academy of Science abstract titled “Natural Sources of Poor Water Quality in Streams of East Texas” (Ledger et. al. 2004). This study characterized surface water streams associated with the regional groundwater in the Eocene-aged Reklaw Formation as acidic with high concentrations of sulfate, and arsenic concentrations greater than 0.01 mg/L.

An observed decline in surface water quality was also noted if springs from the Reklaw Formation discharge to surface water bodies. Abundant sulfur is noted in the Reklaw formation and sediments undergo acid-sulfate weathering, as evidenced in the red-stained soils and sulfate concentrations of greater than 1,000 mg/L (Ledger et. al. 2004). In streams associated with the Reklaw Formation, sulfate levels may exceed 1,000 mg/L.

2.3.2 Local Hydrology

Groundwater flow direction at the Site is generally from west to east, following surface topography towards the Welsh Reservoir. Groundwater elevations and well construction information from monitoring wells completed in the uppermost water-bearing unit at the Site are summarized on **Table 2-3**. Depth to groundwater in the monitoring wells in the area of the PBAP ranges from approximately 10 to 15 ft below ground surface.

Figure 2-10 is a current potentiometric surface map for the uppermost water-bearing unit at the Site based on May 20, 2020 water level data. As shown on **Figure 2-10**, shallow groundwater flow direction in the area of the CCR Units is in a general easterly direction toward the Welsh Reservoir at an average hydraulic gradient of approximately 0.005 foot per foot. Shallow groundwater flow direction in the area of monitoring wells AD-22 and AD-23, which are completed in the Queen City Formation, is southeasterly toward the CCR monitoring wells, which are completed in the Reklaw Formation. The groundwater flow direction and downward vertical gradient indicates shallow groundwater in the Queen City Formation likely is hydraulically connected to the underlying Reklaw Formation. This is consistent with Texas Water Commission Bulletin 6517 description of the Cypress Aquifer: “The Wilcox Group and the Carrizo Sand, Reklaw Formation, and Queen City Sand of the Claiborne Group have similar hydrologic properties and are the principal source of freshwater in the four-county area. The units probably are interconnected hydraulically and they function as single aquifer” (USGS 1965). **Figure 2-11** is a regional hydrologic cross section of the site area.

The hydraulic conductivity of the uppermost water-bearing unit at the Site was determined by conducting aquifer tests. A constant-rate pumping test was conducted at monitoring well AD-6 on September 21, 2017. Based on the AD-6 pumping test data, the hydraulic conductivity for the uppermost water-bearing unit was calculated at 0.05 ft per day (1.83 x 10^{-5} centimeters per second).

To provide a broader understanding of the hydraulic conductivity distribution across the Site, bail down slug tests were performed in October 2018 on a total of 5 wells; 1 up gradient well (AD-17) and 4 down gradient wells (AD-6, AD-9, AD-13 and AD-19) on October 30 and 31, 2018. These wells are all screened in the uppermost water-bearing unit and were chosen based on their distribution across the Site. The hydraulic conductivity estimates from the five monitoring wells tested ranged from 0.15 ft per day (AD-6) to 2.0 ft per day (AD-13). The overall mean hydraulic conductivity estimate was 0.84 ft per day, while the overall geometric mean was 0.60 ft per day.

2.4 Surface Water

The Site is located directly west of Swauano Creek, which was dammed near the southern end of the Site during plant development to form the Welsh Reservoir. The PBAP normal operating water level is near the weir box which has a bottom elevation of 325 ft amsl. The surface water elevation of the Welsh Reservoir, located east of the PBAP, is maintained at approximately 320 ft amsl. The Welsh Reservoir is likely a gaining surface water feature because groundwater elevations at the Site are higher than the normal stage elevation of the Welsh Reservoir (approximately 320 ft amsl) as shown on **Figure 2-10**.

There are no current or historic gauging stations on Swauano Creek; however, there was a historic gauging station on adjacent Boggy Creek, which has a drainage basin area of 72 square miles versus 21.2 square miles for Swauano Creek. The average annual flow of the Boggy Creek gauging station during the driest year on record (1956) was 10.65 cubic feet per second, which corresponds to a flow of approximately 3 cubic feet per second for Swauano Creek.

3 DETECTION AND ASSESSMENT MONITORING STATISTICAL EVALUATION

3.1 General

The groundwater monitoring network for the uppermost water-bearing unit at the PBAP consists of three upgradient monitoring wells (AD-1, AD-5, AD-17) and three downgradient monitoring wells (AD-8, AD-9, AD-15; **Figure 2-1**). Additional details regarding the groundwater monitoring network are provided in the August 22, 2017 report entitled "*Primary Bottom Ash Pond – CCR Groundwater Monitoring Well Network Evaluation*" (Arcadis 2017).

3.2 Detection Monitoring Results

Detection monitoring at the Site involves collection of groundwater samples from the groundwater monitoring network upgradient and downgradient monitoring wells for analyses of Appendix III CCR constituents, which includes boron, calcium, chloride, fluoride, sulfate, pH, and total dissolved solids. Following the baseline monitoring program, which included a minimum collection of eight independent samples from each of the background and downgradient wells that are part of the certified monitoring network, the first round of Detection Monitoring was conducted. Based on detection monitoring conducted at the PBAP in 2017 and 2018, an SSI over the background concentration was calculated for boron in AD-8 (Geosyntec 2019c). Because of the SSIs noted for boron in groundwater samples from AD-8, an Alternate Source Demonstration was completed which did not identify an alternate source for the boron SSI (Geosyntec 2018).

3.3 Assessment Monitoring Results

Groundwater protection standards (GWPSs) were established for the Appendix IV parameters in accordance with 40 CFR Part 257.95(h). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or regional screening level for each Appendix IV parameter.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells (AD-8, AD-9, AD-15) to assess whether Appendix IV parameters were present at an SSL above the GWPS. An SSL was identified for lithium in May 2020, which exceeded the GWPS of 0.390 mg/L at monitoring well AD-9 (0.800 mg/L), despite no observed SSIs in Appendix III parameters for this well (Geosyntec 2020). Additional details regarding the statistical evaluations of the groundwater monitoring data is provided in the September 1, 2020 report entitled "*Statistical Analysis Summary, Primary Bottom Ash Pond*" (Geosyntec 2020).

Because the native soils have the potential to be a natural source of lithium in the regional and local groundwater and soil composition, ASD reports were prepared in February 2019, September 2019, and March 2020 to provide additional information on the sources and distribution of lithium SSLs previously identified in groundwater at PBAP monitoring well AD-9 (Arcadis 2019a, Arcadis 2019b, Arcadis 2020). The conclusions from the ASDs indicated several lines of evidence demonstrating the lithium concentration in groundwater at AD-9 is from naturally occurring sources (ASD Type V), with some additional contributions from sampling methodology error (ASD Type I). This ASD report updates the previous reports based on the recently collected Site-specific soil and groundwater data, including soil and groundwater analytical data collected outlined in Section 4.

4 SOIL AND GROUNDWATER ANALYTICAL DATA EVALUATION

4.1 General

In addition to the detection and assessment monitoring groundwater sampling events conducted at the PBAP in 2017, 2018, 2019, and 2020 for statistical evaluation, a comprehensive site-wide groundwater sampling event was conducted by Arcadis during May 2018, and an offsite soil and groundwater sampling event was conducted by Arcadis during June 2019 to evaluate alternate potential sources of lithium detected in downgradient monitoring well AD-9. The May 2018 evaluation included the following tasks:

- Collection of groundwater samples from the PBAP upgradient monitoring wells (AD-1, AD-5, AD-17), the PBAP downgradient monitoring wells (AD-8, AD-9, AD-15), and other monitoring wells in the area completed in the uppermost water-bearing unit, including upgradient monitoring well AD-18; side gradient monitoring wells MW-9, MW-10, and Temp-1; and downgradient monitoring wells AD-3, AD-4c, AD-10, AD-11, AD-13, AD-14, AD-16R, and AD-19.
- Collection of soil samples from eight soil borings (Temp-1, SB-2 through SB-8) around the perimeter of the CCR units at the site.
- Collection of three CCR material samples from the PBAP (Sample IDs: Ash-1, Ash-2, Ash-3) and one CCR material sample from the HDPE-lined Bottom Ash Storage Pond (Sample ID: Ash-4) for analysis of total metals, pore water concentrations, and leachate water using the Synthetic Precipitation Leaching Procedure (SPLP) (**Table 4-1**).

The June 2019 evaluation included the following tasks:

- Installation of two offsite monitoring wells (AD-22, AD-23) in the Queen City Formation northwest (hydraulically upgradient) of the Site. Monitoring well completion diagrams are provided in **Appendix A**.
- Collection of soil and groundwater samples from the Queen City Formation monitoring wells for Appendix III and Appendix IV parameter analyses.

Additionally, two sentinel downgradient monitoring wells (AD-20, AD-21) were installed in the uppermost water-bearing unit (Reklaw Formation) near the shoreline of the Welsh Reservoir east (hydraulically downgradient) of the CCR units during October 2018.

4.2 Soil and Groundwater Analytical Data Evaluation

4.2.1 Soil Evaluation

The soil evaluation results demonstrate a correlation between lithium and iron in soil. Boring logs from Site area monitoring locations highlight similarities with observations provided in the county-wide soil survey reports. For example, boring locations SB-04 (adjacent to AD-5), SB-05 (adjacent to AD-8), AD-22, and AD-23 contain a greater content of the reddish-brown clay subsoils as noted in the Susquehanna fine sandy loam, which directly overlie the water table in these locations. The reddish brown color generally denotes the presence of iron in these locations, which can be either incorporated directly into the clay mineral structure (e.g. smectite), or as a secondary mineral (e.g. iron hydroxide) that is also present in the aquifer matrix (Stucki 2005). The role of iron incorporated into the clay structure is important to localized geochemical processes, such as cation exchange, redox conditions, and hydrophilic properties, which can influence weathering characteristics and the mobility of trace constituents (i.e. lithium) in groundwater (Stucki 2005). Specifically, in the event that geochemical conditions are or become conducive to iron dissolution (e.g., if conditions become microbially/geochemically reducing), then the mobilization of iron associated with soil can result in the co-mobilization of trace constituents.

As shown on **Table 4-1** and **Figure 4-1**, the highest concentrations of lithium in soil were detected from 3 to 5 feet below ground surface in hydraulically upgradient and offsite Queen City Formation monitoring well AD-22 (up to 18 milligrams per kilogram [mg/kg]), and onsite Reklaw Formation soil boring SB-4 (13.6 mg/kg) located adjacent to monitoring well AD-5 which is hydraulically upgradient (northwest) of the PBAP. This upgradient (background) data indicates lithium concentrations in soil in the area of the PBAP are naturally occurring and not the result of impacts from CCR materials. This is one line of evidence that the lithium detected in groundwater at monitoring well AD-9 is from a naturally occurring source, and not the CCR unit. As shown on **Table 4-1** and **Figure 4-2**, the highest iron concentrations in soil are from soil borings AD-22 and AD-23 (17,600 to 85,500 mg/kg) which are located in the Queen City Formation upgradient of the Site; SB-4 (AD-5; 10,400 mg/kg), located in the Reklaw Formation upgradient (northwest) of the PBAP; and soil boring SB-8 (AD-3; 11,000 mg/kg), located in the Reklaw Formation over 1,000 ft south (side gradient) of the PBAP. **Figure 4-3** shows an apparent correlation between the iron and lithium content in the coal ash, upgradient locations, and downgradient locations. However, SPLP and pore water results from the coal ash samples show that the iron and lithium present in the coal ash is not in a mobile (leachable) form. Therefore, it is more likely that the regional groundwater interaction with naturally occurring lithium and iron in soil is responsible for the observed lithium concentrations and variability across the Site. As detailed below in Section 4.2.2, iron and lithium concentrations in groundwater at the Site show a similar distribution to iron and lithium concentrations in soil, indicating naturally occurring sources for iron and lithium.

4.2.2 Groundwater Evaluation

Groundwater analytical results for the PBAP, the landfill, and the bottom ash storage pond are summarized on **Tables 4-2**, **4-3**, and **4-4**, respectively. As shown on **Figure 4-4** and **Figure 4-5**, the highest lithium concentrations in the most recent (February and May 2020) groundwater samples is at monitoring well AD-17 (0.273 and 0.302 mg/L, respectively), which is west (upgradient) relative to the PBAP. Monitoring well AD-18, which is also west (upgradient) relative to the PBAP, was not sampled during February and May 2020 but historically has the highest lithium concentrations in groundwater at the Site. This data indicates lithium concentrations in groundwater in the area of the PBAP are from a source other than the PBAP.

As shown on **Figure 4-6**, iron concentrations in groundwater are also elevated upgradient (west) relative to the PBAP. **Figure 4-7** shows the relationship of total and dissolved iron concentrations to lithium concentrations in upgradient, side-gradient, and downgradient monitoring wells for 2018 and 2019 data. These results demonstrate a clear correlation between aqueous iron and lithium, with higher lithium concentrations associated with elevated iron. The greatest concentrations of both iron and lithium are observed in the upgradient monitoring wells AD-17 and AD-18. This is consistent with 2020 groundwater data at AD-17. As identified in **Table 4-1** and noted on **Figure 4-7**, SPLP leachate and pore water analyzed from coal ash samples contain lithium in concentrations below detection, or at very low concentrations less than 0.02 mg/L. This data indicates lithium concentrations in groundwater in the area of the PBAP are from a source other than the PBAP. Additionally, the most recent data is included on a lithium concentration versus time graph provided as **Figure 4-8**. Lithium concentrations in AD-9 show a decreasing trend during 2020, which corresponds to lower turbidity in those samples. As shown, the lithium concentration in groundwater at AD-18 is consistent and higher than lithium concentrations in the downgradient PBAP monitoring wells. Lithium concentrations in groundwater at AD-17 are also higher than downgradient PBAP monitoring wells. In addition, coal ash pore water lithium concentrations are plotted at an average concentration of 0.015 mg/L. As shown, upgradient lithium concentrations are higher than the coal ash pore water samples and support that lithium groundwater concentrations in the area of the PBAP are from a source other than the PBAP.

Lithium groundwater concentrations at monitoring well AD-9 were further evaluated with respect to coal ash pore water samples. The coal ash pore water samples exhibit lower concentrations of lithium, as well as lower concentrations of sulfate and chloride (Appendix III constituents typically associated with coal ash), suggesting the groundwater signature at AD-9 is not associated with coal ash influence (**Figure 4-9** and 4-10). This is further supported by the fact that boron, which is present in coal ash pore water at concentrations greater than 0.6 mg/L, is higher in the coal ash pore water than at AD-9 (**Figure 4-9**). If for example the coal ash water samples collected were diluted relative to more representative water emanating from the bottom of the PBAP, then a higher signature would also be expected for boron at AD-9. Concentration ratios of boron, lithium, sulfate, and chloride (constituents which are anticipated to travel with limited attenuation in groundwater) are therefore not consistent with coal ash influence. Similarly, the chloride concentration was compared to lithium concentrations over time in AD-9 (**Figure 4-10**). As shown, there is a general correlation with lithium and chloride concentrations over time that may be related to seasonal variation, weather variability, and/or sampling methodology. Since naturally-occurring lithium in the soil is likely controlled by ion exchange, it would be expected that lithium concentrations would be higher in waters with greater TDS or ionic strength releasing lithium from the soil.

As discussed above in Section 2.2.1, the Queen City Formation, which overlies the Reklaw Formation, is located directly west of the Site. Therefore, groundwater from the Queen City Formation west (upgradient) of the CCR units may be the source of lithium and iron detected in soils and groundwater in the area of the CCR units. As discussed above in Section 2.3.1, elevated naturally occurring iron is documented in the Cypress Aquifer, and as discussed above in Section 2.2.1, the Queen City Formation contains naturally-occurring iron concretions and correspondingly high iron concentrations in soil samples.

Another line of evidence the lithium detected in groundwater in the area of the PBAP is from a naturally occurring source is provided in the 2002 Publication “Springs of Texas” (Gunnar Brune 1981). The Springs of Texas publication states “*Hynson Springs, also known as Marshall, Noonday Camp, and Iron Springs, are six kilometers north of Hallsville. They became very popular as a health resort about 1851. The waters are highly mineralized, containing much iron, sulfur, aluminum, and lithium. Originally there were said to be over 100 springs flowing from the Queen City Formation*.” This spring, which contains naturally-occurring lithium, is located approximately 35 miles southeast of the Site. A copy of this reference is provided in **Appendix B**.

When reviewing historical and recent datasets, a broad relationship was noted between trace metal chemistry and turbidity. Where turbidity values were greatest, greater concentrations of selected CCR monitored constituents were also observed (e.g. arsenic and cadmium) and in some cases, in exceedance of Federal MCLs. As a result, low-flow sampling methodology was employed to reduce the amount of turbidity in the groundwater sample.

A comprehensive groundwater sampling event was conducted at the Site by Arcadis during May 2018 using low-flow methodology. A clean stainless steel low-flow sampling pump with new, well-dedicated polyethylene piping was slowly lowered into the mid-point of the water column at each monitoring well, and groundwater was then pumped at a low flow rate of less than 0.1 liters per minute until the produced water was visually clear. The turbidity of the produced water was measured using calibrated field instruments during well development, and groundwater samples were not collected until the turbidity measurements declined and stabilized. Once low-flow groundwater sampling techniques were properly followed by Arcadis during May 2018, water quality results indicated concentrations of selected constituents to be much less than previously reported and did not exceed criteria. Therefore, it was determined that the sediment disturbances generated during well purging and improper (turbid) groundwater sampling were contributing to the Federal MCL groundwater exceedances. Specifically, since CCR Rule monitoring requires analysis of unfiltered samples, the results suggest that the exceedances were associated with constituents present in undissolved suspended solid particulates rather than in a dissolved form, on a location by location basis. The May 2018 groundwater analytical results are most representative of groundwater quality at the Site because proper low-flow sampling protocols were adhered to and sediment contributions to the analytical results were minimized.

5 SUMMARY AND CONCLUSIONS

This ASD has been prepared in consultation with the Electric Power Research Institute "Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites". The following lines of evidence indicate the SSL related to the lithium concentration in groundwater at AD-9 is from naturally occurring sources (ASD Type V), with some additional contributions from sampling methodology error (ASD Type I):

- An SSI was confirmed for boron within monitoring well AD-8 followed by a failed Alternate Source Demonstration for boron, triggering the assessment monitoring program for the PBAP. Under the assessment monitoring program, an SSL was identified for lithium which exceeded the GWPS of 0.390 mg/L at monitoring well AD-9 (1.11 mg/L), despite no observed SSIs in Appendix III parameters for this well (Geosyntec 2019c). SSIs would be expected for Appendix III parameters if there was a CCR unit source for the lithium exceedance of the SSL, indicating that there may be an alternate source of lithium. This is a key line of evidence that the PBAP is not the source of elevated lithium concentrations in soil at the Site.
- As demonstrated in this ASD report, iron and lithium are associated in the sediments and in groundwater. The subsoils at the Site, particularly the Susquehanna fine sandy loam, contain naturally occurring high clay content. The role of iron incorporated into the clay structure is important to localized geochemical processes, such as cation exchange, redox conditions, and hydrophilic properties, which can influence weathering characteristics and the mobility of trace constituents (i.e. lithium) in groundwater (Stucki 2005). This is a supporting line of evidence.
- The highest lithium concentrations in the soil samples collected during the Arcadis May 2018 and June 2019 investigations was from background soil samples (AD-22, 3-5 ft depth; SB-4, 27 ft depth) located upgradient (northwest) of the PBAP. This is a key line of evidence that the PBAP is not the source of elevated lithium concentrations in soil at the Site.
- Leachate and pore water analyzed from coal ash samples contain lithium in concentrations below detection, or at very low concentrations less than 0.02 mg/L. Comparisons with other potential CCR constituents (chloride, sulfate, and boron) further demonstrate that ion ratios are not consistent with lithium impacts by coal ash at AD-9. This data indicates lithium concentrations in groundwater in the area of the PBAP are from a source other than the PBAP. This is a key line of evidence.
- The highest lithium concentration in groundwater samples collected during the Arcadis May 2018 investigation was from an upgradient (background) monitoring well (AD-18) located west of the PBAP. This is a key line of evidence that the PBAP is not the source of elevated lithium concentrations in groundwater at the Site.
- Iron and lithium concentrations in soil and groundwater at the Site show a similar distribution, indicating there is likely a common source for these metals. The 1965 USGS publication "*Ground-Water Resources of Camp, Franklin, Morris and Titus Counties, Texas"* documents naturally occurring high iron concentrations within zones of the Cypress Aquifer, in which the monitoring wells at the Site are completed. The University of Texas at Austin Bureau of Economic Geology 1966 publication "*Geologic Atlas of Texas, Texarkana Sheet*" documents naturally occurring iron

concretions in the Queen City Formation, which outcrops directly west (upgradient) of the PBAP. This is a supporting line of evidence.

- The 1981 Gunnar Brune publication "*Springs of Texas"* documents naturally occurring elevated lithium in groundwater in the Queen City Formation at Hynson Springs, which is approximately 35 miles from the Site. The publication states "*Hynson Springs, also known as Marshall, Noonday Camp, and Iron Springs, are six kilometers north of Hallsville. They became very popular as a health resort about 1851. The waters are highly mineralized, containing much iron, sulfur, aluminum, and lithium. Originally there were said to be over 100 springs flowing from Queen City sand".* This publication, along with soil and groundwater analytical data at the Site, supports the conclusion that the primary source of lithium in groundwater at the PBAP is from the Queen City Formation, which outcrops directly west (upgradient) of the PBAP. This is a key line of evidence.
- As summarized on **Tables 4-2** through **4-4**, elevated turbidity (>10 nephelometric turbidity units) was present in many of the groundwater samples collected at the Site. Metals concentrations were generally lower during the May 2018 Arcadis groundwater sampling event when proper low-flow sampling techniques were utilized and turbidity was low. Lithium concentrations in AD-9 show a decreasing trend during 2020 which corresponds to lower turbidity in those samples. Effective well development and proper low flow sampling techniques minimize the potential for groundwater analyses to be unrepresentative of formation groundwater. This is a supporting line of evidence.
- This ASD report provides a strong demonstration of naturally occurring sources of lithium in groundwater (ASD Type V) as supported by five key lines of evidence and three supporting lines of evidence.

6 PROFESSIONAL ENGINEER'S CERTIFICATION

I, Kenneth J. Brandner, certify that this report was prepared under my direction and supervision, and that the information contained herein is true and accurate to the best of my knowledge. Based on my experience and knowledge of the site, the alternate source demonstration for lithium at the Primary Bottom Ash Pond meets the requirements of 40 CFR Part 257.95.

Kenneth J. Brandner

Printed Name of Registered Professional Engineer

Kenneth J. Brandner

10-28-20

Signature

STATE OF TEXAS
KENNETH J. BRANDNER
69586
REGISTERED
PROFESSIONAL ENGINEER

69586	Texas	10-28-20
Registration No.	Registration State	Date

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TABLES

Table 2-1
Grain Size Distribution in Soil and Subsoil of the Norfolk Sandy Loam
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Grain Size	Soil	Subsoil
Fine Gravel	0.0%	0.0%
Coarse Sand	0.2%	0.1%
Medium Sand	0.4%	0.3%
Fine Sand	29.4%	29.9%
Very Fine Sand	37.9%	24.0%
Silt	25.9%	25.1%
Clay	5.9%	20.2%

Table 2-2
Grain Size Distribution in Soil and Subsoil of the Susquehanna Fine Sandy Loam
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Grain Size	Soil	Subsoil
Fine Gravel	0.4%	0.0%
Coarse Sand	0.7%	0.2%
Medium Sand	0.9%	0.8%
Fine Sand	53.4%	36.6%
Very Fine Sand	16.0%	10.8%
Silt	21.2%	19.0%
Clay	7.2%	32.8%

Table 2-3
Well Construction and Water Level Data - CCR Units
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Well ID	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft. bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen		Bottom of Screen		6/7/2011	12/6/2011	5/2/2012	11/1/2012	5/14/2013	11/19/2013	5/12/2014	11/16/2014	5/12/2015	3/4/2016	5/26/2016	7/27/2016	10/19/2016
									Depth ft. bls	Elevation ft. msl	Depth ft. bls	Elevation ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl	GW Elev. ft. msl
Monitoring Wells																									
AD-1 [c]	33° 02' 48"	94° 50' 47"	355.57	357.57	25.0	1/11/01	Sch. 40 PVC	2	15.0	340.57	25.0	330.57	338.46	334.92	337.88	337.18	337.43	336.73	338.03	337.64	340.82	342.83	344.89	342.89	341.23
AD-2 [c]	33° 02' 37"	94° 50' 44"	344.16	346.16	25.0	4/26/01	Sch. 40 PVC	2	15.0	329.16	25.0	319.16	330.16	329.07	330.00	329.26	329.83	329.70	330.09	329.69	332.56	332.32	---	---	---
AD-3 [c]	33° 02' 38"	94° 50' 37"	331.10	333.10	17.0	4/26/01	Sch. 40 PVC	2	7.0	324.10	17.0	314.10	323.81	323.19	323.99	323.29	323.77	323.98	324.12	323.28	325.58	325.12	324.59	323.70	323.47
AD-4 [c]	33° 02' 43"	94° 50' 33"	340.61	342.61	30.0	4/26/01	Sch. 40 PVC	2	19.0	321.61	29.0	311.61	324.81	324.84	324.62	324.40	324.74	325.52	325.44	325.13	327.00	326.90	---	---	---
AD-4a [a]	33.04527	94.84258	340.19	342.85	30.0	9/22/09	Sch. 40 PVC	2	20.0	320.19	30.0	310.19	325.01	324.19	325.24	322.90	324.86	324.68	325.64	325.34	327.19	327.12	---	---	---
AD-4b [a]	33.04531	94.84230	329.55	333.23	15.0	9/23/09	Sch. 40 PVC	2	5.0	324.55	15.0	314.55	324.35	324.32	324.50	324.30	324.30	325.21	325.22	324.90	326.58	326.67	---	---	---
AD-4c [a]	33.04507	94.84244	329.15	333.28	15.0	9/23/09	Sch. 40 PVC	2	5.0	324.15	15.0	314.15	324.18	324.50	324.64	324.37	324.11	325.06	325.01	324.71	326.50	326.19	325.89	324.01	323.76
AD-5 [c]	33° 03' 13"	94° 51' 00"	349.00	351.00	30.0	1/11/01	Sch. 40 PVC	2	20.0	329.00	30.0	319.00	336.34	336.58	336.82	336.99	336.78	336.47	336.80	336.01	339.07	338.04	337.62	337.24	337.74
AD-6 [a]	33.05235	94.84757	343.31	346.33	33.0	9/23/09	Sch. 40 PVC	2	23.0	320.31	33.0	310.31	333.04	333.02	332.83	333.02	333.11	332.81	333.11	332.81	333.38	334.00	---	---	---
AD-7 [a]	33.05257	94.84219	347.86	350.82	38.0	9/24/09	Sch. 40 PVC	2	28.0	319.86	38.0	309.86	334.32	334.12	334.19	334.20	334.13	334.58	333.77	333.98	334.09	333.61	---	---	---
AD-8 [a]	33.05187	94.84026	337.53	340.01	29.0	9/21/09	Sch. 40 PVC	2	16.0	321.53	26.0	311.53	325.41	324.09	325.69	325.15	325.79	325.75	325.98	325.77	326.05	325.70	325.68	325.05	325.29
AD-9 [a]	33.04995	94.84196	340.32	343.09	35.0	9/21/09	Sch. 40 PVC	2	20.0	320.32	35.0	305.32	328.46	328.53	328.63	328.44	328.74	329.38	NM	330.18	329.98	329.74	329.28	329.53	328.92
AD-10 [a]	33.04881	94.84047	340.23	343.01	35.0	9/22/09	Sch. 40 PVC	2	20.0	320.23	35.0	305.23	323.44	322.55	323.27	323.35	323.51	323.76	323.57	323.88	323.95	323.55	---	---	---
AD-11 [a]	33.04824	94.84177	339.61	342.18	20.0	9/22/09	Sch. 40 PVC	2	10.0	329.61	20.0	319.61	327.99	328.37	327.82	327.93	327.94	328.13	328.20	327.97	328.96	328.13	328.39	328.14	327.87
AD-12 [a]	33.04901	94.84977	366.27	369.33	30.0	9/24/09	Sch. 40 PVC	2	20.0	346.27	30.0	336.27	348.30	348.29	349.86	349.56	349.99	349.65	349.89	350.01	350.65	350.39	---	---	---
AD-13 [a]	33.04918	94.84275	344.12	347.00	20.0	9/22/09	Sch. 40 PVC	2	6.0	338.12	16.0	328.12	332.36	332.24	333.09	332.26	332.68	333.25	333.35	332.01	337.58	334.76	334.54	332.93	332.39
AD-14 [a]	33.04715	94.84256	342.32	345.43	19.0	9/22/09	Sch. 40 PVC	2	8.0	334.32	18.0	324.32	330.40	329.80	331.67	330.34	330.94	331.69	332.12	330.17	336.63	334.83	334.51	331.71	330.94
AD-15 [d]	33° 03' 04"	94° 50' 27"	340.21	343.29	46.0	12/12/15	Sch. 40 PVC	2	25.5	314.71	45.5	294.71	---	---	---	---	---	---	---	---	---	322.14	321.93	321.28	321.42
AD-16 [d]	33° 02' 49"	94° 50' 29"	350.86	353.97	21.0	12/10/15	Sch. 40 PVC	2	11.0	339.86	21.0	329.86	---	---	---	---	---	---	---	---	---	337.09	335.84	332.14	331.52
AD-16R [e]	33° 02' 49"	94° 50' 28.9"	350.55	353.49	27.0	4/12/17	Sch. 40 PVC	2	12.0	338.55	27.0	323.55	---	---	---	---	---	---	---	---	---	---	---	---	---
AD-17 [d]	33° 02' 57"	94° 51' 06"	353.99	357.10	40.0	12/10/15	Sch. 40 PVC	2	24.0	329.99	39.0	314.99	---	---	---	---	---	---	---	---	---	334.64	334.26	334.30	334.45
AD-18 [d]	33° 03' 03"	94° 51' 03"	346.17	349.28	29.0	12/11/15	Sch. 40 PVC	2	14.0	332.17	29.0	317.17	---	---	---	---	---	---	---	---	---	343.66	343.26	340.81	339.92
AD-19	33.047201°	94.839694°	323.58	326.35	15.0	5/8/18	Sch. 40 PVC	2	5.0	318.58	15.0	308.58	---	---	---	---	---	---	---	---	---	---	---	---	---
AD-20	33° 02' 45.6"	94° 50' 22.8"	324.85	327.65	20.0	10/23/18	Sch. 40 PVC	2	4.0	320.85	19.0	305.85	---	---	---	---	---	---	---	---	---	---	---	---	---
AD-21	33° 02' 49.6"	94° 50' 20"	322.04	325.29	20.0	10/23/18	Sch. 40 PVC	2	3.5	318.54	18.5	303.54	---	---	---	---	---	---	---	---	---	---	---	---	---
AD-22	33° 03' 35"	94° 51' 09"	360.94	360.22	20.0	6/18/19	Sch. 40 PVC	2	5.0	355.94	20.0	340.94	---	---	---	---	---	---	---	---	---	---	---	---	---
AD-23	33° 03' 56"	94° 51' 08"	369.37	368.82	20.0	6/18/19	Sch. 40 PVC	2	5.0	364.37	20.0	349.37	---	---	---	---	---	---	---	---	---	---	---	---	---
Piezometers																									
B-2 [b]	33° 03.078'	94° 50.449'	339.7	339.7	50.0	10/28/09	Sch. 40 PVC	2	10.0	329.70	20.0	319.70	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-4 [b]	33° 03.011'	94° 50.462'	340.6	340.6	50.0	10/27/09	Sch. 40 PVC	2	8.0	332.60	18.0	322.60	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-5 [b]	33° 02.964'	94° 50.428'	340.0	340.0	50.0	10/27/09	Sch. 40 PVC	2	10.0	330.00	20.0	320.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-6 [b]	33° 02.912'	94° 50.462'	340.1	340.1	50.0	10/28/09	Sch. 40 PVC	2	12.0	328.10	22.0	318.10	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Temp-1	33.046864°	94.852059°	356.36	358.17	28.0	5/8/18	Sch. 40 PVC	2	8.0	348.36	28.0	328.36	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-9	33° 03' 18"	94° 50' 19.4"	342.00	344.54	18.0	11/19/01	Sch. 40 PVC	2	3.0	339.00	18.0	324.00	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-10	33° 03' 13.6"	94° 50' 19.4"	341.96	344.80	19.0	11/19/01	Sch. 40 PVC	2	4.0	337.96	19.0	322.96	---	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:
NM - Not measured.
(a) Source: Eagle Environmental Services Well Logs (2009).
(b) Source: ETTL Engineers & Consultants Inc. (June 21, 2010).
(c) Source: Southwest Electric Power, State of Texas Well Report (2001).
(d) Source: Auckland Consulting LLC (January 26, 2016). Monitoring wells AD-15 through AD-18 installed during December 2015.
(e) Monitoring well installed by ARCADIS on April 12, 2017 as a replacement for monitoring well AD-16.
Groundwater Elevation Source: AEP, Shallow Groundwater Data Summary through February 2017.
1983 State Plane Lambert Coordinate System
Datum: NAD 83
ft bls = feet below land surface
ft msl = feet above mean sea level
Elev. = Elevation
--- = No record

