Prepared for

American Electric Power

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GROUNDWATER MONITORING NETWORK EVALUATION

BIG SANDY FLY ASH POND

LOUISA, KENTUCKY

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LIST OF ACRONYMS

AEP	American Electric Power
BSFAP	Big Sandy Fly Ash Pond
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cfs	Cubic feet per second
ft, MSL	Feet above mean sea level
gpm	Gallons per minute
KAR	Kentucky Administrative Regulation
KRS	Kentucky Revised Statutes
KPDES	Kentucky Pollutant Discharge Elimination System
KYDEP - DWM	Kentucky Department for Environmental Protection – Division of Waste Management
KYPCo	Kentucky Power Company
MCL	Maximum Contaminant Level
MW	Megawatt
NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
PE	Professional Engineer
PG	Professional Geologist
PMF	Probable Maximum Flood
PVC	Polyvinyl Chloride
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1. OBJECTIVE

1.1 Purpose

The purpose of this report is to provide an assessment of the groundwater monitoring network associated with the American Electric Power (AEP) Big Sandy Power Plant Fly Ash Pond (BSFAP) with respect to compliance with the United States Environmental Protection Agency's (USEPA's) Coal Combustion Residual (CCR) Rule (Title 40 Code of Federal Regulations (CFR) Section (§) 257.91.

This report was prepared by Mr. Dawit Yifru, geologist. The geology and hydrogeology information evaluated and discussed in this report was prepared under the direction of Mr. Jimmy Whitmer, PG (Kentucky licensed professional geologist (PG) No. 2287). The overall groundwater monitoring network evaluation contained herein was performed by Mr. Scott M. Graves, PE (Kentucky licensed professional engineer (PE) No. 21274). The report was reviewed by Mr. John Seymour, PE (Illinois), in accordance with Geosyntec's senior peer review policies.

1.2 Organization of Report

This report is organized as follows:

- Section 2 presents background information on the power plant and the CCR unit;
- Section 3 presents an evaluation of the existing monitoring network; and
- Section 4 provides a certification from a qualified PE.

A list of the references that are cited in this report is provided in Appendix A. Supporting documentation is provided in Appendices B through D.

1.3 Coordinate System and Datum

The horizontal coordinate values provided in this report are based upon the North American Datum of 1983 (NAD83), Kentucky North Zone. The vertical datum utilized for reporting the elevations within this report is North American Vertical Datum of 1988 (NAVD 88).

2. BACKGROUND INFORMATION

2.1 Facility Location Description

The Kentucky Power Company (KYPCo), a business unit of AEP, operates the Big Sandy Plant – a former 1,060 megawatt (MW) coal-fired power generating station located in Lawrence County, Kentucky approximately 4.5 miles north of Louisa, Kentucky (Figure 2-1). The Big Sandy Plant is located along the Kentucky side of the Big Sandy River that forms the border with West Virginia.

AEP permanently ceased burning coal at the Big Sandy Plant in November 2015 and transitioned to a 278 MW natural-gas-fired power plant facility. As a result, CCR wastes are no longer being generated, operation of the fly ash pond for disposal of CCR waste has ceased, and the BSFAP is currently undergoing closure.

2.2 Description of CCR Unit

The CCRs formerly generated by the Big Sandy Plant were disposed of in a nearby existing surface impoundment (i.e., "CCR unit") known as the BSFAP, which is the subject of this groundwater monitoring network evaluation report. The location of the BSFAP in relation to the main plant area is shown on Figures 2-1 and 2-2. As shown, the BSFAP is located approximately 1.3 miles northwest of the Big Sandy Power Plant and about 4.5 miles north-northwest of Louisa, Kentucky. The BSFAP formerly received wet-sluiced fly ash from the coal burning process as well as bottom ash that was periodically transferred from the Bottom Ash Ponds next to the main plant area.

The BSFAP was formed by constructing a dam across the valley of Horseford Creek, and therefore it has sometimes been referred to as the "Horseford Creek Site" in historical site documents. Figure 2-2 presents a layout map of the BSFAP and its immediate area. Figure 2-2 illustrates that the fly ash pond area is contained by a dam called the "Main Dam" (sometimes referred to as the "Horseford Creek Dam" in historical site documents) located at the north end of the Horseford Creek valley.

Additionally, the fly ash pond area is contained by another dam referred to as the "Saddle Dam" that spans across a small saddle (i.e., pass) between peaks on a ridgeline on the southeastern side of the BSFAP. Along with these dams, the rest the BSFAP is contained by the valley floor and sideslopes. The valley floor is composed of alluvium soil overlying bedrock. The valley sideslopes range in steepness from approximately 2 horizontal to 1 vertical (2H:1V) to 5H:1V (URS, 2013c), and consist of a thin veneer of residual soil (residuum) or weathered bedrock, with some outcrops of sandstone, coal, and shale.

2.2.1 Embankment Configuration

The Main Dam is an approximately 171-ft tall, zoned earth and rock fill dam with downstream slopes varying from 1.75H:1V to 2.25H:1V and upstream slopes varying from 2.H:1V to 2.75H:1V. The

crest of the Main Dam has an elevation of 711 feet above mean sea level (ft, MSL). In the 2015 dam inspection report (AEP, 2015b), the water level in the BSFAP adjacent to the Main Dam was reported at elevation 671.5 ft, MSL creating a freeboard of approximately 40 feet. It is founded on a stratum of alluvium (approximately 17-ft thick on average) which overlies bedrock. The Main Dam also has a compacted clay keyway that cuts through the alluvium and is founded on bedrock. The Main Dam is equipped with a principal service spillway composed of a spillway tower and discharge pipe that passes through the dam which releases water on the downstream side of the dam.

The Saddle Dam is approximately 55-ft tall, has an upstream slope of 2.75H:1V, and a downstream slope of 1.75H:1V. The Saddle Dam is constructed of a combination of compacted clay, bottom ash, and fly ash. The dam is founded primarily on bedrock, along with some stiff residuum clays. The crest of the Saddle Dam is at an elevation of 711 ft, MSL. The Saddle Dam does not have a discharge structure located within the dam. However, an approximately 100-ft wide emergency spillway channel, with an elevation of 706.25 ft, MSL, is situated next to the Saddle Dam.

2.2.2 Area and Volume of CCR Units

The BSFAP currently occupies approximately 130 acres, and has a length from the crest of the Main Dam to the upstream end of the upper pool of approximately 7,800 feet (URS, 2013b). Based on the stage-storage relationship for the fly ash pond (KYPCo, 1993), this would equate to approximately 3,000 acre-feet of storage currently held in the BSFAP. At the maximum operating pool elevation of 705 ft, MSL, the fly ash pond would occupy approximately 176 acres and would have approximately 7,400 acre-feet of storage capacity. Based on current conditions compared to the maximum design operating pool elevation, there is a remaining design storage capacity in the BSFAP of approximately 4,400 acre-feet (i.e., about 7,100,000 cubic yards).

However, AEP permanently ceased burning coal at the Big Sandy Plant in November 2015 and has completed the transition to a natural gas-fired power plant facility. As a result, CCR wastes are no longer being generated, and operation of the fly ash pond for disposal of CCR waste has ceased. AEP began construction to close the BSFAP in August 2016 under the applicable closure provisions of 401 Kentucky Administrative Regulations (KAR) 45:110 for special waste disposal facilities and 40 CFR §257.102 as appropriate, following the more stringent requirements. AEP filed a Closure Plan application with the Kentucky Energy and Environment Cabinet; Kentucky Department for Environmental Protection (KYDEP) – Division of Waste Management (DWM) in June 2013 for final closure of the BSFAP, and received the permit in September 2015. The closure is scheduled for completion in 2020.

2.2.3 Construction and Operational History

The construction and operational history of the Big Sandy Power Plant and BSFAP is provided in Table 2-1. As shown, Unit 1 of the Big Sandy Power Plant began operation in 1963. From 1968 to

1970, the BSFAP was created by construction of the original portion of the Main Dam. Initially, the Main Dam was built with a crest elevation of 625 ft, MSL (85 feet tall). Rock fill berms were also constructed adjacent to the toe of slope of both the upstream and downstream portions of the Main Dam to further buttress the dam. Piezometers were installed in 1969 to monitor performance of the dam.

A second phase of construction was completed in 1979; the Main Dam was raised to a crest at elevation 675 ft, MSL (135 feet tall). This phase also included the construction of an initial saddle dam and emergency spillway. During the second phase, instrumentation was installed at the Main Dam to monitor performance of the dam. The instrumentation system consisted of deformation monuments, piezometers, and flow measurement weirs at the Main Dam.

The third phase of BSFAP expansion, which was constructed in controlled stages from 1993 to 2011 and now represents current existing conditions, involved raising the crest of the Main Dam to elevation 711 ft, MSL (171 feet tall) and constructing a new Saddle Dam with a new adjacent emergency spillway.

2.2.4 Surface Water Control

Storm water runoff from the approximately 675-acre contributing drainage area of the Horseford Creek watershed above the Main Dam currently flows into the BSFAP. The Main Dam is equipped with a principal service spillway composed of a spillway tower and discharge pipe that passes through the dam and which releases water from the BSFAP at Kentucky Pollutant Discharge Elimination System (KPDES)-permitted outfall (plant "Outfall 001") on the downstream side of the dam (KPDES Permit No. KY0000221). The discharged water then flows into Blaine Creek, which in turn flows into the Big Sandy River.

The BSFAP is also equipped with an emergency spillway next to the Saddle Dam. According to the Engineering Report associated with the 1993 Stage 3 raising of the Main Dam to achieve its current condition (KYPCo, 1993), the principal spillway system has the capacity to safely discharge the design flood without engaging the emergency spillway. The KYPCo (1993) Engineering Report also indicates that the emergency spillway is designed to pass the probable maximum flood (PMF) without overtopping the dam.

2.3 Previous Investigations and Studies

Several site investigations and studies have been conducted during operational history of the BSFAP. The following reports containing hydrogeologic and groundwater quality characterizations and assessments were used to provide backup information to support this groundwater monitoring well network evaluation:

- Final Report – Hydrogeologic Site Investigation. June, 2013. URS Corporation;

- Report – Groundwater Monitoring Plan. June, 2013. URS Corporation;
- Kentucky Power Company, Big Sandy Power Plant Ash Pond Closure Drawings, 100% Submittal, June 2013. URS Corporation;
- Big Sandy Fly Ash Pond: Report on Hydrogeology and Groundwater Quality. June 2015. Geosyntec Consultants, Inc.; and
- Big Sandy Fly Ash Pond: Monitoring Well Installation Report. October 2016. Geosyntec Consultants, Inc.

Previous hydrogeologic investigations at the BSFAP included installation of six (6) groundwater monitoring wells (MW-1007 through MW-1012) in 2010. A total of twenty (20) borings were drilled as part of the April 2012 subsurface exploration program by URS Corporation. These borings include eight (8) pond borings (PB-1 through PB-8), five (5) soil borings (SB-3, SB-4, SB-6, SB-7 and SB-8), and seven (7) hydrogeological borings (HB-1 through HB-7) that were subsequently converted into groundwater monitoring wells (MW-1201 through MW-1207). Monitoring wells MW-1206 and MW-1207 were properly abandoned in accordance with 401 KAR 6:350, Section 11, in December 2015 and January 2016. In 2016, eleven borings were drilled and seven (7) groundwater monitoring wells (MW-1601 through MW-1607) were installed. The location of the monitoring wells, borings, and other sampling points is shown on Figure 2-3. Boring logs, monitoring well construction diagrams and geologic cross-sections from the 2010 and 2012 investigations are provided in Appendix B. A geologic cross-section from the 2016 investigation is provided in Appendix C. Boring logs and monitoring well construction diagrams of the wells installed in 2016 are provided in Appendix D.

The hydrogeologic investigations involved drilling; soil, rock, and ash sampling; hydraulic testing; borehole geophysics; well water gauging; and groundwater sampling. In addition, surface water samples and samples from groundwater seeps were collected as part of the groundwater investigation in 2012. The results of these investigations are summarized in the above-referenced documents.

2.4 Hydrogeologic Setting

2.4.1 Climate and Water Budget

The average annual precipitation at the site is approximately 44 inches, with monthly totals averaging between about 3.0 inches in the driest months (October and January) to about 5.5 inches in the wettest month (July). Temperatures range from highs in the mid to upper 80s Fahrenheit in July to highs in the low to mid 40s Fahrenheit in January (Lloyd and Lyke, 1955).

Under previous operating conditions when the Big Sandy Plant was burning coal, they used water to sluice and transfer fly ash and miscellaneous waste to the BSFAP. As mentioned, AEP permanently ceased burning coal at the Big Sandy Plant in November 2015. Closure of the BSFAP has begun, and

operation of the fly ash pond for disposal of CCR waste has ceased. Accordingly, CCR sluice water is no longer generated. The Big Sandy Plant will continue to send sluice water from non-CCR sources to the BSFAP through approximately 2018. Additionally, storm water generated by precipitation in the watershed above the Main Dam also flows into the BSFAP. Finally, there is likely an additional component of water entering the BSFAP due to groundwater seepage into the pond from the subsurface water-bearing strata that encounter ash placed within the valley, as discussed subsequently in Section 2.4.4. Water detained in the BSFAP is released through the principal spillway structure at the Main Dam (Figure 2-3), where it is discharged to a KPDES-permitted outfall on the downstream side of the Main Dam.

There is also a second KPDES-permitted outfall ("Outfall 018") located on the downstream side of the Main Dam associated with the seepage collection system through the collection blanket and chimney drain. According to AEP (2015a), that outfall location experiences a historical average daily flow rate of approximately 0.15 cubic feet per second (cfs) [i.e., about 67 gallons per minute (gpm)]. The discharged water from these BSFAP outfalls flows into Blaine Creek, which in turn flows into the Big Sandy River (a tributary of the Ohio River).

2.4.2 Regional and Local Geologic Setting

The regional geology of the site consists of relatively flat-lying Pennsylvanian-age rock of the Monongahela, Conemaugh, and Breathitt formations in the upland areas and relatively thin Quaternary-age alluvial deposits in the stream valleys (Lloyd and Lyke, 1995). A regional geology map is presented on Figure 2-4. The Monongahela, Conemaugh, and Breathitt formations are the result of sedimentary deposition in a fluvial-deltaic environment, and consist of cyclic sequences of sandstone, siltstones, shales and coals. Alluvial material in the region is present along present-day streams and consists of unconsolidated deposits of silt, sand, and gravel derived from present-day stream processes (Lloyd and Lyke, 1995). A relatively thin layer of residual soils (residuum) generally consisting of clay and sand derived from the weathering of underlying bedrock is present at the ground surface at higher elevations (URS, 2013a).

The local bedrock geology at the BSFAP consists of siltstones, sandstones, shales and coals of the Monongahela, Conemaugh, and Breathitt formations (URS, 2013a). Quaternary-age alluvium is present overlying the bedrock at the base of the BSFAP and along the floodplain of the Blaine Creek. Geologic cross sections illustrating the site subsurface lithologic units and groundwater in relation to the ash are presented in the supporting documentation in Appendix B and Appendix C.

Borings advanced within the BSFAP footprint revealed ash thickness in the pond of up to 130 ft with the ash thickness increasing downstream, from 15 ft at PB-1 location to 133 ft at PB-8 location (the location of Pond Borings is shown in URS (2013) Figure 4.2c in Appendix B). The alluvial deposit that occurs at the bottom of the Horseford Creek valley is composed of sandy lean clay to silty sand and gravel. The thickness of the alluvium varies from approximately 10 ft upstream (at PB-1 location)

to 26 ft in the middle section of the pond (at PB-6 location) to 19 ft downstream (at PB-8 location). The alluvium was also encountered downstream of the Main Dam in MW-1606 and MW-1607 and in the floodplain of Blaine Creek (in MW-1604 and MW-1605) (Discussed in Section 3).

The Monongahela formation, present roughly above 910 ft, MSL elevations, consists of sandstones, siltstones and shales. Only the lowest cross-bedded sandstone member of the Monongahela formation is present on site as a resistant cap on the highest ridge lines [Geosyntec (2015) Figure 3 in Appendix B].

Underlying the Monongahela formation is the Conemaugh formation, which consists of sandstone, siltstone and shale with some limestone and coal beds demarcating the upper and lower portions of the formation. A 2- to 3-ft thick Brush Creek limestone member, located at approximately 780 ft, MSL separates the upper unit and the lower unit. The Conemaugh formation outcrops on the hillsides of the site at approximate elevations of 700 ft to 920 ft, MSL.

Underlying the Conemaugh formation is the Breathitt formation, which consists of sandstone, siltstone and shale with some limestone and coal beds identified as Princess Coals. The uppermost Breathitt formation consists of shale with a resistant sandstone unit near elevation 680 ft, MSL (URS, 2013a). The Princess No. 8 coal bed is not laterally persistent, but is thick enough for commercial mining. The coal bed has an average thickness of 30 inches in northern Lawrence County, where it extends westward for about eight miles from the Big Sandy River near the mouth of Blaine Creek valley (Huddle et al., 1963). Exposure of the Princess No. 7 was reported in the Horseford Creek valley at an approximate elevation of 610 to 620 ft, MSL prior to the creation of the BSFAP (URS, 2013a). The 2016 drilling and monitoring well installation at the BSFAP indicated a coal seam at approximate elevation of 600 ft, MSL. However, the coal seam was not continuous in the Horseford Creek valley. In borings further upstream of the Main Dam (in MW-1608 and MW-1609), a carbon rich shale was encountered at an approximate elevation of 600 ft, MSL.

2.4.3 Regional and Local Hydrogeologic Setting

The near-surface hydrogeology of the region is generally categorized into two systems: (i) an alluvial aquifer system of unconsolidated deposits; and (ii) an aquifer system in the fractures of the bedrock (Lloyd and Lyke, 1995). The alluvial aquifer system typically consists of sand and gravel and occurs in present-day stream valleys. The bedrock mostly consists of repeated beds of fractured sandstone and limestone deposited during the multiple sedimentary cycles.

Groundwater at the BSFAP site is unconfined and is encountered within the fractured bedrock (shale, sandstone, coal) and in the alluvial deposits. Based on potentiometric surface measurements in monitoring wells screened in the alluvium and others screened in the bedrock, these water bearing units appear to be hydraulically interconnected. The water-bearing units are recharged by precipitation, and groundwater generally flows parallel to the topographic slope. The BSFAP is surrounded by ridges, which function as groundwater divides (Figure 2-3). Although there are

fractures present throughout the bedrock, aquifer characteristics of the bedrock and well yields are variable due to the number of fractures and how well the fractures are interconnected.

Groundwater elevations in the overburden/weathered bedrock or fractured bedrock on the hillsides surrounding the BSFAP are higher than the surface water elevation in the pond. Accordingly, groundwater generally flows parallel to the topographic slope and therefore into the BSFAP where these hillsides encounter the ash. Groundwater flow then continues towards the Horseford Creek valley bottom and into the alluvium deposits at the base of the BSFAP, where it then flows along the centerline of the valley towards the Main Dam.

2.4.4 Surface Water and Surface Water-Groundwater Interactions

The BSFAP receives storm water runoff from the approximately 675-acre contributing drainage area of the Horseford Creek watershed upstream from the Main Dam. Some of the surface water flowing into the BSFAP is retained in the pond (i.e., standing water, some of which evaporates and some of which infiltrates into the underlying alluvium). Additionally, surface water is released via the discharge pipe that passes through the Main Dam. The discharged water then flows into Blaine Creek, which from that location flows for approximately 1.5 miles and then joins the Big Sandy River.

Roads overlying the ash material have been constructed at various locations within the BSFAP (Figure 2-2). These roads function as dikes, resulting in ash accumulation of varying elevations throughout the pond area as well as variations in surface water elevations within the pond. The upstream surface water elevation in the pond is approximately 685 ft, MSL, and the downstream surface water elevation in the pond is approximately 670 ft, MSL (URS, 2013b). This difference in water surface elevation appears to be because the surface elevation of the ash varies along the length of the pond, trending from lower surface elevations at the Main Dam, and higher surface elevations at the upstream reaches of the pond. In places, the ash is exposed to the surface (not submerged), and this ash holds back surface water that accumulates behind the exposed ash. Also, as previously noted the BSFAP is currently undergoing closure. As part of closure construction, dewatering and grading of the ash to form the subgrade of an engineered cap has begun in the upstream reaches of the pond.

Based on the site hydrogeology (as described in Section 2.4.3), the surface water and groundwater appear to hydraulically interact with each other. Groundwater elevations in the overburden/weathered bedrock or fractured bedrock on the hillsides surrounding the BSFAP are higher than the surface water elevation in the pond. Accordingly, groundwater generally flows parallel to the topographic slope and eventually discharges into the surface water of the BSFAP. Downstream of the Main Dam, it appears that groundwater from the Horseford Creek alluvium would flow into the Blaine Creek valley alluvium and eventually may make its way into surface water of the creek.

2.4.5 Water Users

Location and description of groundwater withdrawal wells were obtained from the Kentucky Groundwater Data Repository, Water Well and Spring Location Map (http://kgs.uky.edu/kgsmap/KGSWater/viewer.asp). The location of these wells is provided in Figure 2-5. As shown, a total of ten (10) water wells were identified within an approximately 1 mile radius from the BSFAP. Additional information on these wells is provided in Table 2-2. As shown on Table 2-2, six (6) of these wells are used for domestic use, one (1) for industrial use, one (1) for mining, and two (2) water wells for unknown use.

3. MONITORING NETWORK EVALUATION

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Groundwater at the BSFAP is unconfined and is encountered within the fractured bedrock of the Conemaugh and Breathitt formations and in the alluvial deposits at the bottom of the Horseford Creek valley. These bedrock and alluvium water-bearing units appear to be hydraulically connected. Outcrops of sandstone, siltstone, and shale along the hillsides of the Horseford Creek valley surround the ash pond (URS, 2013b). The ash was placed directly above the alluvium in the Horseford Creek valley. Underlying the alluvium is either sandstone or shale of the Breathitt formation. Geologic cross sections illustrating this connectivity of the water bearing formations are provided in Appendix B and Appendix C.

3.1.2 Overall Flow Conditions

As discussed in Section 2.4.4 above, groundwater flow conditions at the BSFAP site are generally consistent with site topography with groundwater flowing from the hillsides surrounding the BSFAP and discharging into the BSFAP. North of the Main Dam it appears that groundwater from the Horseford Creek alluvium would flow into the Blaine Creek valley alluvium and eventually may make its way into surface water of the creek. Groundwater flow directions are shown in Figure 3-1.

Based on the pre-development site topography at the location of the current Saddle Dam, a saddle is present between peaks on a ridgeline on the southeastern side of the BSFAP. This pass, or saddle, functions as a groundwater divide. Natural surface and groundwater flow near the Saddle Dam would be split with a portion flowing towards the west or northwest into the Horseford Creek valley (i.e., towards the BSFAP) and a portion flowing towards the southeast away from the BSFAP. However, during periods of high surface water elevation in the BSFAP, groundwater flow direction may predominately be towards the southeast, away for the BSFAP. The July 2016 groundwater level data indicated that groundwater flow direction in the vicinity of the Saddle Dam is away from the BSFAP.

The Monitoring Well Installation Report (Geosyntec, 2016) indicated that the horizontal hydraulic conductivity (K) of the bedrock units depends on the dimension of fractures identified in the screen interval, and how well the fractures are interconnected. Wells screened in the sandstone unit with one open fracture (such as MW-1601 and MW-1602) have an average K on the order of 10^{-4} cm/sec. Similarly, monitoring well MW-1611 screened in shale and coal seam with multiple open fractures also has a K of 10^{-4} cm/sec. In contrast, monitoring wells screened in the sandstone and shale with multiple but narrow fractures (such as in MW-1603 and MW-1608) resulted in K values on the order of 10^{-5} and 10^{-6} cm/sec. Two borings (designated as MW-1609 and MW-1610) were abandoned because borehole geophysics and packer testing results indicated no measurable groundwater flow in

the target screen intervals. Monitoring wells screened in the sand and gravel alluvium have K values on the order of 10^{-3} cm/sec to 10^{-4} cm/sec.

3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

The term "uppermost aquifer" referred to in §257.91 of the groundwater monitoring systems rule for CCR units is defined in 40 CFR §257.53 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 ground surface to which the aquifer rises during the wet season." Aquifer is defined as "a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs." Per the preamble that accompanies the CCR Rule, this definition includes a shallow, deep, perched, confined, or unconfined aquifer, provided that it yields usable water. "Usable water" is not defined in the CCR Rule nor in Kentucky regulations.

3.2.2 Identified Onsite Hydrostratigraphic Unit(s) – Uppermost Aquifer

The hydrostratigraphy in the vicinity of the BSFAP is characterized by an interconnected water-bearing system comprised of Pennsylvanian-age bedrocks of the Conemaugh and Breathitt formations and the Quaternary alluvium. The bedrocks include sandstones, siltstones, shale, and coal that may grade laterally and vertically into one another. The alluvial deposits include sandy lean clay to silty sand and gravel at the bottom of the Horseford Creek valley and the floodplain of the Blaine Creek.

The interconnected water-bearing system of the fractured bedrock and alluvium is considered to be the uppermost aquifer at the BSFAP site. This is based on the presence of groundwater in numerous monitoring wells screened in the water bearing units, the recovery of these wells during pumping and development, and a potentiometric surface generally consistent with site topography and surface water elevations. This conclusion is further supported by the presence of several nearby water withdrawal wells (discussed in Section 2.4.5) that appear to be screened in the same or a similar hydrogeologic setting/formation or materials.

3.3 Overview of Groundwater Monitoring System Regulatory Requirements

The preamble that accompanies the CCR Rule concisely summarizes the groundwater monitoring system regulatory requirements of Rule 40 CFR §257.91 by stating that "all groundwater monitoring systems must consist of a sufficient number of appropriately located wells (at least one upgradient and three downgradient wells) in order to yield groundwater samples from the uppermost aquifer that represent the quality of background groundwater and the quality of groundwater passing the CCR waste boundary." The upgradient background wells must be located beyond the upgradient extent of potential contamination whereas the downgradient wells will monitor any contaminants leaking into

the groundwater and must be located at the downgradient perimeter of the CCR unit. Although the rule requires a minimum of one upgradient and three downgradient monitoring wells, the number, spacing and depths of the monitoring wells must be determined based on hydrogeology of the site including aquifer thickness, groundwater flow rates and direction.

3.4 Review of Existing Monitoring Network

3.4.1 Overview

The groundwater monitoring network consists of ten (10) groundwater monitoring wells located both upgradient and downgradient of the BSFAP to provide detection monitoring in the uppermost aquifer (fractured bedrock and alluvium). Six (6) groundwater monitoring wells (MW-1011, MW-1012, MW-1203, MW-1601, MW-1602, and MW-1603) are screened in fractured sandstone and shale layers of the Breathitt formation. Four (4) monitoring wells (MW-1604 through MW-1607) are screened in the alluvium. The location of each groundwater monitoring well within the uppermost aquifer is shown in Figure 3-2.

Three (3) of the monitoring wells (MW-1011, MW-1012, and MW-1203) screened in bedrock were installed on the hillside slopes upgradient of the BSFAP and will be used for background monitoring. Three (3) monitoring wells (MW-1601, MW-1602, and MW-1603) installed in bedrock are located downgradient of the BSFAP and will be used for downgradient monitoring. Two (2) monitoring wells (MW-1604 and MW-1605) screened in alluvium will be used for background monitoring; while two (2) other monitoring wells (MW-1606 and MW-1607), screened in alluvium and located below the Main Dam downgradient of the Horseford Creek valley, will be used for downgradient monitoring.

The monitoring wells (except the pre-existing wells MW-1011, MW-1012 and MW-1203) were installed in an eight-inch borehole and have four-inch diameter PVC casings, 10-ft long screens and 0.01-inch slot size. Monitoring wells MW-1011, MW-1012, and MW-1203 were constructed with a two-inch diameter PVC casings and 0.01-inch slot size screens with screen lengths ranging between 10 and 30 ft. Well construction details are summarized in Table 3-1 and boring logs and well construction diagrams are provided in Appendix B and Appendix D.

3.4.2 Compliance Assessment

Review of the groundwater monitoring well network in relation to the geologic and hydrogeologic conditions in the area of the BSFAP indicates that it consists of a sufficient number of wells installed at the appropriate locations and depths to yield groundwater samples from the uppermost aquifer that accurately represent the quality of background groundwater and groundwater passing the waste boundary of the BSFAP. The groundwater monitoring well network is also capable of providing a system for detection of potential contamination in the uppermost aquifer nearest the waste boundary. In particular, the downgradient groundwater monitoring wells are appropriately positioned based on

their close proximity to downgradient waste boundary of the BSFAP and the documented hydrogeology and groundwater flow directions at the site. Based on the above review, the groundwater monitoring network around the BSFAP meets the requirements of 40 CFR §257.91.

4. CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I have reviewed the groundwater monitoring network and well construction details in the vicinity of the Fly Ash Pond at the Big Sandy Plant and based on the evaluation presented in Section 3 of this report, I certify that the groundwater monitoring system has been designed and constructed to meet the requirements of Section 40 CFR §257.91.

Scott M. Graves

Printed Name of Licensed Professional Engineer

12/16/2016

Seal and Signature Date

21274 Kentucky

License No. State

TABLES

Table 2-1. Timeline of Big Sandy Power Plant and BSFAP History

Year	Event
1963	Unit 1 began operation.
1968	Construction of Horseford Creek Dam Phase 1 began in late 1968.
1969	Rock fill berms were constructed on both sides (upstream and downstream) of the embankment in January 1969.
1969	Unit 2 began operation.
1969	Piezometers were installed in late 1969 to monitor the pore water pressures in the embankment fill and foundation soils; the berms were enlarged in late 1969.
1970	Construction of phase 1 was completed in mid-February 1970 when the dam crest reached 625 ft, MSL (i.e. 85 feet tall)
1976	Design for Horseford Creek Dam Phase 2 began in April 1976.
1979	Phase 2 construction was completed in 1979 with the crest at 675 ft, MSL (i.e. 135 feet tall). The service spillway tower and discharge pipe were constructed as part of phase 2. A Saddle Dam and emergency spillway were also constructed in phase 2.
1993	Phase 3 construction begins, which included raising the crest of the Main Dam, constructing a new Saddle Dam, filling the old emergency spillway, and constructing a new emergency spillway.
2009	Construction of the raising of the Main Dam was completed, achieving the final crest elevation of 711 ft, MSL.
2010	AEP installed the MW1000-series wells to monitor groundwater quality downgradient of the BSFAP.
2012	Twenty (20) borings were advanced by URS to assess the local geology and hydrogeology as well as to evaluate the geotechnical characteristics of the soil. Seven (7) borings were converted to MW1200-series monitoring wells.
2016	Eleven (11) borings were drilled under Geosyntec's oversight to supplement the site hydrogeologic information and eight (8) borings were converted to MW1600-series monitoring wells.
2016	Commencement of construction to close the BSFAP began in August 2016.

Table 2-2. Summary of Nearby Groundwater Withdrawal Wells

AKGWA Number	Primary Use	Latitude[1]	Longitude[1]	Construction Date	Elevation (ft)	Total Depth (ft)	Static Water Level (ft)	Approximate Static Water Level Elevation (ft)	Well Yield (gpm)
00011523	Domestic - Single Household	38.189	-82.638	5/23/1988	580	67	50	530	35
00006915	Domestic - Single Household	38.194	-82.653	5/15/1988	580	120	60	520	8
00006916	Domestic - Single Household	38.193	-82.651	5/31/1988	580	105	70	510	20
00002933	Domestic - Single Household	38.192	-82.629	3/3/1987	640	100	50	590	10
30002996	Not Available	38.189	-82.625	NA	NA	NA	NA	NA	NA
00006922	Domestic - Single Household	38.188	-82.615	8/10/1988	810	380	250	560	0.83
00060898	Industrial - General	38.178	-82.613	7/18/2011	576	64	55	521	5-10
00056935	Mining	38.171	-82.645	8/24/2001	680	200	51	629	60
00008075	Domestic - Single Household	38.188	-82.664	2/22/1990	680	80	25	655	20
00051043	Not Available	38.170	-82.644	5/26/1999	580	140	25	555	15

Notes:

1. Latitude and Longitude are based on NAD 83 Geographic Coordinate System.
2. Vertical datum is based on NAVD 88.
3. Groundwater supply well data obtained from Kentucky Groundwater Data Repository, Water Well and Spring Location Map (http://kgs.uky.edu/kgsmap/KGSWater/viewer.asp).
4. NA: Not Available

Table 3-1. Monitoring Network Well Construction Summary

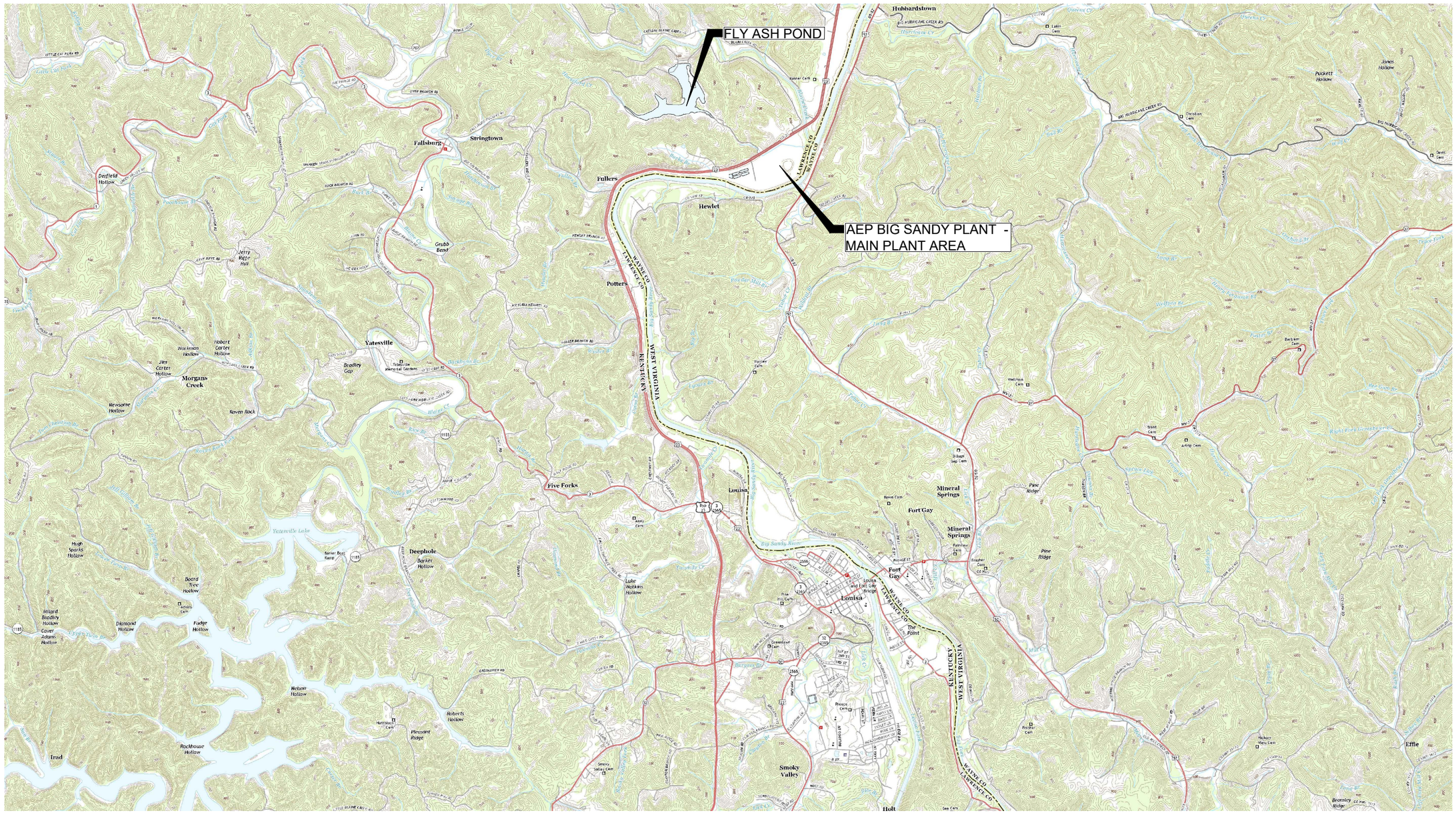
Fly Ash Pond Groundwater Monitoring Network, AEP - Big Sandy Plant
Louisa, Kentucky

Monitoring Well ID	Northing	Easting	TOC Elevation (ft, MSL)	Ground Surface Elevation (ft, MSL)	Stickup Length* (ft)	Well Purpose & Location	Screen Zone Geology	Screen Top BTOC (ft)	Screen Bottom BTOC (ft)	Screen Bottom Elevation (ft, MSL)
MW-1011	251056.62	2105873.28	718.78	716.15	2.63	Sampling (Upgradient)	Bedrock	37.63	77.63	641.1
MW-1012	249566.05	2103715.55	790.56	787.91	2.65	Sampling (Upgradient)	Bedrock	112.65	142.65	647.9
MW-1203	252206.28	2101406.51	731.03	728.30	2.73	Sampling (Upgradient)	Bedrock	39.73	49.73	681.3
MW-1601	254131.13	2104798.67	716.59	713.84	2.75	Sampling (Downgradient)	Bedrock	69.8	79.8	636.8
MW-1602	254183.19	2105862.78	714.53	711.60	2.94	Sampling (Downgradient)	Bedrock	82.4	92.4	622.1
MW-1603	251596.53	2107344.43	675.75	673.24	2.51	Sampling (Downgradient)	Bedrock	24.5	34.5	641.2
MW-1604	254482.33	2108828.43	556.21	553.12	3.09	Sampling (Upgradient)	Alluvium	43.1	53.1	503.1
MW-1605	252760.21	2110694.01	557.46	554.40	3.06	Sampling (Upgradient)	Alluvium	18.6	28.6	528.9
MW-1606	254592.81	2105122.96	554.10	550.99	3.11	Sampling (Downgradient)	Alluvium	44.1	54.1	500.0
MW-1607	254664.49	2105634.33	545.23	542.21	3.02	Sampling (Downgradient)	Alluvium	26.5	36.5	508.7
MW-1608	251052.42	2105883.65	719.08	716.15	2.94	Water Level Measurement	Bedrock	112.9	122.9	596.1
MW-1611	254192.11	2105868.49	714.25	711.64	2.61	Water Level Measurement	Bedrock	107.6	117.6	596.6

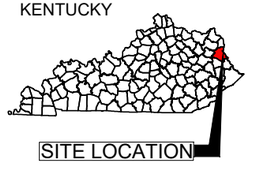
Notes:

1. Northing and Easting are in NAD83 State Plane KY North. Elevations are in based on NAVD88.
2. The Northing and Easting measurements were taken at the top of casing (TOC).
3. ft = Feet
   MSL = Mean Sea Level
   *: Casing length above ground surface
   BTOC = Below Top Of Casing

FIGURES



LAWRENCE COUNTY
KENTUCKY



0 5,000'
SCALE IN FEET

BASE MAP SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5 MINUTE QUADRANGLE MAPS FOR PRICHARD WEST VIRGINIA (DATED 2014), LOUISA KENTUCKY (2013), ADAMS KENTUCKY (2013), AND FALLSBURG KENTUCKY (2013).

