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Stack Out Area - CCR Groundwater Monitoring Well Network Evaluation

H.W. Pirkey Power Plant
2400 FM 3251
Harrison County
Hallsville, Texas

May 25, 2016

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Acronyms and Abbreviation

AEP	American Electric Power Service Cooperation
amsl	above mean sea level
ARCADIS	ARCADIS U.S., Inc.
BAP	bottom ash pond
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
FAP	fly ash pond
FGD	flue gas desulfurization
ft	feet
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
PTI	Permit to Install
TDS	total dissolved solids

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1. Objective

This report was prepared by ARCADIS U.S., Inc. (ARCADIS) for American Electric Power Service Corporation (AEP) to assess the adequacy of the groundwater monitoring well network included in the Coal Combustion Residual (CCR) requirements, as specified in Code of Federal Regulations (CFR) 40 CFR 257.91, for the Stack Out Area CCR Unit at the AEP H.W. Pirkey Generating Plant (Plant) located at 2400 FM 3251 in Hallsville, Harrison County, Texas (**Figure 1**). The CCR requirements include an evaluation of the adequacy of the groundwater monitoring well network to characterize groundwater quality up and down gradient of the CCR unit and an evaluation of whether the CCR unit meets up to 5 location restrictions, which include: the base of the CCR unit is 5 feet (ft) above and isolated from the uppermost aquifer, the CCR unit may not be located in a wetland, within 200 ft of the damage zone of a fault that has displacement during the Holocene, within a seismic impact zone, or in an unstable area.

Four regulated CCR units associated with the Plant were identified for review, which include the West BAP, East BAP, Stack Out Area, and Landfill (**Figure 2**). This report summarizes the evaluation of the groundwater monitoring well network in the uppermost aquifer at the Stack Out Area. The evaluation of the location restriction criteria is not included in this report and will be completed under separate cover.

This evaluation included a review of AEP-provided data associated with previously completed subsurface investigation activities in the vicinity of the Stack Out Area CCR unit, as well as publically-available geologic and hydrogeologic data. The following report also presents the current Conceptual Site Model based on all documents reviewed and will further describe the uppermost aquifer, include an evaluation of the adequacy of the existing monitoring well network, and provide recommendations for monitoring well augmentation, as necessary.

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2. Background Information

The following section provides background information for the AEP H.W. Pirkey Generating Plant Stack Out Area.

2.1 Facility Location Description

The AEP H.W. Pirkey Plant is located in southern Harrison County, approximately 5 miles southeast of Hallsville, Texas, and approximately 8 miles southwest of Marshall, Texas. The Stack Out Area CCR unit is located in the central portion of the Plant, and approximately 1,200 feet northwest of Brandy Branch Reservoir (**Figures 1** and **2**).

2.2 Description of Stack Out Area CCR Unit

The following section will discuss the embankment configuration, area, volume, construction and operational history, and surface water control associated with the Stack Out Area.

2.2.1 Stack Out Area Configuration

The Stack Out Area is an approximate 7-acre storage area for stabilized flue gas desulfurization (FGD) sludge. As shown on **Figure 3**, the Stack Out Area is located directly south of the Surge Pond, directly west of Thickener Tanks 1A and 1B, and directly east of a road that runs south to the on-site Landfill. The dimensions of the Stack Out Area are approximately 650 feet from north to south by 450 feet from east to west.

Stabilized FGD sludge is temporarily stockpiled directly above natural ground surface (native clay) in the Stack Out Area using a radial stacker. The maximum height of the stabilized FGD sludge piles are approximately 41 feet above ground surface. There are no solids retention structures in the Stack Out Area. The stabilized FGD sludge piles are located no closer than approximately 50 feet from the perimeter of the Stack Out Area, thereby preventing the stabilized FGD sludge from migrating beyond the boundaries of the Stack Out Area.

2.2.2 Area/Volume

The Stack Out Area is approximately 7 acres in size. However, as discussed above in Section 2.2.1, the CCR piles in the Stack Out Area are located no closer than approximately 50 feet from the perimeter of the Stack Out Area, therefore the effective storage area of the Stack Out Area is approximately 4.4 acres (550 feet by 350 feet),

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and the maximum CCR storage volume based on a maximum CCR pile height of 41 feet is 180 acre feet.

2.2.3 Construction and Operational History

The H.W. Pirkey Power Plant was constructed in 1983 and 1984, and began operation in 1985. Throughout the life of the Plant, CCR materials (fly ash, bottom ash, economizer ash, FGD sludge) have been generated. The Stack Out Area receives stabilized FGD sludge (**Figure 3**). Prior to storing the FGD sludge in the Stack Out Area, the FGD sludge is dewatered using belt presses, and the dewatering fluid is routed to the Surge Pond for reuse as FGD makeup water. The stabilized FGD sludge is then stockpiled in the Stack Out Area using a radial stacker with an approximate 3-foot-wide by 120-foot-long conveyor belt.

The stabilized FGD sludge is temporarily stored at the Stack Out Area. The stabilized FGD sludge is removed using front-end loaders or similar equipment, placed into trucks, and disposed of at the on-site Landfill CCR Unit located near the south end of the Plant.

Lithologic data from soil borings and monitoring wells confirm the native soils underling the Stack Out Area consist of low-permeability clay. As shown on Geologic Cross Sections B-B' (**Figure 5**) and E-E' (**Figure 8**), the native clay directly below the Stack Out Area extends from the surface to an average depth of approximately 20 feet. Therefore, as shown on **Figures 5** and **8**, the separation distance between the base of the Stack Out Area and uppermost aquifer exceeds 5 feet.

2.2.4 Surface Water Control

The Stack Out Area contains dewatered FGD sludge that is stockpiled using a radial stacker, therefore no sluice water is present in the Stack Out Area. Storm water in the Stack Out Area follows surface topography via gravity sheet flow. The ground surface elevation in the Stack Out Area ranges from approximately 360 to 365 feet amsl (Akron Consulting, 2015). Storm water flow in the Stack Out Area is in a general northerly direction to the Surge Pond, which is a below-grade (incised) non-CCR unit.

2.3 Previous Investigations

The initial soils investigation and design of the Plant was provided in a January 31, 1983 report prepared by Sargent & Lundy entitled "*Henry W. Pirkey Power Plant, Design Summary for Lignite Storage Area and Wastewater Pond Facilities*". This investigation included advancement of soil borings throughout the Plant, including the Stack Out Area.

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In 2009, ETTL Engineers & Consultants (ETTL) conducted geotechnical investigations of earthen embankments associated with several ponds at the Plant. The Stack Out Area was not included in this evaluation because there are no earthen embankments in the Stack Out Area (ETTL, 2010).

In 2010 and January 2011, Apex Geoscience expanded the groundwater monitoring well system at the Plant, including installation of monitoring wells AD-16 through AD-29. Apex Geoscience also conducted video surveillance of the existing monitoring wells and plugged monitoring wells MW-1, MW-5, MW-6, MW-9, MW-11, MW-14, MW-15, M-2, and M-3 (Apex Geoscience, 2011).

In 2011, Johnson & Pace performed hydraulic analysis of several ponds at the Plant. The Stack Out Area was not included in this evaluation because there is no impounded water in the Stack Out Area (Johnson & Pace, May 2011).

In December 2015, Auckland Consulting further expanded the groundwater monitoring well system at the Plant, including installation of six monitoring wells (AD-30 through AD-35) (Auckland Consulting, 2016).

2.4 Hydrogeologic Setting

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 southeast. The central and northern portions of the Plant are located on the outcrop of the Eocene-age Recklaw Formation. The Recklaw Formation consists predominantly of clay and fine grained sand, and attains a maximum thickness of approximately 100 feet (Broom, 1966).

The Recklaw Formation is underlain by the Eocene-age Carrizo Sand, which outcrops in the topographically low southern portion of the Plant. The Carrizo Sand consists of fine to medium grained sand interbedded with silt and clay, and attains a thickness of approximately 100 feet (Broom, 1966).

These features are further illustrated on five lines of cross section that were prepared through the Stack Out Area, with three lines trending from west to east (A-A'; B-B'; C-C'), and the other two lines trending from north to south (D-D'; E-E'). The cross section location map is included as **Figure 3** and the lines of cross section are included as **Figure 4** (A-A') through **Figure 8** (E-E').

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2.4.1 Climate and Water Budget

Average temperatures in Harrison County, Texas range from 47.1° Fahrenheit (F) in January to 83.8°F in July, and the mean annual growing season is 238 days. Average annual precipitation (including liquid water equivalent from snowfall) is approximately 47 inches (Broom, 1966).

2.4.2 Regional and Local Geologic Setting

The central and northern portions of the Plant, including the Stack Out Area, are located on the outcrop of the Eocene-age Recklaw Formation. The Recklaw Formation is underlain by the Eocene-age Carrizo Sand, which outcrops in the topographically low southern end of the Plant (Broom, 1966; Flawn, 1965).

Detailed regional geologic characterization can be found in several published reports including Texas Water Development Report 27 "*Ground-Water Resources of Harrison County, Texas*" (Broom, 1966), The University of Texas at Austin Bureau of Economic Geology "*Geologic Atlas of Texas – Tyler Sheet*" (Flawn, 1965), and U.S. Geological Survey Open-File Report 88-450K "*Petroleum Geology and the Distribution of Conventional Crude Oil, Natural Gas, and Natural Gas Liquids, East Texas Basin*" (USGS, 1988).

Detailed regional and site geologic characterization can also be found in the 2010 ETTL report entitled "*Geotechnical Investigation, Pirkey Power Station, Existing Ash, Surge, Lignite and Limestone Runoff, and Landfill Stormwater Ponds Embankment Investigation, Hallsville, Texas*" (ETTL, 2010).

2.4.3 Surface Water and Surface Water Groundwater Interactions

Figure 9 is a potentiometric surface map based on January 2016 water level data for the uppermost aquifer at the Site, and water level elevations in the Site monitoring wells are summarized on **Table 1**. As shown on **Figure 9**, shallow groundwater flow direction in the Stack Out Area is northwesterly at an average hydraulic gradient of approximately 0.01 foot per foot.

The Stack Out Area is located approximately 1,200 feet northwest of Brandy Branch Reservoir, which was dammed during Plant construction in the 1980's. The normal pool level of Brandy Branch Reservoir is approximately 340 feet amsl. As shown on **Figure 9**, shallow groundwater flow direction at the Site generally follows surface topography to the west and southwest toward Hatley Creek, which is located in a topographically low area approximately one mile west of the Site. Therefore shallow groundwater in the Stack Out Area does not discharge into Brandy Branch Reservoir.

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2.4.4 Water Users

A water well inventory conducted by Banks Information Solutions showed 12 water wells had been drilled within a ½-mile radius of the Site (Banks, 2015). The nearest water well was reportedly drilled approximately 1,000 feet north of the Stack Out Area in 2004 by Bennett Drilling for use as a rig supply well. The water well was screened from 350 to 430 feet below ground surface, therefore this water well is completed in a deeper water bearing unit relative to the uppermost water-bearing unit at the Site.

The second closest water well was reportedly drilled approximately ¼-mile west (downgradient) of the Stack Out Area for NFR Energy in 2008 for use as a rig supply well. The water well was screened from 250 to 310 feet below ground surface, therefore this water well is completed in a deeper water bearing unit relative to the uppermost water-bearing unit at the Site.

All of the water wells identified within a ½-mile radius of the Site were drilled to total depths of 160 feet or deeper except one water well (Well ID: 35-37-4E) that was drilled to a total depth of 55 feet in 1982. This water well was completed with concrete tile from the surface to total depth, and is located approximately ¼-mile east (upgradient) of the Pirkey Power Plant.

