Prepared for

American Electric Power

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Columbus, Ohio 43215

LOCATION RESTRICTION 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
ESP	Electrostatic Precipitator
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
ft, MSL	Feet above mean sea level
gpm	gallons per minute
HB	Hydrogeological Boring
KAR	Kentucky Administrative Regulations
KGS	Kentucky Geological Survey
KPDES	Kentucky Pollutant Discharge Elimination System
KYDEP - DWM	Kentucky Department for Environmental Protection – Division of Waste Management
KYPCo	Kentucky Power Company
MW	Megawatt Monitoring Well
NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
ORAM	Ohio Rapid Assessment Method for Wetlands
PB	Pond Boring
PE	Professional Engineer
PG	Professional Geologist
PGA	Peak Ground Acceleration
SB	Soil Boring
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1. OBJECTIVE

1.1 Purpose

The purpose of this report is to provide an evaluation of 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) new location restrictions regulations (Title 40 Code of Federal Regulations (CFR) Sections (§§) 257.60-64) for existing coal combustion residuals (CCR) surface impoundments.

This report was prepared by Mr. Yacub Bholat and Mr. Dawit Yifru, geotechnical engineer and geologist, respectively. 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 engineering information evaluated and discussed in this report and the resulting overall location restrictions 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 CCR unit with respect to placement above the uppermost aquifer (40 CFR §257.60);
- Section 4 presents an evaluation of the CCR unit with respect to wetlands (40 CFR §257.61);
- Section 5 presents an evaluation of the CCR unit with respect to fault areas (40 CFR §257.62);
- Section 6 presents an evaluation of the CCR unit with respect to seismic impact zones (40 CFR §257.63);
- Section 7 presents an evaluation of the CCR unit with respect to unstable areas (40 CFR §257.64); and
- Section 8 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 Appendix B.

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 1,097 megawatt (MW) coal-fired power generating station located in Lawrence County, Kentucky approximately 4.5 miles north of the town 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. Each of the two power generating units at the Big Sandy Plant is equipped with electrostatic precipitators (ESPs) for removal of fly ash particulate matter.

The CCRs generated by the Big Sandy Plant are disposed of in a nearby existing surface impoundment (i.e., "CCR unit") known as the BSFAP, which is the subject of this location restriction 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.

2.2 Description of CCR Unit

The BSFAP CCR unit is an existing surface impoundment located approximately 1.3 miles northwest of the Big Sandy Power Plant. The BSFAP receives wet-sluiced fly ash from the generating unit's ESPs as well as bottom ash that is periodically transferred from the Bottom Ash Ponds next to the main plant area.

The BSFAP is situated in the valley of Horseford Creek and was formed by constructing a dam across the valley, and therefore the BSFAP 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 2-3 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 sideslopes. The valley sideslopes above the existing BSFAP range in steepness from approximately 2 horizontal to 1 vertical (2H:1V) to 5H:1V (URS, 2013c). This URS (2013c) geotechnical summary report also indicates that the ground surface on the slopes and ridges consist of residual soil (residuum) or weathered bedrock, with some outcrops of exposed sandstone 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 2.75H:1V to 2H:1V. The downstream facing of the dam is lined with riprap from a toe berm at elevation 590 feet above mean sea level (ft, MSL) to the crest of the dam at elevation 711 ft, MSL. The upstream slope of the dam is currently vegetated on its upper slopes above the current waterline and is lined with sandstone rock protection just below and slightly above the current pond water level. In the 2014 dam inspection report (AEP, 2014), 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.

The Main Dam has been expanded (raised) in stages over time as discussed subsequently in Section 2.2.3. It is founded on a stratum of alluvium (approximately 17-ft thick) which overlies bedrock. The Main Dam also has a compacted clay keyway that cuts through the alluvium and is founded on bedrock. The original portion of the Main Dam was constructed primarily of compacted clay, which now serves as the interior core of the expanded dam. There is a collection blanket/chimney drain within the dam, and of the downstream shell of the dam is primarily composed of bottom ash. The toe berm at the downstream base of the dam is composed of dumped sandstone rock fill with a slope of approximately 1.5H:1V. Cross-sections illustrating the configuration of the Main Dam are presented with the supporting documentation contained in Appendix B (see KYPCo (1993) Drawing No. 12 – 30036 – 0 and 12 – 30033 – 0 in Appendix B; see URS (2013b) Figure 4.1d in Appendix B).

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 interior of this dam is composed primarily of a compacted clay core on the upstream side, and bottom ash shell on the downstream side. The downstream facing of the dam slope is lined with riprap and the upstream side is vegetated. The crest of the Saddle Dam is approximately 30-ft wide and 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. Cross-sections illustrating the configuration of the Saddle Dam are presented with the supporting documentation contained in Appendix B (see KYPCo (1993) Drawing No. 12 – 30034 – 0 and 12 – 30035 – 0 in Appendix B).

2.2.2 Area and Volume of CCR Unit

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 will close the BSFAP 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. To that end, in June 2013 AEP filed a Closure Plan application with the Kentucky Energy and Environment Cabinet; Kentucky Department for Environmental Protection (KYDEP) – Division of Waste Management (DWM) for final closure of the BSFAP. The Closure Plan application was approved on July 28, 2015 by KYDEP – DWM.

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 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 Ongoing Monitoring

Several site investigations have been conducted during operational history of the BSFAP. The reports containing these geotechnical, hydrogeologic, and related assessments that were used to provide backup information to support this location restrictions evaluation are as follows:

- Big Sandy Plant Fly Ash Retention Dam Final Raising Design Report. April, 1993. Kentucky Power Company;
- Geotechnical Summary Report – Proposed Pond Closure. November, 2012. URS Corporation;
- Final Report – Hydrogeologic Site Investigation. June, 2013. URS Corporation;
- Report – Groundwater Monitoring Plan. 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 subsurface investigations at the BSFAP included a geotechnical investigation conducted in 1993 as part of the dam raising design, when sixteen (16) borings were drilled to investigate the subsurface conditions at the Main Dam and Saddle Dam. Additionally, seven (7) test trenches were excavated at the clay borrow area (material source used for the proposed dam raising construction). Also, a total of twenty (20) borings were drilled as part of the April 2012 subsurface exploration program by URS Corporation. Eight (8) pond borings (PB-1 through PB-8) and five (5) soil borings (SB-3, SB-4, SB-6, SB-7 and SB-8) were installed in 2012 to characterize the subsurface geology of the site.

Previous hydrogeologic investigations at the BSFAP included installation of five groundwater monitoring wells (MW-1007 through MW-1011) in 2010. Then, as part of the April 2012 subsurface exploration program by URS Corporation, seven (7) hydrogeological borings (HB-1 through HB-7) were drilled and subsequently converted into groundwater monitoring wells (MW-1201 through MW-1207). Additionally, in 2016, eleven (11) borings were drilled and eight (8) additional groundwater monitoring wells (MW-1601 through MW-1607, and MW-1611) were installed (Geosyntec, 2016). These 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 reports. Boring locations are shown in Figure 2-3. Table 2-2 provides details of the soil borings and monitoring well construction.

Additionally, the Main Dam and Saddle Dam undergo annual inspections by AEP geotechnical engineering staff as part of the company's Dam Inspection and Maintenance Program. As part of this program, the long-term performance of the Main Dam is monitored using an instrumentation system consisting of deformation monuments, piezometers, and flow measurement weirs. Currently, fourteen (14) piezometers are monitored on or near the Main Dam embankment and its abutments. A series of monuments are in place to allow measurement of horizontal and vertical deformation movements on the top of embankment and face slopes of the Main Dam. Also, three (3) slope inclinometers are in place within the Main Dam to monitor the magnitude of displacements within the interior of the dam.

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).

The Big Sandy Power Plant uses water to sluice and transfer fly ash and miscellaneous waste to the BSFAP. Additionally, storm water generated by precipitation in the watershed above the Main Dam also flows into the BSFAP. 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.

As part of this location restrictions evaluation, AEP provided a Big Sandy Plant overall water balance schematic showing inflows and outflows from the various features and components of the plant, including the BSFAP. According to this water balance information, the principal spillway at the Main Dam discharges water at an average flow rate of approximately 0.4 cubic feet per second (cfs) [i.e., about 180 gallons per minute (gpm)]. There is also a second KPDES-permitted outfall (plant "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 (2015), that outfall location experiences a historical average daily flow rate of approximately 0.15 cfs (i.e., about 67 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. Overlying the bedrocks are relatively thin deposits of Quaternary-age alluvial material (Lloyd and Lyke, 1995). The 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. Site hydrogeologic cross sections illustrating the site subsurface lithologic units in relation to the ash are presented in the supporting documentation in Appendix B.

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 10 ft upstream 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 flood plain 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 FAP indicated a coal seam at approximate elevation of 600 ft, MSL. However, the coal seam did not appear to be 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 observed at approximate elevation of 600 ft, MSL.

2.4.3 Regional and Local Hydrogeologic Setting

Groundwater at the BSFAP site occurs in the Pennsylvanian-age sedimentary units of the Conemaugh and Breathitt formations and in the Quaternary-age alluvial deposits at the bottom of the Horseford Creek valley. The Conemaugh and Breathitt formations consist of interbedded sandstones, siltstones and shale. 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. Groundwater storage and movement is primarily within the overburden/weathered bedrock near ground surface or slightly deeper in fractured bedrock. Groundwater storage and movement in the alluvial deposit occurs in the inter-granular porosity and permeability of the sediments.

Groundwater at the BSFAP site is unconfined and is encountered at the unconsolidated soil/bedrock contact, within the fractured bedrock (shale, sandstone, coal) below this contact, and in the alluvial deposits. These hydraulically interconnected water bearing units are considered to be the uppermost aquifer at the BSFAP site, for reasons discussed subsequently in Section 3.1. The Horseford Creek valley is surrounded by ridges, which function as groundwater divides (Figure 2-3) and thus groundwater flow direction at the site is generally parallel to the topographic slope of the hillsides (i.e., down-slope) towards the BSFAP within the Horseford Creek valley. At the base of the BSFAP (i.e., along the bottom of the Horseford Creek valley), groundwater occurs in the alluvial deposits and weathered/fractured bedrock with flow direction in the downstream direction along the centerline of the valley, which is the axis of the BSFAP, and 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 and including the reservoir pool formed by 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.

A map showing the location of the Federal Emergency Management Agency (FEMA)- delineated 100-year floodplain of Blaine Creek is presented in Appendix B (see URS “Attachment 15” drawing in Appendix B). The floodplain information is derived from FEMA’s Flood Insurance Rate Map (FIRM) of this area (FIRM Number 21127C0110D, June 16, 2001). The floodplain information shows that the downstream toe of the rock fill toe buttress of the Main Dam is situated at the limit of the 100-year floodplain of Blaine Creek, and set-back approximately 300 to 400 ft from the FEMA-designated floodway. The FEMA map also indicates that the 100-year base flood elevations in the Blaine Creek are at elevation 567 ft, MSL along this segment of Blaine Creek.

Dikes have been constructed at various locations within the BSFAP (Figure 2-3), 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.

Based on the site hydrogeology described above in Section 2.4.3, the surface water in the BSFAP 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 groundwater discharges through the alluvial deposits into the surface water in the Blaine Creek.

North of the Main Dam, groundwater from the Horseford Creek alluvium appears to flow into the Blaine Creek valley alluvium and eventually would make its way into surface water of the creek. Based on the pre-development site topography, natural surface and groundwater flow near the Saddle Dam would also be primarily towards west or northwest into the Horseford Creek valley (i.e., towards and beneath the BSFAP). However, during periods of high surface water elevation in the BSFAP, some groundwater will likely discharge into the Burke Branch valley through water-bearing subsurface units beneath the Saddle Dam.

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. With the exception of two wells (30002996 and 00060898), the water withdrawal wells are located either upgradient of the BSFAP or isolated from the BSFAP by water divides.

3. REQUIRED ISOLATION FROM UPPERMOST AQUIFER

3.1 Aquifer Definition

According to §257.60(a) of the CCR rule, the term "uppermost aquifer" has the same definition as under the provisions in §257.40, where it is defined as: "the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. This definition includes a shallow, deep, perched, confined, or unconfined aquifer, provided that it yields usable water".

To provide further guidance on making the determination of whether a formation is an aquifer, the Kentucky environmental regulations for water wells (401 KAR 6:001(3)) defines an aquifer as "a water-bearing formation that transmits water in sufficient quantity to supply a well."

Because directly-applicable and potentially-relevant regulatory definitions of an aquifer are qualitative rather than quantitative, the following factors will be considered to assess whether a water-bearing formation (or interconnected formations) are an aquifer: (i) whether there are or have been nearby users of groundwater from the same formation or similar hydrogeologic setting; and (ii) whether the hydrogeologic properties of the formation suggest that the formation could supply water in usable quantities to a water well.

3.2 Uppermost Aquifer at the BSFAP and Piezometric Analysis

The site hydrogeologic setting was described in Section 2.4.3. Groundwater at the site is unconfined and is encountered at the unconsolidated soil/bedrock contact, within the fractured bedrock or sandstone below this contact or in the alluvial deposits. Based on the presence of groundwater detected in numerous monitoring wells screened in the above-mentioned water bearing units, the recovery of these wells during pumping and development, and potentiometric surface measured within these wells generally consistent with site topography and surface water elevation, this interconnected water-bearing system of the soil/bedrock contact, fractured bedrock, and alluvium of the Horseford Creek valley is considered to be the uppermost aquifer at the BSFAP site. 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.

Groundwater levels around the BSFAP site area are monitored by a network of monitoring wells. A map showing the groundwater elevations and inferred groundwater flow direction was generated from measurements taken in May 2016 through July 2016, shown in figure 3-1. Additionally, a map showing historical groundwater elevations, resulting potentiometric contours, and inferred groundwater flow direction is presented in the supplemental information in Appendix B. Finally, as mentioned, hydrogeologic cross sections in Appendix B are provided, all of which illustrate the groundwater elevations in and around the BSFAP, in relation to the ash, and the water bearing layers adjacent to and beneath the BSFAP.

3.3 Compliance Assessment

The location restriction for placement above the uppermost aquifer set forth in §257.60(a) indicates that existing or new CCR landfills, existing or new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The results of the compliance assessment with respect to placement above the uppermost aquifer can be summarized as follows:

- The BSFAP is founded on the alluvium within the valley of Horseford Creek. The BSFAP also receives surface water runoff (some of which infiltrates into the ash), as well as groundwater interaction from the sides of the pond where the ash is in contact with water-bearing strata (e.g., fractured bedrock) which are part of the uppermost aquifer system.

- The BSFAP does not have a liner system, and there is no indication of the presence of a separation (e.g., an isolation layer of lower permeability material) between the base of the unit and the uppermost aquifer system.

Because the BSFAP appears to be in direct contact and hydraulic connection with the underlying uppermost aquifer system and is absent of the minimum five foot separation between the base of the CCR unit and the upper limit of the uppermost aquifer required by §257.60, the BSFAP is therefore judged to not be in compliance with the location restriction for placement above the uppermost aquifer.

4. WETLANDS IMPACT

4.1 Definition of Wetlands

According to §257.61 of the CCR rule, for the CCR unit location restriction regarding wetlands, USEPA has adopted the following definition that is relevant to the evaluation of compliance with respect to wetlands:

- *Wetlands* means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

4.2 Review of Local Wetlands

Geosyntec reviewed the United States Fish and Wildlife Service (USFWS) national wetlands inventory database, and other site-specific wetland information provided to us by AEP, and also visited the BSFAP site in June 2015 to review ground conditions that may be indicative of wetlands.

As part of the proposed BSFAP Closure Plan application filed with the KYDEP – DWM, URS conducted a detailed wetlands delineation/stream assessment, and presented their findings in a wetlands study report (URS, 2013a). These included site visits in May, June, and October 2012 to determine whether wetlands and other "waters of the U.S." exist in the area of the BSFAP (URS, 2013a). The project area was evaluated according to procedures outlines in the U.S. Army Corps of Engineers (USACE) *1987 Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)*; the definitions of wetlands in these publications is consistent with USEPA's definition presented above.

A total of seventeen (17) wetlands were identified by URS (2013a) within their 602-acre study area in and around the BSFAP, totaling a combined area of wetlands of 1.64 acres. Maps showing these wetland locations are provided in the supplemental documentation in Appendix B of this report (see URS (2013a) Figure 3-3K in Appendix B).

Because Kentucky does not have a functional assessment protocol for evaluating wetlands, the USACE Louisville district requested that URS ecologists categorize each wetland according to the Ohio Environmental Protection Agency's "Ohio Rapid Assessment Method for Wetlands" (ORAM), which was developed to determine the relative ecological quality and level of disturbance of a particular wetland (URS, 2013a). The categories, as described by URS (2013a), are as follows:

Category 1: These wetlands support minimal wildlife habitat, hydrological and recreational functions, and typically do not provide for or contain critical habitats for threatened or endangered species. In addition, Category 1 wetlands are often hydrologically isolated and have some or all of the following characteristics: low species diversity, no significant habitat or wildlife use, limited potential to achieve wetland functions, and/or a predominance of non-native species. These limited quality wetlands are considered to be a resource that has been severely degraded or has a limited potential for restoration, or is of low ecological functionality.

Category 2: These wetlands "...support moderate wildlife habitat, or hydrological or recreational functions," and as wetlands which are "...dominated by native species but generally without the presence of, or habitat for, rare, threatened or endangered species; and wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions." Category 2 wetlands constitute the broad middle category of "good" quality wetlands, and can be considered a functioning, diverse, healthy water resource that has ecological integrity and human value. Some Category 2 wetlands are lacking in human disturbance and considered to be naturally of moderate quality; others may have been Category 3 wetlands in the past, but have been degraded to Category 2 status.

Category 3: Wetlands that are assigned to Category 3 have "...superior habitat, or superior hydrological or recreational functions." They are typified by high levels of diversity, a high proportion of native species, and/or high functional values. Category 3 wetlands include wetlands which contain or provide habitat for threatened or endangered species, are high quality mature forested wetlands, vernal pools, bogs, fens, or which are scarce regionally and/or statewide. It is important to stress that a wetland may be a Category 3 wetland because it exhibits one or all of the above characteristics. For example, a forested wetland located in the flood plain of a river may exhibit "superior" hydrologic functions (e.g. flood retention, nutrient removal), but not contain mature trees or high levels of plant species diversity.

Thirteen (13) Category 1 wetlands, four (4) Category 2 wetlands, and no (0) Category 3 wetlands were identified in the study area. However, according to URS (2013a), no regulated wetlands were identified within the limits of the fly ash pond (defined as below elevation 705 ft, MSL).

4.3 Compliance Assessment

The location restriction for wetlands set forth in §257.61(a) indicates that a CCR unit cannot be located in wetlands (unless – for a unit that is located in wetlands – certain demonstrations are made to show that the CCR unit meets the requirements of paragraphs (a)(1) through (a)(5) of §257.61). The detailed, site-specific wetlands study in and around the BSFAP performed by URS (2013a) found that the fly ash pond is not within the limits of any regulated wetlands. Geosyntec's review of the national wetlands inventory database and ground conditions during site visits did not reveal information to the contrary. For these reasons, the BSFAP is judged to be in compliance with the requirements of §257.61 for wetlands.

Because the BSFAP is not located in wetlands, there is no need for the demonstrations to show that the CCR unit meets the requirements of paragraphs (a)(1) through (a)(5) of §257.61.

5. FAULT AREAS

5.1 Regional Geologic Structural Features and Tectonic Setting

There are no active seismogenic faults that cross through, or project toward the site based on a review of the available geologic literature [KGS, 2014; USGS, 2005a; USGS, 2005b] within the vicinity of the site. A nearby fault location map showing the site region is provided on Figure 5-1.

5.2 Compliance Assessment

The location restriction for fault areas set forth in §257.62(a) indicates that existing or new CCR landfills, existing or new CCR surface impoundments, and all lateral expansions of CCR units cannot be located within 200 ft of the outermost damage zone of a fault that has had displacement in Holocene time (unless certain demonstrations of acceptability of an alternate set-back are made). The following information indicates that there are no faults within a considerable distance from the BSFAP site area (much greater than the 200-ft minimum set-back distance) that have displaced within Holocene time:

- The USGS seismic hazard program includes maps depicting faults during the Quaternary Period (Holocene and Pleistocene epochs - about the last 1.6 million years). As shown on Figure 5-1, and based on a review of the Quaternary Fault and Fold Database of the United States (USGS, 2015), no Holocene-age fault zones exist near the site.

- According to the Kentucky Geologic Map Information Service, no active geologic faults exist at or close to the site. As shown on Figure 5-1, the nearest fault is located approximately 6.6 miles from the site. Not only is that fault much further than 200-ft from the BSFAP, but that fault is inactive and is estimated to have not displaced for at least 1.6 million years.

For the foregoing reasons, the BSFAP is judged to be in compliance with the requirements of §257.62 for fault areas.

6. SEISMIC IMPACT ZONE

6.1 Definition and Regional information

The location restriction for seismic impact zones set forth in §257.63(a) indicates that existing or new CCR landfills, existing or new CCR surface impoundments, and all lateral expansions of CCR units cannot be located in seismic impact zones unless the owner or operator makes a demonstration, certified by a qualified professional engineer, that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material from a probable earthquake.

A seismic impact zone is defined as an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years. Seismic zones, which represent areas of the United States with the greatest seismic risk, are mapped by the U.S. Geological Survey and readily available for all of the United States (http://earthquake.usgs.gov/hazards/apps/).

The maximum horizontal acceleration in lithified earth material means the maximum expected horizontal acceleration at the ground surface as depicted on a seismic hazard map with a 98% or greater probability that the acceleration will not be exceeded in 50 years. This translates to a 10 % probability of exceeding the maximum horizontal acceleration in 250 years which is equivalent to a 2% probability of exceeding the maximum horizontal acceleration in 50 years.

6.2 Compliance Assessment

The compliance assessment with respect to seismic impact zone for the BSFAP site includes:

- Identify location of the site (i.e., latitude and longitude).
- Using seismic hazard maps, determine the peak ground acceleration (PGA) corresponding to a 2% probability of exceedance in 50 years.
- If the PGA is less than 0.1 g, then the site is not located in a seismic impact zone.

A map of nearby seismic impact zones, and showing the site and the corresponding PGA at this location is provided on Figure 6-1. The BSFAP is located at: 38° 10' 50" N (Latitude), 82° 38' 0" W (Longitude). As shown on Figure 6-1, the PGA for this location is 0.085 g at bedrock.

Based on the information provided in this section, the BSFAP is not situated in a seismic impact zone and is therefore in compliance with the requirements of §257.63 for seismic impact zones.

7. UNSTABLE AREAS

7.1 Definition of Unstable Area

The location restriction for unstable areas set forth in §257.64(a) indicates that an existing or new CCR landfills, existing or new CCR surface impoundment, and all lateral expansions of CCR units cannot be located in an unstable area unless the owner or operator makes a demonstration that recognized and good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. To assess whether an area is unstable, the CCR rule indicates that at minimum, the following factors must be considered:

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

USEPA has adopted the following definitions that are relevant to the evaluation of compliance with respect to unstable areas:

- *Unstable area* means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.
- *Structural components* mean liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of a CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.
- *Poor foundation conditions* mean those areas where features exist which indicate that a natural or human-induced event may result in inadequate foundation support for the structural components of an existing or new CCR unit.
- *Areas susceptible to mass movement* means those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where, because of natural or human-induced events, the movement of earth material at, beneath, or adjacent to the CCR unit results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, and rock fall.