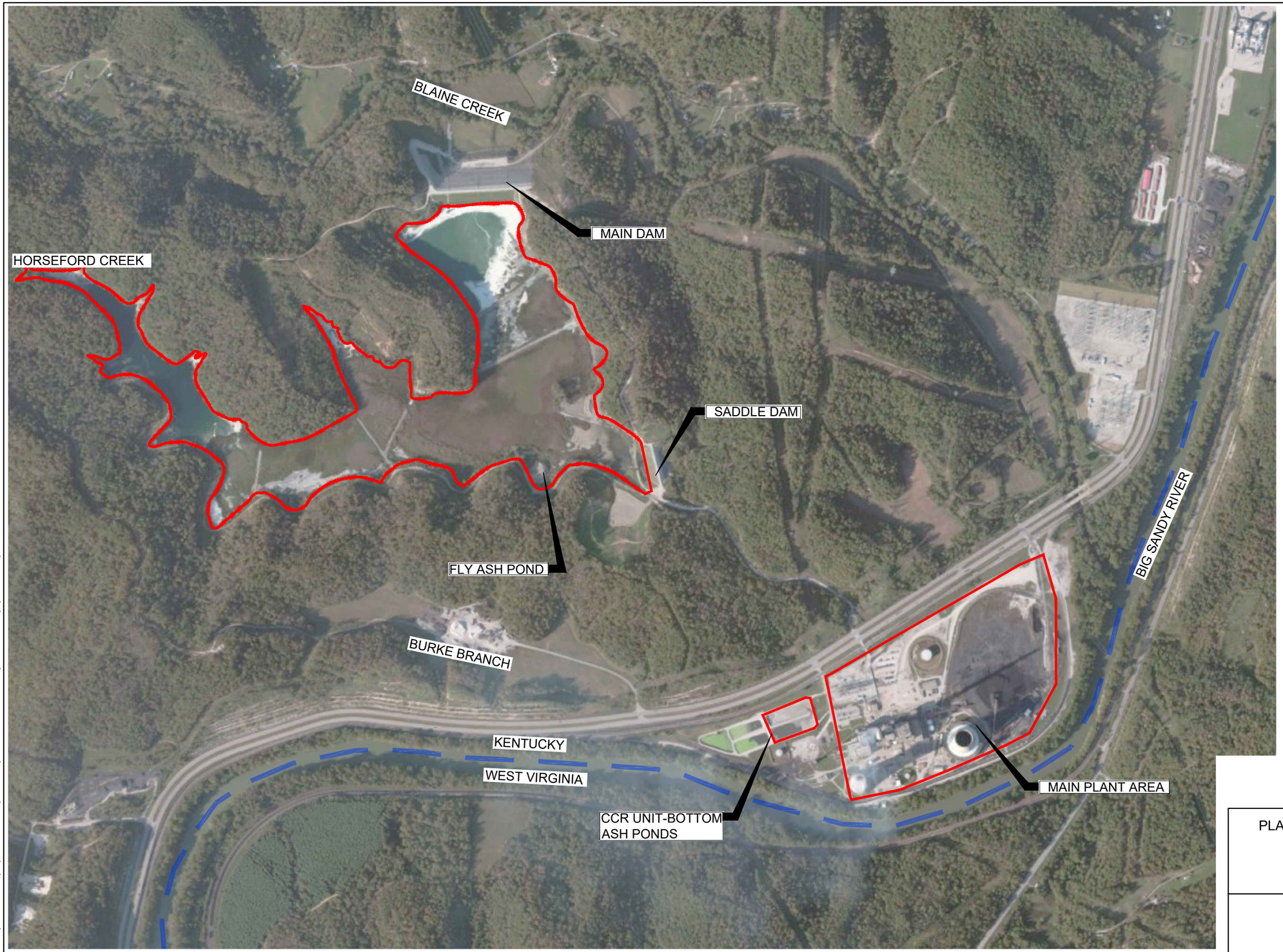
SITE LOCATION MAP
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

FIGURE 2-1

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F01



N

BASE MAP SOURCE: AERIAL IMAGERY ACCESSED VIA ArcGIS ONLINE IN JULY 2015 AND PROVIDED BY MICROSOFT. IMAGE IS DATED 17 AUGUST 2011.

0 1,000'

SCALE IN FEET

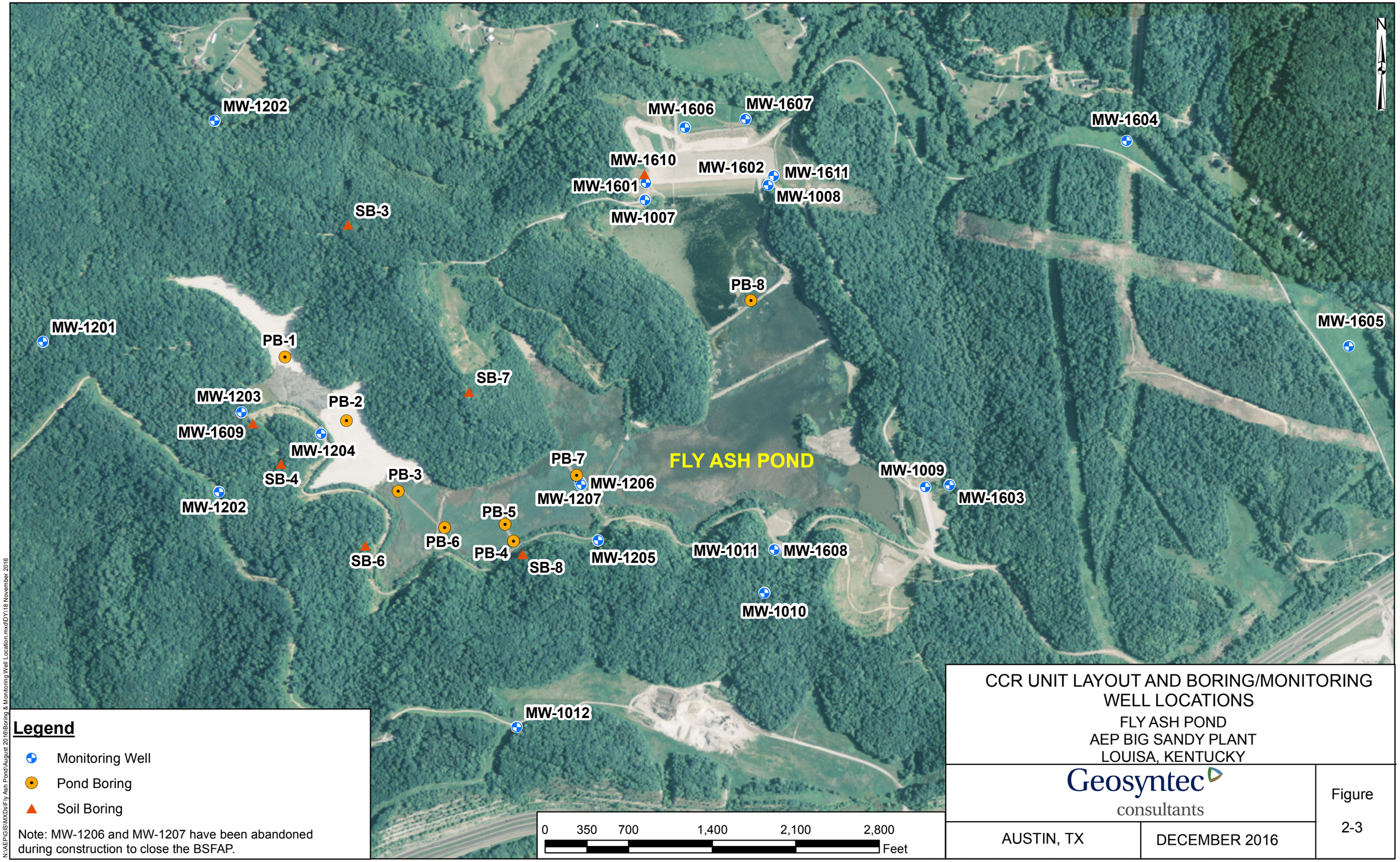
PLANT AND CCR UNIT LOCATION MAP
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

FIGURE 2-2

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F02-2



Legend

- Monitoring Well
- Pond Boring
- Soil Boring

Note: MW-1206 and MW-1207 have been abandoned during construction to close the BSFAP.

N:\AEP\GIS\MXDs\Fly Ash Pond\August 2016\Boring & Monitoring Well Location.mxd\DY\18 November 2016

CCR UNIT LAYOUT AND BORING/MONITORING WELL LOCATIONS

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

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Figure 2-3

LEGEND

FLY ASH POND BOUNDARY

700 — TOP BRUSH CREEK LIMESTONE MEMBER, CONEMAUGH FORMATION

KENTUCKY

Qal — Alluvium

Monongahela and Conemaugh Formations

Pmc, *Monongahela Formation and upper part of Conemaugh Formation*
Pc, *Conemaugh Formation*
a, *Ames Limestone Member*
c, *unnamed coal bed*
b, *Brush Creek Limestone Member*
bc, *Brush Creek coal bed*

Breathitt Formation

P_8, *Princess No. 8 coal bed*
P_7, *Princess No. 7 coal bed*
P_6, *Princess No. 6 coal bed*
P_5, *Princess No. 5 coal bed*

WEST VIRGINIA

Qal	ALLUVIUM
Pna	ALLEGHENY FORMATION
Pnc	CONEMAUGH GROUP

NOTE:

1. GEOLOGIC MAP OF KENTUCKY OBTAINED FROM THE USGS/AASG NATIONAL GEOLOGIC MAP DATABASE.
2. GEOLOGIC MAP OF WEST VIRGINIA OBTAINED FROM THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (WVDEP) GIS RESOURCES AND SOURCED FROM THE 1968 STATE GEOLOGIC MAP OF WEST VIRGINIA, PUBLISHED BY THE WILLIAMS & HEINTZ MAP CORPORATION.

0 — 2,500'
SCALE IN FEET

SURFACE GEOLOGY MAP
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

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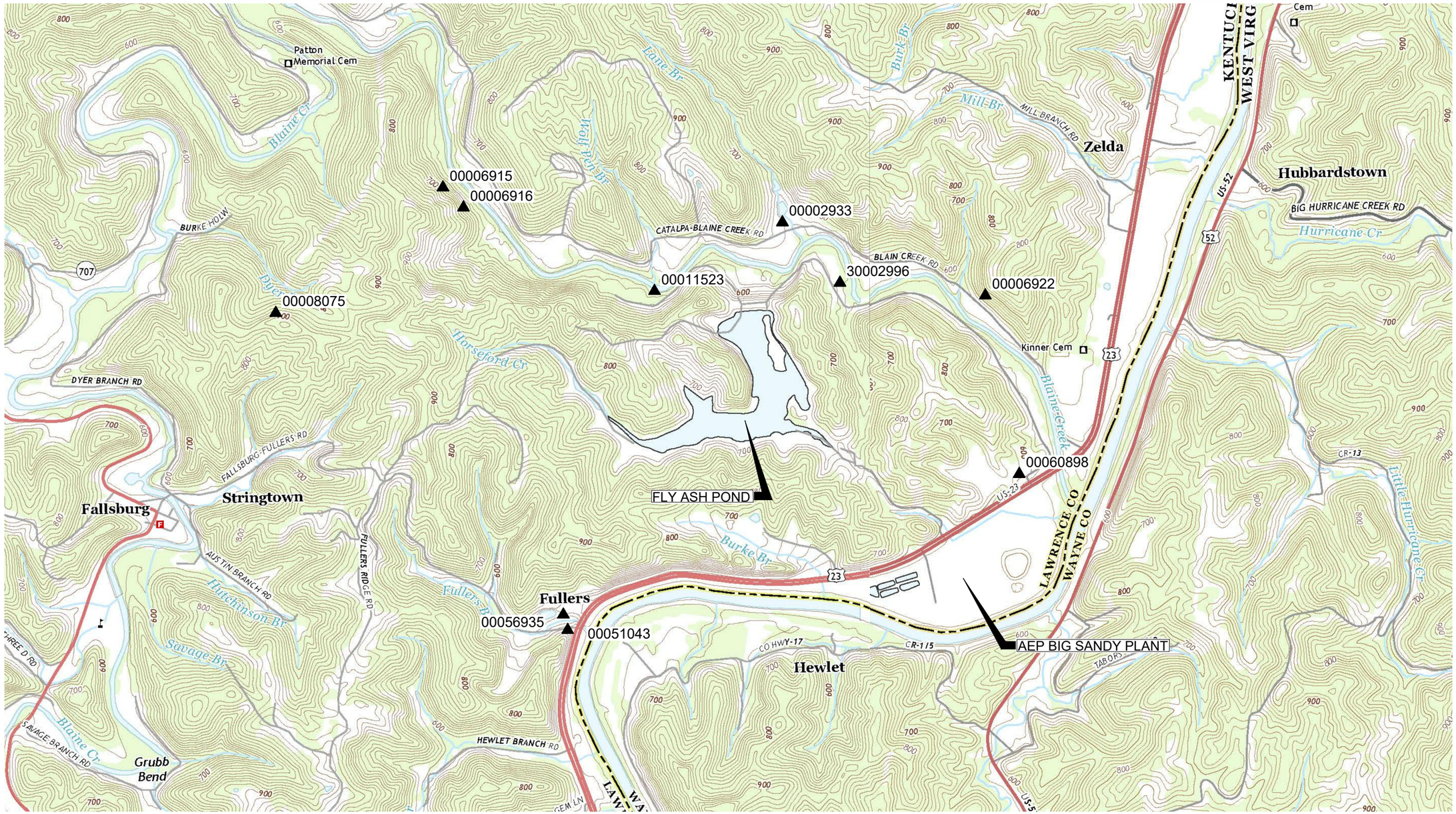
FIGURE 2-4

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F16



LEGEND

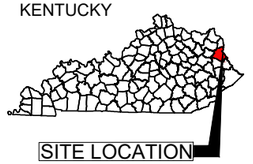
▲ EXISTING GROUNDWATER SUPPLY WELL

NOTES:

1. NUMERICAL CODE NEXT TO EACH WATER WELL SYMBOL REFERS TO THE KENTUCKY WATER WELL I.D. NUMBER.
2. LOCATION AND DESCRIPTION OF GROUNDWATER WITHDRAWAL WELLS WERE OBTAINED FROM KENTUCKY GEOLOGIC MAP INFORMATION SERVICE (KENTUCKY GEOLOGICAL SURVEY, HTTP://KGS.UKY.EDU/KGSMAP/KGSWATER/VIEWER.ASP).

MAP SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5 MINUTE QUADRANGLE MAPS FOR PRICHARD WEST VIRGINIA (2014) AND FALLSBURG KENTUCKY (2013).

LAWRENCE COUNTY
KENTUCKY



0 2,000'
SCALE IN FEET

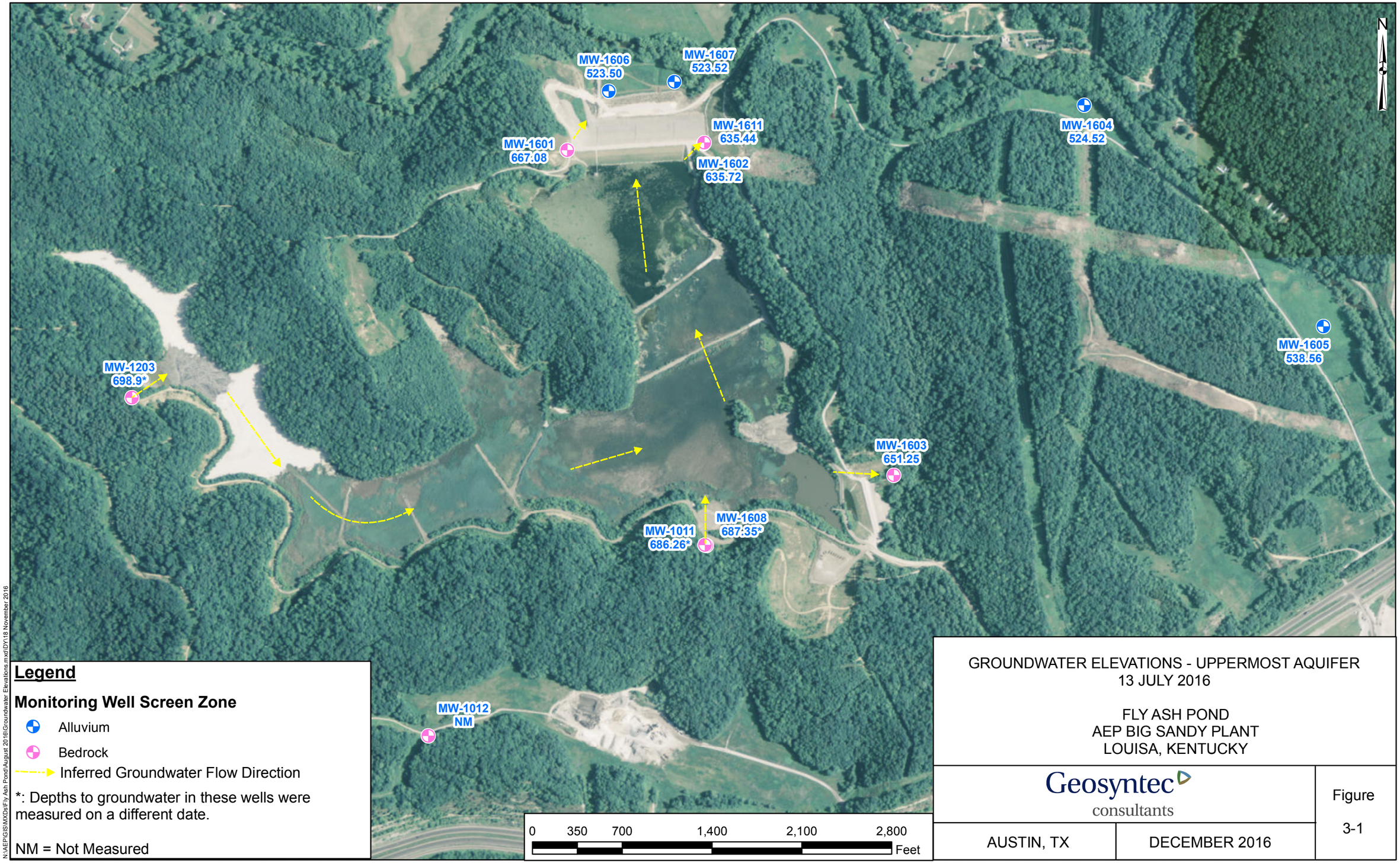
NEARBY GROUNDWATER WITHDRAWAL WELLS
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

FIGURE 2-5

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F07



Legend

Monitoring Well Screen Zone

- Alluvium
- Bedrock
- Inferred Groundwater Flow Direction

*: Depths to groundwater in these wells were measured on a different date.

NM = Not Measured

GROUNDWATER ELEVATIONS - UPPERMOST AQUIFER
13 JULY 2016

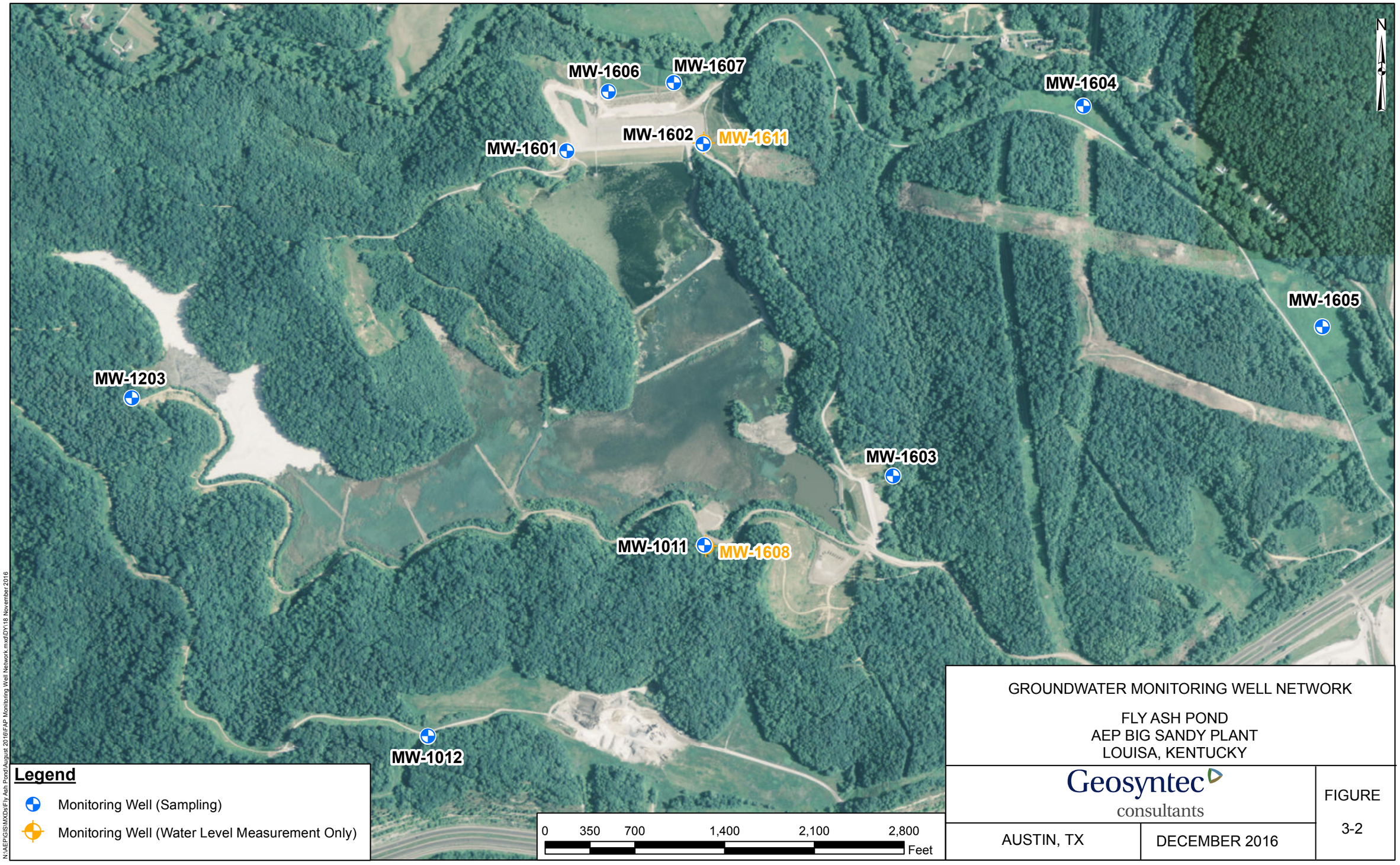
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

Figure 3-1

N:\AEP\GIS\MXDs\Fly Ash Pond\August 2016\Groundwater Elevations.mxd\DY118 November 2016



Legend

- Monitoring Well (Sampling)
- Monitoring Well (Water Level Measurement Only)

N:\AEP\GIS\MXDs\Fly Ash Pond\August 2016\FAP Monitoring Well Network.mxd\DY18 November 2016

GROUNDWATER MONITORING WELL NETWORK

FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | DECEMBER 2016

FIGURE 3-2

APPENDIX A

REFERENCES

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APPENDIX B

SUPPLEMENTAL DOCUMENTATION FROM 2010 AND 2012 INVESTIGATIONS

J:\Projects\AEP\13815142 Big Sandy Special Waste LF\Data-Tech\TI\fig3.2.fh10

A
WEST

B
SOUTHWEST

C
NORTHWEST

D
NORTH

B'
NORTHEAST

C'
SOUTHEAST

D'
SOUTH

A'
EAST

MW–1201
MW–1202
MW–1203
MW–1204
MW–1205
MW–1206
MW–1207
MW–1007
MW–1008
MW–1009
MW–1010
MW–1011

SW-1
SW-2
SP-1
SP-2

PB–1
PB–2
PB–3
PB–4
PB–5
PB–6
PB–7
PB–8

SB–3
SB–4
SB–6
SB–7
SB–8

EXISTING ROAD

0 600 1,200
APPROXIMATE SCALE IN FEET

LEGEND:

- Limit of Hydrogeologic Site Investigation
- Boring Location
- PB — Pond Boring
- SB — Soil Boring
- HB — Hydrogeologic Boring
- MW — Monitoring Well
- Seep Sampling Location
- Surface Water Sampling Location
- A — A' Cross-Section Transect

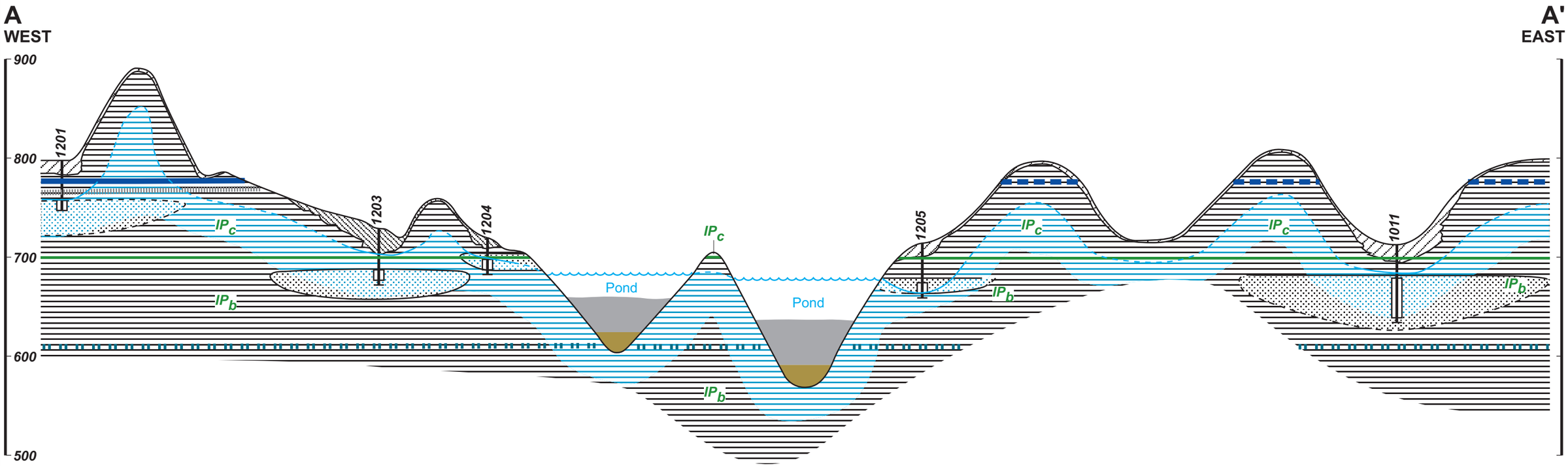
AEP

Big Sandy
Hydrogeologic Site Investigation

FIGURE 3.2
BORING AND WELL LOCATIONS

JOB NO. 13815152

URS



J:\Project\A\AEP\13815142 Big Sandy Special Waste LF\Data-Tech\Tl\xsecs.fh10

LEGEND:

- Brush Creek Limestone (Observed) (Dashed Where Inferred)
- 8” Coal Seam
- 1203 — Well ID
- Well
- Well Screen
- Water Level (Measured October 15, 2012) (Dashed Where Inferred)

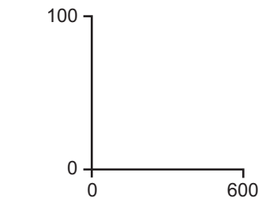
GQ-584 — Geologic Quadrangle Map of Fallsburg Quadrangle, Kentucky-West Virginia, and the Pritchard, Quadrangle in Kentucky, (GQ-584) Joseph A. Sharpe, 1987.

IP_c — Conemaugh Formation (Inferred from GQ-584)

IP_b — Breathitt Formation (Inferred from GQ-584)

Princess Coal #7 (Inferred from GQ-584)

- CL — Clay
- SC — Sandy Clay
- SS — Sandstone
- SH — Shale, Interbedded Shale, Siltstone, Sandstone, Mudstone
- Alluvium
- Ash
- Uppermost Groundwater Zone



SCALE IN FEET
VERTICAL EXAGGERATION = 6x

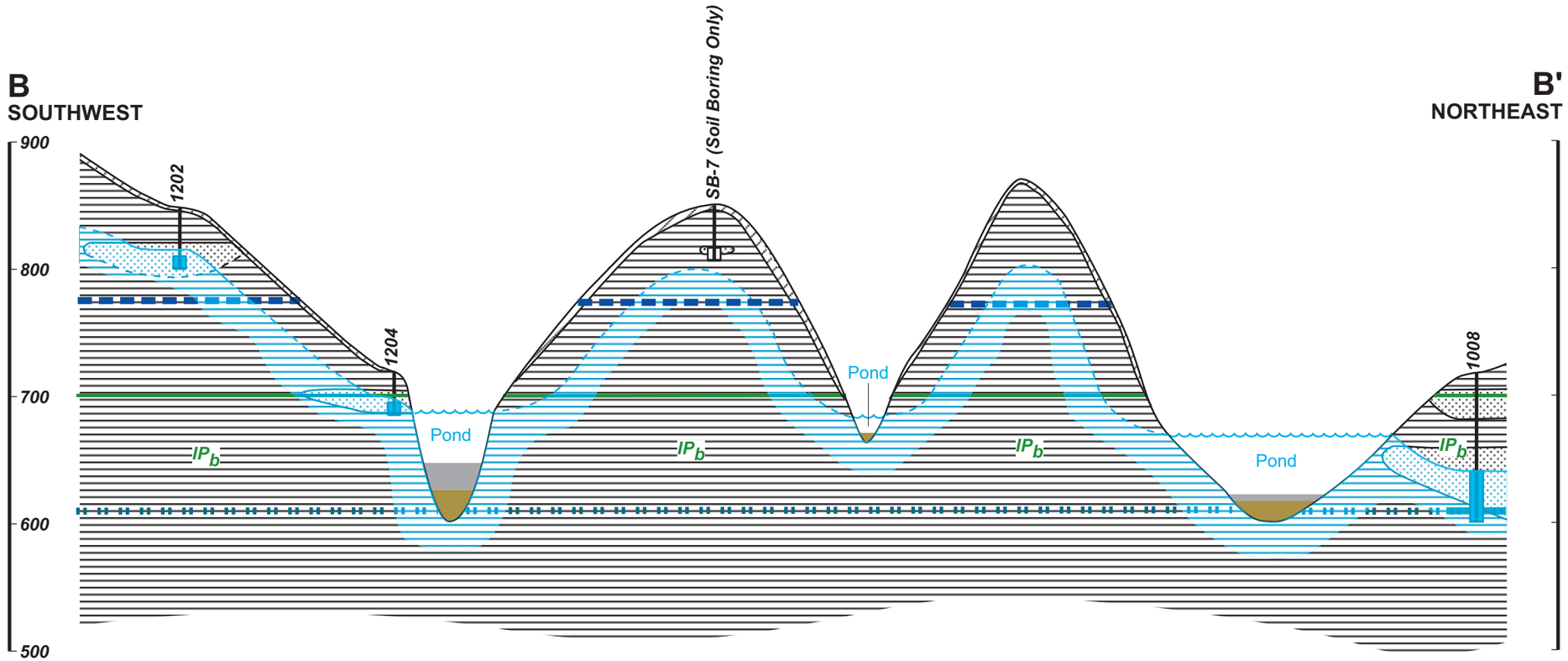
AEP

Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1a
CROSS SECTION A-A'

JOB NO. 13815152

URS



LEGEND:

- Brush Creek Limestone (Inferred from GQ-584)
- 1202 — Well ID
- Well
- Well Screen
- Water Level (Measured October 15, 2012) (Dashed Where Inferred)

GQ-584 — Geologic Quadrangle Map of Fallsburg Quadrangle, Kentucky-West Virginia, and the Pritchard, Quadrangle in Kentucky, (GQ-584) Joseph A. Sharpe, 1987.

- IP_c — Conemaugh Formation (Inferred from GQ-584)
- IP_b — Breathitt Formation (Inferred from GQ-584)
- Princess Coal #7 (Inferred from GQ-584)

- CL — Clay
- SC — Sandy Clay
- SS — Sandstone
- SH — Shale, Interbedded Shale, Siltstone, Sandstone, Mudstone
- Alluvium
- Ash
- Uppermost Groundwater Zone

100
0
0 600
SCALE IN FEET
VERTICAL EXAGGERATION = 6x

AEP

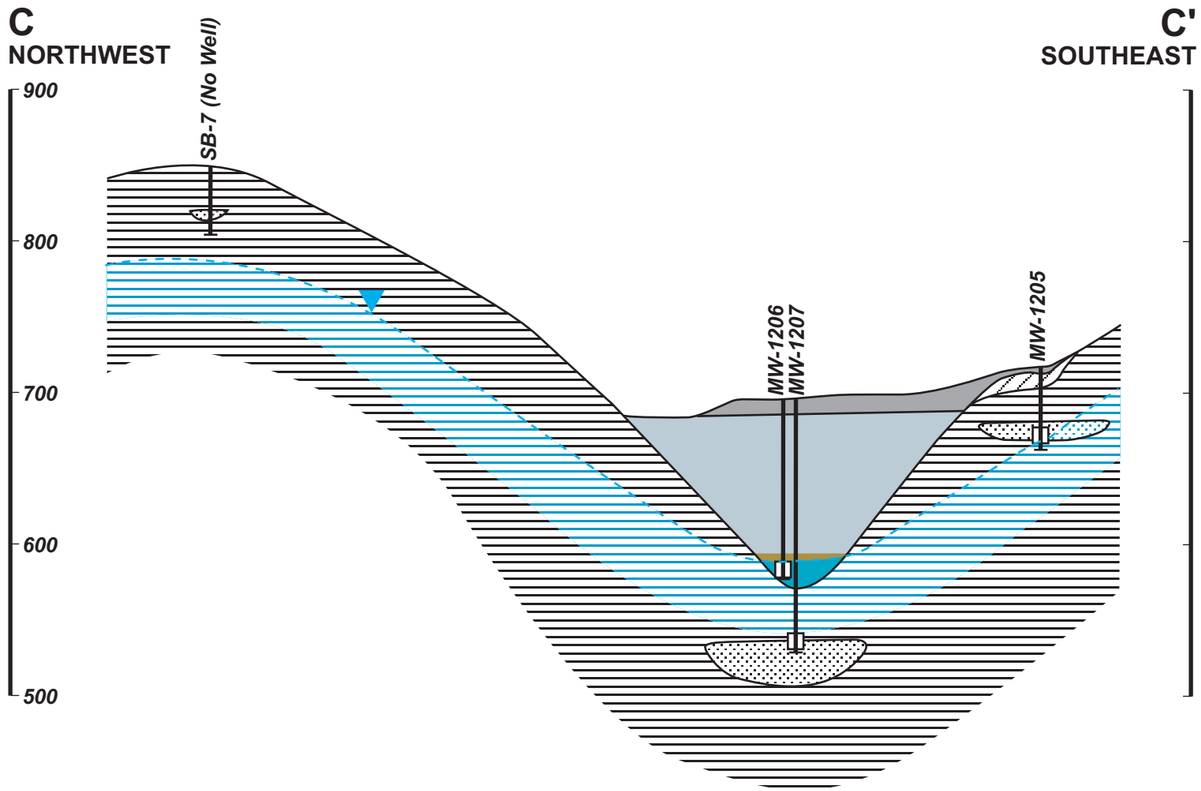
Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1b
CROSS SECTION B-B'

JOB NO. 13815152

URS

J:\Project\A\AEP\13815142 Big Sandy Special Waste LF\Data-Tech\Tl\xsecs.fh10



LEGEND:

- SB-7 — Well ID
- Well
- Well Screen
- Water Level (Measured October 15, 2012) (Dashed Where Inferred)

- CL — Clay
- SC — Sandy Clay
- SH — Shale, Interbedded Shale, Siltstone, Sandstone, Mudstone
- Alluvium
- Ash
- Wet Ash
- Uppermost Groundwater Zone

100
0
0
300
SCALE IN FEET
VERTICAL EXAGGERATION = 3x

AEP

Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1c
CROSS SECTION C-C'

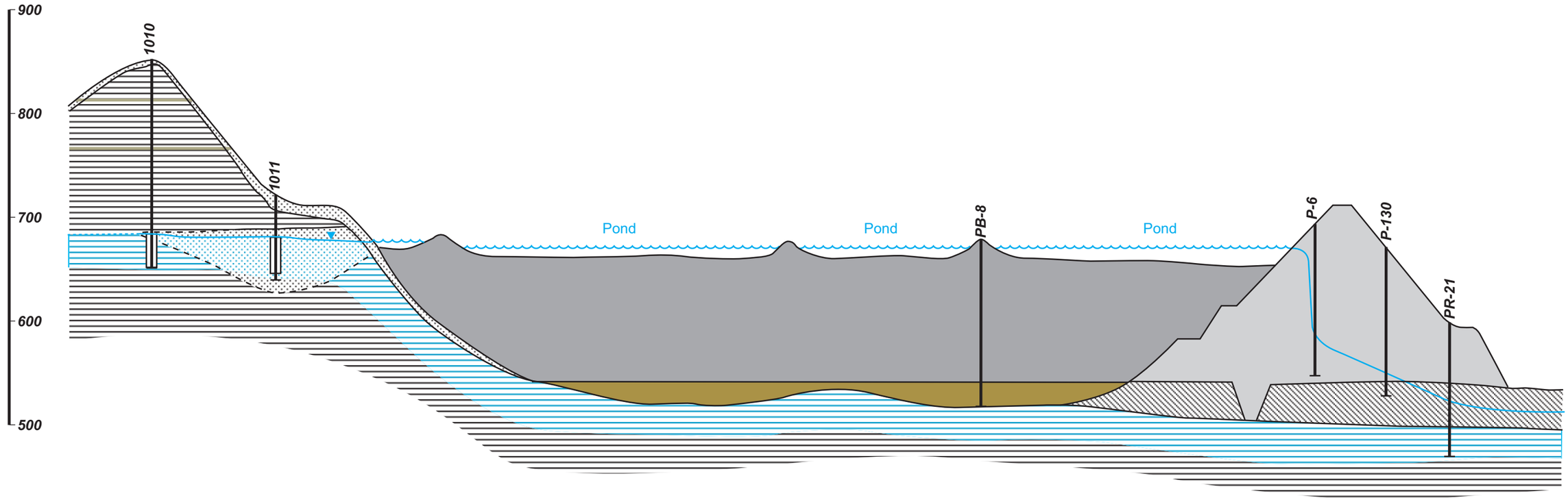
JOB NO. 13815152

URS

J:\Project\AEP\13815142 Big Sandy Special Waste LF\Data-Tech\TI\xsecs c-d.fh10

D
SOUTH

D'
NORTH



100
0
0
600
SCALE IN FEET
VERTICAL EXAGGERATION = 6x

LEGEND:

- Coal Seam
- 1011 Well ID
- Well
- Well Screen
- Water Level (Measured October 15, 2012) (Dashed Where Inferred)

- SC Sandy Clay
- SS Sandstone
- SH Shale, Interbedded Shale, Siltstone, Sandstone, Mudstone
- Alluvium
- Ash
- Uppermost Groundwater Zone

AEP

Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1d
CROSS SECTION D-D'

JOB NO. 13815152

URS

J:\Project\AAEP\13815142 Big Sandy Special Waste LF\Data-Tech\Tl\xsecs c-d.fh10

MW–1201
751.32

MW–1202
818.48

MW–1203
704.14

MW–1204
696.91

MW–1205
671.05

MW–1206
685.78

MW–1207
608.53

MW–1007
668.44

MW–1008
637.90

MW–1009
653.59

MW–1010
686.26

MW–1011
682.99

GAUGE
669.85

PB–1
PB–2
PB–3
PB–4
PB–5
PB–6
PB–7
PB–8
SB–3
SB–4
SB–6
SB–7
SB–8

EXISTING ROAD

700
750
800

0 600 1,200
APPROXIMATE SCALE IN FEET

LEGEND:

- Limit of Hydrogeologic Site Investigation
- Boring Location
- PB — Pond Boring
- SB — Soil Boring
- HB — Hydrogeologic Boring
- MW — Monitoring Well
- Potentiometric Line (Dashed Where Inferred)
- Inferred Flow Direction
- NM — Not Measured
- 818.48 — Groundwater Elevation (Feet, msl)

AEP

Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.2c
GROUNDWATER ELEVATIONS
OCTOBER 15, 2012

JOB NO. 13815152

URS

2012 BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Key to Log of Boring/Rock Core

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION		Well Graphic	REMARKS AND OTHER DETAILS
1	2	3	4	5	6	7	8	9		10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler each 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Recovery:** Percentage of driven sample length actually recovered.

7 **Pocket Penetrometer:** Pocket penetrometer field consistency measurement in tons per square foot (tsf).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

10 **Water Content** Water content of soil sample measured in laboratory, expressed as percent of dry weight of sample.

11 **Well Graphic:** Diagram of well installation

12 **Remarks and Other Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Also includes well details and laboratory testing results.

TYPICAL MATERIAL GRAPHIC SYMBOLS

- BOTTOM ASH
- FLY ASH
- FILL
- SEDIMENTS
- TOPSOIL
- WATER
- PEAT (PT)
- Fat Organic CLAY (OH)
- Lean Organic CLAY (OL)
- Lean CLAY (CL)
- Fat CLAY (CH)
- SILT (ML)
- Clayey SAND (SC)
- Silty SAND (SM)
- Poorly-graded SAND (SP)
- Poorly-graded SAND (SP-SM)
- Clayey GRAVEL (GC)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- COAL
- LIMESTONE
- SANDSTONE
- SHALE

TYPICAL WELL GRAPHIC SYMBOLS

- Filter Sand
- Natural fill
- PVC Pipe in Bentonite Seal
- PVC Pipe in Bentonite Grout
- Bentonite Plug
- PVC Pipe in Filter Sand
- Slotted PVC Pipe in Filter Sand

OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling (ATD)
- Water level at time indicated on log
- Minor change in material properties within a lithologic stratum
- ---- Inferred or gradational lithologic contact

ATD At Time of Drilling
NR Not Recorded
NA Not Applicable

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Split-spoon
- Core Barrel
- Shelby-tube
- Piston Tube
- Core

MINOR SOIL TYPE(s)

"trace" When the soil type's percentage is estimated, using visual/manual procedures, to be between 1 and 15 percent of the total sample.