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3. Groundwater Monitoring Well Network Evaluation

The existing monitoring well network present at the Site was evaluated to determine if any of the wells were viable for continued use as part of the groundwater monitoring well network or also retained as part of a larger groundwater hydraulic monitoring well network. The hydrogeologic conditions were also evaluated to determine if the uppermost aquifer unit has an effective well network. The evaluation was completed in accordance with 40 CFR 257.91 to have an established monitoring well network that effectively monitors the uppermost aquifer up gradient and down gradient of the Site. The up gradient wells represent background groundwater quality and the down gradient wells are to be placed down gradient of the CCR unit boundary to monitor water quality.

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Geologic data from soil borings, piezometers, and monitoring wells installed at the Site show the uppermost aquifer in the Stack Out Area is a very fine to fine grained clayey and silty sand stratum with an average thickness of approximately 20 feet that is located between an elevation of approximately 320 and 340 feet amsl (**Appendix A**). The base of the Stack Out Area is at an elevation of 360 feet amsl. The separation distance between the uppermost aquifer and the base of the Stack Out Area ranges from approximately 10 to 20 feet. This separation distance is further illustrated on cross section B-B' (**Figure 5)** and cross section E-E' (**Figure 8)**.

3.1.2 Overall Flow Conditions

Groundwater is recharged from regional precipitation infiltration. The uppermost aquifer unit (clayey and silty sand) is expected to have a hydraulic conductivity of approximately 10^{-4} centimeters per second (Fetter, 1980). Based on the hydraulic conductivity and saturated thickness in the Stack Out Area (approximately 20 feet), the yield of the uppermost aquifer is anticipated to exceed the TCEQ non-useable (Class 3) limit of 150 gallons per day (TCEQ, 2010).

Available groundwater elevations are summarized on **Table 1** for 2011 through 2016. The most recent comprehensive groundwater data set from January 20, 2016 is depicted on **Figure 9**. The groundwater flow direction in the Stack Out Area is northwesterly towards Hatley Creek, which is located approximately one mile west of the Site.

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3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

Per 40 CFR 257.60(a), new CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five ft) above the upper limit of the uppermost aquifer, or must demonstrate there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high conditions).

The CCR rule definitions for an aquifer and the uppermost aquifer as specified in 40 CFR 257.53 indicates an aquifer is a geologic formation capable of yielding usable quantities of groundwater to wells or springs while an uppermost aquifer is defined as the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers, that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural groundwater surface to which the aquifer rises during the wet season.

3.2.1.1 Common Definitions

An aquifer is commonly defined as a geologic unit that stores and transmits water (readily or at sufficient flow rates) to supply wells and springs (USGS, 2015; Fetter, 2001). The uppermost aquifer is considered the first encountered aquifer nearest to the CCR unit.

3.2.2 Identified Onsite Hydrostratigraphic Unit

The identified Site hydrostratigraphic unit in the Stack Out Area is the clayey and silty sand stratum that is located between an elevation of approximately 320 and 340 feet amsl.

3.3 Review of Existing Monitoring Well Network

3.3.1 Overview

The Site was visited by ARCADIS and AEP personnel on August 19, 2015 to review existing well network conditions and locations. A well construction table that summarizes the location, ground surface elevation, borehole depth, installation date, and associated well construction details of the monitoring well network is included as

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Table 2. Photo documentation of the located wells during the August 19, 2015 site visit is provided in **Appendix B**.

Monitoring wells AD-7, AD-12, AD-13, and AD-22 were previously installed at the Site to monitor the uppermost water-bearing unit (clayey and silty sand stratum) associated with the Stack Out Area. As discussed above in Section 3.1.1, the uppermost water-bearing unit below the Stack Out Area is approximately 20 feet thick and is located between an elevation of approximately 320 and 340 feet amsl.

3.3.2 Gaps in Monitoring Network

As shown on Geologic Cross Sections B-B' (**Figure 5**) and E-E' (**Figure 8**), existing monitoring wells AD-7 and AD-22 are screened in the uppermost water-bearing unit downgradient (northwest) of the Stack Out Area, and will be utilized as downgradient monitoring wells for the Stack Out Area. Existing monitoring wells AD-12 and AD-13 are screened in the uppermost water-bearing unit up gradient (east) of the Stack Out Area, and will be utilized as up gradient monitoring wells for the Stack Out Area.

As shown on **Figure 9**, shallow groundwater flow direction in the Stack Out Area is northwesterly. Two existing monitoring wells (AD-7 and AD-22) were located hydraulically downgradient of the Stack Out Area during the August 19, 2015 site visit, and three downgradient monitoring wells are required to monitor groundwater quality downgradient of a CCR unit. This data gap was addressed by installation of new downgradient monitoring well AD-33 during December 2015 as shown on **Figure 9** and **Figure 10**. With the addition of monitoring well AD-33 on the west side of the Stack Out Area, there are no gaps remaining in the groundwater monitoring network for the Stack Out Area.

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4. Recommended Monitoring Network and PE Certification

The recommended existing groundwater monitoring well network is intended to meet specifications stated in 40 CFR 257.91. Recommended wells are further discussed with respect to location to the Stack Out Area (up gradient or down gradient), well depth, and well construction. The recommended network would provide an improved understanding of groundwater quality, hydraulics, and groundwater flow at the Stack Out Area.

4.1 Recommended Monitoring Well Network Distribution

Two up gradient well locations (existing monitoring wells AD-12 and AD-13) and three down gradient well locations (existing monitoring wells AD-7, AD-22, and AD-33) are recommended to establish a groundwater quality monitoring well network for the Stack Out Area.

4.1.1 Location

The recommended monitoring well network for groundwater quality of the uppermost aquifer at the Stack Out Area is summarized on **Table 3** and illustrated on **Figure 10.**

4.1.2 Depth

The screen depths for the monitoring wells recommended for inclusion in the monitoring network are within the shallow saturated sand stratum (uppermost aquifer) that occurs between an elevation of approximately 320 and 340 feet amsl as shown on Geologic Cross Sections B-B' (**Figure 5**) and E-E' (**Figure 8**). The screen elevations are presented in **Table 3**.

4.1.3 Well Construction

As discussed above in Section 3.3.2, the gap in the monitoring well network for the uppermost aquifer at the Stack Out Area was addressed by installation of monitoring well AD-33 during December 2015. Monitoring well AD-33 was installed by a Texas Department of Licensing and Regulation (TDLR)-licensed water well driller. Well construction data for the monitoring well network are summarized on **Tables 2** and **3**, and the monitoring well completion diagrams are provided in **Appendix A.**

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4.2 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 proposed groundwater monitoring system will be adequate to meet the requirements of 40 CFR Part 257.91.

Kenneth J. Brandner

Printed Name of Registered Professional Engineer

Kenneth J Brandner

Signature

69586	Texas	5-25-16
Registration No.	Registration State	Date

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Tables

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Table 1
Water Level Data
AEP Pirkey Power Plant - CCR Storage Areas
Hallsville, Harrison County, Texas

Well ID	Latitude	Longitude	Ground Surface Elevation[a]	Top of Casing Elevation[a]	Borehole depth ft. bls	Date Installed	Screen Material	Well diameter inches	Top of Screen[b]		Bottom of Screen[b]		4/13/2011	12/15/2011	6/20/2012	1/23/2013	7/7/2013	1/22/2014	7/9/2014	1/28/2015	1/20/2016
									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
Monitoring Wells																					
MW-2/AD-2	32° 27' 54.753"	94° 29' 25.282"	341.25	344.04	40	10/7/83	Sch. 40 PVC	4	20	321.25	40	301.25	326.90	327.12	327.17	327.26	326.62	327.70	327.19	328.62	328.55
MW-3/AD-3	32° 28' 6.829"	94° 29' 21.498"	372.76	375.30	57	11/4/83	Sch. 40 PVC	4	37	335.76	57	315.76	342.95	341.59	343.70	341.10	343.27	341.42	343.96	345.01	347.03
MW-4/AD-4	32° 27' 59.247"	94° 29' 4.692"	363.69	366.79	46	10/10/83	Sch. 40 PVC	4	26	337.69	46	317.69	351.45	351.24	352.44	354.42	349.22	355.58	353.33	359.00	359.16
MW-7/AD-7	32° 27' 43.611"	94° 29' 15.611"	359.61	362.79	40	10/3/83	Sch. 40 PVC	4	20	339.61	40	319.61	344.34	343.75	344.15	344.90	343.35	346.61	346.23	349.17	349.31
MW-8/AD-8	32° 27' 25.095"	94° 29' 14.925"	356.92	359.84	35	10/4/83	Sch. 40 PVC	4	20	336.92	35	321.92	341.65	340.29	341.65	340.72	341.25	341.67	343.36	344.03	347.21
MW-10/AD-10	32° 27' 52.446"	94° 29' 16.545"	359.48	362.21	40	10/10/83	Sch. 40 PVC	4	20	339.48	40	319.48	342.03	341.90	342.19	341.41	339.85	342.27	342.22	344.39	343.97
MW-12/AD-12	32° 27' 51.702"	94° 29' 3.238"	378.84	381.99	51	1/30/86	Sch. 40 PVC	4	31	347.84	51	327.84	358.95	357.99	359.33	368.07	357.41	369.97	367.04	372.75	371.05
MW-13/AD-13	32° 27' 46.002"	94° 29' 5.71"	361.98	364.76	40.5	2/23/88	Sch. 40 PVC	4	30.5	331.48	40.5	321.48	349.46	348.91	349.52	350.81	348.61	351.97	351.29	354.47	354.15
AD-16	32° 27' 40.871"	94° 29' 38.637"	356.81	360.05	35	12/30/10	Sch. 40 PVC	2	15.0	341.81	35.0	321.81	338.08	335.50	337.58	335.43	336.67	339.53	340.84	343.34	347.68
AD-17	32° 28' 2.315"	94° 29' 39.45"	342.65	346.09	30	12/30/10	Sch. 40 PVC	2	10.0	332.65	30.0	312.65	322.66	322.29	323.31	323.51	323.06	325.19	324.15	328.42	326.78
AD-18	32° 28' 9.245"	94° 29' 6.469"	360.48	363.42	25	1/3/11	Sch. 40 PVC	2	15.0	345.48	25.0	335.48	355.53	351.54	357.21	355.47	357.23	360.03	358.06	359.88	360.52
AD-19	32° 27' 50.512"	94° 29' 13.973"	359.50	362.82	30	12/30/10	Sch. 40 PVC	2	10.0	349.50	30.0	329.50	344.07	343.58	344.29	344.62	342.60	345.11	345.76	347.92	347.40
AD-20	32° 27' 51.346"	94° 29' 21.576"	352.30	355.79	35	12/28/10	Sch. 40 PVC	2	15.0	337.30	35.0	317.30	334.50	334.63	334.69	334.78	333.38	335.38	334.87	336.88	336.07
AD-21	32° 27' 45.403"	94° 29' 19.195"	347.23	350.72	30	12/27/10	Sch. 40 PVC	2	10.0	337.23	30.0	317.23	340.43	340.02	340.22	341.57	339.16	342.36	341.67	345.45	343.82
AD-22	32° 27' 41.349"	94° 29' 17.779"	355.57	358.51	30	12/16/10	Sch. 40 PVC	2	10.0	345.57	30.0	325.57	343.64	343.16	343.74	344.83	342.90	346.49	345.77	350.24	350.29
AD-23	32° 27' 3.384"	94° 29' 41.258"	346.72	350.10	35	12/15/10	Sch. 40 PVC	2	15.0	331.72	35.0	311.72	319.65	318.94	319.29	318.66	318.87	319.80	319.79	319.84	321.23
AD-24	32° 27' 1.455"	94° 29' 56.388"	287.68	291.14	20	12/27/10	Sch. 40 PVC	2	5.0	282.68	20.0	267.68	282.92	284.29	285.10	285.63	285.06	288.30	287.10	288.56	---
AD-25	32° 27' 17.187"	94° 29' 58.998"	334.15	337.09	30	12/14/10	Sch. 40 PVC	2	10.0	324.15	30.0	304.15	324.51	321.90	323.14	321.94	322.15	322.56	324.24	326.42	327.00
AD-26	32° 27' 25.426"	94° 29' 54.775"	342.41	345.25	40	12/14/10	Sch. 40 PVC	2	10.0	332.41	40.0	302.41	324.53	323.77	323.62	322.32	322.09	323.24	322.51	323.04	326.06
AD-27	32° 27' 36.66"	94° 29' 47.272"	349.83	352.62	37.5	12/15/10	Sch. 40 PVC	2	17.5	332.33	37.5	312.33	325.82	324.54	326.13	325.39	325.35	326.39	327.91	329.69	330.89
AD-28	32° 27' 55.439"	94° 29' 39.418"	335.92	339.40	40	12/28/10	Sch. 40 PVC	2	15.0	320.92	35.0	300.92	319.67	319.16	319.92	320.21	319.69	320.65	320.22	322.16	321.39
AD-29	32° 28' 8.271"	94° 29' 31.939"	350.21	353.37	30	1/3/11	Sch. 40 PVC	2	10.0	340.21	30.0	320.21	334.68	333.37	334.74	337.47	336.84	338.55	335.85	340.57	338.48
AD-30[d]	32° 27' 56.49"	94° 29' 32.53"	339.04	342.02	25	12/8/15	Sch. 40 PVC	2	10.0	329.04	25.0	314.04	---	---	---	---	---	---	---	---	323.70
AD-31[d]	32° 28' 02.48"	94° 29' 20.90"	357.75	360.75	35	12/8/15	Sch. 40 PVC	2	20.0	337.75	35.0	322.75	---	---	---	---	---	---	---	---	346.60
AD-32[d]	32° 27' 56.20"	94° 29' 11.86"	357.23	359.18	33	12/11/15	Sch. 40 PVC	2	13.0	344.23	33.0	324.23	---	---	---	---	---	---	---	---	352.32
AD-33[d]	32° 27' 38.70"	94° 29' 15.82"	359.30	362.37	30	12/11/15	Sch. 40 PVC	2	15.0	344.30	30.0	329.30	---	---	---	---	---	---	---	---	351.13
AD-34[d]	32° 27' 10.13"	94° 29' 57.93"	304.64	307.61	25	12/11/15	Sch. 40 PVC	2	10.0	294.64	25.0	279.64	---	---	---	---	---	---	---	---	307.61
AD-35[d]	32° 27' 09.64"	94° 29' 42.74"	316.01	318.95	20	12/11/15	Sch. 40 PVC	2	3.0	313.01	18.0	298.01	---	---	---	---	---	---	---	---	309.85
Piezometers[c]																					
W-3 (PW-3)	32° 27' 57.6"	94° 29' 31.8"	356.30	356.30	38	10/20/09	Sch. 40 PVC	2	28.0	328.30	38.0	318.30	NM	NM	NM	NM	NM	NM	NM	NM	NM