Table 2-3
Well Construction and Water Level Data - CCR Units
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

ARCADIS Design & Consultancy for natural and built assets

Well ID	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft. bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen Depth ft. bls	Top of Screen Elevation ft. msl	Bottom of Screen Depth ft. bls	Bottom of Screen Elevation ft. msl	12/12/2016 GW Elev. ft. msl	1/17/2017 GW Elev. ft. msl	2/23/2017 GW Elev. ft. msl	10/6/2017 GW Elev. ft. msl	5/15/2018 GW Elev. ft. msl	10/29/2018 GW Elev. ft. msl	6/19/2019 GW Elev. ft. msl	7/24/2019 GW Elev. ft. msl	2/17/2020 GW Elev. ft. msl	5/20/2020 GW Elev. ft. msl
Monitoring Wells																						
AD-1 [c]	33° 02' 48"	94° 50' 47"	355.57	357.57	25.0	1/11/01	Sch. 40 PVC	2	15.0	340.57	25.0	330.57	340.58	341.18	339.74	337.70	340.57	339.10	345.37	343.95	341.88	344.09
AD-2 [c]	33° 02' 37"	94° 50' 44"	344.16	346.16	25.0	4/26/01	Sch. 40 PVC	2	15.0	329.16	25.0	319.16	---	---	---	---	331.50	331.25	333.61	332.55	---	333.22
AD-3 [c]	33° 02' 38"	94° 50' 37"	331.10	333.10	17.0	4/26/01	Sch. 40 PVC	2	7.0	324.10	17.0	314.10	323.78	325.04	324.92	323.24	324.30	324.15	325.42	324.72	---	325.38
AD-4 [c]	33° 02' 43"	94° 50' 33"	340.61	342.61	30.0	4/26/01	Sch. 40 PVC	2	19.0	321.61	29.0	311.61	---	---	---	---	---	---	---	325.58	---	326.90
AD-4a [a]	33.04527	94.84258	340.19	342.85	30.0	9/22/09	Sch. 40 PVC	2	20.0	320.19	30.0	310.19	---	---	---	---	---	---	---	325.74	---	327.10
AD-4b [a]	33.04531	94.84230	329.55	333.23	15.0	9/23/09	Sch. 40 PVC	2	5.0	324.55	15.0	314.55	---	---	---	---	---	---	---	324.95	---	326.60
AD-4c [a]	33.04507	94.84244	329.15	333.28	15.0	9/23/09	Sch. 40 PVC	2	5.0	324.15	15.0	314.15	325.07	326.39	324.89	324.20	324.95	325.62	325.98	324.73	---	326.20
AD-5 [c]	33° 03' 13"	94° 51' 00"	349.00	351.00	30.0	1/11/01	Sch. 40 PVC	2	20.0	329.00	30.0	319.00	337.01	338.34	336.17	337.40	337.25	336.98	337.18	336.89	338.56	337.79
AD-6 [a]	33.05235	94.84757	343.31	346.33	33.0	9/23/09	Sch. 40 PVC	2	23.0	320.31	33.0	310.31	---	---	---	---	---	333.42	333.42	---	---	333.62
AD-7 [a]	33.05257	94.84219	347.86	350.82	38.0	9/24/09	Sch. 40 PVC	2	28.0	319.86	38.0	309.86	---	---	---	---	---	---	335.00	334.61	---	334.26
AD-8 [a]	33.05187	94.84026	337.53	340.01	29.0	9/21/09	Sch. 40 PVC	2	16.0	321.53	26.0	311.53	325.92	326.76	324.27	326.12	325.63	326.36	326.17	325.80	326.04	326.32
AD-9 [a]	33.04995	94.84196	340.32	343.09	35.0	9/21/09	Sch. 40 PVC	2	20.0	320.32	35.0	305.32	329.31	330.50	328.05	329.47	329.40	329.98	330.01	329.57	329.58	329.75
AD-10 [a]	33.04881	94.84047	340.23	343.01	35.0	9/22/09	Sch. 40 PVC	2	20.0	320.23	35.0	305.23	---	---	---	---	323.53	324.19	324.06	323.76	---	323.61
AD-11 [a]	33.04824	94.84177	339.61	342.18	20.0	9/22/09	Sch. 40 PVC	2	10.0	329.61	20.0	319.61	328.20	328.90	328.25	327.85	327.61	327.83	328.72	327.97	328.10	328.33
AD-12 [a]	33.04901	94.84977	366.27	369.33	30.0	9/24/09	Sch. 40 PVC	2	20.0	346.27	30.0	336.27	---	---	---	---	349.52	348.28	350.81	---	---	350.22
AD-13 [a]	33.04918	94.84275	344.12	347.00	20.0	9/22/09	Sch. 40 PVC	2	6.0	338.12	16.0	328.12	332.84	334.54	331.83	331.42	331.83	331.52	332.98	332.23	333.38	333.29
AD-14 [a]	33.04715	94.84256	342.32	345.43	19.0	9/22/09	Sch. 40 PVC	2	8.0	334.32	18.0	324.32	330.79	332.63	330.87	329.91	330.76	330.52	333.94	331.85	333.44	333.97
AD-15 [d]	33° 03' 04"	94° 50' 27"	340.21	343.29	46.0	12/12/15	Sch. 40 PVC	2	25.5	314.71	45.5	294.71	321.71	321.64	322.81	322.07	321.74	322.01	322.24	321.43	322.12	322.17
AD-16 [d]	33° 02' 49"	94° 50' 29"	350.86	353.97	21.0	12/10/15	Sch. 40 PVC	2	11.0	339.86	21.0	329.86	331.43	330.96	330.71	---	---	---	---	---	---	---
AD-16R [e]	33° 02' 49"	94° 50' 28.9"	350.55	353.49	27.0	4/12/17	Sch. 40 PVC	2	12.0	338.55	27.0	323.55	---	---	---	327.12	328.68	326.71	335.13	332.11	---	330.36
AD-17 [d]	33° 02' 57"	94° 51' 06"	353.99	357.10	40.0	12/10/15	Sch. 40 PVC	2	24.0	329.99	39.0	314.99	334.64	334.05	333.94	334.17	334.35	333.91	335.39	334.94	334.94	335.10
AD-18 [d]	33° 03' 03"	94° 51' 03"	346.17	349.28	29.0	12/11/15	Sch. 40 PVC	2	14.0	332.17	29.0	317.17	339.38	338.97	340.38	339.43	342.75	340.97	343.70	342.65	---	343.87
AD-19	33.047201°	94.839694°	323.58	326.35	15.0	5/8/18	Sch. 40 PVC	2	5.0	318.58	15.0	308.58	---	---	---	---	321.24	321.54	322.65	---	---	---
AD-20	33° 02' 45.6"	94° 50' 22.8"	324.85	327.65	20.0	10/23/18	Sch. 40 PVC	2	4.0	320.85	19.0	305.85	---	---	---	---	---	323.28	322.89	---	---	---
AD-21	33° 02' 49.6"	94° 50' 20"	322.04	325.29	20.0	10/23/18	Sch. 40 PVC	2	3.5	318.54	18.5	303.54	---	---	---	---	---	320.26	320.72	---	---	---
AD-22	33° 03' 35"	94° 51' 09"	360.94	360.22	20.0	6/18/19	Sch. 40 PVC	2	5.0	355.94	20.0	340.94	---	---	---	---	---	---	358.24	---	---	357.93
AD-23	33° 03' 56"	94° 51' 08"	369.37	368.82	20.0	6/18/19	Sch. 40 PVC	2	5.0	364.37	20.0	349.37	---	---	---	---	---	---	364.98	---	---	364.61
Piezometers																						
B-2 [b]	33° 03.078'	94° 50.449'	339.7	339.7	50.0	10/28/09	Sch. 40 PVC	2	10.0	329.70	20.0	319.70	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-4 [b]	33° 03.011'	94° 50.462'	340.6	340.6	50.0	10/27/09	Sch. 40 PVC	2	8.0	332.60	18.0	322.60	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-5 [b]	33° 02.964'	94° 50.428'	340.0	340.0	50.0	10/27/09	Sch. 40 PVC	2	10.0	330.00	20.0	320.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
B-6 [b]	33° 02.912'	94° 50.462'	340.1	340.1	50.0	10/28/09	Sch. 40 PVC	2	12.0	328.10	22.0	318.10	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Temp-1	33.046864°	94.852059°	356.36	358.17	28.0	5/8/18	Sch. 40 PVC	2	8.0	348.36	28.0	328.36	---	---	---	---	345.55	342.79	350.08	NM	NM	NM
MW-9	33° 03' 18"	94° 50' 19.4"	342.00	344.54	18.0	11/19/01	Sch. 40 PVC	2	3.0	339.00	18.0	324.00	---	---	---	---	331.34	331.24	NM	NM	NM	NM
MW-10	33° 03' 13.6"	94° 50' 19.4"	341.96	344.80	19.0	11/19/01	Sch. 40 PVC	2	4.0	337.96	19.0	322.96	---	---	---	---	332.29	332.75	337.26	NM	NM	NM

NOTES:
NM - Not measured.
(a) Source: Eagle Environmental Services Well Logs (2009).
(b) Source: ETTL Engineers & Consultants Inc. (June 21, 2010).
(c) Source: Southwest Electric Power, State of Texas Well Report (2001).
(d) Source: Auckland Consulting LLC (January 26, 2016). Monitoring wells AD-15 through AD-18 installed during December 2015.
(e) Monitoring well installed by ARCADIS on April 12, 2017 as a replacement for monitoring well AD-16.
Groundwater Elevation Source: AEP, Shallow Groundwater Data Summary through February 2017.
1983 State Plane Lambert Coordinate System
Datum: NAD 83
ft bls = feet below land surface
ft msl = feet above mean sea level
Elev. = Elevation
--- = No record

Table 4-1
Soil and Coal Ash Sample Analytical Results (mg/kg) - CCR Units
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Sample ID	Date Sampled	Sample Depth (feet)	Units	Appendix III Parameters						Appendix IV Parameters															
				Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Soil Samples																									
Temp-1	5/8/18	15'	mg/kg	14.3	43.3	15	<1	5.0	93	<0.25	1.77	16.8	<0.05	<0.05	5.22	0.28	1.77	0.104	0.004	1.18	<0.25	1.26	0.273	<12.5	5.4
SB-2	5/10/18	22'	mg/kg	11.9	35.8	13	2	3.9	878	<0.25	<0.25	18.3	0.08	<0.05	3.53	0.551	3.98	0.08	0.005	0.287	0.684	<0.25	0.159	890	4.46
(AD-17)																									
SB-3	5/10/18	30'	mg/kg	3.05	90.2	94	1	3.8	1,194	<0.25	3.83	13.6	<0.05	0.132	9.21	0.649	4.22	0.322	0.009	1.64	<0.25	<0.25	0.593	3,960	6.87
(AD-18)																									
SB-4	5/9/18	5'	mg/kg	(FOC = 0.00723 g/g)			---	4.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
(AD-5)		27'	mg/kg	7.76	634	8	1	6.4	724	<0.25	1.81	20.4	0.115	0.417	6.73	4.76	3.2	13.6	0.006	0.561	0.536	<0.25	0.657	10,400	65.5
(Background)		27'	mg/kg	(FOC = 0.00688 g/g)																					
SB-5	5/9/18	19'	mg/kg	5.45	655	16	3	7.2	69	<0.25	1.11	8.53	0.109	0.241	3.75	3.58	2.96	10.5	0.044	0.313	0.297	<0.25	0.216	6,210	35.5
(AD-8)																									
SB-6	5/9/18	21'	mg/kg	5.33	397	20	2	7.8	116	<0.25	1.11	17.9	0.09	0.24	3.5	3.37	2.67	10.3	0.051	0.299	0.471	<0.25	2.502	5,970	38.4
(AD-9)																									
SB-7	5/9/18	13'	mg/kg	8.11	1,360	19	<1	5.0	198	<0.25	10.1	65	0.154	0.356	6.87	3.21	3.14	5.3	0.004	1.39	<0.25	<0.25	0.262	9,220	28.4
(AD-13)																									
SB-8	5/9/18	12'	mg/kg	16.6	6,150	13	1	5.2	24	<0.25	3.3	213	0.409	0.452	8.22	4.13	9.05	4.63	0.013	0.488	<0.25	<0.25	0.433	11,000	25.4
(AD-3)																									
AD-20	10/23/18	15-17	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.567	---	---
AD-21	10/23/18	15-17	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.424	---	---
AD-22	6/18/19	3-5	mg/kg	16.7	110	---	---	4.84	---	<0.25	8.43	136	0.544	0.935	29.9	13	18.9	18	0.053	0.711	1.81	<0.25	---	25,800	---
		6-8	mg/kg	10.2	18.7	---	---	4.1	---	<0.25	20.9	30.4	0.246	0.723	17.7	9.65	8.95	2.9	0.009	0.446	1.08	<0.25	---	22,500	---
		11-13	mg/kg	8.83	219	---	---	4.26	---	<0.25	5.96	77.1	0.293	0.571	16.5	8.75	6.57	4.4	0.045	0.536	0.885	<0.25	---	17,600	---
AD-23	6/18/19	3-5	mg/kg	32.7	115	---	---	4.64	---	<0.25	14.1	45.5	0.805	3.23	49	30.8	11	7.74	0.035	1.14	4.27	<0.25	---	85,500	---
		5-7	mg/kg	10.2	22.7	---	---	4.25	---	<0.25	6.3	31.7	0.288	0.775	19	9.74	8.56	4.83	0.014	0.378	1.12	<0.25	---	22,700	---
		10-12	mg/kg	9.16	200	---	---	4.21	---	<0.25	4.13	28.3	0.288	0.613	23.9	8.19	7.03	3.41	0.015	1.03	0.635	<0.25	---	18,500	---
Coal Ash Samples																									
Ash-1	5/10/18	1-2'	mg/kg	34.4	33,800	30.5	8.21	7.1	219	<0.877	14.6	607	1.02	0.464	31.8	5.55	16.9	11.6	0.0473	2.66	2.27	<0.54	2.92	37,500	139
		SPLP:	mg/L	0.594	30.2	---	---	---	---	<0.00344	<0.00411	0.284	<0.000333	<0.000164	0.00273	<0.000553	<0.00285	<0.0086	<0.0000653	0.0176	<0.00363	<0.00287	0.0991	<0.0305	<0.00267
		Pore Water:	mg/L	0.643	113	20.1	1.86	7.4	6.6	<0.00344	0.0095	3.43	<0.000333	<0.000164	0.00396	<0.000553	<0.00285	0.0123	<0.0000653	0.00484	<0.00363	<0.00287	0.755	---	0.357
Ash-2	5/10/18	1-2'	mg/kg	92.6	96,000	53.8	11.2	7.3	293	<1.56	19.4	2,760	1.64	1.56	41.2	9.63	24.5	15.5	0.0967	2.08	5.25	<0.957	2.32	18,300	365
		SPLP:	mg/L	0.526	24.1	---	---	---	---	<0.00344	<0.00411	0.192	<0.000333	<0.000164	0.00222	<0.000553	<0.00285	<0.0086	<0.0000653	0.0165	<0.00363	<0.00287	0.112	<0.0305	<0.00267
		Pore Water:	mg/L	0.772	143	20.4	0.28	7.6	8.73	<0.00344	0.0106	3.99	<0.000333	<0.000164	0.00196	<0.000553	0.00346	0.0173	<0.0000653	0.00428	<0.00363	<0.00287	0.508	---	0.376
Ash-3	5/10/18	1-2'	mg/kg	29	14,300	11.5	10.7	7.4	152	<0.687	11.8	766	0.845	0.394	19.2	5.77	12.2	6.87	0.0403	1.79	1.44	<0.423	1.754	21,100	110
		SPLP:	mg/L	0.958	19.8	---	---	---	---	<0.00344	<0.00411	0.0315	<0.000333	<0.000164	0.00389	<0.000553	<0.00285	<0.0086	<0.0000653	0.0222	<0.00363	<0.00287	<0.256	0.471	<0.00267
		Pore Water:	mg/L	1.000	103	13.0	0.998	7.6	51.1	<0.00344	0.0108	1.54	<0.000333	<0.000164	0.00110	<0.000553	<0.00285	<0.0086	<0.0000653	0.0111	<0.00363	<0.00287	0.594	---	0.715
Ash-4	5/10/18	1-2'	mg/kg	281	106,000	27.6	1.34	10.5	961	<0.757	9.72	3,390	2.23	1.06	35.1	16.2	16.3	20.4	0.0340	2.21	1.30	<0.466	3.18	24,200	177
		SPLP:	mg/L	1.3	25.1	---	---	---	---	<0.00344	<0.00411	0.0216	<0.000333	<0.000164	0.00329	<0.000553	<0.00285	<0.0086	<0.0000653	<0.00281	<0.00363	<0.00287	<0.407	<0.0305	<0.00267
		Pore Water:	mg/L	4.75	63.5	28.8	0.697	10.8	381	<0.00344	0.00745	0.217	<0.000333	<0.000164	0.00225	0.00093	<0.00285	<0.0086	<0.0000653	0.0798	<0.00363	<0.00287	0.259	---	0.00814

NOTES:
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
FOC = Fraction organic carbon (Walkley Black)
--- = Not analyzed
SPLP = Synthetic precipitation leaching procedure (concentrations shown in milligrams per liter)
Total concentrations (mg/kg) shown in normal font, SPLP and Pore Water concentrations (mg/L) shown in italics.
Radium concentrations for soil shown in picoCuries per gram. SPLP concentrations shown in picoCuries per liter.

Table 4-2
Groundwater Sampling Analytical Results (mg/L) - Primary Bottom Ash Pond
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

ARCADIS Design & Consultancy for natural and built assets

Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Background (Upgradient) Wells																									
AD-1	05/26/16	0.346	36.5	5	<1	5.93	--	42	252	<0.005	<0.005	0.191	<0.001	<0.001	<0.001	<0.005	<0.005	0.010	0.000033	<0.005	<0.005	<0.002	1.18	--	--
	07/27/16	0.350	39.6	4	<1	5.93	--	36	239	<0.005	<0.005	0.191	<0.001	<0.001	<0.001	<0.005	<0.005	0.019	<0.000025	<0.005	<0.005	<0.002	0.9952	--	--
	09/29/16	0.332	15	5	<1	5.37	--	35	173	<0.005	<0.005	0.141	<0.001	<0.001	0.005	<0.005	<0.005	0.014	<0.000025	<0.005	<0.005	<0.002	1.38	--	--
	10/19/16	0.398	19.1	4	<1	5.15	--	42	192	<0.005	<0.005	0.114	<0.001	<0.001	<0.001	<0.005	<0.005	0.008	<0.000025	<0.005	<0.005	<0.002	1.141	--	--
	12/12/16	0.394	8.74	4	<1	5.18	--	40	200	<0.005	<0.005	0.072	<0.001	<0.001	<0.001	<0.005	<0.005	0.008	<0.000025	<0.005	<0.005	<0.002	0.719	--	--
	01/17/17	0.656	129	4	<1	7.13	--	68	538	<0.005	<0.005	0.410	<0.001	<0.001	<0.001	<0.005	<0.005	<0.001	<0.000025	<0.005	<0.005	<0.002	3.009	--	--
	02/23/17	0.700	147	9	<1	6.88	--	68	612	<0.005	<0.005	0.488	<0.001	<0.001	<0.001	<0.005	<0.005	0.001	<0.000025	<0.005	<0.005	<0.002	4.309	--	--
	06/07/17	0.449	15.1	4	<0.083	5.06	109	42	176	<0.00093	0.00114	0.09346	0.00037	<0.00007	0.00066	0.00077	<0.00068	0.00902	0.000007	<0.00029	0.0021	<0.00086	0.676	--	--
	10/06/17	--	--	--	--	5.25	97.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.352	12.1	3	<0.083	4.82	8.4	--	174	<0.00093	<0.00105	0.08823	0.00048	<0.00007	<0.00023	0.0008	<0.00068	0.00816	<0.000005	<0.00029	<0.00099	<0.00086	0.837	0.03	0.025
	Dissolved	*0.35*	*12*	--	--	4.82	8.4	--	--	*<0.00093*	*<0.00105*	*0.08582*	*0.00044*	*<0.00007*	*<0.00023*	*0.00083*	*<0.00068*	*0.00799*	*<0.000005*	*<0.00029*	*0.00197*	*<0.00086*	*0.531*	0.01	0.026
	05/24/18	0.345	10.2	4	<0.083	5.19	118	43	150	0.00317 J	<0.00105	0.0799	0.00039 J	<0.00007	<0.00023	0.00035 J	<0.00068	0.00814	0.000006 J	<0.00029	0.00138 J	<0.00086	1.983	--	--
	08/14/18	0.443	5.95	5	<0.083	5.18	102	44	160	0.00003 J	0.00021	0.063	0.000482	0.00002	0.00016	0.000797	0.000238	0.00708	0.000013 J	0.00021	0.0017	0.00003 J	1.10	--	--
	02/20/19	0.504	142	2.82	0.24	7.31	113	49.2	522	0.00016	0.00046	0.457	0.00009 J	0.00001 J	0.000306	0.000399	0.000124	0.00155	<0.000025	0.001 J	0.0007	<0.0005	3.16	--	--
	05/30/19	0.689	--	1.59	0.29	--	61.3	43.3	588	0.00016	0.00060	0.512	0.000244	0.00001 J	0.0001 J	0.000756	0.000197	<0.009	<0.000005	0.00243	0.0014	<0.0001	--	0.099	0.0625
	07/24/19	0.644	62.7	2	0.106 J	5.97	52.1	58	180	0.00008 J	0.00039	0.245	0.00054	0.00002 J	0.0001 J	0.000789	0.0001 J	0.00557	<0.000005	0.002 J	0.0034	<0.0001	1.819	--	--
	02/17/20	0.626	115	3.41	0.31	5.81	29.4	56.3	488	0.00033	0.00049	0.303	0.00007 J	0.00002 J	0.0001 J	0.00028	0.0001 J	0.00105	<0.000002	0.001 J	0.0023	<0.0001	2.665	--	--
	05/20/20	0.801	126	1.83	0.20	7.22	0.0	51.4	508	0.00015	0.00053	0.394	0.000270	0.00002 J	0.0001 J	0.000490	0.0001 J	0.00301	<0.000002	0.002 J	0.0028	<0.0001	2.312	--	--
AD-5	05/31/16	0.03	36.9	15	<1	6.38	--	123	337	<0.005	<0.005	0.057	<0.001	<0.001	<0.001	0.014	<0.005	0.135	<0.000025	<0.005	<0.005	<0.002	1.63	--	--
	07/28/16	0.04	44.7	16	<1	6.38	--	163	360	<0.005	<0.005	0.093	<0.001	<0.001	<0.001	0.015	<0.005	0.191	<0.000025	<0.005	<0.005	<0.002	4.75	--	--
	09/29/16	0.04	46.3	15	<1	5.29	--	190	416	<0.005	<0.005	0.087	<0.001	<0.001	<0.001	0.014	<0.005	0.186	<0.000025	<0.005	<0.005	<0.002	3.33	--	--
	10/20/16	0.05	50.7	14	<1	5.92	--	267	448	<0.005	<0.005	0.07	<0.001	<0.001	<0.001	0.009	<0.005	0.225	<0.000025	<0.005	<0.005	<0.002	2.319	--	--
	12/13/16	0.05	49.6	13	<1	6.29	--	233	484	<0.005	<0.005	0.053	<0.001	<0.001	<0.001	0.013	<0.005	0.199	<0.000025	<0.005	<0.005	<0.002	2.182	--	--
	01/17/17	0.04	49.8	14	<1	6.27	--	234	438	<0.005	<0.005	0.047	<0.001	<0.001	<0.001	0.012	<0.005	0.239	<0.000025	<0.005	<0.005	<0.002	1.023	--	--
	02/23/17	0.04	33.0	15	<1	5.48	--	127	286	<0.005	<0.005	0.042	<0.001	<0.001	<0.001	0.013	<0.005	0.166	<0.000025	<0.005	<0.005	<0.002	1.788	--	--
	06/07/17	0.05281	49.7	14	<0.083	5.96	867	82	300	<0.00093	0.00385	0.0877	0.00008	0.00039	0.00028	0.01193	<0.00068	0.124	<0.000005	<0.00029	<0.00099	<0.00086	2.32	--	--
	10/06/17	--	--	--	--	5.59	249	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.05063	30.1	21	<0.083	5.79	<100	--	248	<0.00093	<0.00105	0.07627	0.00014	0.00037	<0.00023	0.01907	<0.00068	0.118	<0.000005	<0.00029	<0.00099	<0.00086	1.495	14.4	0.45
	Dissolved	*0.03752*	*29.1*	--	--	5.79	<100	--	--	*<0.00093*	*<0.00105*	*0.06865*	*<0.00002*	*<0.00007*	*<0.00023*	*0.01747*	*<0.00068*	*0.119*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.043*	*2.051*	8.38	0.43
	05/24/18	0.05007	28.1	22	<0.083	6.22	17.8	60	242	<0.00093	<0.00105	0.07116	<0.00002	0.00023 J	0.0008 J	0.01424	<0.00068	0.121	<0.000005	<0.00029	<0.00099	<0.00086	1.946	--	--
	08/15/18	0.05	40.5	19	<0.083	6.23	57.1	240	428	0.00001 J	0.00169	0.0637	0.000055	0.000008 J	0.000072	0.0114	0.000079	0.147	<0.000005	0.00013	0.00008 J	<0.00005	0.316	--	--
	02/21/19	0.033	33.9	24.7	0.21	5.38	164	46.5	220	0.00002 J	0.00159	0.0694	0.00008 J	<0.00005	0.000432	0.00858	0.000147	0.0807	<0.000025	<0.002	0.0001 J	<0.0005	1.27	--	--
	05/30/19	0.03 J	--	22.3	0.29	--	150	51.3	238	<0.00002	0.00305	0.0605	0.00008 J	<0.0001	0.00006 J	0.0118	0.00005 J	0.104	0.000006	<0.0004	0.00005 J	<0.0001	--	23.4	0.331
	07/24/19	0.04 J	41.1	18	0.112 J	6.3	108	90	354	<0.00002	0.00248	0.0774	0.00005 J	<0.00001	0.00005 J	0.00838	<0.00005	0.108	<0.000005	<0.0004	0.00006 J	<0.0001	2.533	--	--
	02/17/20	0.03 J	39.8	19.8	0.22	5.45	422	43.7	248	0.00003 J	0.00217	0.109	0.00009 J	0.00002 J	0.000336	0.00452	0.000227	0.0732	<0.000002	0.0009 J	0.0002	<0.0001	2.393	--	--
	05/20/20	0.03 J	40.2	22.3	0.18	6.83	355	55.5	264	<0.00002	0.00178	0.0931	0.00005 J	0.00001 J	0.0001 J	0.00765	0.00007 J	0.0740	<0.000002	<0.0004	0.00009 J	<0.0001	1.612	--	--
AD-17	05/26/16	0.121	200	43	<1	7.17	--	1,166	1,810	<0.005	<0.005	0.021	<0.001	0.002	0.001	0.063	<0.005	0.370	0.000032	<0.005	<0.005	<0.002	1.53	--	--
	07/27/16	0.119	195	32	<1	7.17	--	1,005	1,576	<0.005	<0.005	0.020	<0.001	0.004	0.001	0.068	<0.005	0.374	<0.000025	<0.005	<0.005	<0.002	2.78	--	--
	09/29/16	0.111	191	36	<1	6.17	--	1,055	1,663	<0.005	<0.005	0.031	<0.001	<0.001	0.003	0.058	<0.005	0.354	<0.000025	<0.005	<0.005	<0.002	2.358	--	--
	10/20/16	0.124	194	32	1.0	6.14	--	1,163	1,612	<0.005	<0.005	0.034	<0.001	0.002	0.004	0.065	<0.005	0.394	<0.000025	<0.005	<0.005	<0.002	2.224	--	--
	12/13/16	0.135	196	31	<1	6.03	--	1,096	1,560	<0.005	<0.005	0.017	<0.001	0.003	<0.001	0.068	<0.005	0.323	<0.000025	<0.005	<0.005	<0.002	2.384	--	--
	01/17/17	0.101	196	33	<1	5.96	--	1,445	1,686	<0.005	<0.005	0.014	<0.001	0.003	0.068	0.068	<0.005	0.341	<0.000025	<0.005	<0.005	<0.002	2.436	--	--
	02/22/17	0.135	189	30	<1	5.67	--	1,055	1,628	<0.005	<0.005	0.020	<0.001	0.002	0.001	0.073	<0.005	0.331	<0.000025	<0.005	<0.005	<0.002	2.288	--	--
	06/06/17	0.121	188	30	<0.083	5.81	156	1,105	1,578	<0.00093	<0.00105	0.01033	<0.00002	0.00606	<0.00023	0.0748	<0.00068	0.329	0.000013	<0.00029	<0.00099	<0.00086	1.598	--	--
	10/05/17	--	--	--	--	5.92	598	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.247	213	45	<0.083	5.51	<100	--	1,846	<0.00093	<0.00105	0.00978	<0.00002	0.00915	<0.00023	0.07451	<0.00068	0.306	<0.000005	<0.00029	0.00414	<0.00086	1.514	260	3.72
	Dissolved	*0.231*	*205*	--	--	5.51	<100	--	--	*<0.00093*	*<0.00105*	*0.00737*	*<0.00002*	*0.00609*	*<0.00023*	*0.07938*	*<0.00068*	*0.301*	*<0.000005*	*<0.00029*	*0.00515*	*0.02*	*1.57*	241	3.56
	05/24/18	0.239	193	39	<0.083	6.28	7.8	1,067	1,836	<0.00093	<0.00105	0.00965	<0.00002	0.00646	<0.00023	0.07173	<0.00068	0.308	<0.000005	<0.00029	<0.00099	<0.00086	1.939	--	--
	08/15/18	0.118	187	40	<0.083	5.60	418	1,170	1,750	0.00002 J	0.00183	0.0128	0.000069	0.00025	0.000604	0.0435	0.0011	0.243	0.000011 J	0.00035	0.0003	0.000074	2.35	--	--
	02/21/19	0.151	207	43.2	0.180	6.93	274	1,060	1,720	0.00008 J	0.00251	0.120	0.00024	0.00027	0.00334	0.0645	0.00249	0.268	0.000007 J	0.0007 J	0.0008	<0.0005	2.66	--	--
	05/30/19	0.158	--	41.7	<0.04	--	176	1,120	1,546	<0.00002	0.00041	0.0196	0.00002 J	0.00003 J	0.000246	0.0511	0.00003 J	0.341	<0.000005	<0.0004	0.00006 J	<0.0001	--	145	3.40
	07/24/19	0.113	216	37	0.085 J	5.96	113	1,127	1,864	<0.00002	0.00107	0.0143	0.00013	0.00003 J	0.000228	0.0577	0.000263	0.283	<0.000005	<0.0004	0.0001 J	<0.0001	3.45	--	--
	02/17/20	0.104	184	36	0.16	5.85	52.4	1,070	1,750	<0.00002	0.00072	0.00960	0.00004 J	<0.00001	0.00008 J	0.0423	<0.00005	0.273	<0.000004	<0.0004	<0.00003	<0.0001	3.46	--	--
	05/20/20	0.115	250	47.7	0.15	5.71	35.9	1,190	1,890	<0.00002	0.00086	0.0114	0.00007 J	0.00002 J	0.000231	0.0700	0.00008 J	0.302	<0.000002	<0.0004	0.00009 J	<0.0001	2.76	--	--
Offsite Background (Upgradient) Monitoring Wells																									
AD-22	06/19/19	0.04 J	2.61	17.3	0.1 J	5.59	<100	17.4	148	<0.0002	0.00163	0.104	0.0004 J	<0.0001	0.002 J	0.0181	0.0007 J	0.03 J	0.000003 J	<0.004	0.0006 J	<0.001	1.403	16.2	--
AD-23	06/19/19	0.03 J	1.16	6.04	0.05 J	5.72	44.1	0.8	52	<0.0002	0.00201	0.082	0.0006 J	<0.0001	0.00911	0.0111	0.001 J	<0.009	0.000004 J	<0.004	0.0009 J	<0.001	0.617	6.54	--
Background Statistical Evaluation Summary - Upper Prediction Limits:[a]										0.003	0.005	0.69	0.00054	0.0065[d]	0.0031	0.075[d]	0.0034	0.39[d]	0.000033	0.002	0.005	0.001	4.07[e]	--	--