- *Karst terrain* means an area where karst topography, with its characteristic erosional surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terranes include, but are not limited to, dolines, collapse shafts (sinkholes), sinking streams, caves, seeps, large springs, and blind valleys.

7.2 Compliance Assessment

7.2.1 Areas Susceptible to Bearing Capacity, Static Stability, Seismic Stability or Settlement Failures

This subsection addresses the geotechnical phenomena of bearing capacity, static stability, seismic stability, or settlement failures (i.e., potential types of mass movement) at, beneath, or adjacent to the BSFAP. This includes the subsurface foundation materials beneath the BSFAP, as well as man-made structural components of the BSFAP. Areas characterized as having an active or substantial possibility of experiencing these geotechnical phenomena can be indicators of areas susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit.

Site Investigations and Analyses

Previously-performed stability and settlement analyses associated with the 1993 design (now constructed) of the raising of the Main Dam and construction of the Saddle Dam were used to help evaluate whether the site is situated in a potentially unstable area. The site investigation and calculations discussed below provide an indication that recognized and good engineering practices were incorporated into the design, which helps support this unstable areas compliance assessment for the BSFAP.

As part of the 1993 design for raising the Main Dam and constructing the Saddle Dam, a thorough site investigation and laboratory testing program was conducted to characterize the geotechnical properties of the site soils associated with the dams. The location of borings that have been drilled at the site are shown on Figure 2-3. From samples taken in these borings, a total of sixty-four (64) triaxial compression and sixteen (16) direct shear tests were performed on foundation soils of the Main Dam and Saddle Dam, existing soils of the Main Dam, soils from the borrow area used to construct the compacted clay portions of the dams, and bottom ash samples used to construct the compacted bottom ash downstream shell of the dams. Additionally, one consolidation test was performed on a sample from the existing Main Dam soils and another test was performed on a sample from the Main Dam foundation soils.

Using the results of these laboratory tests and previous site investigation information, a series of settlement and stability analyses were performed as part of the resulting design report package (KYPCo, 1993) for the Main Dam and Saddle Dam. It is noted that although the site is not observed to be in a regulatory-defined seismic impact zone, seismic stability was also evaluated. The results of the stability analyses for the upstream and downstream slopes of the Main Dam and Saddle Dam (KYPCo, 1993) indicate that the calculated factors of safety were acceptable. .

The computed settlements in KYPCo (1993) estimate that the Main Dam would experience approximately 7 inches of settlement due to the added load caused by raising of the dam. The computed settlements estimate that the foundation of the newly constructed Saddle Dam would settle up to one (1) inch, and that the embankment core and shell material within the Saddle Dam would settle approximately 14 inches. These were considered acceptable.

It is noted that it was beyond the scope of this location restrictions evaluation to assess whether these calculations demonstrate that the structural integrity criteria for existing CCR surface impoundments as set forth in 40 CFR §257.73 are met, or whether these calculations could serve as a periodic structural stability or safety factor assessment outlined in 40 CFR §257.73(d) and (e), respectively. The calculations provide an indication that recognized and good engineering practices were incorporated into the analysis of the existing structure, which helps support this unstable areas compliance assessment.

Results of Inspections and Monitoring

The performance over time of existing containment structures at a CCR surface impoundment provides relevant information to assess whether the CCR unit is situated in a potentially unstable area. Observations, measurements, and other collected data can identify documented instability or related concerns, or conversely, can document performance without stability problems. The information can show whether the structures are performing consistently with their design expectations.

At the BSFAP, dam safety inspections are conducted annually on the Main Dam and Saddle Dam (i.e., the structural containment components of the CCR unit). The most recent inspection report (AEP, 2014) concluded that the Main Dam and Saddle Dam did not show any visible signs of significant settlement, instability, or misalignment. This is consistent with conditions observed during Geosyntec's June 2015 site visit conducted at the outset of this location restrictions evaluation process.

The 2014 dam safety inspection report also included an evaluation of the instrumentation monitoring data at the Main Dam. These include the following relevant observations and conclusions (AEP, 2014):

- Review of piezometric levels and seepage flows at the Main Dam were within historical normal ranges and have been generally steady since 2011.

- Review of the pre-raising (pre-1998) vertical deformation data for the Main Dam indicated a maximum top of dam settlement on the crest of the embankment of 9.3 inches, which are considered normal values for dams this height. Since raising has been completed, survey measurements show displacements of the top of dam of generally less than one inch.

- Measurements of downstream face monuments indicates normal horizontal movements in the downstream direction of the dam, in the range of less than about six inches. The settlements correlate to less than 0.5% strain, and are normal and with no signs of increasing deformation rates.

- The slope inclinometers show maximum movements of the interior of the dam in the downstream direction of 1.3 inches.

- The crest of the Main Dam was reported to be in good condition, with no signs of instability, misalignment, cracking, or large displacement. The slope of the Main Dam did not show any visible signs of significant settlement, instability, or misalignment. The abutments were in satisfactory stable condition.

From the information presented in this subsection, the BSFAP does not appear to be in an area susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit due to insufficient bearing capacity, static stability, seismic stability, or settlement; at, beneath, or adjacent to the BSFAP.

7.2.2 Areas Susceptible to Liquefaction

This subsection addresses the phenomenon of liquefaction, which refers to the change in state of soil from a granular media to a liquefied media. Liquefaction typically occurs in loose, saturated or partially-saturated soils in which cyclic shear deformations (such as those induced from seismic events) reduces the effective of the soils to zero, corresponding to a total loss of shear strength of the soil. The most common occurrence of liquefaction is in loose soils (typically sands) that are saturated and experience a significant seismic event. Accordingly, areas susceptible to liquefaction can experience mass movements or related forces that could impair the integrity of structural components of the CCR unit.

The BSFAP has undergone several previous subsurface investigations and geotechnical evaluations. The 1993 Dam Raising Design Report (KYPCo) and the 2012 Geotechnical Summary Report (URS, 2013c) indicate that alluvium and residuum soils were found to overly bedrock beneath the BSFAP. In both investigations, these soils were observed to consist primarily of sandy clay soils of medium plasticity and medium-dense to very stiff consistency. These types of soils are not considered to be liquefiable.

Because of the low seismicity of the region discussed in Section 6 and the consistency and composition of the foundation soils beneath the dams, liquefaction associated with the Main Dam or

Saddle Dam resulting from seismic design ground motions is not anticipated. Accordingly, the BSFAP does not appear to be in an area susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit due to liquefaction.

7.2.3 Areas Susceptible to Mass Movements from Natural Phenomena

This subsection addresses natural phenomena (geologic or geomorphically-induced) that, for areas prone to these phenomena, could be indicators that an area is susceptible to mass movements or otherwise naturally unstable. These phenomena include landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, or rock falls. Susceptibility to instability due to excessive surface erosion is also considered in this subsection.

Published information from the Kentucky Geological Society (KGS) was reviewed to check for known landslides in the area. A map of nearby KGS-documented landslides is presented on Figure 7-1. As shown, there have been no KGS-mapped landslides at or immediately adjacent to the BSFAP site. Additionally, the geotechnical investigation by URS (2013c) provides a report of site reconnaissance that included checking for and identifying indicators of slope failures on the slopes around the BSFAP. Aside from an existing slope failure on a steep man-made cut slope of a borrow area that did not affect the BSFAP, no areas of obvious failures, slides, avalanches, or rock falls were observed in naturally formed slopes. No area was observed to feature substantial signs of historical slope failure or instability. The report concluded that observations do not indicate that the existing slopes are unstable or distressed.

Surface erosion is also not anticipated to result in mass movement in this area. The valley sideslopes above the existing BSFAP are inclined from about 2H:1V to 5H:1V, and at these elevations the surficial material is composed of either bedrock outcrops, or residual soils in thin veneers generally consisting of clay derived from the weathering of underlying bedrock. These materials are not particularly erosion-prone, and mass movements due to surface erosion of these types of materials are not expected. With respect to surface erosion of the Main Dam and Saddle Dam, the upstream slopes are vegetated and the downstream slopes are lined with riprap or dumped rock fill erosion protection, and are not expected to undergo surface erosion.

From the information presented in this subsection, the BSFAP does not appear to be in an area susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit due to natural geologic or geomorphically-induced phenomena.

7.2.4 Areas Impacted by Human Induced Activities

This subsection addresses human induced activities, such as mining, land subsidence due to excessive drawdown of groundwater or minerals, or filling that has occurred over man-made unstable ground, that, for areas in and around such conditions, could be indicators of an area susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit.

Published information from the Kentucky Mine Mapping Information Survey and from the West Virginia Geological and Economic Survey was reviewed to check for the presence of mines in and around the BSFAP. Underground mining is a human-induced activity that under certain circumstances could have the potential to cause instability (e.g., underground mine collapse and resulting surficial land subsidence or movement). A map of nearby mining activity is presented on Figure 7-2. From this map, there are no known underground mines in and around the BSFAP site area (the closest area of mining is about eight (8) miles from the site). Accordingly, mass movement or other impacts to the due to mining are not anticipated.

Additionally, to evaluate the potential for mass movements that could be induced by land subsidence due to drawdown from nearby wells (i.e., large withdrawals of groundwater or oil/gas), information on nearby water, oil/gas wells was considered. Four (4) oil and gas wells have been drilled in the past, south of the site in the Fullers Branch valley, as shown on the supplemental documentation provided in Appendix B (see URS “Attachment 15” map in Appendix B). However, those wells are separated from the BSFAP by the ridgeline that forms the border of the Horseford Creek valley and in general there does not appear to be extensive oil and gas exploration/withdrawal activity close to the BSFAP site that could lead to human-induced mass movement. Also, as discussed in Section 2.4.5 and shown on Figure 2-5, ten (10) water withdrawal wells were identified within approximately one (1) mile of the BSFAP. From the low yield and low capacity of these wells (Table 2-3), quantities of groundwater withdrawal to the extent that could lead to human-induced impacts or mass movement are not anticipated.

Neither the Main Dam, nor the Saddle Dam were constructed by filling over man-made unstable ground. The Main Dam is founded on natural materials – a stratum of medium dense to very stiff alluvium overlying bedrock (along with a compacted clay keyway founded on bedrock). The Saddle Dam is founded on natural materials – primarily on bedrock (along with some of the foundation on stiff clay residuum soils).

From the information presented in this subsection, the BSFAP does not appear to be in an area susceptible to mass movements or related forces that could impair the integrity of structural components of the CCR unit due to anthropogenic phenomena resulting from mining, land subsidence due to excessive drawdown of groundwater or minerals, or filling that has occurred over man-made unstable ground.

7.2.5 Presence of Karst Terrain

This subsection addresses whether there is karst terrain in and around the site that could make the site naturally unstable. Karst topography develops as a result of dissolution of limestone, dolomite, or other soluble rock. Resulting subterranean features such as caves and sinkholes that form in karst areas could collapse, and the presence of these features at a site are indicators of a potentially unstable area.

Published geologic maps were consulted to check whether the site is situated in an area of karst terrain. A map showing nearby karst zones in the region is presented on Figure 7-3. From this map, based on information from the Kentucky Geological Survey (KGS, 2014) and from the USGS's map of karst areas of the United States (Weary and Doctor, 2014), there are areas of karst occurrence areas in parts of Kentucky located about 30 to 90 miles west of the site. However, there are no mapped karst zones in and around the BSFAP site area (none within about 25 miles of the site). Geosyntec also consulted a published KGS map of sinkholes (which could be indicators of karst terrain). No sinkholes were mapped in Lawrence County (http://kgs.uky.edu/kgsweb/download/karst/sinkpick.htm).

It is noted that although limestone is described as a minor constituent in the Breathitt formation (Huddle et al., 1963), none of the borings encountered a limestone unit beneath the base of the BSFAP area to the depths investigated. The Brush Creek limestone within the Conemaugh formation has been observed along slopes overlying the ash pond. These formations at the site that contain limestone are not karstic. There have been no mapped, observed, or reported karst terrain or features attributed to karst (sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys) in or around the site.

7.2.6 Areas Susceptible to Coastal or River Erosion

This subsection addresses whether there are areas in and around the site that are susceptible to coastal or river erosion that could lead to instability. The BSFAP is hundreds of miles inland from any coastlines, and therefore not subject to coastal erosion. The closest major river to the BSFAP is the Big Sandy River. The BSFAP is, at its closest point, about 0.5 miles away from the Big Sandy River, and at a much higher ground elevation than that of the river (protected by ridges that are well over 100-ft higher than the river). Therefore, the BSFAP is not anticipated to experience river erosion from the Big Sandy River.

The downstream side of the BSFAP is at the Main Dam that was constructed across the Horseford Creek valley, near where it joins the Blaine Creek valley. The base of the Main Dam is located a few hundred feet south of Blaine Creek. Floodplain information discussed in Section 2.4.4 shows that the downstream toe of the Main Dam of the BSFAP is situated at the limit of the FEMA-designated 100-year floodplain of Blaine Creek, and set-back approximately 300 to 400 ft from the FEMA-designated floodway. "Floodway" refers to the zone associated with the creek channel and banks that conveys the flood waters, and is where the more rapidly flowing waters (and therefore potentially erosive forces) occur during a flood event. A "floodplain" refers to adjacent areas outside of the stream bank where waters may rise during a flood event, and these areas tend to be much more stagnant waters. Since the downstream slopes of the Main Dam are lined with riprap or dumped rock fill erosion protection, and since only the toe of the slope is situated at the floodplain (but set back over 300-ft from the flowing waters of the floodway), the site does not appear to be in an area subject to river erosion.

7.3 Summary of Unstable Area Compliance Assessment

The results of the compliance assessment with respect to unstable areas can be summarized as follows:

- On-Site or Local Soil Conditions That May Result in Differential Settling. The BSFAP site does not appear to be situated on poor foundation conditions that could differentially settle significantly or provide inadequate foundation support to the extent that could make the CCR unit susceptible to mass movements or otherwise impair the integrity of the structural components. This is based on subsurface investigations and design analyses, and is supported by the observations and data analysis of the ongoing dam safety inspection program.

- On-Site or Local Geologic or Geomorphologic Features. The BSFAP site is not located in karst terrain, nor does there appear to be evidence of other geologic or geomorphologic features (surface erosion, coastal or river erosion, landslides, avalanches, debris slides and flows, soil fluctuation, block sliding, and rock fall) that could make the CCR unit susceptible to mass movements or otherwise impair the integrity of the structural components.

- On-Site or Local Human-Made Features or Events (Both Surface and Subsurface). The BSFAP site is not located in an area of known subsurface mines, or in an area experiencing significant water or mineral withdrawal, nor do there appear to be evidence of other human-made features or man-induced events that could result in the downslope transport of soil and rock material that would make the CCR unit susceptible to mass movements or otherwise impair the integrity of the structural components.

For the foregoing reasons and based on the information provided in this section, the BSFAP does not appear to be situated in an unstable area, and is therefore judged to be in compliance with the requirements of §257.64 for unstable areas.

8. CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

Based on the evaluations presented in this report, the existing BSFAP CCR unit at the Big Sandy Plant is, in my professional opinion, demonstrated to be in compliance with the USEPA minimum location restriction requirements for the siting criteria listed below. Note that for the reasons discussed in Section 3.3 of this report, the BSFAP does not appear to be in compliance with the isolation from uppermost aquifer zone requriements of 40 CFR §257.60, and cannot be certified. By means of this certification, I am stating that the demonstrations contained herein meet the requirements of:

- 40 CFR §257.61(a) for Wetlands;
- 40 CFR §257.62(a) for Fault Areas;
- 40 CFR §257.63(a) for Seismic Impact Zones; and
- 40 CFR §257.64(a) for Unstables Areas.

Scott M. Graves

Printed Name of Licensed Professional Engineer

STATE OF KENTUCKY
SCOTT M. GRAVES
21274
LICENSED
PROFESSIONAL ENGINEER

10/10/2016

Seal and Signature | Date

21274 | Kentucky

License No. | State

TABLES

Table 2-1. Timeline of Big Sandy Power Plant 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.

Table 2-2. Summary of Drilled Soil Borings and Installed Groundwater Monitoring Wells

Well ID	Northing [1]	Easting[1]	Ground Elevation[2] (ft)	Depth (ft)
Monitoring Wells				
MW-1007	253987.4	2104789.3	708.9	86.0
MW-1008	254111.2	2105825.2	719.1	113.0
MW-1009	251577.9	2107141.0	710.5	124.0
MW-1010	250692.0	2105790.1	846.4	245.0
MW-1011	251056.6	2105873.3	716.2	81.0
MW-1201	252798.0	2099724.0	799.4	49.5
MW-1202	251651.6	2101180.0	849.6	44.5
MW-1203	252205.1	2101406.0	728.7	54.4
MW-1204	252025.3	2102075.0	721.3	35.0
MW-1205	251131.0	2104397.0	714.3	54.5
MW-1206	251617.9	2104243.0	695.4	124.5
MW-1207	251598.3	2104256.0	695.0	166.0
MW-1601	254131.1	2105873.3	716.2	77.63
MW-1602	254183.2	2103715.6	787.9	142.7
MW-1603	251596.5	2101406.5	728.3	49.7
MW-1604	254482.3	2104798.7	713.8	79.8
MW-1605	252760.2	2105862.8	711.6	92.4
MW-1606	254592.8	2107344.4	673.2	34.5
MW-1607	254664.5	2108828.4	553.1	53.1
MW-1611	254192.1	2110694.0	554.4	28.6
Pond Borings				
PB-1	252600.8	2101790.8	695.1[3]	57.0
PB-2	252113.7	2102286.4	695.1[3]	77.0
PB-3	251582.4	2102704.0	698.3	93.0
PB-4	251302.5	2103601.0	700.0	112.2
PB-5	251174.1	2103663.0	700.9	57.1
PB-6	251301.0	2103083.0	698.6	100.0
PB-7	251635.0	2104228.0	695.3	127.0
PB-8	253100.3	2105679.0	674.0	153.0

Notes:

1. Northing and Easting are based on NAD 83 State Plane Coordinate System (Kentucky North).
2. Vertical datum is based on NAVD 88.
3. Elevation of the water surface in the pond.

Table 2-2 (cont.). Summary of Drilled Soil Borings and Installed Groundwater Monitoring Wells

Well ID	Northing [1]	Easting[1]	Ground Elevation[2] (ft)	Depth (ft)
Soil Borings				
SB-3	253,542.1	2,102,379.0	845.7	54.0
SB-4	251,829.7	2,101,718.0	794.0	30.0
SB-6	251,202.5	2,102,399.0	768.8	39.3
SB-7	252,280.4	2,103,342.0	850.4	29.7
SB-8	251,071.0	2,103,738.0	711.3	49.3

Notes:

1. Northing and Easting are based on NAD 83 State Plane Coordinate System (Kentucky North).
2. Vertical datum is based on NAVD 88.
3. Elevation of the water surface in the pond.

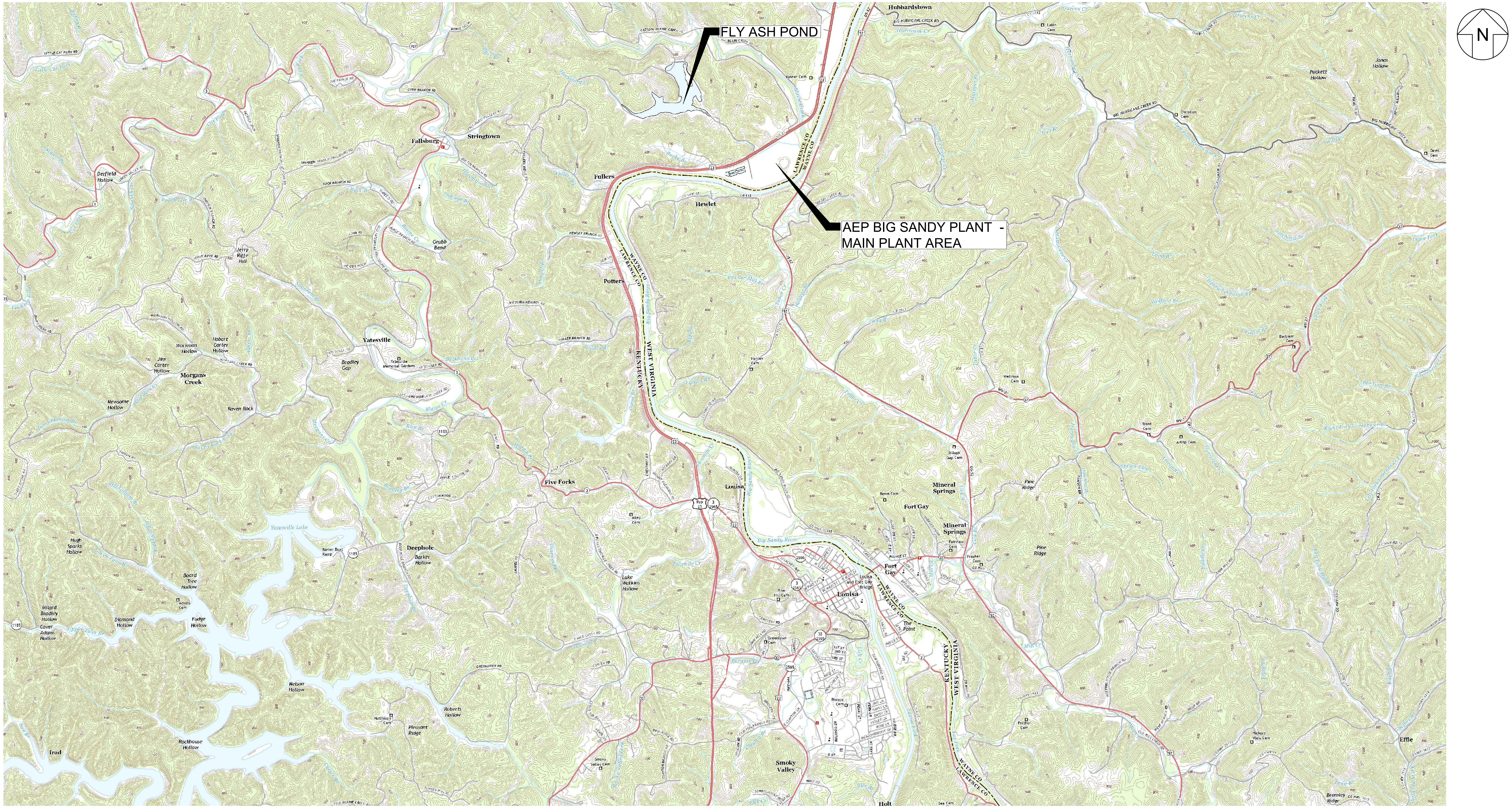
Table 2-3. Summary of Nearby Groundwater Withdrawal Wells

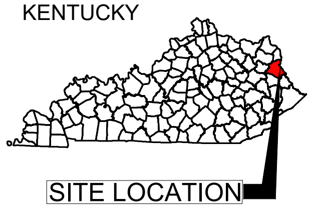
AKGWA Number	Primary Use	Latitude[1]	Longitude[1]	Construction Date	Elevation (ft)	Total Depth (ft)	Static Water Level (ft)	Approximate Static Water Level Elevation (ft)	Well Yield (gpm)
00011523	Domestic - Single Household	38.189	-82.638	5/23/1988	580	67	50	530	35
00006915	Domestic - Single Household	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

FIGURES





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).