(a) Source: Apex Geoscience Inc. (March 23, 2011).
(b) Screen length and screened intervals for AD-2 through AD-12 estimated from video surveillance (Apex Geoscience Inc., March 23, 2011).
(c) Souce: EETL (October 2010).
(d) Source: Auckland Consulting LLC (January 26, 2016). Monitoring wells AD-30 through AD-35 installed during December 2015.
Groundwater Elevation Source: AEP, Pirkey Monitoring Well Groundwater Elevations through January 2015.
NM - Not Measured

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Table 2
Well Construction Details
AEP Pirkey Power Plant - CCR Units
Hallsville, Harrison County, Texas

Well ID	Latitude	Longitude	Ground Surface Elevation[a]	Top of Casing Elevation[a]	Borehole depth ft. bls	Date Installed	Screen Material	Well diameter inches	Top of Filter Pack		Bottom of Filter Pack		Top of Screen[b]		Bottom of Screen[b]	
									Depth ft. bls	Elevation ft. msl	Depth ft. bls	Elevation ft. msl	Depth ft. bls	Elevation ft. msl	Depth ft. bls	Elevation ft. msl
Monitoring Wells																
MW-2/AD-2	32° 27' 54.753"	94° 29' 25.282"	341.25	344.04	40	10/7/83	Sch. 40 PVC	4	18	323	40	301	20	321.25	40	301.25
MW-3/AD-3	32° 28' 6.829"	94° 29' 21.498"	372.76	375.30	57	11/4/83	Sch. 40 PVC	4	35	338	57	316	37	335.76	57	315.76
MW-4/AD-4	32° 27' 59.247"	94° 29' 4.692"	363.69	366.79	46	10/10/83	Sch. 40 PVC	4	24	340	46	318	26	337.69	46	317.69
MW-7/AD-7	32° 27' 43.611"	94° 29' 15.611"	359.61	362.79	40	10/3/83	Sch. 40 PVC	4	18	342	40	320	20	339.61	40	319.61
MW-8/AD-8	32° 27' 25.095"	94° 29' 14.925"	356.92	359.84	35	10/4/83	Sch. 40 PVC	4	18	339	35	322	20	336.92	35	321.92
MW-10/AD-10	32° 27' 52.446"	94° 29' 16.545"	359.48	362.21	40	10/10/83	Sch. 40 PVC	4	18	341	40	319	20	339.48	40	319.48
MW-12/AD-12	32° 27' 51.702"	94° 29' 3.238"	378.84	381.99	51	1/30/86	Sch. 40 PVC	4	29	350	51	328	31	347.84	51	327.84
MW-13/AD-13	32° 27' 46.002"	94° 29' 5.71"	361.98	364.76	40.5	2/23/88	Sch. 40 PVC	4	17.5	344.5	40.5	321.5	30.5	331.48	40.5	321.48
AD-16	32° 27' 40.871"	94° 29' 38.637"	356.81	360.05	35	12/30/10	Sch. 40 PVC	2	13	344	35	322	15.0	341.81	35.0	321.81
AD-17	32° 28' 2.315"	94° 29' 39.45"	342.65	346.09	30	12/30/10	Sch. 40 PVC	2	8	335	30	313	10.0	332.65	30.0	312.65
AD-18	32° 28' 9.245"	94° 29' 6.469"	360.48	363.42	25	1/3/11	Sch. 40 PVC	2	13	347	25	335	15.0	345.48	25.0	335.48
AD-19	32° 27' 50.512"	94° 29' 13.973"	359.50	362.82	30	12/30/10	Sch. 40 PVC	2	8	352	30	330	10.0	349.50	30.0	329.50
AD-20	32° 27' 51.346"	94° 29' 21.576"	352.30	355.79	35	12/28/10	Sch. 40 PVC	2	13	339	35	317	15.0	337.30	35.0	317.30
AD-21	32° 27' 45.403"	94° 29' 19.195"	347.23	350.72	30	12/27/10	Sch. 40 PVC	2	8	339	30	317	10.0	337.23	30.0	317.23
AD-22	32° 27' 41.349"	94° 29' 17.779"	355.57	358.51	30	12/16/10	Sch. 40 PVC	2	8	348	30	326	10.0	345.57	30.0	325.57
AD-23	32° 27' 3.384"	94° 29' 41.258"	346.72	350.10	35	12/15/10	Sch. 40 PVC	2	13	334	35	312	15.0	331.72	35.0	311.72
AD-24	32° 27' 1.455"	94° 29' 56.388"	287.68	291.14	20	12/27/10	Sch. 40 PVC	2	3	285	20	268	5.0	282.68	20.0	267.68
AD-25	32° 27' 17.187"	94° 29' 58.998"	334.15	337.09	30	12/14/10	Sch. 40 PVC	2	8	326	30	304	10.0	324.15	30.0	304.15
AD-26	32° 27' 25.426"	94° 29' 54.775"	342.41	345.25	40	12/14/10	Sch. 40 PVC	2	8	334	40	302	10.0	332.41	40.0	302.41
AD-27	32° 27' 36.66"	94° 29' 47.272"	349.83	352.62	37.5	12/15/10	Sch. 40 PVC	2	15.5	334.3	37.5	312.3	17.5	332.33	37.5	312.33
AD-28	32° 27' 55.439"	94° 29' 39.418"	335.92	339.40	40	12/28/10	Sch. 40 PVC	2	13	323	35	301	15.0	320.92	35.0	300.92
AD-29	32° 28' 8.271"	94° 29' 31.939"	350.21	353.37	30	1/3/11	Sch. 40 PVC	2	8	342	30	320	10.0	340.21	30.0	320.21
AD-30[d]	32° 27' 56.49"	94° 29' 32.53"	339.04	342.02	25	12/8/15	Sch. 40 PVC	2	8	331	25	314	10.0	329.04	25.0	314.04
AD-31[d]	32° 28' 02.48"	94° 29' 20.90"	357.75	360.75	35	12/8/15	Sch. 40 PVC	2	18	340	35	323	20.0	337.75	35.0	322.75
AD-32[d]	32° 27' 56.20"	94° 29' 11.86"	357.23	359.18	33	12/11/15	Sch. 40 PVC	2	11	346	33	324	13.0	344.23	33.0	324.23
AD-33[d]	32° 27' 38.70"	94° 29' 15.82"	359.30	362.37	30	12/11/15	Sch. 40 PVC	2	12	347	30	329	15.0	344.30	30.0	329.30
AD-34[d]	32° 27' 10.13"	94° 29' 57.93"	304.64	307.61	25	12/11/15	Sch. 40 PVC	2	8	297	25	280	10.0	294.64	25.0	279.64
AD-35[d]	32° 27' 09.64"	94° 29' 42.74"	316.01	318.95	20	12/11/15	Sch. 40 PVC	2	2.5	313.5	20	296	3.0	313.01	18.0	298.01
Piezometers[c]																
W-3 (PW-3)	32° 27' 57.6"	94° 29' 31.8"	356.30	356.30	38	10/20/09	Sch. 40 PVC	2	26	330	38	318	28.0	328.30	38.0	318.30

General Note:
Elevations in feet above mean sea level.

Footnotes:
(a) Source: Apex Geoscience Inc. (March 23, 2011).
(b) Screen length and screened intervals for AD-2 through AD-12 estimated from video surveillance (Apex Geoscience Inc., March 23, 2011). Top of sand pack estimated 2 feet above top of screened interval.
(c) Souce: EETL (October 2010).
(d) Source: Aukland Consulting LLC (January 26, 2016).
Acronyms and Abbreviations:
NA = Data not available
ft = feet
bls = below land surface
msl = mean sea level

Table 3
Proposed Well Network
AEP Pirkey Power Plant - Stack Out Area
Hallsville, Harrison County, Texas

Well ID	Exisiting/ Proposed	Hydrostratigraphic Unit Target	Location Description		Screen Top Target Elevation[(a)] (ft amsl)	Screen Bottom Target Elevation[(a)] (ft amsl)	Screen Length (ft)	Comments
Upgradient								
AD-12	Exisiting	Uppermost Water-Bearing Unit	Northeast of Stack Out Area	Upgradient	347.8	327.8	20	Existing well installed in 1986; well will be utilitzed to establish backgroud water quality
AD-13	Exisiting	Uppermost Water-Bearing Unit	East of Stack Out Area	Upgradient	331.5	321.5	10	Existing well installed in 1988; well will be utilitzed to establish backgroud water quality
Downgradient								
AD-7	Existing	Uppermost Water-Bearing Unit	Northwest of Stack Out Area	Down gradient	339.6	319.6	20	Existing well installed in 1983; uppermost shallow aquifer adjacent to Stack Out Area - downgradient
AD-22	Existing	Uppermost Water-Bearing Unit	West of Stack Out Area	Down gradient	345.6	325.6	20	Existing well installed in 2010; uppermost shallow aquifer adjacent to Stack Out Area - downgradient
AD-33	Existing	Uppermost Water-Bearing Unit	West of Stack Out Area	Down gradient	344.3	329.3	15	New monitoring well installed during December 2015 in uppermost shallow aquifer adjacent to Stack Out Area - downgradient

Footnotes:
a. Target elevations are an estimated range.