Table 4-2
Groundwater Sampling Analytical Results (mg/L) - Primary Bottom Ash Pond
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

ARCADIS Design & Consultancy for natural and built assets

Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Point of Compliance Wells																									
AD-8	05/31/16	1.46	32.6	36	1	6.91	--	217	524	<0.005	<0.005	0.034	<0.001	<0.001	0.002	0.007	<0.005	0.122	<0.000025	<0.005	<0.005	<0.002	1.046	--	--
	07/28/16	1.44	25.9	26	<1	6.91	--	202	469	<0.005	<0.005	0.026	<0.001	<0.001	<0.001	0.009	<0.005	0.098	<0.000025	<0.005	<0.005	<0.002	1.584	--	--
	09/29/16	1.51	24.3	28	<1	7.65	--	186	432	<0.005	<0.005	0.023	<0.001	<0.001	<0.001	0.007	<0.005	0.111	<0.000025	<0.005	<0.005	<0.002	6.3	--	--
	10/20/16	1.54	25.9	30	<1	6.07	--	184	424	<0.005	<0.005	0.024	<0.001	<0.001	<0.001	0.007	<0.005	0.135	<0.000025	<0.005	<0.005	<0.002	0.345	--	--
	12/12/16	1.53	23.6	27	<1	5.62	--	168	442	<0.005	<0.005	0.021	<0.001	<0.001	<0.001	0.007	<0.005	0.11	<0.000025	<0.005	<0.005	<0.002	1.083	--	--
	01/19/17	1.53	18.7	24	1	6.21	--	153	352	<0.005	<0.005	0.02	<0.001	<0.001	<0.001	0.006	<0.005	0.094	<0.000025	<0.005	<0.005	<0.002	0.823	--	--
	02/22/17	1.67	19.3	22	<1	6.78	--	163	356	<0.005	<0.005	0.019	<0.001	<0.001	<0.001	0.006	<0.005	0.092	<0.000025	<0.005	<0.005	<0.002	0.536	--	--
	06/06/17	1.39	17.4	22	0.6628	5.63	54	151	368	<0.00093	<0.00105	0.01908	<0.00002	<0.00007	<0.00023	0.00386	<0.00068	0.09491	0.000008	<0.00029	<0.00099	<0.00086	1.0735	--	--
	10/05/17	--	--	--	--	6.68	41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/30/18	1.29	17.2	22	0.716	6.07	3.0	--	368	<0.00093	<0.00105	0.02283	0.00004	<0.00007	<0.00023	0.00521	<0.00068	0.08418	0.000009	<0.00029	<0.00099	<0.00086	1.106	0.673	0.388
	Dissolved	*1.31*	*17.1*	--	--	6.07	3.0	--	--	*<0.00093*	*<0.00105*	*0.02046*	*<0.00002*	*<0.00007*	*<0.00023*	*0.00513*	*<0.00068*	*0.08356*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*0.5773*	< 0.01	0.363
	05/23/18	--	--	--	0.501 J	6.20	*48.2*	--	--	0.00319 J	<0.00105	0.02212	<0.00002	<0.00007	<0.00023	0.00319 J	<0.00068	0.0956	<0.000005	<0.00029	0.00175 J	<0.00086	0.3366	--	--
	8/15/18[b]	1.30	15.0	24	0.615 J	6.77	104	122	288	0.00001 J	0.00031	0.0212	0.000008 J	0.000002 J	0.00005	0.00536	0.000039	0.0555	0.000007 J	0.00016	0.00007 J	0.000129	3.44	--	--
	02/21/19	1.47	17.6	23.2	0.660	6.40	88.2	163	352	<0.0001	0.00057	0.0281	0.00003 J	0.00003 J	0.000456	0.00288	0.000223	0.0911	<0.000025	<0.002	0.0001 J	<0.0005	0.417	--	--
	05/29/19	1.07	--	19.5	0.89	--	76.4	150	324	<0.00002	0.00037	0.0303	<0.00002	0.00002 J	0.0001 J	0.00603	0.00007 J	0.067	<0.000005	<0.0004	0.00006 J	0.0001 J	--	1.07	0.457
	07/23/19	1.21	20.8	15	0.559 J	6.58	31.4	145	392	<0.00002	0.00041	0.031	<0.00002	0.00002 J	0.00009 J	0.00707	0.00008 J	0.0641	<0.000005	<0.0004	0.00008 J	0.0001 J	0.72	--	--
	02/17/20	1.25	14.6	17	0.67	6.50	78.4	159	344	<0.00002	0.00055	0.0389	<0.00002	0.00005 J	0.000244	0.00102	0.0001 J	0.124	<0.000002	<0.0004	0.00008 J	<0.0001	1.257	--	--
	05/19/20	1.23	15.1	16.5	0.66	6.37	2.2	149	336	<0.00002	0.00027	0.0211	<0.00002	0.00004 J	0.0002 J	0.00117	<0.00005	0.0872	<0.000002	<0.0004	0.00007 J	<0.0001	0.344	--	--
AD-9	05/31/16	0.12	229	88	<1	6.32	--	1,352	2,541	<0.005	<0.005	0.051	<0.001	0.001	<0.001	0.027	<0.005	1.32	<0.000025	<0.005	<0.005	<0.002	2.95	--	--
	07/28/16	0.105	255	98	<1	6.32	--	1,464	2,564	<0.005	<0.005	0.031	<0.001	0.002	<0.001	0.022	<0.005	1.38	0.000045	<0.005	0.008	<0.002	1.447	--	--
	09/29/16	0.115	220	86	<1	4.72	--	1,301	2,448	<0.005	<0.005	0.033	<0.001	<0.001	<0.001	0.012	<0.005	1.17	<0.000025	<0.005	<0.005	<0.002	3.199	--	--
	10/19/16	0.109	228	76	1	5.22	--	1,350	2,494	<0.005	<0.005	0.026	<0.001	<0.001	<0.001	0.016	<0.005	1.44	<0.000025	<0.005	<0.005	<0.002	1.311	--	--
	12/12/16	0.108	250	92	<1	5.72	--	1,639	2,667	<0.005	<0.005	0.027	<0.001	0.002	<0.001	0.024	<0.005	1.33	<0.000025	<0.005	<0.005	<0.002	3.0	--	--
	01/19/17	0.312	91.1	54	<1	5.43	--	884	1,360	<0.005	<0.005	0.098	0.002	<0.001	<0.001	0.042	<0.005	0.634	<0.000025	<0.005	<0.005	<0.002	2.349	--	--
	02/22/17	0.1	258	86	<1	5.77	--	1,774	2,662	<0.005	<0.005	0.022	<0.001	<0.001	<0.001	0.024	<0.005	1.41	<0.000025	<0.005	<0.005	<0.002	2.32	--	--
	06/06/17	0.146	191	19	<0.083	4.61	100	105	308	<0.00093	<0.00105	0.04227	0.00077	0.00222	<0.00023	0.02416	<0.00068	1.00	0.000006	<0.00029	<0.00099	<0.00086	1.586	--	--
	10/05/17	--	--	--	--	5.78	102	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/16/18	0.08607	10.5	85	<0.083	4.20	<100		1,972	<0.00093	<0.00105	0.04937	0.00134	0.00023	<0.00023	0.01628	<0.00068	0.217	<0.000005	<0.00029	<0.00099	<0.00086	1.582	0.446	0.378
	Dissolved	*0.07126*	*10.2*	--	--	4.20	<100	--	--	*<0.00093*	*<0.00105*	*0.04695*	*0.00122*	*0.00012*	*<0.00023*	*0.01592*	*<0.00068*	*0.204*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*1.549*	0.166	0.369
	05/23/18	--	--	--	<0.083	5.30	44.6	--	--	<0.00093	<0.00105	0.03045	0.00032 J	0.00288	<0.00023	0.0267	<0.00068	1.20	<0.000005	<0.00029	<0.00099	0.00846	2.556	--	--
	8/15/18[b]	0.198	230	103	<0.083	4.96	237	1,910	2,694	<0.01	0.00168	0.0242	0.000268	0.00006	0.00042	0.0111	0.000262	0.851	0.000013 J	0.00011	0.0003	0.000062	1.864	--	--
	02/21/19	1.39	211	89	0.19	4.98	115	1,350	2,240	<0.0001	0.00118	0.0524	0.000474	0.00009	0.000313	0.0148	0.00008 J	1.12	0.00001 J	<0.002	0.0003	0.0001 J	2.51	--	--
	05/29/19	0.06 J	--	44	0.16	--	27.2	503	1,758	<0.00002	0.0002	0.0497	0.000941	0.00021	0.000346	0.0159	0.00007 J	0.225	<0.000005	<0.0004	0.0002	0.0002 J	--	0.485	0.363
	07/23/19	0.081	222	77	0.5736 J	6.28	8.7	1,701	2,460	<0.00002	0.00139	0.0321	0.000361	0.00006	0.0002 J	0.0127	0.0002 J	1.11	<0.000005	<0.0004	0.0004	<0.0001	1.689	--	--
	02/17/20	0.120	11.5	19.9	0.15	6.02	6.8	100	282	<0.00002	0.00033	0.0528	0.000979	0.00024	0.000608	0.0177	0.0002 J	0.218	0.000002 J	<0.0004	0.0003	0.0002 J	1.938	--	--
	05/19/20	0.066	11.3	44.8	0.1 J	4.90	8.3	536	902	<0.00002	0.00025	0.0516	0.000933	0.00024	0.000458	0.0165	0.00007 J	0.160	0.000003 J	<0.0004	0.0004	0.0002 J	1.854	--	--
AD-15	05/31/16	0.329	5.09	30	<1	5.58	--	24	188	<0.005	0.012	0.215	<0.001	<0.001	0.017	0.011	0.007	0.017	0.000054	<0.005	<0.005	<0.002	2.28	--	--
	07/28/16	0.407	3.83	34	<1	5.58	--	28	196	<0.005	0.006	0.124	<0.001	<0.001	0.004	0.006	<0.005	0.021	<0.000025	<0.005	<0.005	<0.002	1.322	--	--
	09/29/16	0.360	13.7	28	<1	4.57	--	23	367	<0.005	0.131	1.93	0.015	0.007	0.28	0.134	0.161	0.149	0.000707	<0.005	0.014	<0.002	9.92	--	--
	10/19/16	0.152	4.57	26	<1	4.35	--	17	152	<0.005	0.023	0.415	0.002	<0.001	0.054	0.019	0.022	0.036	0.0001	<0.005	<0.005	<0.002	3.567	--	--
	12/12/16	0.334	3.60	26	<1	4.67	--	19	204	<0.005	0.006	0.184	<0.001	<0.001	0.015	0.010	<0.005	0.013	0.000026	<0.005	<0.005	<0.002	3.36	--	--
	01/19/17	0.413	3.35	32	<1	5.77	--	25	176	<0.005	0.006	0.153	<0.001	<0.001	0.009	0.007	<0.005	0.008	<0.000025	<0.005	<0.005	<0.002	2.386	--	--
	02/22/17	0.100	4.21	20	<1	4.95	--	8	88	<0.005	0.020	0.353	0.002	<0.001	0.049	0.020	0.019	0.025	0.000058	<0.005	<0.005	<0.002	2.261	--	--
	06/06/17	0.321	3.57	27	<0.083	4.83	246	19	184	<0.00093	0.00854	0.166	0.00061	0.00048	0.01235	0.00844	0.00298	0.0108	0.000022	<0.00029	0.00271	<0.00086	2.491	--	--
	10/05/17	--	--	--	--	5.94	208	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/30/18	0.08009	2.49	22	<0.083	4.60	7.32		94	<0.00093	0.00222	0.08419	0.00024	<0.00007	<0.00023	0.00403	<0.00068	0.00395	<0.000005	<0.00029	<0.00099	<0.00086	1.749	6.64	0.036
	Dissolved	*0.05773*	*2.49*	--	--	4.60	7.32	--	--	*<0.00093*	*<0.00105*	*0.08405*	*0.00019*	*<0.00007*	*<0.00023*	*0.00346*	*<0.00068*	*0.00378*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*0.748*	< 0.01	0.034
	Field Filtered[c]	*0.301*	*3.03*	*35*	*<0.083*	4.60	7.32	--	*8*	*<0.00093*	*0.00216*	*0.08611*	*0.00012*	*<0.00007*	*<0.00023*	*0.00421*	*<0.00068*	*0.00498*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*1.630*	7.09	0.061
	FF Dissolved[c]	*0.309*	*3*	--	--	4.60	7.32	--	--	*<0.00093*	*<0.00105*	*0.08373*	*0.00024*	*<0.00007*	*<0.00023*	*0.0038*	*<0.00068*	*0.00516*	*<0.000005*	*0.00048*	*<0.00099*	*<0.00086*	*5.743*	<0.01	0.062
	05/23/18	--	--	--	<0.083	4.76	147	--	--	<0.00093	0.00256 J	0.102	0.00003 J	0.0001 J	0.00263	0.00474 J	<0.00068	0.00562	<0.000005	<0.00029	0.00154 J	0.00137 J	1.46	--	--
	8/15/18[b]	0.341	3.04	37	<0.083	4.59	249	24	174	0.00003 J	0.00326	0.0852	0.000116	0.00001 J	0.000481	0.00371	0.000438	0.00338	0.000008 J	0.00005 J	0.0009	0.00009	1.076	--	--
	02/21/19	0.169	2.67	28.2	0.09	4.98	116	10.6	150	<0.0001	0.00221	0.0766	0.000208	0.00001 J	0.000225	0.0029	0.000104	0.00294	<0.000025	<0.002	0.0004	<0.0005	0.841	--	--
	05/29/19	<0.02	--	21.4	0.06	--	185	2.1	34	<0.0001	0.00410	0.199	0.00186	0.00008 J	0.0103	0.00595	0.0101	0.01 J	0.000081	<0.002	0.0057	<0.0005	--	18.4	0.0423
	07/23/19	0.306	3.45	28	0.086 J	3.17	885	18	214	0.00003 J	0.00210	0.113	0.000573	0.00004 J	0.00226	0.00541	0.00287	0.00414	0.000025	<0.0004	0.0016	<0.0001	2.245	--	--
	02/17/20	0.419	3.64	34.3	0.11	4.48	211	21.5	234	0.00009 J	0.00912	0.115	0.000390	0.00002 J	0.00601	0.00408	0.00480	0.00509	0.000013	0.00332	0.0017	0.0001 J	2.546	--	--
	05/19/20	0.376	3.37	34.1	0.07	5.26	24.8	19	216	0.00002 J	0.00394	0.0803	0.00009 J	0.00001 J	0.0002 J	0.00328	0.00009 J	0.00383	<0.000002	<0.0004	0.0007	<0.0001	1.115	--	--

Table 4-2
Groundwater Sampling Analytical Results (mg/L) - Primary Bottom Ash Pond
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

		Appendix III Parameters								Appendix IV Parameters															
Well	**Date Sampled**	**Boron (total)**	**Calcium (total)**	**Chloride**	**Fluoride**	**pH**	**Turbidity (field)**	**Sulfate**	**TDS**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Chromium**	**Cobalt**	**Lead**	**Lithium**	**Mercury**	**Molybdenum**	**Selenium**	**Thallium**	**Radium 226 and 228 (pCi/L)**	**Iron**	**Manganese**
Supplemental Downgradient Monitoring Wells																									
AD-10	5/16/2018	0.08311	15.5	40	<0.083	3.72	<100	--	280	<0.00093	0.0022	0.03855	0.00166	0.00033	<0.00023	0.02432	<0.00068	0.316	<0.000005	<0.00029	<0.00099	0.00098	1.704	0.338	0.25
	Dissolved	*0.07733*	*15.3*	--	--	--	--	--	--	*<0.00093*	*<0.00105*	*0.03712*	*0.00149*	*0.00009*	*<0.00023*	*0.02412*	*<0.00068*	*0.296*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*1.505*	0.282	0.251
Supplemental Sidegradient Monitoring Wells																									
MW-9	5/15/2018	0.578	44.8	93	<0.083	4.74	57.4	--	780	0.00097	<0.00105	0.01661	0.00021	0.00019	<0.00023	0.03083	<0.00068	0.03225	0.000127	<0.00029	<0.00099	<0.00086	0.779	0.142	0.306
	Dissolved	*0.556*	*44.7*	--	--	--	--	--	--	*<0.00093*	*<0.00105*	*0.01588*	*0.00015*	*0.00036*	*<0.00023*	*0.03189*	*0.00813*	*0.03151*	*0.00015*	*<0.00029*	*<0.00099*	*<0.00086*	*0.2578*	< 0.01	0.308
MW-10	5/15/2018	0.707	59.3	5	<0.083	6.68	1.7	--	346	<0.00093	0.00128	0.08634	0.00006	<0.00007	<0.00023	0.00385	<0.00068	0.01001	<0.000005	0.00079	0.01898	<0.00086	0.969	0.101	0.054
	Dissolved	*0.689*	*59.8*	--	--	--	--	--	--	*<0.00093*	*<0.00105*	*0.08253*	*<0.00002*	*<0.00007*	*<0.00023*	*0.00064*	*<0.00068*	*0.00924*	*<0.000005*	*0.00082*	*0.01651*	*<0.00086*	*1.026*	< 0.01	0.002
EPA MCLs:																									
MCL					4					0.006	0.01	2	0.004	0.005	0.1				0.002		0.05	0.002	5[e]		
Rule Specified																0.006	0.015	0.04		0.1					
Background Limit					0.58					0.003	0.005	0.69	0.00054	0.0065[d]	0.0031	0.075[d]	0.0034	0.39[d]	0.000033	0.002	0.005	0.001	4.07[e]		
Interwell Background Value(s) (UPL, LPL where applicable) AD-8, AD-9, AD-15		0.700				4.8-7.0																			
Intrawell Background Value (UPL) AD-8			15.1	16.5	0.66			149	336																
Intrawell Background Value (UPL) AD-9			299	138	1.00			2,530	3,070																
Intrawell Background Value (UPL) AD-15			5.40	38.8	1.00			33.2	249																

NOTES:
All concentration data are provided in milligrams per liter (mg/L) unless otherwise noted.
J = Analyte was positively identified, though the quantitation was below Reporting Limit.
MCL - Maximum contaminant level
LPL = Lower prediction limit
UPL = Upper prediction limit
pCi/L = PicoCuries per liter
-- = Not analyzed
a = Data taken from Geosyntec "Statistical Analysis Summary, Primary Bottom Ash Pond" dated September 1, 2020".
b = Some inorganic analyte groundwater samples collected 9/17/18.
c = Sample ID "AD-15 DUP" was field filtered (FF) using a 5 micron filter.
d = Calculated Upper Tolerance Limit is higher than MCL.
e = Data is "Combined Radium, Total".
Denotes groundwater sample collected by ARCADIS using low-flow methods.
Unless otherwise noted, values shown are total (unfiltered) analyses.
Dissolved (0.45-micron lab filtered) parameter concentrations shown in italics.