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

SITE LOCATION MAP FLY ASH POND AEP BIG SANDY PLANT LOUISA, KENTUCKY	
Geosyntec consultants	FIGURE 2-1
AUSTIN, TX — OCTOBER 2016	

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

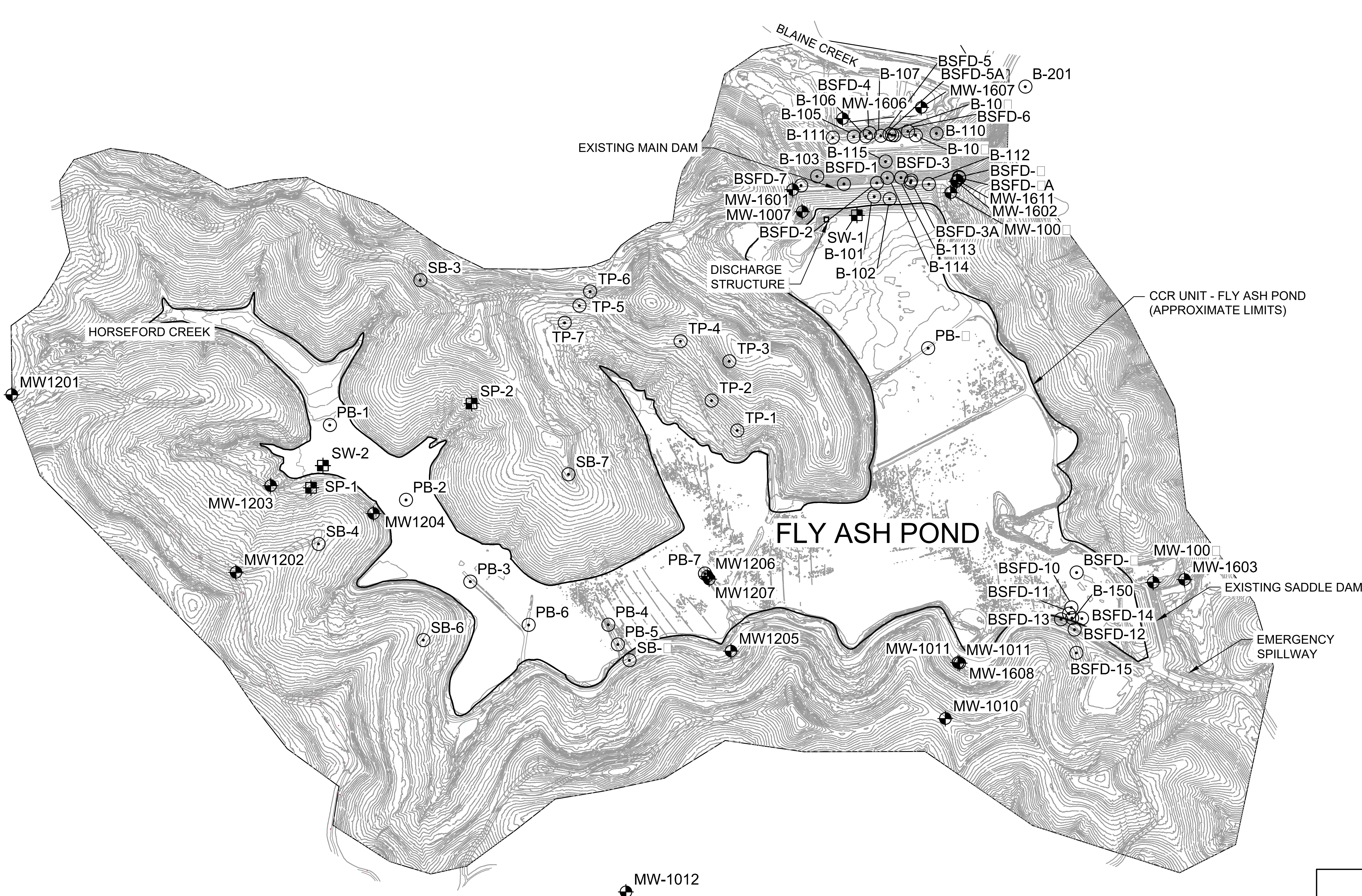
PLANT AND CCR UNIT LOCATION MAP
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | OCTOBER 2016

FIGURE 2-2

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



LEGEND

- EXISTING GROUNDWATER MONITORING WELL
- SAMPLING LOCATION (SW - SURFACE WATER SAMPLE, SP - SEEP SAMPLE)
- PREVIOUSLY DRILLED SOIL BORING OR INVESTIGATION (SB BSFD - SOIL BORING, PB - POND BORING, TP - TEST PIT)

NOTES:

1. TOPOGRAPHIC BASE MAP BASED ON AERIAL PHOTOGRAPHY, FLOWN MARCH 22, 2015 BY HENDERSON AERIAL SURVEYS INC.
2. LOCATION OF EXISTING POINTS (SOIL BORINGS, INVESTIGATIONS, TEST PITS, SAMPLES, AND MONITORING WELLS) ARE APPROXIMATE.
3. MW-1604 AND MW-1605 ARE NOT SHOWN.

0 700'
SCALE IN FEET

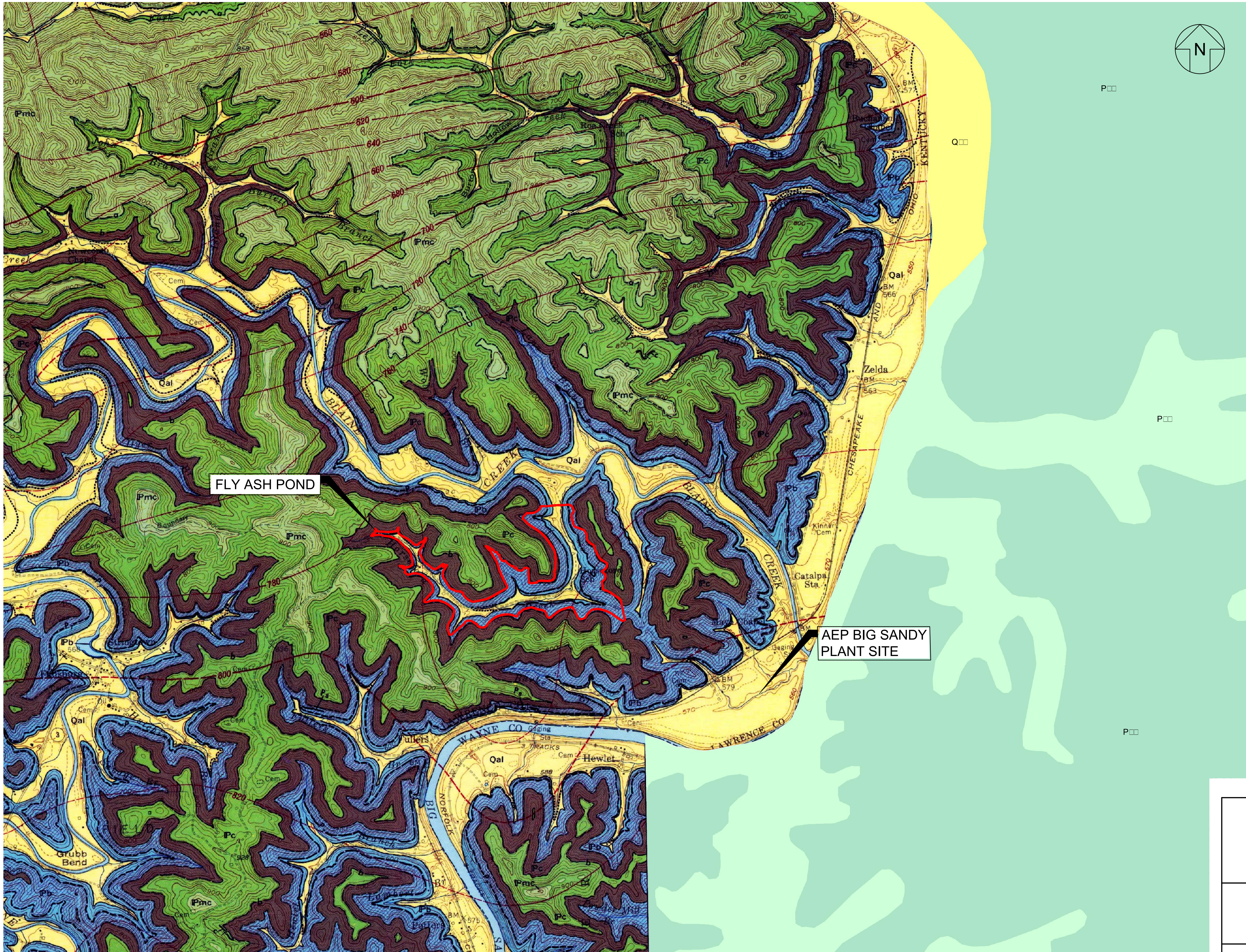
CCR UNIT LAYOUT AND BORING
MONITORING WELL LOCATIONS
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | OCTOBER 2016

FIGURE 2-3

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F02A



LEGEND

FLY ASH POND BOUNDARY

700 — TOP BRUSH CREEK LIMESTONE MEMBER, CONEMAUGH FORMATION

KENTUCKY

Qal — Alluvium

IPmc, IPc — Monongahela and Conemaugh Formations
IPmc, Monongahela Formation and upper part of Conemaugh Formation
IPc, Conemaugh Formation
a, Ames Limestone Member
c, unnamed coal bed
b, Brush Creek Limestone Member
bc, Brush Creek coal bed

IPb — Breathitt Formation
P8, Princess No. 8 coal bed
P7, Princess No. 7 coal bed
P6, Princess No. 6 coal bed
P5, Princess No. 5 coal bed

WEST VIRGINIA

Q□□ — ALLUVIUM

P□□ — ALLEGHENY FORMATION

P□□ — 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 1□6□ STATE GEOLOGIC MAP OF WEST VIRGINIA, PUBLISHED BY THE WILLIAMS □ HEINT□ MAP CORPORATION.

0 2,500'
SCALE IN FEET

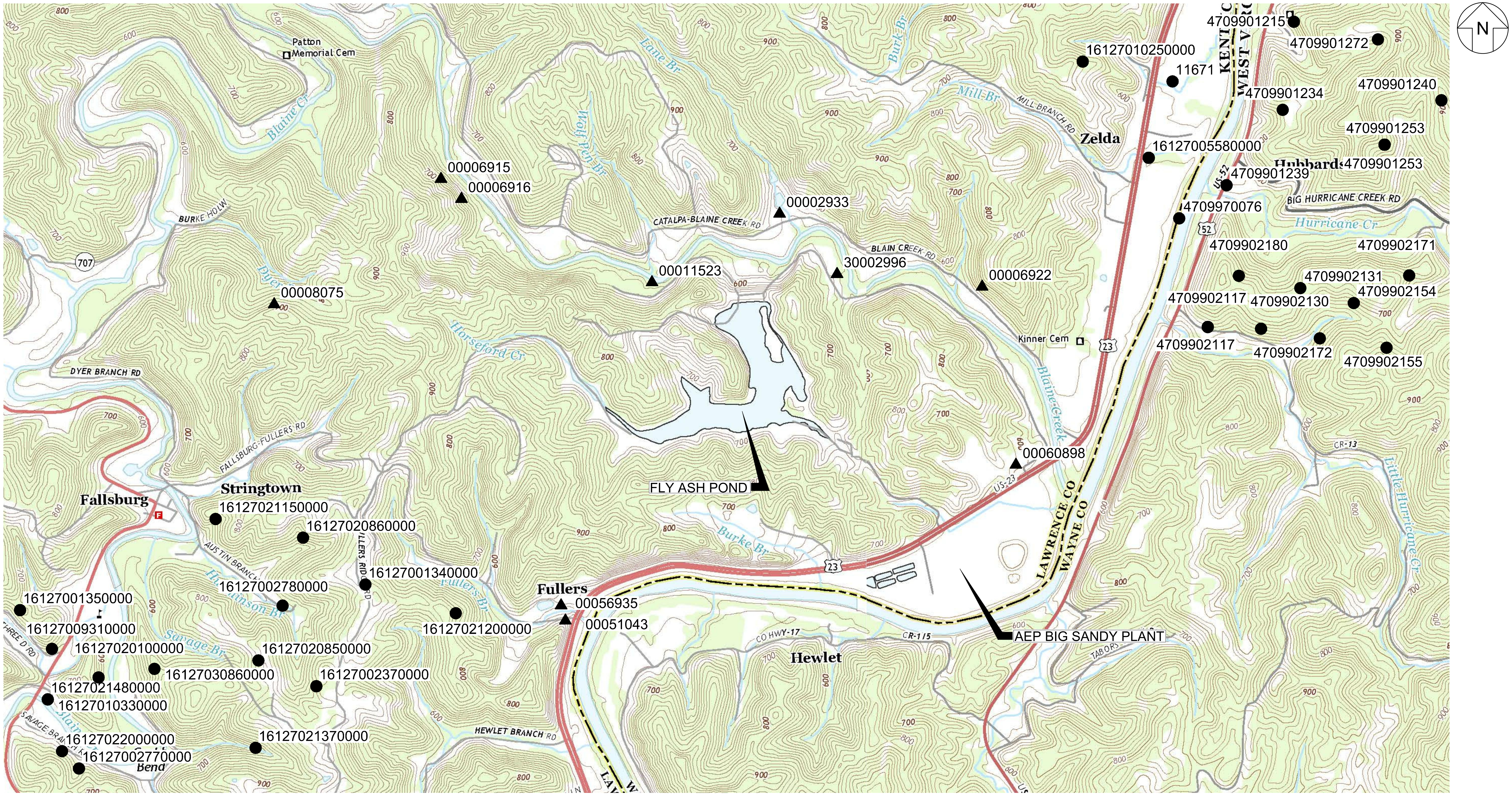
SURFACE GEOLOGY MAP
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | OCTOBER 2016

FIGURE 2-4

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



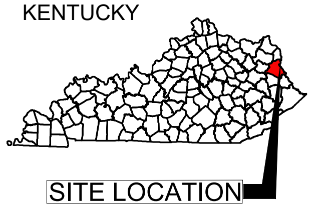
LEGEND

- ▲ EXISTING GROUNDWATER SUPPLY WELL
- ● OIL AND/OR GAS WELL

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

NOTES:

1. NUMERICAL CODE NEXT TO EACH WATER WELL SYMBOL REFERS TO THE AMERICAN PETROLEUM INSTITUTE (API) WELL IDENTIFIER NUMBER. WHERE THE API NUMBER WAS UNAVAILABLE, THE KENTUCKY RECORD NUMBER IS LISTED.
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).
3. LOCATION AND DESCRIPTION OF OIL AND GAS WELLS WERE OBTAINED FROM THE KENTUCKY GEOLOGIC MAP INFORMATION SERVICE (KENTUCKY GEOLOGICAL SURVEY, HTTP://KGS.UKY.EDU/KGSMAP/KGSWATER/VIEWER.ASP) AND FROM THE OIL AND GAS WELLS OF WEST VIRGINIA MAP (WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY, HTTP://IMS.WVGS.WVNET.EDU/WVOG/VIEWER.HTM).



0 2,000'

SCALE IN FEET

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

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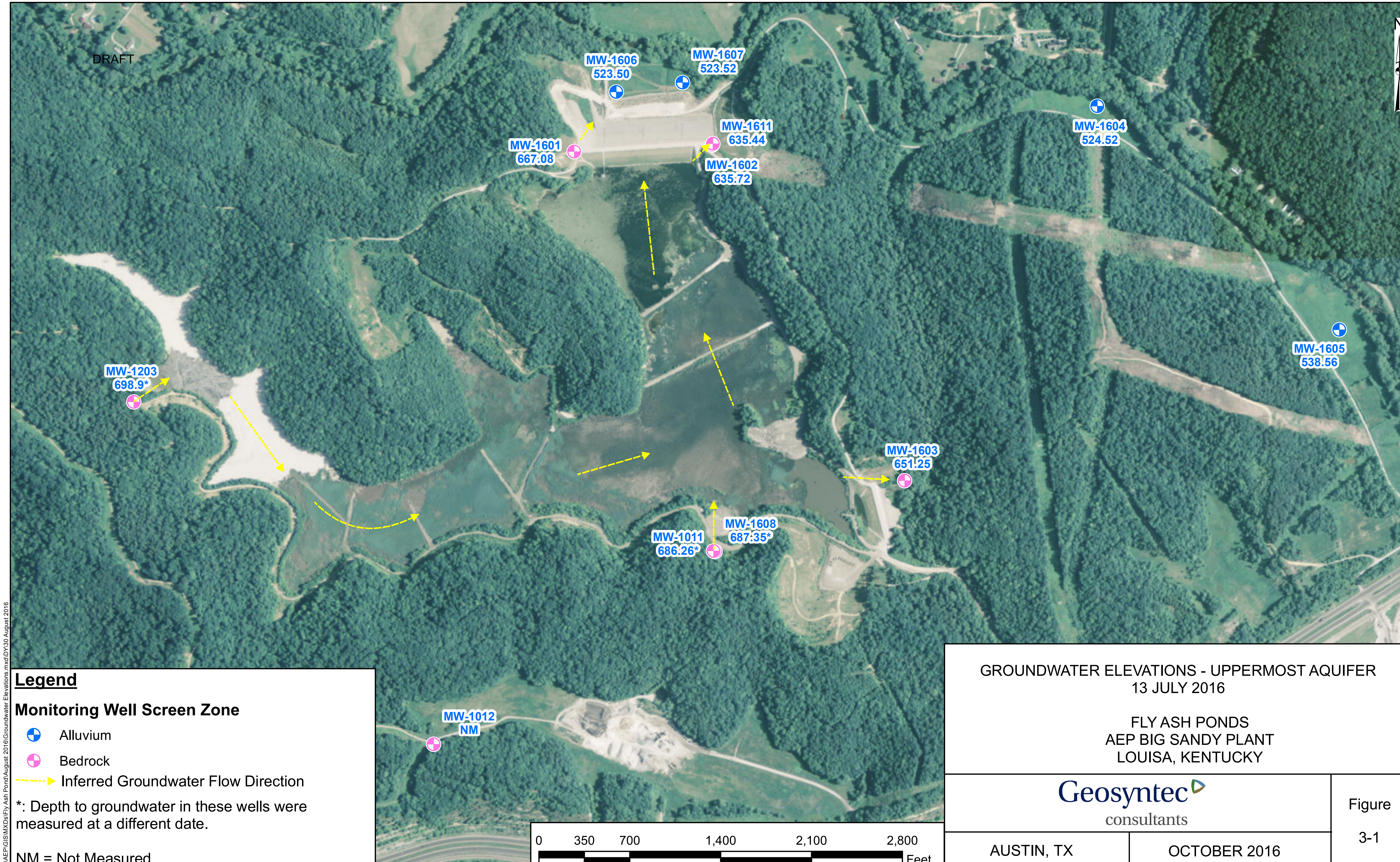
AUSTIN, TX | OCTOBER 2016

FIGURE 2-5

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F14



Legend

Monitoring Well Screen Zone

- Alluvium
- Bedrock
- Inferred Groundwater Flow Direction

*: Depth to groundwater in these wells were measured at a different date.

NM = Not Measured

GROUNDWATER ELEVATIONS - UPPERMOST AQUIFER
13 JULY 2016

FLY ASH PONDS
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

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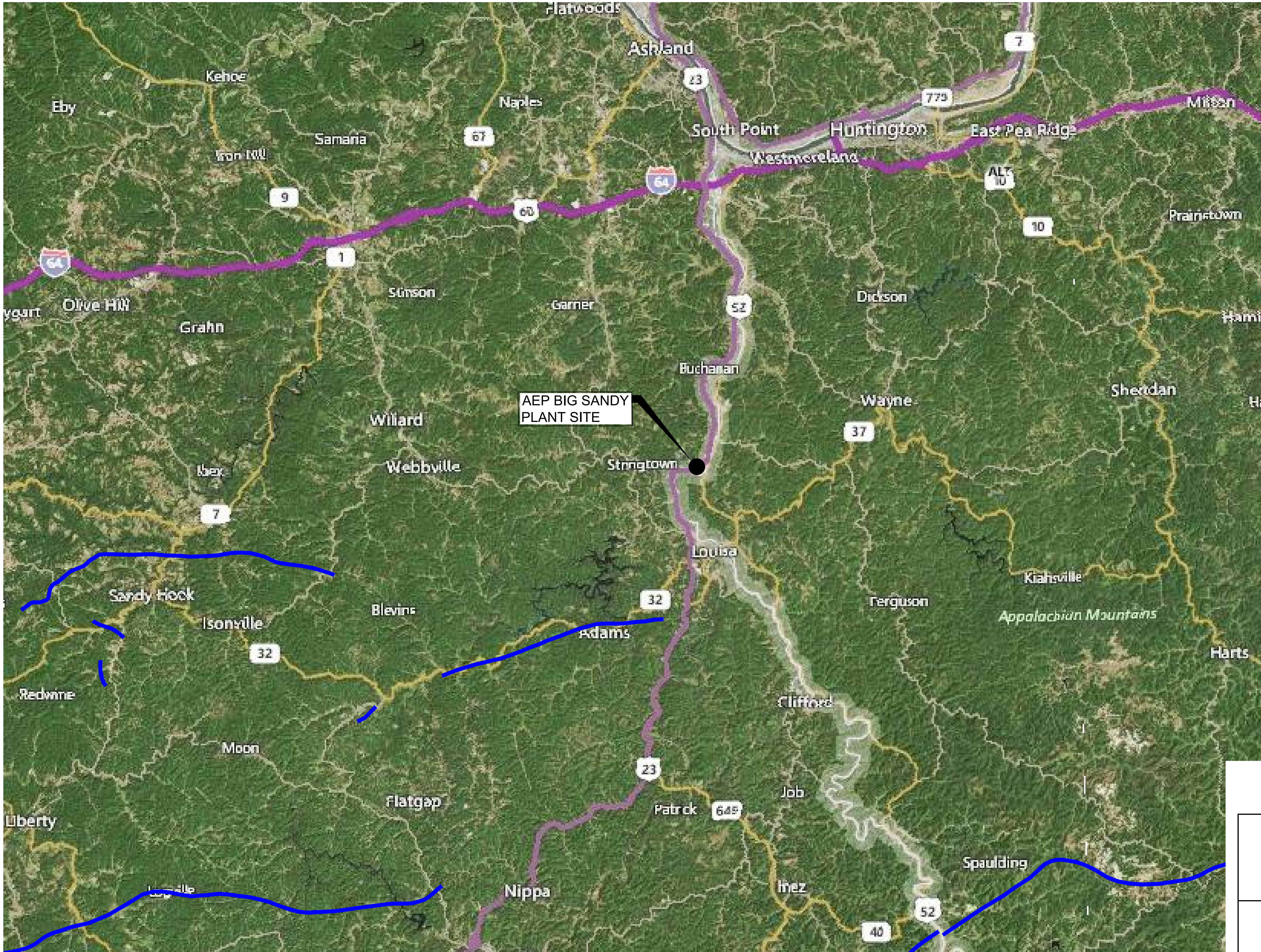
Figure 3-1

N:\AEP\GIS\MXDs\Fly Ash Pond\August 2016\Groundwater Elevations.mxd\DY\30 August 2016



LEGEND

FAULT LOCATION (NOTE 2)

NOTES:

1. FAULT LOCATIONS OBTAINED FROM THE KENTUCKY GEOLOGIC MAP INFORMATION SERVICE [SOURCED FROM THE KENTUCKY GEOLOGICAL SURVEY (HTTP://KGS.UKY.EDU/KGSMAP/KGSGEOSERVER/VIEWER.ASP)] AND FROM THE WEST VIRGINIA GEOLOGIC MAP DATA [USGS, 2005].
2. FAULTS SHOWN ARE INACTIVE. THERE ARE NO KNOWN HOLOCENE FAULTS IN AND AROUND THE SITE AND WITHIN THE EXTENTS OF THIS MAP.