"with" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 15 percent and less than 30 percent of the total sample.

"y" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 30 percent of the total sample.

Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.

URS

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	Key to Log of Boring Sheet 2 of 2

KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

DISCONTINUITY DESCRIPTORS

a Dip of discontinuity, measured relative to a plane normal to the core axis.

b **Discontinuity Type:**

- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

c **Aperture (inches):**

- W - Wide (0.5-2.0)
- MW - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- VN - Very Narrow (<0.05)
- T - Tight (0)

d **Type of Infilling:**

- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Fe - Iron Oxide
- Gy - Gypsum
- H - Healed
- Mn - Manganese Oxide
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand

e **Amount of Infilling:**

- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- No - None

f **Surface Shape of Joint:**

- Pl - Planar
- Wa - Wavy
- St - Stepped
- Ir - Irregular

g **Roughness of Surface:**

- Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- SR - Slightly Rough [asperities on the discontinuity surfaces are distinguishable and can be felt]
- R - Rough [some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive]
- VR - Very Rough [near-vertical steps and ridges occur on the discontinuity surface]

h **Discontinuity Spacing (feet):**

- EW - Extremely Wide (>6)
- W - Wide (2-6)
- M - Moderate (0.7-2)
- C - Close (0.2-0.7)
- VC - Very Close (<0.2)

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh/Unweathered	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition	Approximate Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 - 150
Very Weak Rock	Can be peeled by pocket knife	150 - 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 - 3,500
Medium Strong Rock	Can be indented 5 mm with sharp end of pick	3,500 - 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 - 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 - 35,000
Extremely Strong Rock	Can only be chipped with hammer blows	> 35,000

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Date(s) Drilled	**4/10/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**49.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**799.4 ft above msl**
Borehole Backfill	**Borehole finished as monitoring well MW-1201**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,798.0 E 2,099,724.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
				WOH		1.0		Stiff, moist, brown to reddish brown lean CLAY (CL), trace silt and sand			Grout
	1	SS	SS-1	2	50	2.0					
				2		2.0		Stiff to very stiff, moist, brown to reddish brown, very fine sandy lean CLAY (CL) [RESIDUUM]			SCH 40 PVC 2" diameter riser
				3		3.25					
	2							becomes very stiff to hard			
				5		3.5					
	3	SS	SS-2	5	50	4.5			17.7		*PL=17 LL=35 PI=18 %F=67.9*
				5		3.5					
				7		4.5					
	4										
795				2		1.75		becomes mottled reddish brown and light gray			
	5	SS	SS-3	2	63	3.0					
				5		4.0					
				7		3.0					
	6										
				7				Medium dense, moist, dark reddish brown fine to medium clayey SAND (SC) with trace oxidized sandstone gravel, with tan and light gray mottling [RESIDUUM]			
	7	SS	SS-4	10	100	3.5					
				11		4.5					
				11		4.25					
	8										
				3		3.5		Very stiff to hard, moist, light gray to light tan, fat CLAY (CH), trace sand [RESIDUUM]			
	9	SS	SS-5	6	92	>4.5		1/4" dark red-brown, highly weathered shale seam			
790				7		3.5					
				9		>4.5					
	10										
				2		3.75					
	11	SS	SS-6	5	92	4.0					
				9		4.25					
				15		4.25					
	12	SS	SS-7	50/5"	8	>4.5		becomes gray to light gray			
								Quartz SANDSTONE, gray, slight to no weathering, very strong, slight to moderate HCL reaction (4.5"-6"), grading more flaggy and micaceous at 9"			*Auger/spoon refusal at 12.5 ft bgs*
	13	R	R1	24%	50						
								Fracture #1: 0, B, N, None ,None, Ir, SR, M			
785	14										
	15										
	16										
								SHALE, gray, slight to moderately weathered, very weak			
	17	R	R2	30%	50			Fracture #2: 0, B, 0, None, None, PI, SR, VC			
	18										
	19										
780											
	20	R	R3	27%	77						

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20							becomes dark gray and slightly fossiliferous		*Brush creek limestone*
	21							Microcrystalline LIMESTONE, gray, slight to no weathering, very strong, fossiliferous		**SCH 40 PVC 2" diameter riser**
	22		R3	27%	77			SHALE, dark gray, slight to moderate weathering, very weak, slightly fossiliferous		
	23							Microcrystalline LIMESTONE, light gray to gray, slight to moderate weathering, strong		*Brush creek limestone*
	24							Fracture #3: 0, B, N to MW, None, None, Ir, R, EW		
775								SHALE, dark gray, slight to moderate weathering, very weak		
	25							becomes gray		
	26							becomes green, slight to no weathering, strong with trace brown clay in bedding planes		
	27		R4	13%	30			COAL, black, slight to no weathering, very weak		
	28							MUDSTONE, black to dark gray, slight to moderate weathering, medium strong		
	29							becomes gray		
770										
	30									
	31									
	32		R5	68%	87					
	33									
	34									
765										
	35							becomes with sand, trace mica (muscovite)		**Bentonite seal**
	36							becomes slightly fissile		
	37		R6	45%	100			2-inch gray sandstone seam		
	38							becomes wavy bedding		**Filter sand**
	39							becomes without wavy bedding, without muscovite		
760								becomes with sand, semi-fissile		
	40									**SCH 40 PVC 2" diameter 0.01" slotted screen**
	41									
	42		R7	52%	92			Quartz SANDSTONE with biotite and muscovite, slight weathering, medium strong, ~15° dip, cross bedded		
	43							Fracture #4: 15%, B, T, Ca, Pa, Pl, SR, VC		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R7	52%	92						Filter sand
755	45										
	46										
	47		R8	85%	100						
	48										
	49										
750	50							End of Boring at 49.5´ bgs			
	51										
	52										
	53										
	54										
745	55										
	56										
	57										
	58										
	59										
740	60										
	61										
	62										
	63										
	64										
735	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Date(s) Drilled	**4/13/12**	Logged By	**S. Becker**	Checked By	**J. Lach/V. Gautam**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**44.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**849.6 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1202**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 254,651.6 E 2,101,180.0**	Groundwater Level(s)	**Water level @ 28.85 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
				2		1.5		Loose, moist, brown, sandy CLAY (SC), trace gravel (topsoil)			Grout
	1	SS	SS-1	3 3 3	100	3.5 2.0 1.5		Loose, moist, brown sandy CLAY (SC), trace gravel [RESIDUUM] becomes mottled brown and gray			SCH 40 PVC 2" diameter riser
	2										
	3	SS	SS-2	3 4 5 5	83	2.5 2.5 2.75 2.5		Stiff to very stiff, moist, tannish brown and gray mottled lean CLAY (CL), trace sand, trace gravel [RESIDUUM] becomes reddish brown and gray mottled			
	4							becomes with weathered brown shale fragments			
845	5	SS	SS-3	2 4 5 6	21						
	6							becomes without shale fragments, hard			
	7	SS	SS-4	4 6 8 9	13	3.25					
	8							becomes gray and tan mottled, without sand, dry to moist, without gravel			
	9	SS	SS-5	3 6 9 12	58	3.0 4.5 4.5 3.5			17.7		*PL=21 LL=45 PI=24 %F=91*
840	10							becomes light gray			
	11	SS	SS-6	3 5 8 11	79	4.25 3.0 2.5					
	12							becomes brownish red			
	13	SS	SS-7	6 10 13 12	63	4.0 4.5 4.5		becomes gray to light gray, without silt			
	14										
835	15	SS	SS-8	6 16 16 24	75	>4.5		SHALE, greenish gray, highly weathered, very to extremely weak			
	16							becomes brownish gray, dry			
	17	SS	SS-9	24 49 50/4"	75			becomes greenish gray			
	18										
	19										*18 to 20 ft bgs - No Split Spoon Collected*
830	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21	SS-10		9 12 15 16	96					SCH 40 PVC 2" diameter riser
	22	SS-11		50/4"	63					
	23									
	24									*Augered 24-25 ft bgs to begin setup for wireline coring*
825	25							22.4 to 25 ft, bgs - No Recovery - HSA Only becomes with 1-2" weathered limestone 25 ft, bgs - Begin HQ Rock Coring		
	26							becomes with iron-stained lamina, slightly to moderately weathered, strong to very strong		
	27	R1		41%	48					*Dry run* *No water*
	28									Bentonite seal
	29									
820	30							Quartz SANDSTONE, gray, slightly to moderately weathered, strong, micaceous (muscovite), with iron-staining, thinly bedded		*Dry run* *No water*
	31							becomes with biotite Fracture #1: 0, B, T-N, Fe, Su, Ir, SR, M		Filter sand
	32	R2		27%	70			Fracture #2: 0, B, T, Fe, Su, Ir, SR, VC		SCH 40 PVC 2" diameter 0.01" slotted screen
	33									
	34							becomes wet		
815	35									*Water used*
	36							becomes without iron staining, no weathering, very strong to strong Fracture #3: 0, B, T-VN, --, No, Pl-Wa, SR, VC		
	37	R3		98%	103			Fracture #4: 0, B, MW-W, Fe, Su, Pl-Wa, R, M		
	38									
	39									
810	40									
	41									
	42	R4		68%	98			SHALE, greenish gray, no weathering, very weak		
	43							Fracture #5: 0, B, T, Cl-No, Su -No, Pl, S-SR, VC		

Report: GEO_CR_WELL; File K:\PROJECTS\AAEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:12 AM

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44	R4		68%	98						Filter sand
805	45							End of Boring at 44.5´ bgs			
	46										
	47										
	48										
	49										
800	50										
	51										
	52										
	53										
	54										
795	55										
	56										
	57										
	58										
	59										
790	60										
	61										
	62										
	63										
	64										
785	65										
	66										

Report: GEO_CR_WELL; File K:\PROJECTS\AAEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:12 AM

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Date(s) Drilled	**4/16/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**728.7 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1203**	Sampling Method(s)	**Split-spoon/Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,205.1 E 2,101,406.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0			3				Loose, moist, brown clayey SAND (SC), trace sandstone gravel [FILL]			Grout
	1	SS	SS-1	2 2 4	50	0.75 1.5			16.4		*PL=18 LL=31 PI=13* *%G=8.3 %S=44.5* *%F=47.2*
	2			4		3.5		Stiff to very stiff, moist, reddish brown, lean CLAY (CL) [FILL]			SCH 40 PVC 2" diameter riser
	3	SS	SS-2	4 5	71	3.0		1" red-brown medium sand seam 2" medium reddish brown sand seam with sandstone fragments			
725	4			6		3.0					
	5	SS	SS-3	3 4 7 7	83	3.5 4.5 4.5 3.5		becomes with sandstone fragments (gravel) with red-brown sand iron-staining	16.7		*PL=17 LL=31 PI=15*
	6			14		4.5		Dense, dry to moist, red to brown, clayey SAND (SC) with gravel [ALLUVIUM]			*Iron staining on sand and gravel*
	7	SS	SS-4	15 17 20	92	4.5 >4.5 >4.5					
	8			7		4.0		becomes mottled brown and orange			
720	9	SS	SS-5	12 13 16	100	4.0 4.5 4.0			10.4		*%G=19.3 %S=49.8* *%F=30.9*
	10			5							
	11	SS	SS-6	13 14 12	100			becomes increasing sand and gravel content			
	12			11		3.5		Very stiff to hard, moist red-brown fat CLAY (CH) trace sand and gravel [ALLUVIUM]			
	13	SS	SS-7	17 27	92	3.25 3.5			17.6		
715	14			17		>4.5		4" reddish brown sand layer with trace clay			
	15	SS	SS-8	3 6 10 8	100	1.0 2.0 3.0		Medium stiff to stiff, moist, red-brown silty, clayey SAND (SC-SM) with weathered sandstone gravel [ALLUVIUM]			
	16			23		1.0					
	17	SS	SS-9	15 13 12	83	3.0 2.5 3.5		2" sandstone fragment in spoon	12.2		*PL=15 LL=20 PI=5* *%G=16.6 %S=53.6* *%F=29.8*
	18			4				Loose, moist to wet, red-brown clayey SAND (SC), trace sandstone gravel [ALLUVIUM]			
710	19	SS	SS-10	3 6 6	63						
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20			9				becomes brown		Grout
	21	SS	SS-11	4 5 24	58				13.9	SCH 40 PVC 2" diameter riser
	22			11				becomes medium dense		
	23	SS	SS-12	10 12 9	100					
705	24			4		3.5		Hard, moist, tan and brown mottled lean CLAY (CL), trace sand [RESIDUUM]		
	25	SS	SS-13	8 10 17	83	4.5 >4.5 >4.5				
	26	SS	SS-14	40 50/4"	40			SHALE, greenish tan, moderately weathered, extremely weak		
	27									
	28	SS	SS-15	50/4"	50			becomes greenish gray, slightly-moderately weathered		
700	29									
	30							Fracture#1: 0, B, T, Cl-No, Su-No, Ir, S-SR, VC		
	31							becomes brown		
	32	R	R1	44%	78			becomes mottled gray, light brown and red Fracture#2: 38, Sh, T, Cl, Su, Pl, S, VC		Bentonite seal
	33							Fracture#3: 30, Sh, N, Cl, Su, Pl, S, VC		
695	34							becomes greenish gray		
	35									Filter sand
	36									
	37	R	R2	58%	85			SANDSTONE, gray with very light black banding, slightly weathered, strong, micaceous (muscovite and biotite)		SCH 40 PVC 2" diameter 0.01" slotted screen
	38							Fracture#4: 0, B, MW, No, No, St, SR-S, C		
690	39									
	40							Fracture#5: 0, B, T, No-Sd, Sp, Pl, S-SR, VC		
	41	R	R3		100					
	42							Fracture#6: 25, Sh, T, Fe, Su, Pl-Wa, SR, VC		
	43							7" area Fe staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
685	44		R3		100			Fracture#7: 25, Sh, T, Cl, Pa, Pl, SR, VC 5" Fe staining 12" Fe staining			SCH 40 PVC 2" diameter 0.01" slotted screen
	45										
	46							Fracture#8: 0-15, B, T, Fe, Su, Pl, SR, VC			
	47		R4	70%	100			Fe staining			Filter sand
	48										
680	49										
	50										
	51										
	52		R5	92%	92						
	53										
675	54										
	55							End of Boring at 54.5´ bgs			
	56										
	57										
	58										
670	59										
	60										
	61										
	62										
	63										
665	64										
	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Date(s) Drilled	**4/18/12**	Logged By	**J. Lach**	Checked By	**V. Gautam**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA, 6" OD bit with HQ core**	Total Depth of Borehole	**35.0 ft**
Drill Rig Type	**CME 550 Truck**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**721.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1204**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,025.3 E 2,102,075.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0									2.5 ft stickup
				6				Light brown, heavily weathered sandstone (access road)		Grout 20% mix ~30 gallons used
	1			22	86	>4.5		Hard, dry, light brown, lean CLAY (CL) [RESIDUUM OR FILL]		
720				42						
	2			50/3				Heavily weathered SANDSTONE, light brown, with some lean clay, dry (Auger Cuttings)		SCH 40 PVC 2" diameter riser
	3									*No recovery - HSA cuttings consist of mixture of lean clay and heavily weathered sandstone fragments - all dry*
	4									
	5							Fine to medium grained SANDSTONE, brown, moderately weathered, strong		*Auger refusal at 5.0 ft bgs*
	6							MUDSTONE, greenish brown, moderately weathered, weak Fracture #1: 0, B, No, W, VN, Pl, SR		
715										
	7		R1	18%	70			Fracture #2: 0, B, No, W, VN, Pl, SR		
	8									
	9							2" brown lean clay seam Fracture #3: 0, B, No, W, VN, Pl, SR		
	10							becomes lightly weathered, extremely weak, micaceous, with iron staining		
	11									
710										
	12		R2	22%	23					*Driller reported constant down pressure Little to no H20 loss*
	13									
	14							Micaceous SANDSTONE, greenish gray, strong		
								becomes brown, moderately weathered (14.5 to 14.6 ft)		
	15							becomes greenish gray, very strong		
								becomes brown, slightly weathered		Bentonite Hydrated
	16									
705								becomes greenish gray, micaceous, cross-bedded, very weak		
	17							Fracture #4: 0, B, No, W, VN, Pl, SR		
	18		R3	85%	90					#5 filter sand
								becomes mottled with partial brown iron staining and greenish gray, strong in brown stained portions		
	19									
	20							becomes greenish gray, weak, with iron staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							becomes greenish gray, micaceous, weak			SCH 40 PVC 2" diameter 0.1" slotted screen
	21										
700								Fracture #5: 0, B, No, W, VN, Pl, SR			
	22							becomes brown, coarse, very strong, micaceous			
								becomes greenish gray, strong, very micaceous, wet,			#5 filter sand
	23	R	R4	65%	82			coarse grained			
								becomes brown, coarse, very strong			
	24							becomes dark brown, moderately weathered, strong			
								becomes light gray, coarse, very strong with some			
	25							sections of slight weathering, brown			
	26										
695											
	27							becomes gray, coarse-grained, micaceous, weak with			
		R	R5	80%	100			stained sections (strong where stained)			
	28										
	29							Fracture #6: 90, J, Su, W, VN, Ir, VR			
	30							Fracture #7: 0, B, No, W, VN, Pl, SR			2" diameter sump
	31							SHALE, gray, fissile, strong			
690								MUDSTONE, gray, very weak, slightly fissile			
	32										
		R	R6	75%	88			becomes with decreasing fissility			
	33							SHALE, gray, fissile, weak			
								becomes with brown staining			
	34							MUDSTONE, gray, very weak, not fissile			
	35							End of Boring at 35´ bgs			
	36										
685											
	37										
	38										
	39										
	40										
	41										
680											
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Sheet 1 of 3

Date(s) Drilled	**4/19/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**714.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1205**	Sampling Method(s)	**Split-spoon, HQ Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,131.0 E 2,104,397.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
		SS	SS-1	2 1 2 1	100			Very loose, moist, black bottom ash, trace gravel [BOTTOM ASH]			**Bentonite grout**
	1										**SCH 40 PVC 2" diameter riser**
	2										
		SS	SS-2	2 1 3 4	33	2.0		Medium stiff to very stiff, moist, brown to tan lean CLAY (CL) with sand and trace gravel [RESIDUUM]			
	4										
710		SS	SS-3	9 5 8 8	100	2.75 1.0 2.75 1.5		3" red sand seam	15.8		*PL=17 LL=33 PI=16 %F=47.6* *Shelby tube sample 5-7' bgs* *Down pressure (psi) = 200-600 psi*
	5										
	6							becomes stiff to very stiff, reddish-brown, trace sand			
		SS	SS-4	9 6 7 8	83	2.0 1.75 3.5 >4.5		becomes with trace tan-brown shale fragments	16.1		*PL=16 LL=32 PI=16 %F=49.5*
	8							SHALE, tan, moderate to highly weathered, weak to extremely weak, dry to moist			
705	9	SS	SS-5	8 15 12 12	75						
	10							becomes dry			
		SS	SS-6	4 17 23 19	100						
	12										
		SS	SS-7	21 28 29 35	83						
700	14										
	15	SS	SS-8	11 20 21 20	100			becomes white/gray			
	16	SS	SS-9	50/3"	100			becomes greenish gray			*Outside of spoon wet*
	17										
	18										
	19										
695		R	R1	17%	37			becomes gray, slight weathering, very weak to extremely weak			*Auger to 19.5 ft to begin coring.*
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									SCH 40 PVC 2" diameter riser
	22		R1	17%	37					
	23									Bentonite grout
	24									
690								becomes red		
	25									
	26							becomes black and red		
	27		R2	47%	70					
	28							becomes gray		
	29									
685										
	30							Fracture #1: 0, B, T, Cl-No, Su-No, Pl, S, M-W		
	31									
	32		R3	35%	57					
	33									
	34									
680										
	35									
	36							becomes sandy		Bentonite chips
	37		R4	0%	100			SANDSTONE, gray, moderately to highly weathered, weak to medium strong, micaceous, thinly bedded, with numerous bedding plane fractures		
	38							Fracture #2: 0, B, T, Cl-No, Su-No, Pl, S, M		Filter sand
	39									
675										
	40									SCH 40 PVC 2" diameter 0.01 slotted screen
	41									
	42		R5	42%	100			becomes slightly-moderately weathered		
	43									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
670	44		R5	42%	100						
	45										
	46										SCH 40 PVC 2" diameter 0.01 slotted screen
	47		R6	55%	93						
	48										
665	49										
	50										Filter sand
	51										
	52		R7		100			Sandy SHALE, gray, moderately weathered, moderately strong to weak			
	53							becomes less sandy			
	54							coal seam, 2" coal seam, 3"			
660								End of Boring at 54.5´ bgs			
	55										
	56										
	57										
	58										
	59										
655	60										
	61										
	62										
	63										
	64										
650	65										
	66										

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Sheet 1 of 6

Date(s) Drilled	**4/23/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline**	Drill Bit Size/Type	**8.0" ID steel casing, 4.0" ID core barrel**	Total Depth of Borehole	**124.5 ft**
Drill Rig Type	**Versa-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.4 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1206**	Sampling Method(s)	**Rotosonic Core Barrel**	Hammer Data	**Not Applicable**
Boring Location	**N 251,617.9 E 2,104,243.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						See log for PB-7 from 0-111 ft bgs			Bentonite chips
	1									
	2									
	3									SCH 40 PVC 2" diameter riser
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
675	20								
	21								Bentonite chips
	22								
	23								SCH 40 PVC 2" diameter riser
	24								
	25								
670	26								
	27								
	28								
	29								
	30								
665	31								
	32								
	33								
	34								
	35								
660	36								
	37								
	38								
	39								
	40								
655	41								
	42								
	43								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
650	44								
	45								Bentonite chips
	46								
	47								SCH 40 PVC 2" diameter riser
	48								
	49								
645	50								
	51								
	52								
	53								
	54								
640	55								
	56								
	57								
	58								
	59								
635	60								
	61								
	62								
	63								
	64								
630	65								
	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67									Bentonite chips
	68									
	69									SCH 40 PVC 2" diameter riser
625	70									
	71									
	72									
	73									
	74									
620	75									
	76									
	77									
	78									
	79									
615	80									
	81									
	82									
	83									
	84									
610	85									
	86									
	87									
	88									
	89									
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	91								Bentonite chips
	92								
	93								SCH 40 PVC 2" diameter riser
	94								
	95								
600	96								
	97								
	98								
	99								
	100								
595	101								
	102								
	103								
	104								
	105								
590	106								
	107								
	108								
	109								Bentonite seal
	110								
585	111				0.5		Soft, moist to wet, dark gray to dark greenish gray, sandy lean CLAY (CL) [ALLUVIUM]		# 5 filter sand
	112	CB-1		90	0.5				
	113						becomes greenish gray, trace oxidized red and gray		

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114					2.5		becomes very stiff with sand seams		SCH 40 PVC 2" diameter 0.01" slotted screen
						2.5				
	115							becomes with trace gray to dark gray sandstone fragments		
580						2.75				
	116									
						2.25				
	117	CB	CB-1		90					
						3.0				
	118									
						2.5				
	119									# 5 filter sand
						2.5				
	120							becomes greenish brown		
575						4.5				
	121									
						1.5		becomes brownish gray, intermittent sandy clay seams		
	122									
						2.0		becomes with trace sandy shale and sandstone cobbles and gravel		
	123	CB	CB-2		95					*Install MW-1206 at 123.5 ft on 4/24/2012*
						1.25		becomes stiff, grayish brown		*Clay expansion to 123.6 ft overnight*
	124									
								End of Boring at 124.5´ bgs		*Core barrel refusal at 124.5 ft bgs*
	125									
570										
	126									
	127									
	128									
	129									
	130									
565										
	131									
	132									
	133									
	134									
	135									
560										
	136									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Sheet 1 of 8

Date(s) Drilled	**4/24/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline HQ**	Drill Bit Size/Type	**8" ID steel casing, 6" OD bit HQ Wireline**	Total Depth of Borehole	**166.0 ft**
Drill Rig Type	**Vibra-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.0 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1207**	Sampling Method(s)	**HQ Wireline**	Hammer Data	**Not applicable**
Boring Location	**N 251,598.3 E 2,104,256.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0						See log for boring PB-7		**Bentonite grout**
	1								**SCH 40 PVC 2" diameter riser**
	2								*Augered to 126 ft without sampling*
	3								
	4								
690	5								
	6								
	7								
	8								
	9								
685	10								
	11								
	12								
	13								
	14								
680	15								
	16								
	17								
	18								
	19								
675	20								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20									
	21									SCH 40 PVC 2" diameter riser
	22									Bentonite grout
	23									
	24									
670	25									
	26									
	27									
	28									
	29									
665	30									
	31									
	32									
	33									
	34									
660	35									
	36									
	37									
	38									
	39									
655	40									
	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44									SCH 40 PVC 2" diameter riser
650	45									
	46									Bentonite grout
	47									
	48									
	49									
645	50									
	51									
	52									
	53									
	54									
640	55									
	56									
	57									
	58									
	59									
635	60									
	61									
	62									
	63									
	64									
630	65									
	66									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67									SCH 40 PVC 2" diameter riser
	68									
	69									Bentonite grout
625	70									
	71									
	72									
	73									
	74									
620	75									
	76									
	77									
	78									
	79									
615	80									
	81									
	82									
	83									
	84									
610	85									
	86									
	87									
	88									
	89									
605	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	91									SCH 40 PVC 2" diameter riser
	92									
	93									Bentonite grout
	94									
600	95									
	96									
	97									
	98									
	99									
595	100									
	101									
	102									
	103									
	104									
590	105									
	106									
	107									
	108									
	109									
585	110									
	111									
	112									
	113									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114									SCH 40 PVC 2" diameter riser
580	115									Bentonite grout
	116									
	117									
	118									
	119									
575	120									
	121									
	122									
	123									
	124									
570	125									
	126	HQ1		0%	0			No recovery 126-131. Driller notes "softer material"		
	127									
	128									
	129									
565	130									
	131	HQ2		0%	0			No recovery 131-136. Shale cuttings		
	132									
	133									
	134									
560	135									
	136	HQ3		18%	80			SHALE, light gray to gray, moderately weathered, very to extremely weak		

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137							Fracture #1: 0, B, N-T, Cl, SP, Pl, S-SR, VC-M		SCH 40 PVC 2" diameter riser
	138									
	139	HQ	3	18%	80					Bentonite grout
555	140							becomes with trace gray sandstone layers (occasional), up to 1/4"		
	141									
	142									
	143	HQ	4	0%	50					
	144									
550	145							becomes dark gray to greenish gray, without sandstone seams		
	146									
	147							becomes dark gray to black		
	148							becomes light gray		
	149	HQ	5	38%	38					
545	150									Bentonite seal
	151							3" layer of light gray, moist clay, with shale fragments		
	152									
	153							becomes interbedded with gray micaceous sandstone layers up to 1/4"		#5 filter sand
	154	HQ	6	37%	83					
540	155									SCH 40 PVC 2" diameter 0.01" slotted screen
	156							6" sandstone, gray, slightly weathered, strong, thinly bedded to shaly		
	157							becomes extremely weak, highly fractured		
	158	HQ	7	25%	73					
	159							interbedded sandstone up to 1/4"		
535	160							becomes dark gray, with thin light gray clay deposits on bedding		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
		HQ	HQ7	25%	73						
	161							SANDSTONE, gray, moderately weathered medium strong to very strong, flaggy, with thinly interbedded shale, micaceous			SCH 40 PVC 2" diameter 0.01" slotted screen
	162										
	163							Fracture #2: 0, B, T-VN, Cl, SP, Pl, S-SR, VC-M			#5 filter sand
		HQ	HQ8	42%	100						
	164										
530	165										
	166							End of Boring at 166´ bgs			
	167										
	168										
	169										
525	170										
	171										
	172										
	173										
	174										
520	175										
	176										
	177										
	178										
	179										
515	180										
	181										
	182										
	183										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Sheet 1 of 3

Date(s) Drilled	**4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**57.0 ft**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 695.1 ft above msl**
Borehole Backfill	**Cement Bentonite Grout**	Sampling Method(s)	**Piston tube/Split-spoon**	Hammer Data	**140#/30" Manual drop**
Boring Location	**38°10'57.4" N 83°38'41.3" W**	Groundwater Level(s)	**0' bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						Water ▽			*Barge drilling- water @ 695.1.*
	1									
	2									
	3									
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20										
	21										
	22										
	23							Soft sediments			*Top of sediment @ 22.5 ft. Casing sank to 27.5 ft.*
	24										
670	25										
	26										
	27							Loose, wet fly ash as silty sand (SM) [FLY ASH]			
	28	SS	SS-1	1 WH 0 0	38						
	29										
665	30										
	31	P	P-1		91						
	32										
	33										
	34										
660	35										
	36	P	P-2		77						
	37										
	38	SS	SS-2	3 6 8 5	100						
	39										
655	40										*Rods sank to 42'*
	41										
	42							12" loose, wet, fly ash as silt (ML), trace fine sand [FLY ASH]			
	43					<0.5					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44					2.0		Soft, moist, dark gray, lean CLAY (CL) [ALLUVIUM]			
								becomes stiff, yellow, some sand, trace gravel			
650	45							becomes very stiff, yellow brown with orange iron staining, with sand, trace gravel			
	46	SS	3	3 3 4 5	38	2.5					
	47										
	48										
	49										
645	50							becomes stiff to very stiff, sandy, trace gravel			
	51	SS	4	6 7 12 12	33	1.0 2.5					
	52										
	53										
	54							Shale, gray, dry, crushed			*Drilling change encountered @ 53.5 ft bgs*
640	55										
	56	SS	5	45 50/2"	33						
	57							End of Boring at 57´ bgs			
	58										
	59										
635	60										
	61										
	62										
	63										
	64										
630	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-2

Sheet 1 of 4

Date(s) Drilled	**4/17/12-4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**77.0 ft**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 695.1 ft above msl**
Borehole Backfill	**Bentonite chips**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Manual drop**
Boring Location	**38°10'52.5" N 83°33'35.2" W**	Groundwater Level(s)	**0 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						Water			*Pond elevation - 695.1 ft*
	1									
	2									
	3									
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20										
	21										
	22										
	23							Soft sediments			*Pond bottom @ 23' bgs*
	24										
670	25										*Casing sank to 25'*
	26	SS	SS-1	2 1 2 3	17			Very loose, wet, gray bottom ash as medium to fine SAND (SP-SM) with some gravel and shale fragments, trace plant fragments [BOTTOM ASH]			
	27										
	28										
	29										
665	30										
	31	P	P-1		0			Loose, wet, fly ash as silty SAND (SM), light and dark laminations [FLY ASH]			
	32										*1 blow for 24 inches*
	33	SS	SS-2	1 0 0 0	0						
	34										
660	35										
	36										
	37										
	38	P	P-2		91						
	39										
655	40	SS	SS-3	2 1 1 2	27						
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
650	45										*Push to 45' bgs - casing sank to 46' bgs*
	46							becomes gray, with silty sand			
	47	SS-4		1 0 0 0							
	48										
	49										
645	50	P-3			99						
	51							becomes with silt and some fine black sand			
	52	SS-5		WH 0 0 0	100	>1.0		Very soft to stiff, moist, dark gray, lean CLAY (CL) [ALLUVIUM]			
	53										
	54										
640	55							becomes yellow			
	56	P-4									
	57							becomes soft, moist, grey/yellow, some silt, trace gravel, sand at base - root			
	58	SS-6		3 3 6 14	75	0.5 1.0		becomes stiff	20.6		*PL=16 LL=27 PI=12*
	59										
635	60										
	61	ST-1			50						
	62							becomes stiff, yellow brown with orange mottles, with gravel and trace sand			
	63	SS-7		7 8 9 5	25	1.5 2.0					
	64										
630	65										
	66	SS-8		3 WR WR	33	0.5		Loose, moist, orange brown with gray mottles, sandy CLAY (SC), trace gravel [ALLUVIUM]			

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67			6							*End at 67' 4/17/12* *Start on 4/18/12* *Begin by drilling to 70'*
	68										
	69							Very stiff, moist, yellow brown with gray mottles, silty CLAY (CL), some sand and gravel [RESIDUUM]			
625	70			5							
	71		SS-9	7 13 11	38	2.5 3.0			16.8		*PL=17 LL=24 PI=7*
	72										
	73										
	74							Shale, light gray, moderately weathered, dry			
620	75										
	76		SS-10	50/3"	13						
	77							End of Boring at 77´ bgs			
	78										
	79										
615	80										
	81										
	82										
	83										
	84										
610	85										
	86										
	87										
	88										
	89										
	90										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-3

Sheet 1 of 5

Date(s) Drilled	**4/9/12-4/10/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary with recirculated mud**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**93.0 ft**
Drill Rig Type	**CME 55 Track Mounted and ATV-remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.3 ft above msl**
Borehole Backfill	**Finished as 2" PVC riser pipe set w/ grout**	Sampling Method(s)	**Split-spoon/Piston/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,582.4 E 2,102,704.0**	Groundwater Level(s)	**4' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3									*Augered to 6' without sampling*
695	4								▽	
	5									
	6	SS	SS-1	1 2 WOH 1	63			Very loose, wet, fly ash as interbedded light and dark sandy SILT (ML) and silty SAND (SM), trace root fibers [FLY ASH]		
	7									
690	8	SS	SS-2	1 2 1 1						
	9									
	10									
	11									
	12									
	13	SS	SS-3	WOH 0 0 0	79			becomes without root fibers		
685	14									
	15									
	16									
	17									
	18	SS	SS-4	WOR 0 0 1	75					
680	19									
	20									

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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21		P-1		71					
	22									
	23			WOH						
675	24	SS-5		0 0 0	0					
	25									
	26									
	27							Medium dense, moist, dark gray trace brown, bottom ash as medium to fine sand (SM), trace coal gravel [BOTTOM ASH]		*Increased drilling resistance @ 27' bgs*
	28			7						
670	29	SS-6		13 13 14	67					
	30							Wet, light to dark gray, fly ash as silty SAND (SM) to silt (ML) [FLY ASH]		
	31									
	32									
	33							Very loose, wet, black, bottom ash and coal fragments as coarse SAND (SP-SM) with gravel [BOTTOM ASH]		
665	34		P-2		0					
	35									
	36									
	37									
	38									
660	39		P-3		0					
	40							becomes black and gray, medium to coarse, with gravel		
	41		SS-7	1 1 1 2	100					
	42							becomes gravelly		*coal gravel up to 7/8"*
	43		SS-8	1	8					
655										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44	SS	8	0 1 0	8					
	45									
	46									
	47									
650	48	SS	9	1 0 0 0	0					*Sample @ 47.5-49.5' bgs was driven to 50.5' bgs with 1 blow*
	49									
	50									
	51									
	52									
	53	SS	10	WOH 0 1 1	0			becomes coarse to fine		
645	54									
	55									
	56							Very loose, wet, light gray, fly ash as sandy SILT (ML) with interbedded fine sand [FLY ASH]		
	57									
	58	P	4		67					
640	59									
	60									
	61									
	62									
	63	SS	11	1 1 1 3	92			becomes with minor interbedded silty sand-laminations		
635	64									
	65									
	66									

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Project Location: Louisa, KY
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68	P	5		83					
630	69									
	70									
	71									
	72									
	73									
625	74							Loose, moist, brown and black, clayey SAND (SC) with decayed plant matter (topsoil)		
	75	SS	12	4 5 5 7	58	1.75 <0.5 1.25		becomes sandy silty clay (CL-ML), trace reddish brown root fibers Soft to stiff, moist, brown with gray mottling sandy lean CLAY (CL) [ALLUVIUM]		
	76									
	77									
	78	ST	1	4 5 5 7	79			Medium dense, moist, variably brown with dark gray and gray mottling, gravelly clayey SAND (SC) [ALLUVIUM]		
620	79									*1 5/8" sandstone on bottom of tube*
	80	SS	13	18 6 6 9	33					
	81									
	82									
	83	SS	14	8 11 17 20	50			Medium dense, moist, variably brown with gray mottling, oxidation staining, clayey GRAVEL (GC), as completely to highly weathered sandstone, horizontal bedding [RESIDUUM]		
615	84									
	85									
	86							Medium dense, moist, variably brown with gray mottling, clayey SAND (SC), with gravel as completely weathered sandstone [RESIDUUM]		
	87									
	88	SS	15	4 6 12 15	100					
610	89									
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
PB-3

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	91						Sandy silty shale, gray with oxidation staining, moderately weathered, weak			
	92									
	93	SS-16	50/4.5"	100						
605							End of Boring at 93´ bgs			*Set PVC casing at 93' bgs. Cement-bentonite grout placed using tremie pipe*
	94									
	95									
	96									
	97									
	98									
600										
	99									
	100									
	101									
	102									
	103									
595										
	104									
	105									
	106									
	107									
	108									
590										
	109									
	110									
	111									
	112									
	113									
585										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Sheet 1 of 5

Date(s) Drilled	**4/11/12-4/13/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**112.2 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.0 ft above msl**
Borehole Backfill	**2" PVC riser pipe set with grout**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,302.5 E 2,103,601.0**	Groundwater Level(s)	**Encountered at 7.6' bgs ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
700	0									2.5' stickup
										Grout
	1									*Bottom ash access road*
	2									
	3									
	4									
695	5									
	6							Very loose, moist, dark gray bottom ash as coarse to fine SAND (SP-SM), trace gravel [BOTTOM ASH]		
	7	SS	SS-1	2 2 2 2	83					
	8							Very loose, wet, light gray to dark gray fly ash as silty SAND (SM) with minor interbedded sandy silt (ML) trace cat-tail roots [FLY ASH]		
	9	SS	SS-2	2 2 2 1	33					
690	10									
	11									
	12									
	13							becomes without cat-tails		
	14	SS	SS-3	2 1 1 1	75			becomes horizontally bedded		
685	15									
	16									
	17									
	18									*@ 18' bgs begin open hole mud rotary*
	19	P	P-1		98					
680	20									

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Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
680	20									*sand becoming finer*
	21	SS	4	WOH 2 2 1	46					
	22									
	23									
	24	SS	5	2 1 1 1	50					
675	25									
	26									
	27									
	28	P	2		54					
	29									
670	30	SS	6	1 2 2 1	58					
	31									
	32									
	33	P	3		50					
	34									
665	35	SS	7	WOH 1 0 1	54					
	36									
	37							becomes mostly sand silt (ML) with minor silty sand (SM)		*Split-spoon intended at 37-39 fell to 43' bgs on WOH.*
	38	SS	8	WOH 0 0 0	58					
	39									
660	40									
	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44								
655	45								
	46								
	47								
	48	P-4		50					
	49								
	50	SS-9	WOH 0 0 1	67					
650	51								
	52								
	53								
	54								
	55						Loose, wet, variably gray, trace brown bottom ash as medium fine SAND (SP-SM), trace gravel, with interbedded minor fly ash as sandy silt (ML), mostly laminated [BOTTOM ASH]		
645	56								
	57								
	58	SS-10	3 4 4 4	71					
	59								
	60								
640	61						Very loose, wet, gray, fly ash as fine silty SAND (SP-SM), with minor interbedded sandy silt [FLY ASH]		
	62								
	63	P-5		98					
	64								
	65	SS-11	WOH 0 1 0	63					
635	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Sheet 4 of 5

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69							becomes mostly sandy SILT (ML), with minor interbedded silty sand (SM) [FLY ASH]		
630	70									
	71									
	72									
	73		SS-12	1 0 0 0	75					*1 blow for 6 ft when attempting to sample @ 72-74' bgs. Driven to 78' bgs*
	74									
625	75									
	76									
	77									
	78									
	79									
620	80									
	81							Loose, wet, mostly dark gray with interbedded light gray, bottom ash as medium fine SAND (SP-SM), with interbedded fly ash as fine silty sand to sandy silt [BOTTOM ASH]		*Drilling resistance increases @ 80.5'*
	82									
	83		SS-13	4 4 5 3	58					
	84									
615	85									
	86							Stiff, moist, brown and red sandy lean CLAY (CL), trace gravel as sandstone gravel [ALLUVIUM]		
	87									*Topsoil in slough of sample @ 87-89' bgs.*
	88		SS-14	2 7 10 11	83	2.0 1.5 1.25 2.0		becomes orange-brown		
	89									
610	90		ST-1		100					*400 to 600 psi down pressure*