Table 4-3
Groundwater Sampling Analytical Results (mg/L) - Landfill
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH (field)	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Background (Upgradient) Wells																									
AD-5	05/31/16	0.03	36.9	15	<1	6.38	--	123	337	<0.005	<0.005	0.057	<0.001	<0.001	<0.001	0.014	<0.005	0.135	<0.000025	<0.005	<0.005	<0.002	1.63	--	--
	07/28/16	0.04	44.7	16	<1	6.38	--	163	360	<0.005	<0.005	0.093	<0.001	<0.001	<0.001	0.015	<0.005	0.191	<0.000025	<0.005	<0.005	<0.002	4.75	--	--
	09/29/16	0.04	46.3	15	<1	5.29	--	190	416	<0.005	<0.005	0.087	<0.001	<0.001	<0.001	0.014	<0.005	0.186	<0.000025	<0.005	<0.005	<0.002	3.33	--	--
	10/20/16	0.05	50.7	14	<1	5.92	--	267	448	<0.005	<0.005	0.07	<0.001	<0.001	<0.001	0.009	<0.005	0.225	<0.000025	<0.005	<0.005	<0.002	2.319	--	--
	12/13/16	0.05	49.6	13	<1	6.29	--	233	484	<0.005	<0.005	0.053	<0.001	<0.001	<0.001	0.013	<0.005	0.199	<0.000025	<0.005	<0.005	<0.002	2.182	--	--
	01/17/17	0.04	49.8	14	<1	6.27	--	234	438	<0.005	<0.005	0.047	<0.001	<0.001	<0.001	0.012	<0.005	0.239	<0.000025	<0.005	<0.005	<0.002	1.023	--	--
	02/23/17	0.04	33.0	15	<1	5.48	--	127	286	<0.005	<0.005	0.042	<0.001	<0.001	<0.001	0.013	<0.005	0.166	<0.000025	<0.005	<0.005	<0.002	1.788	--	--
	06/07/17	0.05281	49.7	14	<0.083	5.96	867	82	300	<0.00093	0.00385	0.0877	0.00008	0.00039	0.00028	0.01193	<0.00068	0.124	<0.000005	<0.00029	<0.00099	<0.00086	2.32	--	--
	10/06/17	--	--	--	--	5.59	249	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.05063	30.1	21	<0.083	5.79	<100	--	248	<0.00093	<0.00105	0.07627	0.00014	0.00037	<0.00023	0.01907	<0.00068	0.118	<0.000005	<0.00029	<0.00099	<0.00086	1.495	14.4	0.45
	Dissolved	*0.03752*	*29.1*	--	--	5.79	<100	--	--	*<0.00093*	*<0.00105*	*0.06865*	*<0.00002*	*<0.00007*	*<0.00023*	*0.01747*	*<0.00068*	*0.119*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.043*	*2.051*	8.38	0.43
	05/24/18	0.05007	28.1	22	<0.083	6.22	17.8	60	242	<0.00093	<0.00105	0.07116	<0.00002	0.00023 J	0.0008 J	0.01424	<0.00068	0.121	<0.000005	<0.00029	<0.00099	<0.00086	1.946	--	--
	08/15/18	0.05	40.5	19	<0.083	6.23	57.1	240	428	0.00001 J	0.00169	0.0637	0.000055	0.000008 J	0.000072	0.0114	0.000079	0.147	<0.000005	0.00013	0.00008 J	<0.01	0.316	--	--
	02/21/19	0.033	33.9	24.7	0.21	5.38	164	46.5	220	0.00002 J	0.00159	0.0694	0.00008 J	<0.00005	0.000432	0.00858	0.000147	0.0807	<0.000025	<0.002	0.0001 J	<0.0005	1.27	--	--
	05/30/19	0.03 J	--	22.3	0.29	--	150	51.3	238	<0.00002	0.00305	0.0605	0.00008 J	<0.00001	0.00006 J	0.0118	0.00005 J	0.104	0.000006	<0.0004	0.00005 J	<0.0001	--	23.4	0.331
	07/24/19	0.04 J	41.1	18	0.112 J	6.3	108	90	354	<0.00002	0.00248	0.0774	0.00005 J	<0.00001	0.00005 J	0.00838	<0.00005	0.108	<0.000005	<0.0004	0.00006 J	<0.0001	2.533	--	--
	02/17/20	0.03 J	39.8	19.8	0.22	5.45	422	43.7	248	0.00003 J	0.00217	0.109	0.00009 J	0.00002 J	0.000336	0.00452	0.000227	0.0732	<0.000002	0.0009 J	0.0002	<0.0001	2.393	--	--
	05/20/20	0.03 J	40.2	22.3	0.18	6.83	355	55.5	264	<0.00002	0.00178	0.0931	0.00005 J	0.00001 J	0.0001 J	0.00765	0.00007 J	0.0740	<0.000002	<0.0004	0.00009 J	<0.0001	1.612	--	--
AD-18[d]	05/26/16	0.146	409	422	<1	5.1	--	5,135	10,000	<0.005	<0.005	0.012	0.014	0.003	<0.001	0.922	<0.005	2.07	0.000168	<0.005	0.006	0.003	12.58	--	--
	07/27/16	0.148	457	432	2	5.1	--	4,930	9,476	<0.005	<0.005	0.019	0.005	0.002	<0.001	0.734	<0.005	1.94	0.000091	<0.005	0.007	0.003	10.62	--	--
	09/29/16	0.156	469	637	4	5.59	--	4,632	9,569	<0.005	<0.005	0.02	0.004	<0.001	<0.001	0.666	<0.005	1.86	0.000117	<0.005	0.007	<0.002	7.05	--	--
	10/20/16	0.188	498	876	0.8664	5.7	--	5,537	9,540	<0.005	<0.005	0.021	0.002	0.001	<0.001	0.569	<0.005	2.06	0.000053	<0.005	<0.005	<0.002	5.82	--	--
	12/13/16	0.178	510	695	5	5.75	--	4,382	8,912	<0.005	<0.005	0.021	0.007	0.001	<0.001	0.641	<0.005	1.74	0.00005	<0.005	<0.005	<0.002	9.6	--	--
	01/17/17	0.050	412	159	5	4.49	--	5,414	8,562	<0.005	0.01	0.014	0.022	0.001	<0.001	0.929	<0.005	1.95	0.000224	<0.005	<0.005	0.002	22.51	--	--
	02/22/17	0.090	401	151	6	4.37	--	5,169	8,412	<0.005	<0.005	0.014	0.026	0.002	<0.001	0.961	<0.005	1.82	0.000107	<0.005	<0.005	0.00228	19.11	--	--
	06/06/17	0.125	428	304	6.53	4.27	121	5,920	9,394	<0.00093	0.00331	0.01038	0.01883	0.00303	<0.00023	0.940	<0.00068	2.15	0.000113	<0.00029	0.00212	<0.00086	16.12	--	--
	10/05/17	--	--	--	--	5.87	165	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.163	433	362	9.4	3.61	104.1	--	9,952	0.00224	0.00276	0.00813	0.01733	0.0036	0.00098	0.928	<0.00068	2.07	0.000043	<0.00029	0.00194	0.00144	19.95	19.7	14.1
	Dissolved	*0.153*	*423*	--	--	--	--	--	--	*0.00467*	*0.00189*	*0.00748*	*0.01676*	*0.00316*	*<0.00023*	*0.898*	*<0.00068*	*2.06*	*0.000012*	*<0.00029*	*0.00135*	*0.01466*	*18.09*	19.1	13.7
	05/30/19	0.09 J	--	390	3.56	--	91.3	6,120	9,564	<0.0002	0.040	0.009 J	0.021	0.004 J	<0.004	1.130	0.005 J	1.27	0.000035	<0.04	0.103	<0.01	--	11.2	7.53
Background Statistical Evaluation Summary - Upper Prediction Limits:[a]										0.003	0.005	0.69	0.00054	0.0065d	0.0031	0.075[d]	0.0034	0.39[d]	0.000033	0.002	0.005	0.001	4.07[e]	--	--
Point of Compliance Wells																									
AD-11	05/31/16	2.47	8.47	9	2	5.21	--	518	388	<0.005	<0.005	0.014	0.004	<0.001	0.003	0.026	<0.005	0.032	<0.000025	<0.005	<0.005	<0.002	1.77	--	--
	07/28/16	2.83	8.88	10	2	5.21	--	596	1,000	<0.005	<0.005	0.012	0.004	<0.001	<0.001	0.026	<0.005	0.047	<0.000025	<0.005	<0.005	<0.002	2.23	--	--
	09/29/16	3.4	10.7	12	2	4.08	--	683	1,065	<0.005	<0.005	0.052	0.005	<0.001	0.007	0.03	<0.005	0.047	<0.000025	<0.005	<0.005	<0.002	3.92	--	--
	10/19/16	3.77	8.78	11	<1	3.68	--	706	1,024	<0.005	<0.005	0.02	0.005	<0.001	0.002	0.027	<0.005	0.047	<0.000025	<0.005	<0.005	<0.002	2.56	--	--
	12/12/16	3.36	8.98	10	2	3.75	--	548	1,044	<0.005	<0.005	0.013	0.004	<0.001	<0.001	0.025	<0.005	0.041	<0.000025	<0.005	<0.005	<0.002	1.569	--	--
	01/17/17	2.81	10.3	11	2	4.41	--	760	1,048	<0.005	<0.005	0.013	0.004	<0.001	<0.001	0.025	<0.005	0.046	<0.000025	<0.005	<0.005	<0.002	1.082	--	--
	02/22/17	2.88	9.31	10	2	4.34	--	558	876	<0.005	<0.005	0.019	0.004	<0.001	0.002	0.024	<0.005	0.035	<0.000025	<0.005	<0.005	<0.002	1.45	--	--
	06/06/17	2.79	9.93	10	1.366	3.86	219	556	960	<0.00093	0.00123	0.01012	0.00279	0.00041	0.00032	0.02216	<0.00068	0.03654	<0.000005	<0.00029	<0.00099	<0.00086	1.902	--	--
	10/05/17	--	--	--	--	4.43	162	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/16/18	1.48	4.37	10	<0.083	3.77	75.3		558	0.00417	0.00127	0.01281	0.00148	0.00053	0.00041	0.00935	<0.00068	0.01978	<0.000005	0.00094	0.00103	<0.00086	1.264	1.35	0.063
	Dissolved	*1.45*	*4.28*	--	--	3.77	75.3	--	--	*<0.00093*	*0.00278*	*0.01202*	*0.00098*	*<0.00007*	*<0.00023*	*0.00877*	*<0.00068*	*0.01836*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*1.656*	1.25	0.062
	05/23/18	--	--	--	<0.083	*4.05*	*49.8*	--	--	<0.00093	0.0026 J	0.01627	0.00089 J	0.00018 J	0.0008 J	0.00863	<0.00068	0.01875	0.000007 J	<0.00029	0.00134 J	0.046	1.912	--	--
	08/15/18	1.84	6.61	15	<0.083	4.73	112	410	720	--	0.00105	0.0119	0.00118	0.00037	0.000257	0.0153	--	0.0175	<0.000005	--	0.0024	0.0002	2.6	--	--
	05/29/19	1.40	--	6.96	0.47	--	67.6	367	680	<0.0001	0.00113	0.0182	0.00138	0.0002 J	0.0004 J	0.00969	0.000804	0.02 J	<0.000005	<0.002	0.0022	<0.0005	--	1.46	0.0669
	07/23/19	1.56	7.19	6	0.338	--	170	342	700	<0.0002	0.00059	0.0164	0.000987	0.00024	0.000413	0.0105	0.000976	0.0153	<0.000005	<0.0004	0.001	0.0002 J	2.246	--	--
	02/17/20	1.47	20.5	8.19	0.42	4.85	25.5	350	622	0.00003 J	0.00039	0.0579	0.000431	0.00021	0.000334	0.00841	0.000493	0.0142	0.000007	0.002 J	0.0008	0.001 J	2.106	--	--
	05/19/20	1.54	24.3	--	--	6.25	1.0	--	--	0.00004 J	0.00055	0.0357	0.000782	0.00026	0.000254	0.0114	0.000427	0.0138	0.000006	<0.0004	0.0014	0.0001 J	2.352	--	--
AD-13	05/31/16	1.19	8.02	12	<1	6.05		177	900	<0.005	<0.005	0.062	<0.001	<0.001	<0.001	<0.005	<0.005	0.011	<0.000025	<0.005	<0.005	<0.002	1.22	--	--
	07/27/16	1.23	3.7	15	1	6.05		187	--	<0.005	<0.005	0.036	<0.001	<0.001	<0.001	<0.005	<0.005	0.026	<0.000025	<0.005	<0.005	<0.002	1.601	--	--
	09/29/16	1.37	2.7	17	1	4.56		207	431	<0.005	<0.005	0.04	<0.001	<0.001	<0.001	<0.005	<0.005	0.02	<0.000025	<0.005	<0.005	<0.002	2.213	--	--
	10/19/16	1.67	3.66	19	1	4.34		226	482	<0.005	<0.005	0.03	<0.001	<0.001	<0.001	<0.005	<0.005	0.022	<0.000025	<0.005	<0.005	<0.002	3.662	--	--
	12/05/16	--	--	--	--	--		--	532	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/13/16	1.96	3.77	18	1	4.79		287	596	<0.005	<0.005	0.051	0.001	<0.001	0.007	0.007	<0.005	0.025	<0.000025	<0.005	<0.005	<0.002	2.27	--	--
	01/19/17	0.402	33.5	7	<1	5.38		90	222	<0.005	0.006	0.112	<0.001	<0.001	0.004	<0.005	<0.005	0.004	<0.000025	<0.005	<0.005	<0.002	2.228	--	--
	02/23/17	1.27	10.3	13	<1	5.06		183	392	<0.005	<0.005	0.041	<0.001	<0.001	<0.001	<0.005	<0.005	0.015	<0.000025	<0.005	<0.005	<0.002	1.556	--	--
	06/06/17	1.68	3.03	15	0.6679	4.22	171	244	494	0.00153	<0.00105	0.01712	0.00089	0.00014	<0.00023	0.00624	<0.00068	0.02082	<0.000005	<0.00029	0.00103	<0.00086	1.565	--	--
	10/06/17	--	--	--	--	4.61	173	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4-3
Groundwater Sampling Analytical Results (mg/L) - Landfill
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH (field)	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
AD-13 (cont.)	05/16/18	1.42	7.48	10	0.5362	4.20	1.4		532	<0.00093	<0.00105	0.0216	0.00088	0.00011	<0.00023	0.00809	<0.00068	0.02603	<0.000005	<0.00029	<0.00099	<0.00086	2.064	0.858	0.046
	Dissolved	1.41	7.31	--	--	4.20	1.4	--	--	<0.00093	<0.00105	0.02097	0.0008	<0.00007	<0.00023	0.00784	<0.00068	0.02439	<0.000005	<0.00029	<0.00099	<0.00086	1.407	0.712	0.045
	05/23/18	--	--	--	0.6534 J	4.52	52.7	--	--	<0.00093	<0.00105	0.02653	0.00087 J	<0.00007	0.00073 J	0.00937	<0.00068	0.0291	0.000008 J	<0.00029	<0.00099	<0.043	2.16	--	--
	08/14/18	1.49	10.1	18	0.7442	4.82	131	316	620	--	0.00137	0.0169	0.000971	0.00031	0.000503	0.0131	--	0.0321	<0.000005	--	0.0017	0.000277	4.0	--	--
	05/30/19	0.477	--	3.6	0.53	--	83.6	94	196	0.00003 J	0.00032	0.0609	0.000385	0.00007	0.00031	0.00315	0.00005 J	0.009 J	<0.000005	<0.0004	0.0004	<0.0001	--	0.086	0.0141
	07/23/19	0.780	6.16	5	0.169	--	216	146	334	0.00002 J	0.00037	0.0236	0.000443	0.00009	0.000283	0.00382	0.000204	0.0175	<0.000005	<0.0004	0.0003	0.0001 J	1.748	--	--
	02/17/20	0.929	17.6	7.79	0.69	4.93	104	236	442	0.00003 J	0.00059	0.0594	0.000528	0.00012	0.000354	0.00384	0.0001 J	0.0132	0.000012	0.0005 J	0.0011	<0.0001	3.790	--	--
	05/19/20	0.936	19.2	--	--	5.49	0.0	--	--	0.00005 J	0.00053	0.0503	0.000533	0.00009	0.000261	0.00387	0.00006 J	0.0147	0.000034	0.001 J	0.0013	<0.0001	1.977	--	--
AD-14	05/31/16	1.28	2.88	4	<1	4.75	--	115	285	<0.005	<0.005	0.031	<0.001	<0.001	<0.001	0.010	<0.005	0.012	0.00003	<0.005	<0.005	<0.002	0.87	--	--
	07/27/16	1.14	2.51	5	<1	4.75	--	111	267	<0.005	<0.005	0.084	<0.001	<0.001	0.001	0.009	<0.005	0.024	<0.000025	<0.005	<0.005	<0.002	1.487	--	--
	09/29/16	1.14	1.19	5	<1	4.17	--	111	252	<0.005	<0.005	0.03	<0.001	<0.001	<0.001	0.009	<0.005	0.015	<0.000025	<0.005	<0.005	<0.002	4.817	--	--
	10/19/16	1.25	2.48	4	<1	3.88	--	118	276	<0.005	<0.005	0.039	<0.001	0.001	<0.001	0.009	<0.005	0.014	<0.000025	<0.005	<0.005	<0.002	1.972	--	--
	12/12/16	1.25	2.41	5	<1	4.11	--	101	296	<0.005	<0.005	0.047	<0.001	0.001	0.001	0.009	<0.005	0.013	0.000037	<0.005	<0.005	<0.002	1.271	--	--
	01/17/17	0.915	10.3	4	<1	6.07	--	92	254	<0.005	<0.005	0.038	<0.001	<0.001	<0.001	<0.005	<0.005	0.013	<0.000025	<0.005	<0.005	<0.002	1.825	--	--
	02/22/17	1.06	9.48	4	<1	5.39	--	90	212	<0.005	<0.005	0.042	<0.001	<0.001	<0.001	<0.005	<0.005	0.012	<0.000025	<0.005	<0.005	<0.002	0.512	--	--
	06/06/17	1.26	7.69	6	<0.083	4.77	167	108	256	<0.00093	<0.00105	0.04483	0.00038	0.00067	0.00127	0.00678	<0.00068	0.0127	0.000021	<0.00029	0.00261	<0.00086	1.138	--	--
	10/06/17	--	--	--	--	4.57	150	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/16/18	1.61	4.67	11	<0.083	4.11	5.1	--	332	<0.00093	<0.00105	0.03161	0.00094	0.00204	<0.00023	0.01501	<0.00068	0.01638	0.000137	<0.00029	0.00221	<0.00086	1.097	0.09	0.008
	Dissolved	1.56	4.55	--	--	4.11	5.1	--	--	<0.00093	<0.00105	0.02938	0.00094	0.00193	<0.00023	0.01476	<0.00068	0.01523	0.000149	<0.00029	0.00387	<0.00086	0.5903	0.06	0.007
	05/23/18	--	--	--	<0.083	4.17	43.2	--	--	<0.00093	<0.00105	0.02817	0.00078 J	0.00161	<0.00023	0.01434	<0.00068	0.0152	0.000145	<0.00029	0.00362	<0.043	1.601	--	--
	08/14/18	1.51	4.51	12	<0.083	4.27	198	204	384	--	0.00039	0.024	0.000854	0.00199	0.000276	0.0176	--	0.011	0.000181	--	0.0037	0.000242	1.5	--	--
	05/29/19	1.21	--	3.65	0.19	--	20.6	122	274	<0.0001	0.0005	0.0434	0.000709	0.00087	0.0002 J	0.00774	0.0001 J	0.02 J	0.000181	<0.0002	0.0019	<0.0005		0.005 J	0.00023
	07/23/19	1.25	9.93	8	0.162	--	21.7	171	440	<0.00002	0.00043	0.0362	0.000934	0.00249	0.000286	0.0185	0.0002	0.0155	0.000123	<0.0004	0.0027	0.0002 J	2.731	--	--
	02/17/20	1.12	38.7	2	0.24	5.21	5.5	85.6	294	0.00007 J	0.00043	0.0444	0.000179	0.00020	0.0002 J	0.00232	0.00007 J	0.00630	0.000003 J	0.002 J	0.0025	0.0001 J	2.552	--	--
	05/19/20	1.22	15.1	--	--	5.36	0.5	--	--	0.00003 J	0.00032	0.0353	0.000396	0.00032	0.000307	0.00381	0.0001 J	0.00875	0.000002 J	0.001 J	0.0015	<0.0001	0.778	--	--
Supplemental Downgradient Monitoring Well																									
AD-10	5/16/2018	0.08311	15.5	40	<0.083	3.72	<100	--	280	<0.00093	0.0022	0.03855	0.00166	0.00033	<0.00023	0.02432	<0.00068	0.316	<0.000005	<0.00029	<0.00099	0.00098	1.704	0.338	0.25
	Dissolved	0.07733	15.3	--	--	--	--	--	--	<0.00093	<0.00105	0.03712	0.00149	0.00009	<0.00023	0.02412	<0.00068	0.296	<0.000005	<0.00029	<0.00099	<0.00086	1.505	0.282	0.251
Supplemental Sidegradient Monitoring Wells																									
Temp-1	5/17/2018	0.662	26.2	34	<0.083	4.90	23.8	--	556	<0.00093	<0.00105	0.07752	0.00058	<0.00007	0.00102	0.01058	<0.00068	0.01075	<0.000005	<0.00029	<0.00099	<0.00086	1.277	1.94	0.203
	Dissolved	0.621	24.6	--	--	--	--	--	--	<0.00093	<0.00105	0.06778	0.00042	<0.00007	<0.00023	0.00946	<0.00068	0.00986	<0.000005	<0.00029	<0.00099	0.00191	2.278	0.813	0.192
AD-12	6/19/2019	0.569	34.1	44.1	0.32	6.3	40.1	131	436	<0.0001	0.00123	0.0581	0.0004 J	0.00005 J	0.0003 J	0.0126	<0.0001	0.042	<0.000002	<0.002	0.0005 J	<0.0005	2.007	25.9	--
EPA MCLs:																									
MCL					4					0.006	0.01	2	0.004	0.005	0.1				0.002		0.05	0.002	5[c]		
Rule Specified																0.006	0.015	0.04		0.1					
Background Limit					0.58					0.003	0.005	0.69	0.00054	0.0065d	0.0031	0.075[d]	0.0034	0.39[d]	0.000033	0.002	0.005	0.001	4.07[e]		
Interwell Background Value(s) (UPL, LPL where applicable) AD-8, AD-9, AD-15		0.700				4.8-7.0																			
Intrawell Background Value (UPL) AD-8			15.1	16.5	0.660			149	336																
Intrawell Background Value (UPL) AD-9			299	138	1.00			2,530	3,070																
Intrawell Background Value (UPL) AD-15			5.40	38.8	1.00			33.2	249																

NOTES:
All concentration data are provided in milligrams per liter (mg/L) unless otherwise noted.
J = Analyte was positively identified, though the quantitation was below Reporting Limit.
MCL = Maximum contaminant level
LPL = Lower prediction limit
UPL = Upper prediction limit
pCi/L = PicoCuries per liter
-- = Not analyzed
a = Data taken from Geosyntec "Statistical Analysis Summary, Primary Bottom Ash Pond" dated September 1, 2020.
b = Calculated Upper Tolerance Limit is higher than MCL.
c = Data is "Combined Radium, Total".
d = AD-18 is not part of the designated CCR Monitoring Well Network and used for background understanding only
Denotes groundwater sample collected by ARCADIS using low-flow methods.
Unless otherwise noted, values shown are total (unfiltered) analyses.
Dissolved (0.45-micron lab filtered) parameter concentrations shown in italics.

Table 4-4
Groundwater Sampling Analytical Results (mg/L) - Bottom Ash Storage Pond
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

ARCADIS Design & Consultancy for natural and built assets

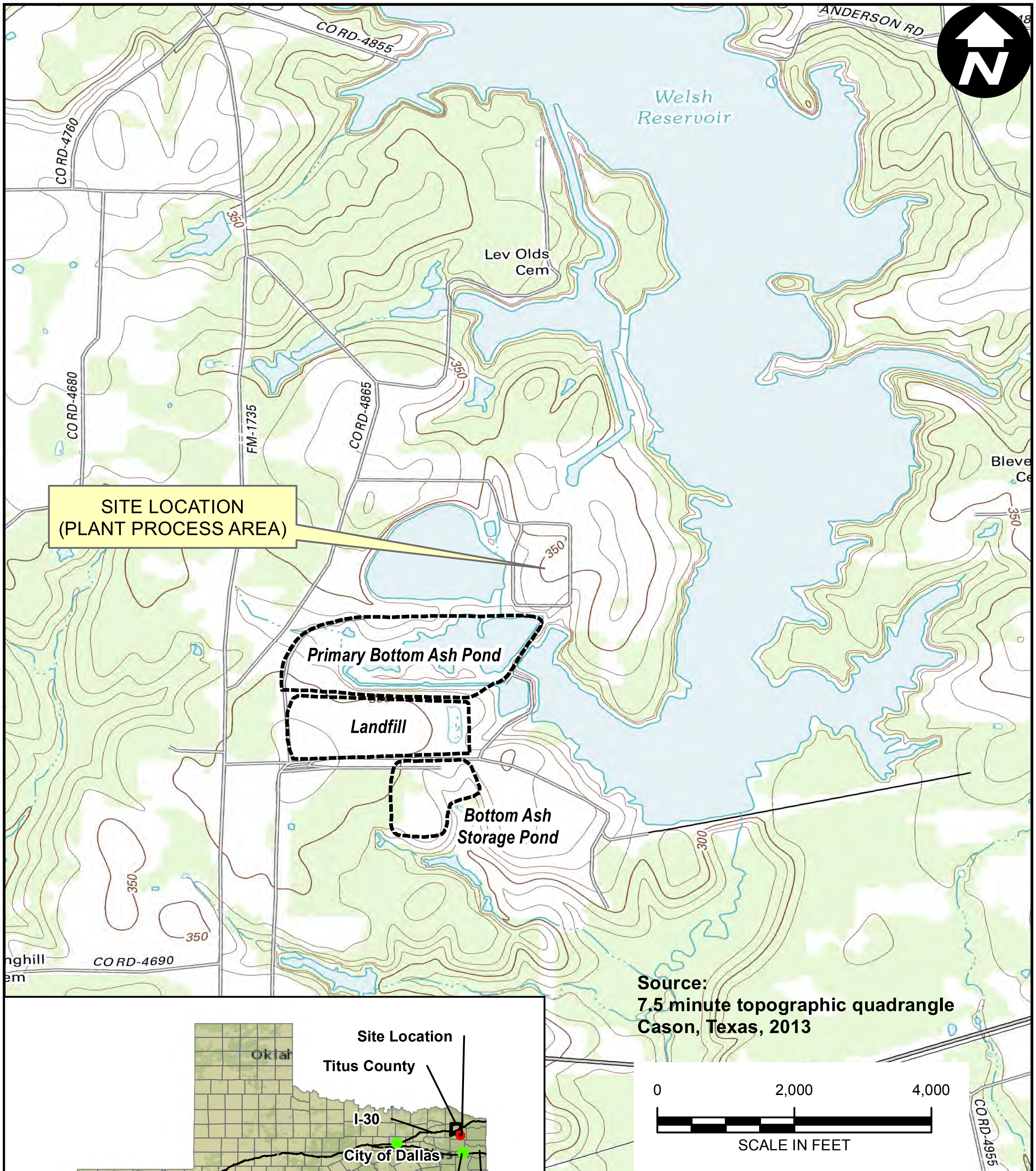
Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH (field)	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Background (Upgradient) Wells																									
AD-1	05/26/16	0.346	36.5	5	<1	5.93	--	42	252	<0.005	<0.005	0.191	<0.001	<0.001	<0.001	<0.005	<0.005	0.010	0.000033	<0.005	<0.005	<0.002	1.18	--	--
	07/27/16	0.350	39.6	4	<1	5.93	--	36	239	<0.005	<0.005	0.191	<0.001	<0.001	<0.001	<0.005	<0.005	0.019	<0.000025	<0.005	<0.005	<0.002	0.9952	--	--
	09/29/16	0.332	15	5	<1	5.37	--	35	173	<0.005	<0.005	0.141	<0.001	<0.001	0.005	<0.005	<0.005	0.014	<0.000025	<0.005	<0.005	<0.002	1.38	--	--
	10/19/16	0.398	19.1	4	<1	5.15	--	42	192	<0.005	<0.005	0.114	<0.001	<0.001	<0.001	<0.005	<0.005	0.008	<0.000025	<0.005	<0.005	<0.002	1.141	--	--
	12/12/16	0.394	8.74	4	<1	5.18	--	40	200	<0.005	<0.005	0.072	<0.001	<0.001	<0.001	<0.005	<0.005	0.008	<0.000025	<0.005	<0.005	<0.002	0.719	--	--
	01/17/17	0.656	129	4	<1	7.13	--	68	538	<0.005	<0.005	0.410	<0.001	<0.001	<0.001	<0.005	<0.005	<0.001	<0.000025	<0.005	<0.005	<0.002	3.009	--	--
	02/23/17	0.700	147	9	<1	6.88	--	68	612	<0.005	<0.005	0.488	<0.001	<0.001	<0.001	<0.005	<0.005	0.001	<0.000025	<0.005	<0.005	<0.002	4.309	--	--
	06/07/17	0.449	15.1	4	<0.083	5.06	109	42	176	<0.00093	0.00114	0.09346	0.00037	<0.00007	0.00066	0.00077	<0.00068	0.00902	0.000007	<0.00029	0.0021	<0.00086	0.676	--	--
	10/06/17	--	--	--	--	5.25	97.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.352	12.1	3	<0.083	4.82	8.4	--	174	<0.00093	<0.00105	0.08823	0.00048	<0.00007	<0.00023	0.0008	<0.00068	0.00816	<0.000005	<0.00029	<0.00099	<0.00086	0.837	0.03	0.025
	Dissolved	*0.35*	*12*	--	--	4.82	8.4	--	--	*<0.00093*	*<0.00105*	*0.08582*	*0.00044*	*<0.00007*	*<0.00023*	*0.00083*	*<0.00068*	*0.00799*	*<0.000005*	*<0.00029*	*0.00197*	*<0.00086*	*0.531*	0.01	0.026
	05/24/18	0.345	10.2	4	<0.083	5.19	118	43	150	0.00317 J	<0.00105	0.0799	0.00039 J	<0.00007	<0.00023	0.00035 J	<0.00068	0.00814	0.000006 J	<0.00029	0.00138 J	<0.00086	1.983	--	--
	08/14/18	0.443	5.95	5	<0.083	5.18	102	44	160	0.00003 J	0.00021	0.063	0.000482	0.00002	0.00016	0.000797	0.000238	0.00708	0.000013 J	0.00021	0.0017	0.00003 J	1.10	--	--
	02/20/19	0.504	142	2.82	0.24	7.31	113	49.2	522	0.00016	0.00046	0.457	0.00009 J	0.00001 J	0.000306	0.000399	0.000124	0.00155	<0.000025	0.001 J	0.0007	<0.0005	3.16	--	--
	05/30/19	0.689	--	1.59	0.29	--	61.3	43.3	588	0.00016	0.00060	0.512	0.000244	0.00001 J	0.0001 J	0.000756	0.000197	<0.009	<0.000005	0.00243	0.0014	<0.0001	--	0.099	0.0625
	07/24/19	0.644	62.7	2	0.106 J	5.97	52.1	58	180	0.00008 J	0.00039	0.245	0.00054	0.00002 J	0.0001 J	0.000789	0.0001 J	0.00557	<0.000005	0.002 J	0.0034	<0.0001	1.819	--	--
	02/17/20	0.626	115	3.41	0.31	5.81	29.4	56.3	488	0.00033	0.00049	0.303	0.00007 J	0.00002 J	0.0001 J	0.00028	0.0001 J	0.00105	<0.000002	0.001 J	0.0023	<0.0001	2.665	--	--
	05/20/20	0.801	126	1.83	0.20	7.22	0.0	51.4	508	0.00015	0.00053	0.394	0.000270	0.00002 J	0.0001 J	0.000490	0.0001 J	0.00301	<0.000002	0.002 J	0.0028	<0.0001	2.312	--	--
AD-5	05/31/16	0.03	36.9	15	<1	6.38	--	123	337	<0.005	<0.005	0.057	<0.001	<0.001	<0.001	0.014	<0.005	0.135	<0.000025	<0.005	<0.005	<0.002	1.63	--	--
	07/28/16	0.04	44.7	16	<1	6.38	--	163	360	<0.005	<0.005	0.093	<0.001	<0.001	<0.001	0.015	<0.005	0.191	<0.000025	<0.005	<0.005	<0.002	4.75	--	--
	09/29/16	0.04	46.3	15	<1	5.29	--	190	416	<0.005	<0.005	0.087	<0.001	<0.001	<0.001	0.014	<0.005	0.186	<0.000025	<0.005	<0.005	<0.002	3.33	--	--
	10/20/16	0.05	50.7	14	<1	5.92	--	267	448	<0.005	<0.005	0.07	<0.001	<0.001	<0.001	0.009	<0.005	0.225	<0.000025	<0.005	<0.005	<0.002	2.319	--	--
	12/13/16	0.05	49.6	13	<1	6.29	--	233	484	<0.005	<0.005	0.053	<0.001	<0.001	<0.001	0.013	<0.005	0.199	<0.000025	<0.005	<0.005	<0.002	2.182	--	--
	01/17/17	0.04	49.8	14	<1	6.27	--	234	438	<0.005	<0.005	0.047	<0.001	<0.001	<0.001	0.012	<0.005	0.239	<0.000025	<0.005	<0.005	<0.002	1.023	--	--
	02/23/17	0.04	33.0	15	<1	5.48	--	127	286	<0.005	<0.005	0.042	<0.001	<0.001	<0.001	0.013	<0.005	0.166	<0.000025	<0.005	<0.005	<0.002	1.788	--	--
	06/07/17	0.05281	49.7	14	<0.083	5.96	867	82	300	<0.00093	0.00385	0.0877	0.00008	0.00039	0.00028	0.01193	<0.00068	0.124	<0.000005	<0.00029	<0.00099	<0.00086	2.32	--	--
	10/06/17	--	--	--	--	5.59	249	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.05063	30.1	21	<0.083	5.79	<100	--	248	<0.00093	<0.00105	0.07627	0.00014	0.00037	<0.00023	0.01907	<0.00068	0.118	<0.000005	<0.00029	<0.00099	<0.00086	1.495	14.4	0.45
	Dissolved	*0.03752*	*29.1*	--	--	5.79	<100	--	--	*<0.00093*	*<0.00105*	*0.06865*	*<0.00002*	*<0.00007*	*<0.00023*	*0.01747*	*<0.00068*	*0.119*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.043*	*2.051*	8.38	0.43
	05/24/18	0.05007	28.1	22	<0.083	6.22	17.8	60	242	<0.00093	<0.00105	0.07116	<0.00002	0.00023 J	0.0008 J	0.01424	<0.00068	0.121	<0.000005	<0.00029	<0.00099	<0.00086	1.946	--	--
	08/15/18	0.05	40.5	19	<0.083	6.23	57.1	240	428	0.00001 J	0.00169	0.0637	0.000055	0.000008 J	0.000072	0.0114	0.000079	0.147	<0.000005	0.00013	0.00008 J	<0.01	0.316	--	--
	02/21/19	0.033	33.9	24.7	0.21	5.38	164	46.5	220	0.00002 J	0.00159	0.0694	0.00008 J	<0.00005	0.000432	0.00858	0.000147	0.0807	<0.000025	<0.002	0.0001 J	<0.0005	1.27	--	--
	05/30/19	0.03 J	--	22.3	0.29	--	150	51.3	238	<0.00002	0.00305	0.0605	0.00008 J	<0.00001	0.00006 J	0.0118	0.00005 J	0.104	0.000006	<0.0004	0.00005 J	<0.0001	--	23.4	0.331
	07/24/19	0.04 J	41.1	18	0.112 J	6.3	108	90	354	<0.00002	0.00248	0.0774	0.00005 J	<0.00001	0.00005 J	0.00838	<0.00005	0.108	<0.000005	<0.0004	0.00006 J	<0.0001	2.533	--	--
	02/17/20	0.03 J	39.8	19.8	0.22	5.45	422	43.7	248	0.00003 J	0.00217	0.109	0.00009 J	0.00002 J	0.000336	0.00452	0.000227	0.0732	<0.000002	0.0009 J	0.0002	<0.0001	2.393	--	--
	05/20/20	0.03 J	40.2	22.3	0.18	6.83	355	55.5	264	<0.00002	0.00178	0.0931	0.00005 J	0.00001 J	0.0001 J	0.00765	0.00007 J	0.0740	<0.000002	<0.0004	0.00009 J	<0.0001	1.612	--	--
AD-17	05/26/16	0.121	200	43	<1	7.17	--	1,166	1,810	<0.005	<0.005	0.021	<0.001	0.002	0.001	0.063	<0.005	0.370	0.000032	<0.005	<0.005	<0.002	1.53	--	--
	07/27/16	0.119	195	32	<1	7.17	--	1,005	1,576	<0.005	<0.005	0.020	<0.001	0.004	0.001	0.068	<0.005	0.374	<0.000025	<0.005	<0.005	<0.002	2.78	--	--
	09/29/16	0.111	191	36	<1	6.17	--	1,055	1,663	<0.005	<0.005	0.031	<0.001	<0.001	0.003	0.058	<0.005	0.354	<0.000025	<0.005	<0.005	<0.002	2.358	--	--
	10/20/16	0.124	194	32	1.0	6.14	--	1,163	1,612	<0.005	<0.005	0.034	<0.001	0.002	0.004	0.065	<0.005	0.394	<0.000025	<0.005	<0.005	<0.002	2.224	--	--
	12/13/16	0.135	196	31	<1	6.03	--	1,096	1,560	<0.005	<0.005	0.017	<0.001	0.003	<0.001	0.068	<0.005	0.323	<0.000025	<0.005	<0.005	<0.002	2.384	--	--
	01/17/17	0.101	196	33	<1	5.96	--	1,445	1,686	<0.005	<0.005	0.014	<0.001	0.003	0.068	0.068	<0.005	0.341	<0.000025	<0.005	<0.005	<0.002	2.436	--	--
	02/22/17	0.135	189	30	<1	5.67	--	1,055	1,628	<0.005	<0.005	0.020	<0.001	0.002	0.001	0.073	<0.005	0.331	<0.000025	<0.005	<0.005	<0.002	2.288	--	--
	06/06/17	0.121	188	30	<0.083	5.81	156	1,105	1,578	<0.00093	<0.00105	0.01033	<0.00002	0.00606	<0.00023	0.0748	<0.00068	0.329	0.000013	<0.00029	<0.00099	<0.00086	1.598	--	--
	10/05/17	--	--	--	--	5.92	598	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.247	213	45	<0.083	5.51	<100	--	1,846	<0.00093	<0.00105	0.00978	<0.00002	0.00915	<0.00023	0.07451	<0.00068	0.306	<0.000005	<0.00029	0.00414	<0.00086	1.514	260	3.72
	Dissolved	*0.231*	*205*	--	--	5.51	<100	--	--	*<0.00093*	*<0.00105*	*0.00737*	*<0.00002*	*0.00609*	*<0.00023*	*0.07938*	*<0.00068*	*0.301*	*<0.000005*	*<0.00029*	*0.00515*	*0.02*	*1.57*	241	3.56
	05/24/18	0.239	193	39	<0.083	6.28	7.8	1,067	1,836	<0.00093	<0.00105	0.00965	<0.00002	0.00646	<0.00023	0.07173	<0.00068	0.308	<0.000005	<0.00029	<0.00099	<0.00086	1.939	--	--
	08/15/18	0.118	187	40	<0.083	5.6	418	1,170	1,750	0.00002 J	0.00183	0.0128	0.000069	0.00025	0.000604	0.0435	0.0011	0.243	0.000011 J	0.00035	0.0003	0.000074	2.35	--	--
	02/21/19	0.151	207	43.2	0.180	6.93	274	1,060	1,720	0.00008 J	0.00251	0.120	0.00024	0.00027	0.00334	0.0645	0.00249	0.268	0.000007 J	0.0007 J	0.0008	<0.0005	2.66	--	--
	05/30/19	0.158	--	41.7	<0.04	--	176	1,120	1,546	<0.00002	0.00041	0.0196	0.00002 J	0.00003 J	0.000246	0.0511	0.00003 J	0.341	<0.000005	<0.0004	0.00006 J	<0.0001	--	145	3.40
	07/24/19	0.113	216	37	0.085 J	5.96	113	1,127	1,864	<0.00002	0.00107	0.0143	0.00013	0.00003 J	0.000228	0.0577	0.000263	0.283	<0.000005	<0.0004	0.0001 J	<0.0001	3.45	--	--
	02/17/20	0.104	184	36	0.16	5.85	52.4	1,070	1,750	<0.00002	0.00072	0.0096	0.00004 J	<0.00001	0.00008 J	0.0423	<0.00005	0.273	<0.000004	<0.0004	<0.00003	<0.0001	3.46	--	--
	05/20/20	0.115	250	47.7	0.15	5.71	35.9	1,190	1,890	<0.00002	0.00086	0.0114	0.00007 J	0.00002 J	0.000231	0.07	0.00008 J	0.302	<0.000002	<0.0004	0.00009 J	<0.0001	2.76	--	--
AD-18[c]	05/26/16	0.146	409	422	<1	5.1	--	5,135	10,000	<0.005	<0.005	0.012	0.014	0.003	<0.001	0.922	<0.005	2.07	0.000168	<0.005	0.006	0.003	12.58	--	--
	07/27/16	0.148	457	432	2	5.1	--	4,930	9,476	<0.005	<0.005	0.019	0.005	0.002	<0.001	0.734	<0.005	1.94	0.000091	<0.005	0.007	0.003	10.62	--	--
	09/29/16	0.156	469	637	4	5.59	--	4,632	9,569	<0.005	<0.005	0.02	0.004	<0.001	<0.001	0.666	<0.005	1.86	0.000117	<0.005	0.007	<0.002	7.05	--	--
	10/20/16	0.188	498	876	0.8664	5.7	--	5,537	9,540	<0.005	<0.005	0.021	0.002	0.001	<0.001	0.569	<0.005	2.06	0.000053	<0.005	<0.005	<0.002	5.82	--	--
	12/13/16	0.178	510	695	5	5.75	--	4,382	8,912	<0.005	<0.005	0.021	0.007	0.001	<0.001	0.641	<0.005	1.74	0.00005	<0.005	<0.005	<0.002	9.60	--	--
	01/17/17	0.050	412	159	5	4.49	--	5,414	8,562	<0.005	0.01	0.014	0.022	0.001	<0.001	0.929	<0.005	1.95	0.000224	<0.005	<0.005	0.002	22.51	--	--
	02/22/17	0.090	401	151	6	4.37	--	5,169	8,412	<0.005	<0.005	0.014	0.026	0.002	<0.001	0.961	<0.005	1.82	0.000107	<0.005	<0.005	0.00228	19.11	--	--
	06/06/17	0.125	428	304	6.53	4.27	121	5,920	9,394	<0.00093	0.00331	0.01038	0.01883	0.00303	<0.00023	0.940	<0.00068	2.15	0.000113	<0.00029	0.00212	<0.00086	16.12	--	--
	10/05/17	--	--	--	--	5.87	165	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/17/18	0.163	433	362	9.4	3.61	104.1	--	9,952	0.00224	0.00276	0.00813	0.01733	0.0036	0.00098	0.928	<0.00068	2.07	0.000043	<0.00029	0.00194	0.00144	19.95	19.7	14.1
	Dissolved	*0.153*	*423*	--	--	--	--	--	--	*0.00467*	*0.00189*	*0.00748*	*0.01676*	*0.00316*	*<0.00023*	*0.898*	*<0.00068*	*2.06*	*0.000012*	*<0.00029*	*0.00135*	*0.01466*	*18.09*	19.1	13.7
	05/30/19	0.09 J	--	390	3.56	--	91.3	*6,120*	9,564	<0.0002	0.04	0.009 J	0.021	0.004 J	<0.004	1.130	0.005 J	1.27	0.000035	<0.04	0.103	<0.01	--	11.2	7.53