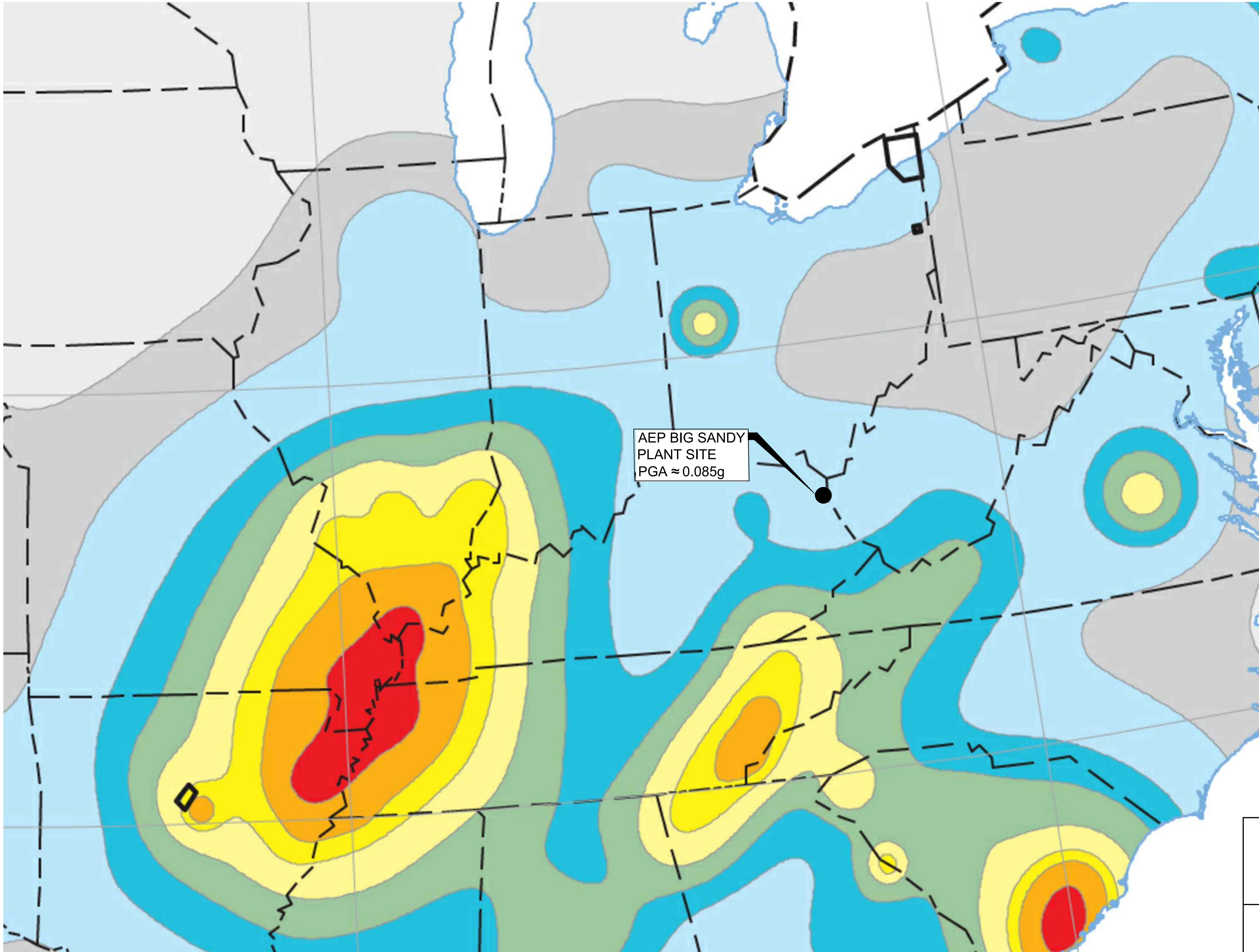
0 5

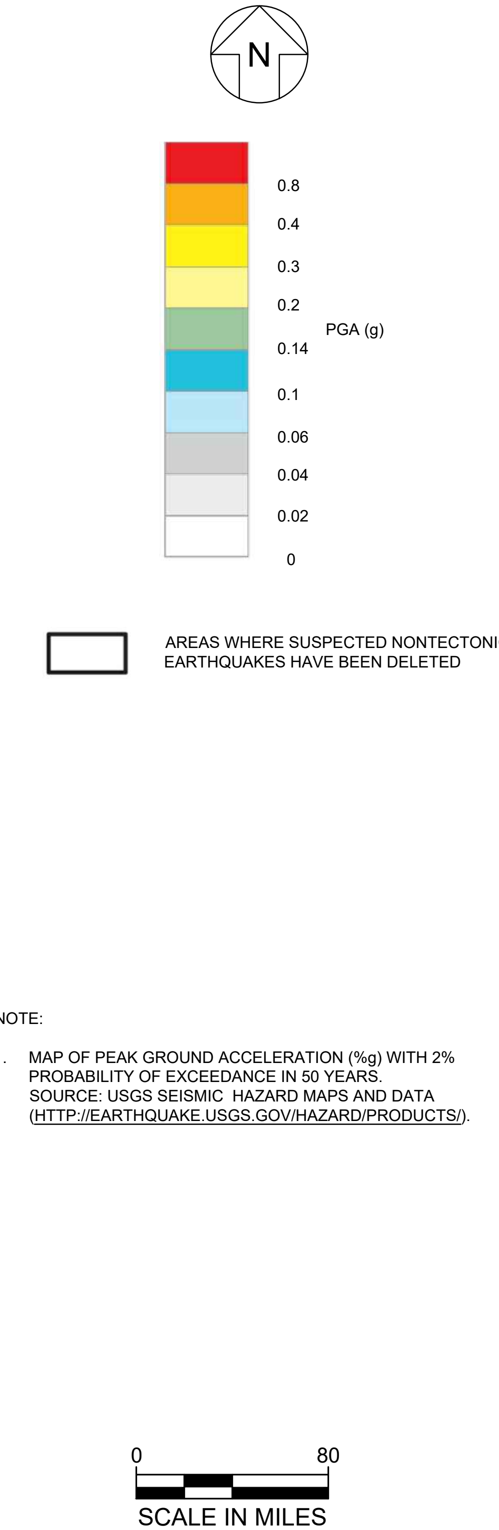
SCALE IN MILES

BASE MAP SOURCE: 2015 BING MAPS COURTESY OF MICROSOFT CORPORATION.

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F06

NEARBY FAULT LOCATION MAP FLY ASH POND AEP BIG SANDY PLANT LOUISA, KENTUCKY	
Geosyntec consultants	FIGURE 5-1
AUSTIN, TX	OCTOBER 2016





NOTE:

1. MAP OF PEAK GROUND ACCELERATION (%g) WITH 2% PROBABILITY OF EXCEEDANCE IN 50 YEARS. SOURCE: USGS SEISMIC HAZARD MAPS AND DATA (HTTP://EARTHQUAKE.USGS.GOV/HAZARD/PRODUCTS/).

NEARBY SEISMIC IMPACT ZONES
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

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FIGURE 6-1

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F04

BASE MAP SOURCE: 2015 BING MAPS COURTESY OF MICROSOFT CORPORATION.

N

LEGEND

KNOWN LANDSLIDE LOCATION

NOTE:

1. LANDSLIDE LOCATIONS OBTAINED FROM THE KENTUCKY GEOLOGIC MAP INFORMATION SERVICE AND SOURCED FROM THE KENTUCKY GEOLOGICAL SURVEY (HTTP://KGS.UKY.EDU/KGSMAP/KGSGEOSERVER/VIEWER.ASP).

0 2,500'

SCALE IN FEET

POTENTIALLY UNSTABLE AREAS -
NEARBY LANDSLIDES
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

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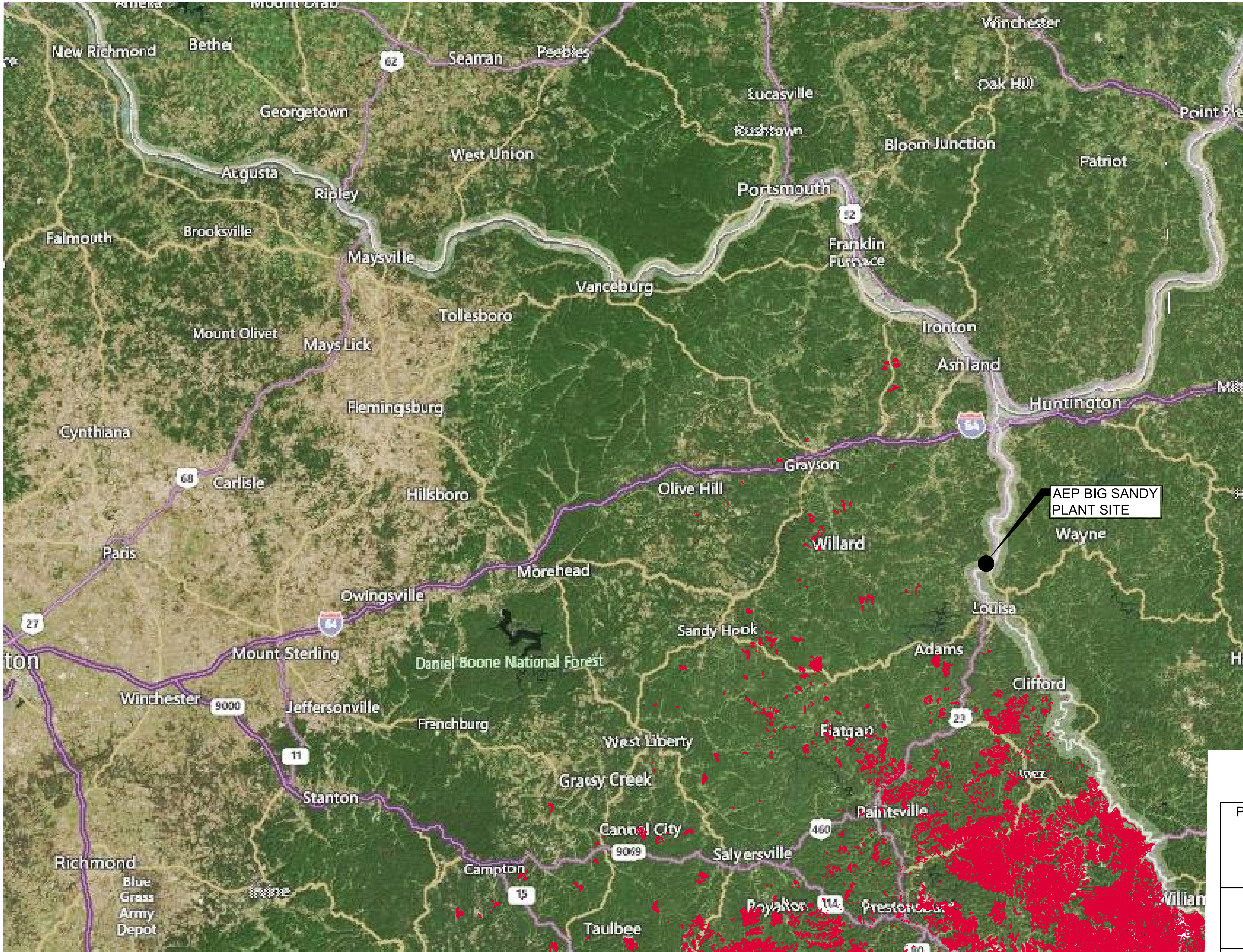
FIGURE 7-1

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F10



BASE MAP SOURCE: 2015 BING MAPS COURTESY OF MICROSOFT CORPORATION.

LEGEND

COAL MINE

NOTE:

COAL MINE LOCATIONS OBTAINED FROM THE KENTUCKY MINE MAPPING INFORMATION SYSTEM PROVIDED BY THE KENTUCKY DIVISION OF MINE SAFETY (HTTP://MINEMAPS.KY.GOV/DEFAULT.ASPX?SRC=DOWNLOADS) AND FROM THE COAL BED MAPPING PROJECT PROVIDED BY THE WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY (HTTP://WWW.WVGS.WVNET.EDU/GIS/CBMP/ALL_MINING.HTML).

0 10

SCALE IN MILES

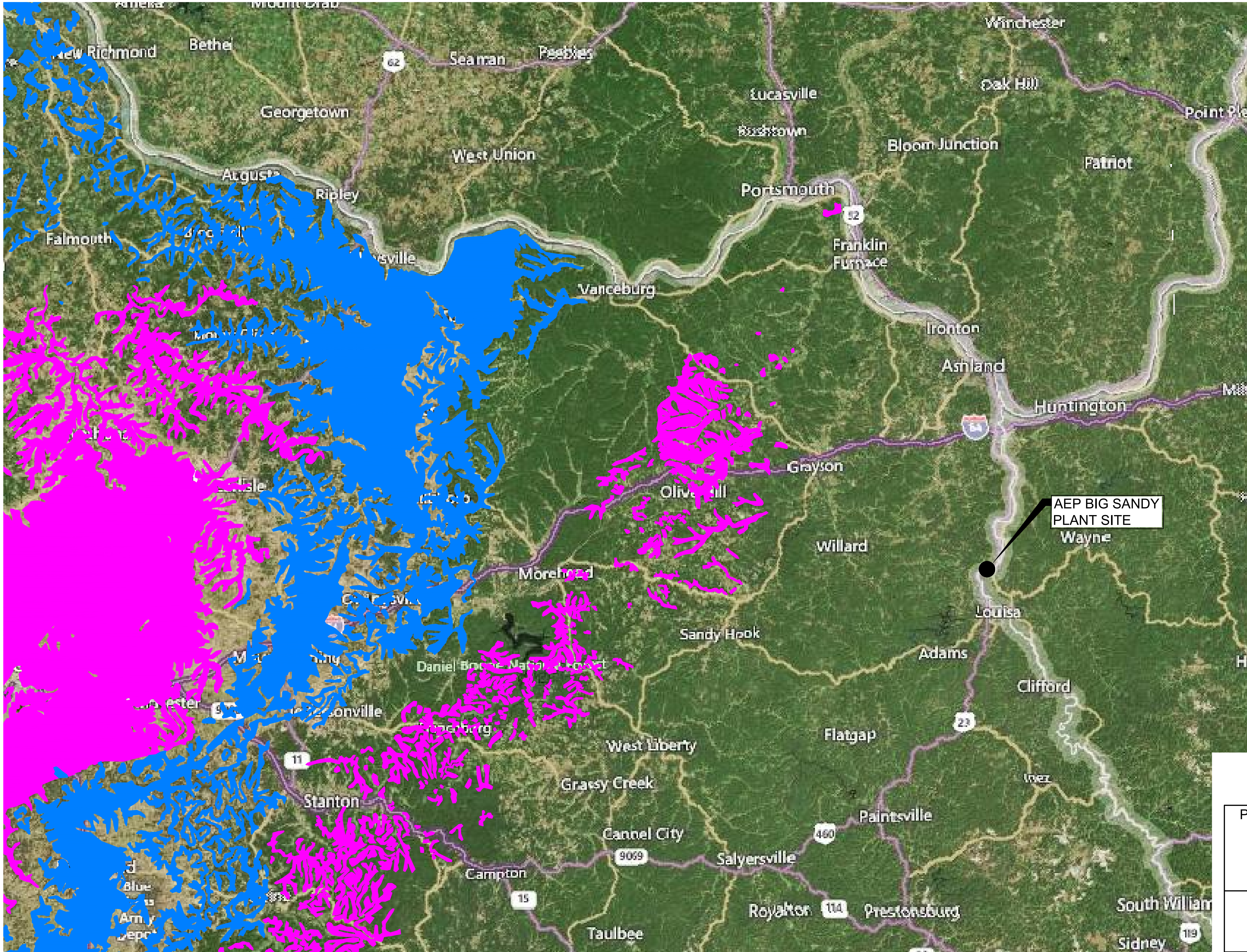
POTENTIALLY UNSTABLE AREAS - MAP OF NEARBY MINING ACTIVITY
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX | OCTOBER 2016

FIGURE 7-2

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F05



N

LEGEND

KENTUCKY KARST MODERATE

KENTUCKY KARST MAJOR

NOTE:

1. KARST ZONES OBTAINED FROM THE KENTUCKY GEOLOGIC MAP INFORMATION SERVICE [SOURCED FROM THE KENTUCKY GEOLOGICAL SURVEY (HTTP://KGS.UKY.EDU/KGSMAP/KGSGEOSERVER/VIEWER.ASP)] AND FROM "KARST IN THE UNITED STATES: A DIGITAL MAP COMPILATION AND DATABASE" [USGS, 2014].

0 10

SCALE IN MILES

BASE MAP SOURCE: 2015 BING MAPS COURTESY OF MICROSOFT CORPORATION.

POTENTIALLY UNSTABLE AREAS - MAP OF NEARBY KARST ZONES
FLY ASH POND
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

FIGURE 7-3

AUSTIN, TX | OCTOBER 2016

P:\CADD\PROJECTS\B\BIG SANDY\PERMIT\CCR COMPLIANCE (TXL0510.02)\FIGURES\TXL051002F09

APPENDIX A

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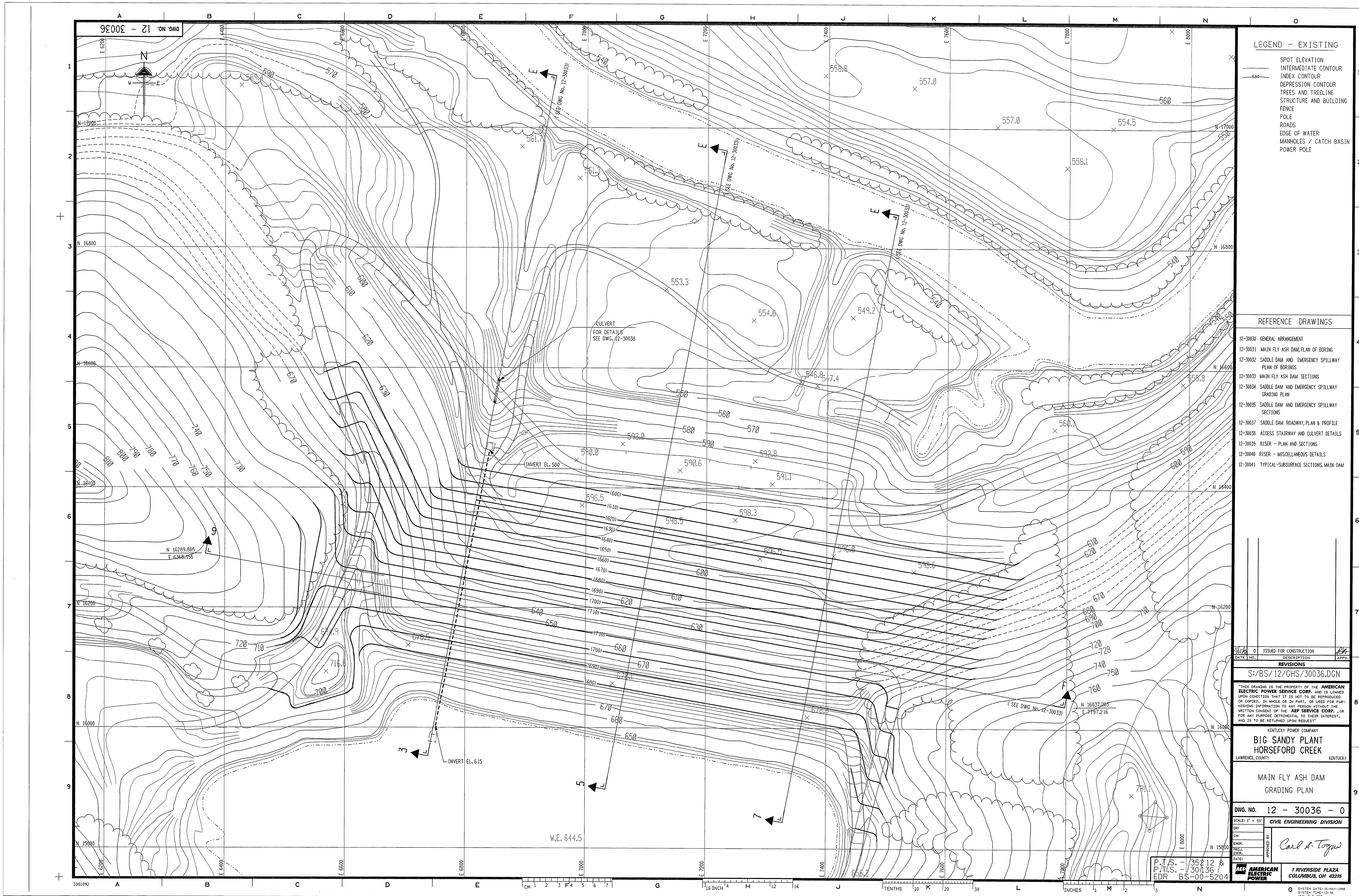
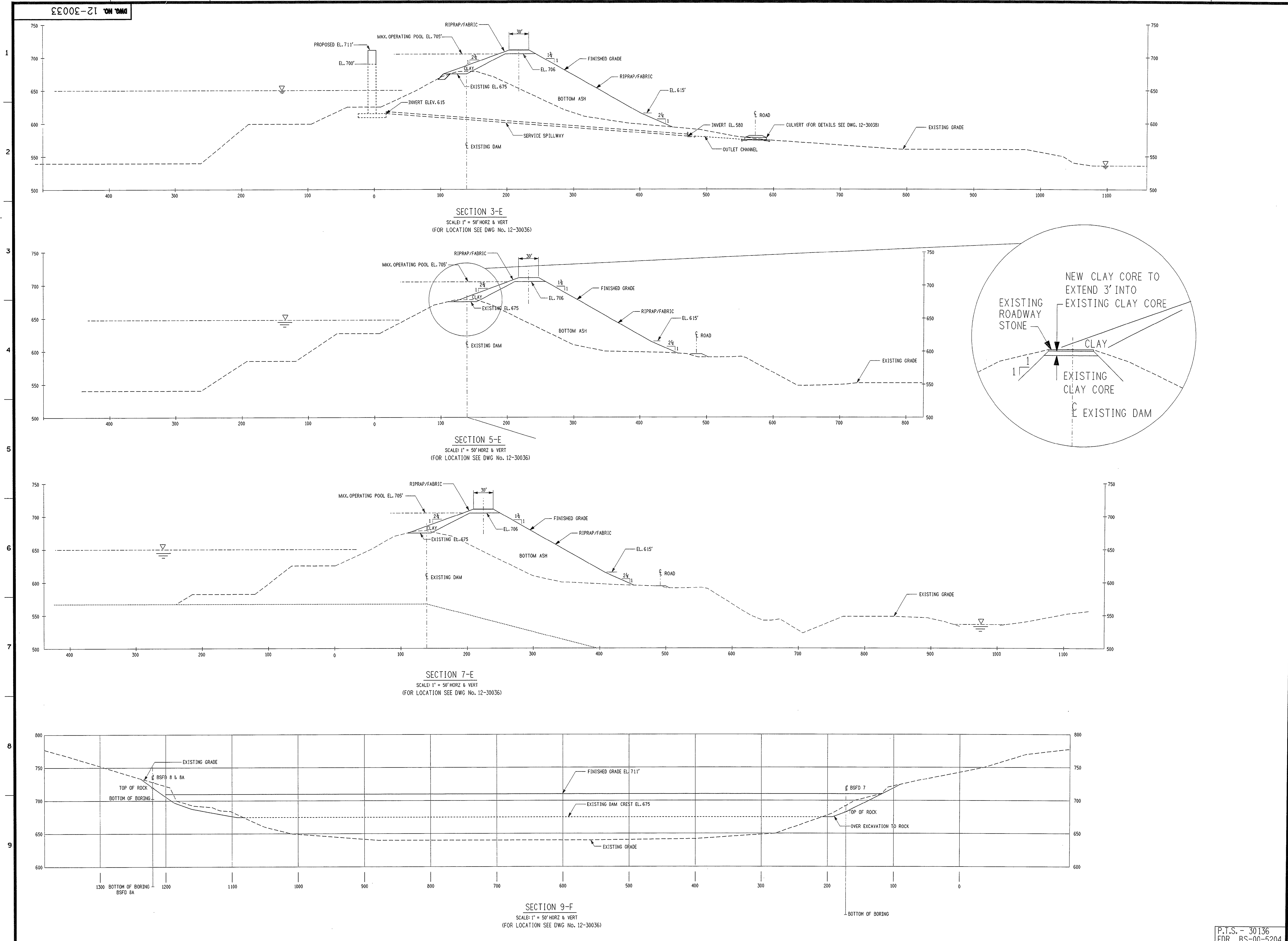
APPENDIX B