Acronyms and Abbreviations:
U=Upgradient
D=Downgradient
ft = feet
amsl = above mean sea level

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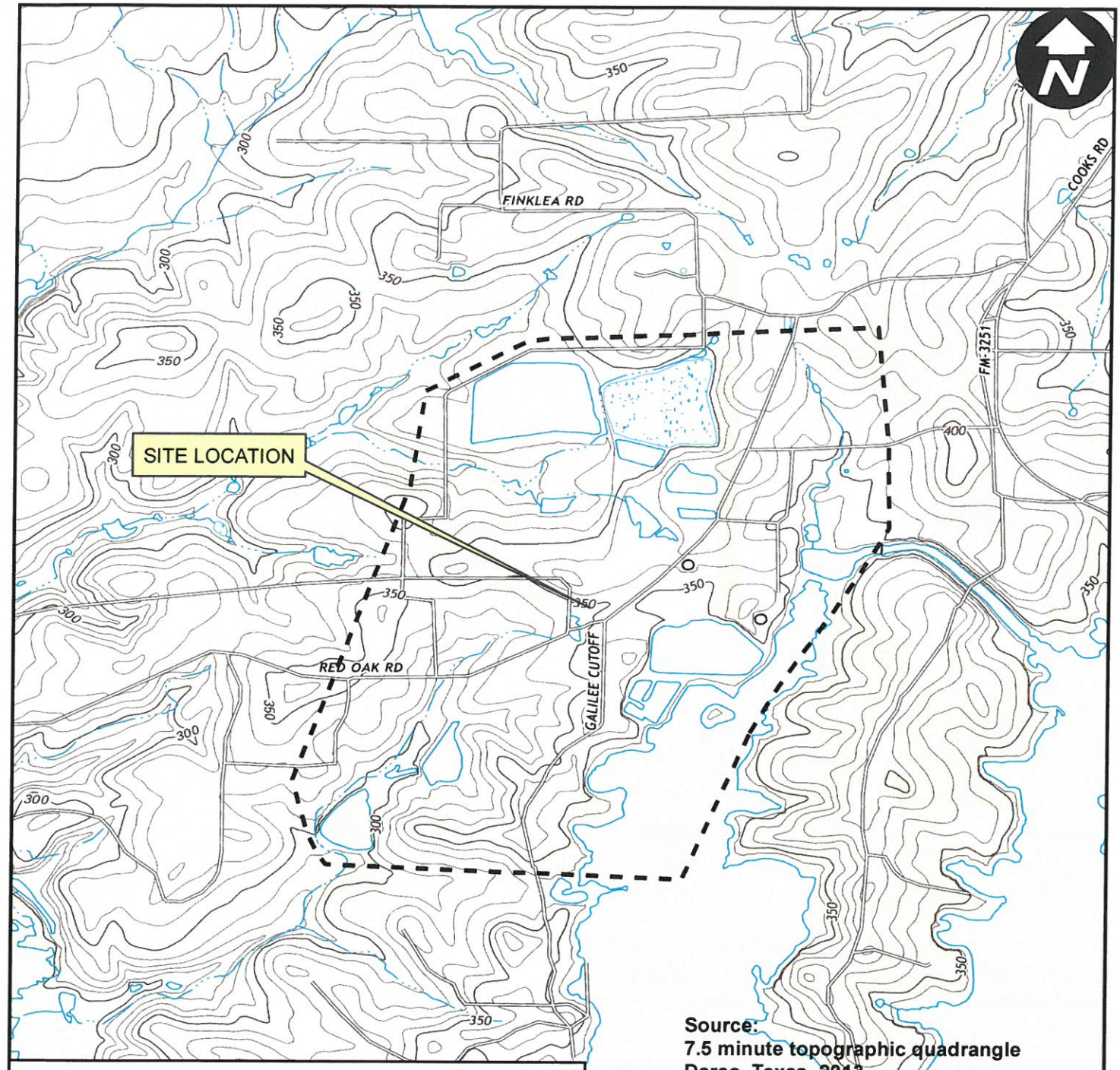
Figures



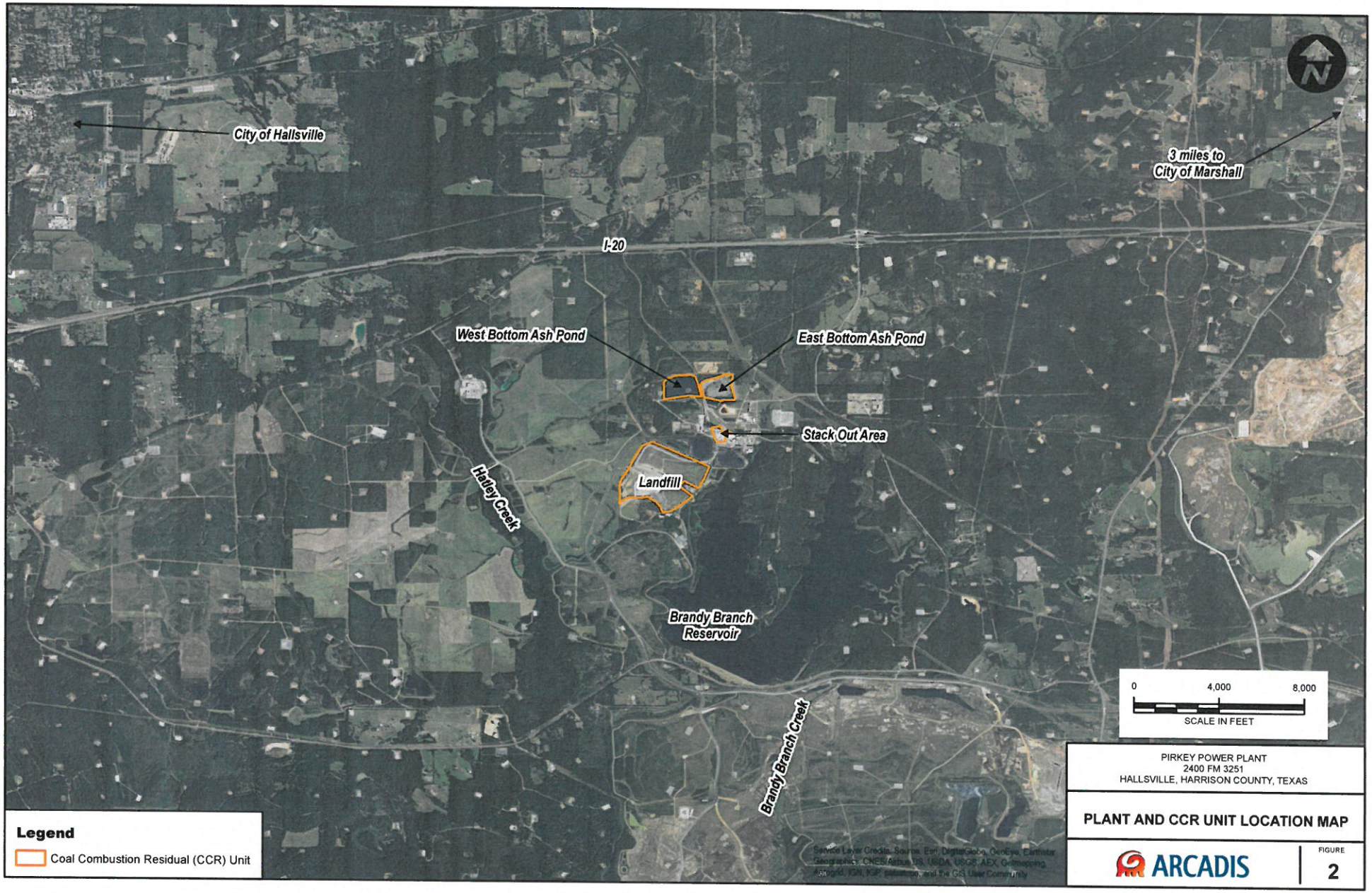
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

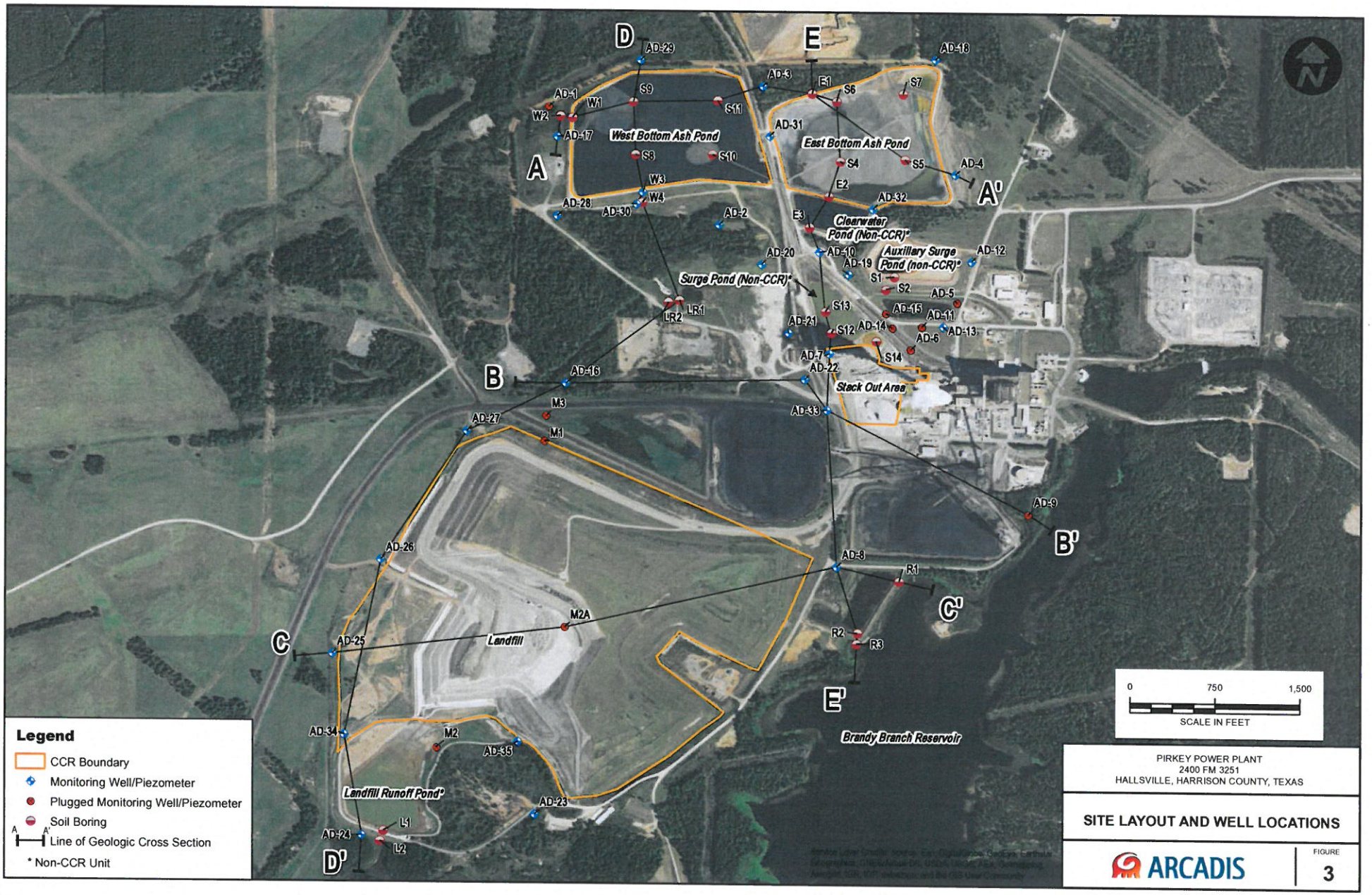
SITE LOCATION MAP

ARCADIS

FIGURE
1

Document Path: Z:\GISPROJECTS_ENVAEP\Pirkey Plant\MXD\Figure 1 - Site Location Map.mxd