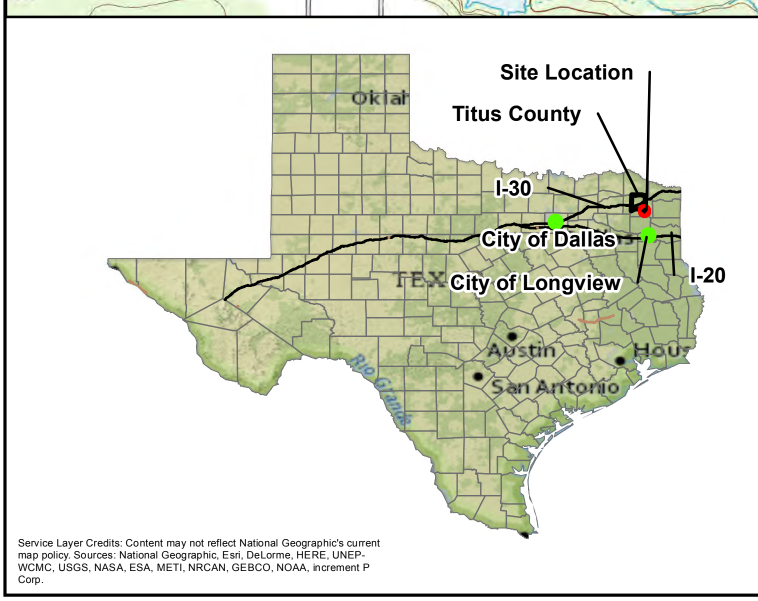
Table 4-4
Groundwater Sampling Analytical Results (mg/L) - Bottom Ash Storage Pond
AEP J. Robert Welsh Power Plant
Pittsburg, Titus County, Texas

Well	Date Sampled	Appendix III Parameters								Appendix IV Parameters															
		Boron (total)	Calcium (total)	Chloride	Fluoride	pH (field)	Turbidity (field)	Sulfate	TDS	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226 and 228 (pCi/L)	Iron	Manganese
Point of Compliance Wells																									
AD-3	05/31/16	0.02	1.41	9	<1	6.58	--	4	106	<0.005	<0.005	0.053	<0.001	<0.001	<0.001	<0.005	<0.005	0.010	0.00085	<0.005	<0.005	<0.002	1.02	--	--
	07/27/16	0.02	0.706	8	<1	6.58	--	5	118	<0.005	<0.005	0.036	<0.001	<0.001	<0.001	<0.005	<0.005	0.024	0.000589	<0.005	<0.005	<0.002	0.1786	--	--
	09/30/16	0.02	<0.5	9	<1	4.75	--	6	127	<0.005	<0.005	0.043	<0.001	<0.001	<0.001	<0.005	<0.005	0.019	0.00039	<0.005	<0.005	<0.002	0.552	--	--
	10/19/16	0.06	0.794	8	<1	3.71	--	9	112	<0.005	<0.005	0.041	<0.001	<0.001	<0.001	<0.005	<0.005	0.018	0.000351	0.006	<0.005	<0.002	1.589	--	--
	12/12/16	0.02	1.05	8	<1	4.67	--	11	138	<0.005	<0.005	0.045	<0.001	<0.001	<0.001	<0.005	<0.005	0.017	0.000321	<0.005	<0.005	<0.002	0.546	--	--
	01/19/17	0.02	0.746	9	<1	4.60	--	4	76	<0.005	<0.005	0.041	<0.001	<0.001	<0.001	<0.005	<0.005	0.014	0.000504	<0.005	<0.005	<0.002	0.229	--	--
	02/23/17	0.02	0.573	9	<1	4.69	--	5	104	<0.005	<0.005	0.037	<0.001	<0.001	<0.001	<0.005	<0.005	0.014	0.000501	<0.005	<0.005	<0.002	0.4592	--	--
	06/07/17	0.03326	0.543	9	0.2625	4.49	56.6	5	104	<0.00093	0.00191	0.038	0.00024	0.00008	0.00075	0.00128	<0.00068	0.01503	0.000365	<0.00029	<0.00099	<0.00086	0.459	--	--
	10/06/17	--	--	--	--	5.15	65.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/15/18	0.01869	0.56	9	<0.083	4.31	11.1		132	0.00166	0.0016	0.0365	0.00034	0.00008	<0.00023	0.00136	<0.00068	0.01459	0.00037	<0.00029	0.00323	0.00127	0.016	0.188	0.004
	Dissolved	*0.01132*	*0.595*	--	--	4.31	11.1	--	--	*<0.00093*	*<0.00105*	*0.0361*	*0.00023*	*<0.00007*	*<0.00023*	*0.00133*	*<0.00068*	*0.01445*	*0.000379*	*<0.00029*	*<0.00099*	*<0.00086*	*0.242*	< 0.01	0.004
	05/24/18	0.0069 J	0.545	8	<0.083	4.58	8.50	3	98	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/30/19	<0.02	--	9.03	0.18	--	57.2	2.3	110	0.00006 J	0.00103	0.0632	0.000158	0.00005 J	0.000316	0.00171	0.000382	0.03 J	0.000245	<0.0004	0.0003	<0.0001	--	*1.54*	0.011
	11/25/19	--	0.734	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AD-4c	05/31/16	0.05	0.798	10	<1	5.41	--	32	204	<0.005	<0.005	0.088	<0.001	<0.001	0.009	<0.005	<0.005	0.004	0.000191	<0.005	<0.005	<0.002	1.29	--	--
	07/27/16	0.03	0.666	12	<1	5.41	--	35	208	<0.005	<0.005	0.059	<0.001	<0.001	0.004	<0.005	<0.005	0.015	0.000185	<0.005	<0.005	<0.002	0.5075	--	--
	09/29/16	0.02	<0.5	11	<1	4.96	--	45	212	<0.005	<0.005	0.074	<0.001	<0.001	0.008	<0.005	<0.005	0.006	0.00016	<0.005	<0.005	<0.002	2.572	--	--
	10/19/16	0.04	0.578	10	<1	4.30	--	35	212	<0.005	<0.005	0.069	<0.001	<0.001	0.009	<0.005	<0.005	0.006	0.000141	<0.005	<0.005	<0.002	1.657	--	--
	12/12/16	0.02	0.341	11	<1	4.62	--	36	252	<0.005	<0.005	0.021	<0.001	<0.001	<0.001	<0.005	<0.005	0.004	0.000143	<0.005	<0.005	<0.002	0.685	--	--
	01/19/17	0.02	0.761	10	<1	4.67	--	43	184	<0.005	<0.005	0.075	<0.001	<0.001	0.004	<0.005	<0.005	0.005	0.000125	<0.005	<0.005	<0.002	2.045	--	--
	02/23/17	0.02	0.467	9	<1	5.10	--	40	196	<0.005	<0.005	0.030	<0.001	<0.001	<0.001	<0.005	<0.005	0.004	0.000098	<0.005	<0.005	<0.002	0.517	--	--
	06/07/17	0.03331	0.573	10	<0.083	4.88	351	39	228	<0.00093	0.00119	0.05142	0.00019	0.00008	0.00403	0.00075	<0.00068	0.00482	0.000147	<0.00029	<0.00099	<0.00086	0.953	--	--
	10/06/17	--	--	--	--	5.38	308	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/16/18	0.0186	0.498	14	<0.083	4.67	6.40		232	<0.00093	<0.00105	0.02572	0.0001	<0.00007	0.00044	0.00049	<0.00068	0.00394	0.000228	<0.00029	<0.00099	<0.00086	0.435	0.592	< 0.001
	Dissolved	*0.02017*	*0.468*	--	--	4.67	6.40	--	--	*<0.00093*	*<0.00105*	*0.02223*	*0.00006*	*<0.00007*	*<0.00023*	*0.00043*	*<0.00068*	*0.0039*	*0.000031*	*<0.00029*	*<0.00099*	*<0.00086*	*0.354*	0.394	0.002
	05/24/18	0.02505	0.434	14	<0.083	*5.17*	*48.1*	42	224	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/14/18	--	--	15	--	--	125	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/29/19	<0.02	--	14.8	0.16	--	158	52.8	208	<0.0004	0.0006 J	0.0295	<0.0004	<0.0002	<0.0008	<0.0004	<0.0004	<0.009	0.000206	<0.008	<0.0006	<0.002	--	0.327	0.0007 J
	11/25/19	--	--	--	--	--	--	--	290	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AD-16	01/26/16	0.05	2.81	6	<1	3.84	--	49	180	<0.005	0.02	0.198	0.002	<0.001	0.054	0.013	0.016	0.015	0.000259	<0.005	<0.005	<0.002	4.478	--	--
	03/21/16	0.04	2.04	6	<1	4.20	--	47	104	<0.005	<0.005	0.119	<0.001	<0.001	0.009	<0.005	<0.005	0.007	0.000114	<0.005	<0.005	<0.002	4.44	--	--
	05/31/16	0.03	1.55	6	<1	4.44	--	40	96	<0.005	<0.005	0.127	<0.001	<0.001	0.001	<0.005	<0.005	0.002	0.000037	<0.005	<0.005	<0.002	5.99	--	--
	07/27/16	0.04	3.42	7	<1	4.44	--	70	184	<0.005	0.01	0.123	0.002	<0.001	0.011	0.022	<0.005	0.035	0.000212	<0.005	<0.005	<0.002	7.21	--	--
AD-16R	06/06/17	0.04198	2.75	7	0.3438	3.68	46.9	54	204	<0.00093	0.00707	0.0464	0.00221	0.00103	0.00176	0.04174	<0.00068	0.0293	<0.000005	<0.00029	0.00198	<0.00086	6.66	--	--
	06/28/17	0.06398	1.24	6	0.2512	3.91	--	55	200	<0.00093	0.00528	0.04143	0.00216	0.00092	0.00095	0.04087	<0.00068	0.02932	<0.000005	<0.00029	<0.00099	<0.00086	12.11	--	--
	07/28/17	0.02841	1.92	7	<0.083	2.77	--	48	162	<0.00093	0.0037	0.04851	0.00217	0.00128	0.00107	0.04533	<0.00068	0.02617	0.000006	<0.00029	0.00127	0.00143	8.52	--	--
	08/02/17	0.03177	1.86	7	<0.083	3.00	--	49	174	<0.00093	0.00446	0.04961	0.00206	0.00122	0.00095	0.04311	<0.00068	0.02498	<0.000005	<0.00029	0.00174	0.00202	5.45	--	--
	10/06/17	--	--	--	--	3.29	31.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/15/18	0.04030	2.73	6	<0.083	3.18	0.0		212	0.00269	0.0074	0.04301	0.00278	0.00129	0.0007	0.04123	<0.00068	0.02977	<0.000005	0.00103	<0.00099	<0.00086	5.89	1.47	0.053
	Dissolved	*0.02614*	*2.59*	--	--	3.18	0.0	--	--	*<0.00093*	*0.00294*	*0.04155*	*0.0022*	*0.00071*	*0.00025*	*0.03996*	*<0.00068*	*0.0278*	*<0.000005*	*<0.00029*	*<0.00099*	*<0.00086*	*5.90*	0.599	0.05
	05/23/18	0.03202	2.53	6	<0.083	*3.79*	*36.9*	67	204	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/14/18	--	--	--	--	--	142	44	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/30/19	<0.02	--	5.43	0.19	--	77.1	41.6	80	0.00002 J	0.00176	0.0724	0.000424	0.00008	0.000334	0.00438	0.00006 J	0.01 J	0.000296	<0.0004	0.0006	0.0002 J	--	0.072	0.0079
	11/25/19	--	--	--	--	--	--	--	222	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Supplemental Downgradient Monitoring Wells																									
AD-19	5/17/2018	0.07234	9.4	34	<0.083	5.72	42.1	--	372	<0.00093	<0.00105	0.05026	0.00073	<0.00007	0.00117	0.0111	<0.00068	0.02924	<0.000005	0.00078	0.00194	<0.00086	1.421	3.04	0.089
	Dissolved	*0.06293*	*8.76*	--	--	--	--	--	--	*<0.00093*	*<0.00105*	*0.04*	*0.00025*	*<0.00007*	*<0.00023*	*0.00965*	*<0.00068*	*0.02842*	*<0.000005*	*0.00041*	*<0.00099*	*0.012*	*2.577*	2.13	0.08
AD-20	10/31/18	0.029	3.14	18.4	0.09	4.88	13	12.5	140	0.00004	0.00185	0.205	0.000651	0.00114	0.000514	0.0161	0.000425	0.0126	<0.00005	<0.0004	0.0008	0.0003	4.16	1.11	0.0742
AD-21	10/30/18	0.025	5.0	17	0.23	5.04	0.0	27.4	180	0.00006	0.00124	0.0868	0.00181	0.00065	0.000263	0.0337	0.000148	0.034	<0.00005	<0.0004	0.0011	0.0002	3.76	3.13	0.154
EPA MCLs:																									
MCL					4					0.006	0.01	2	0.004	0.005	0.1				0.002	N/A	0.05	0.002	5[b]		
Rule Specified																0.006	0.015	0.04		0.1					
Background Limit					0.58					0.003	0.005	0.69	0.00054	0.0065[d]	0.0031	0.075[d]	0.0034	0.39[d]	0.000033	0.002	0.005	0.001	4.07[e]		
Interwell Background Value(s) (UPL, LPL where applicable) AD-8, AD-9, AD-15		0.700				4.8-7.0																			
Intrawell Background Value (UPL) AD-8			15.1	16.5	0.66			149	336																
Intrawell Background Value (UPL) AD-9			299	138	1.00			2,530	3,070																
Intrawell Background Value (UPL) AD-15			5.40	38.8	1.00			33.2	249																

NOTES:
All concentration data are provided in milligrams per liter (mg/L) unless otherwise noted.
J = Analyte was positively identified, though the quantitation was below Reporting Limit.
MCL = Maximum contaminant level
LPL = Lower prediction limit
UPL = Upper prediction limit
pCi/L = PicoCuries per liter.
-- = Not analyzed.
a = Calculated Upper Tolerance Limit is higher than MCL.
b = Data is "Combined Radium, Total".
c = AD-18 is not part of the designated CCR Monitoring Well Network and used for background understanding only
Denotes groundwater sample collected by ARCADIS using low-flow sampling methods.
Unless otherwise noted, values shown are total (unfiltered) analyses.
Dissolved (0.45-micron lab filtered) parameter concentrations shown in italics.

FIGURES





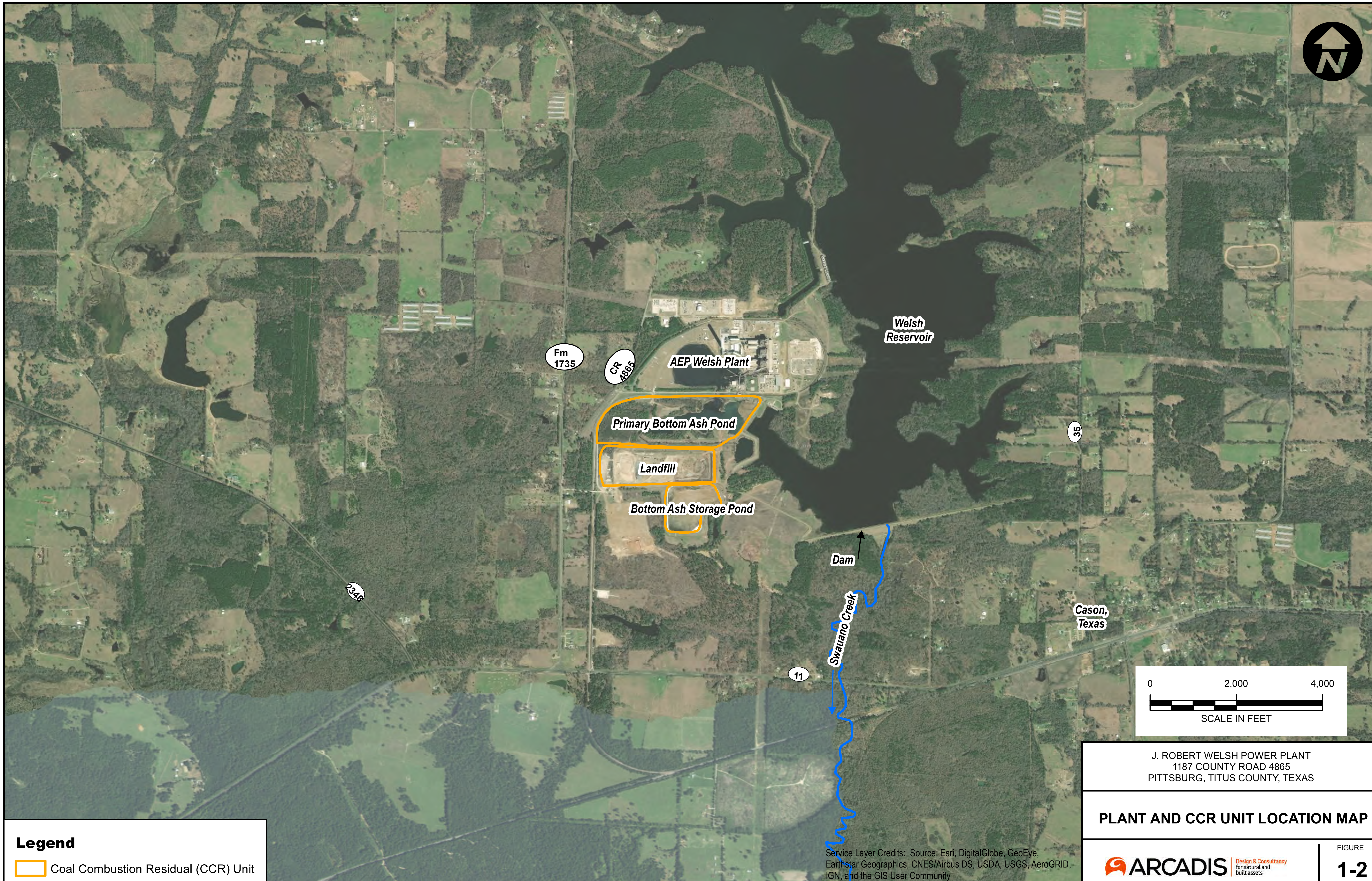
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1-1

Document Path: Z:\GISProjects_ENV\AEP\Welsh Plant\MXD\Landfill report\Dec2017Update\fig 1 - site map.mxd



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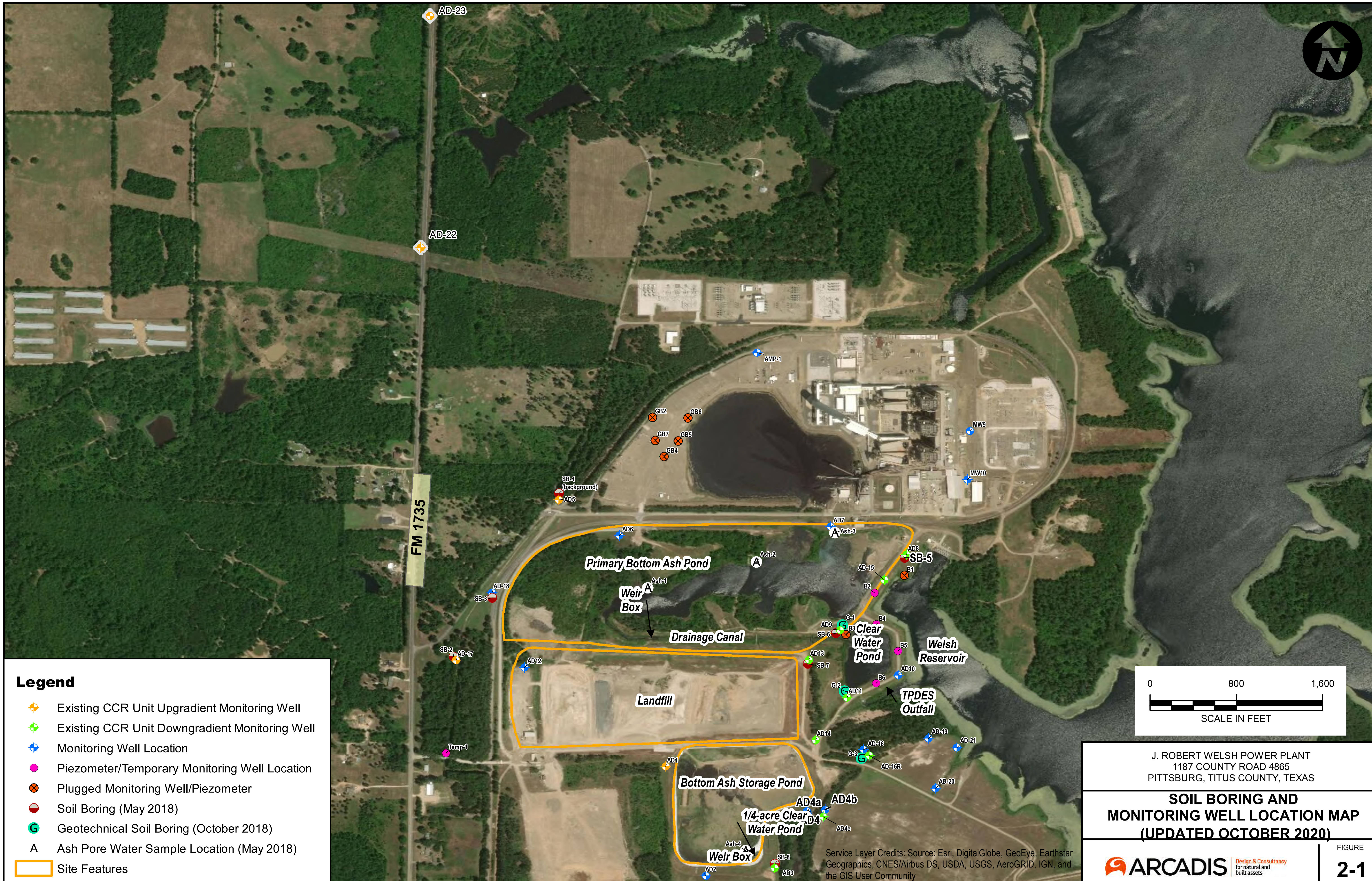
PITTSBURG, TITUS COUNTY, TEXAS

PLANT AND CCR UNIT LOCATION MAP

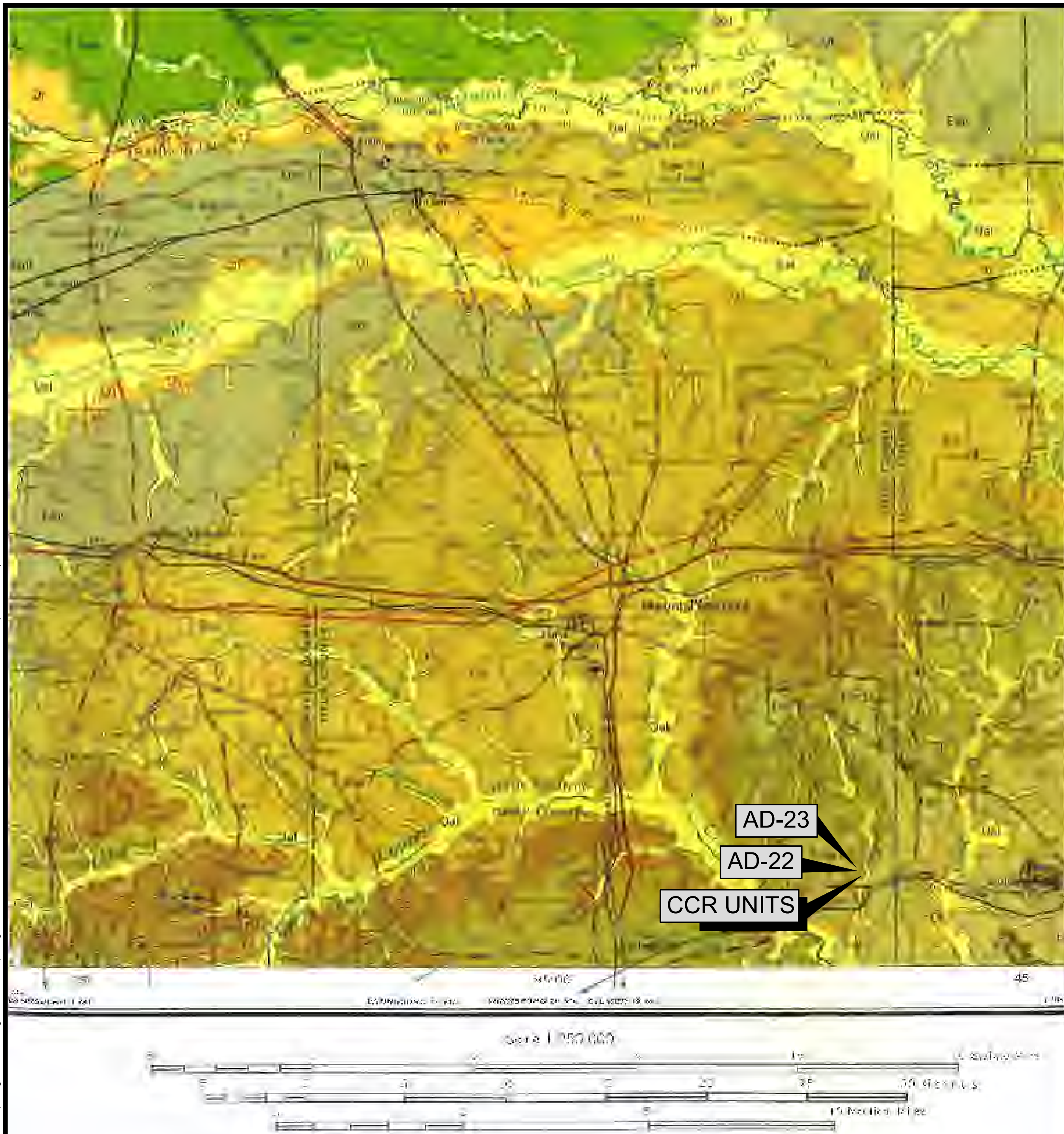
ARCADIS Design & Consultancy for natural and built assets

FIGURE
1-2

Document Path: Z:\GISProjects_ENV\AEP\Welsh Plant\MXD\Lithium_ASD_Report\fig 1-2 - CCR location.mxd



Document Path: Z:\GISProjects_ENV\AEP\Welsh Plant\MXD\Landfill report\September 2019\Fig 2-1-SoilBoring_MonitoringWellLocations.mxd



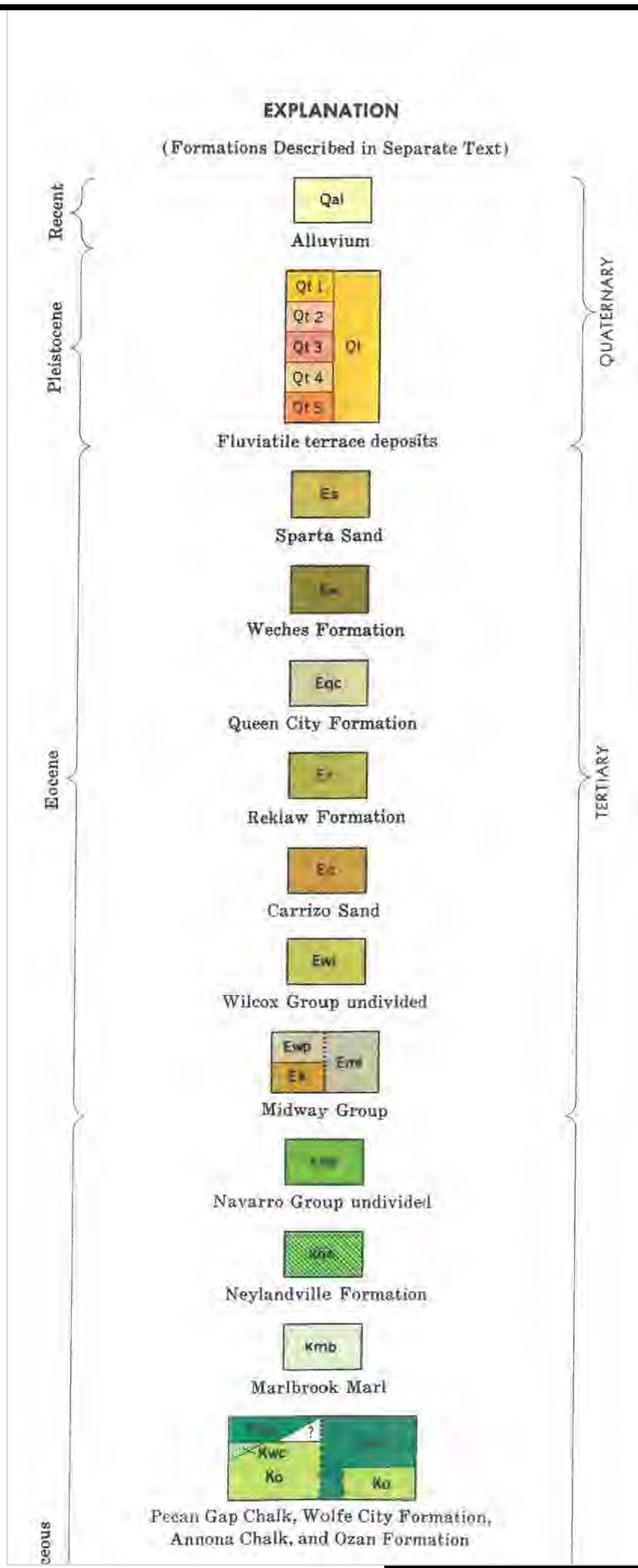
REF: "GEOLOGIC ATLAS OF TEXAS, TEXARKANA SHEET", UNIVERSITY OF TEXAS AT AUSTIN BUREAU OF ECONOMIC GEOLOGY, 1966.