SUPPORTING DOCUMENTATION

DRAWINGS PREPARED BY KYPCo (1993)



AEPBSP-000008



REFERENCE DRAWINGS

12-30030 GENERAL ARRANGEMENT
12-30031 MAIN FLY ASH DAM, PLAN OF BORINGS
12-30032 SADDLE DAM AND EMERGENCY SPILLWAY PLAN OF BORINGS
12-30034 SADDLE DAM AND EMERGENCY SPILLWAY GRADING PLAN
12-30035 SADDLE DAM AND EMERGENCY SPILLWAY SECTIONS
12-30036 MAIN FLY ASH DAM, GRADING PLAN
12-30037 SADDLE DAM ROADWAY, PLAN & PROFILE
12-30038 ACCESS STAIRWAY AND CULVERT DETAILS
12-30039 RISER - PLAN AND SECTIONS
12-30040 RISER - MISCELLANEOUS DETAILS
12-30041 TYPICAL-SUBSURFACE SECTIONS, MAIN DAM

DATE	NO.	DESCRIPTION	APPD.
5/15/98	0	ISSUED FOR CONSTRUCTION	

REVISIONS

S:/BS/12/GHS/30033.DGN

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KENTUCKY POWER COMPANY
BIG-SANDY
HORSEFORD CREEK
LAWRENCE KENTUCKY

MAIN FLY ASH DAM
SECTIONS

DWG. NO. 12-30033 - 0

SCALE: 1"=50' CIVIL ENGINEERING DIVISION

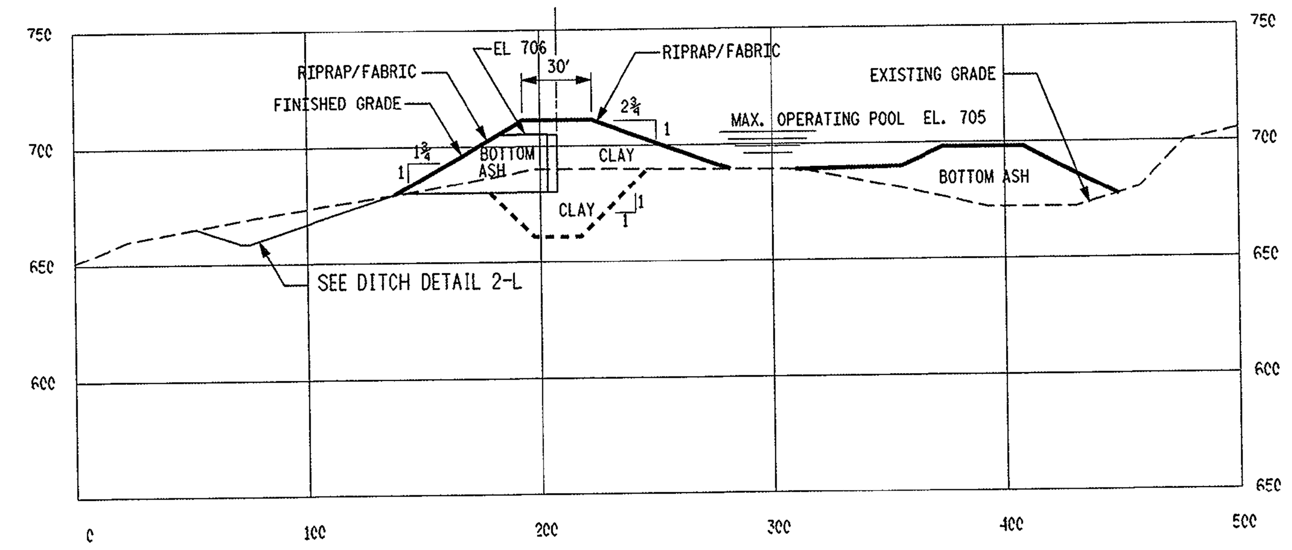
APPROVED BY Carl A. Togni

AMERICAN ELECTRIC POWER 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

P.T.S. - 30136
EDR BS-00-5204

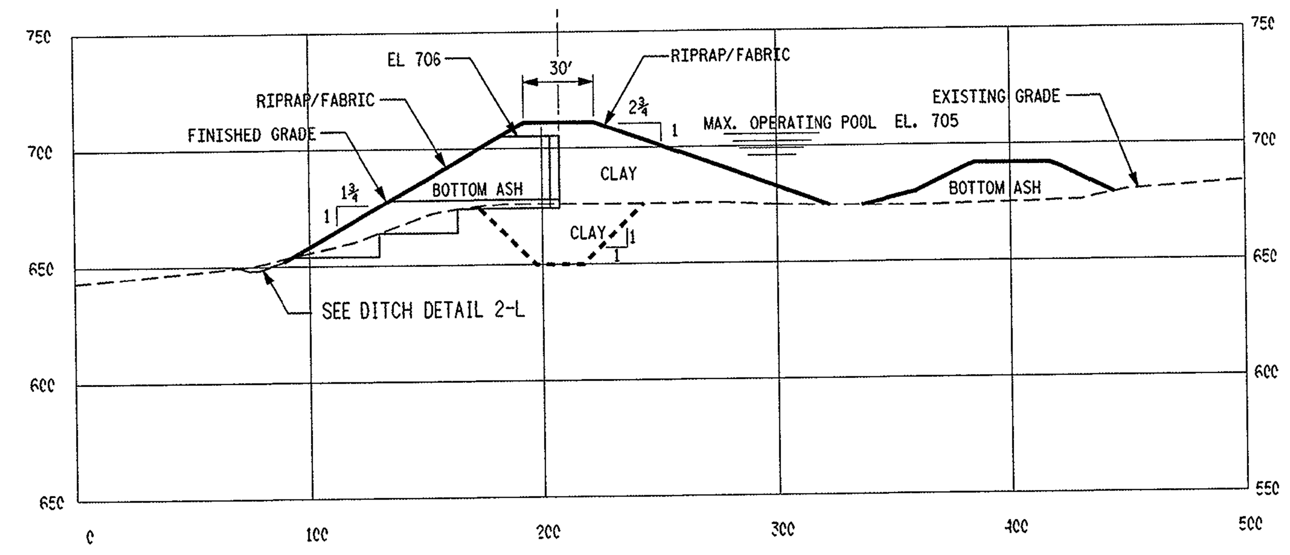
DWG. NO. 12 - 30034
LEGEND - EXISTING
SPOT ELEVATION
INTERMEDIATE CONTOUR
INDEX CONTOUR
DEPRESSION CONTOUR
TREES AND TREELINE
STRUCTURE AND BUILDING
FENCE
POLE
ROADS
EDGE OF WATER
MANHOLES / CATCH BASIN
POWER POLE
REFERENCE DRAWINGS
12-30030 GENERAL ARRANGEMENT
12-30031 MAIN FLY ASH DAM, PLAN OF BORINGS
12-30032 SADDLE DAM AND EMERGENCY SPILLWAY PLAN OF BORINGS
12-30033 MAIN FLY ASH DAM SECTIONS
12-30035 SADDLE DAM SECTIONS
12-30036 MAIN FLY ASH DAM, GRADING PLAN
12-30037 SADDLE DAM ROADWAY, PLAN & PROFILE
12-30038 ACCESS STAIRWAY AND CULVERT DETAILS
12-30039 RISER - PLAN AND SECTIONS
12-30040 RISER - MISCELLANEOUS DETAILS
12-30041 TYPICAL-SUBSURFACE SECTIONS, MAIN DAM
(TOP OF DAM ELEV. 711)
N 12463.028
E 8199.080
N 13770.246
E 8183.632
5/15/98 0 ISSUED FOR CONSTRUCTION
DATE NO. DESCRIPTION APPD.
REVISIONS
S:/BS/12/GHS/30034.DGN
"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP. ,OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST"
KENTUCKY POWER COMPANY
BIG SANDY PLANT
HORSEFORD CREEK
LAWRENCE, COUNTY KENTUCKY
SADDLE DAM AND
EMERGENCY SPILLWAY
GRADING PLAN
DWG. NO. 12 - 30034 - 0
SCALE: 1" = 40'
CIVIL ENGINEERING DIVISION
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY
P.T.S. - 35212 &
P.T.S. - 30136
EDR BS-00-5240
AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
SYSTEM DATE-15-MAY-1998
SYSTEM TIME-13:42
15th FLR. CED

DWG. NO. 12-30035



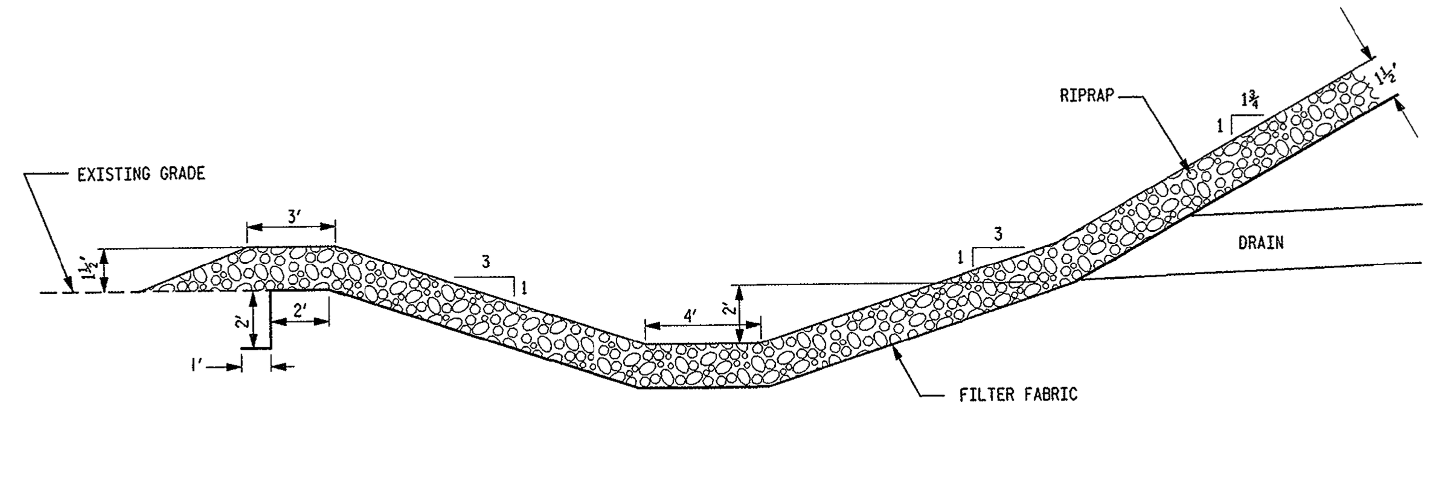
SECTION 3-B

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)



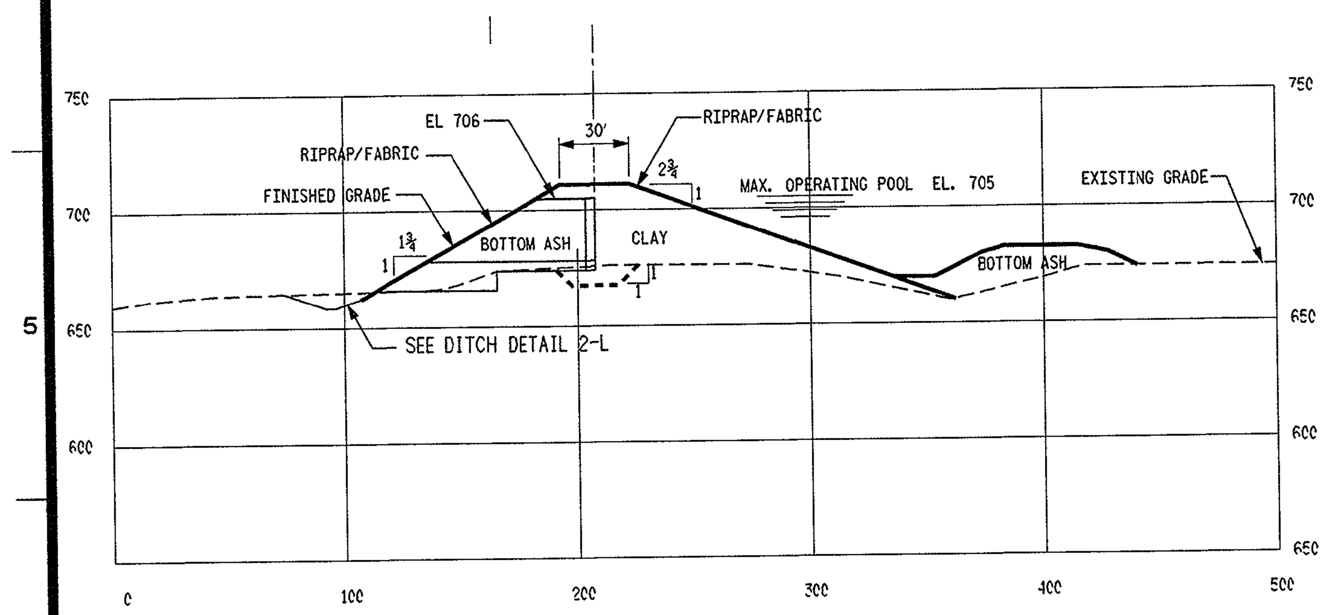
SECTION 3-G

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)



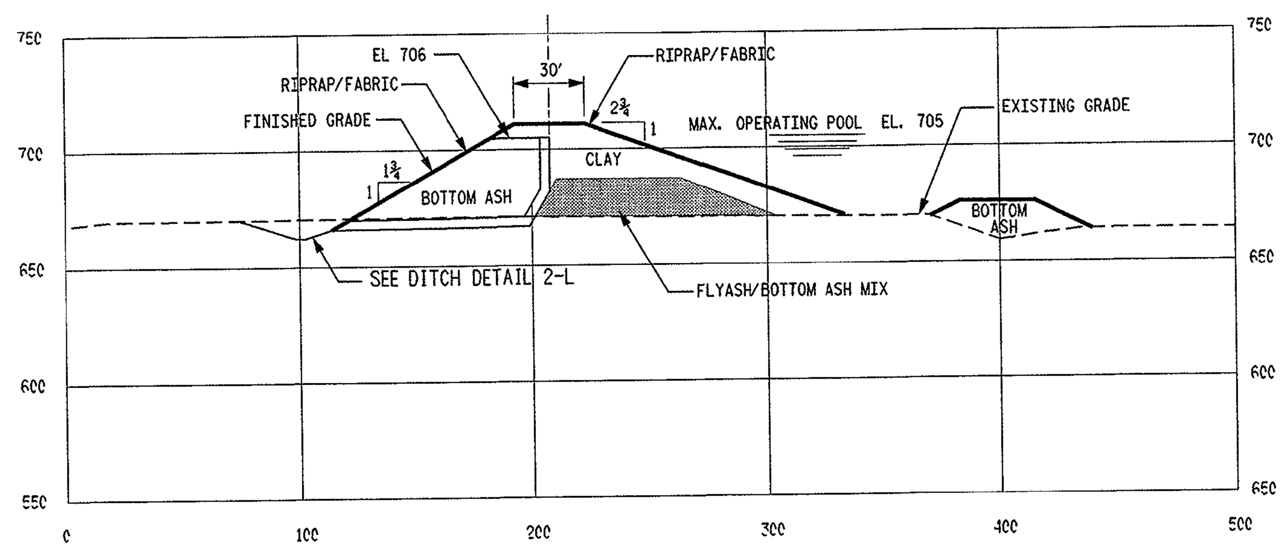
SECTION 2-L

DITCH DETAIL
SCALE: 1" = 4'



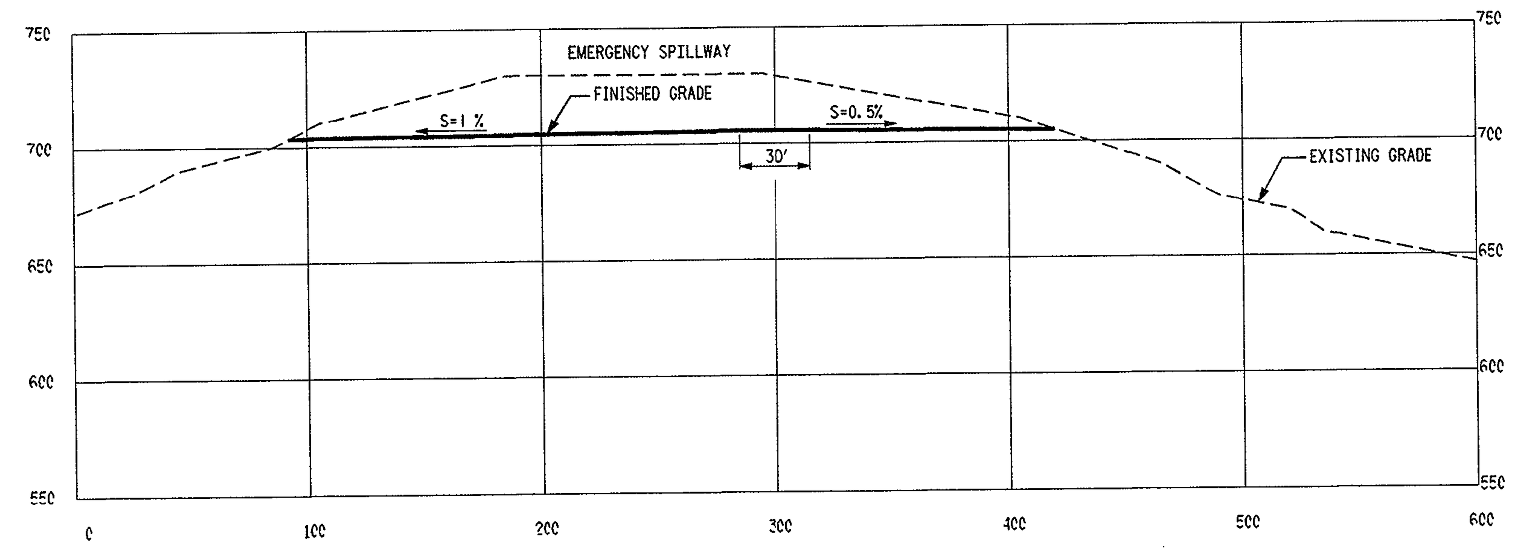
SECTION 6-B

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)



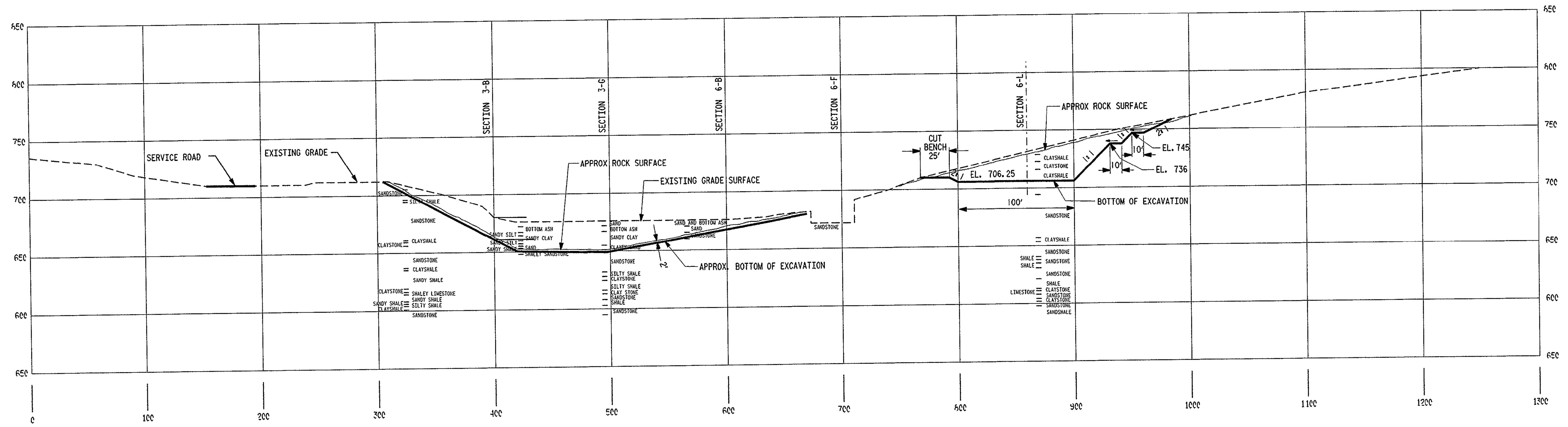
SECTION 6-F

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)



SECTION 6-L

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)



SADDLE DAM SECTION 9-G

SCALE: 1" = 50' HORZ & VERT
(FOR LOCATION SEE DWG No. 12-30034)

REFERENCE DRAWINGS

- 12-30030 GENERAL ARRANGEMENT
- 12-30031 MAIN FLY ASH DAM, PLAN OF BORINGS
- 12-30032 SADDLE DAM AND EMERGENCY SPILLWAY PLAN OF BORINGS
- 12-30033 MAIN FLY ASH DAM SECTIONS
- 12-30034 SADDLE DAM AND EMERGENCY SPILLWAY GRADING PLAN
- 12-30036 MAIN FLY ASH DAM, GRADING PLAN
- 12-30037 SADDLE DAM ROADWAY, PLAN & PROFILE
- 12-30038 ACCESS STAIRWAY AND CULVERT DETAILS
- 12-30039 RISER - PLAN AND SECTIONS
- 12-30040 RISER - MISCELLANEOUS DETAILS
- 12-30041 TYPICAL-SUBSURFACE SECTIONS, MAIN DAM