City of Hallsville
3 miles to City of Marshall
I-20
West Bottom Ash Pond
East Bottom Ash Pond
Stack Out Area
Landfill
Hadley Creek
Brandy Branch Reservoir
Brandy Branch Creek
N
0
4,000
8,000
SCALE IN FEET
Legend
Coal Combustion Residual (CCR) Unit
PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS
PLANT AND CCR UNIT LOCATION MAP
ARCADIS
FIGURE
2
Document Path: Z:\GISPROJECTS_ENVAEP\Pirkey Plant\MXD\Figure 2 - Plant and CCR Unit Location Map.mxd



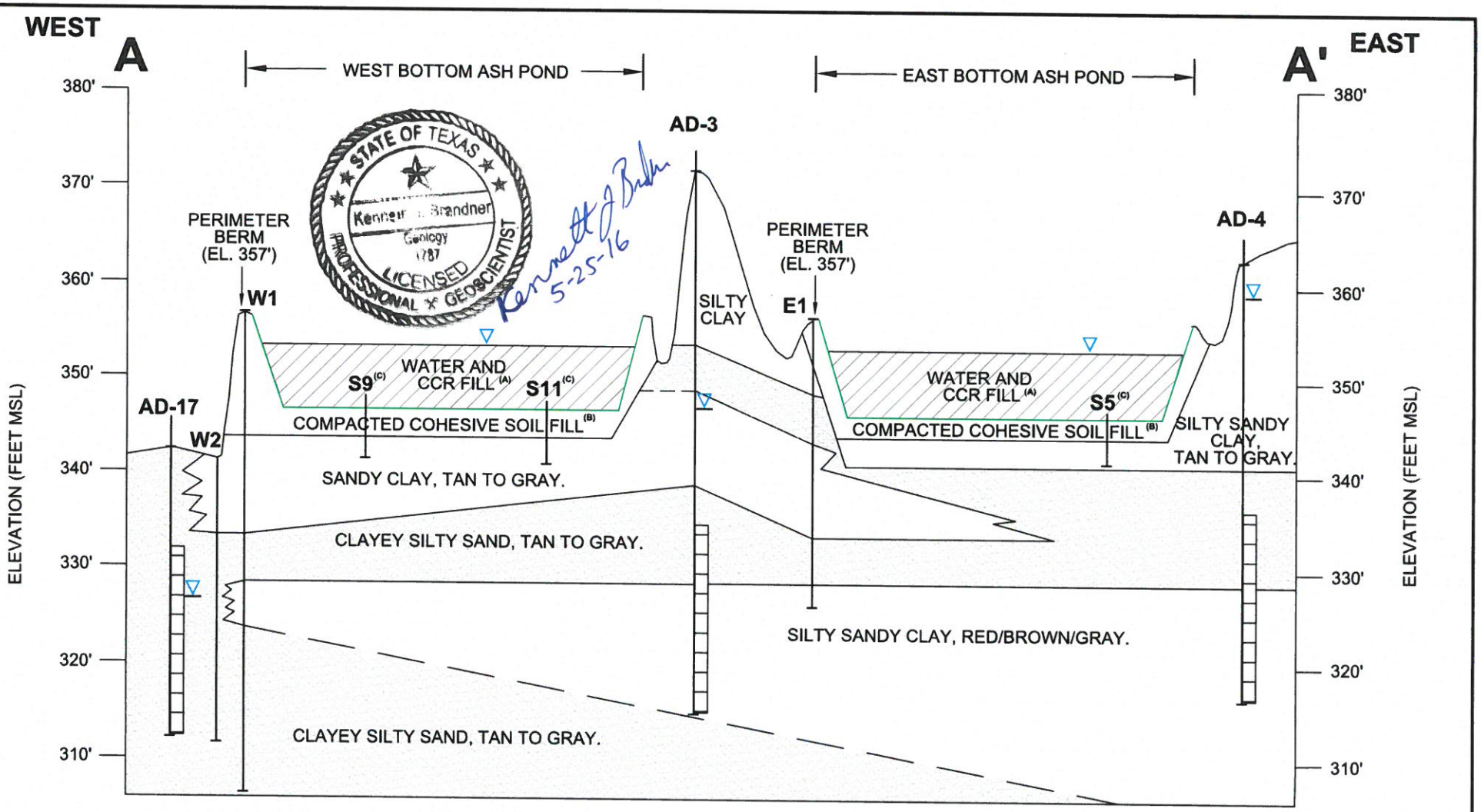
Document Path: Z:\GIS\PROJECTS_ENVAEP\Pirkey Plant\MXD\Figure 3 - Site Layout and Well Locations.mxd

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

SITE LAYOUT AND WELL LOCATIONS

ARCADIS

FIGURE 3



LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (1/20/16)
- BASE OF CCR UNIT

0 300'
HORIZONTAL SCALE

NOTES:

A) TOP OF WEST BOTTOM ASH POND AND EAST BOTTOM ASH POND PERIMETER BERM ELEVATION IS 357', OPERATING ELEVATION IS 354'(JOHNSON & PACE, MAY 2011). BASE ELEVATION OF WEST BOTTOM ASH POND AND EAST BOTTOM ASH POND IS 347' (SARGENT & LUNDY, JANUARY 1983).
B) COMPACTED COHESIVE SOIL FROM ELEVATION 344' TO 347' (SARGENT & LUNDY, SEPTEMBER 1984;AMEC, AUGUST 2011).
C) SOIL BORING INSTALLED BY SOUTHWESTERN LABORATORIES DURING ASH POND CONSTRUCTION IN 1983.

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION A - A'

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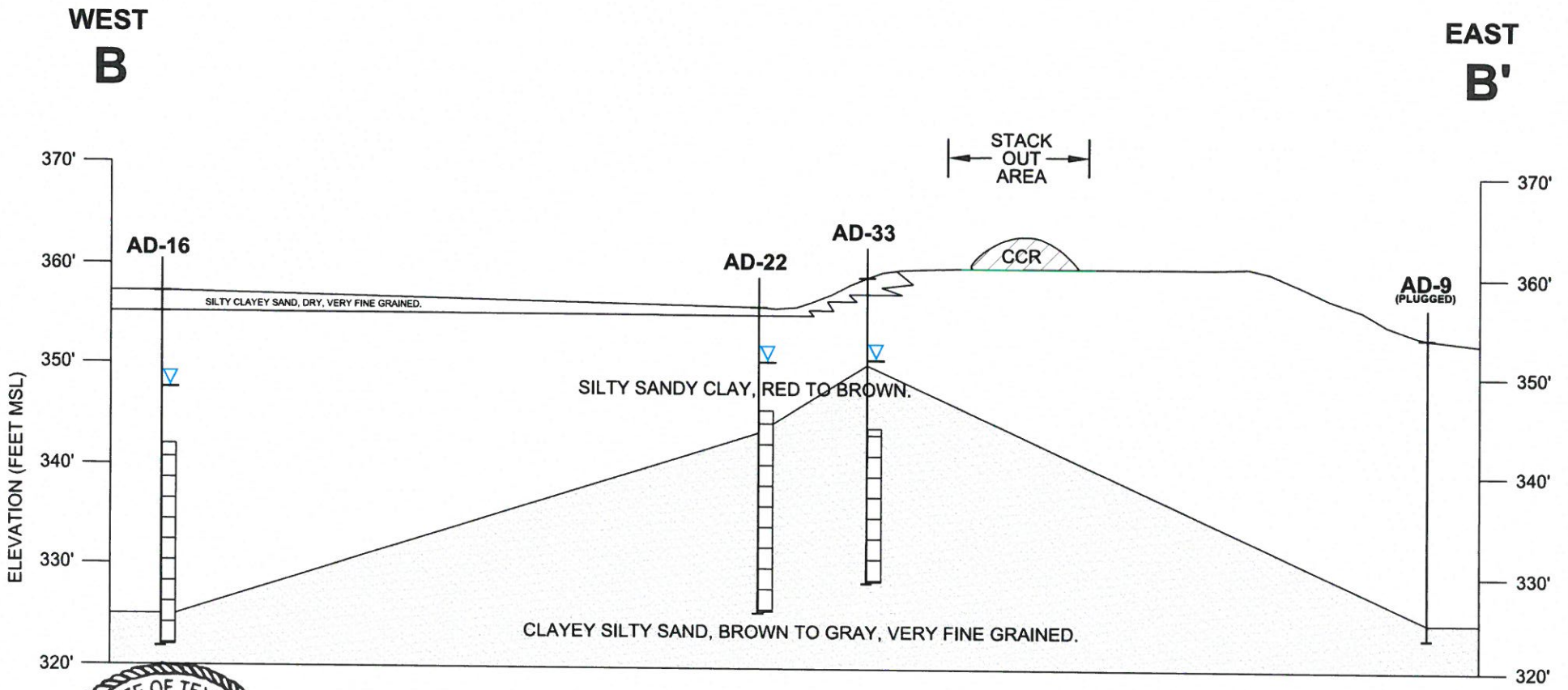
FIGURE 4



STATE OF TEXAS
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1797
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PROFESSIONAL GEOSCIENTIST

Kenneth J Brandner 5-25-16

LEGEND

- MONITORING WELL SCREENED INTERVAL
- WATER LEVEL IN MONITORING WELL (1/20/16)
- BASE OF CCR UNIT

0 300'
HORIZONTAL SCALE

NOTES:
A) BASE OF STACK OUT AREA CCR UNIT LOCATED AT GRADE, ELEVATION TAKEN FROM MAY 2012 AND JUNE 23, 2015 TOPOGRAPHIC SURVEYS BY BEACON AVIATION.
B) ELEVATION OF CCR MATERIAL ABOVE STACK OUT AREA VARIES.