J. ROBERT WELSH POWER PLANT
PITTSBURG, TITUS COUNTY, TEXAS

REGIONAL GEOLOGIC MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2-2A

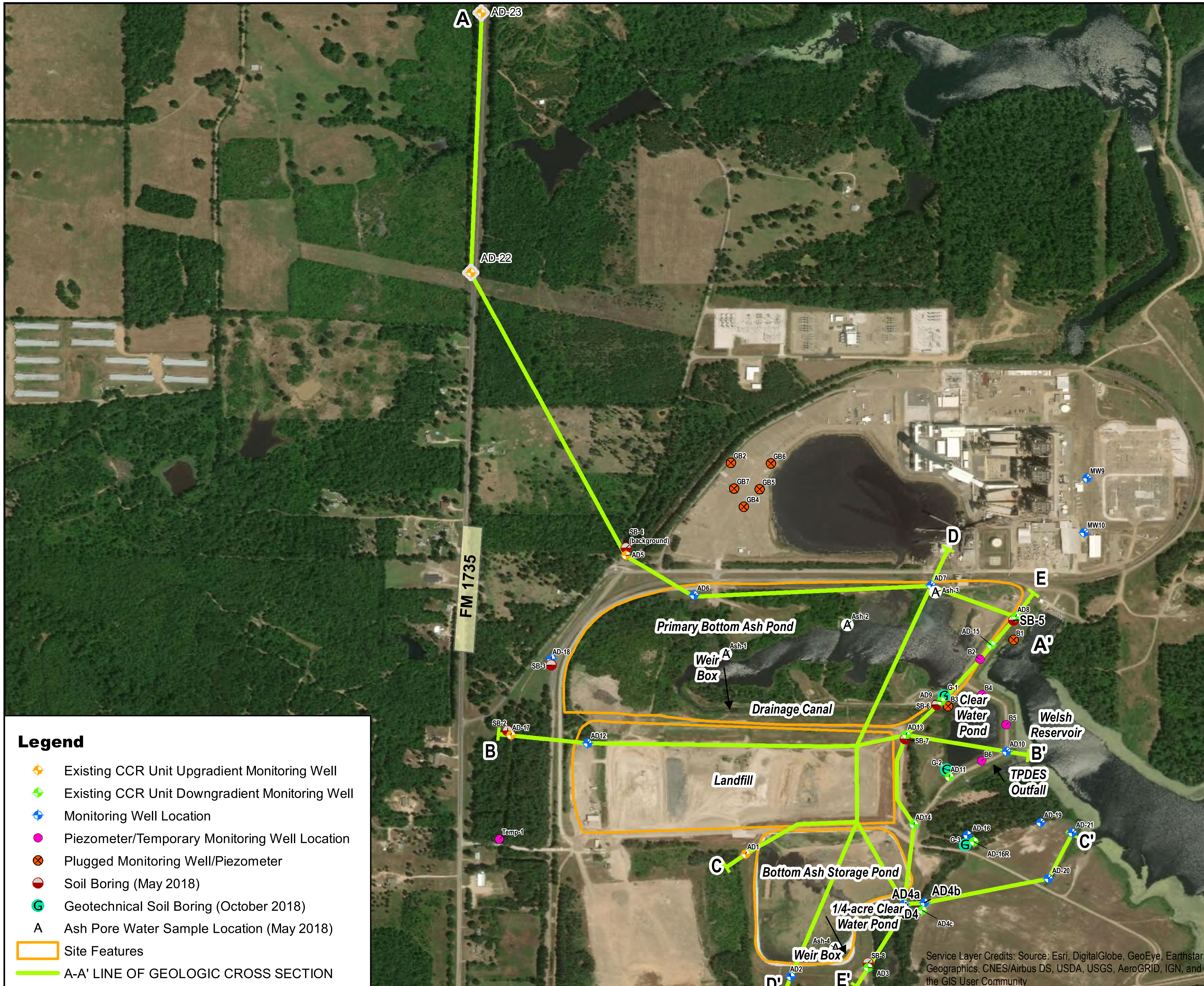


J. ROBERT WELSH POWER PLANT
PITTSBURG, TITUS COUNTY, TEXAS

REGIONAL GEOLOGIC MAP LEGEND

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2-2B



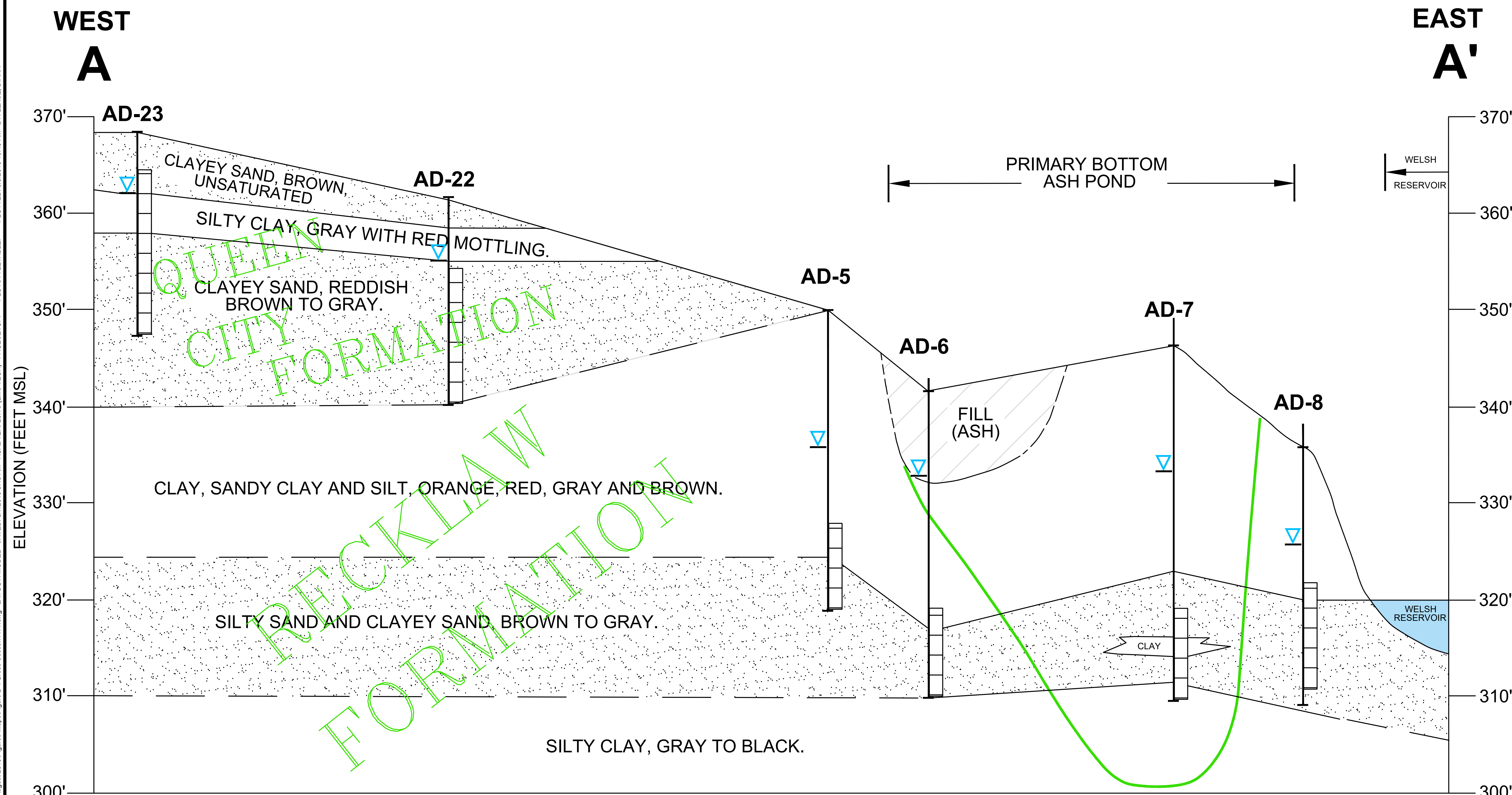
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2-3

Document Path: Z:\GISProjects_ENV\AEP\Welsh Plant\MXD\Landfill report\September 2019\Fig2-3-Cross Section LocationsREV.mxd



0 600'
HORIZONTAL SCALE

NOTE: BASE OF ASH POND TAKEN FROM "WELSH POWER PLANT-UNIT 1 FLY ASH STORAGE AREA PHASE I " DRAWING ID WEPX-88, DATED 12-3-76; AND U.S. GEOLOGICAL SURVEY 7 1/2 MINUTE SERIES TOPOGRAPHIC MAP, CASON, TX QUADRANGLE, 1964 (PHOTO REVISED 1980).

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN EVALUATION (6/19/19)
- PROJECTED BASE OF PRIMARY BOTTOM ASH POND (SEE NOTE)

J. ROBERT WELSH POWER PLANT
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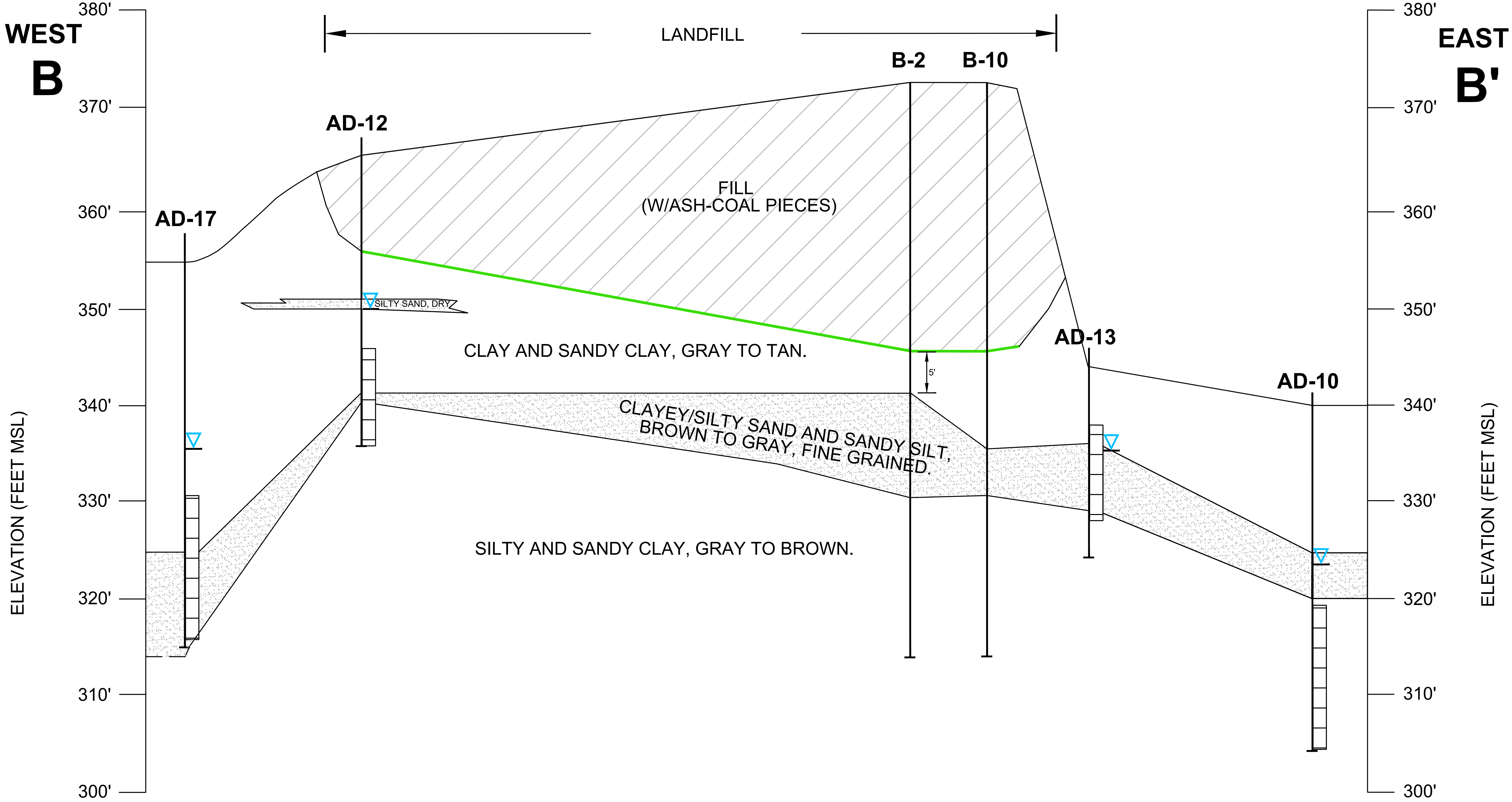
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION A - A'

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2-4



0 300'
HORIZONTAL SCALE

NOTE: BASE OF LANDFILL ELEVATION TAKEN FROM "WELSH POWER PLANT- UNIT 1 FLY ASH STORAGE AREA PHASE I" DRAWING ID WEPX-88, DATED 12/3/76.

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (3/4/16)
- BASE OF LANDFILL (SEE NOTE)

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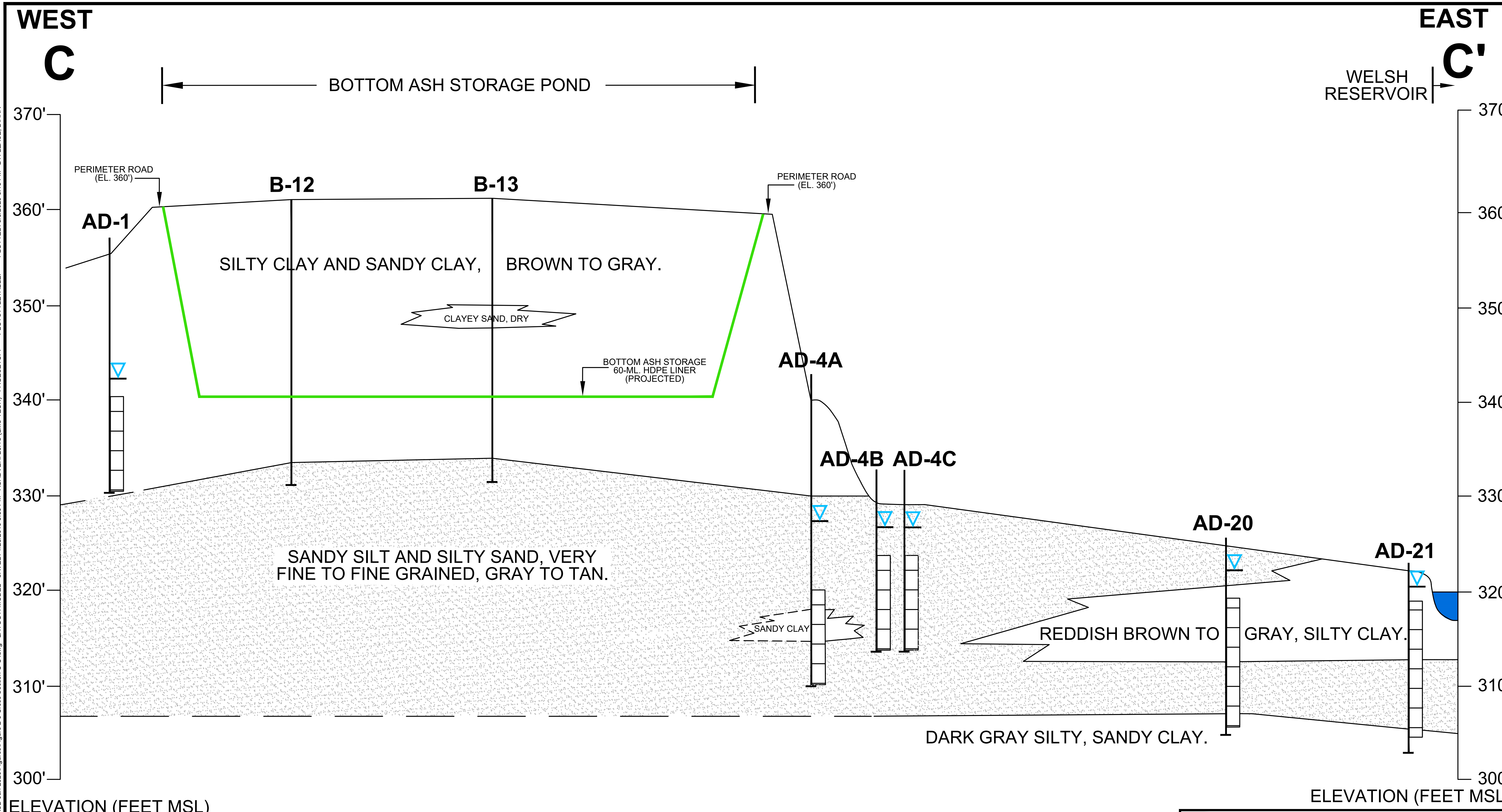
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION
B - B'

ARCADIS

FIGURE
2-5



0 200'
HORIZONTAL SCALE

NOTE: BASE OF BOTTOM ASH STORAGE HAS A 60-ML. HDPE LINER AT ELEVATION 340.0' , TAKEN FROM FREESE AND NICHOLS "HYDRAULIC ANALYSIS OF WELSH POWER PLANT ASH PONDS, AMERICAN ELECTRIC POWER COMPANY", DATED DECEMBER 2010.

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (10/29/18)
- PROJECTED BASE OF ASH STORAGE (SEE NOTE)

J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION C - C'

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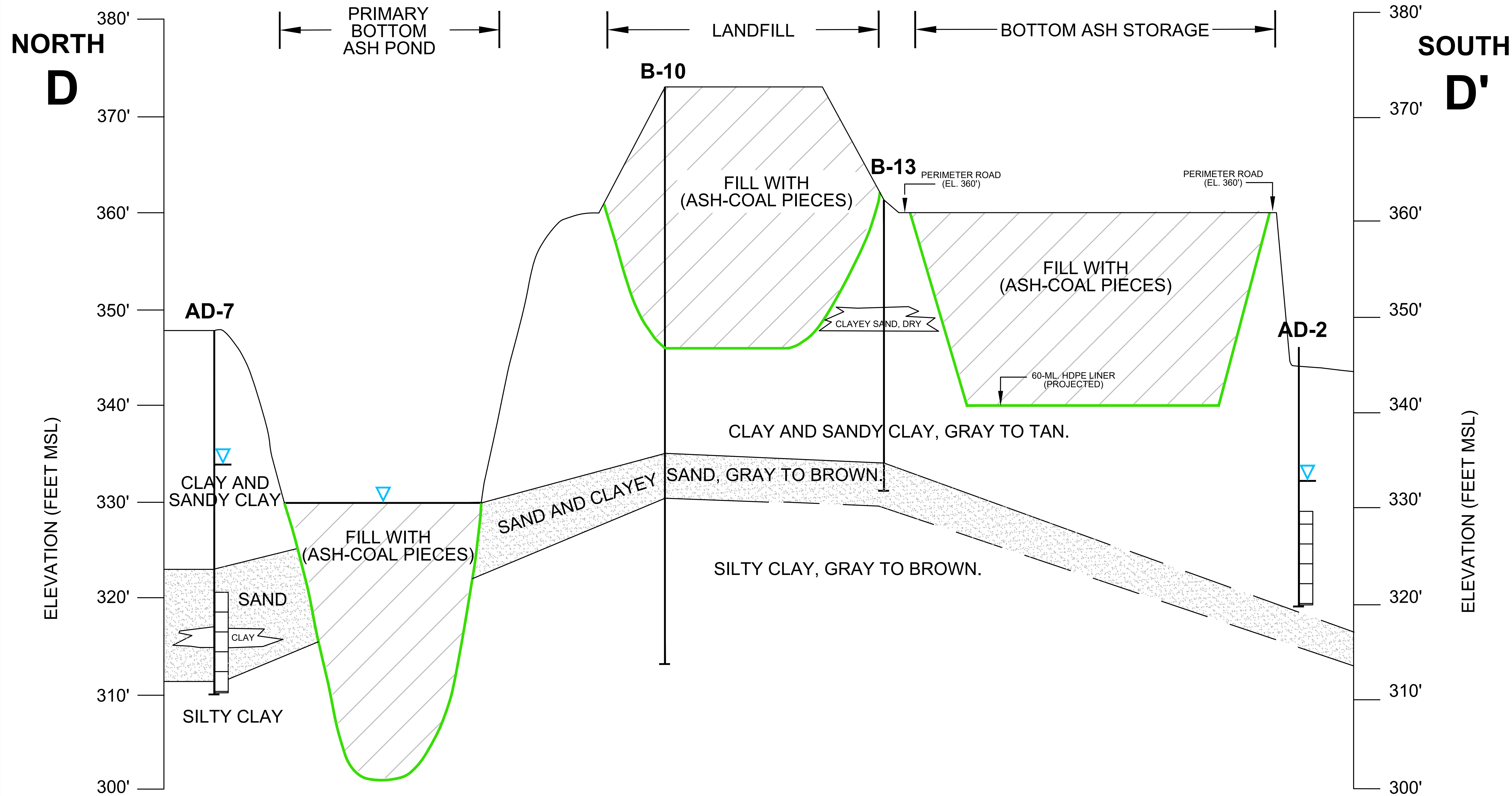
FIGURE 2-6



0 300'
HORIZONTAL SCALE

NOTE: BASE OF PRIMARY BOTTOM ASH POND TAKEN FROM "WELSH POWER PLANT-UNIT 1 FLY ASH STORAGE AREA PHASE I " DRAWING ID WEPX-88, DATED 12-3-76; AND U.S. GEOLOGICAL SURVEY 7 1/2 MINUTE SERIES TOPOGRAPHIC MAP, CASON, TX QUADRANGLE, 1964 (PHOTO REVISED 1980).

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (5/12/15)
- BASE OF CCR UNIT

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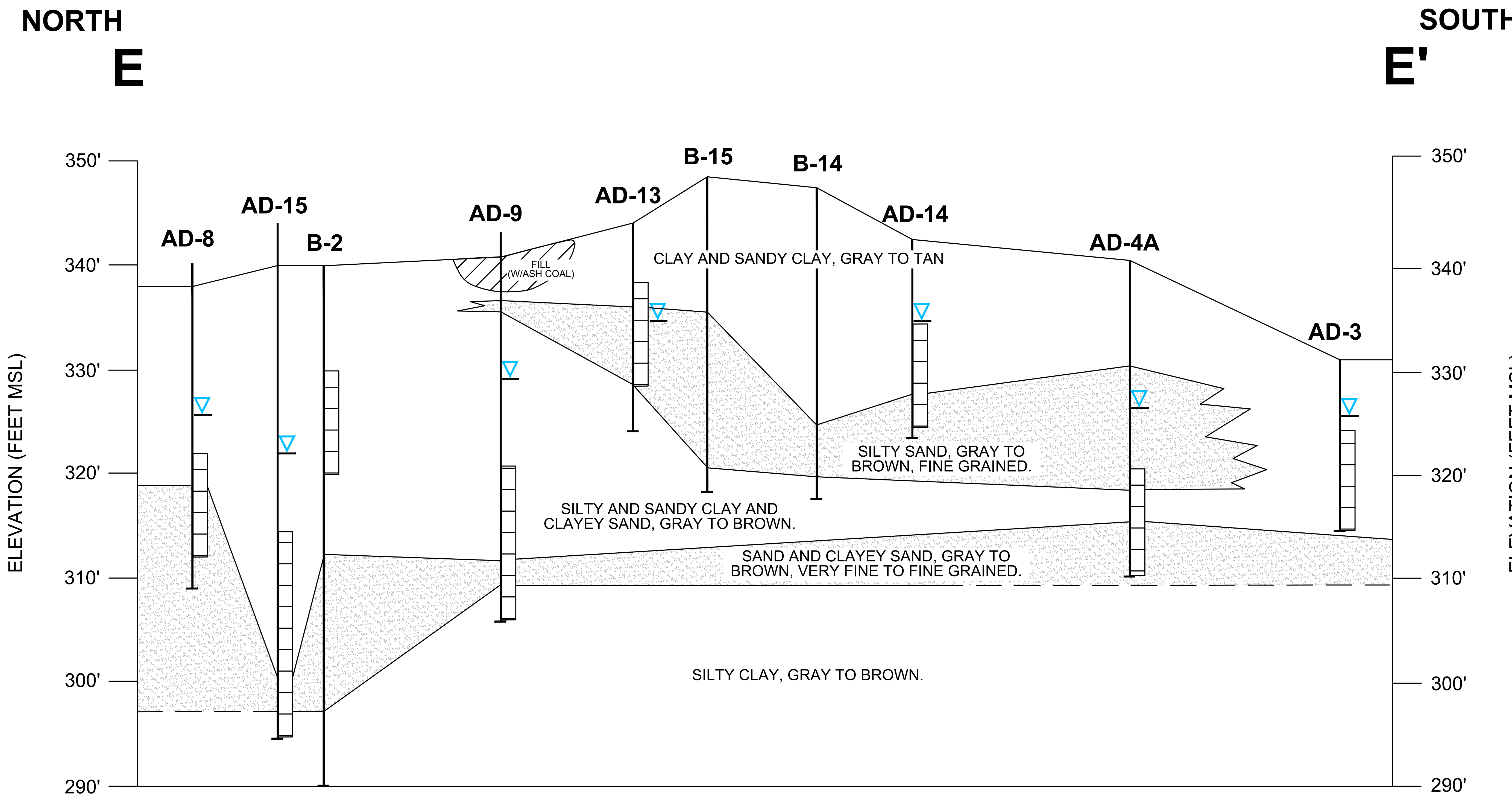
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION D - D'

ARCADIS

FIGURE
2-7



0 — 300'
HORIZONTAL SCALE

LEGEND

MONITORING WELL SCREENED INTERVAL

WATER LEVEL IN MONITORING WELL (3/4/16)

J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

CROSS SECTION E - E'

ARCADIS

FIGURE
2-8

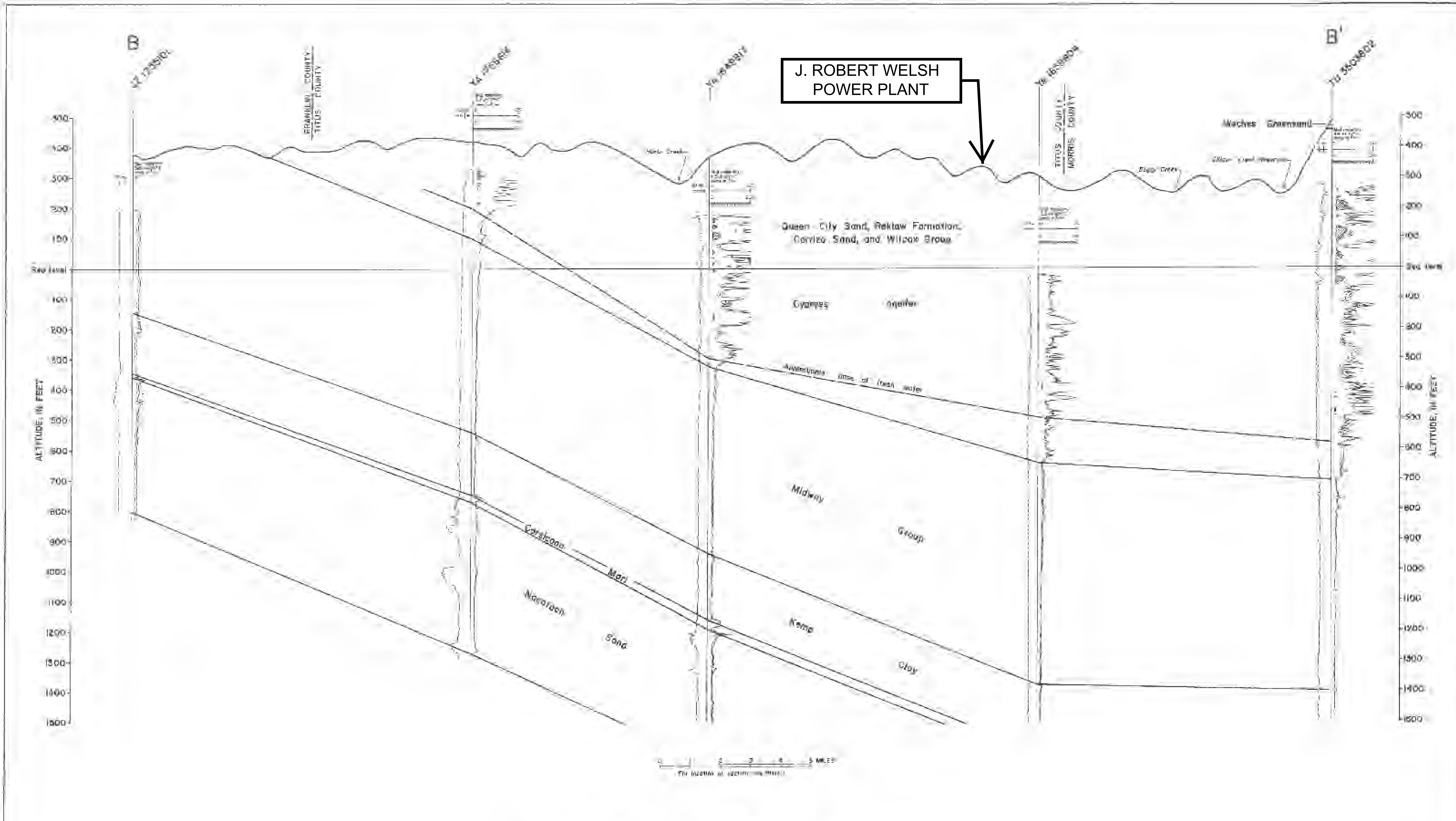
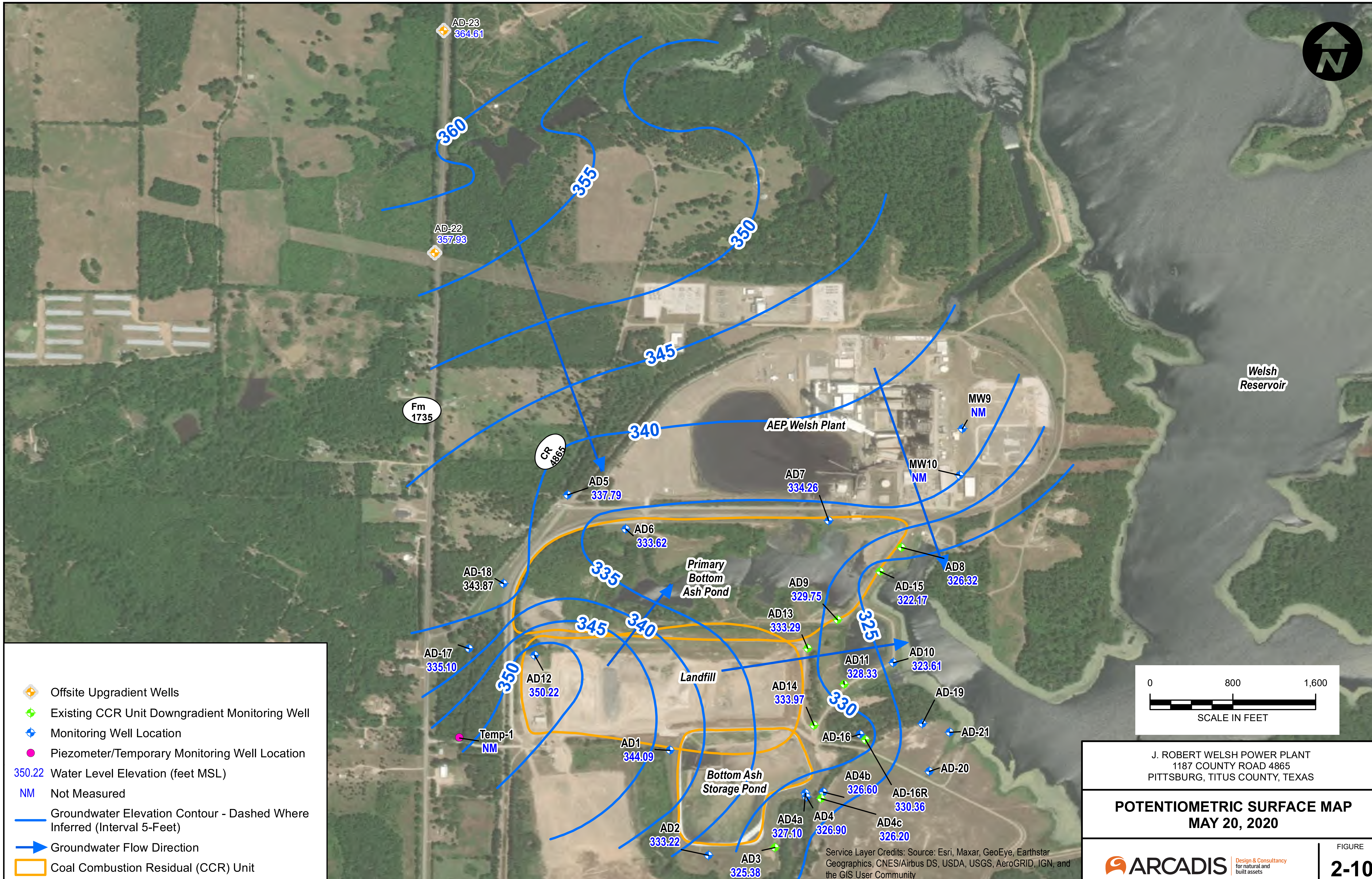