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Project Location: Louisa, KY
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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	ST-1			100	2.5		becomes very stiff		
	92							Medium dense, moist, variably orange-brown with trace black and gray mottling, clayey SAND (SC) to sandy lean clay (CL), trace weathered sandstone gravel, trace coal particles [ALLUVIUM]		
	93	SS-15		10 7 7 12	63	2.0 0.75 1.0				
	94									
605	95									
	96									
	97							becomes brownish-gray		
	98	SS-16		WOH 0 14 5	100	0.75 0.75 0.5		Medium stiff, moist, gray with black peat particles, organic CLAY (OH), trace sand seams [ALLUVIUM]		
	99							Medium stiff, moist, dark brownish-gray fibrous PEAT (PT) with interbedded clayey SAND (SC), trace undecayed stems [ALLUVIUM]		
600	100	ST-2			100	0.5				*150 to 300 psi down pressure*
	101									
	102							Medium stiff, moist, brown, organic lean CLAY (OL) with greenish-gray sand seams, trace peat particles [ALLUVIUM]		
	103	SS-17		WOH 0 3 7	83	0.75 0.75 0.75				
	104									
595	105									
	106							Medium dense, moist, greenish-gray with brown oxidation staining, clayey SAND (SC) with horizontally bedded sandstone gravel [RESIDUUM]		*Increased drilling resistance @ 106' bgs.*
	107									
	108	SS-18		11 11 9 11	38				12.0	*PL=15 LL=25 PI=10 %G=24.8 %S=35.3 %F=39.9*
	109									
590	110									
	111							Sandstone, medium to fine, gray, slightly weathered, medium strong		*Increased drilling resistance @ 111' bgs.*
	112	SS-19		50/1/2"	100			End of Boring at 112.15´ bgs		*Set PVC casing at 112' Cement-bentonite grout placed using tremie pipe.*
	113									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-5

Sheet 1 of 3

Date(s) Drilled	**4/13/12,4/16/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**57.1 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.9 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,174.1 E 2,103,663.0**	Groundwater Level(s)	**Encountered 8' bgs ATD, W.L. @ 10.5' bgs on 4/16/12**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
700	0							Very loose, moist, dark gray bottom ash as coarse to fine sand (SP-SM to SM), trace gravel [BOTTOM ASH]			Grout
	1										SCH 40 PVC 2" diameter riser
	2										*Bottom ash access road material to 10.5 ft*
	3										*Auger to 7 ft without sampling.*
	4										
	5										
695	6										
	7	SS	1	2 1 1 1	92						
	8							becomes wet	▽		
	9										
	10										
690	11							Very loose, wet, light and dark gray fly ash as interbedded fine silty SAND (SM) and sandy SILT (ML) [FLY ASH]			
	12	SS	2	3 2 1 1	71						
	13										
	14										
	15										
685	16										
	17	SS	3	WOR 0 WOH 0	42			becomes all fine silty sand, mostly light gray			
	18										
	19										
	20										

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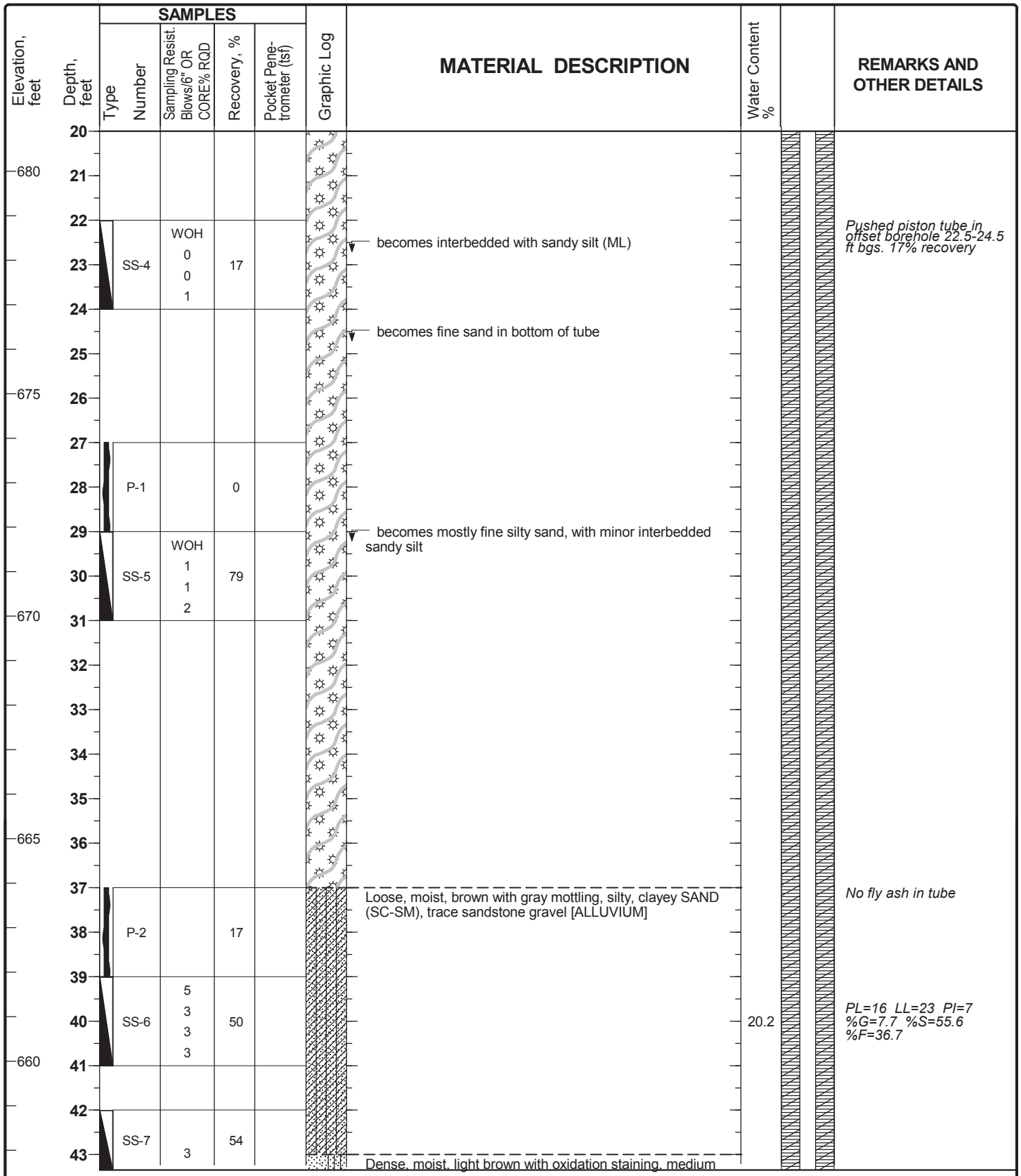
Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-5



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-5

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44		SS-7	5 25 22	54			to fine SAND (SP-SM), with completely weathered sandstone gravel [ALLUVIUM]		
	45									*Lose mud return between 42-47' bgs*
655	46									
	47							Loose, moist, dark brown, clayey SAND (SC) to sandy lean CLAY (CL) with decayed plant matter [ALLUVIUM]		
	48		SS-8	3 4 5 10	75			Loose, moist, light brown, medium to fine SAND (SP-SM) with gravel as completely weathered sandstone [ALLUVIUM]		
	49									
	50									
650	51							Very dense, moist, brown with gray mottling, oxidation staining, silty SAND (SM) as completely to highly weathered sandstone [RESIDUUM]		
	52									
	53		SS-9	22 38 46 50/2"	85					*%G=4.0 %S=56.6 %F=39.4*
	54									
	55							Sandstone, fine to medium, gray, slightly weathered to fresh, medium strong		
645	56									
	57		SS-10	50/1/4"	100			End of Boring at 57.1´ bgs		*Set PVC casing at 57' bgs. Cement-bentonite grout placed using tremie pipe*
	58									
	59									
	60									
640	61									
	62									
	63									
	64									
	65									
635	66									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-6

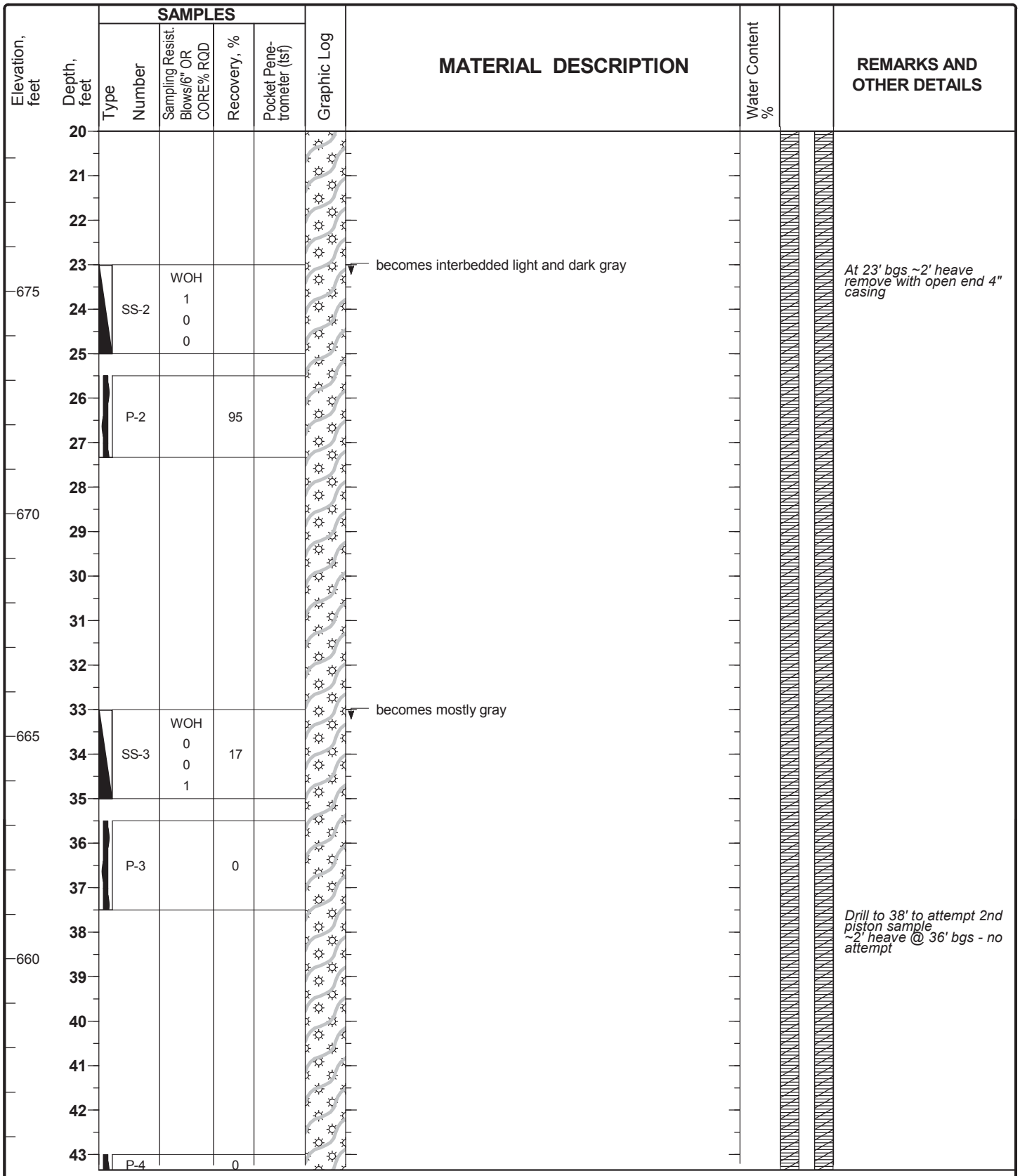
Sheet 1 of 5

Date(s) Drilled	**4/2/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**100.0 ft**
Drill Rig Type	**CME 55 Track Mounted Remote-control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.6 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,301.0 E 2,103,083.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0						Bottom ash access road [BOTTOM ASH]		2.6' stickup Grout
	1								*Drilled without sampling to 13' bgs.*
	2								
	3								2" SCH 40 PVC riser pipe
695	4								
	5								
	6								
	7								
	8								
690	9								
	10								
	11								
	12								
	13								
685	14	SS-1	1 2 1 2	25			Very loose, wet, gray with dark gray streaks fly ash as fine silty SAND (SM) [FLY ASH]		
	15								
	16								
	17	P-1		75					
	18								
680	19								
	20								

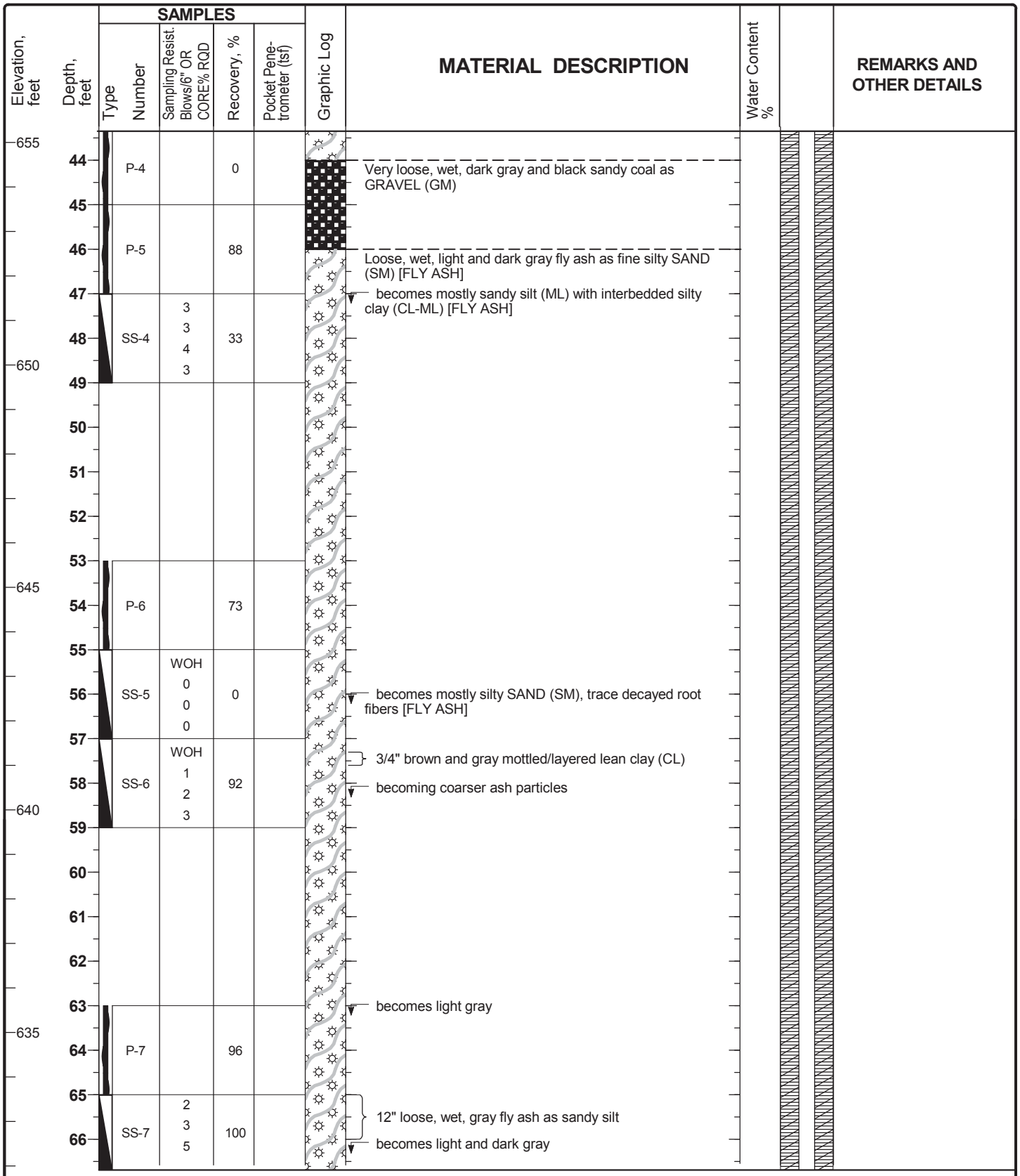
Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-6



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-6



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67			6						
	68									
630	69									
	70									
	71									*tube bent*
	72									
	73	P	P-8		100			Wet, brown, silty GRAVEL (GM), as sandstone fragments [ALLUVIUM]		*Fly ash mixed with gravel*
625	74									
	75									
	76									
	77							Stiff, moist, brown with oxidation staining, sandy lean CLAY (CL) to clayey sand (SC), trace gravel, trace root fibers [ALLUVIUM]		*Drilling resistance change @ 76.5' bgs*
	78			4		1.75				
620	79	SS	SS-8	7 7 17	54	1.5 1.5				
	80									
	81	ST	ST-1		50			Medium dense, moist, variably brown with oxidation staining, medium to fine SAND (SP-SM), trace gravel as sandstone fragments [ALLUVIUM]		*Shelby tube sample: 250 to 750 psi down pressure*
	82			7						
	83	SS	SS-9	6 9 9	4				14.4	
615	84									
	85									
	86							Stiff to very stiff, moist, grayish-green, trace oxidation staining, lean CLAY (CL), with sand, trace shale particles [ALLUVIUM]		
	87									
	88			3		1.25		1" clayey sand seam		
610	89	SS	SS-10	6 10 10	63	1.5 2.5				
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
PB-6

Sheet 5 of 5

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91									
	92							Loose, moist, greenish-grayish brown to brown with oxidation staining, fine to medium clayey SAND (SC), with interbedded lean clay seams, trace sandstone gravel [ALLUVIUM]		
	93			5						
605	94		SS-11	3 3	50	<0.5				
	95			5						
	96									
	97							Stiff, moist, grayish-brown, sandy lean CLAY (CL), trace peat [ALLUVIUM]		
	98			WOR		1.0				
600	99		SS-12	12 50/3"	100	1.0 1.25			21.8	*PL=17 LL=31 PI=14 %F=60.7*
	100							Sandstone, fine, gray with oxidation staining, moderately weathered, very weak to weak		
	101							End of Boring at 100´ bgs		*Set PVC casing @ 100' bgs. Cement-bentonite grout placed using tremie pipe.*
	102									
	103									
595	104									
	105									
	106									
	107									
	108									
590	109									
	110									
	111									
	112									
	113									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7

Sheet 1 of 6

Date(s) Drilled	**4/17/12-4/19/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**127.0 ft**
Drill Rig Type	**CME 55 Tracked ATV**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**695.3 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,635.0 E 2,104,228.0**	Groundwater Level(s)	**Encountered 8' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									
	2									*Augered to 8' without sampling.*
	3									
	4									2" SCH 40 PVC riser pipe
	5									
690	6									
	7									
	8								▽	
	9	SS	SS-1	2 1 1 1	58			Very loose, wet, light gray with interbedded dark gray fly ash as mostly fine SAND (SP-SM to SM) with interbedded minor sandy SILT (ML) [FLY ASH]		
685	10									
	11									
	12									
	13							becomes mostly sandy silt (ML)		
	14	SS	SS-2	1 0 0 0	67					
	15									
680	16									
	17									
	18									
	19	SS	SS-3	1 0 1 1	58					
	20									

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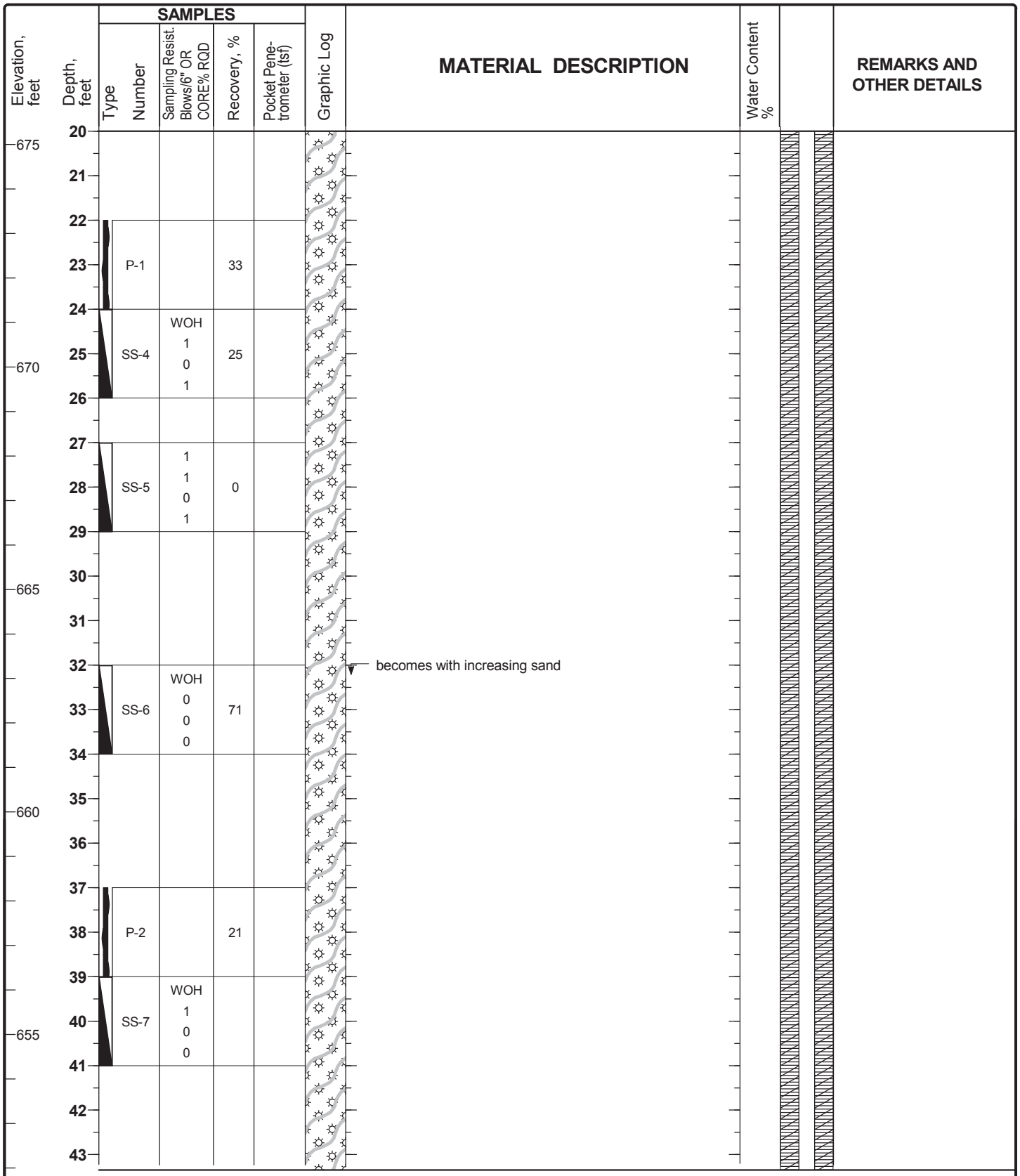
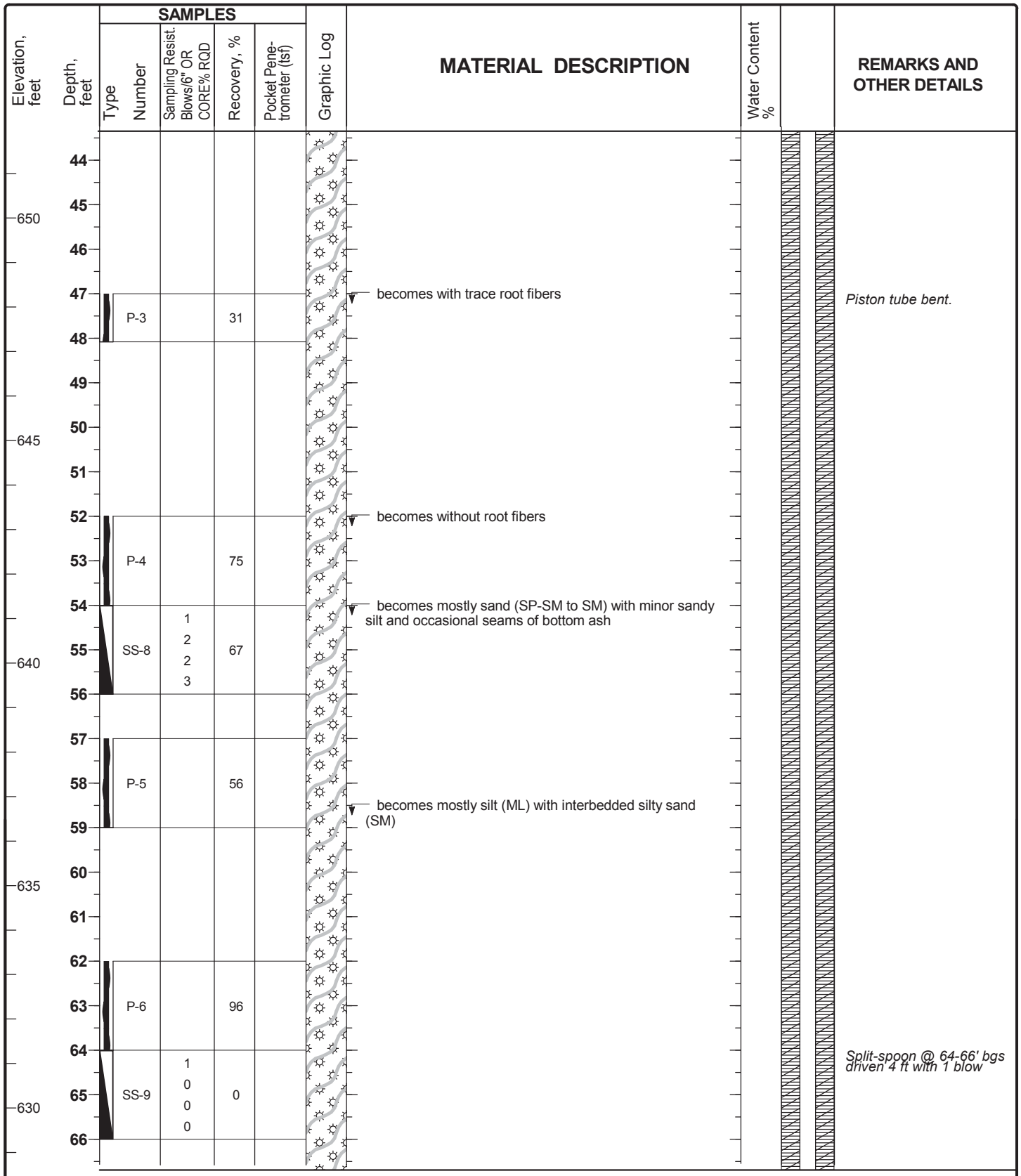
Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69									
625	70									
	71									
	72									
	73		P-7		92					
	74									
	75		SS-10	2 1 3 6	92			becomes interbedded SM/SP/ML with light brown lean clay laminae		
620	76									
	77									
	78		P-8		75			becomes light brown and gray SILT (ML) with interbedded sand (SP-SM to SM), trace grass		
	79									
	80		SS-11	1 1 1 2	0					
615	81									
	82									
	83		P-9		92					
	84							becomes mostly sandy silt (ML)		
	85		SS-12	2 2 2 4	83			becomes mostly fine silty sand (SM)		
610	86									
	87									
	88		P-10		75					
	89							becomes mostly fine silty sand (SM) with minor interbedded sandy silt (ML)		
	90		SS-13	WOR 0	100					*Sample at 89-91' bgs fell to 96' bgs under weight of rods*

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	91	SS	SS-13	0 0	100					
	92									
	93									
	94									
	95									
600	96									
	97	SS	SS-14	WOR 0 0 0	0					*Split-spoon @ 97-99' bgs fell to 101.5' bgs*
	98									
	99									
595	100									
	101									
	102							Medium dense, wet to moist, tan to brown with black staining and oxidation staining, clayey GRAVEL (GC), trace root fibers [ALLUVIUM]		*Gravel is sandstone fragments up to 1/2" diameter*
	103	SS	SS-15	4 6 6 10	25					
	104									
590	105									
	106							Loose, wet, brown with oxidation staining, medium to fine SAND (SP-SM), trace interbedded lean clay [ALLUVIUM]		*Lean clay layers are <1" thick*
	107									
	108	SS	SS-16	3 4 3 2	71				23.7	*%G=0.0 %S=72.5 %F=27.5*
	109									
585	110									
	111							Medium dense, moist, brown with oxidation staining, gray and greenish gray, trace white, clayey SAND (SC) interbedded with silty sand (SM), trace sandstone gravel [ALLUVIUM]		
	112	SS	SS-17	10 9 5	25					
	113									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114	SS-17	4	25					
	115								
580	116								
	117						becomes all clayey sand (SC) with sandstone gravel		
	118	SS-18	12 11 11 11	54			Very stiff, moist, gray to dark brown and greenish gray lean CLAY (CL) with sand, trace sandstone gravel [ALLUVIUM]	15.1	*%G=11.8 %S=53.3 %F=34.9*
	119								
	120						Very dense, moist, variably brown with gray mottling, with oxidation staining, medium to fine SAND (SP-SM), with gravel as sandstone fragments [RESIDUUM]		
575	121								
	122								
	123	SS-19	10 30 33 50/1½"	71				14.1	*%G=11.1 %S=67.8 %F=21.1*
	124						Gray and dark gray shale, moderately weathered, weak		*Hard drilling 124-127' bgs*
	125								
570	126								
	127	SS-20	50/½"	100			becomes silty, dark gray, fresh, medium strong End of Boring at 127´ bgs		*Set PVC casing at 127' bgs. Cement-bentonite grout placed using tremie pipe.*
	128								
	129								
565	130								
	131								
	132								
	133								
	134								
	135								
560	136								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
PB-8

Sheet 1 of 7

Date(s) Drilled	**4/20/12,4/23/12-4/25/12**	Logged By	**T. George**	Checked By	
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**153.0 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**674.0 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 253,100.3 E 2,105,679.0**	Groundwater Level(s)	**3.1 ft ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash splitter dike [BOTTOM ASH]		3.0' stickup Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3								▽	*Drilled to 13' bgs without sampling*
670	4									
	5									
	6									
	7									
	8									
665	9									
	10									
	11									
	12									
	13							Very loose, wet, dark gray, bottom ash as coarse to fine SAND (SP-SM) trace gravel [BOTTOM ASH]		*Split-spoon @ 13' driven with 1 blow to 16'*
660	14	SS-1		1 0 0 0	100					*Bottom ash splitter dike*
	15									
	16									
	17									
	18									*~6" heave noted*
655	19	SS-2		1 0 1 0	100					
	20									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									
	22							becomes loose		
	23	SS	SS-3	5 5 3 1	75			Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		*Bottom of splitter dike @ 23.5' bgs*
650	24									
	25									
	26									
	27	SS	SS-4	1 0 1 1						*Sample @ 27-29' fell 6" to 29.5' bgs*
645	29									
	30									
	31									
	32									
	33	P	P-1		88			becomes very loose, wet, gray, SILT (ML) with fine sand		
640	34									*Split-spoon @ 34'-36' WOR from 34'-41' bgs*
	35	SS	SS-5	WOR 0 0 0	0					
	36									
	37									
	38									
635	39									
	40									
	41									
	42							becomes light gray, interbedded with minor silty sand (SM)		
	43	SS	SS-6	1 0 0	8					*Split-spoon @ 42-44' 1 blow drives spoon 4 ft to 46' bgs*

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
630	44	SS-6	0	8					
	45								
	46								
	47						becomes mostly silty sand (SM) with interbedded sandy silt (ML)		*At 47-49' bgs rods fell 13' from 47-60' bgs*
	48	SS-7	WOR 0 0 0	100					
625	49								
	50								
	51								
	52								
	53								
620	54								
	55								
	56								
	57								
	58								
615	59								
	60								
	61								
	62								
	63	P-2		92					
610	64		WOR						*Split-spoon @ 64-66' fell to 67' bgs*
	65	SS-8	0 0 0	100					
	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									*Roller bit to 67'*
	68	SS	SS-9	WOH 0 0 0	33					
605	69									
	70							Very loose, wet, dark gray bottom ash as coarse to medium SAND (SP-SM), trace gravel [BOTTOM ASH]		
	71									
	72									
	73	SS	SS-10	1 1 1 1	33			Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		
600	74									
	75									*Drill rods clogged. Remove and flush.*
	76									
	77									*Bottom of piston tube is fly ash as sandy silt (ML)*
	78	P	P-3		88					
595	79									
	80	SS	SS-11	WOR 0 0 0	0					
	81									
	82									
	83									
590	84									
	85									
	86									
	87									
	88	P	P-4		88					
585	89									
	90	SS	SS-12	WOR 0	0					*Split-spoon @ 89-91' fell to 91.5' bgs*

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES: Type / Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	SS-12	0 0	0					
	92								
	93								
580	94								
	95								
	96								
	97	P-5		96					*Bottom of piston tube is fly ash as silty sand (SM)*
	98								
575	99						becomes loose, interbedded light and dark gray, medium to fine SAND (SP-SM) to silty SAND (SM), with minor interbedded sandy silt [FLY ASH]		
	100	SS-13	2 2 3 2	63					
	101								
	102								
	103								
570	104						becomes very loose, mostly sandy SILT (ML) to silty SAND (SM) with minor interbedded (SP-SM)		
	105								
	106								
	107								
	108	SS-14	1 0 0 1	79					
565	109								
	110								
	111								
	112						becomes mostly silty sand (SM) with minor interbedded sandy silt (ML)		
	113	SS-15	2 1 0	58					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
560	114	SS-15	1	58					
	115								
	116								
	117								
	118	P-6		96					
555	119						becomes mostly sandy silt (ML)		
	120	SS-16	WOR 0 0 0	13					
	121								
	122								
	123								
550	124								
	125								
	126						becomes light gray with interbedded grayish brown mostly sandy SILT (ML) with minor interbedded silty sand, trace decayed plant stems		
	127								*Split-spoon at 127-129' fell to 131' bgs*
	128	SS-17	WOR 0 0 0	88					
545	129								
	130								
	131								*Roller bit dropped to 132' when reinserted at 127'*
	132								
	133						Dense, wet, dark gray, medium to fine silty SAND (SM) with brown sandstone gravel [ALLUVIUM]		*Material is possibly a fill*
540	134								
	135								
	136								

Report: GEO_CR_WELL; File K:\PROJECTS\AAEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:46 AM

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137									
	138	SS	18	20 17 18 21	79					
535	139									
	140							becomes moist, variably brown with gray mottling, trace greenish-gray, trace brownish-red		
	141									
	142									
	143	SS	19	19 17 26 31	79					
530	144									
	145									
	146									
	147									*Split-spoon at 147': 6" recovery appears the same as sample @ 142'. Blow counts may not be representative of material.*
	148	SS	20	21 2 1 11	25			No material in sampler representative of blow counts @ 147.5-149	14.3	*%G=31.4 %S=49.3 %F=19.3*
525	149									
	150									*Drill change at 150'*
	151							becomes with trace decayed vegetation		
	152	SS	21	15 50/1"	100					
	153							Micaceous, silty sandstone, light gray, slightly weathered, weak to medium strong End of Boring at 153´ bgs		*Set PVC casing @ 152.5 ft bgs. Cement-bentonite grout placed using tremie pipe.*
520	154									
	155									
	156									
	157									
	158									
515	159									
	160									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3

Date(s) Drilled	**4/11/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**54.0 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**845.7 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 253,542.1 E 2,102,379.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
845	0	SS-1	50/4"	100			Dense, moist, medium to fine grained SAND (SP) [FILL]			*Road material as weathered sandstone*
	1									
	2									
	3	SS-2	50/5"	100						
	4									
	5	SS-3	50/4"	100						
840	6									
	7									
	8									
	9									
	10									*Shale in cuttings*
835	11									
	12	SS-4	18 31 50/4"	75			Shale, gray brown, highly to completely weathered			
	13									
	14	SS-5	20 50/5"	100						
	15									
830	16									
	17	SS-6	21 36 50/4"	88						
	18									
	19	SS-7	36 50/4"	80			becomes light brown			*Vertical filled fracture noted*
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20										
825	21										
	22	SS	SS-8	35 50/4"	100						
	23										
	24	SS	SS-9	35 50/5"	91						
	25										
820	26	SS	SS-10	50/3"	100						
	27										
	28	SS	SS-11	50/5"	100						
	29							becomes gray			
	30							Dark grey, fine sandstone			*Auger refusal @ 30' bgs*
815	31										
	32							Sandstone, light green, moderately weathered, weak rock - iron staining on fractures Fracture #1: 0, B, Vn, Fe, None, PL, R			
	33							Shale, light gray, moderately weathered, extremely weak			
	34	R	R1	92.4%	87			Sandstone, light gray with iron staining (red), moderately weathered, strong rock			
	35							Shale, light brown, moderately weathered, extremely weak rock becomes dark gray, weak			
810	36							3" sandstone, pebbly, strong			
	37							becomes light brown			
	38							Fracture #2: 90, J, VN, Fe, Sp, IR, R			
	39							Fracture #2			
	40							becomes sandy, gray Fracture #2 Fracture #3: 60, J, VN, Fe, Sp, IR, R Fracture #3			
805	41	R	R2	88.3%	100						
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
	45							Sandstone, gray, moderately weathered, weak, medium grained			
800	46		R2	88.3%	100						
	47							Fracture #4: 45, J, None, None, None, IR, R			
	48										
	49							Light gray shale, extremely weak becomes with sandy laminae			
795	50										
	51		R3	83.3%	80						
	52										
	53										
	54							End of Boring at 54´ bgs			
	55										
790	56										
	57										
	58										
	59										
	60										
785	61										
	62										
	63										
	64										
	65										
780	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**30.0 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**794.0 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,829.7 E 2,101,718.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							Stiff, moist, light brown with gray mottling lean CLAY (CL) [RESIDUUM]			
	1	SS-1		3 4 5 9	21				23.8		
	2							becomes very stiff with no mottling			
	3	SS-2		4 6 10 22	67				20.2		*PL=23 LL=45 PI=22 %F=96.5*
790	4							becomes with gray mottling			
	5	SS-3		5 15 26 50/1"	89			becomes buff to tan, sandy	12.6		
	6							Sandstone, light brown to tan, moderately weathered, strong, mica on split surfaces			
	7										
	8	R1		84.7%	100			Fracture #1: 0, B, VN, CL, Sn, Wa, S, C			
785	9							Shale, brown, extremely weak			
	10							Fracture #2: 90, J, VN, Fe, Fi becomes orange-stained			
	11							1" sandstone, strong becomes with iron staining, orange to gray, extremely weak			
	12	R2		50%	60			Sandstone, dark brown, strong, quartz crystal lined, iron stained			
	13							Fracture #1 Fracture #3: 90, B, VN, Fe, Pa, Ir			
780	14										
	15							becomes fine-grained, iron staining			
	16							Fracture #1 Fracture #3			
	17	R3		56.7%	61			Fracture #3			
	18							Shale, gray to black, extremely weak			
775	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20										
	21										
	22		R3	56.7%	61						
	23										
770	24										
	25							becomes moderately weathered, extremely weak to very weak			
	26										
	27		R4	85%	100			Fracture #4: 90, J, T, None, None, Wa, S			
	28							becomes sandy, weak to very weak, slightly weathered, no fractures			
765	29										
	30							End of Boring at 30´ bgs			
	31										
	32										
	33										
760	34										
	35										
	36										
	37										
	38										
755	39										
	40										
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-6