DATE	NO.	DESCRIPTION	APPD.
5/15/98	0	ISSUED FOR CONSTRUCTION	PJA

REVISIONS

S:/BS/12/GHS/30035.DGN

KENTUCKY POWER COMPANY
BIG-SANDY PLANT
HORSEFORD CREEK
LAWRENCE KENTUCKY

SADDLE DAM AND EMERGENCY SPILLWAY SECTIONS

DWG. NO. 12-30035 - 0

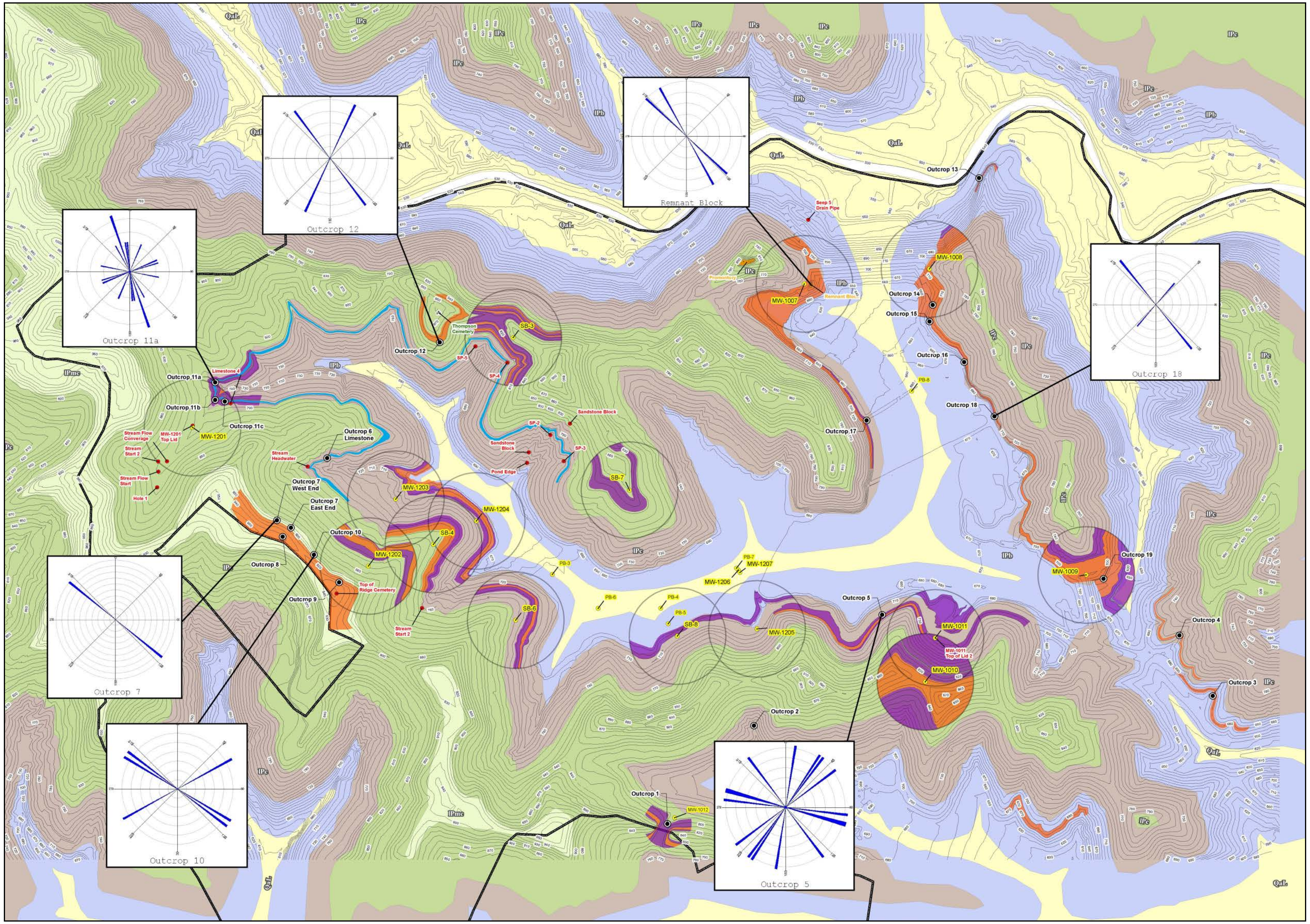
SCALE: 1"=50'
CIVIL ENGINEERING DIVISION
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY
Original Signed By:
CARL S. TOGNI

P.T.S. - 35212 &
P.T.S. - 30136
EDR BS-00-5204

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS1092
3303
0 SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR:MINUTE
15th FLR. CED

DRAWING PREPARED BY GEOSYNTEC



Property Boundary

Outcrop

Well / Boring Location

Survey Features 4-8-2013

Cemetery

10-Foot Contour

Observed Exposures and Projected Boring Logs

Coal

Shale

Limestone

Sandstone

USGS Geologic Units*

Explanation

QaL - Alluvium

IPmc - Monongahela and upper Conemaugh

IPc - Conemaugh

IPc - Conemaugh, Brush Creek coal bed

IPb - Breathitt

Fracture/ Joint Orientation and Frequency

Geologic Units digitized from *Geologic Quadrangle Map: Fallsburg and Prichard Quadrangles, KY.-W.VA.* Sharpe, 1967.

Figure was originally presented as Figure 3.1 in *Hydrogeologic Site Investigation: AEP Big Sandy Horseford Creek.* URS, 2013.

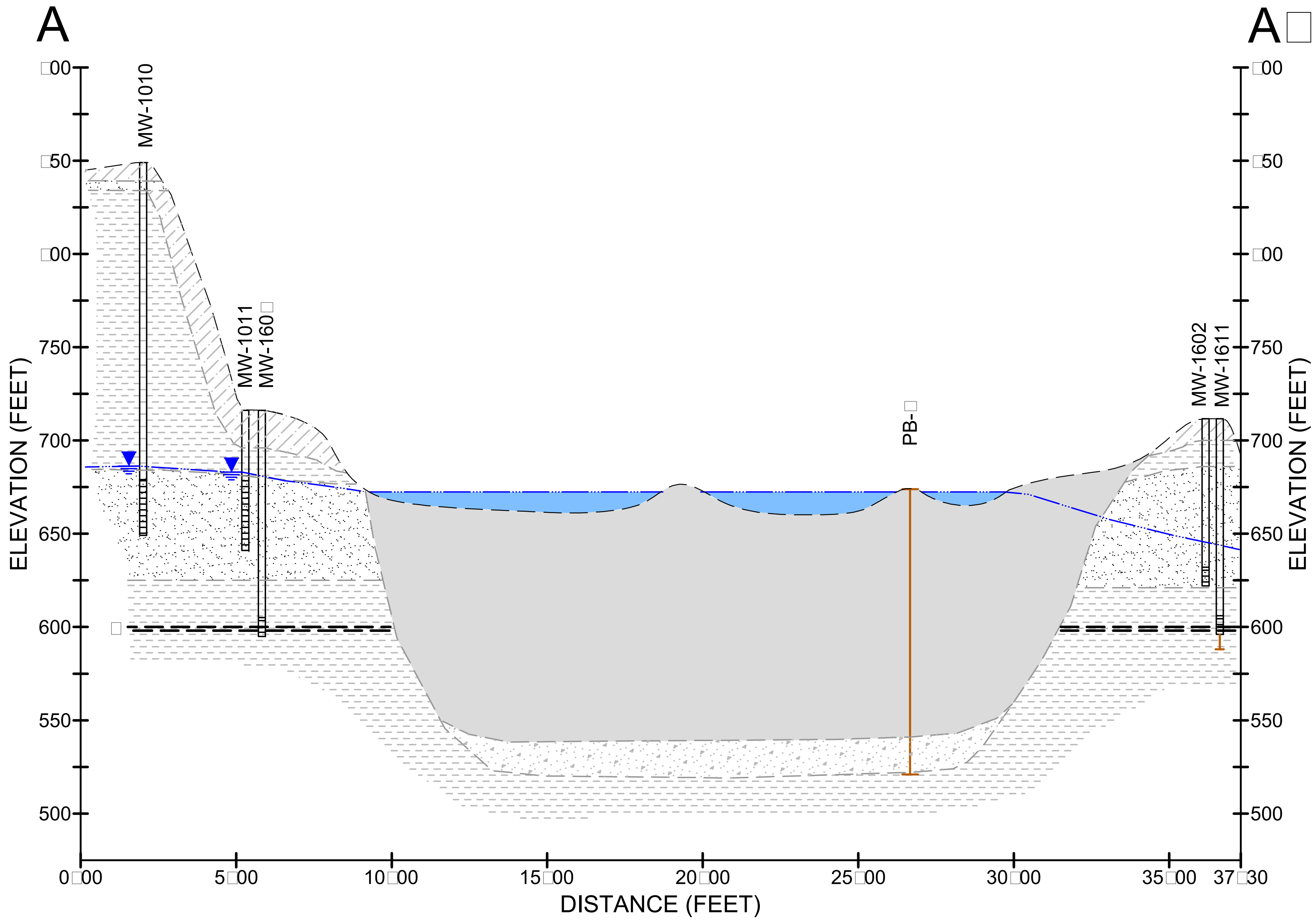
April 2013 Geological Mapping Survey Results

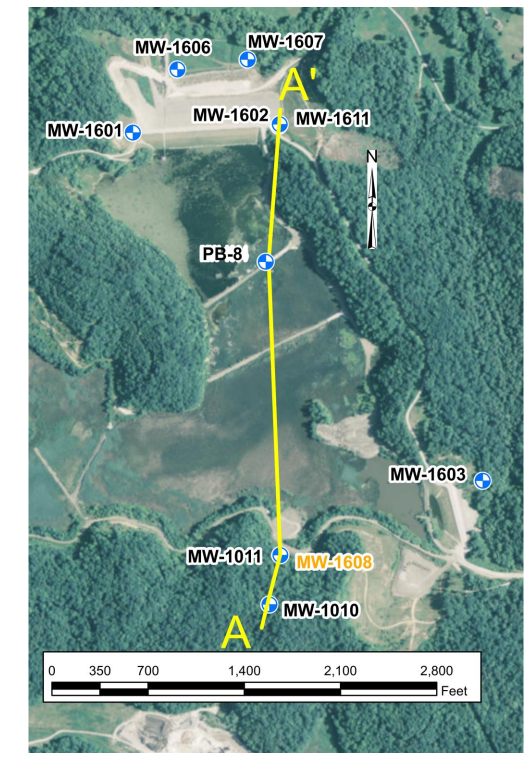
AEP Big Sandy Fly Ash Pond

Geosyntec consultants

Figure 3

Columbus, OH | 20-May-205





KEY MAP

LEGEND

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

NOTES:

1. GROUNDWATER ELEVATION IS BASED ON THE JULY 13, 2016 MEASUREMENT.
2. SOIL BORING PB-□ AND MONITORING WELLS MW-1010 AND MW-1011 DATA WERE OBTAINED FROM FINAL REPORT HYDROGEOLOGIC SITE INVESTIGATION (URS, JUNE 2013)

0 450□ □00□

SCALE IN FEET (HORIZONTAL)

0 75□ 150□

SCALE IN FEET (VERTICAL)
VERTICAL EXAGGERATION □6X

GEOLOGIC CROSS SECTION A-A□

BIG SANDY FLY ASH POND
LOUISA, KENTUCKY

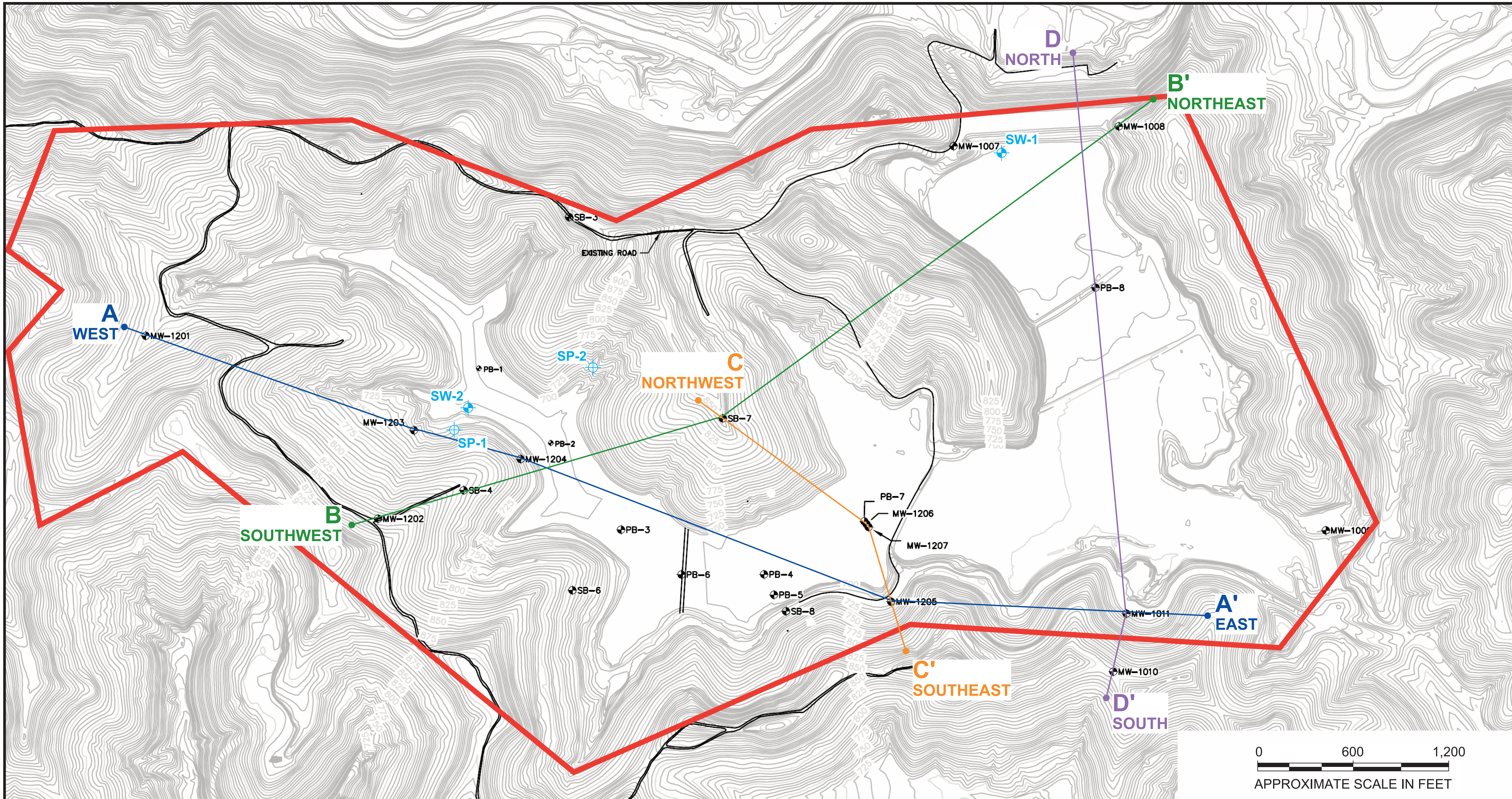
Geosyntec consultants

FIGURE 1

PROJECT NO: TX0510 | OCTOBER 2016

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

DRAWINGS PREPARED BY URS (2013b)



LEGEND:

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

AEP

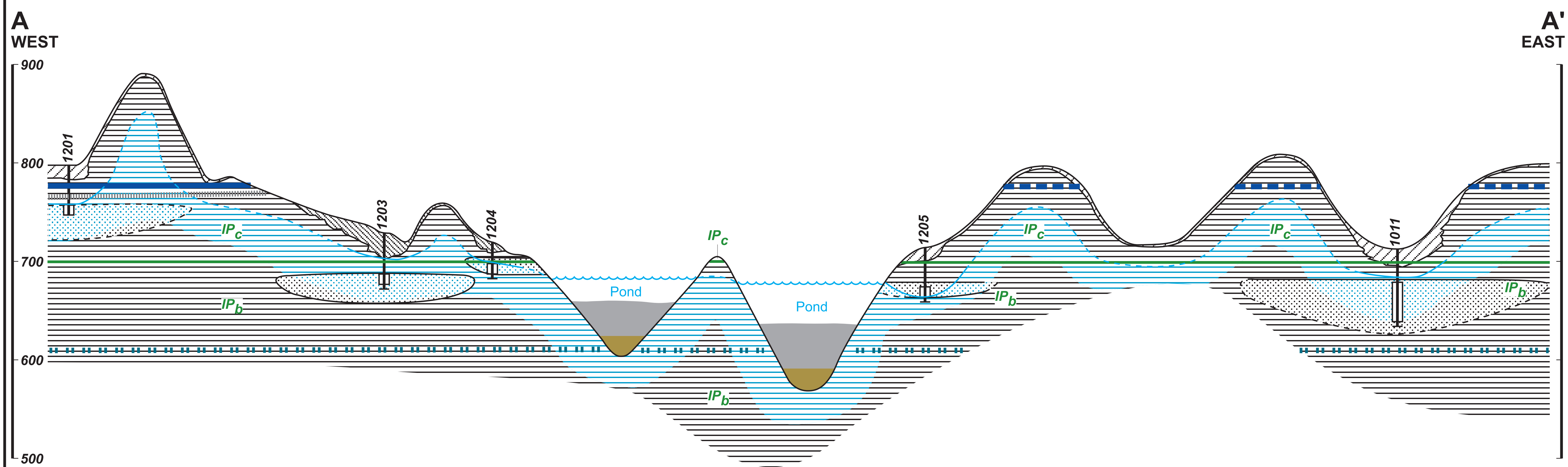
Big Sandy
Hydrogeologic Site Investigation

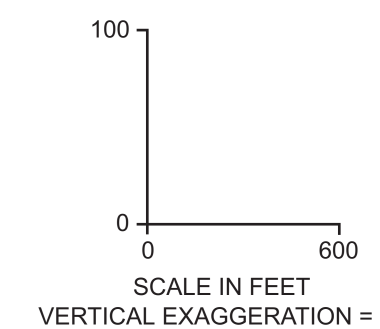
FIGURE 3.2
BORING AND WELL LOCATIONS

JOB NO. 13815152

URS

J:\Project\AAEP\13815142 Big Sandy Special Waste LF\Data-Tech\TI\fig3.2.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

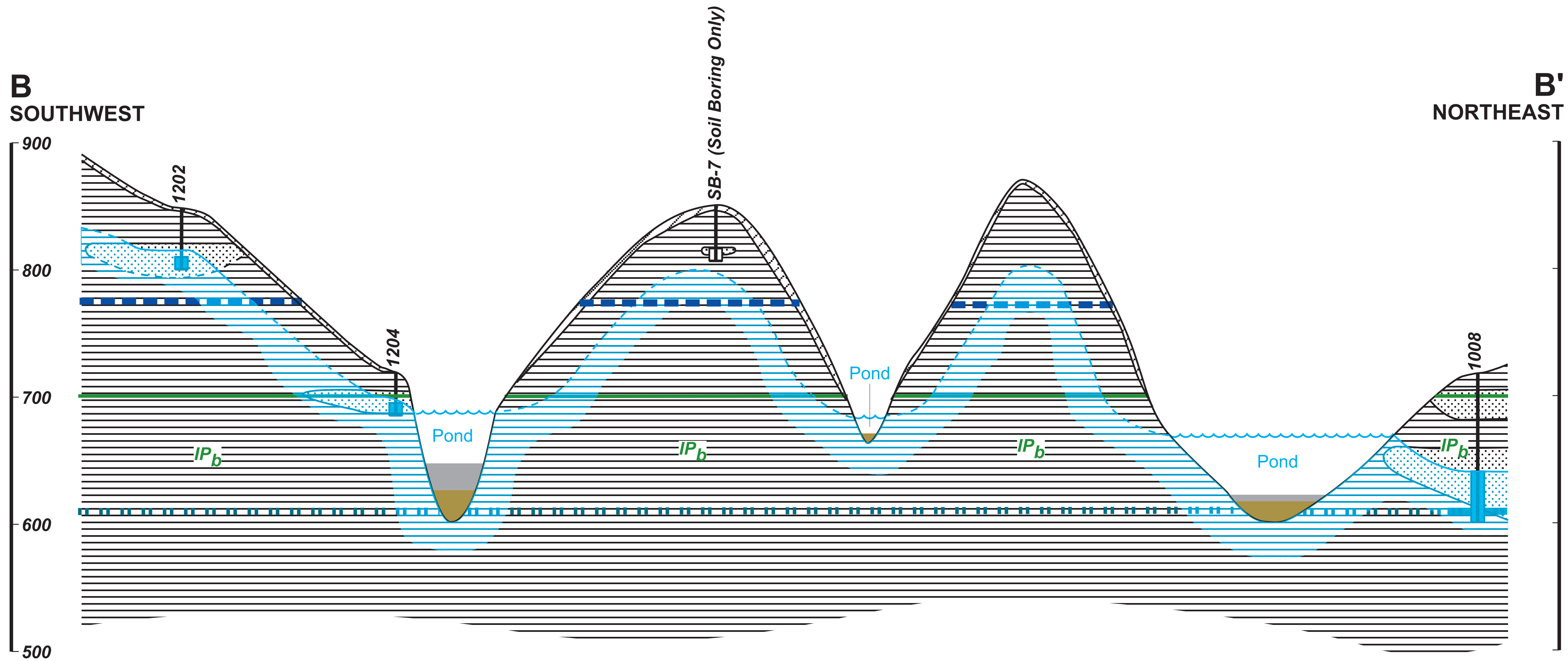
AEP

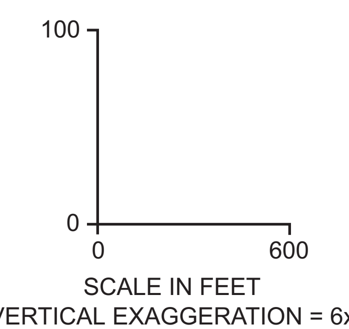
Big Sandy Hydrogeologic Site Investigation

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)