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
B - B'

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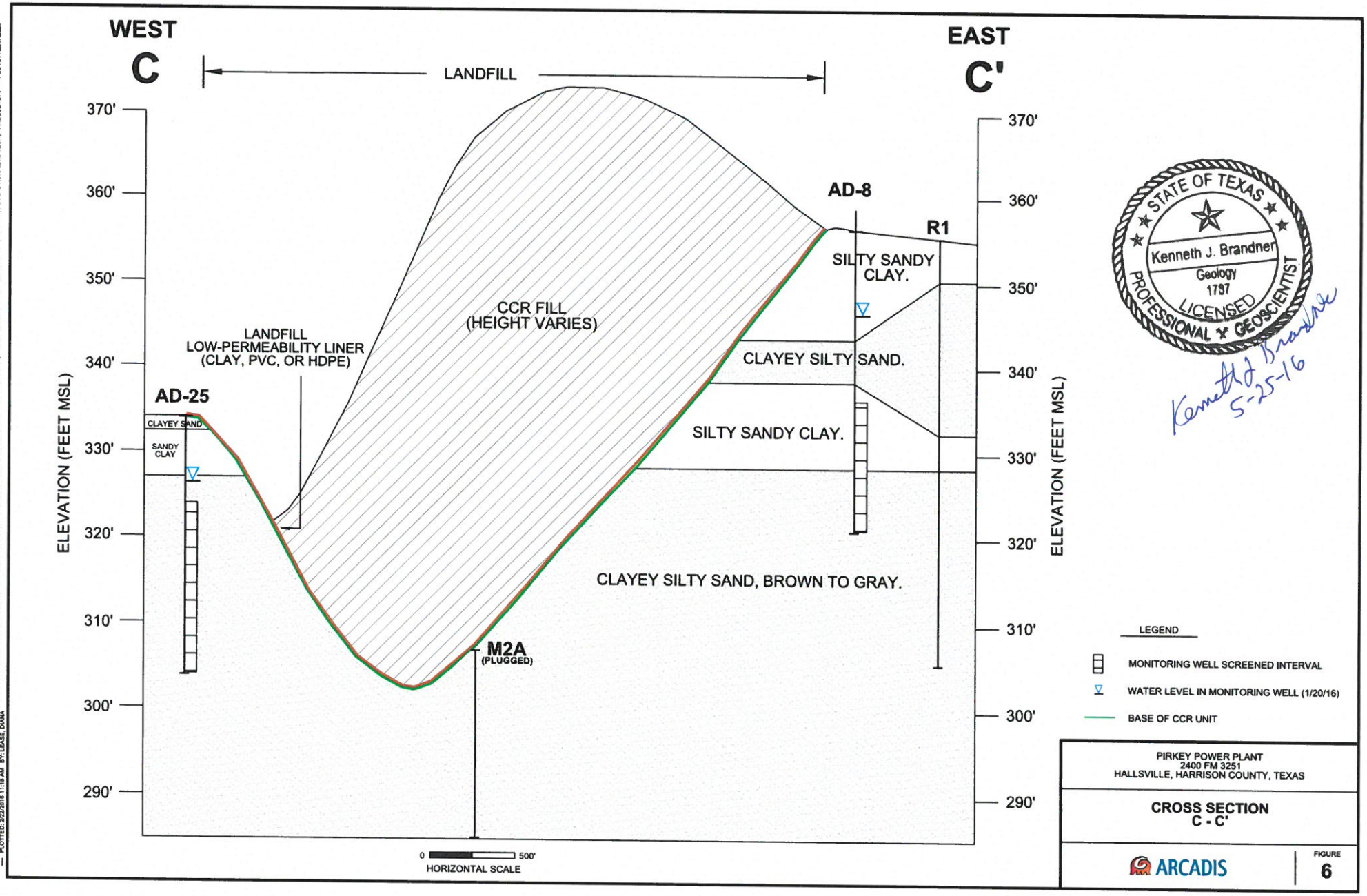
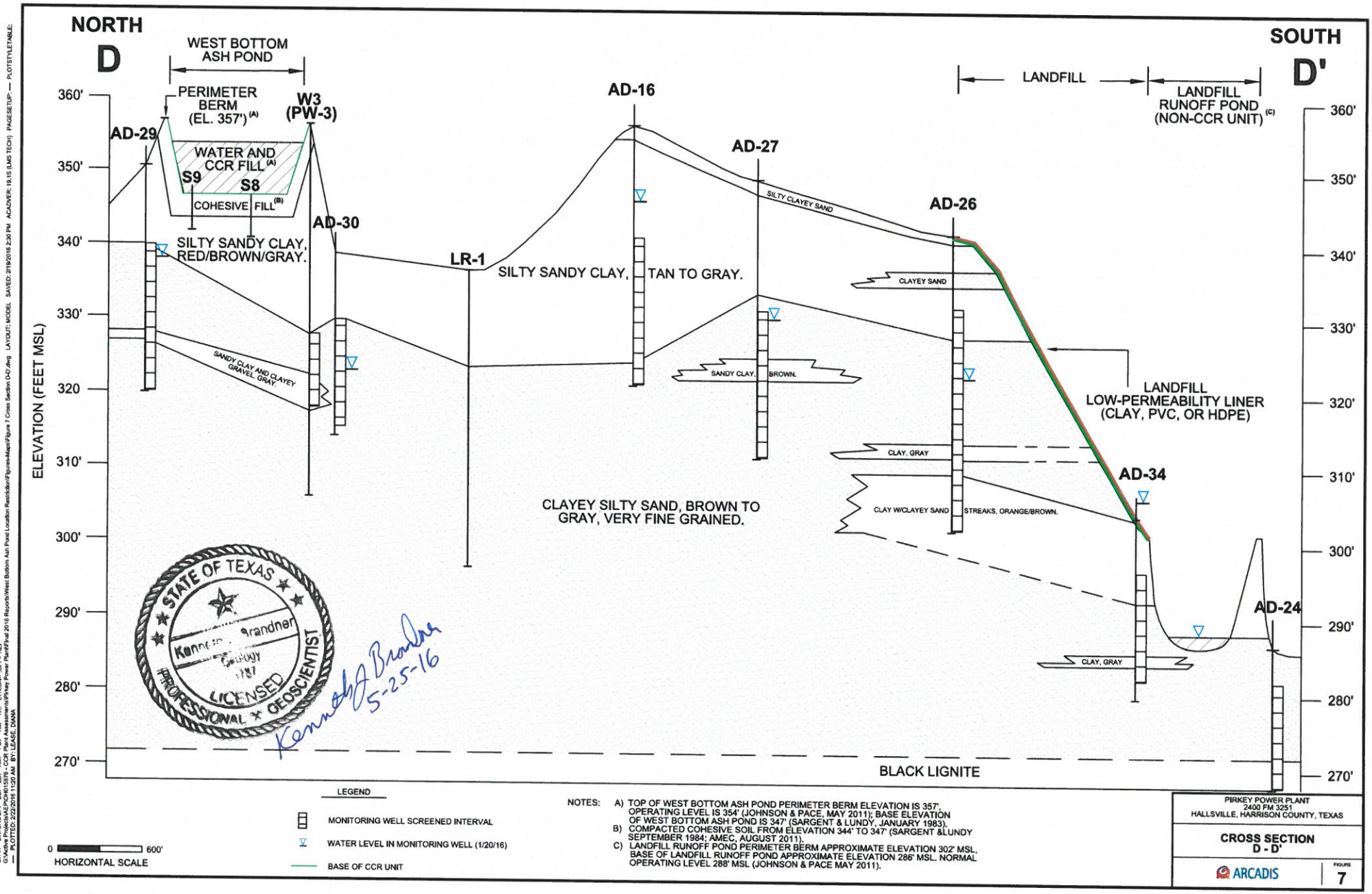
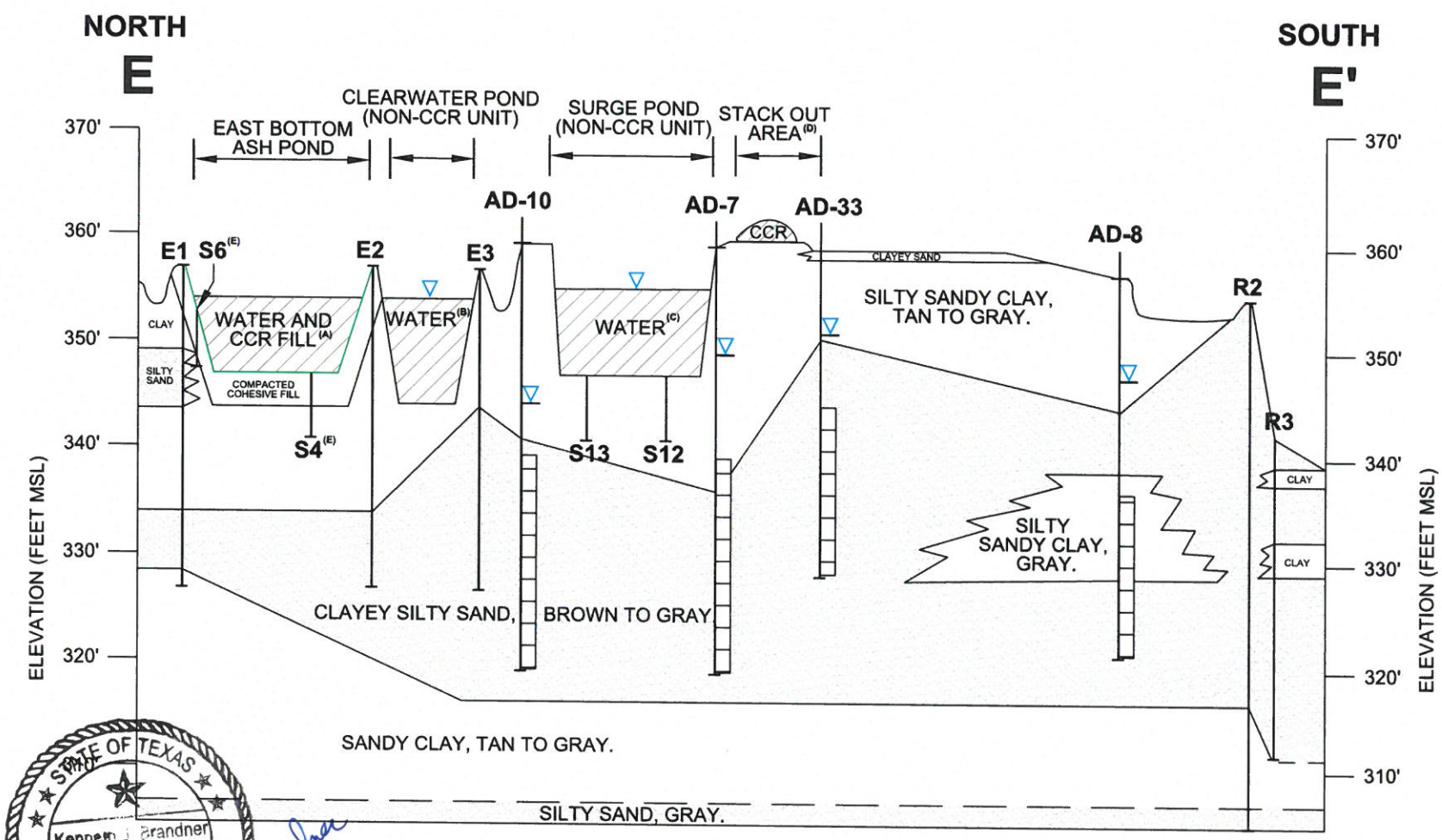
FIGURE
5







NOTES:

A) TOP OF EAST BOTTOM ASH POND PERIMETER BERM ELEVATION IS 357', OPERATING LEVEL IS 354' (JOHNSON & PACE, MAY 2011); BASE ELEVATION OF EAST BOTTOM ASH POND IS 347' (SARGENT & LUNDY, JANUARY 1983).
B) TOP OF CLEARWATER POND PERIMETER BERM ELEVATION IS 357',OPERATING LEVEL IS 354' (JOHNSON & PACE, MAY 2011). BASE ELEVATION OF CLEARWATER POND IS 344' (SARGENT & LUNDY, JANUARY 1983).
C) BASE ELEVATION OF SURGE POND (347-352'MSL) AND POND DESIGN LEVEL (355'MSL) TAKEN FROM JANUARY 31, 1983 SARGENT & LUNDY REPORT "DESIGN SUMMARY FOR LIGNITE STORAGE AREA AND WASTEWATER POND FACILITIES".
D) BASE OF STACK OUT AREA CCR UNIT LOCATED AT GRADE. ELEVATION TAKEN FROM MAY 2012 AND JUNE 23, 2015 TOPOGRAPHIC SURVEYS BY BEACON AVIATION.
E) SOIL BORING INSTALLED BY SOUTHWESTERN LABORATORIES DURING ASH POND CONSTRUCTION IN 1983.

PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

CROSS SECTION
E - E'

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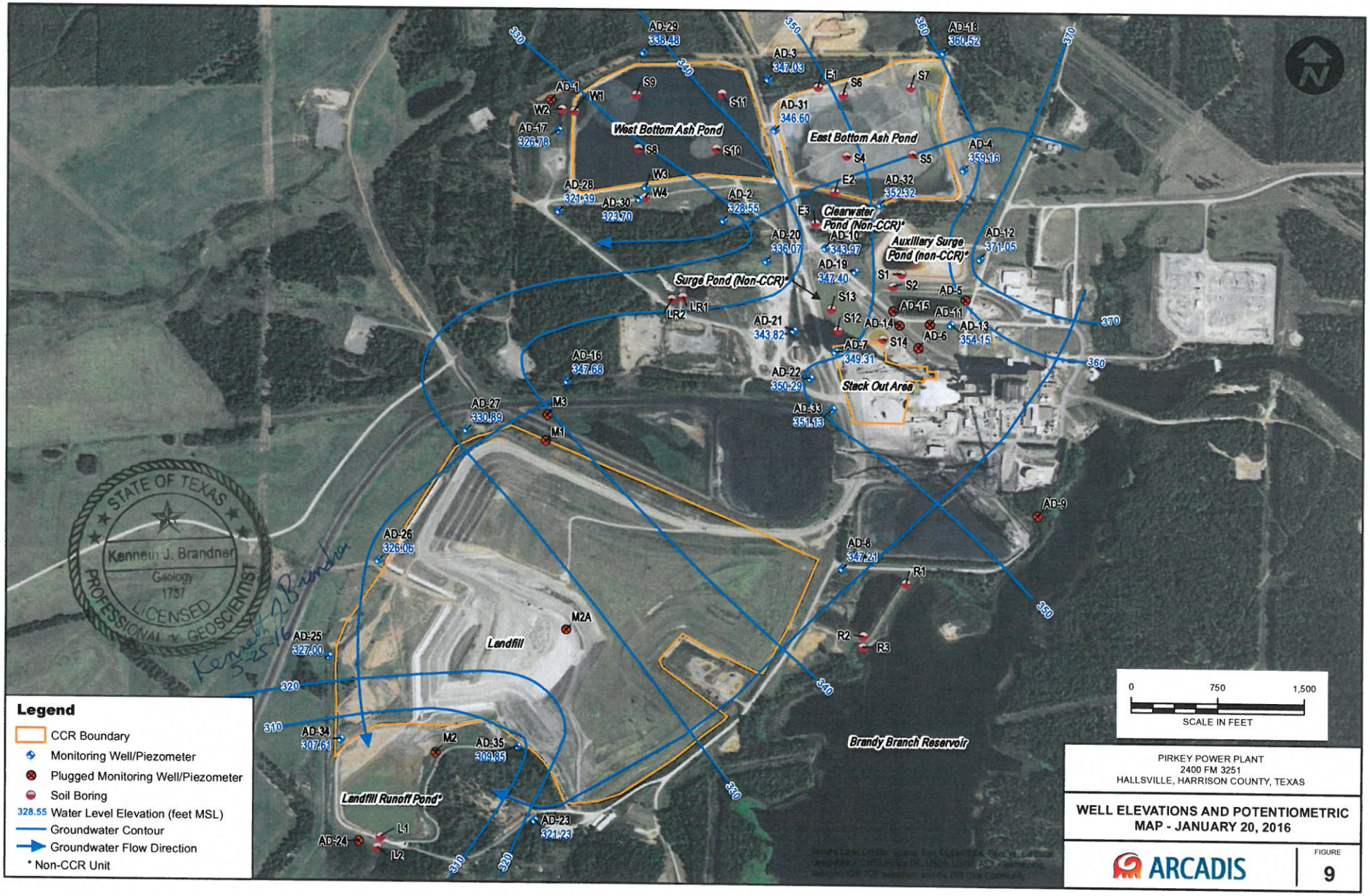
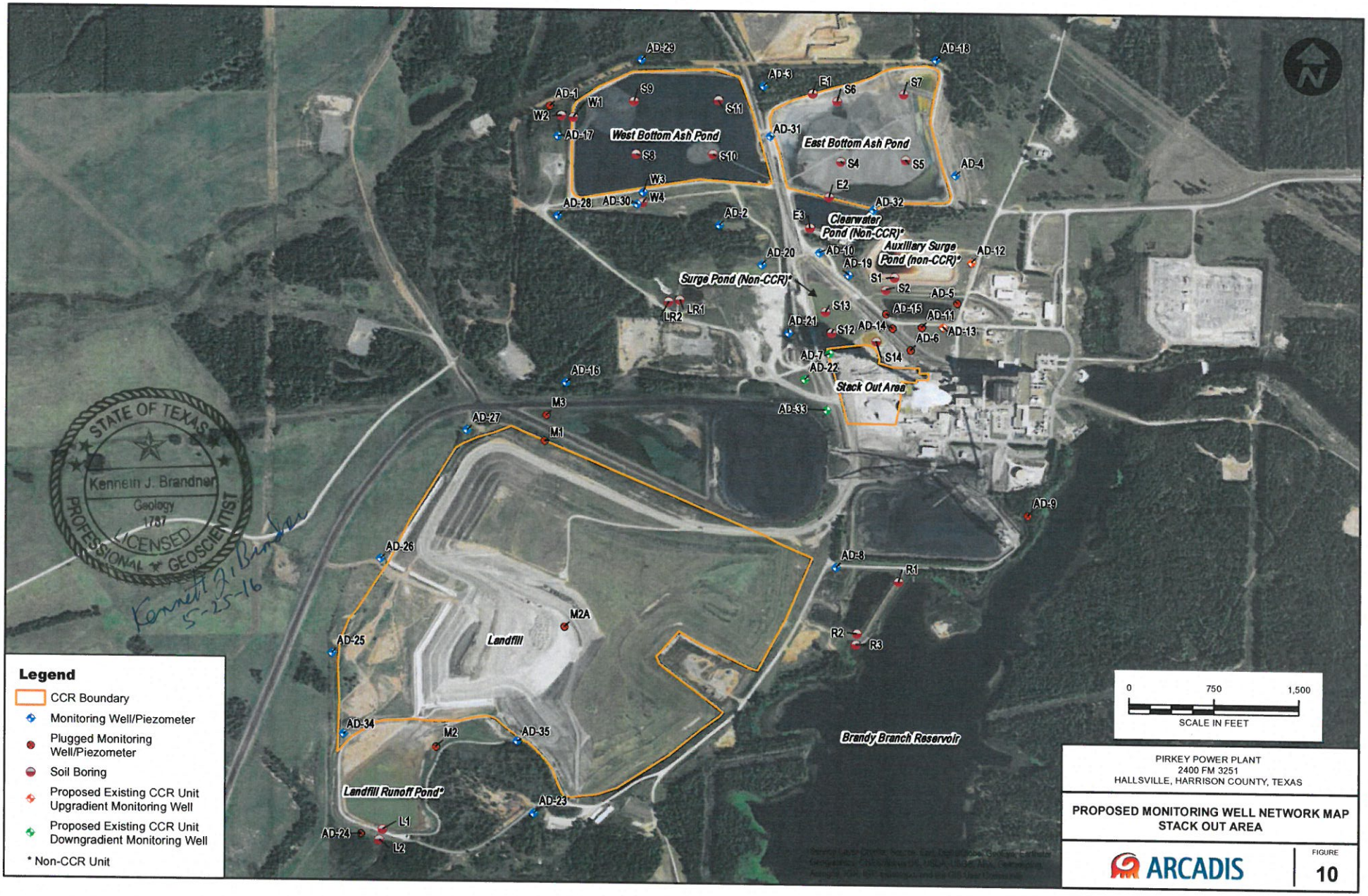
FIGURE
8



Document Path: Z:\GIS\PROJECTS_ENV\AEP\Pirkey Plant\MXD\Figure 9 - Well Elevations and Potentiometric Map - January 20, 2016.mxd



Legend

- CCR Boundary
- Monitoring Well/Piezometer
- Plugged Monitoring Well/Piezometer
- Soil Boring
- Proposed Existing CCR Unit Upgradient Monitoring Well
- Proposed Existing CCR Unit Downgradient Monitoring Well

* Non-CCR Unit

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PIRKEY POWER PLANT
2400 FM 3251
HALLSVILLE, HARRISON COUNTY, TEXAS

PROPOSED MONITORING WELL NETWORK MAP
STACK OUT AREA

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FIGURE
10

Document Path: Z:\GISPROJECTS_ENVVAEP\Pirkey Plant\MXD\Figure 10 - Proposed Well Network - Stack Out Area.mxd

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Appendix A

Boring/Well Construction Logs

832964

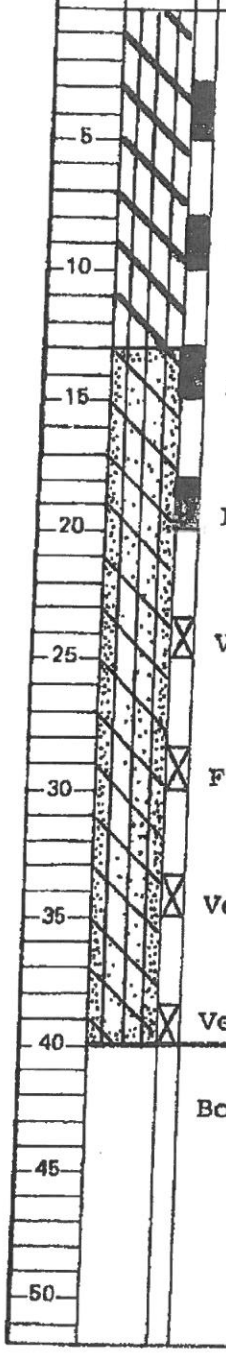
LOG OF BORING

PROJECT: Waste Water Ponds
CLIENT: SWEPCO

BORING NO.: MW-6
LOCATION: Hallsville

Date: 10-3-83 Type: Auger Ground Elevation:

Legend: ▩ Sample X Penetration ▼ Water



Description of Stratum
Stiff tan and grey clay w/silt lenses and iron ore
Very stiff tan and grey clay w/silt lenses and iron ore
Firm tan and grey clayey silty sand
Loose brown and grey clayey silty sand
Very dense grey clayey silty sand 25-25=11½" 50 B/11½"
Firm grey clayey silty sand 7-7-17 24 B/F
Very dense grey clayey silty sand 25-25=9" 50 B/9"
Very dense grey clayey silty sand 18-32=10½" 50 B/10½"
Bottom of boring at 40 feet.