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**39.3 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**768.8 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,202.5 E 2,102,399.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							1" dark brown topsoil		
	1	SS	SS-1	4 3 7 6	38	2.25		Stiff, moist, light brown with trace dark brown mottling, fat CLAY (CH) [RESIDUUM]		
	2							2" sandstone gravel		
	3	SS	SS-2	2 3 5 11	58	2.25 to 3.25		becomes stiff to very stiff, with brown mottles	26.3	*PL=23 LL=62 PI=37 %F=89.6*
765	4							2" cemented shale with red/orange iron stains		
	5	SS	SS-3	3 5 9 22	83	>4.5		becomes hard		
	6							becomes black	29.5	*PL=30 LL=59 PI=29*
	7									
	8	SS	SS-4	19 25 21 38	96	>4.5		9" coal seam		
760	9							becomes with coal		
	10									
	11	SS	SS-5	12 21 27 50/3"	100	2.5		5 1/2" coal seam becomes stiff, black and gray 2 1/2" coal seam becomes with black coal		
	12									
	13	SS	SS-6	30 50/5"	100			3" coal seam		
755	14							3" shale, light gray, very weathered 3" coal seam Shale, gray with some black partings		
	15	SS	SS-7	49 50/3"	100					
	16									
	17									*Back of spoon wet* *Auger refusal @ 17.2' bgs*
	18							becomes light gray, moderately weathered, weak		
750	19	R	R1	70.7%	97			Fracture #1: 60, V, N, Cl, Fi, Wa, R		
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							Fracture #2: 90, V, N, Cl, Fi, Wa, R			
	21										
	22	R	1	70.7%	97			becomes sandy shale			*Interbedded sandy shale and shale interbeds with sand are 3" to 1/8"; shale beds are 1/8 to 1 1/2" thick*
	23										
745	24										
	25							Fracture #3: 30 to 90, J, N, None, None, Ir, Vr			
	26							Fracture #3			
	27										
	28										
740	29	R	2	61.6%	98			Sandstone, light gray, some lamination, some iron staining, slightly weathered, strong rock			
	30										
	31										
	32										
	33										
735	34										
	35							Shale, gray, moderately weathered, weak rock			
	36										
	37	R	3	100%				Sandy shale, light gray, slightly weathered, strong rock, interbeds of sandy shale and shale			
	38										
730	39										
	40							End of Boring at 39.3´ bgs			
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/Core**	Drill Bit Size/Type	**3 1/4" HSA/3" Core**	Total Depth of Borehole	**29.7 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**850.4 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,280.4 E 2,103,342.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
850	0							Medium stiff, moist, brown, lean CLAY (CL) (topsoil)			
	1		SS-1	4 3 3 8	38	1 2.0		becomes stiff, trace brown mottles [RESIDUUM]			
	2										
	3		SS-2	3 5 8 15	42	3.5 to 4.5		becomes very stiff to hard, light brown with red mottles			
	4										
	5										
845	6		SS-3	10 22 40 50/3"	86	3.5 >4.0		becomes dark red becomes with red mottles	10.4		*PL=19 LL=39 PI=20 %F=71.7*
	7							Shale, sandy, light brown, moderately weathered, weak			
	8										
	9							becomes very weak			
840	10										
	11		R1	15%	29						
	12										
	13										
	14										
	15							becomes shale fragments, moderately weathered, very weak with iron-staining			
835	16										
	17										
	18		R2	0%	18			8" sandstone fragments, brown with iron staining, strong, but fractured vertically and horizontal			
	19										
	20										

Report: GEO_CR_WELL; File K:\PROJECTS\A\AEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:53 AM

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
830	20										
	21										*Shale is mechanically broken-- no fractures observable*
	22		R2	0%	18						
	23										
	24										
	25							becomes brown shale, moderately weathered, weak			*25-27' bgs: shale is soft--mechanically broken No fractures observable*
825	26										
	27		R3	20%	20						
	28										
	29										
	30							End of Boring at 29.7´ bgs			
820	31										
	32										
	33										
	34										
	35										
815	36										
	37										
	38										
	39										
	40										
810	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**49.3 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**711.3 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,071.0 E 2,103,738.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							3" Bottom ash (road fill)			
		SS	SS-1	4 3 5 15	58	3.25 to 3.5		Very stiff, moist, light yellow/brown, lean CLAY (CL) [RESIDUUM]			
710	1							Shale, light yellow brown, with orange red iron oxidation staining, completely to moderately weathered			
	2										
	3	SS	SS-2	9 6 8 13	13						
	4										
	5										
	6	SS	SS-3	9 19 31 34	96						
705	7										
	8	SS	SS-4	11 21 32 50	58			becomes light gray, without iron oxidation			
	9										
	10							becomes with red mottle staining			
	11	SS	SS-5	10 18 47 50/3"	76			becomes red with gray mottles			
700	12										
	13	SS	SS-6	21 49 50/3"	80			2" crushed chert nodules becomes gray with red mottles to light gray			
	14										
	15	SS	SS-7	15 18 50/3"	80			becomes gray with some red mottles			
695	16										
	17										
	18	SS	SS-8	12 50/5"	100			becomes with some orange mottles			
	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							becomes with orange staining			
		SS	SS-9	18 31 50/5"	100						
690	21										
	22							becomes without orange staining, crushed			
	23	SS	SS-10	50/3"	100						
	24										
	25	SS	SS-11	50/5"	100			1" sandstone, gray, crushed			
	26										
685	27										
	28										
	29							Sandstone, gray with zones of iron staining, moderately weathered, medium strong, fine-grained Fracture #1: 10, J, VN, Fe, Su, PL, SR			*Auger refusal @ 28.4' bgs*
	30							Fracture #1			
	31	R	R1	85.7%	95			Fracture #1			
680	32										
	33										
	34										
	35							becomes with shale fragments			
	36							becomes sandstone massive with orange Fe staining			
675	37							Fracture #1			
	38							shale, orange concretion			
	39	R	R2	93.3%	100			becomes gray, slightly weathered, strong, no fractures			
	40										
	41										
670	42							becomes slightly weathered to fresh, strong, medium-grained			
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R2	93.3%	100			becomes with orange staining			*No natural fractures*
	45										
	46										
665	47		R3	100%	100						
	48										
	49							End of Boring at 49.3´ bgs			
	50										
	51										
660	52										
	53										
	54										
	55										
	56										
655	57										
	58										
	59										
	60										
	61										
650	62										
	63										
	64										
	65										
	66										
645											

2010 INITIAL BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

FRONTZ DRILLING
WOOSTER, OHIO

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1007

Date: 11/19/2010 **Proj. No.:** E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Reitz
Surface Elevation: 692'
Total Depth: 90' **Diameter:**
Comments:

Project: Big Sandy
Location:
Driller:
Drilling Method: Air Rotary
Top of Casing Elevation:
Sampling Method:

Depth (feet)	REC / RQD	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
10.0				Yellow brown Sandstone
20.0		S1		
30.0		S2		
		S3		
40.0		S4		
		S5		Yellow brown fine to coarse sandstone, minor limonite (added water when groundwater encountered at approximatley 49' bgs)
50.0		S6		color to light gray
		S7		color to yellow brown
60.0		S8		
		S9		color to light gray
70.0		S10		
		S11		
80.0		S12		Gray Shale and Coal (black sheen in return water)
90.0				
100.0				
110.0				
120.0				
130.0				
140.0				
150.0				

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1007

Date: 11/23/2010 Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Retz
Surface Elevation:
Total Depth: 200' Diameter: 6"-15"
Comments:

Project: Big Sandy
Location: Louiza, Ky
Driller:
Drilling Method: Sonic/HQ core
Top of Casing Elevation:
Sampling Method:

Depth (feet)	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
160.0			Medium gray medium to very coarse Sandstone
170.0			
180.0			
190.0			
200.0			
210.0			
220.0			
230.0			

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER BS-CL-2133

COMPANY Frontz Drilling, Inc.

PROJECT Big Sandy Plant

COORDINATES 38.18628 N -82.63430 W

SYSTEM GPS

WELL No KY6555 BORING No. MW-1007 INSTALLED 12-7-10

GROUND ELEVATION FT 692

AEP supplied

TOP RISER: FT 2

GROUT SEAL: Bentonite Grout

Bariod Quick-Grout

BENTONITE SEAL: Bentonite Pellets

3/8" Pel Plug TR 30/60

SCREEN: dia., 2"x3-1/2" PrePack

PVC .007 & .010 slot

GRAVEL PACK: #7 in PrePack

#4 Borehole

RISER PIPE: , dia , 2" Sch. 40 PVC

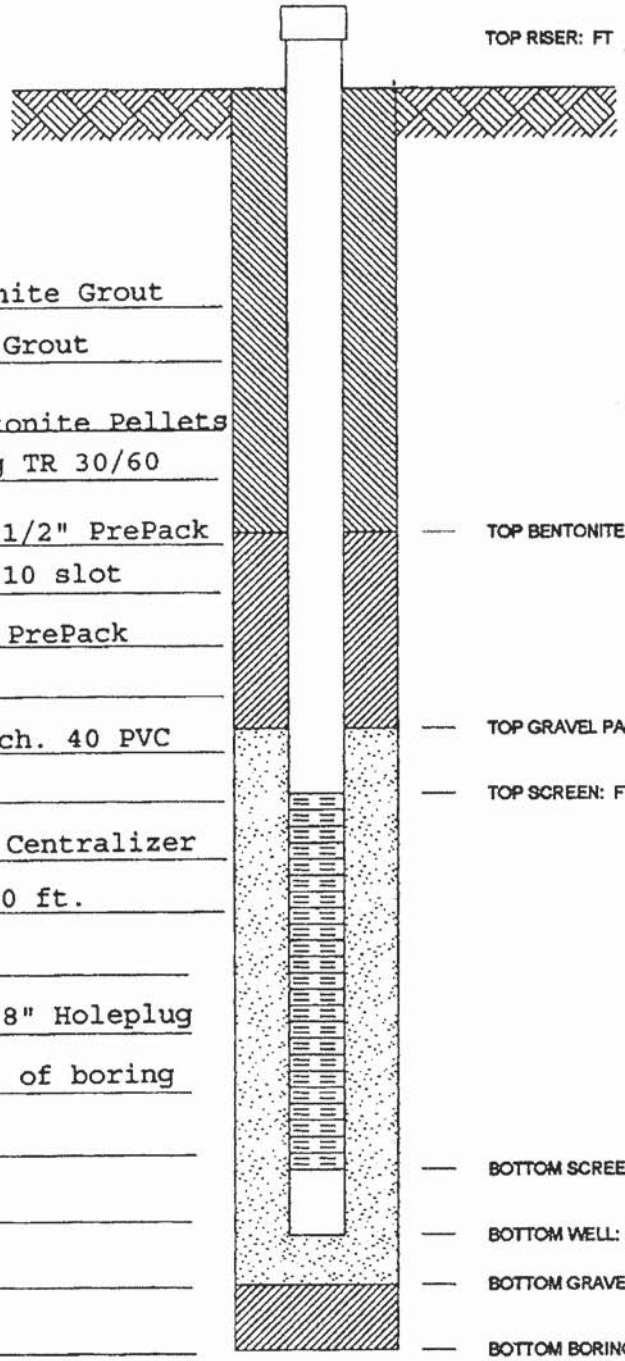
SPACERS, DEPTH: PVC Centralizer

77 ft. and 40 ft.

Notes:

Bentonite 3/8" Holeplug

Bottom 8 ft. of boring



TOP BENTONITE SEAL: FT 40

TOP GRAVEL PACK: FT 45

TOP SCREEN: FT 47

BOTTOM SCREEN: FT 77

BOTTOM WELL: FT 77

BOTTOM GRAVEL PACK: FT 78

BOTTOM BORING: FT 86

BLANK_MONT_WELL_LOG CIVIL LAB.GPJ AEP.GDT 11/24/09

FRONTZ DRILLING
WOOSTER, OHIO

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1008

Date: 11/17/2010 Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Reitz
Surface Elevation:
Total Depth: 120' Diameter:
Comments:

Project: Big Sandy
Location:
Driller:
Drilling Method: Air Rotary
Top of Casing Elevation:
Sampling Method:

Depth (feet)	REC / RQD	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
		S1		Yellow brown silty Clay
		S2		color to yellow gray
10.0		S3		
		S4		color to yellow brown Sandstone
20.0		S5 ▼		Groundwater encountered at approximately 25' bgs
		S6		
30.0		S7		
		S8		Medium gray Shale
40.0		S9		
		S10		
50.0		S11		Same as above with fine sand
		S12		
60.0		S13		Medium gray Sandstone
		S14		
70.0		S15		
		S16		
80.0		S17		
		S18		
90.0		S19		
		S20		color to light gray Sandstone
100.0		S21		Medium gray Shale
		S22		Possible coal (black sheen in return water)
110.0		S23		
120.0				
130.0				
140.0				
150.0				

FRONTZ DRILLING
WOOSTER, OHIO

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1008

Date: 11/23/2010 Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Retz
Surface Elevation:
Total Depth: 200' Diameter: 6"-15"
Comments:

Project: Big Sandy
Location: Louiza, Ky
Driller:
Drilling Method: Sonic/HQ core
Top of Casing Elevation:
Sampling Method:

Depth (feet)		Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
160.0				Medium gray medium to very coarse Sandstone
170.0				
180.0				
190.0				
200.0				
210.0				
220.0				
230.0				

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER BS-CL-2133

COMPANY Frontz Drilling, Inc.

PROJECT Big Sandy Plant

COORDINATES 38.18657 N -82.63066 W

SYSTEM GPS

WELL No KY6556 BORING No. MW-1008 INSTALLED 12-7-10

GROUND ELEVATION FT 725

AEP supplied

TOP RISER: FT 2

GROUT SEAL: Bentonite Grout

Bariod Quick-Grout

BENTONITE SEAL: Bentonite Pellets

3/8" Pel Plug TR 30/60

SCREEN: dia., 2"x3-1/2" PrePack

PVC .007 & .010 slot

GRAVEL PACK: #7 in PrePack

#4 Borehole

RISER PIPE: , dia., 2" Sch. 40 PVC

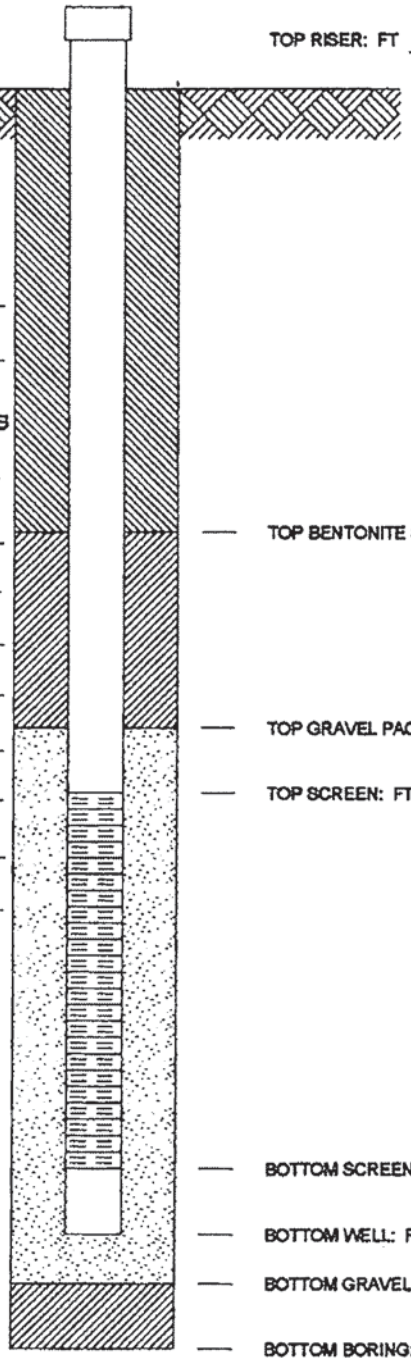
SPACERS, DEPTH: PVC Centralizer

100 ft. and 50 ft.

Notes:

Bentonite 3/8" Holeplug

Bottom 11 ft. of Boring



TOP BENTONITE SEAL: FT. 53

TOP GRAVEL PACK: FT. 58

TOP SCREEN: FT. 60

BOTTOM SCREEN: FT 100

BOTTOM WELL: FT. 100

BOTTOM GRAVEL PACK: FT. 102

BOTTOM BORING: FT 113

BLANK_MONT_WELL_LOG CIVIL LAB.GPJ AEP.GDT 11/24/09

FRONTZ DRILLING
WOOSTER, OHIO

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1009

Date: 11/18/2010 Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Reitz
Surface Elevation:
Total Depth: 124' Diameter:
Comments:

Project: Big Sandy
Location:
Driller:
Drilling Method: Air Rotary
Top of Casing Elevation:
Sampling Method:

Depth (feet)	REC / RQD	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
10.0		S1		Yellow brown Sandstone
20.0		S2		
		S3		
30.0		S4		
		S5		
40.0		S6		Gray Shale
		S7		Yellow brown Sandstone
50.0		S8		Gray Shale
		S9		
60.0		S10		
		S11		Water encountered at approximately 68' bgs; (added water, black sheen in return)
70.0		S12		Possible coal
		S13		
80.0		S14		Light gray Sandstone
		S15		
90.0		S16		Color grades to medium gray
		S17		Possible coal
100.0		S18		Medium gray Shale
		S19		
110.0		S20		
		S21		
120.0		S22		
130.0				
140.0				
150.0				

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1009

Date: 11/23/2010 **Proj. No.:** E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Retz
Surface Elevation:
Total Depth: 200' **Diameter:** 6"-15"
Comments:

Project: Big Sandy
Location: Louiza, Ky
Driller:
Drilling Method: Sonic/HQ core
Top of Casing Elevation:
Sampling Method:

Depth (feet)		Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
80.0				Medium gray medium to very coarse Sandstone

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER BS-CL-2133

COMPANY Frontz Drilling, Inc.

PROJECT Big Sandy Plant

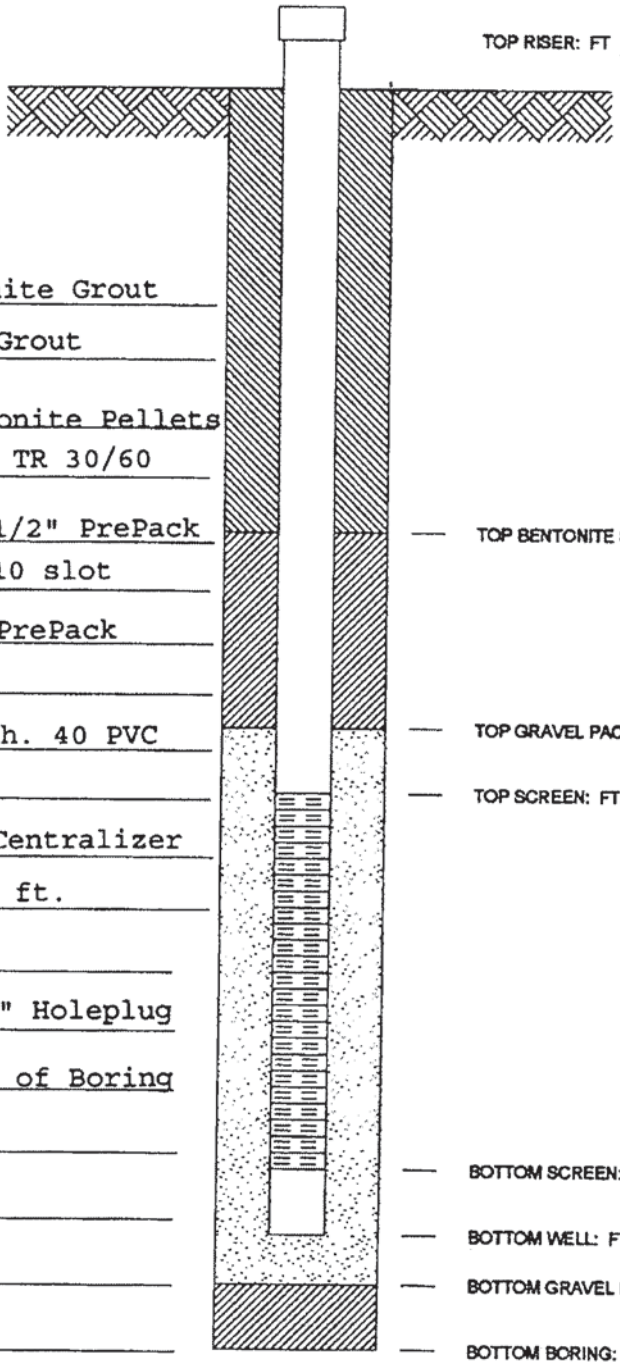
COORDINATES 38.17955 N -82.62633 W

SYSTEM GPS

WELL No KY6557 BORING No. MW-1009 INSTALLED 12-7-10

GROUND ELEVATION FT 733

AEP supplied



TOP RISER: FT 2

GROUT SEAL: Bentonite Grout

Bariod Quick-Grout

BENTONITE SEAL: Bentonite Pellets

3/8" Pel Plug TR 30/60

SCREEN: dia., 2"x3-1/2" PrePack

PVC .007 & .010 slot

GRAVEL PACK: #7 in PrePack

#4 Borehole

RISER PIPE: , dia , 2" Sch. 40 PVC

SPACERS, DEPTH: PVC Centralizer

85 ft. and 55 ft.

TOP BENTONITE SEAL: FT 58

TOP GRAVEL PACK: FT 63

TOP SCREEN: FT 65

BOTTOM SCREEN: FT 85

BOTTOM WELL: FT 85

BOTTOM GRAVEL PACK: FT 87

BOTTOM BORING: FT 124

Notes:

Bentonite 3/8" Holeplug

Bottom 37 ft. of Boring

BLANK_MONT_WELL_LOG CIVIL LAB.GPJ AEP.GDT 11/24/09

FRONTZ DRILLING
WOOSTER, OHIO

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1010

Date: _____ Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Reitz
Surface Elevation: _____
Total Depth: 200' Diameter: _____
Comments:

Project: Big Sandy
Location: _____
Driller: _____
Drilling Method: Air Rotary
Top of Casing Elevation: _____
Sampling Method: _____

Depth (feet)	REC / RQD	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
10.0		S1		Red gray Sandstone
		S2		
20.0		S3		
		S4		
30.0		S5		Medium gray Shale
		S6		Coal
40.0		S7		Medium gray Shale
		S8		
50.0		S9		
		S10		
60.0		S11		
		S12		
70.0		S13		
		S14		
80.0		S15		Coal with carbonaceous Shale
		S16		Medium gray Shale
90.0		S17		
		S18		
100.0		S19		Same as above with some sand
		S20		
110.0		S21		
		S22		
120.0		S23		
		S24		
130.0		S25		
		S26		
140.0		S27		Medium gray Shale
		S28		
150.0				

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: B-1010

Date: Proj. No.: E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Retz
Surface Elevation:
Total Depth: 200' Diameter:
Comments:

Project: Big Sandy
Location: Louiza, Ky
Driller:
Drilling Method: Air Rotary
Top of Casing Elevation:
Sampling Method:

Depth (feet)	Sample #	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)
	S29		
	S30		
160.0			
	S31		
	S32		Gray Sandstone
170.0			Gray Shale
	S33		
	S34		
180.0			
	S35		
	S36		
190.0			
	S37		Same as above with some sand
	S38		
200.0			
210.0			

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER BS-CL-2133

COMPANY Frontz Drilling, Inc.

WELL No. KY6558 BORING No. MW-1010 INSTALLED 12-6-10

PROJECT Big Sandy Plant

COORDINATES 38.17721 N -82.63093 W

SYSTEM GPS

GROUND ELEVATION FT. 849

AEP supplied

TOP RISER: FT 2

GROUT SEAL: Bentonite Grout

Bariod Quick-Grout

BENTONITE SEAL: Bentonite Pellets

3/8" Pel Plug TR 30/60

SCREEN: dia., 2"x3-1/2" PrePack

PVC .007 & .010 slot

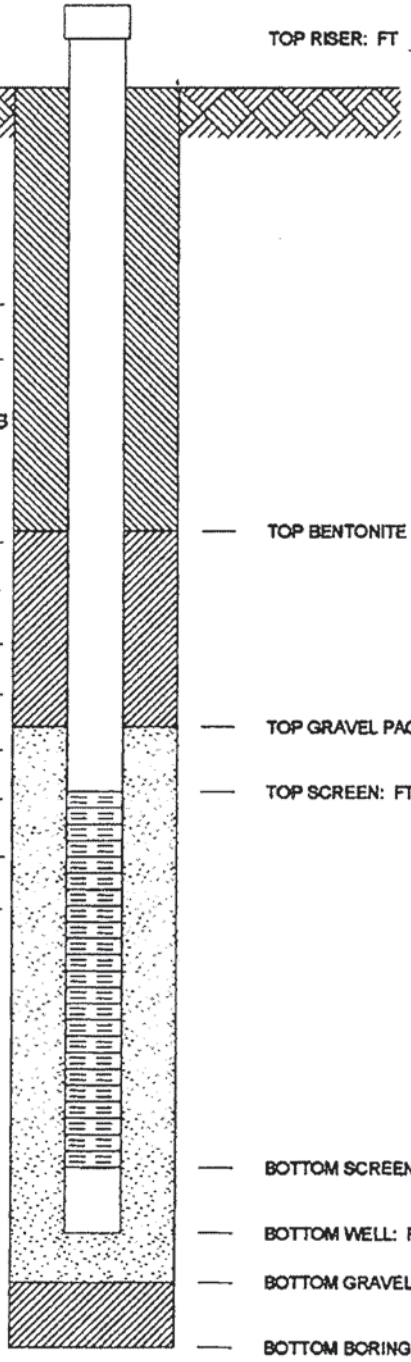
GRAVEL PACK: #7 in PrePack

#4 Borehole

RISER PIPE: , dia., 2" Sch. 40 PVC

SPACERS, DEPTH: PVC Centralizer

100 ft, 160 ft, 200 ft



TOP BENTONITE SEAL: FT. 163

TOP GRAVEL PACK: FT 168

TOP SCREEN: FT. 170

BOTTOM SCREEN: FT. 200

BOTTOM WELL: FT. 200

BOTTOM GRAVEL PACK: FT 201

BOTTOM BORING: FT. 245

Notes:

Bentonite 3/8" Holeplug

Bottom 44 ft. of boring

BLANK_MONT_WELL_LOG CIVIL LAB.GPJ AEP.GDT 11/24/09

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: 1011

Date: 11/16 to 11/18 2010 **Proj. No.:** E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Reitz
Surface Elevation: 685'
Total Depth: 80' **Diameter:**
Comments:

Project: Big Sandy
Location: Ash pond (south)
Driller:
Drilling Method: Sonic/HQ core
Top of Casing Elevation:
Sampling Method:

Depth (feet)	REC / RQD	Well Construction	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)	Sample Number
				Fill	
				Mottled very light gray and red Clay	
5.0				mottled medium red brown and light gray weathered Shale	
				Light gray Clay with limonite stains and yellow brown very fine sand, silty	
10.0				Gray brown very fine Sand, some yellow brown clay	
				Light yellow brown silty Clay; medium gray shale with limonite beds	
15.0	1' / 0%			Dark gray green Shale pieces	
20.0				Dark gray green wethered Shale	
25.0	8' / 50%				
30.0				Grades to medium gray medium to coarse Sandstone	
35.0	8.8' / 51%				
40.0				Same as above with limonite staining	
45.0	8.4' / 78%				
50.0					
55.0	10' / 71%			Medium gray fine to coarse Sandstone; fine interbedded medium gray shale and medium to coarse sandstone	
60.0				Meduim gray coarse to very coarse Sandstone Carbonaceous lens at 62.6 to 63.1	
65.0	9.9' / 53%			Medium gray medium to coarse Sandstone, grades to very coarse Sandstone	
70.0					
75.0	9.7' / 47%			Dark gray Shale lens	

Frontz Drilling, Inc.
2031 Millersburg Road
Wooster, Ohio 44691
330-263-5301

Soil Boring Log

Boring No: 1011

Date: 11/23/2010 **Proj. No.:** E10028
Client: AEP
Drilling Company: Frontz Drilling, Inc.
Logged By: Larry Retz
Surface Elevation:
Total Depth: 200' **Diameter:** 6"-15"
Comments:

Project: Big Sandy
Location: Louiza, Ky
Driller:
Drilling Method: Sonic/HQ core
Top of Casing Elevation:
Sampling Method:

Depth (feet)		Well Construction	Lithology	Description/Soil Classification (Color, Texture, Moisture, Structures)	Sample Number
80.0	9.7' / 47%			Medium gray medium to very coarse Sandstone	

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER BS-CL-2133

COMPANY Frontz Drilling, Inc.

PROJECT Big Sandy Plant

COORDINATES 38.17819 N -82.63071 W

SYSTEM GPS

WELL No KY6559 BORING No. MW1011 INSTALLED 12-8-10

GROUND ELEVATION FT. 685

AEP supplied

TOP RISER: FT 2

GROUT SEAL: Bentonite Grout

Bariod Quick-Grout

BENTONITE SEAL: Bentonite Pellets

3/8" Pel Plug TR 30/60

SCREEN: dia., 2"x3-1/2" PrePack

PVC .007 & .010 slot

GRAVEL PACK: #7 in PrePack

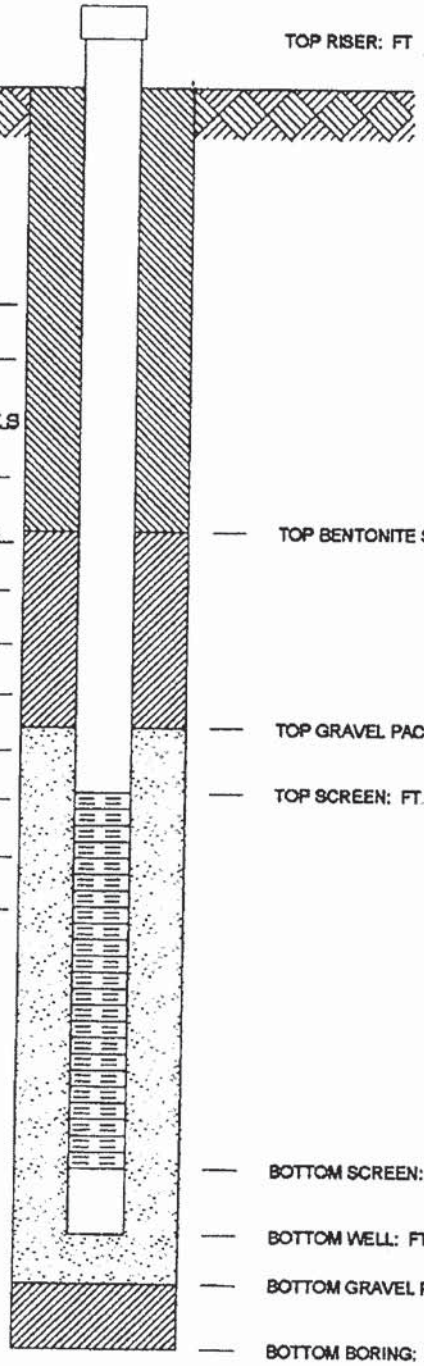
#4 Borehole

RISER PIPE: , dia., 2" Sch. 40 PVC

SPACERS, DEPTH: PVC Centralizer

75 ft

Notes:



TOP BENTONITE SEAL: FT. 28

TOP GRAVEL PACK: FT. 33

TOP SCREEN: FT. 35

BOTTOM SCREEN: FT. 75

BOTTOM WELL: FT. 75

BOTTOM GRAVEL PACK: FT. 81

BOTTOM BORING: FT. 81

BLANK_MONT_WELL_LOG CIVIL LAB.GPJ AEP.GDT 11/24/09

2010 REVISED BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **BIG SANDY**

COORDINATES _____

GROUND ELEVATION **692.0** SYSTEM _____

WATER LEVEL	▽	▼	▼
TIME			
DATE			

BORING NO **MW-1007** DATE **2/11/15** SHEET **1** OF **2**

BORING START **12/7/10** BORING FINISH **12/7/10**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **47** BOTTOM **77**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG _____

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										BROWN SANDSTONE		
							5					
							10					
							15					
							20					
							25					
							30					
							35					
							40					
							45					

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER _____

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO **MW-1007** DATE **2/11/15** SHEET **2** OF **2**

PROJECT **BIG SANDY** BORING START **12/7/10** BORING FINISH **12/7/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							55					
							60					
							65			GRAY SANDSTONE		
							70					
							75					
							80			GRAY SHALE & COAL		
							85					

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **BIG SANDY**

COORDINATES _____

GROUND ELEVATION **725.0** SYSTEM _____

WATER LEVEL	▽	▼	▼
TIME			
DATE			

BORING NO **MW-1008** DATE **2/11/15** SHEET **1** OF **2**

BORING START **12/7/10** BORING FINISH **12/7/10**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **60** BOTTOM **100**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG _____

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							5			BROWN SILTY CLAY		
							10			BROWN SANDSTONE		
							15					
							20					
							25					
							30					
							35			GRAY SHALE		
							40					
							45					

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER _____

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-1008** DATE **2/11/15** SHEET **2** OF **2**

PROJECT **BIG SANDY** BORING START **12/7/10** BORING FINISH **12/7/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							55			GRAY SANDSTONE & SHALE		
							60			BROWN SANDSTONE		
							65					
							70					
							75					
							80					
							85					
										GRAY STANDSTONE		
										GRAY SHALE		

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **BIG SANDY**

COORDINATES _____

GROUND ELEVATION **733.0** SYSTEM _____

WATER LEVEL	▽	▼	▼
TIME			
DATE			

BORING NO **MW-1009** DATE **2/11/15** SHEET **1** OF **3**

BORING START **12/7/10** BORING FINISH **12/7/10**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **65** BOTTOM **85**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG _____

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							5			BROWN SANDSTONE		
							10					
							15					
							20					
							25					
							30					
							35					
							40			GRAY SHALE		
							45			BROWN SANDSTONE		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER _____

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-1009** DATE **2/11/15** SHEET **2** OF **3**

PROJECT **BIG SANDY** BORING START **12/7/10** BORING FINISH **12/7/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							55			GRAY SHALE		
							60					
							65					
							70					
							75					
							80					
							85			GRAY SANDSTONE		
							90			GRAY SHALE		
							95					
							100					
							105					
							110					

Continued Next Page

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-1009** DATE **2/11/15** SHEET **3** OF **3**

PROJECT **BIG SANDY** BORING START **12/7/10** BORING FINISH **12/7/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							120					

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **BIG SANDY**

COORDINATES _____

GROUND ELEVATION **849.0** SYSTEM _____

WATER LEVEL	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-1010** DATE **2/11/15** SHEET **1** OF **4**

BORING START **12/6/10** BORING FINISH **12/6/10**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **170** BOTTOM **200**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG _____

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							5			GRAY SANDSTONE		
							10					
							15					
							20					
							25					
							30			GRAY SHALE W/COAL		
							35					
							40					
							45			GRAY SHALE		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER _____

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO **MW-1010** DATE **2/11/15** SHEET **2** OF **4**

PROJECT **BIG SANDY** BORING START **12/6/10** BORING FINISH **12/6/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							55					
							60					
							65					
							70					
							75					
							80			BLACK COAL		
							85			GRAY SHALE		
							90					
							95					
							100					
							105			GRAY SHALE & SANDSTONE		
							110					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO **MW-1010** DATE **2/11/15** SHEET **3** OF **4**

PROJECT **BIG SANDY** BORING START **12/6/10** BORING FINISH **12/6/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							120					
							125					
							130					
							135			GRAY SHALE		
							140					
							145					
							150					
							155					
							160					
							165			GRAY SANDSTONE		
							170			GRAY SHALE		
							175					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO **MW-1010** DATE **2/11/15** SHEET **4** OF **4**

PROJECT **BIG SANDY** BORING START **12/6/10** BORING FINISH **12/6/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							185					
							190					
							195					
							200					
							205			GRAY SANDSTONE		
							210			BLACK COAL		
							215			GRAY SHALE		
							220					
							225					
							230					
							235					
							240					

AEP BS FAP.GPJ AEP.GDT 2/11/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **BIG SANDY**

COORDINATES **N 251,056.6 E 2,105,873.3**

GROUND ELEVATION **716.2** SYSTEM **State Plane using NAD83/88**

Water Level, ft			
TIME			
DATE			

BORING NO. **MW-1011** DATE **11/19/15** SHEET **1** OF **1**

BORING START **12/6/10** BORING FINISH **12/6/10**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **2.63** DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **35** BOTTOM **75**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							0			FILL		
							5			RED CLAY		
							10			GRAY AND BROWN SHALE		
							15			GRAY SHALE		
							20					
							25					
							30			GRAY SANDSTONE W/SHALE		
							35					
							40					
							45					
							50					
							55					
							60					
							65					
							70					
							75			GRAY SANDSTONE		
							80					

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER

AEP BS FAP.GPJ AEP.GDT 11/19/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **BIG SANDY**

COORDINATES **N 249,566.1 E 2,103,715.6**

GROUND ELEVATION **787.9** SYSTEM **State Plane using NAD83/88**

Water Level, ft			
TIME			
DATE			

BORING NO. **MW-1012** DATE **11/19/15** SHEET **1** OF **2**

BORING START **12/8/10** BORING FINISH **12/8/10**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **2.65** DIA **5.78**

DEPTH TO TOP OF WELL SCREEN **110** BOTTOM **140**

WELL DEVELOPMENT **Yes** BACKFILL **Grout**

FIELD PARTY **Frontz Drilling** RIG

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							5			SOIL BROWN SHALE		
							10					
							15					
							20					
							25					
							30					
							35			GRAY SHALE		
							40					
							45					
							50					
							55					
							60					
							65					
							70					
							75					
							80					
							85					
							90					
							95					
							100					
							105					
							110			GRAY SANDSTONE & SHALE		
							115					
							120					

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
X	AIR HAMMER	8"

Continued Next Page

PIEZOMETER TYPE: PT = OPEN TUBE POROUS TIP, SS = OPEN TUBE SLOTTED SCREEN, G = GEONOR, P = PNEUMATIC

WELL TYPE: OW = OPEN TUBE SLOTTED SCREEN, GM = GEOMON

RECORDER

AEP BS FAP.GPJ AEP.GDT 11/19/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-1012** DATE **11/19/15** SHEET **2** OF **2**

PROJECT **BIG SANDY** BORING START **12/8/10** BORING FINISH **12/8/10**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
							130			GRAY SANDSTONE		
							135					
							140					
							145			GRAY SHALE & SANDSTONE		
							150					
							155					
							160					
							165					
							170					
							175					
							180					
							185					
							190					
							195					
							200					
							205					
							210					

AEP BS FAP.GPJ AEP.GDT 11/19/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

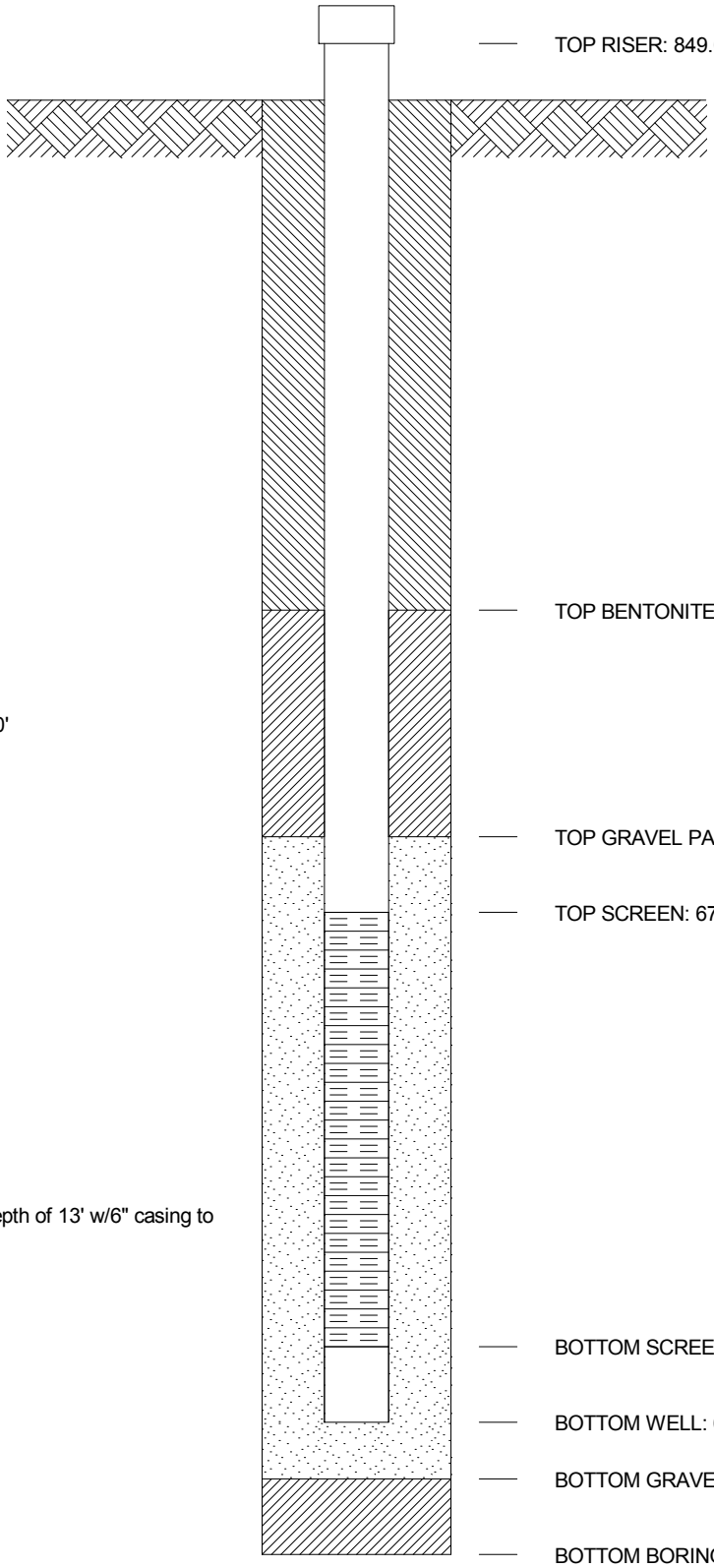
COMPANY _____ WELL No. **MW-1010** BORING No. **MW-1010** INSTALLED **12/8/10**

PROJECT **BIG SANDY**

COORDINATES **N 250,692.0 E 2,105,790.1**

SYSTEM **State Plane using NAD83/88**

GROUND ELEVATION 846.42 FT.