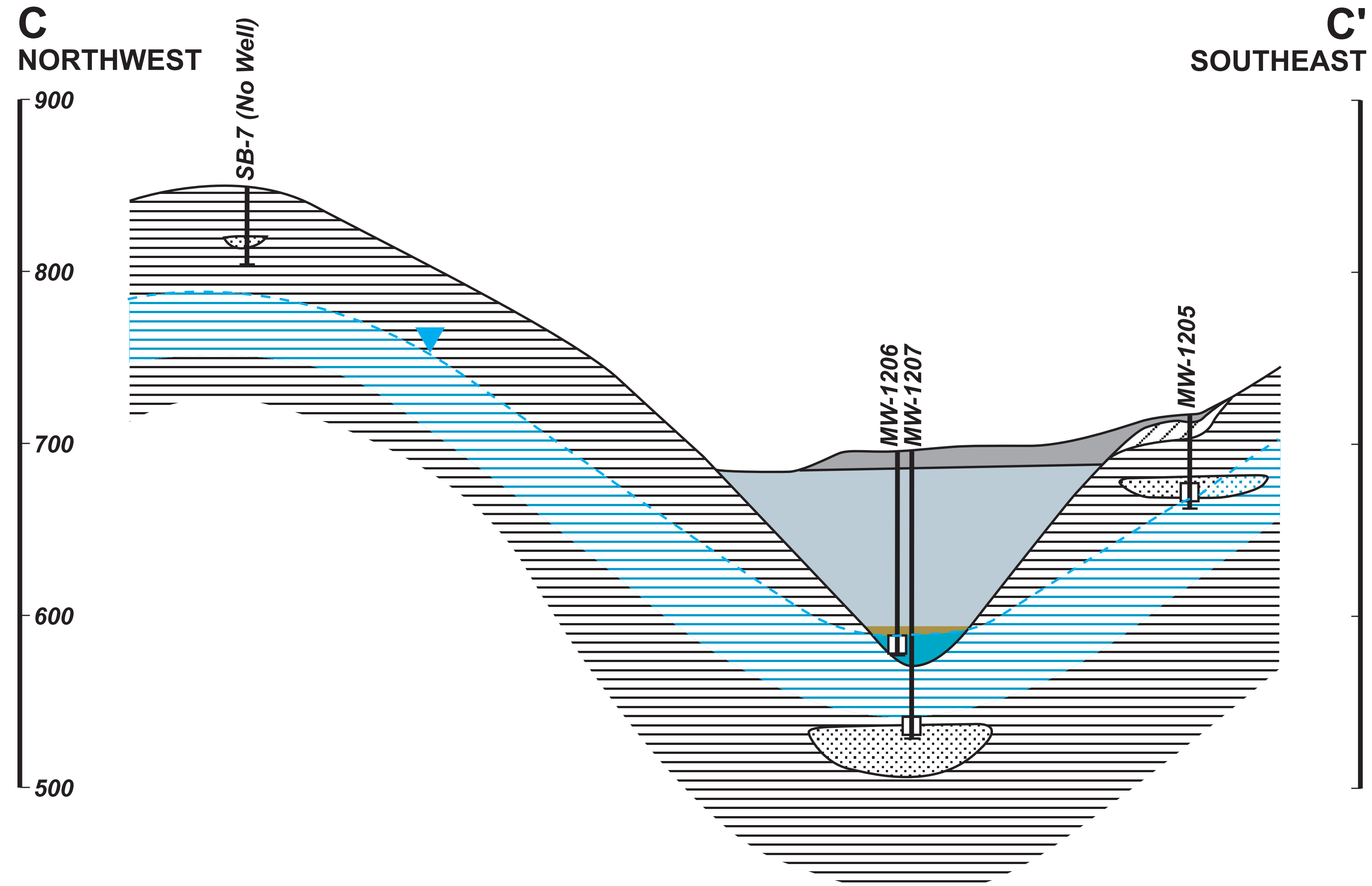
CL	Clay
SC	Sandy Clay
SS	Sandstone
SH	Shale, Interbedded Shale, Siltstone, Sandstone, Mudstone
	Alluvium
	Ash
	Uppermost Groundwater Zone

Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1b
CROSS SECTION B-B'

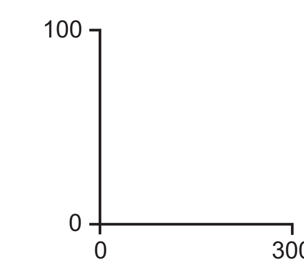
JOB NO. 13815152

URS



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	



SCALE IN FEET
VERTICAL EXAGGERATION = 3x

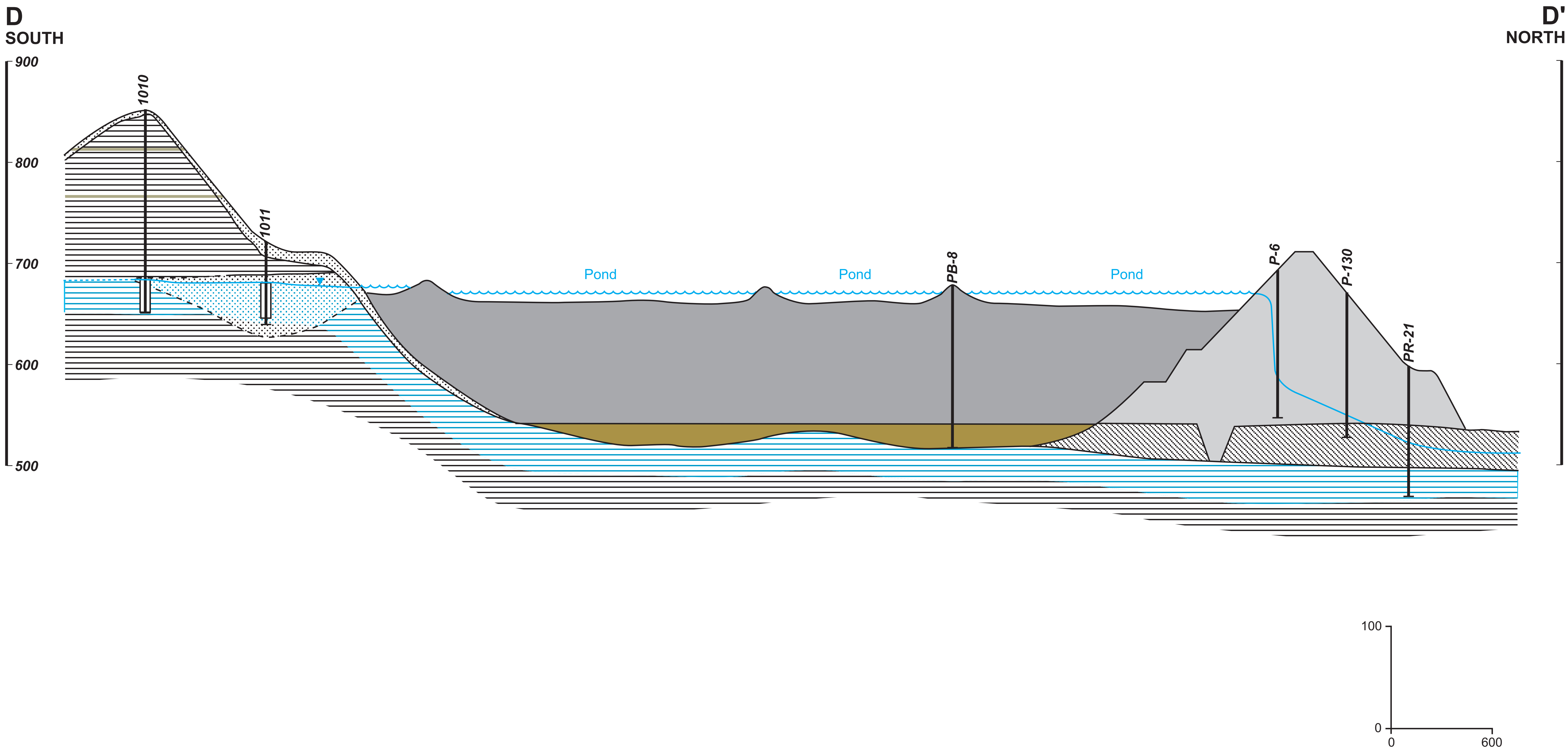
Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1c
CROSS SECTION C-C'

JOB NO. 13815152

URS

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



LEGEND:

Coal Seam

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

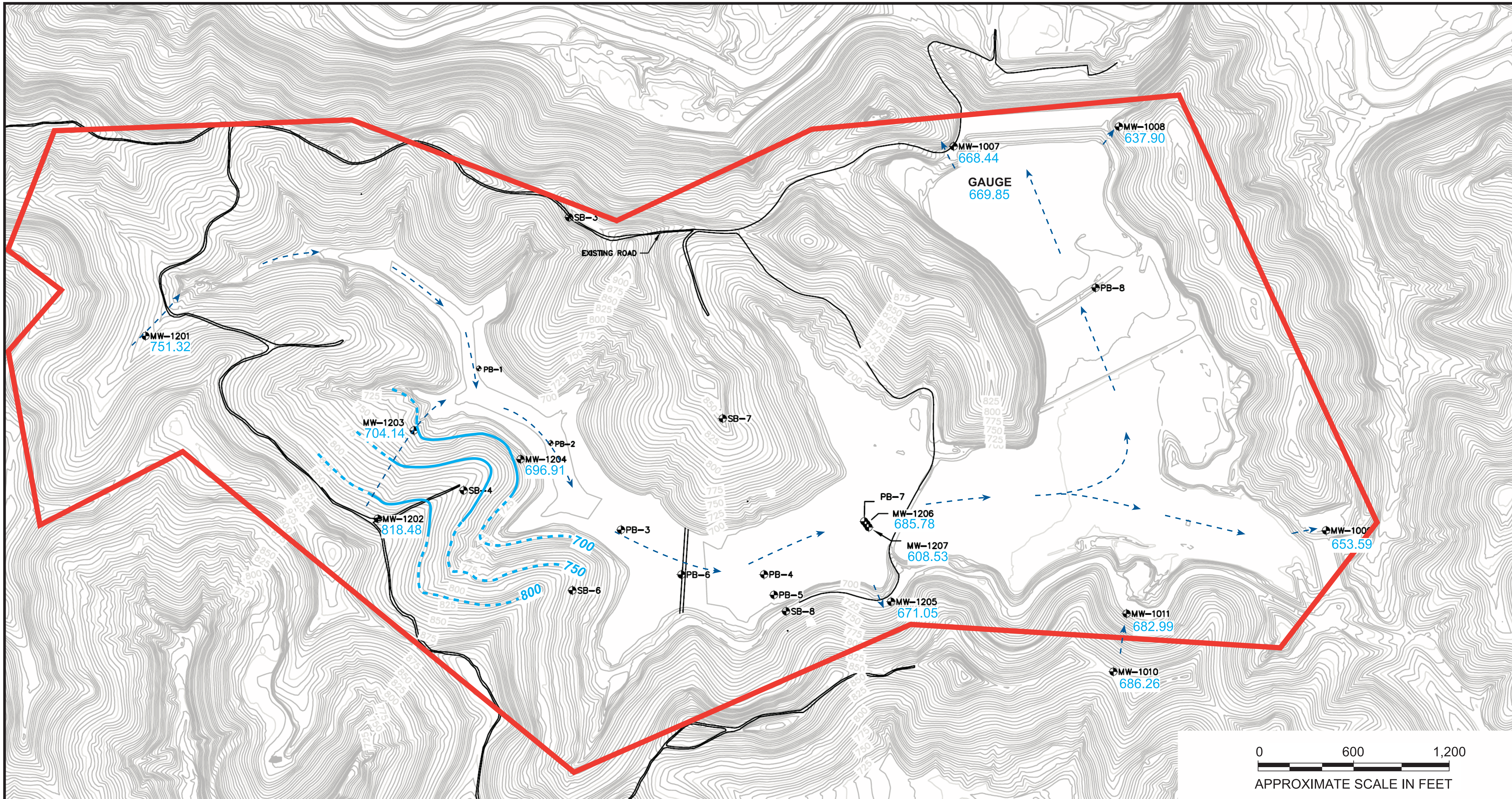
Big Sandy
Hydrogeologic Site Investigation

FIGURE 4.1d
CROSS SECTION D-D'

JOB NO. 13815152

URS

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



LEGEND:

(red outline)	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

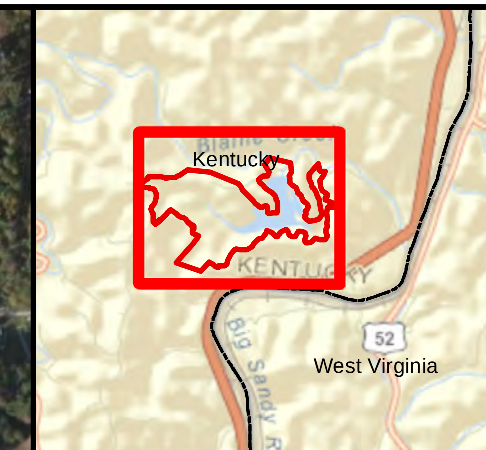
FIGURE 4.2c
GROUNDWATER ELEVATIONS
OCTOBER 15, 2012

JOB NO. 13815152

URS

J:\Project\A\AEP\13815142 Big Sandy Special Waste LF\Data-Tech\TI\fig4.3c.fh10

DRAWINGS PREPARED BY URS (2013a)



N

LEGEND

- Project Survey Boundary
- Delineated Wetland
- Delineated Pond
- RBA Delineated Stream
- Stream Flow Direction

High Gradient Stream Habitat Areas

- Area 1 Delineated Stream
- Area 2 Delineated Stream
- Area 3 Delineated Stream
- Area 4 Delineated Stream
- Area 5 Delineated Stream
- Area 6 Delineated Stream
- Area 7 Delineated Stream

0 750 1,500

Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

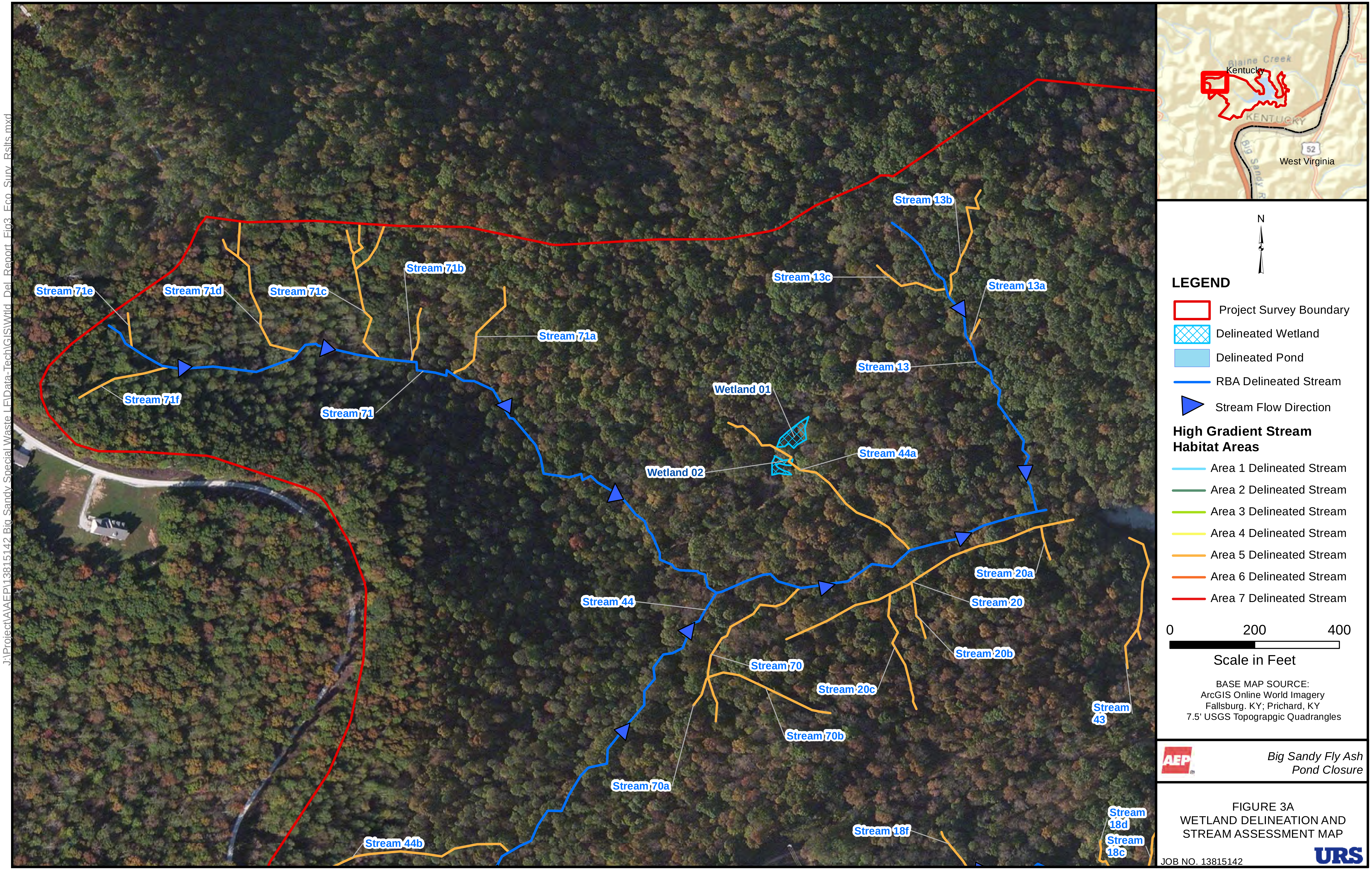
AEP

Big Sandy Fly Ash Pond Closure

FIGURE 3
WETLAND DELINEATION AND
STREAM ASSESSMENT MAP

JOB NO. 13815142

URS



Stream 71e
Stream 71d
Stream 71c
Stream 71b
Stream 71a
Stream 71f
Stream 71
Stream 13b
Stream 13c
Stream 13a
Stream 13
Wetland 01
Wetland 02
Stream 44a
Stream 44
Stream 20a
Stream 20
Stream 20b
Stream 70
Stream 20c
Stream 70b
Stream 70a
Stream 43
Stream 44b
Stream 18f
Stream 18d
Stream 18c
Blaine Creek
Kentucky
KENTUCKY
Big Sandy R
52
West Virginia
N
LEGEND
Project Survey Boundary
Delineated Wetland
Delineated Pond
RBA Delineated Stream
Stream Flow Direction
High Gradient Stream Habitat Areas
Area 1 Delineated Stream
Area 2 Delineated Stream
Area 3 Delineated Stream
Area 4 Delineated Stream
Area 5 Delineated Stream
Area 6 Delineated Stream
Area 7 Delineated Stream
0
200
400
Scale in Feet
BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles
Big Sandy Fly Ash Pond Closure
FIGURE 3A
WETLAND DELINEATION AND STREAM ASSESSMENT MAP
JOB NO. 13815142
URS
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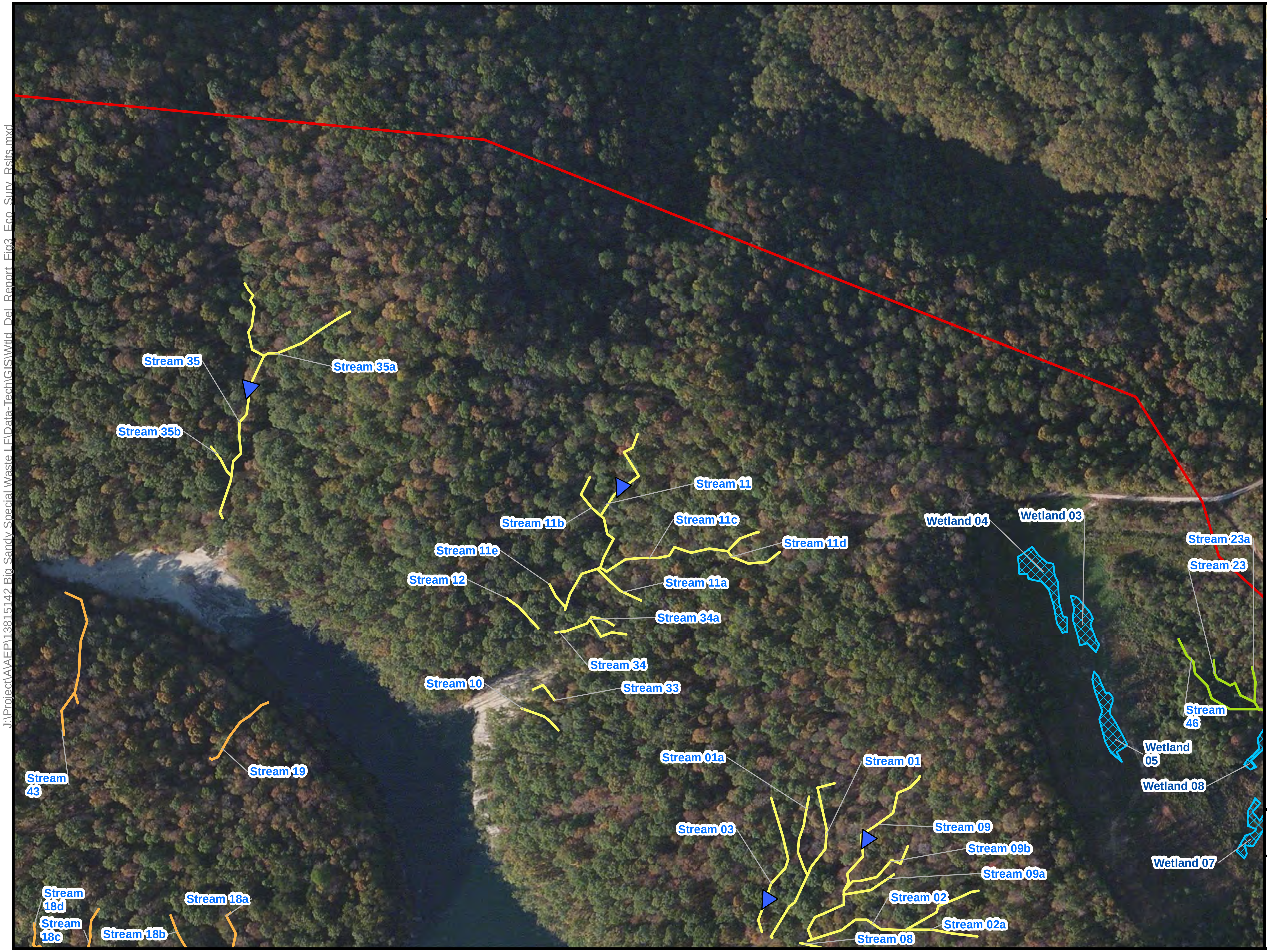
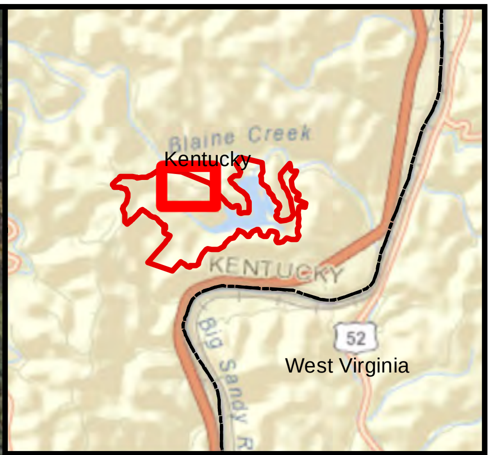




N

LEGEND

Project Survey Boundary

Delineated Wetland

Delineated Pond

RBA Delineated Stream

Stream Flow Direction

High Gradient Stream Habitat Areas

Area 1 Delineated Stream

Area 2 Delineated Stream

Area 3 Delineated Stream

Area 4 Delineated Stream

Area 5 Delineated Stream

Area 6 Delineated Stream

Area 7 Delineated Stream

0 200 400

Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

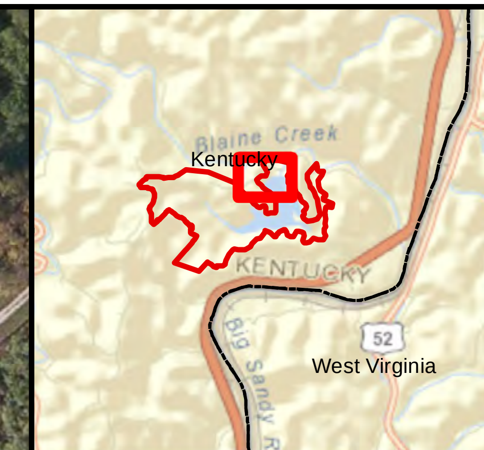
AEP

Big Sandy Fly Ash Pond Closure

FIGURE 3B
WETLAND DELINEATION AND
STREAM ASSESSMENT MAP

JOB NO. 13815142

URS



N

LEGEND

- Project Survey Boundary
- Delineated Wetland
- Delineated Pond
- RBA Delineated Stream
- Stream Flow Direction