Plate 3
Geologic Section B – B', Franklin, Titus, and Morris Counties
U. S. Geological Survey in cooperation with the Texas Water Commission **(TWC BULLETIN 6517)**

REGIONAL GEOLOGIC CROSS SECTION

FIGURE 2-9



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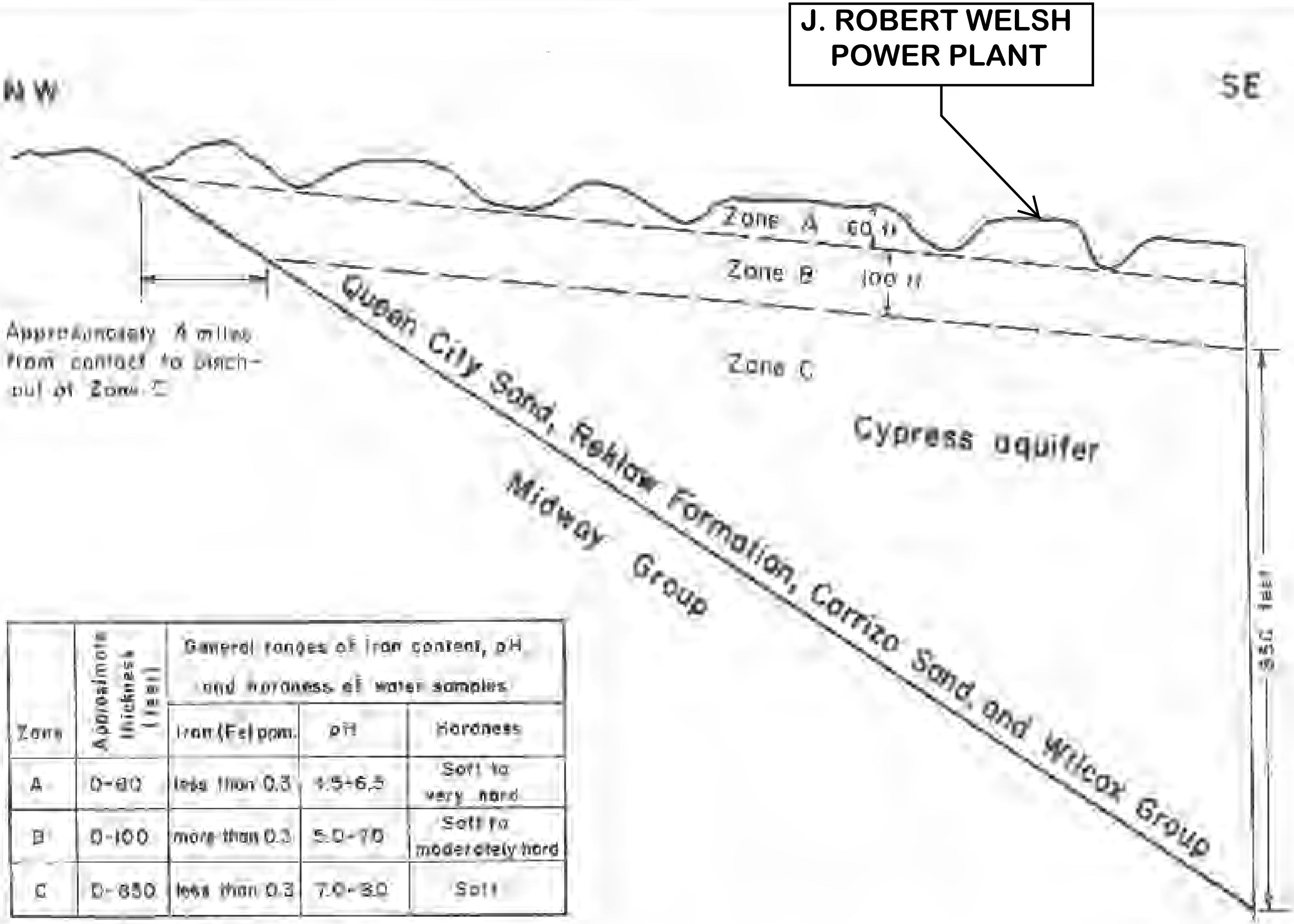


Zone	Approximate thickness (feet)	General ranges of iron content, pH, and hardness of water samples		
		Iron (Fe) ppm.	pH	Hardness
A	0-60	less than 0.3	4.5-6.5	Soft to very hard
B	0-100	more than 0.3	5.0-7.0	Soft to moderately hard
C	0-850	less than 0.3	7.0-8.0	Soft

Figure 12

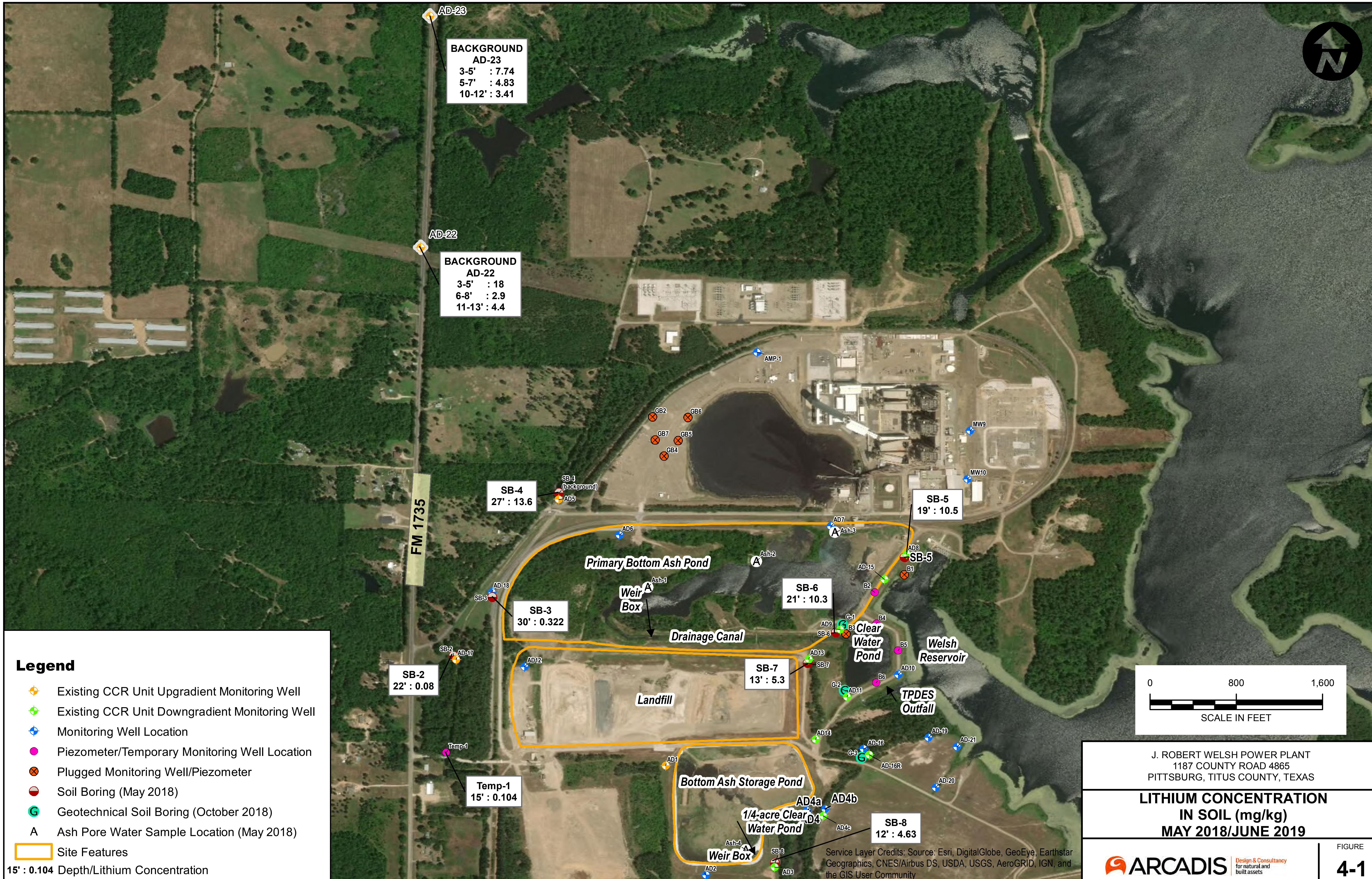
Diagrammatic Section Showing Zones A, B, and C in the Cypress Aquifer

U.S. Geological Survey in cooperation with the Texas Water Commission

(TWC BULLETIN 6517)

REGIONAL HYDROLOGIC CROSS SECTION

FIGURE 2-11



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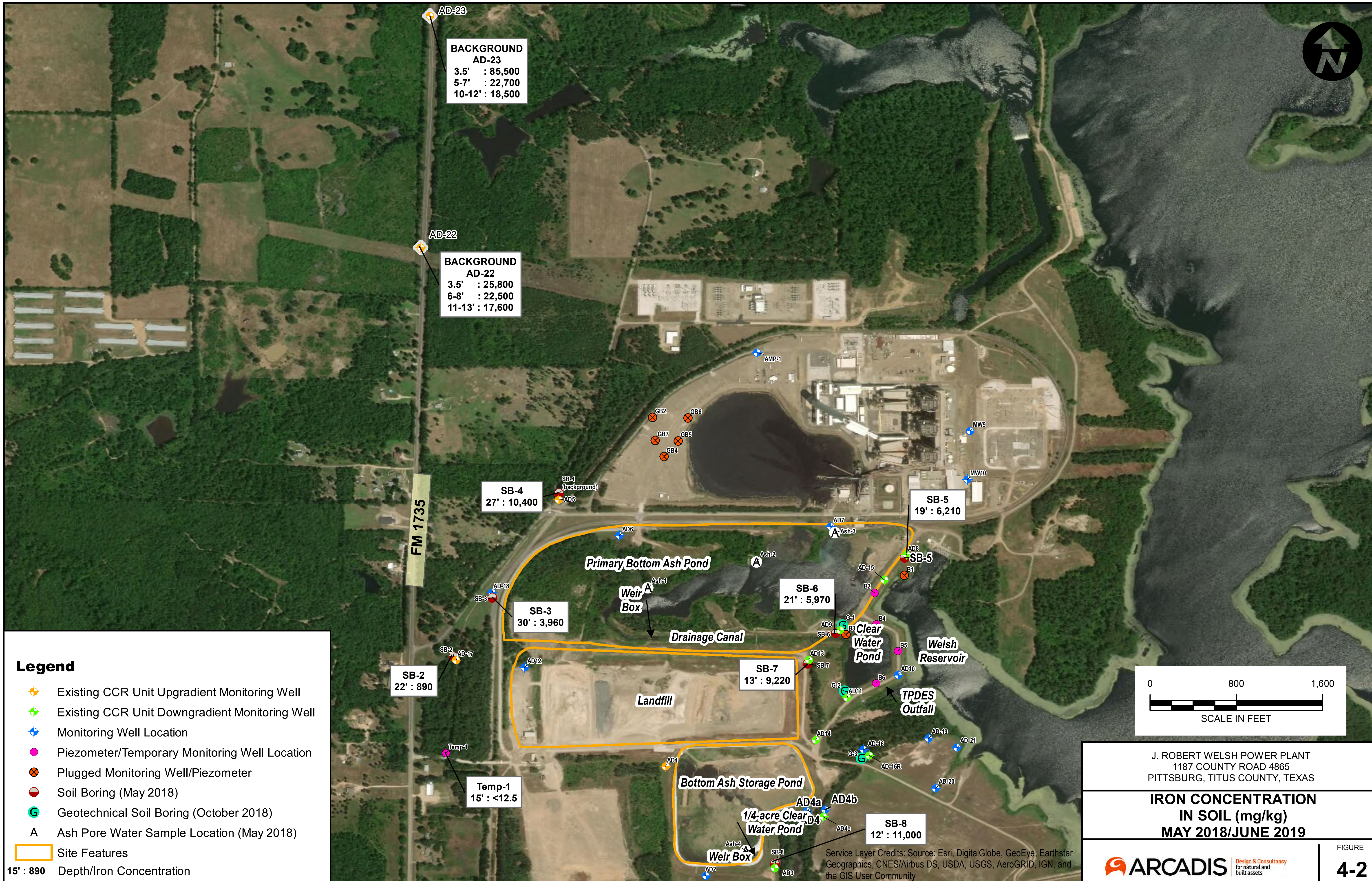

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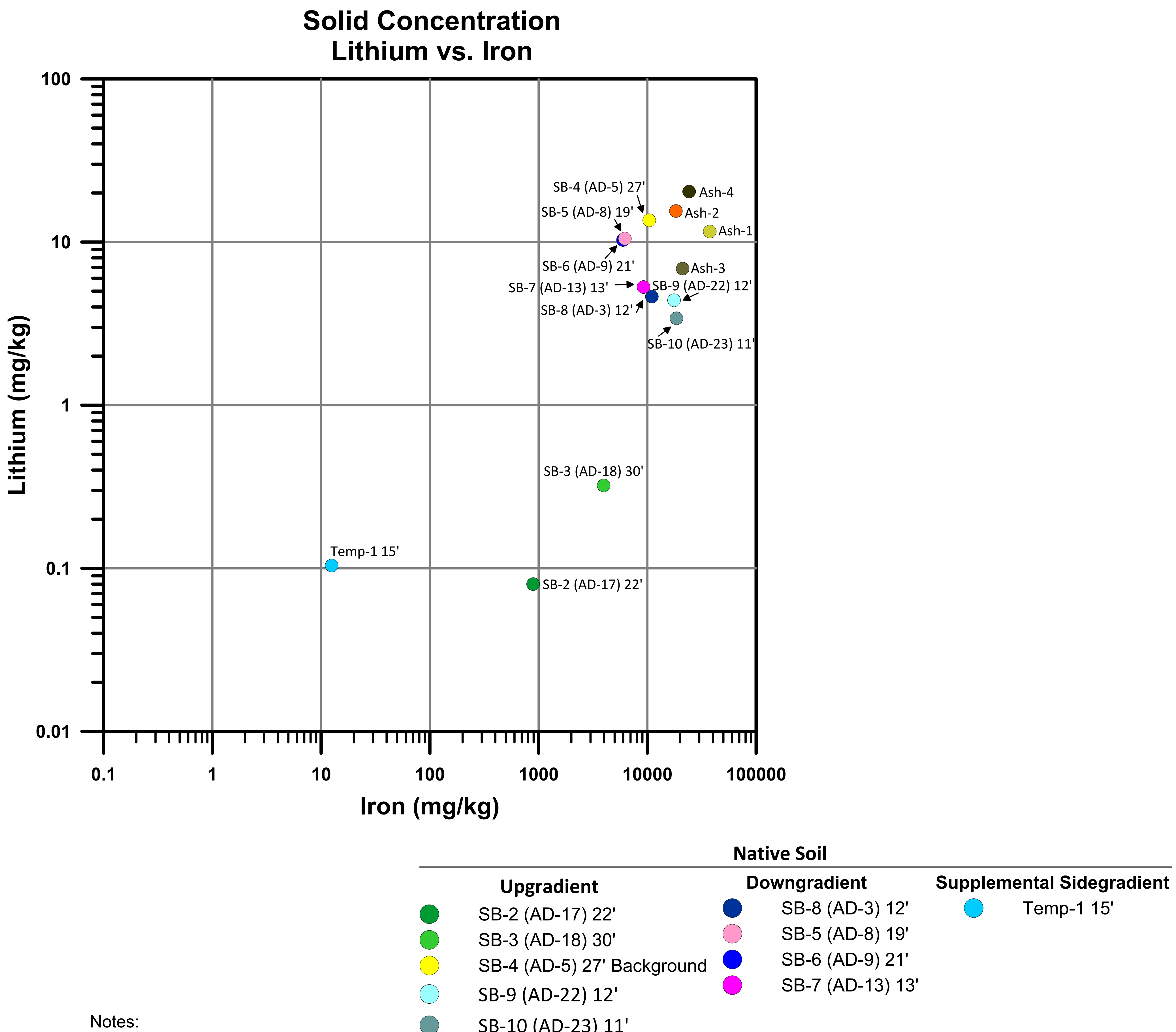

Notes:
mg/kg - milligrams per kilogram

J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

LITHIUM VS. IRON SOLIDS CONCENTRATION PLOT

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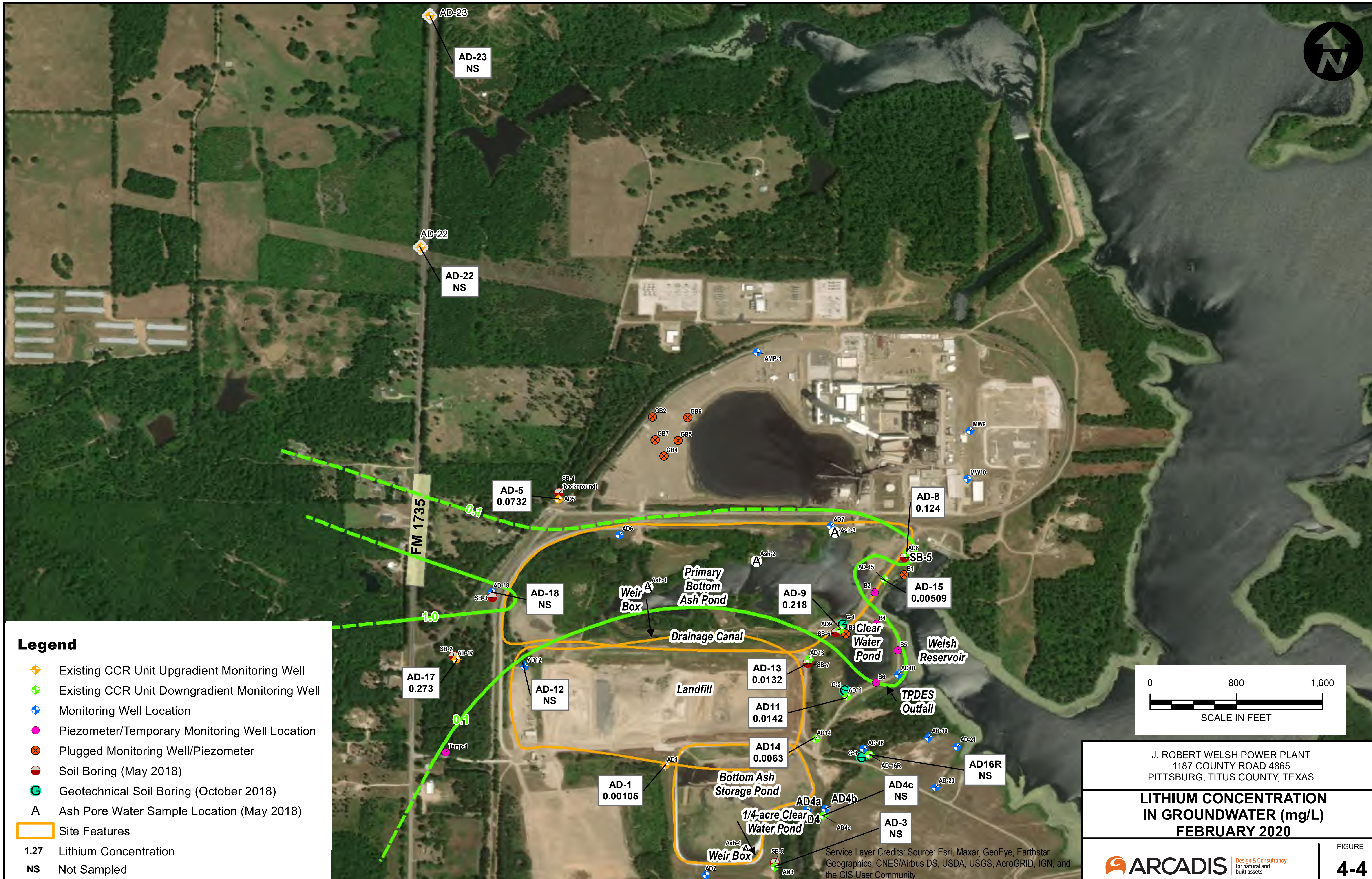
FIGURE
4-3



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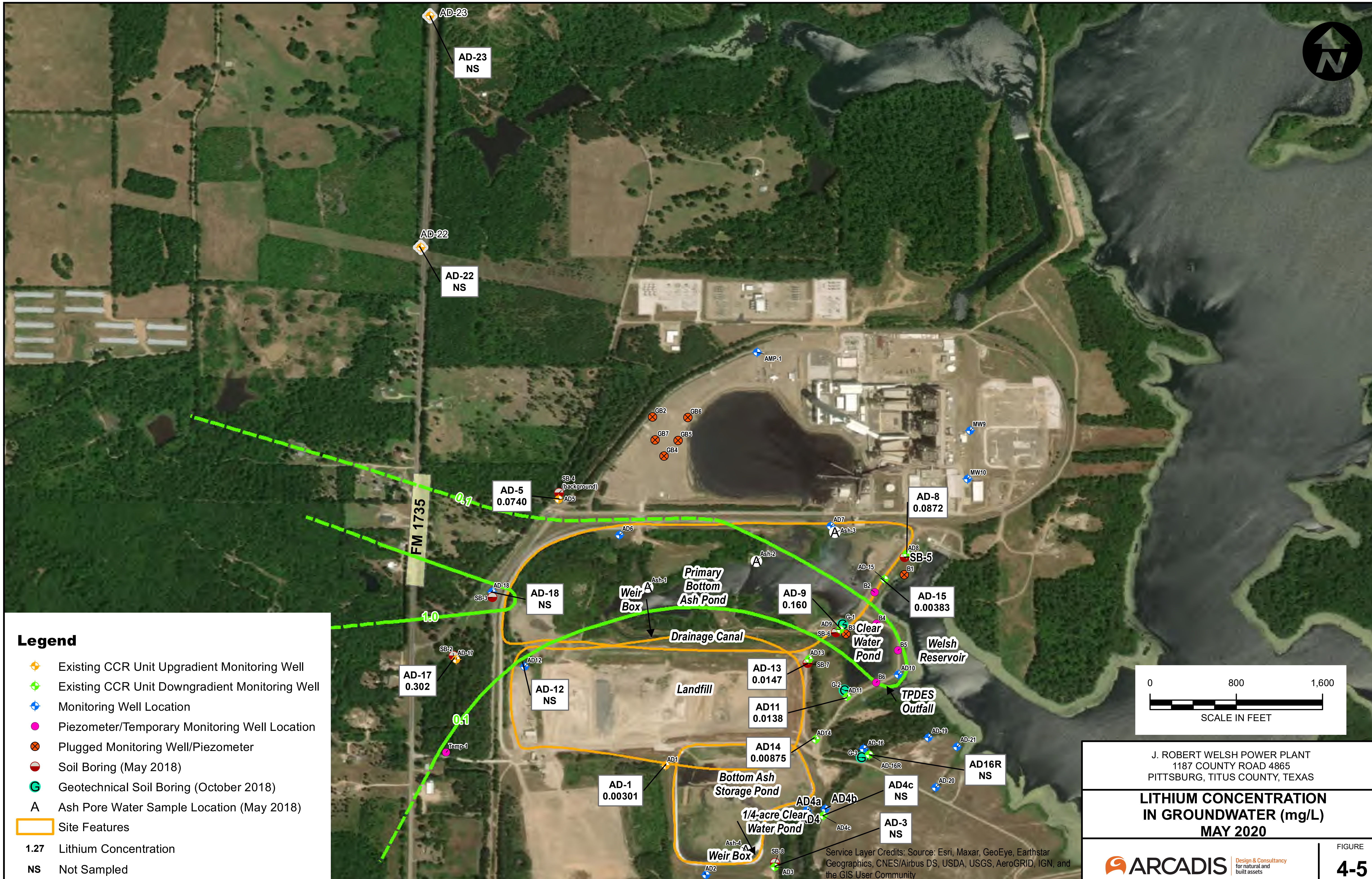


Legend

- Existing CCR Unit Upgradient Monitoring Well
- Existing CCR Unit Downgradient Monitoring Well
- Monitoring Well Location
- Piezometer/Temporary Monitoring Well Location
- Plugged Monitoring Well/Piezometer
- Soil Boring (May 2018)
- Geotechnical Soil Boring (October 2018)
- A Ash Pore Water Sample Location (May 2018)
- Site Features
- 1.27 Lithium Concentration
- NS Not Sampled

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

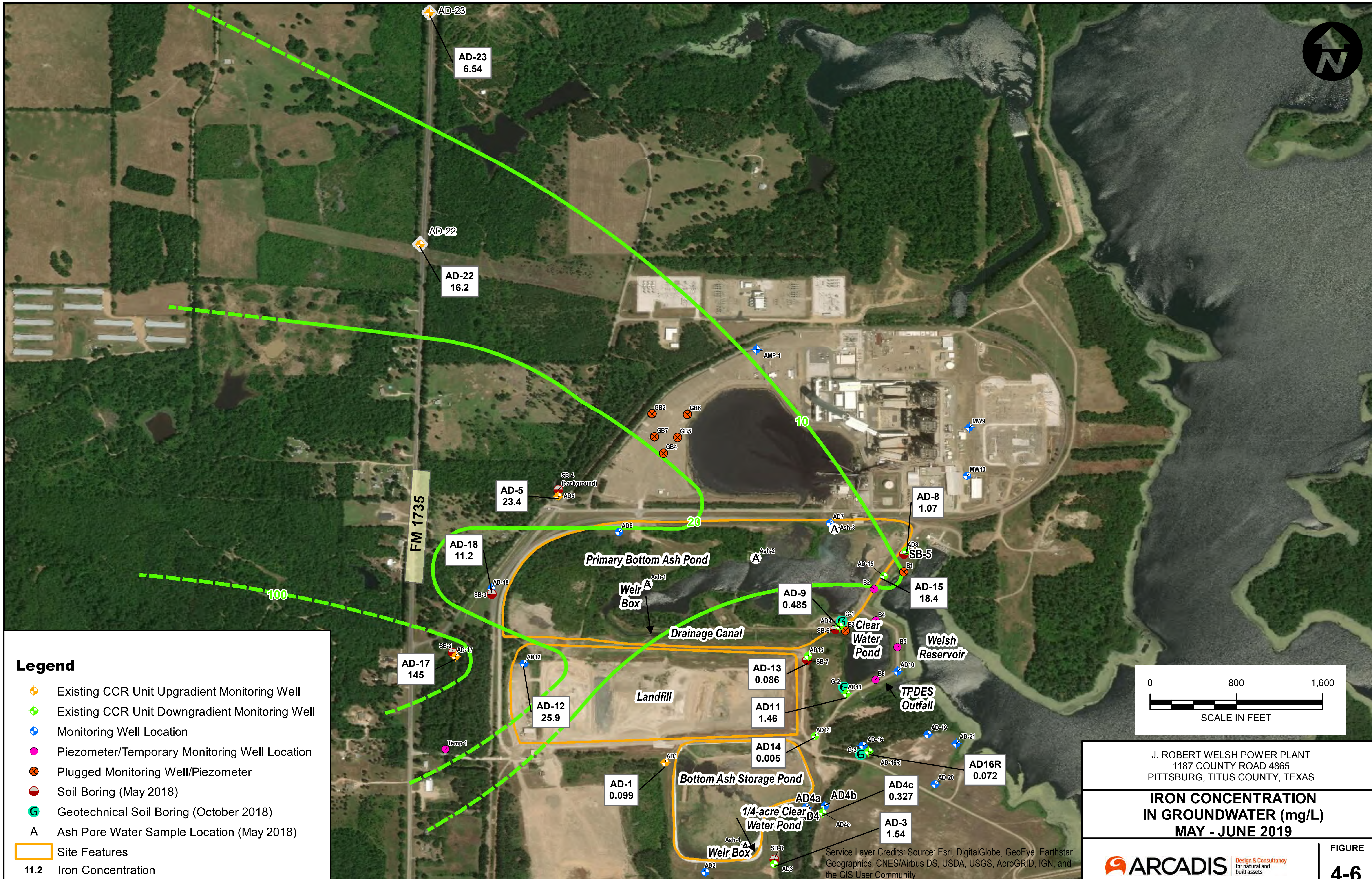
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

LITHIUM CONCENTRATION IN GROUNDWATER (mg/L) MAY 2020

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4-5

Document Path: U:_ENV\AEP\Welsh Plant\MXD\Landfill report\May 2020\Fig 4-5-SoilBoring_LithiumGWresultsMay2020.mxd



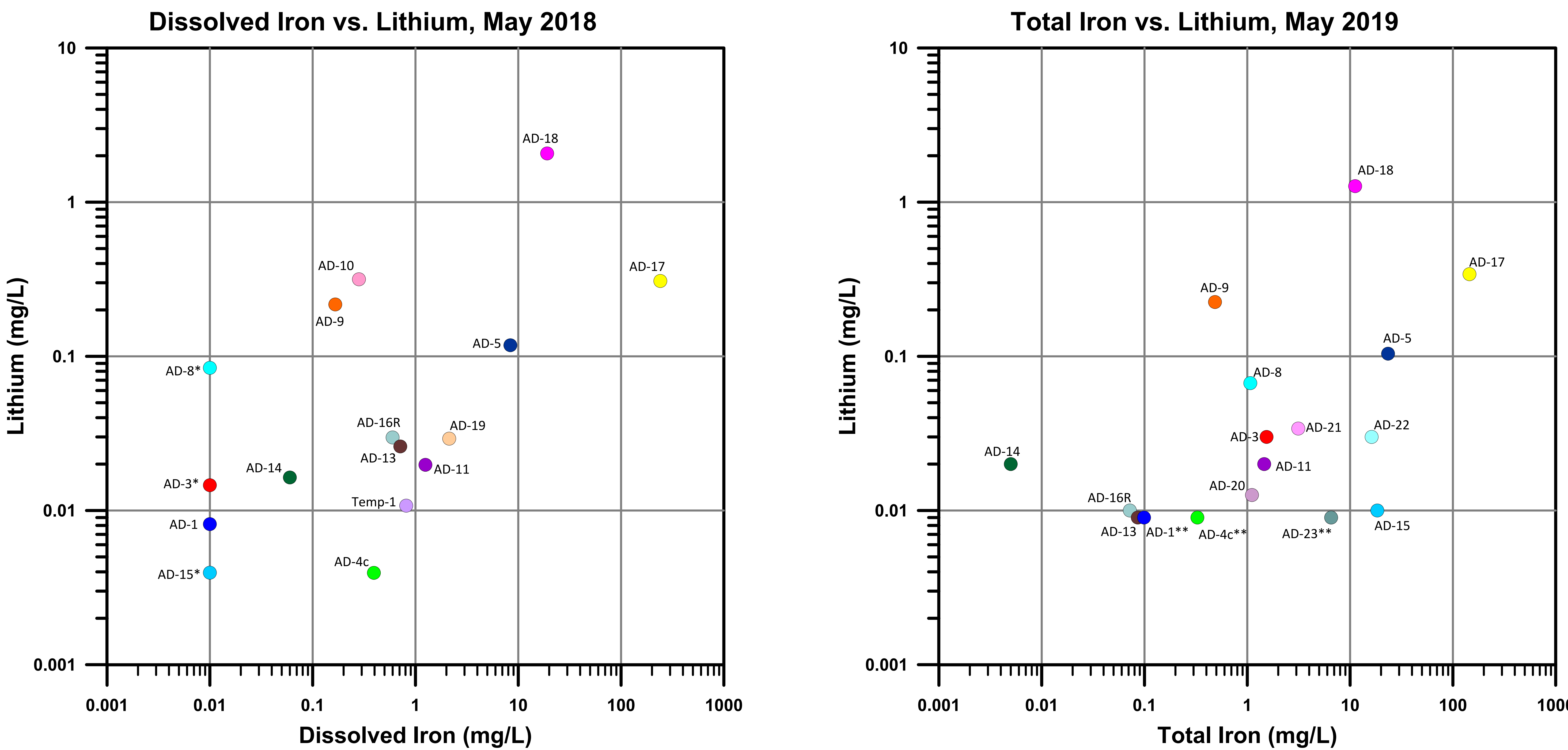
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