GROUT SEAL: Bentonite

BENTONITE SEAL: Grout

SCREEN: 2" dia., PVC .010, 30'

GRAVEL PACK:

RISER PIPE: , dia., PVC

SPACERS, DEPTH:

Notes: KY Well #6558
Temporary 7.25" borehole to depth of 13' w/6" casing to depth of 14'

GEOMCNST BS FAP.GPJ AEP.GDT 11/1/16

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

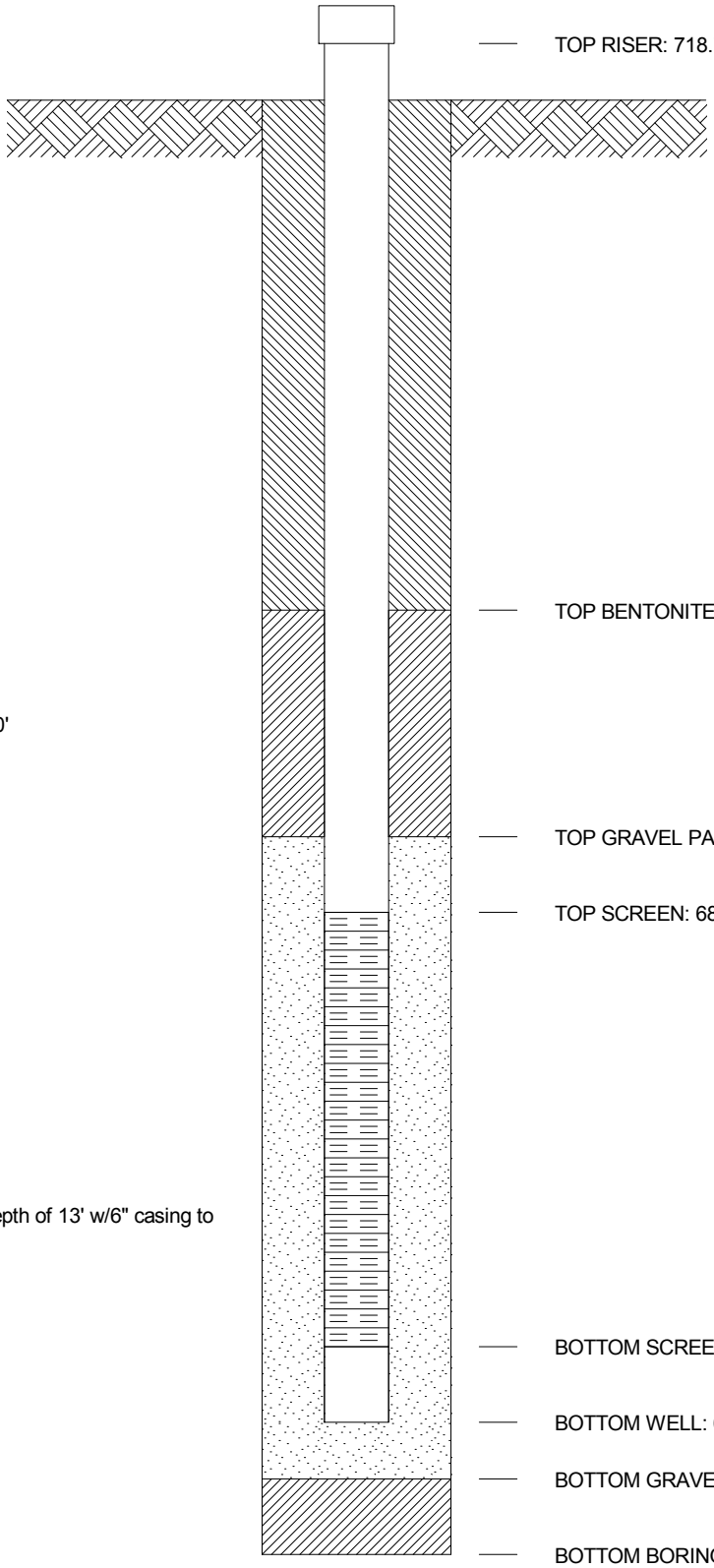
COMPANY _____ WELL No. **MW-1011** BORING No. **MW-1011** INSTALLED **12/6/10**

PROJECT **BIG SANDY**

COORDINATES **N 251,056.6 E 2,105,873.3**

SYSTEM **State Plane using NAD83/88**

GROUND ELEVATION 716.15 FT.



GROUT SEAL: Bentonite

BENTONITE SEAL: Grout

SCREEN: 2" dia., PVC .010, 30'

GRAVEL PACK:

RISER PIPE: , dia., PVC

SPACERS, DEPTH:

Notes: KY Well #6559
Temporary 7.25" borehole to depth of 13' w/6" casing to depth of 14'

GEOMCNST BS FAP.GPJ AEP.GDT 11/19/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

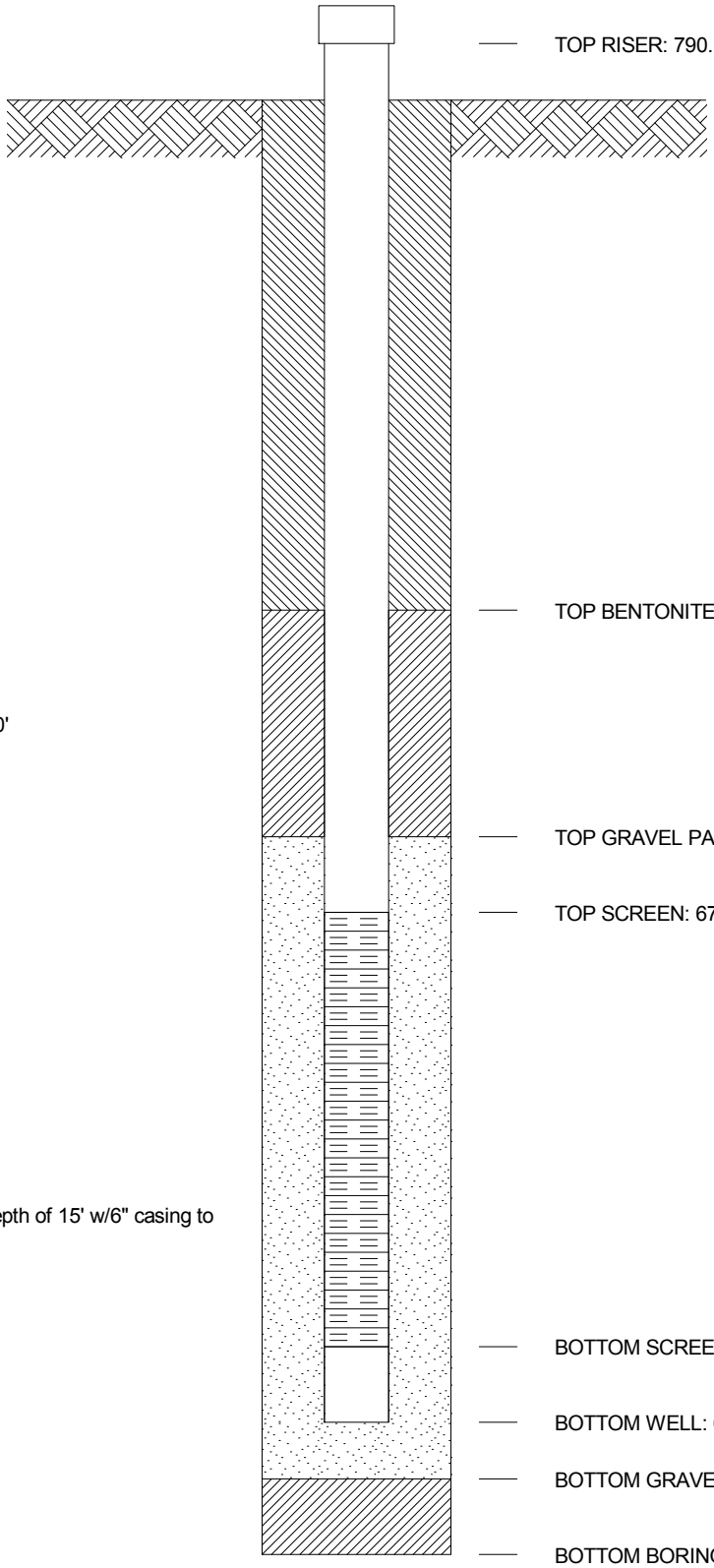
COMPANY _____ WELL No. **MW-1012** BORING No. **MW-1012** INSTALLED **12/8/10**

PROJECT **BIG SANDY**

COORDINATES **N 249,566.1 E 2,103,715.6**

SYSTEM **State Plane using NAD83/88**

GROUND ELEVATION 787.91 FT.



GROUT SEAL: Bentonite

BENTONITE SEAL: Grout

SCREEN: 2" dia., PVC .010, 30'

GRAVEL PACK:

RISER PIPE: , dia., PVC

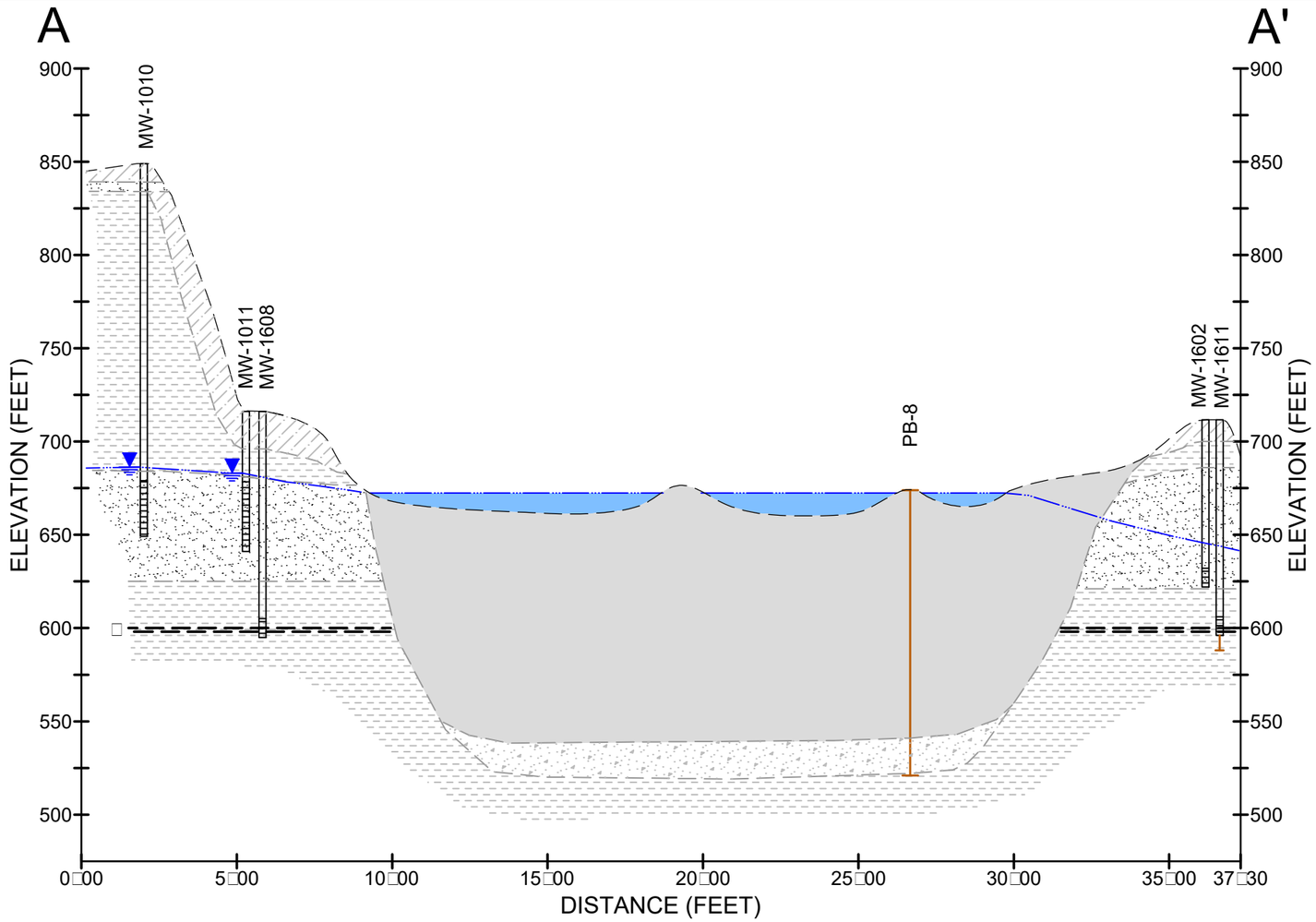
SPACERS, DEPTH:

Notes: KY Well #6561
Temporary 7.25" borehole to depth of 15' w/6" casing to depth of 16'

GEOMCNST BS FAP.GPJ AEP.GDT 11/19/15

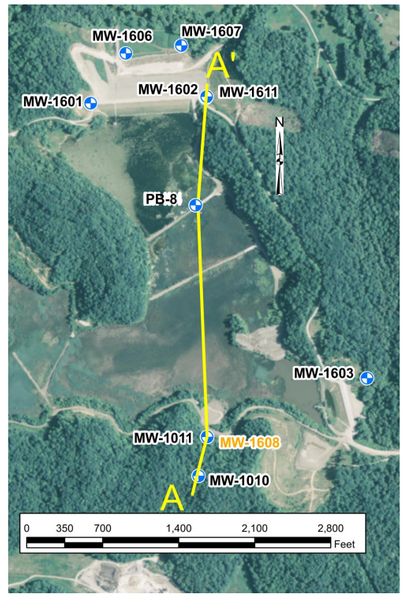
APPENDIX C

SUPPLEMENTAL DOCUMENTATION FROM 2016 INVESTIGATION



LEGEND

- RESIDUAL SOIL: CLAY, SILT AND SAND
- ASH
- SHALE
- SANDSTONE
- ALLUVIUM: SILTY SAND WITH GRAVEL, CLAY
- COAL /CARBON RICH SHALE
- EXISTING GROUND SURFACE
- WATER TABLE SURFACE
- SOIL BORING
- MONITORING WELL



KEY MAP

NOTES:

1. SUBSURFACE LITHOLOGIC ELEVATIONS BETWEEN BORINGS ARE INTERPRETED BASED ON AVAILABLE INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE.
2. GROUNDWATER ELEVATIONS WERE MEASURED ON JULY 13, 2016. GROUNDWATER ELEVATIONS IN MW-1010, MW-1011 AND MW-1603 WERE MEASURED ON A DIFFERENT DATE.
3. SOIL BORING PB-8 AND MONITORING WELLS MW-1010 AND MW-1011 DATA WERE OBTAINED FROM FINAL REPORT HYDROGEOLOGIC SITE INVESTIGATION (URS, □UNE 2013)

0 450' 900'
SCALE IN FEET (HORI□ONTAL)

0 75' 150'
SCALE IN FEET (VERTICAL)
VERTICAL EXAGGERATION □ 6X

GEOLOGIC CROSS SECTION A-A'

BIG SANDY FLY ASH POND
LOUISA, KENTUCKY

Geosyntec consultants

PRO□ECT NO: TX0510 | OCTOBER 2016

FIGURE 1

T: \PROJECTS_CADD\L\LAWRENCE COUNTY – KENTUCKY\FIGURES\TXL0510F002

APPENDIX D

BORING LOGS AND MONITORING WELL CONSTRUCTION DIAGRAMS

FROM THE 2016 INSTALLATIONS

Geosyntec consultants
engineers | scientists | innovators

BORING AND WELL LOG LEGEND

LITHOLOGY	WATER LEVEL	WELL/BORING COMPLETION	SAMPLE TYPE	DESCRIPTION
				ASPHALT
				CONCRETE
				FILL
				TOPSOIL
				COBBLES
				IGNEOUS Rock
				METAMORPHIC Rock
				SEDIMENTARY Rock
				Well-graded GRAVEL (GW)
				Poorly graded GRAVEL (GP)
				Silty GRAVEL (GM)
				Clayey GRAVEL (GC)
				Well-graded GRAVEL with silt (GW-GM)
				Poorly graded GRAVEL with silt (GP-GM)
				Well-graded GRAVEL with clay (GW-GC)
				Poorly graded GRAVEL with clay (GP-GC)
				Well-graded SAND (SW)
				Poorly graded SAND (SP)
				Silty SAND (SM)
				Clayey SAND (SC)
				Well-graded SAND with silt (SW-SM)
				Poorly graded SAND with silt (SP-SM)
				Well-graded SAND with clay (SW-SC)
				Poorly graded SAND with clay (SP-SC)
				SILT (ML)
				Lean CLAY (CL)
				Organic SOIL (OL)
				Elastic SILT (MH)
				Fat CLAY (CH)
				Organic SOIL (OH)
				PEAT (PT)
				Volume Descriptors: Trace = <5% Few = 5-10% Little = 15-25% Some = 30-45% Mostly = >=50%
				Water Level During Drilling Water Level at End of Drilling/in Completed Well
				Cap Riser Screen Cement Bentonite Grout Bentonite Seal Filter Pack Backfill
			GR	Grab
			EN	Encore
			SS	Split Spoon
			SH	Shelby Tube
			CO	Core Barrel
			DP	Direct Push
			ID	Lab Sample and ID

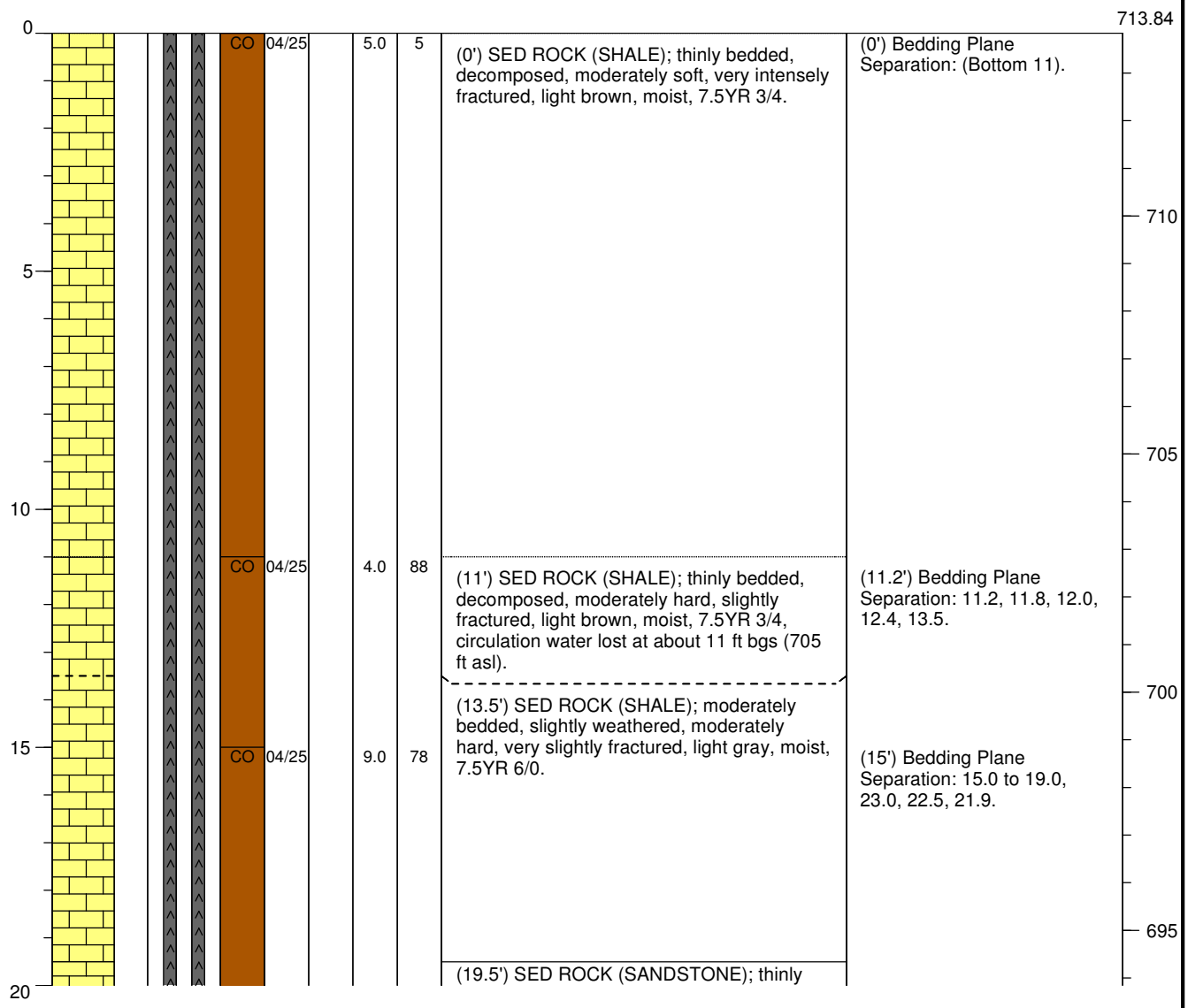
NOTES:

Geosyntec consultants
engineers | scientists | innovators

Client: American Electric Power
Project: Big Sandy Plant
Address: 23000 US-23, Louisa, KY

WELL LOG
Well No. MW-1601
Page: 1 of 5

Drilling Start Date:	04/25/2016	Boring Depth (ft):	84	Well Depth (ft):	77
Drilling End Date:	04/25/2016	Boring Diameter (in):	8	Well Diameter (in):	4
Drilling Company:	Layne	Sampling Method(s):	Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Rock Coring/Air Hammer	DTW During Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	CS1500	DTW After Drilling (ft):	46.0	Screen Material:	Sch 40 PVC Slotted
Driller:	Kimberly Keizer	Top of Casing Elev. (ft msl):	716.59	Seal Material(s):	Bentonite Pellets
Logged By:	Nardos Tilahun	Location (X,Y):	2104798.67, 254131.13*	Filter Pack:	Global Filter Pack #5



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.75 ft above ground surface. Ground surface elevation is 713.84 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1601
Page: 2 of 5

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**84**	Well Depth (ft):	**77**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**46.0**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**716.59**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104798.67, 254131.13***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20									bedded, intensely weathered, moderately hard, slightly fractured, light brown, moist, 7.5YR 3/4.		
				CO	04/25		10.0	95			690
25										(25.1') Bedding Plane Separation: 25.1, 25.9, 26.5, 27.0, 27.2, 27.3, 29.0, 32.2.	
									(28') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, moist, 7.5YR 6/0.		685
30											
				CO	04/25		5.0	25			680
35										(34.7') Bedding Plane Separation: 34.7, 35.3, 35.6 to 39.0.	
									(36') SED ROCK (SHALE); laminated, decomposed, soft, very intensely fractured, light gray, moist, 7.5YR 6/0.		675
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.75 ft above ground surface. Ground surface elevation is 713.84 ft MSL.

Geosyntec consultants
engineers | scientists | innovators

Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1601
Page: 3 of 5

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**84**	Well Depth (ft):	**77**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**46.0**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**716.59**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104798.67, 254131.13***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
40											
				CO	04/25		4.0	50		(44') Bedding Plane Separation: 44.0 to 49.0.	670
45		▼									
				CO	04/25		4.0	20	(49') SED ROCK (COAL); laminated, moderately weathered, moderately soft, moderately fractured, black, moist, 7.5YR 2/0.	(49') Bedding Plane Separation: 49.0 to 54.0.	665
50									(49.5') SED ROCK (SHALE); laminated, decomposed, soft, very intensely fractured, light gray, moist, 7.5YR 6/0.		
				CO	04/25		10.0	100	(54') SED ROCK (SANDSTONE); moderately bedded, intensely weathered, hard, slightly fractured, light brown, moist, 7.5YR 3/4.	(54.4') Bedding Plane Separation: 54.4, 54.7, 55.0, 55.4, 56.1, 60.2. (55.6') Random Fracture at 55.6, 59.2.	660
55											
										(59.2') Random Fracture at 55.6, 59.2.	655
60											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.75 ft above ground surface. Ground surface elevation is 713.84 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1601
Page: 4 of 5

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**84**	Well Depth (ft):	**77**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**46.0**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**716.59**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104798.67, 254131.13***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
60											
65				CO	04/25		10.0	100	(65') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet, 7.5YR 6/0.	(65') Bedding Plane Separation: 65.0, 67.5, 70.4.	650
70				CO	04/25		10.0	90			645
75									(75') SED ROCK (SANDSTONE); moderately bedded, intensely weathered, moderately hard, slightly fractured, light brown, wet, 7.5YR 3/4.	(74.4') Bedding Plane Separation: 74.4, 75.2, 76.5, 82.0, 82.7 to 84.0. (77') Random Fracture: Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Random Fracture at 77.0.	640
80									(79') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured,		635

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.75 ft above ground surface. Ground surface elevation is 713.84 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1601
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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**84**	Well Depth (ft):	**77**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**46.0**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**716.59**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104798.67, 254131.13***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80									light gray, wet, 7.5YR 6/0.		
									(81.5') SED ROCK (SHALE); laminated, fresh, moderately hard, very slightly fractured, light gray, wet, 7.5YR 6/0.		
									(82.5') SED ROCK (COAL); thinly bedded, slightly weathered, moderately hard, slightly fractured, black, wet, 7.5YR 2/0.		630
85									(84') SED ROCK (COAL); thinly bedded, slightly weathered, moderately hard, slightly fractured, black, wet, End of coring.		
											625
90											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.75 ft above ground surface. Ground surface elevation is 713.84 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG

Well No. **MW-1602**

Page: **1 of 5**

Drilling Start Date:	**04/28/2016**	Boring Depth (ft):	**94**	Well Depth (ft):	**90**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**65.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.53**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105862.78, 254183.19***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
0									(0') Poorly graded GRAVEL with sand (GP); mostly fine-coarse grained gravel, some medium-coarse sand, trace silt, trace clay, loose, moist, light gray.		711.60
									(1.5') Lean CLAY (CL); trace silt, mostly clay, medium plasticity, stiff, moist, brown, 7.5YR 4/3.		710
5											705
									(7.5') Gravelly SILT (ML); little fine-coarse gravel, some fine-medium sand, some silt, few clay, low plasticity, medium stiff, moist, brown, 7.5YR/4/3.		
10									(10') SED ROCK (SHALE); laminated, decomposed, soft, very intensely fractured, light gray, dry, 7.5YR 6/0.		700
									(12') No Recovery: Split Spoon ends, Rock Coring begins.		
15									(14') SED ROCK (SHALE); laminated, decomposed, soft, very intensely fractured, light gray, moist, 7.5YR 6/0.		695
20									0-20' geology logged from MW-1611		

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 711.60 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG
Well No. MW-1602
Page: 2 of 5

Drilling Start Date:	**04/28/2016**	Boring Depth (ft):	**94**	Well Depth (ft):	**90**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**65.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.53**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105862.78, 254183.19***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20				CO	04/28 14:42		3.1	75	(20') SED ROCK (SHALE); thinly bedded, fresh, moderately hard, unfractured, light gray, moist, 7.5YR 6/0, casing set at 20 ft bgs.	(20.1') Bedding Plane Separation: 20.1, 22.0.	
											690
25				CO	04/27 14:17		10.0	100	(24.0') SED ROCK (SANDSTONE); thinly bedded, fresh, moderately soft, very slightly fractured, light gray, moist, 7.5YR 6/0.		
									(26') SED ROCK (SANDSTONE); fine sand, thickly bedded, intensely weathered, hard, slightly fractured, light brown, wet, 7.5YR 3/4, Breathitt Formation. Circulation water was lost at about 27 ft bgs.	(26.8') Random Fracture: Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed); Lost circulation around 27 ft bgs.	685
30									Circulation water was back at about 30 ft bgs.	(27.8') Random Fracture at 27.8.	
										(24.3') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Slightly Weathered, Mod Soft); Filling (Very Thin, Sand, Slightly Weathered, Mod Soft, Not Healed); Bedding Plane Separation: 24.3, 24.6, 24.8, 25.0, 27.8, 28.3, 31.0.	680
35				CO	04/27 14:42		10.0	85		(34.4') Fracture at 34.4, 34.6 and 34.8. (35') Bedding Joint: Slightly Open; Surface (Smooth, Planar, Moderately Weathered, Soft); Filling (Thin, Clay, Moderately Weathered, Soft, Not Healed); Fracture at 35.2,	675
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 711.60 ft MSL.

Geosyntec consultants engineers | scientists | innovators	Client: American Electric Power Project: Big Sandy Fly Ash Pond Address: Lawrence County, Louisa, KY	WELL LOG Well No. MW-1602 Page: 3 of 5

Drilling Start Date:	04/28/2016	Boring Depth (ft):	94	Well Depth (ft):	90
Drilling End Date:	04/28/2016	Boring Diameter (in):	8	Well Diameter (in):	4
Drilling Company:	Layne	Sampling Method(s):	Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Rock Coring/Air Hammer	DTW During Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	CS1500	DTW After Drilling (ft):	65.3	Screen Material:	Sch 40 PVC Slotted
Driller:	Kimberly Keizer	Top of Casing Elev. (ft msl):	714.53	Seal Material(s):	Bentonite Pellets
Logged By:	Nardos Tilahun	Location (X,Y):	2105862.78, 254183.19*	Filter Pack:	Global Filter Pack #5

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
40									(40.5') SED ROCK (SHALE); clay, laminated, moderately weathered, moderately soft, moderately fractured, light gray, wet, 7.5YR 6/0, Breathitt Formation.	35.5, 35.7, 36.5, 38.5, 38.6, 40.1, 40.8, 40.9. (42).	670
									(40.5') SED ROCK (SHALE); laminated, moderately weathered, moderately soft, moderately fractured, light gray, wet, 7.5YR 6/0.		
45				CO	04/28 17:10		10.0	70	(42') SED ROCK (SANDSTONE); very thinly bedded, intensely weathered, moderately soft, intensely fractured, light brown, wet, 7.5YR 3/4.	(46.2') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed); Bedding Plane Separation: 46.2, 46.5, 46.6, 53.8.	665
50									Lost some of the circulation water at about 53 ft bgs.	(50.8') Random Fracture: Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Moderately Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed); Random Fracture: 50.8 to 53.5. Lost some of the circulation water at about 53 ft bgs. (Bottom 53.5).	660
				CO	04/29 08:19		10.0	100			
55									(54.3') SED ROCK (SANDSTONE); moderately bedded, slightly weathered, hard, very slightly fractured, light gray, wet, 7.5YR 6/0.	(54.3') Bedding Joint: Slightly Open; Surface (Smooth, Planar, Moderately Weathered, Mod Soft); Filling (Very Thin, Clay, Moderately Weathered, Mod Soft, Not Healed); Fracture at 55.5 and 56.8, 58.2. (Bottom 58.5).	655
									(58.5') SED ROCK (SANDSTONE); thickly bedded, intensely weathered, hard, very slightly fractured, light brown, wet, 7.5YR		
60											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 711.60 ft MSL.

Geosyntec consultants engineers | scientists | innovators	Client: American Electric Power Project: Big Sandy Fly Ash Pond Address: Lawrence County, Louisa, KY	WELL LOG Well No. MW-1602 Page: 4 of 5

Drilling Start Date:	04/28/2016	Boring Depth (ft):	94	Well Depth (ft):	90
Drilling End Date:	04/28/2016	Boring Diameter (in):	8	Well Diameter (in):	4
Drilling Company:	Layne	Sampling Method(s):	Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Rock Coring/Air Hammer	DTW During Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	CS1500	DTW After Drilling (ft):	65.3	Screen Material:	Sch 40 PVC Slotted
Driller:	Kimberly Keizer	Top of Casing Elev. (ft msl):	714.53	Seal Material(s):	Bentonite Pellets
Logged By:	Nardos Tilahun	Location (X,Y):	2105862.78, 254183.19*	Filter Pack:	Global Filter Pack #5

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
60									3/4.	(55.5') Bedding Plane Separation: 55.5, 56.8, 58.2, 59.8.	
									(58.5') SED ROCK (SANDSTONE); fine sand, thickly bedded, intensely weathered, hard, very slightly fractured, light brown, wet, 7.5YR 3/4, Breathitt Formation.		650
				CO	04/29 08:51		10.0	100	(64') SED ROCK (SANDSTONE); moderately bedded, moderately weathered, hard, very slightly fractured, wet, 7.5YR 3/4 and 7.5YR 6/0 alternating.		
65										(65.1') Bedding Plane Separation: Slightly Open; Surface (Slightly Rough, Planar, Moderately Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Moderately Weathered, Mod Soft, Not Healed); Fracture at 65.1, 66.4, 68.6, 70.3. (Bottom 73).	645
70										(65.7') Fracture Zone: Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Soft); Filling (Moderately Thin, Clay, Moderately Weathered, Mod Soft, Not Healed).	640
				CO	04/29 09:20		10.0	100			
75										(76.3') Bedding Plane Separation: Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Soft); Filling (Moderately Thin, Iron Oxide, Intensely Weathered, Soft, Not Healed); Bedding Plane Separation: 76.3, 80.0, 81.3, 82.0, 82.7, 83.5.	635
80											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 711.60 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG

Well No. **MW-1602**

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Drilling Start Date:	**04/28/2016**	Boring Depth (ft):	**94**	Well Depth (ft):	**90**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**65.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.53**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105862.78, 254183.19***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80											630
85				CO	04/29 09:57		10.0	100	(84') SED ROCK (SANDSTONE); moderately bedded, intensely weathered, hard, very slightly fractured, light brown, wet, 7.5YR 3/4, 89-89.5: light grey fresh Sandstone, unfractured.	(83.5') Random Fracture: Slightly Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed). (85.6') Bedding Joint at 85.6. Bedding Plane Separation: 85.6, 90.4, 93.0.	625
90									(89.5') SED ROCK (SHALE); moderately bedded, fresh, moderately hard, unfractured, light gray, wet, 7.5YR 6/0.	(84.9') Random Fracture: Slightly Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Moderately Weathered, Mod Soft, Partly Healed).	620
95									(94') SED ROCK (SHALE); moderately bedded, fresh, moderately hard, unfractured, light gray, wet. End of Boring	(93.7') Random Fracture: Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Soft); Filling (Moderately Thin, Clay, Moderately Weathered, Soft, Not Healed).	615
100											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 711.60 ft MSL.

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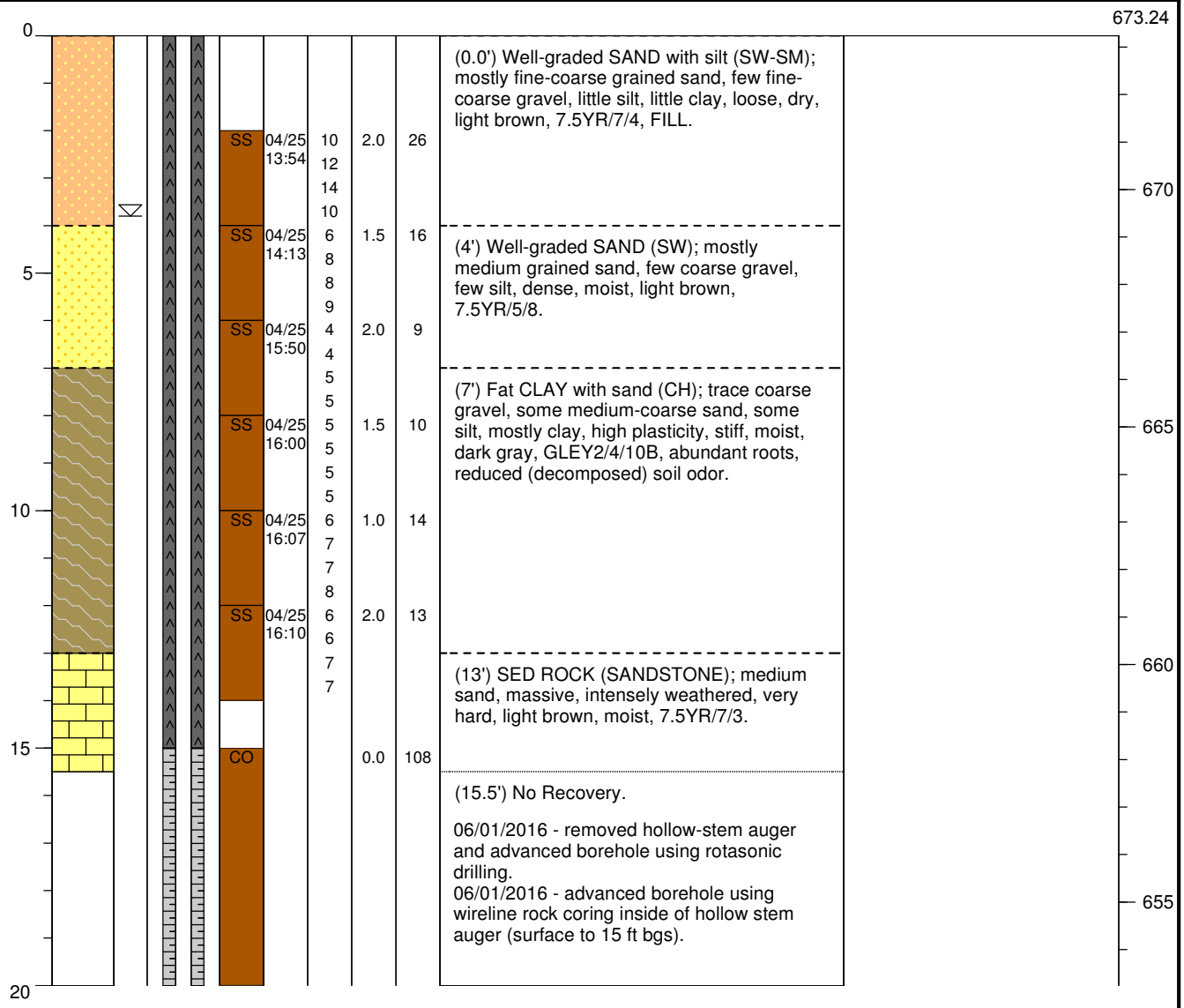
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1603
Page: 1 of 2

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**40**	Well Depth (ft):	**32**
Drilling End Date:	**06/01/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS & Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring**	DTW During Drilling (ft):	**3.8**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**SCR-13**	DTW After Drilling (ft):	**21.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Keith Fehrman**	Top of Casing Elev. (ft msl):	**675.75**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**N. Tilahun/J. Ivanowski**	Location (X,Y):	**2107344.43, 251596.53***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.51 ft above ground surface. Ground surface elevation is 673.24 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1603
Page: 2 of 2

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**40**	Well Depth (ft):	**32**
Drilling End Date:	**06/01/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS & Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring**	DTW During Drilling (ft):	**3.8**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**SCR-13**	DTW After Drilling (ft):	**21.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Keith Fehrman**	Top of Casing Elev. (ft msl):	**675.75**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**N. Tilahun/J. Ivanowski**	Location (X,Y):	**2107344.43, 251596.53***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20				CO	06/01 18:16		5.0	20	(20') Well-graded SAND (SW); mostly fine grained sand, loose, saturated, light yellowish-brown.		
									(22') SED ROCK (SANDSTONE); fine sand, massive, slightly weathered, hard, unfractured, light yellowish-brown, wet.		650
25				CO			4.5	24	(23') SED ROCK (SHALE); silt, laminated, decomposed, soft, intensely fractured, dark gray, wet, iron oxide staining; organic matter.		
									(24') SED ROCK (SHALE); silt, laminated, decomposed, very soft, intensely fractured, black, wet, nearly all organic matter; slight coaly texture.		645
									(25') SED ROCK (CLAYSTONE); clay, moderately bedded, intensely weathered, moderately soft, slightly fractured, pale bluish-gray, wet.		
30				CO			4.6	70	(29') SED ROCK (SANDSTONE); very fine sand, very thinly bedded, intensely weathered, moderately hard, very intensely fractured, light reddish-brown, wet.	(31') Bedding Joint: 5°-10° Dip, Open; Surface (Slightly Rough, Planar); Filling (Clay).	
									(30') SED ROCK (SANDSTONE); very fine sand, laminated, slightly weathered, very hard, moderately fractured, dark bluish-gray, wet, some micaceous minerals.		640
35				CO			5.0	90	(32') SED ROCK (SANDSTONE); very fine sand, laminated, fresh, very hard, unfractured, dark bluish-gray, moist.		
									(35.5') Fractured zone; slight iron-oxide staining on surface.		635
									(39.5') As Above. End of Boring.		
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.51 ft above ground surface. Ground surface elevation is 673.24 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG

Well No. MW-1604

Page: 1 of 3

Drilling Start Date:	**06/06/2016**	Boring Depth (ft):	**50.5**	Well Depth (ft):	**50**
Drilling End Date:	**06/06/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Cuttings**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**19.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**28.7**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**556.21**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2108828.43, 254482.33***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	SOIL/ROCK VISUAL DESCRIPTION	MEASURE: PID (ppm)	MEASURE: Lab Sample	ELEV. (ft msl)
0								(0') Lean CLAY (CL); mostly clay, medium plasticity, soft, moist, light brown.			553.12
5											550
10											545
15											540
20								(19') Poorly graded SAND (SP); mostly fine-medium grained sand, loose, moist, light brown.			535

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.09 ft above ground surface. Ground surface elevation is 553.12 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG
Well No. MW-1604
Page: 2 of 3

Drilling Start Date:	**06/06/2016**	Boring Depth (ft):	**50.5**	Well Depth (ft):	**50**
Drilling End Date:	**06/06/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Cuttings**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**19.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**28.7**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**556.21**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2108828.43, 254482.33***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	SOIL/ROCK VISUAL DESCRIPTION	MEASURE: PID (ppm)	MEASURE: Lab Sample	ELEV. (ft msl)
20								(19.5') Lean CLAY (CL); mostly clay, medium plasticity, soft, moist, light brown.			
								(23') Poorly graded SAND (SP); mostly fine-medium grained sand, very loose, wet, light brown.			530
25								(25') Lean CLAY (CL); mostly silt, trace clay, medium plasticity, medium stiff, wet, dark gray.			525
30								(30') Lean CLAY (CL); mostly clay, medium plasticity, medium stiff, wet, light brown.			520
35								(38') Poorly graded SAND (SP); mostly fine-medium grained sand, trace silt, trace clay, loose, wet, light brown.			515
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.09 ft above ground surface. Ground surface elevation is 553.12 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Fly Ash Pond**
Address:	**Lawrence County, Louisa, KY**

WELL LOG
Well No. MW-1604
Page: 3 of 3

Drilling Start Date:	**06/06/2016**	Boring Depth (ft):	**50.5**	Well Depth (ft):	**50**
Drilling End Date:	**06/06/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Cuttings**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**19.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**28.7**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**556.21**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2108828.43, 254482.33***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	SOIL/ROCK VISUAL DESCRIPTION	MEASURE: PID (ppm)	MEASURE: Lab Sample	ELEV. (ft msl)
40								(40') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine-coarse gravel, trace silt, loose, saturated, light brown.			510
45											505
50								(50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine-coarse gravel, trace silt, loose, saturated, light brown, End of Boring.			500
55											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.09 ft above ground surface. Ground surface elevation is 553.12 ft MSL.