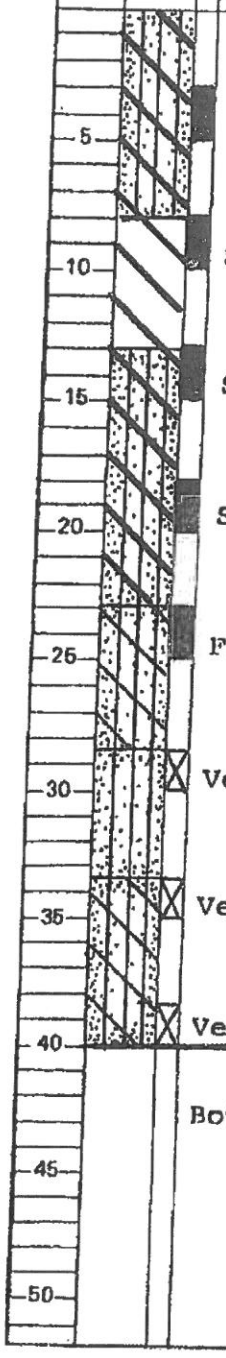
832964

LOG OF BORING

PROJECT: Waste Water Ponds
CLIENT: SWEPCO

BORING NO.: MW-7
LOCATION: Hallsville

Date: 10-3-83 Type: Auger Ground Elevation:



Legend: ■ Sample X Penetration ▼ Water

Description of Stratum
Stiff red, tan and grey sandy silty clay w/iron ore
Stiff tan and grey clay w/iron ore
Stiff tan and grey silty sandy clay lenses w/iron ore
Stiff tan and grey very sandy silty clay
Firm tan and grey clayey silty sand
Very dense grey silty sand 23-27=12" 50 B/F
Very dense grey clayey silty sand 17-35=12" 50 B/F
Very dense grey clayey silty sand 25-25=10½" 50 B/10½"
Bottom of boring at 40 feet.

832964

LOG OF BORING

PROJECT: Monitor Wells at Metal Cleaning Waste Pond BORING NO.: MW-12
CLIENT: Southwestern Electric Power Company LOCATION: Hallsville, TX

Date: 1/30/86 Type: Rotary N 6+13.25; W-6+90.36 Ground Elevation: 378.41

Legend: ■ Sample X Penetration ▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
5			Brown and tan sandy clay
10			Brown, tan and gray sandy clay
15			Tan and gray sandy clay
20			Brown and tan sandy clay
25			Gray and tan sandy clay
30			Brown and gray clay
35			Brown and gray clay
40			Gray silty sand
45			Gray silty sand
50			Gray silty sand

Water encountered at 27.5 feet.
Bottom of Boring at 51 feet.

SOUTHWESTERN LABORATORIES

Observation Well Installation Report

Location	Date	Station #	City
Pirkey Power Plant	2-23-88	Elev. 361.85 0+33.3N, 8+84.7 W	Hallsville, Texas

Project	Observation Well Number	Location
880284	MW-13	

Type of Rig	Installed By	Date	Time
CME 55	DS, DY, LM	2-23-88	

Method of Installation: Hollow-stem auger

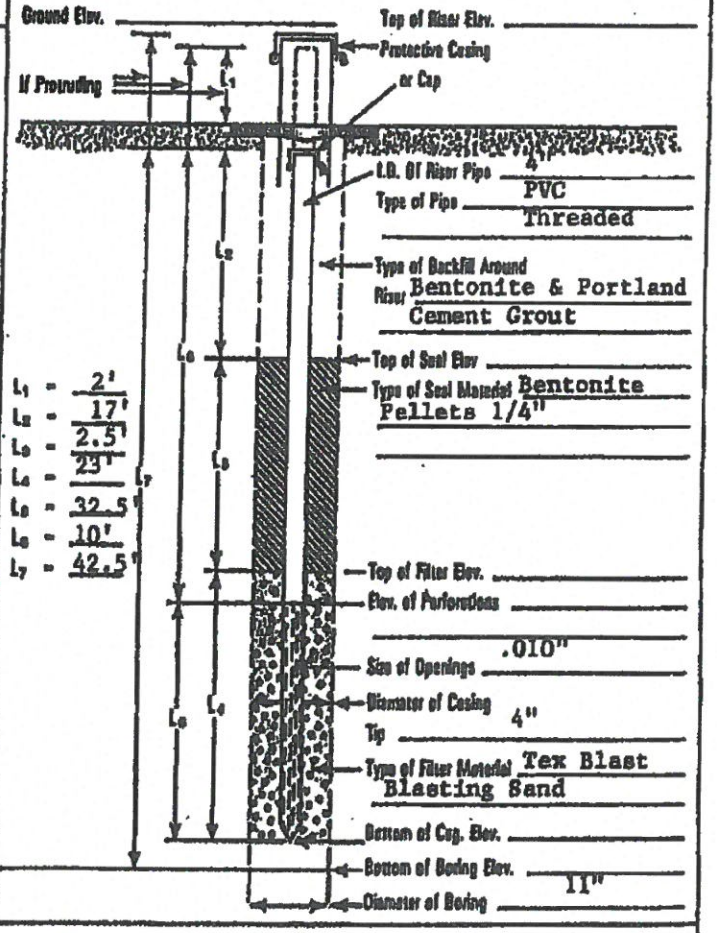
Log of Boring and Observation Well

Boring

Depth in ft.	Cored Interval	Description

Observation Well

Type of Observation Well: ☐ Flush ☒ Locking Cap ☒ Protruding ☐ Manhole



L1 = 2'
L2 = 17'
L3 = 2.5'
L4 = 23'
L5 = 32.5'
L6 = 10'
L7 = 42.5'

Remarks: L2, L5, L7 are measured from the top of the PVC pipe, which protrudes 2' above the ground surface.

Inspected By

APEX PROJECT NO.: 110-089 ☐ BORING BORING NUMBER: ____ ■ MONITOR WELL MONITOR WELL NUMBER: AD-22

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/16/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'03.3" Datum: WGS-84 WELL LOCATION: Triangle- South side Quansit Hut
LONGITUDE: W94°29'41.3"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1				0-0.5 SC	Clayey sand, light brown, very fine grained	None	Moist
2-12				0.5-12 CL	Lean clay, light brown mottled with light gray Few iron ore (small) pebbles in clayey sandy streaks	None	Slightly Moist
13-20			▽	12-20 SC	Clayey sand, grayish brown with orangish brown streaks, very fine grained Slightly wet @ 12.5' from seepage Large amount of iron ore 15-17' Very firm 18-18.5'	None	Slightly Wet
21-25				20-25 SC	(Dense crystalline rock 21-21.1'), light brown clayey sand, greenish black, mica, black clay streaks, very fine grained, wet @ 20'	None	Wet
26-30				25-30 SM	Sand, greenish brown (1') grading to orangish brown, silty, very fine grained	None	Wet
31-40					Boring Terminated at 30'		

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 30 feet
Filter Sand (Size/Interval): 8-30'
Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-8'
Surface Completion ☐ Flush ■ Above Ground

Riser Interval: +3 (ags)-10'
Screen Interval: 10-30'
Water level: 12.5'
3'

Note: This log is not to be used separate from this report.

Hydrex ENVIRONMENTAL, INC.

Monitor Well

Monitor Well No.: AD-33

PROJECT INFORMATION

PROJECT:	Pirkey Power Plant
PROJECT NO.:	I-04-1021
LOGGED BY:	Jeffrey D. Sammons, P.G.
SUPERVISING PG:	Jeffrey D. Sammons, P.G.
COMPLETION:	12/11/2015
DEVELOPMENT:	12/16/2015
SITE LOCATION:	2400 FM 3251, Hallsville, Texas
WELL OWNER:	AEP

DRILLING INFORMATION

DRILLER:	Buford Collier
DRILLER'S LICENSE NO.:	60089
RIG TYPE:	Geoprobe 3230DT
METHOD OF DRILLING:	Hollow Stem Auger
SAMPLING METHODS:	Split Core
SURFACE ELEVATION:	382.37 (Top of Casing)
HOLE DIAMETER:	8.25"
LATITUDE	32 27' 38.70" LONGITUDE 94 28' 15.82"

STATE OF TEXAS — JEFFREY D. SAMMONS — GEOLOGY #10070 — LICENSED PROFESSIONAL GEOSCIENTIST — 1.21.16

▼ Water Level Upon Installation ▽ Water Level at Time of Drilling ■ Geotechnical Lab Sample

TBPG No. 50027

DESCRIPTION	USCS	% MOISTURE	% FINES	LL	PL	PI
CLAYEY SAND: very fine to fine sand, some silt, dark brownish black and brown, very moist	SC					
FAT CLAY: trace sand and silt, reddish brown and light gray - some iron ore gravel at 2.0' - some silt and ironstone in thin seams at 2.5', light gray, yellowish brown, and reddish brown,	CH	29	93	74	32	42
CLAYEY SAND: interbedded clays and fine to very fine sand and silt, some iron ore gravel, light reddish brown and light gray	SC					
- some clay and trace of iron ore gravel at 11', light gray and reddish brown, moist		21	35	35	23	12
- trace clay at 13', thin saturated ironstone and gravel seams at 13' to 16', reddish brown, light reddish brown, and light gray - dark reddish brown at 15' - clay lense at 15.5' to 16.5', light reddish brown and light gray						
SILTY CLAYEY SAND: very fine to fine sand, reddish brown, very moist to saturated	SM-SC					
- some clay lenses and iron ore gravel at 20' - clayey at 20.5' to 21' - trace clay at 21', light gray, saturated		23	19	27	18	9
- some iron ore gravel at 28', reddish brown, very moist						
CLAYEY SAND: very fine to fine sand, dark gray and gray, moist	SC	23	30	25	18	7

WELL CONSTRUCTION

- Locking Well Casing Cover
- Locking Well Cap
- Protective Well Casing
- Concrete Pad
- Ground Surface
- Cement
- Bentonite
- 2" Sch. 40 PVC Riser
- 20/40 Silica Sand
- 0.010" Slotted Sch. 40 PVC Well Screen
- PVC Bottom Cap

NOTES: This log should not be used separately from the original report. Not all USCS descriptors were laboratory verified.

832964

LOG OF BORING

PROJECT: Waste Water Ponds
CLIENT: SWEPCO

BORING NO.: S-12
LOCATION: Hallsville, TX

Date: 9-15-83 Type: Ground Elevation: 348.3

Legend: ■ Sample X Penetration ▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
			Red and grey sandy silty clay
			Red and grey clay w/silt lenses
5			Red and grey clay
			Bottom of boring at 6 feet.
			No water encountered.
10			
15			
20			
25			
30			
35			
40			
45			
50			

832964

LOG OF BORING

PROJECT: Waste Water Ponds
CLIENT: SWEPCO

BORING NO.: S-14
LOCATION: Hallsville, TX

Date: 9-15-83 Type: Ground Elevation: 352.9

Legend: ■ Sample X Penetration ▼ Water

Depth, Feet	Symbol	Sample	Description of Stratum
			Brown and red clay w/silt lenses
			Brown and red slightly silty clay
5			Brown and red sandy silty clay
			Bottom of boring at 6 feet.
			No water encountered.
10			
15			
20			
25			
30			
35			
40			
45			
50			

ARCADIS

Appendix B

Photographic Log

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
1	8/19/2015

Direction Photo Taken:

East Southeast

Description:

P8190405
AD-21 Ground water monitoring well northeast of Stack Out Area.

ARCADIS

PHOTOGRAPHIC LOG

Project Name:	Location:	Project No.
AEP – Pirkey Power Plant	Hallsville, Harrison County, Texas	OH015976.0001

Photo No.	Date:
2	8/19/2015

Direction Photo Taken:

Southeast

Description:

P8190438
Stack Out Area