IRON CONCENTRATION IN GROUNDWATER (mg/L) MAY - JUNE 2019

ARCADIS Design & Consultancy for natural and built assets

FIGURE 4-6

Document Path: Z:\GISProjects_ENV\AEP\Welsh Plant\MXD\Landfill report\September 2019\Fig 4-5-SoilBoring_IronGWresultsMay2018-June2019.mxd



Upgradient Wells
- AD-1
- AD-17
- AD-18
- AD-5
- AD-22 (installed Jun 2019)
- AD-23 (installed Jun 2019)

Downgradient Wells
- AD-10
- AD-11
- AD-13
- AD-14
- AD-15
- AD-16R
- AD-19
- AD-3
- AD-4c
- AD-8
- AD-9
- AD-20 (installed Oct 2018)
- AD-21 (installed Oct 2018)

Sidegradient Wells
- MW-9
- MW-10
- Temp-1

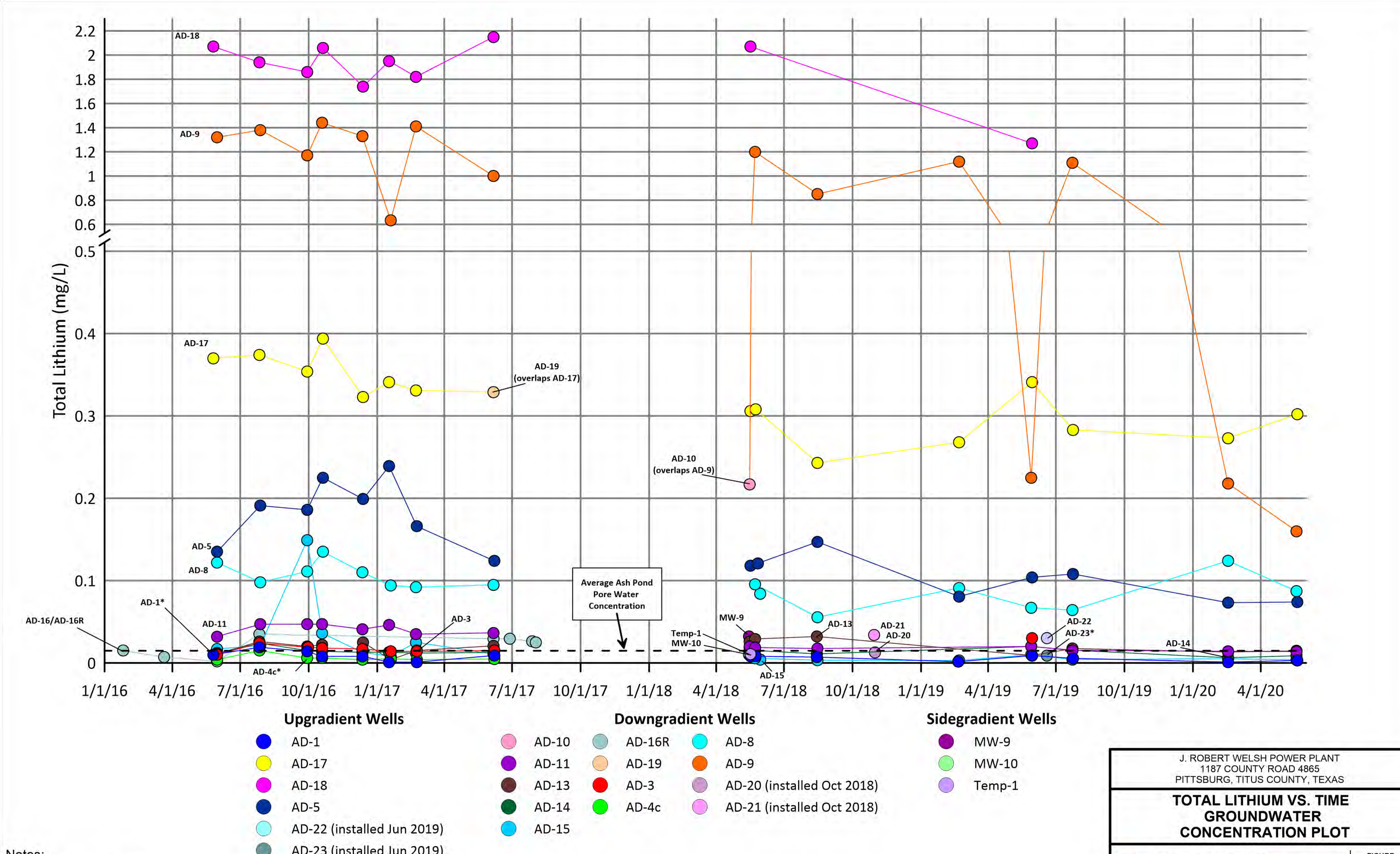
Notes:
TDS - total dissolve solids
mg/L - milligrams per liter
Concentrations of iron and lithium in coal ash were below detection
Concentrations of lithium in coal ash porewater were less than 0.02 mg/L
AD-22 and AD-23 groundwater concentrations are total only
*Iron was not detected, result is plotted at the reporting limit
**Lithium was not detected, result is plotted at the reporting limit

J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

IRON VS. LITHIUM GROUNDWATER CONCENTRATION PLOT

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4-7



Notes:
mg/L - milligrams per liter
*When lithium was not detected, result is plotted at the reporting limit

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1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

TOTAL LITHIUM VS. TIME GROUNDWATER CONCENTRATION PLOT

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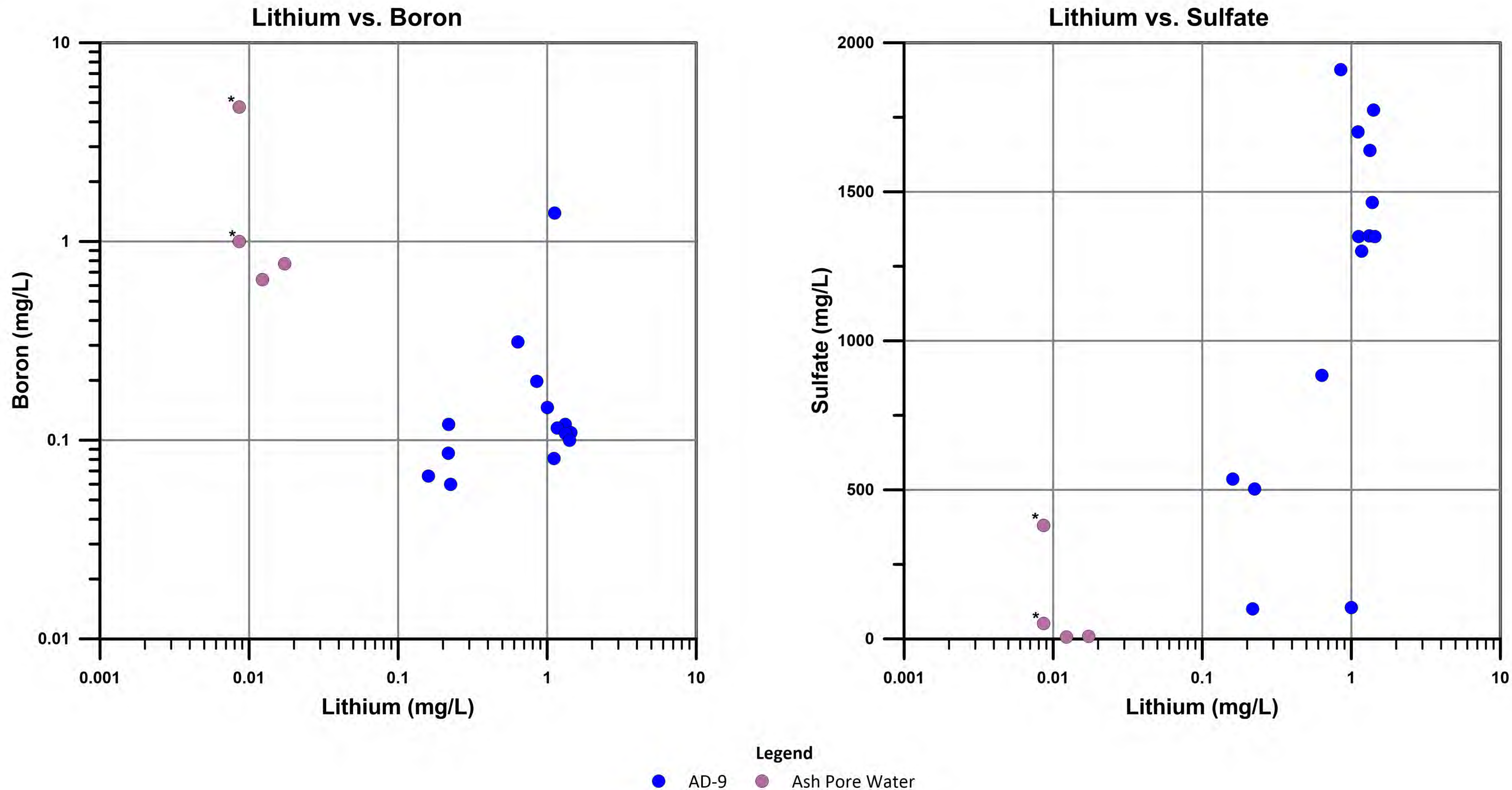
FIGURE
4-8



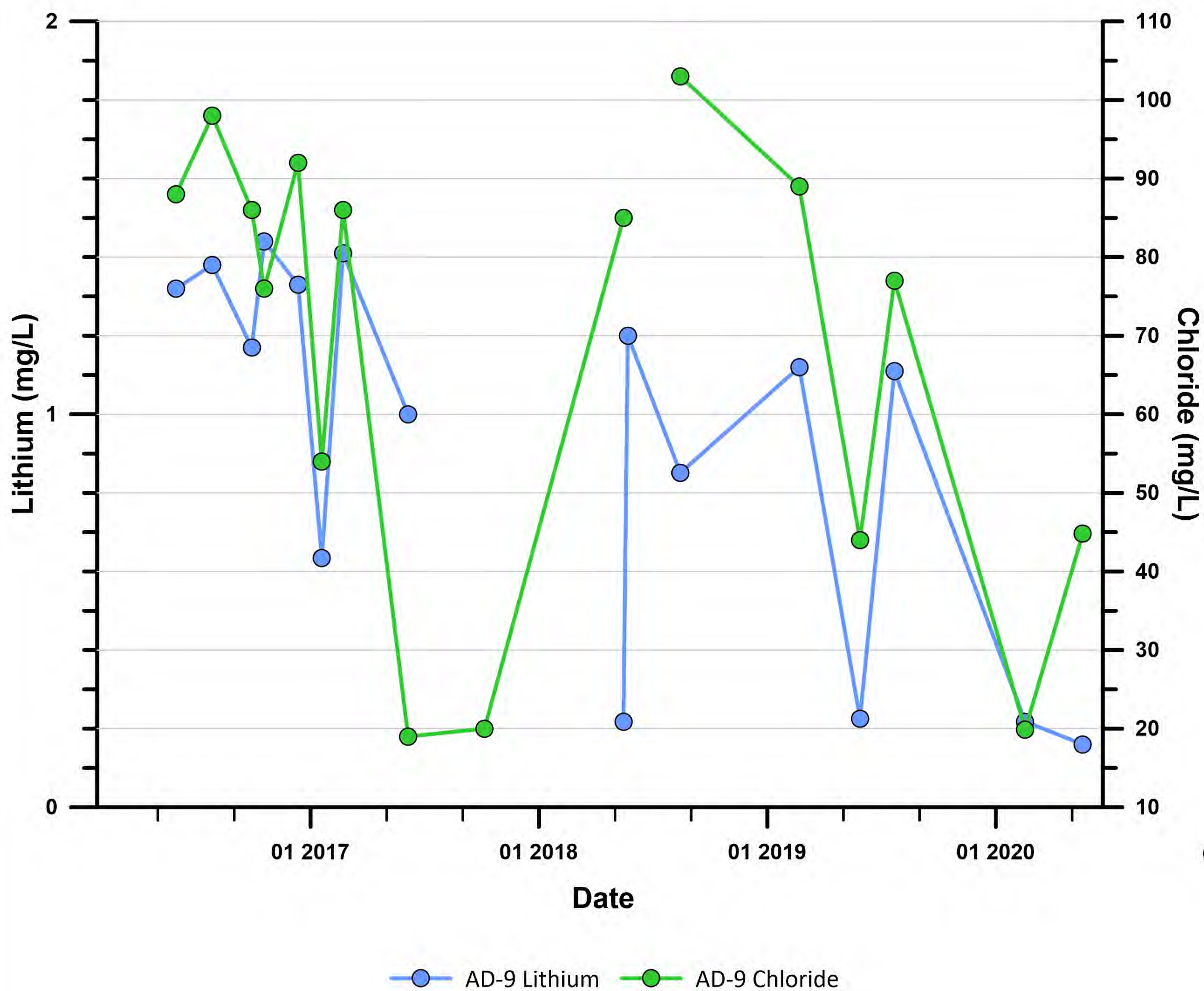
Notes:
mg/L - milligrams per liter
*When lithium was not detected, result is plotted at the reporting limit

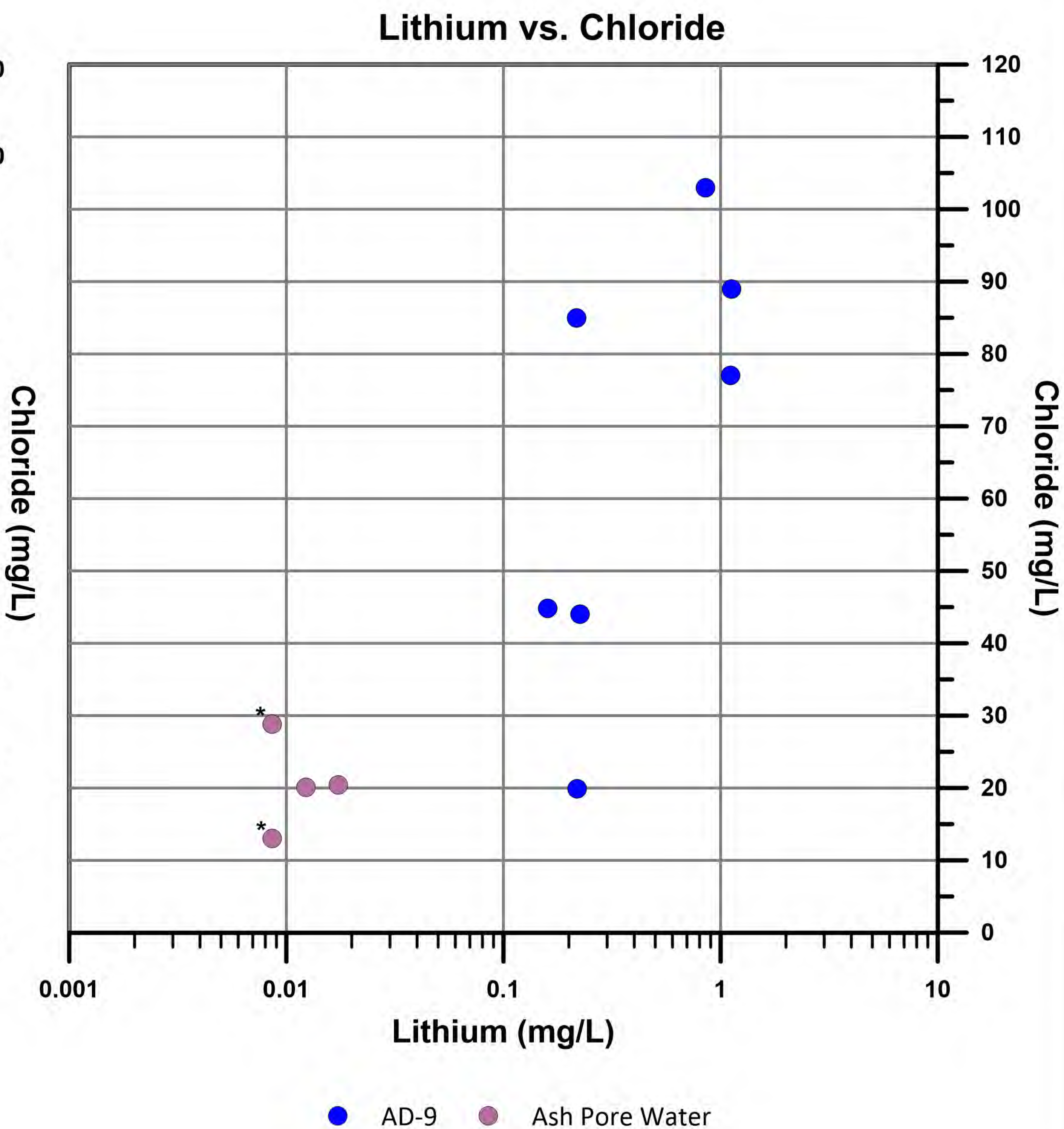
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

LITHIUM VS. BORON AND SULFATE GROUNDWATER CONCENTRATION PLOT

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4-9





J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4865
PITTSBURG, TITUS COUNTY, TEXAS

LITHIUM VS. CHLORIDE GROUNDWATER CONCENTRATION PLOT

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4-10

Notes:
mg/L - milligrams per liter
*When lithium was not detected, result is plotted at the reporting limit

APPENDIX A

Monitoring Well Completion Diagrams – 2019 Monitoring Wells

WELL LOG

DEPTH	SAMPLE	ANALYZED	TYPE	SAMPLE DESCRIPTION
				(0-2.5') SAND (SP), BROWN, FINE GRAINED.
			SB	(2.5-6') SILTY CLAY (CL), GRAY WITH RED MOTTLING AND IRON NODULES.
5				
				(6-20') CLAYEY SAND (SC), GRAY WITH RED MOTTLING, FINE GRAINED, WET @ 9.5'.
			SB	
10				
			SB	
15				
			SB	
20				
				TOTAL DEPTH = 20 FEET BGS

STATE OF TEXAS
Kenneth J. Brandner
Geology
1787
LICENSED
PROFESSIONAL GEOSCIENTIST

8-7-19

WELL	AD-22
CLIENT	AEP
PROJECT	TX015976.0004
LOCATION	WELSH POWER PLANT
DATE	6/18/19
DRILLING METHOD	HSA
CASING	2" PVC, 0-5' BGS
SCREEN	5-20' BGS, 2" PVC MILL-SLOT
CEMENT	0-1' BGS
BENTONITE	1-3' BGS
SAND PACK	3-20' BGS
GROUND ELEV. / TOP OF CASING ELEV.	360.94' / 360.22'

CT - CUTTINGS
SB - SPLIT BARREL (5')
SS - SPLIT SPOON (2')

HC LEVEL
WATER LEVEL

SAND
SILT
CLAY
FILL/CONCRETE
BENTONITE
GRAVEL

PAGE 1 OF 1

711 N. CARANCAHUA, #1080
CORPUS CHRISTI, TEXAS 78401
TEL: (361) 883-1353 FAX: (361) 883-7565
ARCADIS Design & Consultancy for natural and built assets

STATE OF TEXAS WELL REPORT for Tracking #515172

Owner:	AEP	Owner Well #:	AD-22
Address:	1187 County Road 4865 Pittsburg, TX 75686	Grid #:	16-58-4
Well Location:	FM 1735 Pittsburg, TX 75686 In ROW along west side of FM 1735, WNW of the AEP - Welsh Plant	Latitude:	33° 03' 35" N
		Longitude:	094° 51' 09" W
		Elevation:	No Data
Well County:	Titus		
Type of Work:	New Well	Proposed Use:	Monitor

Drilling Start Date: **6/18/2019** Drilling End Date: **6/18/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	7.25	0	20

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	0	1	Concrete
	1	3	Bentonite
	3	20	Sand

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Strata Depth (ft.)	*Water Type*
Water Quality:	**No Data**	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **WEST Drilling**

101 Industrial Drive
Waxahachie, TX 75165

Driller Name: **Robert Williams**   License Number: **59501**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	*Bottom (ft.)*	*Description*
0	**2.5**	**brown sand**
2.5	**6**	**gray and red, mottled, silty clay with Fe nodules**
6	**20**	**gray, clayey sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	*Type*	*Material*	*Sch./Gage*	*Top (ft.)*	*Bottom (ft.)*
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**20**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

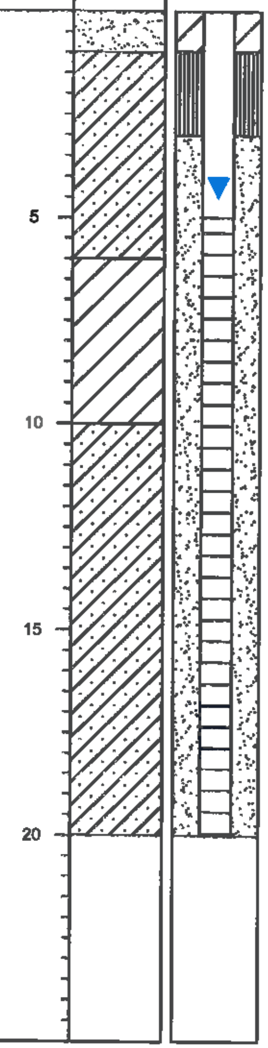
TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

WELL LOG

DEPTH	SAMPLE ANALYZED	TYPE	SAMPLE DESCRIPTION
0		SB	(0-1') SAND (SP), BROWN, FINE GRAINED. (1-6') CLAYEY SAND (SC), BROWN TO RED.
5		SB	(6-10') SILTY CLAY (CL), GRAY WITH RED MOTTLING AND IRON NODULES.
10		SB	(10-20') CLAYEY SAND (SC), REDDISH-BROWN, FINE GRAINED, WET @ 10'.
15		SB	
20			TOTAL DEPTH = 20 FEET BGS



STATE OF TEXAS
Kenneth J. Brandner
Geology
1787
LICENSED PROFESSIONAL GEOSCIENTIST
8-7-19

AD-23
WELL

AEP
CLIENT

TX015976.0004
PROJECT

WELSH POWER PLANT
LOCATION

6/18/19
DATE

HSA
DRILLING METHOD

2" PVC, 0-5' BGS
CASING

5-20' BGS, 2" PVC MILL-SLOT
SCREEN

0-1' BGS
CEMENT

1-3' BGS
BENTONITE

3-20' BGS
SAND PACK

369.37' / 368.82'
GROUND ELEV. / TOP OF CASING ELEV.

CT - CUTTINGS
SB - SPLIT BARREL (5')
SS - SPLIT SPOON (2')

▽ HC LEVEL
▼ WATER LEVEL

SAND · SILT · CLAY · FILL/CONCRETE · BENTONITE · GRAVEL

711 N. CARANCAHUA, #1080
CORPUS CHRISTI, TEXAS 78401
TEL: (361) 883-1353 FAX: (361) 883-7565
ARCADIS Design & Consultancy for natural and built assets

STATE OF TEXAS WELL REPORT for Tracking #515173

Owner:	**AEP**	Owner Well #:	**AD-23**
Address:	**1187 County Road 4865** **Pittsburg, TX 75686**	Grid #:	**16-58-4**
Well Location:	**FM 1735** **Pittsburg, TX 75686**	Latitude:	**33° 03' 56" N**
		Longitude:	**094° 51' 08" W**
	In ROW along west side of FM 1735, WNW of the AEP - Welsh Plant	Elevation:	**No Data**
Well County:	**Titus**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **6/18/2019** Drilling End Date: **6/18/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**7.25**	**0**	**20**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**1**	**Concrete**
	1	**3**	**Bentonite**
	3	**20**	**Sand**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Strata Depth (ft.)	*Water Type*
Water Quality:	**No Data**	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: **The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.**

Company Information: **WEST Drilling**

101 Industrial Drive
Waxahachie, TX 75165

Driller Name: **Robert Williams** License Number: **59501**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	*Bottom (ft.)*	*Description*
0	**1**	**brown sand**
1	**6**	**gray and red, clayey sand**
6	**10**	**gray and red, mottled, silty clay with Fe nodules**
10	**20**	**reddish brown, clayey sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	*Type*	*Material*	*Sch./Gage*	*Top (ft.)*	*Bottom (ft.)*
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**20**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
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APPENDIX B

Springs of Texas Reference

Springs of Texas

VOLUME I

Gunnar Brune

Second edition

The paper used in this book meets the minimum requirements of the American National Standard for Permanence of Paper for Printed Library Materials, Z39.48-1984. Binding materials have been chosen for durability.

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College of Agriculture and Life Sciences,
Texas A&M University

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INTRODUCTION TO THE SECOND EDITION

Helen C. Besse

When Gunnar Brune self-published *Springs of Texas, Volume I*, in 1981, most of the state water planning agencies and local environmental communities either did not recognize the importance of his work or were not aware of its existence. Brune had spent the previous decade conducting research and field studies, and then writing this book that describes the physical characteristics of springs, the archeology and history of springs' use, the ecological setting of springs, and the local use and lore surrounding springs for 183 out of 254 Texas counties. Gunnar Brune died before he could complete volume II.

Gunnar Brune described many of the large springs across the state as well as innumerable small springs present along river and stream courses that provide the base flow for waterways across the state. Brune repeatedly stated in the 1981 edition of this book that many of the springs he described had failed or were failing. With the pronounced influx of population in the last twenty years and the increased agricultural and industrial activities around the state, one can only wonder how many of the more than 2,000 springs have gone dry since he described them through the 1970s.

Nevertheless, this book is even more important today. Its value to water planners, elected officials, policy makers, municipal, county, and state administrators, wildlife stewards, environmentalists, and water lovers has not diminished. Springs are "the canary in the coal mine." The health of our springs reflects the health of our underground water resources and in turn the state's surface resources as well.

In the section "The Prehistoric Setting of Springs," Brune provided a quote from another book on the beliefs that early Americans had about springs. It is appropriate to repeat those words here:

> Gods and heroes were born out of springs, and they often came and went between the above and below worlds through their pools. Every pueblo had sacred springs somewhere nearby. There was every reason to sanctify them – physical, as life depended upon water; spiritual, as they had natural mystery which suggested supernatural qualities, for how could it be that when water fell as rain, or as snow, and ran away, or dried up, there should be other water which came and came, secretly and sweetly, out of the ground and never failed (Horgan 1954).

F. Halley's farm. According to Dr. John Klein, a nearby resident and writer, the Klein settlement began here in 1848. The Sellars store was at the springs. They issued from Montgomery silt with many iron concretions at about 0.72 lps on April 11, 1978. The pools, containing duckweed, pennywort, and water primrose, were home to a family of ducks and ducklings. Probably the flow formerly continued down Spring Gully past Klein cemetery, 0.6 kilometer downstream, but on this date, even after rains, the channel here was dry except for some standing water. Many wells pump nearby.

Magnolia Garden Springs (15) are four kilometers northeast of Sheldon along the San Jacinto River. At Martha Dempsey's Good Times marina several very small springs trickle from Deweyville sand, including one which flows 0.15 lps from a pipe. Near the entrance to the nearby Magnolia Gardens marina, according to Jean Manson, springs flowed until about 1923. They are quite dry now. Very small springs are said to feed Simms Lake, across the river and 0.6 kilometer farther east. This formerly popular swimming hole is now closed to the public.

At Beaumont Place northeast of Houston, near the intersection of Highways 90 and 526, is another Spring Gully. The channel is now a drainage ditch into which very small springs and seeps (14) drain from Beaumont silt and sand.

Eight kilometers west of La Porte is Willow Springs Bayou, also called Willow Springs Gully or Ditch. **Willow Springs (8)** are chiefly between North L Street and Spencer Road. On April 9, 1978, the discharge of Willow Springs Bayou at North L Street was 0.18 lps, and at Spencer Road it was 0.70 lps. Many willows still fringe the channel, along with cattails.

A third Spring Gully is located eight kilometers southwest of La Porte. Springs (9) in Beaumont silt produced a discharge of about 0.18 lps in 1978 in the gully at the Red Bluff road crossing. Cottonmouths hide here among the willows and cattails.

HARRISON COUNTY

Harrison County is endowed with numerous springs of all types, some highly mineralized and valued for their healing properties. Most appear to be flowing as strongly as ever, because there has been little demand on the groundwater reservoirs. However, water levels in the artesian sands are declining as much as 4.6 meters per year in some areas. Most of the Caddo Indian villages were located at springs. Early French and Spanish explorers, some over 400 years ago, visited many of the same springs that can be seen today. The New Madrid earthquake of 1811 - 1812, which enlarged Caddo Lake, may have affected the flow of some springs. In general, however, the water-bearing formations were not greatly affected by the quake.

Most of the spring waters of the county issue from Eocene sands. They are usually fresh, soft, and acid, being of the sodium bicarbonate type. The iron content is often very high. Mineralized waters may also be high in aluminum and sulfate, may be slightly saline, and can be very hard. The analyses shown for 1942 in the table of Selected Chemical Analyses are probably too low in dissolved-solids content, perhaps because of high rainfall at the time the samples were collected. Most of the writer's field studies were made on January 23 - 28, 1976.

It was around **Locke Springs (1)** that the community of Marshall first appeared. In 1831 there were at least 20 springs flowing from the Reklaw sand near the intersection of Franklin and Houston Streets and up the hill toward the courthouse. In early times water was hauled from these springs in barrels to fill the cisterns on the town square. Most of the springs have now been paved over, but the remaining ones still flowed 1.4 liters per second in 1976.

Hynson Springs (10), also known as **Marshall, Noonday Camp**, and **Iron Springs**, are six kilometers north of Hallsville. They became very popular as a health resort about 1851. The waters are highly mineralized, containing much iron, sulfur, aluminum, and lithium. Originally there were said to be over 100 springs flowing from Queen City sand. Now not more than 20 can be found, possibly because the water table has fallen. During the Civil War the water from the springs was used in a leather-tanning factory. From 1891 to 1905 the large Hotel Randall accommodated thousands of visitors to the springs. Today there are an open-air auditorium and a number of cabins, but everything is in a sad state of disrepair. A historical marker is located at the springs. The discharge record, in liters per second, is as follows:

Jan. 28, 1942	[illegible]	
Jul. 21, 1964	[illegible]	
Jan. 27, 1976	0.13 (main spring)	1.4 (all springs)

Rock Springs (7) are just east of the Rock Springs church on Highway 449 about 13 kilometers west of Marshall. This and several other springs upstream flowed 2.3 lps from the Queen City sand in 1976. The Frenchman Henri Joutel of La Salle's party may have stopped here for refreshment in 1687.

Mulberry Springs (9), nine kilometers south-southwest of Harleton, are 100 meters north of the