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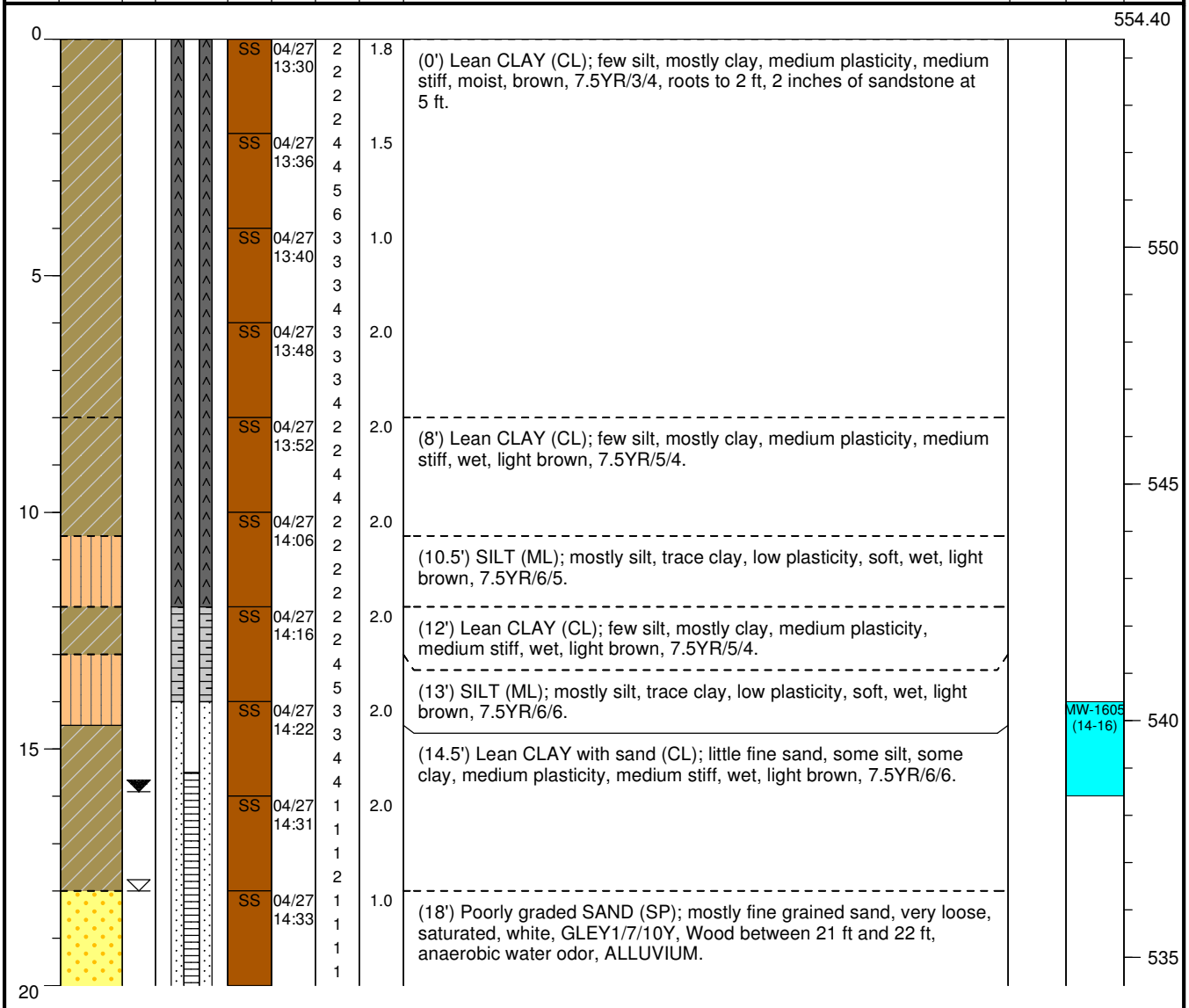
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1605
Page: 1 of 2

Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**32**	Well Depth (ft):	**26**
Drilling End Date:	**04/27/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**18.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**15.9**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**557.46**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2110694.01, 252760.21***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.06 ft above ground surface. Ground surface elevation is 554.40 ft MSL.

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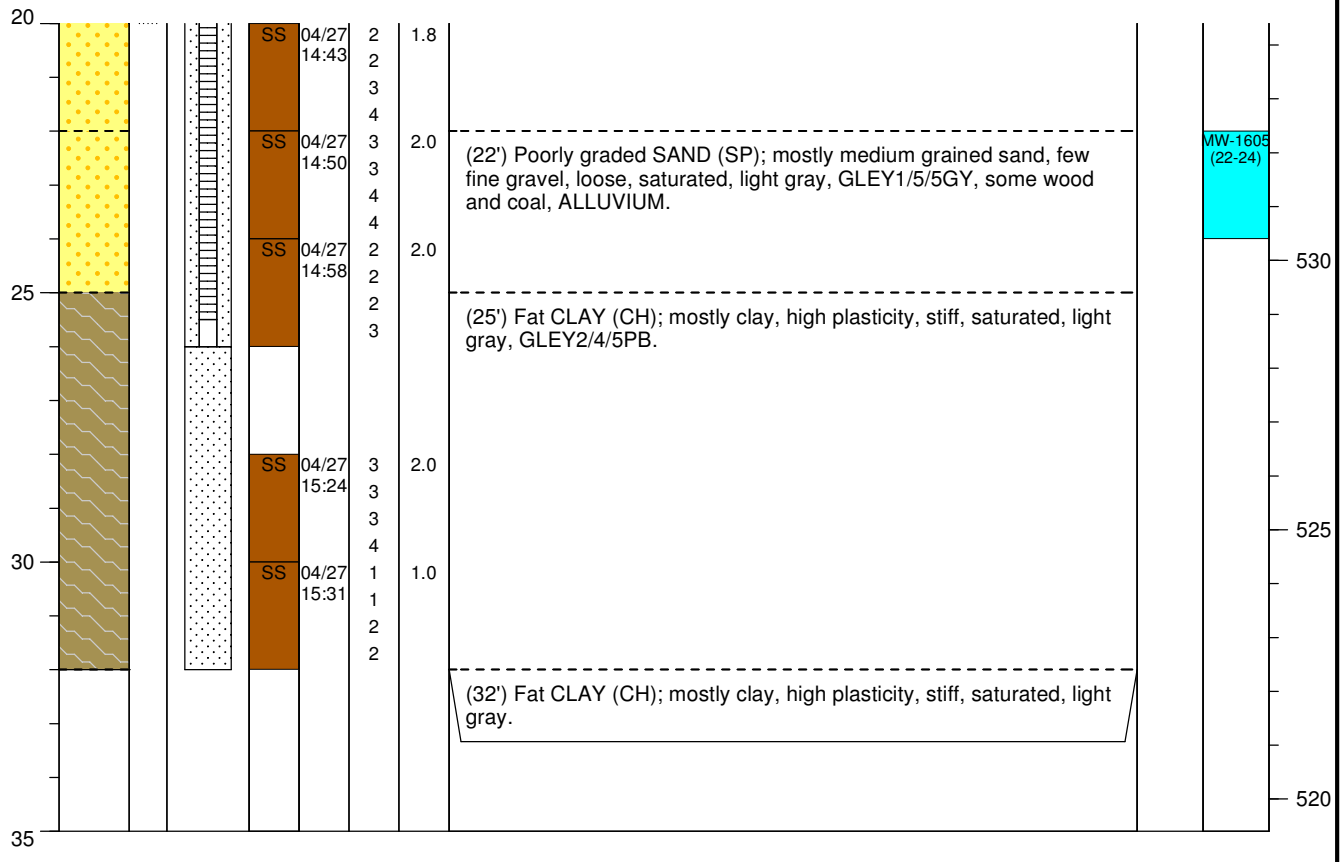
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1605
Page: 2 of 2

Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**32**	Well Depth (ft):	**26**
Drilling End Date:	**04/27/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**18.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**15.9**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**557.46**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2110694.01, 252760.21***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.06 ft above ground surface. Ground surface elevation is 554.40 ft MSL.

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Client:	**American Electric Power**
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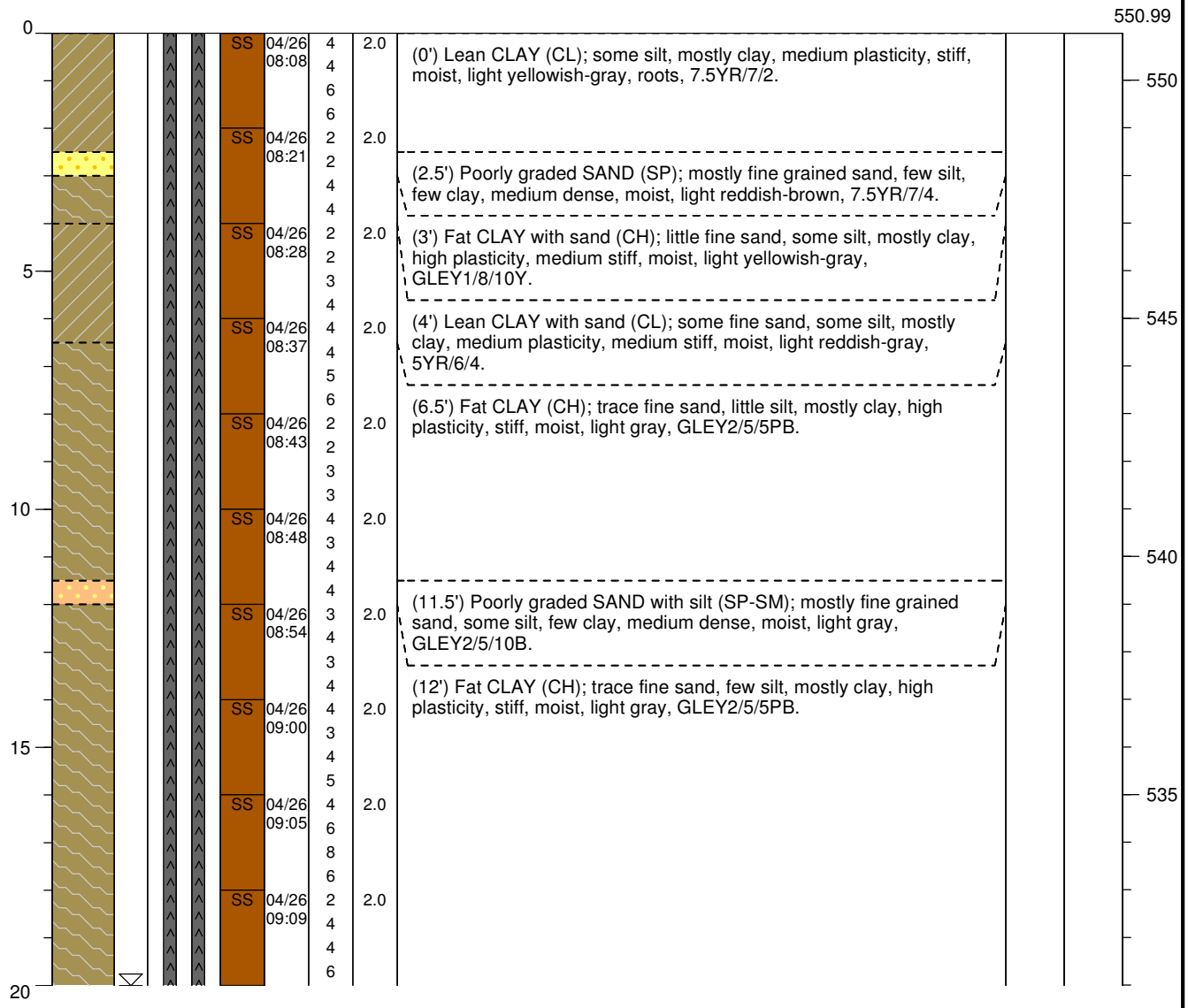
Address:	**23000 US-23, Louisa, KY**

WELL LOG

Well No. **MW-1606**

Page: **1 of 3**

Drilling Start Date:	**04/26/2016**	Boring Depth (ft):	**52**	Well Depth (ft):	**51.3**
Drilling End Date:	**04/26/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**20.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**30.6**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**554.10**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105122.96, 254592.81***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.11 ft above ground surface. Ground surface elevation is 550.99 ft MSL.

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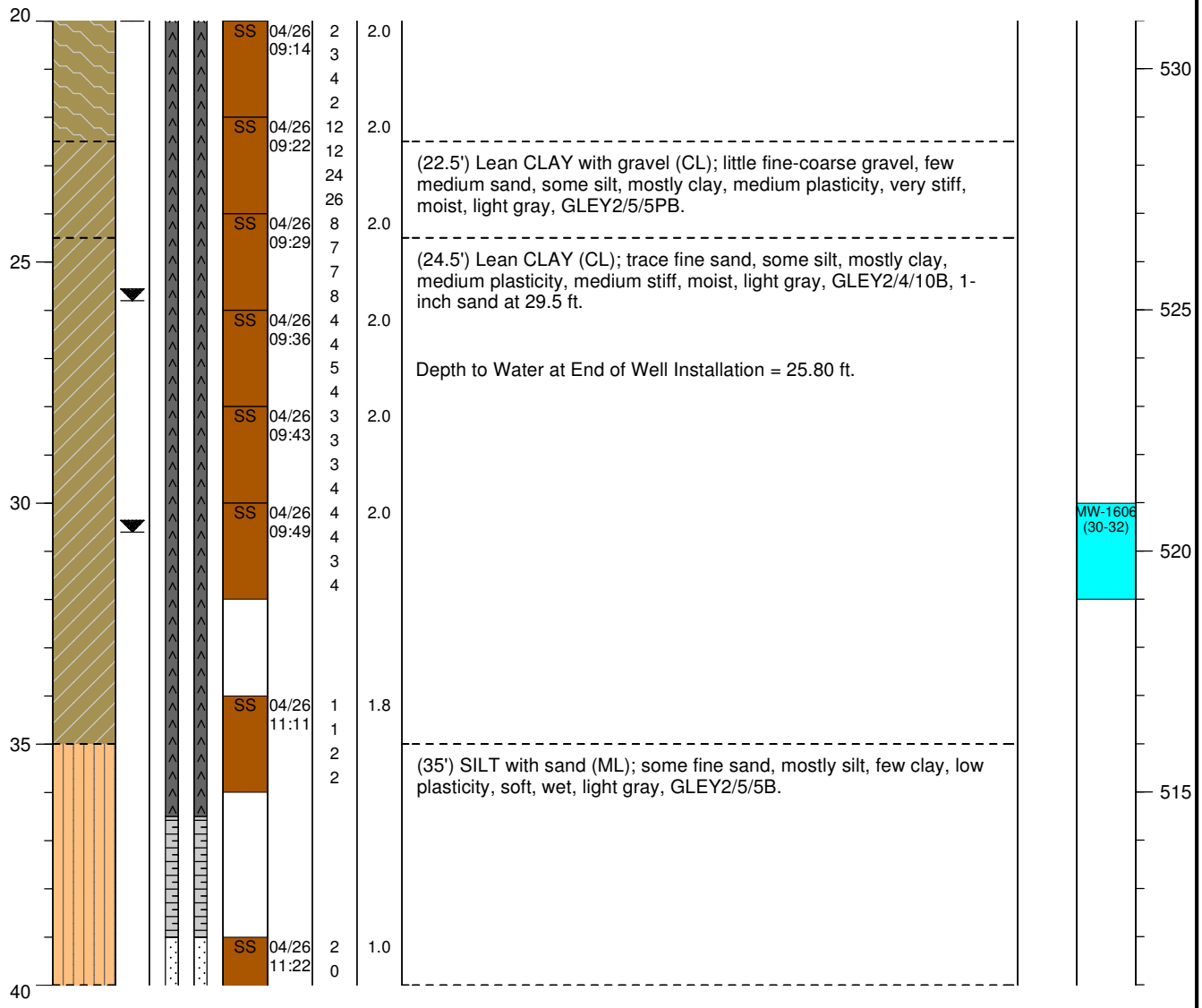
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1606
Page: 2 of 3

Drilling Start Date:	**04/26/2016**	Boring Depth (ft):	**52**	Well Depth (ft):	**51.3**
Drilling End Date:	**04/26/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**20.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**30.6**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**554.10**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105122.96, 254592.81***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.11 ft above ground surface. Ground surface elevation is 550.99 ft MSL.

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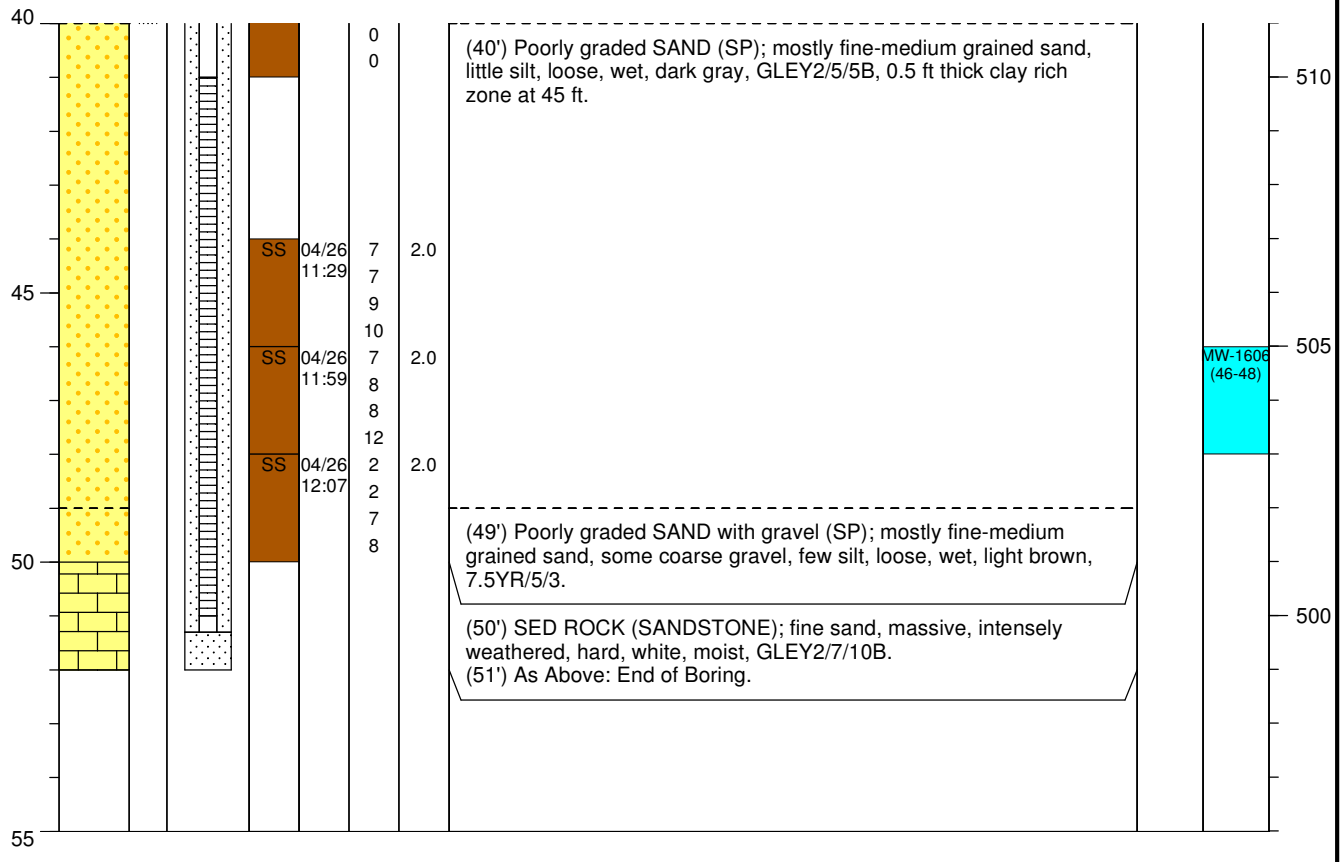
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1606
Page: 3 of 3

Drilling Start Date:	**04/26/2016**	Boring Depth (ft):	**52**	Well Depth (ft):	**51.3**
Drilling End Date:	**04/26/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**20.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**30.6**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**554.10**	Seal Material(s):	**Bentonite Chips**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105122.96, 254592.81***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.11 ft above ground surface. Ground surface elevation is 550.99 ft MSL.

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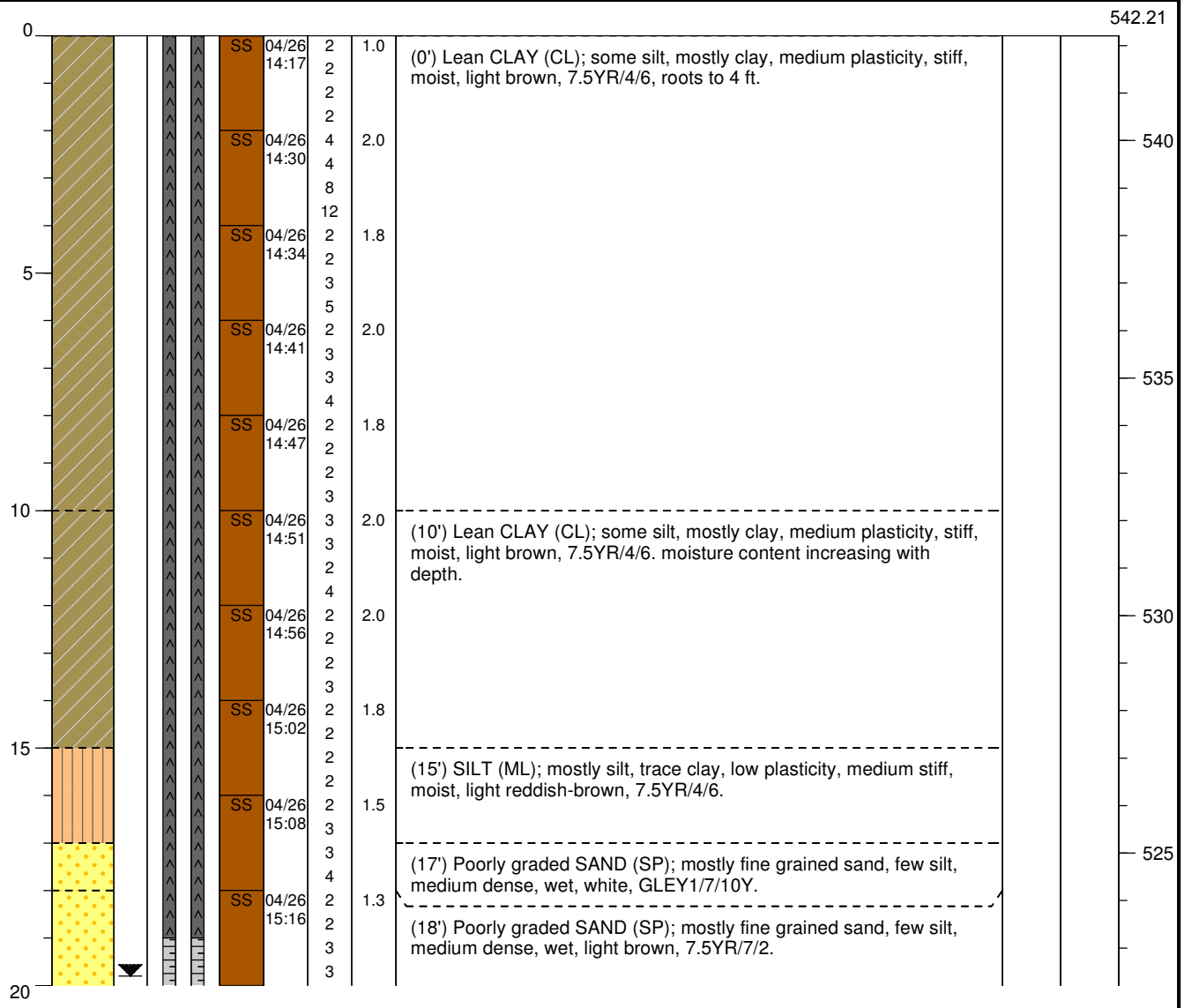
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1607
Page: 1 of 2

Drilling Start Date:	**04/26/2016**	Boring Depth (ft):	**34.5**	Well Depth (ft):	**34**
Drilling End Date:	**04/26/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**23.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**19.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**545.23**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105634.33, 254664.49***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.02 ft above ground surface. Ground surface elevation is 542.21 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1607
Page: 2 of 2

Drilling Start Date:	**04/26/2016**	Boring Depth (ft):	**34.5**	Well Depth (ft):	**34**
Drilling End Date:	**04/26/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**Split Spoon**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**23.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CME95**	DTW After Drilling (ft):	**19.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Tim Woods**	Top of Casing Elev. (ft msl):	**545.23**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105634.33, 254664.49***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	SOIL/ROCK VISUAL DESCRIPTION	MEASURE: PID (ppm)	MEASURE: Lab Sample	ELEV. (ft msl)
20				SS	04/26 15:23	2 2	1.0	(21') Poorly graded SAND (SP); mostly medium grained sand, trace silt, trace clay, loose, saturated, light yellowish-brown, 7.5YR/8/4.			
				SS	04/26 15:32	2 3	2.0			MW-1607 (22-24)	520
						3 3		(23') SILT with sand (ML); some fine sand, mostly silt, trace clay, low plasticity, medium stiff, saturated, dark gray, GLEY2/4/10B.			
25				SS	04/26 15:43	3 3	2.0				
						3 4					
				SS	04/26 15:51	4 2	2.0				515
						3 3					
						3					
				SS	04/26 15:58	4 5	2.0				
						5 7		(29') Poorly graded SAND (SP); mostly medium grained sand, few silt, loose, saturated, white, GLEY1/7/5GY.			
30				SS	04/26 16:07	3 3	1.8				
						4 5					
				SS	04/26 16:14	7 9	1.8	(32') Poorly graded SAND with gravel (SP); some fine-coarse grained sand, some fine-coarse gravel, few silt, loose, saturated, light brown, 2.5YR/7/1.		MW-1607 (32-34)	510
						15 17		(34') Poorly graded SAND with gravel (SP); some fine-coarse grained sand, some fine-coarse gravel, few silt, dense, saturated, light brown.			
35											505
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 3.02 ft above ground surface. Ground surface elevation is 542.21 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1608
Page: 1 of 7

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
0				SS	04/25 09:06	1 1	1.0	3	(0') Poorly graded SAND (SP); mostly medium-coarse grained sand, few fine-coarse gravel, very loose, moist, light gray, GLEY2/5/5PB.		716.15
				SS	04/25 09:08	2 2	1.0	6	(1.5') Fat CLAY (CH); trace fine sand, little silt, mostly clay, high plasticity, medium stiff, moist, light reddish-brown, 7.5YR/5/6.		
				SS	04/25 09:22	4 4 6	1.5	16	(3') Poorly graded SAND (SP); mostly fine-medium grained sand, few coarse gravel, loose, moist, light brown, 7.5YR/7/6.		715
5				SS	04/25 09:29	8 9 12	2.0	39	(5') Lean CLAY (CL); few silt, mostly clay, medium plasticity, stiff, moist, light purplish-brown, 2.5YR/4/6.	Sample: MW-1608 (5-8)	
				SS	04/25 09:35	14 25 26 15	1.5	41	(6.5') Lean CLAY (CL); few silt, mostly clay, medium plasticity, very stiff, moist, white, GLEY1/8/N.		710
				SS	04/25 09:47	16 25 26 17	1.5	36	(10') SILT with gravel (ML); little fine-coarse gravel, few medium-coarse sand, mostly silt, few clay, nonplastic, soft, dry, light yellowish-brown, 7.5YR/8/4.		
10				SS	04/25 09:54	18 18 24 12	1.0	42	(12') SED ROCK (SHALE); very thinly bedded, intensely weathered, moderately hard, intensely fractured, light gray, dry, GLEY2/7/10B.		705
				SS	04/25 10:01	17 25 42 30	2.0	81			
15				SS	04/25 10:19	39 42 49 35	1.5	95			700
				SS	04/25 10:23	40 55 42 44	2.0	92	(17') Lean CLAY (CL); little silt, mostly clay, medium plasticity, very stiff, dry, dark reddish-brown, 7.5YR/6/2.		
20						48 48					

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 716.15 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1608
Page: 2 of 7

Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20				SS	04/25 10:45	38 48 60	1.0	108	(20') SED ROCK (SHALE); clay, very thinly bedded, slightly weathered, hard, moderately fractured, light gray, dry, GLEY2/7/10B.		695
				SS	04/25 23:09	42 100	1.0	100			
				SS	04/25 23:11	42 100	1.0	100	(23') SED ROCK (SHALE); clay, thinly bedded, slightly weathered, very hard, moderately fractured, light gray, dry, GLEY2/6/10B.		
25											690
				CO	04/26 11:56		7.0		(27') SED ROCK (SHALE); laminated, intensely weathered, soft, intensely fractured, light gray, moist, 7.5YR 6/0.		
30											685
35				CO	04/26 12:32		8.3		(36') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet, 7.5YR 6/0.		680
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.93 ft above ground surface. Ground surface elevation is 716.15 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1608
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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
40									(40') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet, 7.5YR 6/0.		675
45				CO	04/26 13:43		10				670
50											665
55				CO	04/26 13:54		10			(54.9') Bedding Plane Separation: Fractures at 54.9, 56.9, 58.3, 55.5, 55.9, 56.1, 60.5, 62.5.	660
60											

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1608
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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
60									(60') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet, 7.5YR 6/0.		655
65				CO	04/26 14:13		10.0			(65.9') Bedding Plane Separation: Fractures at 65.9, 66.8, 73.0, 73.3.	650
70											645
75				CO	04/26 14:38		10.0		(74') Dark grey carbon rich layers from 75.3 to 76.6 and 83.5 to 84.0.	(75.3') Bedding Plane Separation: Fractures at 75.3, 76.2, 83.7, 83.9.	640
80											

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Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1608
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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80											635
				CO	04/26 15:16		10			(84.8') Bedding Plane Separation: Fracture at 84.8 and 86.1.	
85											630
90									(90') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet.	(90.5') Bedding Plane Separation: (Bottom 94).	625
									(90.5') SED ROCK (COAL); very thinly bedded, intensely weathered, moderately soft, intensely fractured, dark gray, wet, 7.5YR 3/0.	(90.5') Bedding Plane Separation: 90.5-105.5.	
				CO	04/26 16:17		10				
95											620
100											

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Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
100											615
105				CO	04/26 17:12		9.5		(105.5') SED ROCK (SHALE); thinly bedded, moderately weathered, soft, moderately fractured, light gray, wet, 7.5YR 6/0 fracture zone: 106.7-107.0, 108.0-108.3, 110.0-110.5, 111.0-111.5.		610
110											605
115									(114') SED ROCK (SHALE); thinly bedded, moderately weathered, soft, moderately fractured, light gray, wet.		600
									(116') SED ROCK (SHALE); thinly bedded, slightly weathered, soft, moderately fractured, dark gray, wet, carbon rich shale.		
120									(118') SED ROCK (SHALE); thinly bedded, moderately weathered, soft, moderately fractured, light gray, wet.		

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Project:	**Big Sandy Plant**
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WELL LOG
Well No. MW-1608
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Drilling Start Date:	**04/25/2016**	Boring Depth (ft):	**121**	Well Depth (ft):	**120**
Drilling End Date:	**06/24/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**HSA/Rock Coring/Air Hammer**	DTW During Drilling (ft):	**29.0**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**29.3**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**719.08**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**D. Yifru & N. Tilahun**	Location (X,Y):	**2105883.65, 251052.42***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
120									(121') SED ROCK (SHALE); thinly bedded, moderately weathered, soft, moderately fractured, very dark gray, wet.		595
125											

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BORING LOG
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Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
0									Boring log discription from MW-1203.		725
5											720
10											715
15											710
20											

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Monitoring well was not installed in this borehole.

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BORING LOG
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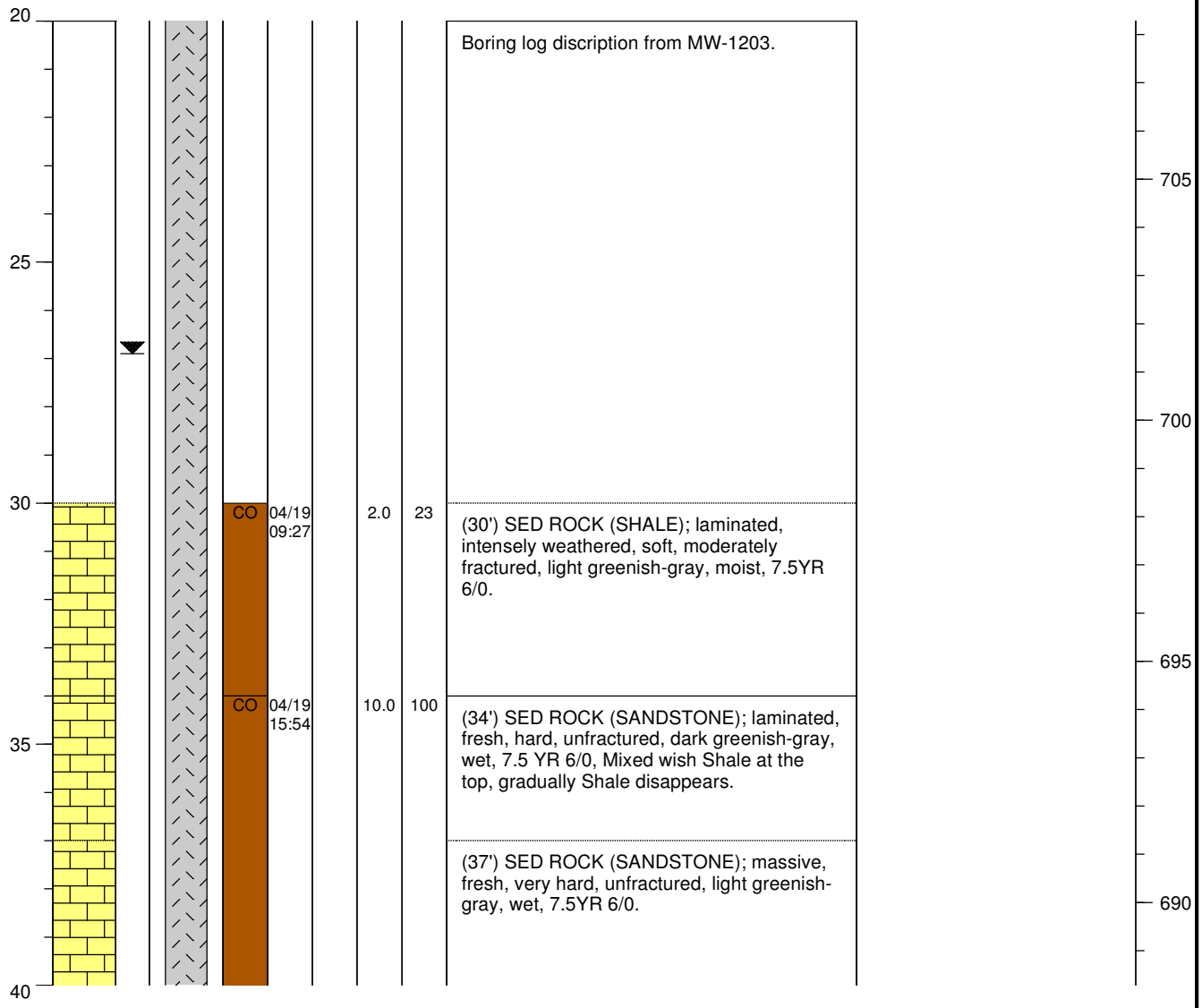
Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***



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Project:	**Big Sandy Plant**
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BORING LOG
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Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
40										(42') Bedding Plane Separation at 42.0, 42.3, 42.4.	685
				CO	04/19 17:01		10.0	100	(44') SED ROCK (SANDSTONE); massive, fresh, very hard, unfractured, light greenish-gray, wet.	(43.6') Bedding Plane Separation at 43.6, 43.8.	
45									(44.5') SED ROCK (SANDSTONE); thickly bedded, intensely weathered, very hard, slightly fractured, light reddish-brown, wet, 7.5YR 3/4.	(46.3') Random Fracture: (True) Moderately Discontinuous, Moderately Open; Surface (Rough, Planar, Moderately Weathered, Mod Hard); Filling (Moderately Thin, Hematite, Intensely Weathered, Mod Hard, Not Healed); (Bottom 46.5)	680
									(46.5') SED ROCK (SANDSTONE); thickly bedded, fresh, very hard, unfractured, light greenish-gray, wet, 7.5 YR 6/0.		
50										(46.5') Random Fracture: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Clean); Random Fracture: 46.3 to 46.5.	675
				CO	04/19 16:37		10.0	100	(54') SED ROCK (SANDSTONE); moderately bedded, fresh, very hard, unfractured, light greenish-gray, wet, 7.5YR 6/0, 54 to 50 ft mostly thinly bedded, 50 to 52 ft flow texture.		
55										(58.2') Bedding Plane Separation at 58.2, 58.4, 58.8, 62.3.	670
60											

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BORING LOG
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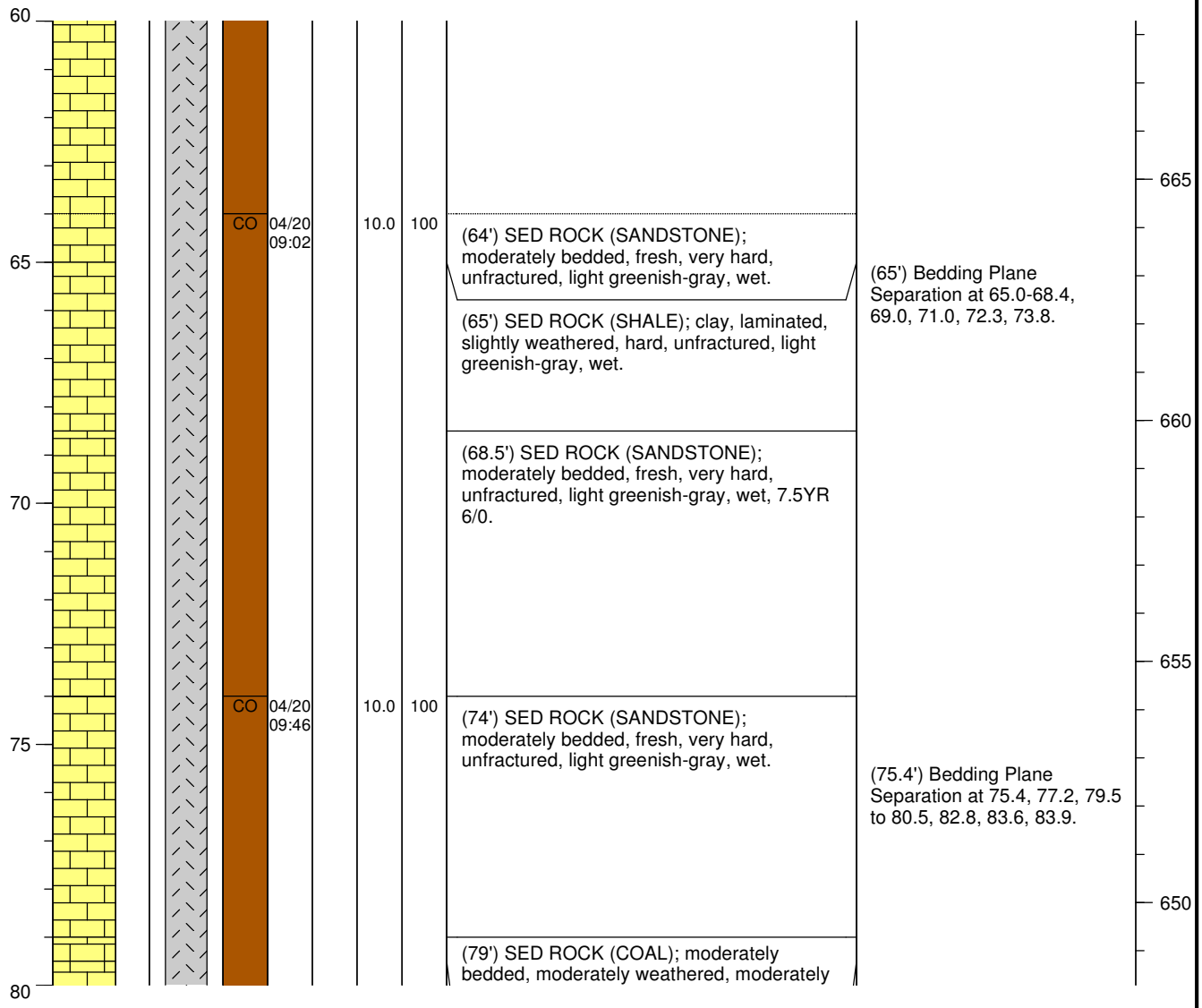
Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***



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BORING LOG
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Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80									soft, slightly fractured, dark gray, wet, 10YR 2/1, honeycombed at 79.5 ft.		
									(79.5') SED ROCK (SHALE); moderately bedded, fresh, hard, moderately fractured, light gray, wet, 7.5YR 6/0, highly fractured from 79.5 to 80.5.		645
85				CO	04/20 11:01		10.0	63	(84') SED ROCK (SHALE); moderately bedded, moderately weathered, hard, moderately fractured, light gray, wet, 7.5YR 6/0, fracture zone interval: 85.9-86.2, 86.8-89.3, 88.0-88.4, 91.793.0.	(84') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Fresh, Mod Hard); Filling (Clean); (94) (85.9') Bedding Plane Separation at 85.9-86.2, 86.8-89.3, 88.0-88.4, 91.7-93.0.	640
90											635
95				CO	04/20 11:53		10.0	50	(94') SED ROCK (SHALE); thinly bedded, intensely weathered, moderately soft, intensely fractured, light gray, wet, YR7.5 6/0.	(94') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Clean); Bedding Plane Separation at 94.0-98.5, 100.8, 101.0, 101.1, 102.7.	630
100									(98.5') SED ROCK (SHALE); moderately bedded, slightly weathered, very hard, very slightly fractured, light gray, wet, 7.5YR 6/0.		

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Client:	**American Electric Power**
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Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
100											
											625
				CO	04/20 12:47		10.0	90	(104') SED ROCK (SHALE); thinly bedded, slightly weathered, hard, very slightly fractured, light gray, wet, 7.5YR 6/0.	(104') Bedding Plane Separation: 104-114.	
105									(106') SED ROCK (SHALE); laminated, intensely weathered, moderately soft, intensely fractured, light gray, wet, 7.5YR 6/0.		
									(107') SED ROCK (SHALE); moderately bedded, slightly weathered, hard, very slightly fractured, light gray, wet, 7.5YR 6/0.		620
110											
											615
				CO	04/20 14:04		10.0	90	(114') SED ROCK (SHALE); thinly bedded, fresh, hard, very slightly fractured, light gray, wet, 7.5YR 6/0.	(115.2') Bedding Plane Separation: 115.2, 115.4, 115.8, 116.6 to 117.3, 118.0, 120.4, 120.8, 121.2, 123.5 to 124.0.	
115									(115.5') SED ROCK (SANDSTONE); thickly bedded, slightly weathered, hard, very slightly fractured, light gray, wet, 7.5YR.		
									(116.6') SED ROCK (SHALE); moderately bedded, moderately weathered, hard, slightly fractured, dark gray, wet, 10YR 2/1, Breathitt Formation. Carbon rich Shale.		610
120											

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Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
120									(117.3') SED ROCK (SHALE); clay, moderately bedded, slightly weathered, hard, slightly fractured, light gray, wet, 7.5YR 6/0, Breathitt Formation.		605
125				CO	04/20 14:55		10.0	58	(124') SED ROCK (SHALE); moderately bedded, intensely weathered, moderately hard, intensely fractured, light gray, wet, 7.5YR 6/0, fracture zone intervals: 125.2-127.4, 128.0-132.5.	(124') Bedding Plane Separation: 124-134. (125') Fracture Zone: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Clean, Slightly Weathered, Mod Soft, Partly Healed); (132)	600
130											595
135				CO	04/20 16:35		10.0	20	(134') SED ROCK (SHALE); laminated, intensely weathered, moderately hard, intensely fractured, light gray, wet, 7.5YR 6/0.	(134') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Clean); Bedding Plane Separation: 134-144.	590
140											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Monitoring well was not installed in this borehole.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG

Boring No. MW-1609

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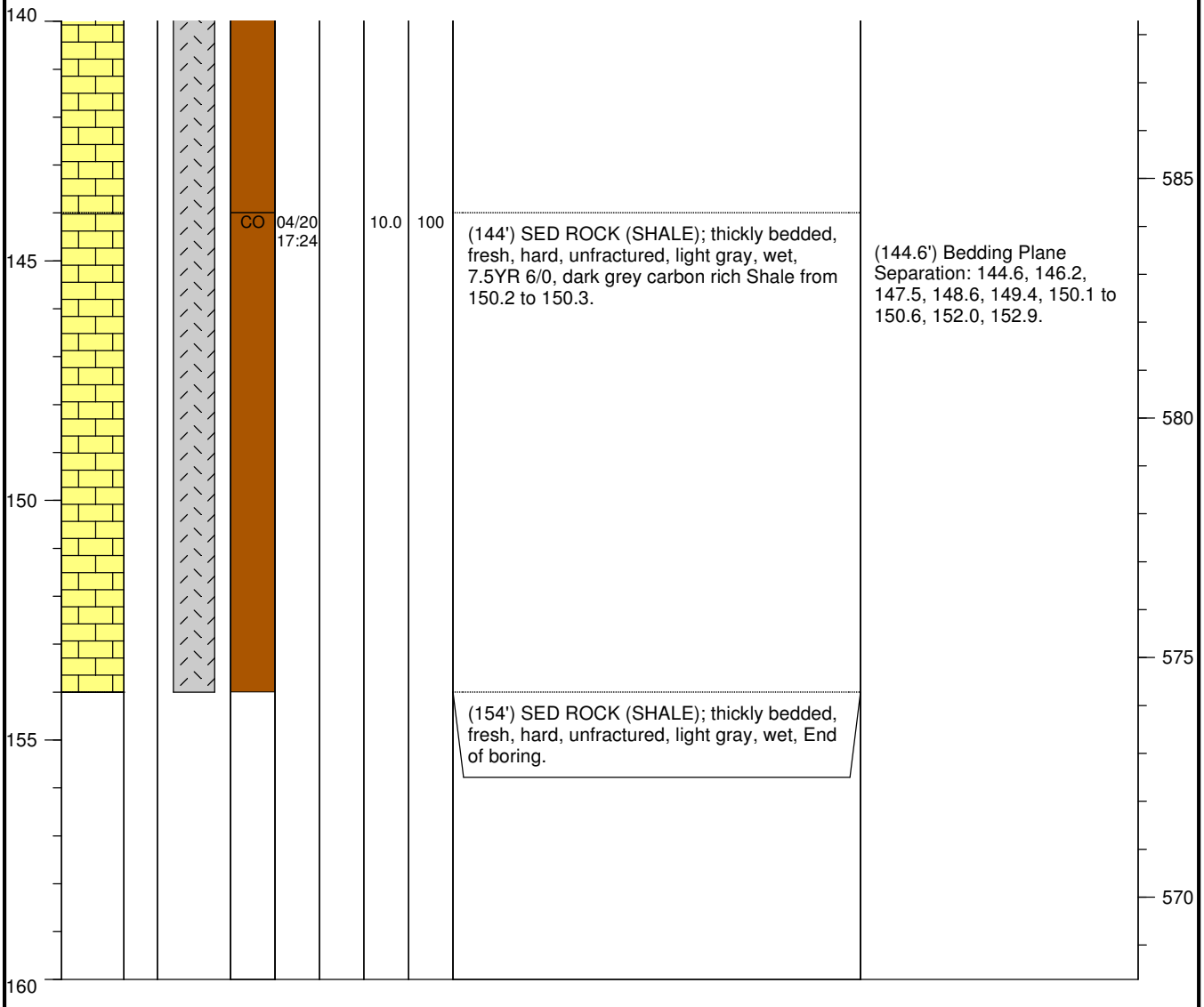
Drilling Start Date:	**04/19/2016**	Boring Depth (ft):	**154 (Abandoned)**
Drilling End Date:	**04/20/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**26.9**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**728.28**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2101420.87, 252205.98***



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Monitoring well was not installed in this borehole.

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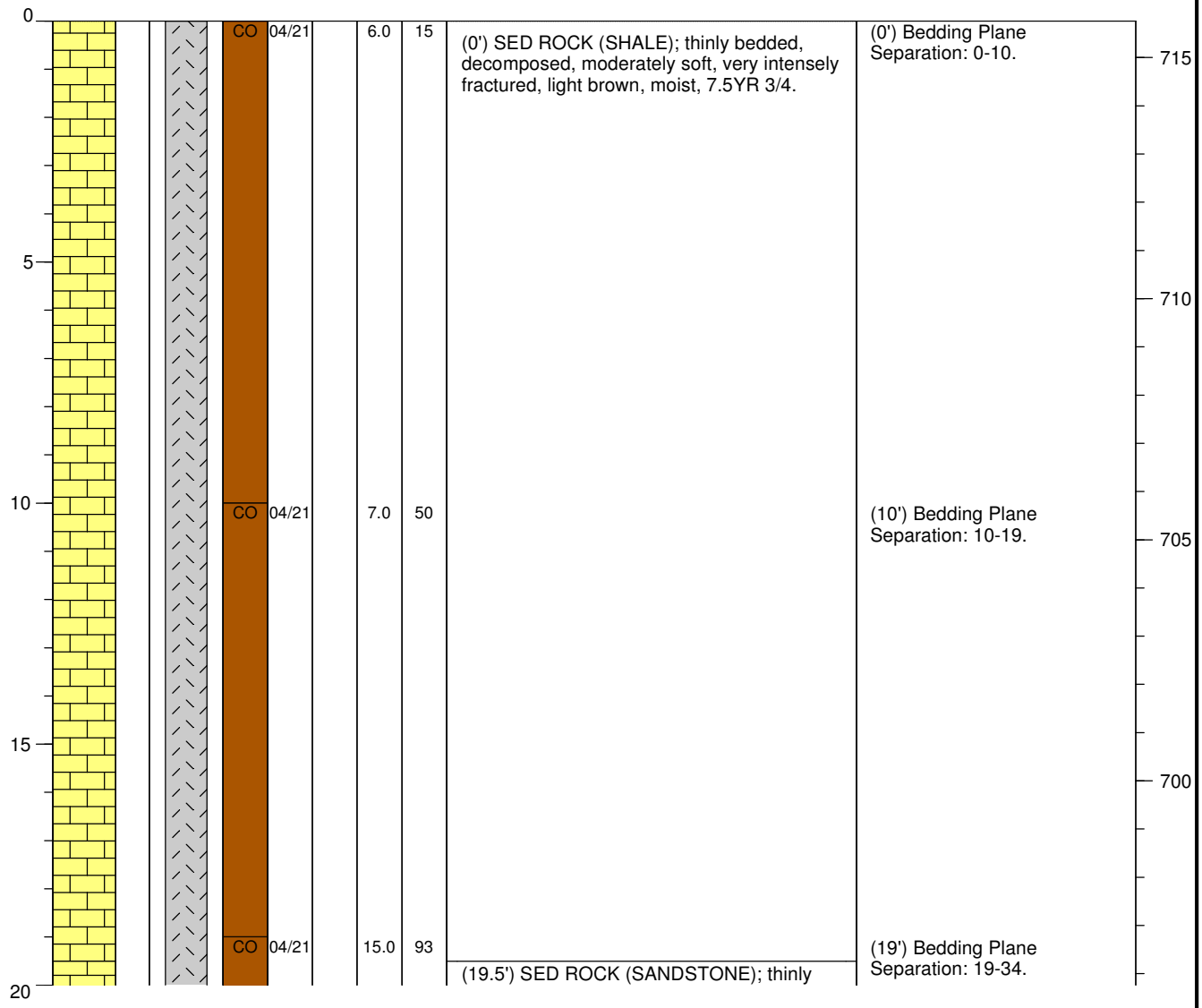
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
Page: 1 of 7

Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Monitoring well was not installed in this borehole.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20									bedded, fresh, hard, slightly fractured, light gray, moist, 7.5YR 6/0.		695
25									(23') SED ROCK (SANDSTONE); thinly bedded, intensely weathered, moderately hard, slightly fractured, light brown, moist, 7.5YR 3/4.		690
30									(28') SED ROCK (SANDSTONE); moderately bedded, slightly weathered, moderately hard, slightly fractured, light gray, moist, 7.5YR 6/0.		685
35				CO	04/21		8.5	40	(35.5') SED ROCK (SHALE); laminated, intensely weathered, moderately soft, intensely fractured, light gray, moist, 7.5YR 6/0.	(34') Bedding Plane Separation: 34-44.	680
40											

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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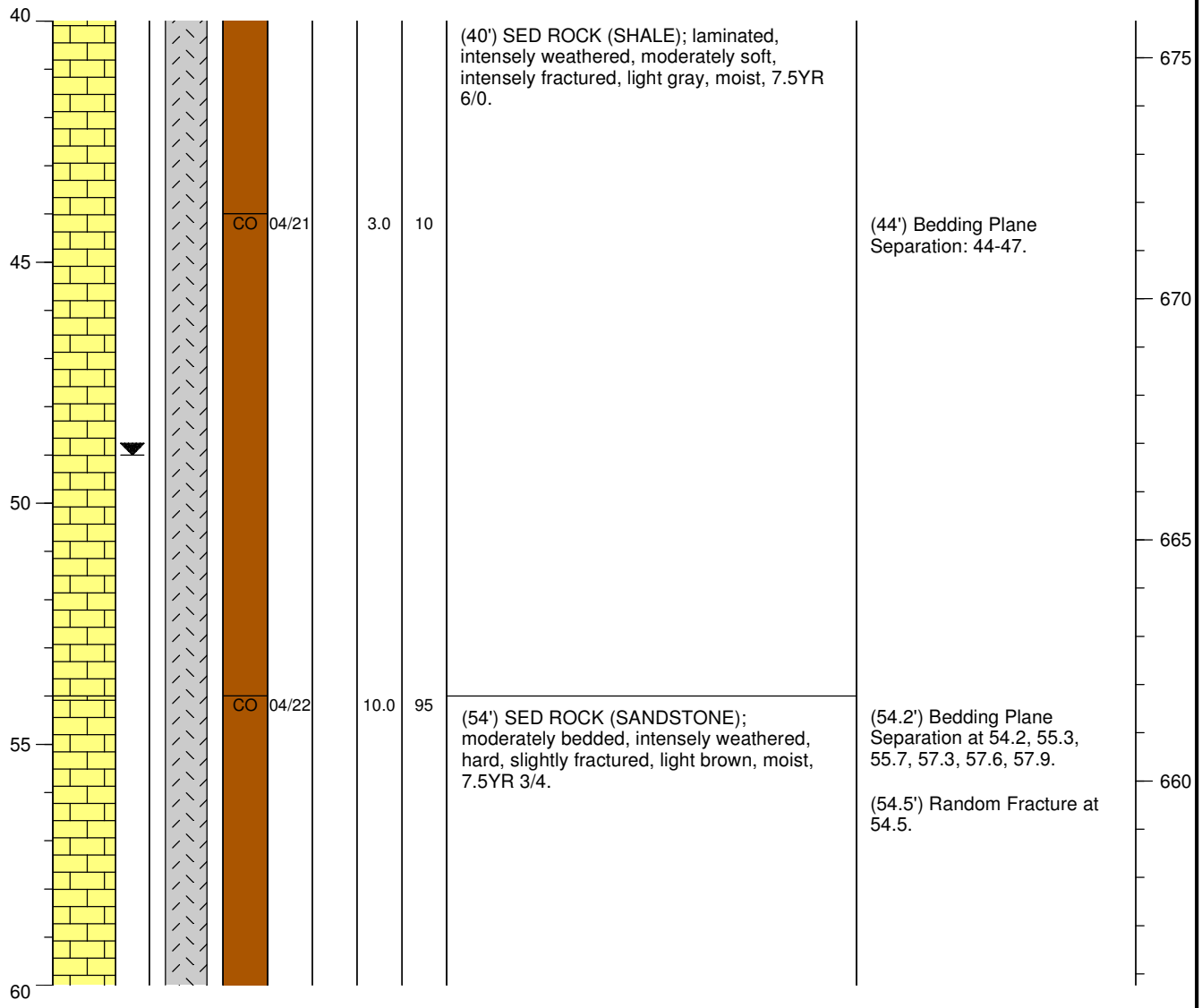
Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Monitoring well was not installed in this borehole.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
60											655
65				CO	04/22		10.0	100	(63') SED ROCK (SANDSTONE); moderately bedded, fresh, hard, unfractured, light gray, wet, 7.5YR 6/0.		650
70											645
75				CO	04/22		10.0	75		(76.6') Bedding Plane Separation: 76.6, 77.6, 82.0 to 84.0.	640
80									(78.5') SED ROCK (SANDSTONE); moderately bedded, intensely weathered, moderately hard, unfractured, light brown,		

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80									wet, 7.5YR 3/4.		635
									(79.5') SED ROCK (SANDSTONE); moderately bedded, fresh, moderately hard, unfractured, light gray, wet, 7.5YR 6/0.		
									(80.5') SED ROCK (SANDSTONE); moderately bedded, intensely weathered, moderately hard, unfractured, light brown, wet, 7.5YR 3/4.		
85				CO	04/22 11:14		8.0	65	(81.5') SED ROCK (COAL); thinly bedded, slightly weathered, moderately hard, slightly fractured, black, wet, 7.5YR 2/0.	(84') Bedding Plane Separation: 84.0 to 86.0, 87.0 to 94.0.	630
									(83.5') SED ROCK (SHALE); laminated, intensely weathered, soft, intensely fractured, light gray, wet, 7.5YR 6/0.		
									(86') SED ROCK (SHALE); clay, thinly bedded, slightly weathered, hard, very slightly fractured, light gray, wet.		
90											625
95				CO	04/22 11:31		10.0	100	(94') SED ROCK (SHALE); moderately bedded, slightly weathered, moderately hard, very slightly fractured, light gray, wet, 7.5YR 6/0.		620
										(97.6') Bedding Plane Separation: 97.6, 99.4, 101.0 to 104.0.	
100											

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
100											615
105				CO	04/22 12:30		10.0	50	(104') SED ROCK (SHALE); very thinly bedded, slightly weathered, moderately hard, very slightly fractured, light gray, wet, 7.5YR 6/0.	(104') Bedding Plane Separation: 104.0 to 112.5.	610
110									(109.0') SED ROCK (SHALE); laminated, intensely weathered, soft, intensely fractured, light gray, wet, 7.5YR 6/0, carbon rich Shale 110.0 to 110.3.		605
115				CO	04/22 13:41		10.0	90	(112') SED ROCK (SANDSTONE); fine sand, thinly bedded, moderately weathered, moderately soft, very intensely fractured, light gray, wet, 7.5YR 6/0, Breathitt formation.	(114') Bedding Plane Separation: Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Soft); Filling (Very Thin, Clay, Intensely Weathered, Soft, Partly Healed); Bedding Plane Separation: 114.0 to 124.0.	600
									(114') SED ROCK (SHALE); laminated, intensely weathered, soft, intensely fractured, light gray, wet, 7.5YR 6/0, from 114.5 to 116.0 dark grey Carbon rich Shale mixed with light grey Shale.		
120											

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

BORING LOG
Boring No. MW-1610
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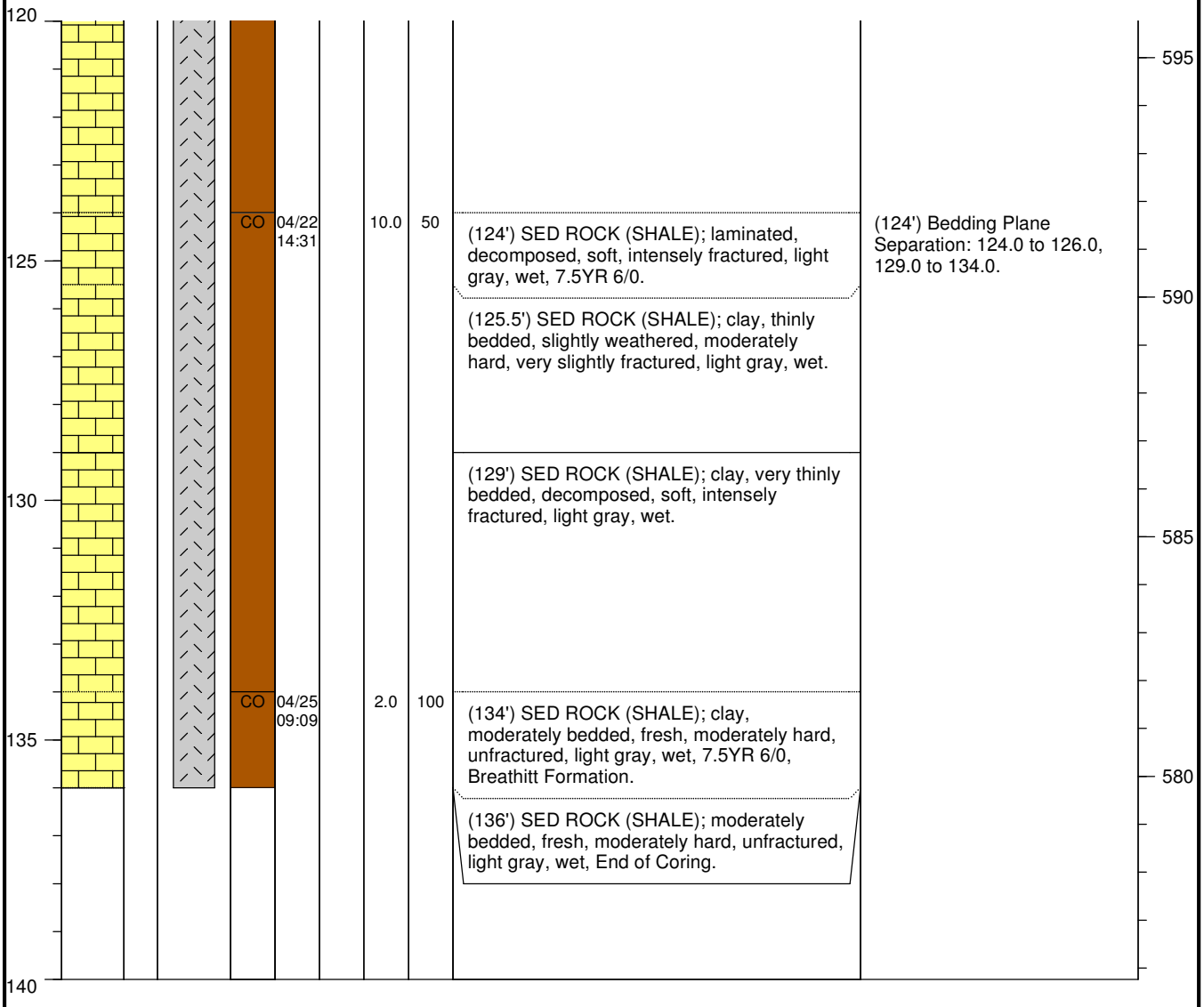
Drilling Start Date:	**04/21/2016**	Boring Depth (ft):	**136 (Abandoned)**
Drilling End Date:	**04/25/2016**	Boring Diameter (in):	**8**
Drilling Company:	**Layne**	Sampling Method(s):	**Core Barrel**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**49.0**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**49.0**
Driller:	**Kimberly Keizer**	Ground Surface Elev. (ft):	**715.76**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2104799.937, 254147.538***



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Monitoring well was not installed in this borehole.

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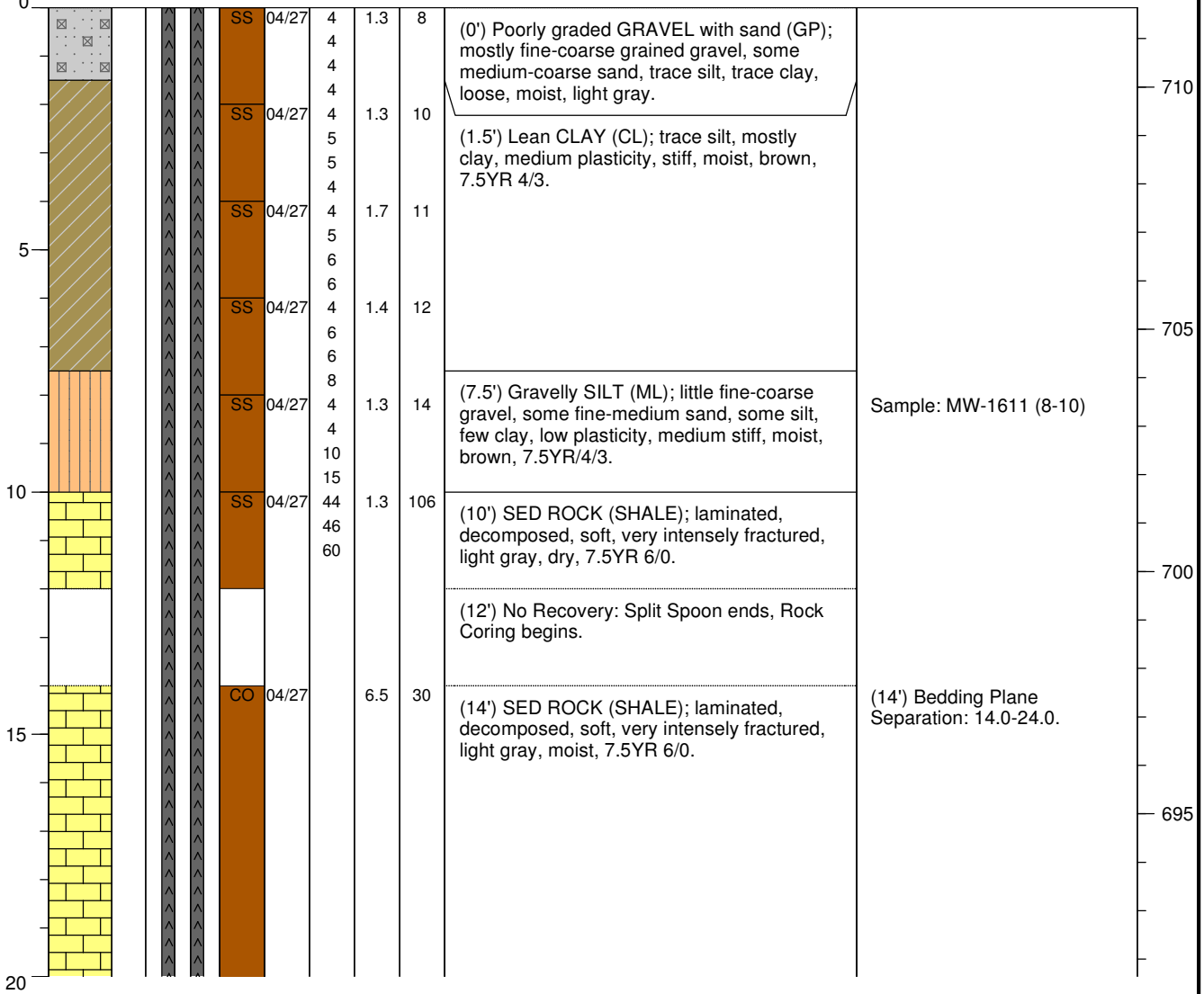
Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1611
Page: 1 of 7

Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**124**	Well Depth (ft):	**115.5**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**68.2**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**75.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.25**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105868.49, 254192.11***	Filter Pack:	**Global Filter Pack #5**



NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.61 ft above ground surface. Ground surface elevation is 711.64 ft MSL.

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Client:	**American Electric Power**
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Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1611
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Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**124**	Well Depth (ft):	**115.5**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**68.2**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**75.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.25**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105868.49, 254192.11***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
20											
									(22') SED ROCK (SHALE); very thinly bedded, moderately weathered, moderately soft, slightly fractured, light gray, moist, 7.5YR 6/0.		690
				CO	04/27 14:17		10.0	100	(24') SED ROCK (SHALE); clay, thinly bedded, fresh, hard, unfractured, light gray, wet.	(24.8') Bedding Plane Separation: 24.8, 26.3, 27.5, 30.5.	
25									(25') SED ROCK (SANDSTONE); very fine sand, moderately bedded, slightly weathered, hard, very slightly fractured, light gray, wet.		685
30											680
									(32') SED ROCK (SANDSTONE); fine sand, moderately bedded, intensely weathered, hard, slightly fractured, light brown, wet. Fracture at 34.4, 34.6 and 34.8		
				CO	04/27 14:42		10.0	90		(34.4') Random Fracture at 34.4, 34.5, 34.8, 41.5 to 42.0, 42.6, 43.1.	
35									(35') SED ROCK (SANDSTONE); very thinly bedded, fresh, moderately hard, moderately fractured, light gray, wet, 7.5YR 6/0, some inter-bedded shales.	(34.8') Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed); Bedding Plane Separation: 34.8 to 36.5, 38.5, 38.6, 40.1, 40.8, 40.9.	675
40											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.61 ft above ground surface. Ground surface elevation is 711.64 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1611
Page: 3 of 7

Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**124**	Well Depth (ft):	**115.5**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**68.2**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**75.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.25**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105868.49, 254192.11***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
40											670
									(42') SED ROCK (SANDSTONE); very thinly bedded, intensely weathered, moderately soft, intensely fractured, light brown, wet, 7.5YR 3/4.		
45				CO	04/27 15:02		10.0	100	(44') SED ROCK (SANDSTONE); very thinly bedded, intensely weathered, moderately soft, intensely fractured, light brown, wet.	(46') Slightly Open; Surface (Smooth, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed); Bedding Plane Separation: 46.0	665
50											660
55				CO	04/27 15:27		10.0	100	(54') SED ROCK (SANDSTONE); very thinly bedded, intensely weathered, moderately soft, intensely fractured, light brown, wet, 55.3 - 57.0: Light grey Sandstone, fresh, unfractured.	(54') Random Fracture at 54.0, 54.2.	655
										(57.5') Bedding Plane Separation: 57.5, 60.4, 60.6.	
60											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.61 ft above ground surface. Ground surface elevation is 711.64 ft MSL.

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Client: American Electric Power
Project: Big Sandy Plant
Address: 23000 US-23, Louisa, KY

WELL LOG
Well No. MW-1611
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Drilling Start Date:	04/27/2016	Boring Depth (ft):	124	Well Depth (ft):	115.5
Drilling End Date:	04/28/2016	Boring Diameter (in):	8	Well Diameter (in):	4
Drilling Company:	Layne	Sampling Method(s):	SS, Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Rock Coring/Air Hammer	DTW During Drilling (ft):	68.2	Riser Material:	Sch 40 PVC
Drilling Equipment:	CS1500	DTW After Drilling (ft):	75.8	Screen Material:	Sch 40 PVC Slotted
Driller:	Kimberly Keizer	Top of Casing Elev. (ft msl):	714.25	Seal Material(s):	Bentonite Pellets
Logged By:	Nardos Tilahun	Location (X,Y):	2105868.49, 254192.11*	Filter Pack:	Global Filter Pack #5

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
60											650
65				CO	04/27 15:55		10.0	100	(64') SED ROCK (SANDSTONE); fine sand, moderately bedded, moderately weathered, hard, very slightly fractured, wet, 7.5YR 3/4 and 7.5YR 6/0 alternating, Breathitt Formation.	(65.7') Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Soft); Filling (Moderately Thin, Clay, Moderately Weathered, Mod Soft, Not Healed); Bedding Plane Separation: 65.7.	645
70											640
75				CO	04/27 16:26		10.0	100		(77') Bedding Plane Separation: 77.0, 80.2, 83.6.	635
80											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.61 ft above ground surface. Ground surface elevation is 711.64 ft MSL.

Geosyntec consultants engineers | scientists | innovators	Client: **American Electric Power** Project: **Big Sandy Plant** Address: **23000 US-23, Louisa, KY**	**WELL LOG** Well No. **MW-1611** Page: **5 of 7**

Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**124**	Well Depth (ft):	**115.5**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**68.2**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**75.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.25**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105868.49, 254192.11***	Filter Pack:	**Global Filter Pack #5**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
80											
											630
85				CO	04/28 08:19		10.0	100	(84') SED ROCK (SANDSTONE); fine sand, moderately bedded, intensely weathered, hard, very slightly fractured, light brown, wet, 7.5YR 3/4, Breathitt Formation. 90-90.5: light grey fresh Sandstone, unfractured.	(83.5') Random Fracture: Slightly Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Intensely Weathered, Mod Soft, Not Healed).	
											625
										(84.9') Random Fracture: Slightly Open; Surface (Slightly Rough, Planar, Intensely Weathered, Mod Soft); Filling (Very Thin, Iron Oxide, Moderately Weathered, Mod Soft, Partly Healed). Bedding Plane Separation: 84.9, 89.9, 93.5.	
90									(90.5') SED ROCK (SHALE); clay, moderately bedded, fresh, moderately hard, unfractured, light gray, wet, 7.5YR 6/0, Breathitt Formation.		
											620
										(93.7') Random Fracture: Moderately Open; Surface (Slightly Rough, Planar, Intensely Weathered, Soft); Filling (Moderately Thin, Clay, Moderately Weathered, Soft, Not Healed).	
95				CO	04/28 09:12		10.0	100			
										(96.8') Slightly Open; Surface (Slightly Rough, Planar, Moderately Weathered, Soft); Filling (Very Thin, Clay, Moderately Weathered, Soft, Not Healed); Bedding Plane Separation: 96.8, 97.0, 101.5, 102.1, 103 to 104.	615
100											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
Top of casing (TOC) is 2.61 ft above ground surface. Ground surface elevation is 711.64 ft MSL.

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Client:	**American Electric Power**
Project:	**Big Sandy Plant**
Address:	**23000 US-23, Louisa, KY**

WELL LOG
Well No. MW-1611
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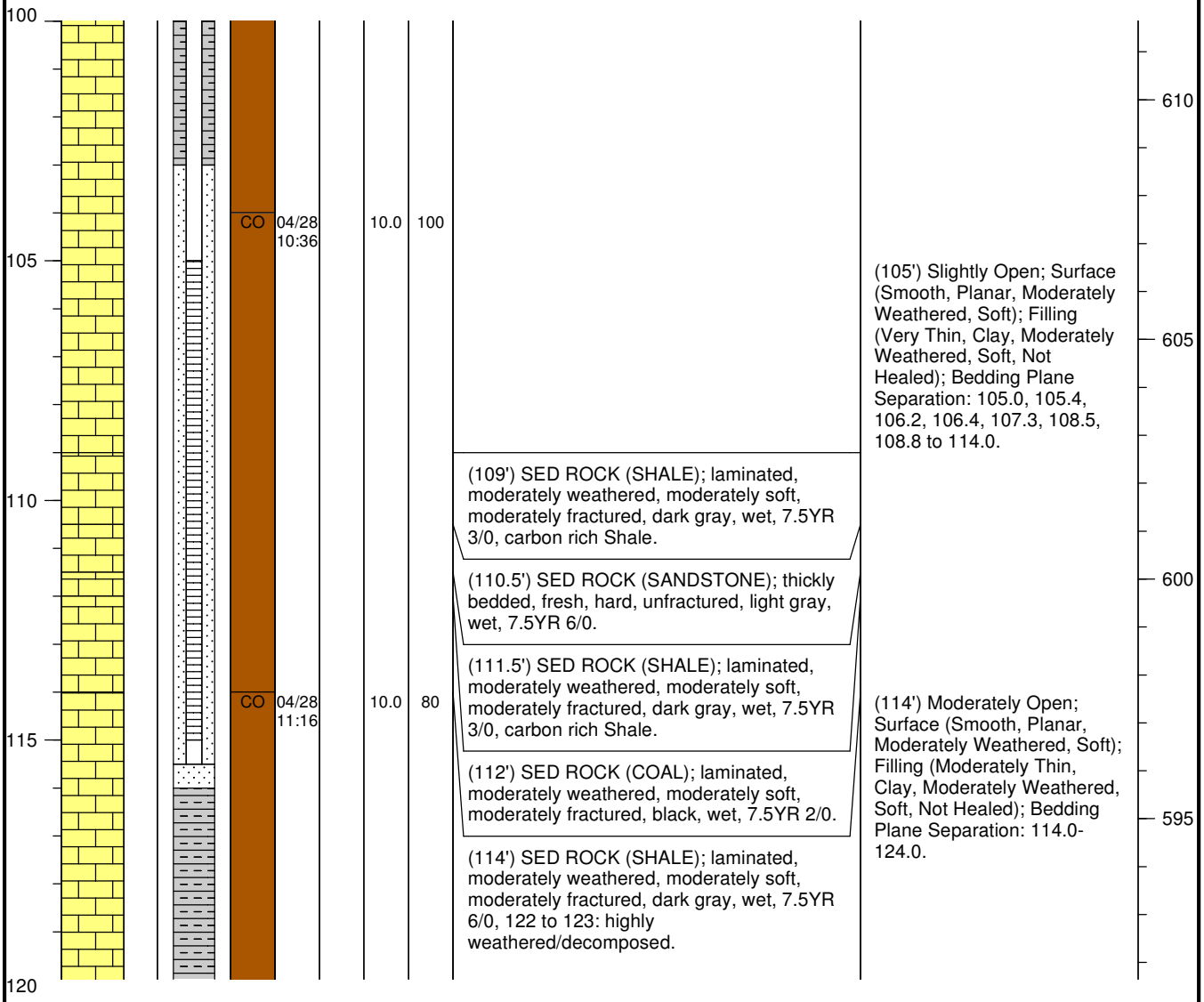
Drilling Start Date:	**04/27/2016**	Boring Depth (ft):	**124**	Well Depth (ft):	**115.5**
Drilling End Date:	**04/28/2016**	Boring Diameter (in):	**8**	Well Diameter (in):	**4**
Drilling Company:	**Layne**	Sampling Method(s):	**SS, Core Barrel**	Screen Slot (in):	**0.010**
Drilling Method:	**Rock Coring/Air Hammer**	DTW During Drilling (ft):	**68.2**	Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**CS1500**	DTW After Drilling (ft):	**75.8**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**Kimberly Keizer**	Top of Casing Elev. (ft msl):	**714.25**	Seal Material(s):	**Bentonite Pellets**
Logged By:	**Nardos Tilahun**	Location (X,Y):	**2105868.49, 254192.11***	Filter Pack:	**Global Filter Pack #5**



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DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	ELEV. (ft msl)
120											590
125									(124') SED ROCK (SHALE); laminated, moderately weathered, moderately soft, moderately fractured, dark gray, wet, End of coring.		585
130											

NOTES: *Northing and easting are in NAD83 Kentucky North. Elevation is in ft MSL NAVD88.
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