High Gradient Stream Habitat Areas

- Area 1 Delineated Stream
- Area 2 Delineated Stream
- Area 3 Delineated Stream
- Area 4 Delineated Stream
- Area 5 Delineated Stream
- Area 6 Delineated Stream
- Area 7 Delineated Stream

0 200 400

Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

Big Sandy Fly Ash Pond Closure

FIGURE 3C
WETLAND DELINEATION AND
STREAM ASSESSMENT MAP

JOB NO. 13815142

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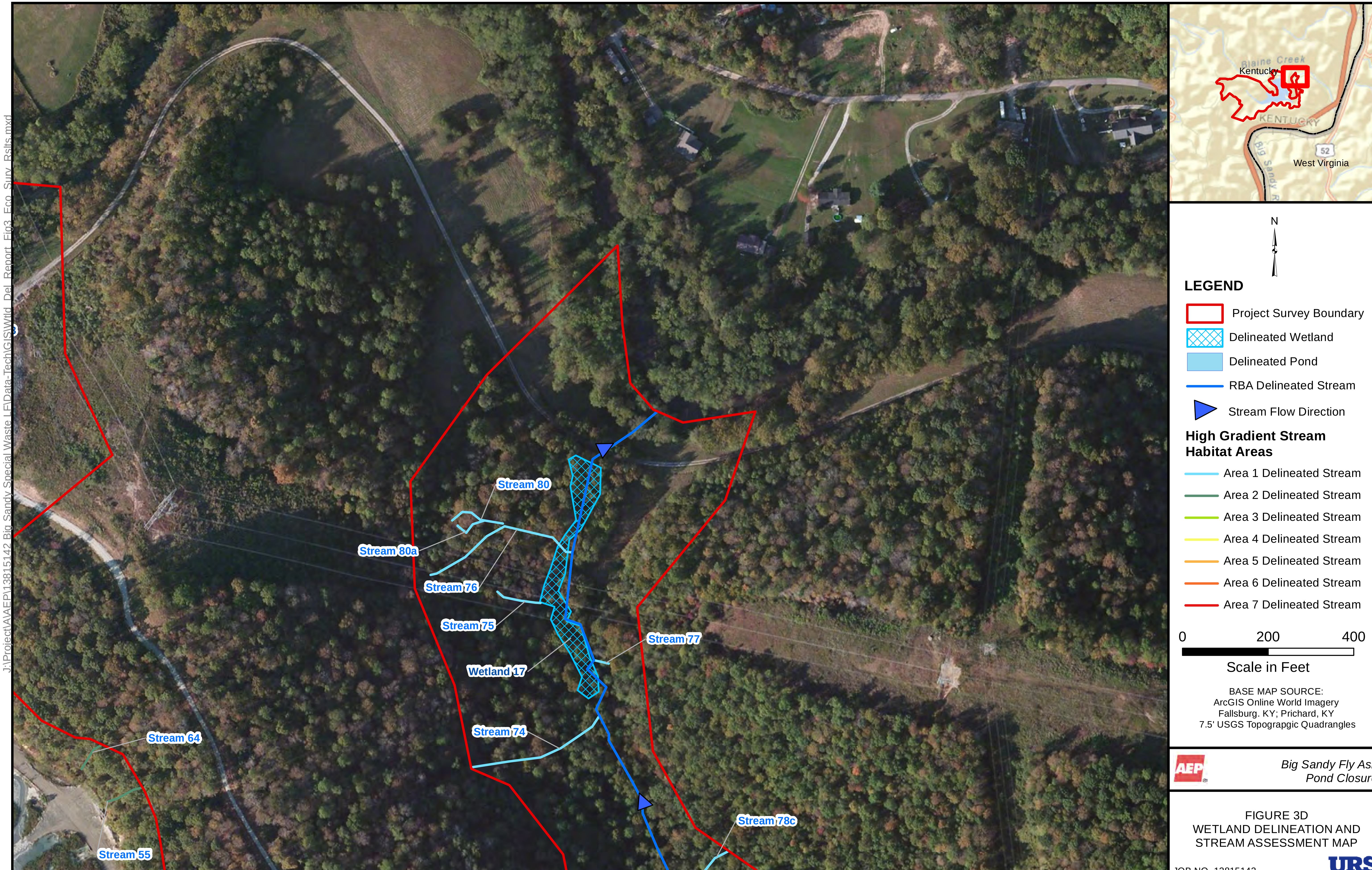

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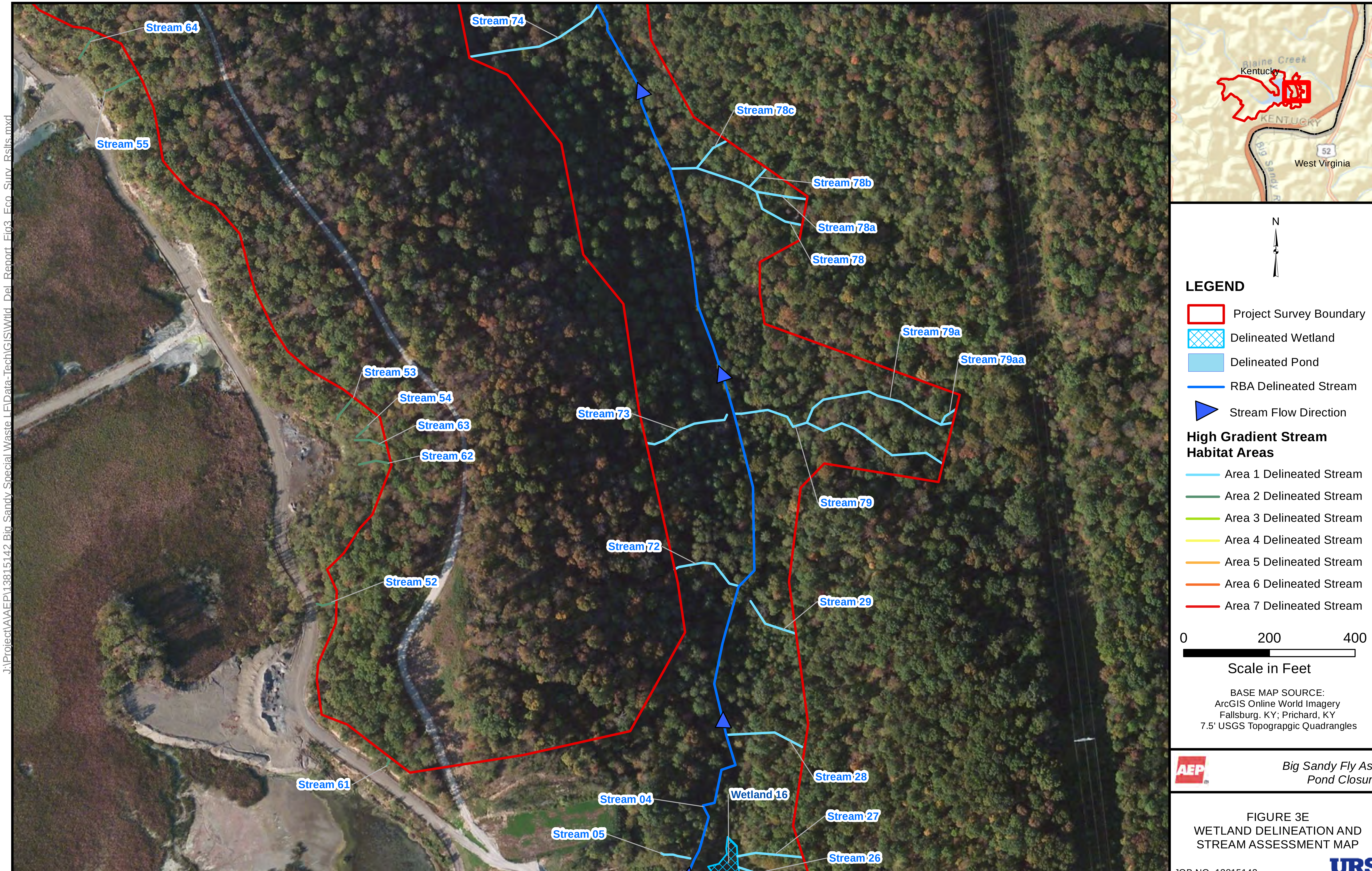
Stream 80
Stream 80a
Stream 76
Stream 75
Wetland 17
Stream 77
Stream 74
Stream 64
Stream 55
Stream 78c
Blaine Creek
Kentucky
KENTUCKY
West Virginia
Big Sandy R
52
N
LEGEND
Project Survey Boundary
Delineated Wetland
Delineated Pond
RBA Delineated Stream
Stream Flow Direction
High Gradient Stream Habitat Areas
Area 1 Delineated Stream
Area 2 Delineated Stream
Area 3 Delineated Stream
Area 4 Delineated Stream
Area 5 Delineated Stream
Area 6 Delineated Stream
Area 7 Delineated Stream
0
200
400
Scale in Feet
BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles
AEP
Big Sandy Fly Ash Pond Closure
FIGURE 3D
WETLAND DELINEATION AND STREAM ASSESSMENT MAP
JOB NO. 13815142
URS


Stream 64
Stream 74
Stream 55
Stream 78c
Stream 78b
Stream 78a
Stream 78
Stream 79a
Stream 79aa
Stream 53
Stream 54
Stream 73
Stream 63
Stream 62
Stream 79
Stream 72
Stream 52
Stream 29
Stream 28
Stream 61
Stream 04
Wetland 16
Stream 27
Stream 05
Stream 26
Blaine Creek
Kentucky
KENTUCKY
52
Big Sandy R
West Virginia
N
LEGEND
Project Survey Boundary
Delineated Wetland
Delineated Pond
RBA Delineated Stream
Stream Flow Direction
High Gradient Stream Habitat Areas
Area 1 Delineated Stream
Area 2 Delineated Stream
Area 3 Delineated Stream
Area 4 Delineated Stream
Area 5 Delineated Stream
Area 6 Delineated Stream
Area 7 Delineated Stream
0
200
400
Scale in Feet
BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles
Big Sandy Fly Ash Pond Closure
FIGURE 3E
WETLAND DELINEATION AND STREAM ASSESSMENT MAP
JOB NO. 13815142
URS
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AEP

Big Sandy Fly Ash Pond Closure

FIGURE 3F
WETLAND DELINEATION AND STREAM ASSESSMENT MAP

JOB NO. 13815142

URS

FIGURE 3G
WETLAND DELINEATION AND
STREAM ASSESSMENT MAP

JOB NO. 13815142

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BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

AEP

Big Sandy Fly Ash Pond Closure

FIGURE 3H
WETLAND DELINEATION AND STREAM ASSESSMENT MAP

JOB NO. 13815142

URS

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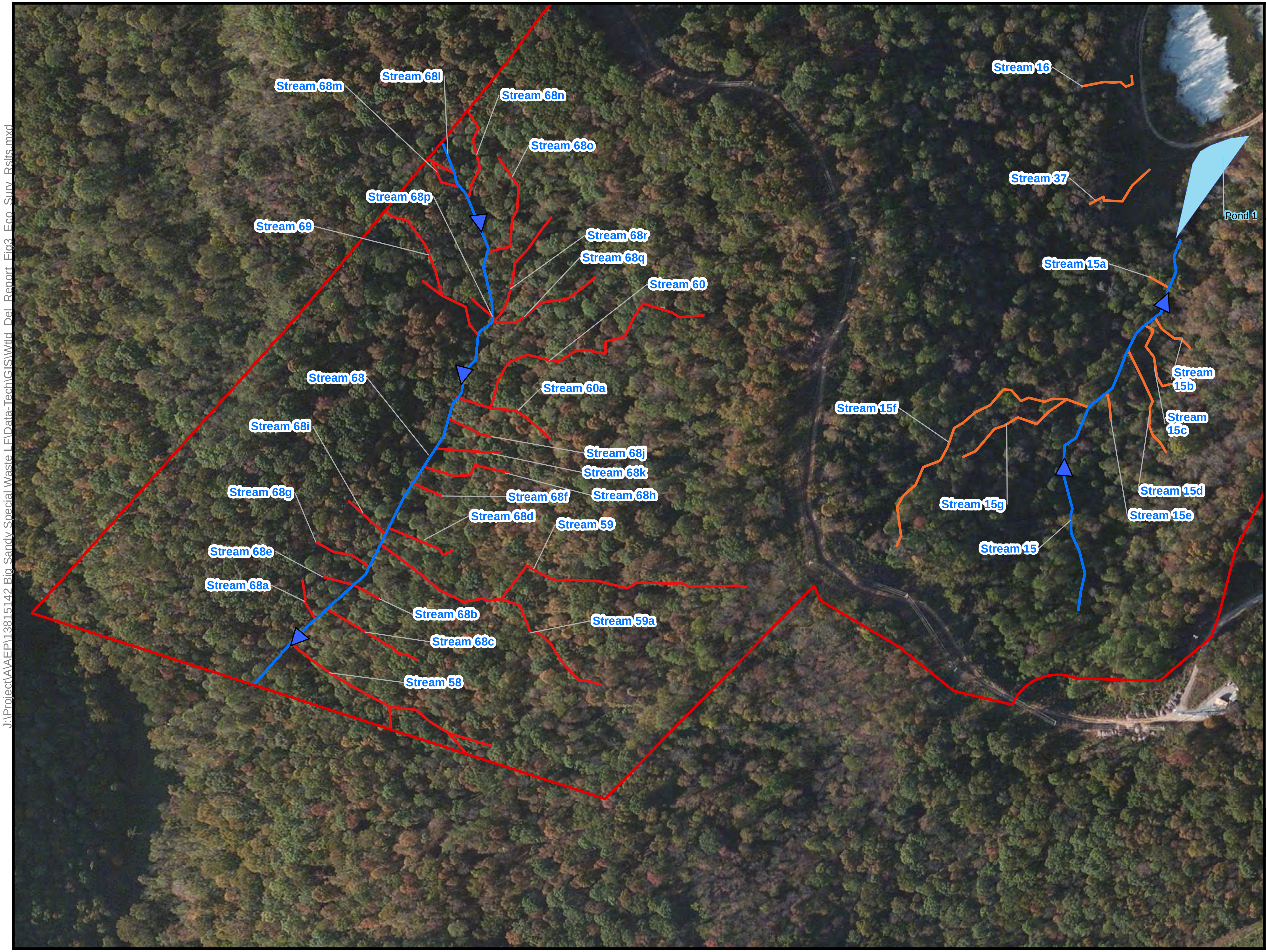
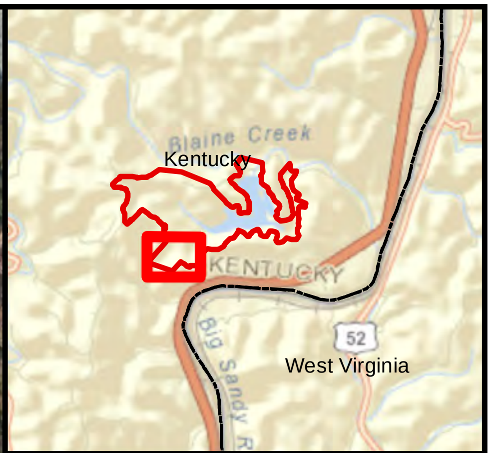




N

LEGEND

- Project Survey Boundary
- Delineated Wetland
- Delineated Pond
- RBA Delineated Stream
- Stream Flow Direction

High Gradient Stream Habitat Areas

- Area 1 Delineated Stream
- Area 2 Delineated Stream
- Area 3 Delineated Stream
- Area 4 Delineated Stream
- Area 5 Delineated Stream
- Area 6 Delineated Stream
- Area 7 Delineated Stream

0 200 400

Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

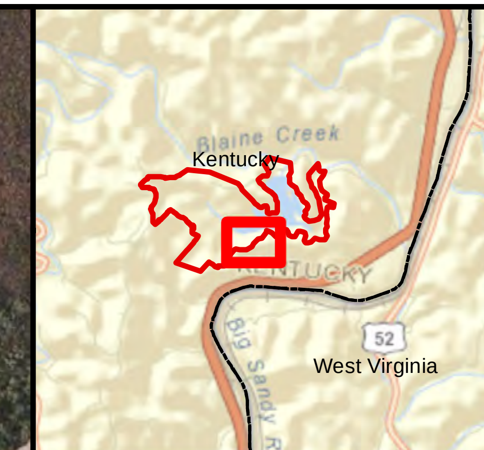
AEP

Big Sandy Fly Ash Pond Closure

FIGURE 3I
WETLAND DELINEATION AND
STREAM ASSESSMENT MAP

JOB NO. 13815142

URS



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N

LEGEND

Project Survey Boundary
Delineated Wetland
Delineated Pond
RBA Delineated Stream
Stream Flow Direction

High Gradient Stream Habitat Areas

Area 1 Delineated Stream
Area 2 Delineated Stream
Area 3 Delineated Stream
Area 4 Delineated Stream
Area 5 Delineated Stream
Area 6 Delineated Stream
Area 7 Delineated Stream

0 200 400
Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

Big Sandy Fly Ash Pond Closure

FIGURE 3J
WETLAND DELINEATION AND STREAM ASSESSMENT MAP

JOB NO. 13815142

N

LEGEND

- Project Survey Boundary
- Delineated Wetland
- Delineated Pond
- RBA Delineated Stream
- Stream Flow Direction

High Gradient Stream Habitat Areas

- Area 1 Delineated Stream
- Area 2 Delineated Stream
- Area 3 Delineated Stream
- Area 4 Delineated Stream
- Area 5 Delineated Stream
- Area 6 Delineated Stream
- Area 7 Delineated Stream

0 200 400

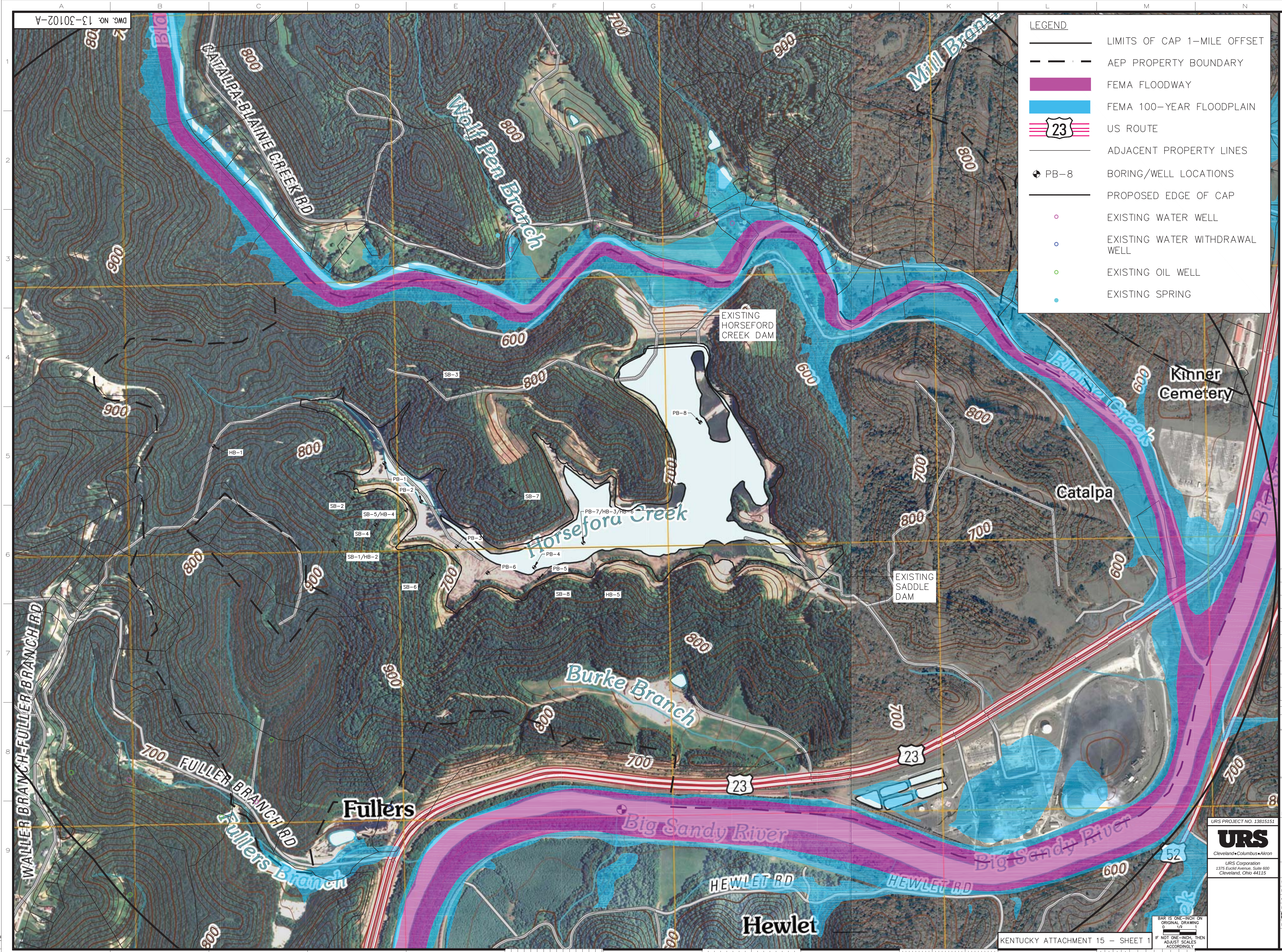
Scale in Feet

BASE MAP SOURCE:
ArcGIS Online World Imagery
Fallsburg. KY; Prichard, KY
7.5' USGS Topograpgic Quadrangles

Big Sandy Fly Ash Pond Closure

FIGURE 3K
WETLAND DELINEATION AND STREAM ASSESSMENT MAP

JOB NO. 13815142



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SCALE: 1" = 400'

NOTES:

1. CONTOURS TAKEN FROM USGS PRICHARD, WV-KY AND FALLSBURG, KY-WV 7.5 MINUTE SERIES QUADRANGLE MAPS PRODUCED 2011. FEATURES SHOWN ON THIS MAP ARE APPROXIMATE AND SHOULD BE USED BY THE CONTRACTOR FOR ANY OTHER PURPOSES.
2. FEMA FLOODPLAINS FROM FMSM ENGINEERS (2006) BASED ON WORK PERFORMED BY ESRI GEONET PROVIDED TO URS BY AEP.
3. THERE ARE NO KNOWN MINE WORKS, UN-PLUGGED WELLS, ARCHEOLOGICAL SITES, CULTURAL OR HISTORICAL RESOURCES OR CRITICAL HABITATS THAT HAVE BEEN IDENTIFIED WITHIN THE PROPOSED PROJECT BOUNDARY AT THE TIME OF THIS PERMIT APPLICATION SUBMITTAL.
4. ADJACENT PROPERTY OWNER INFORMATION OBTAINED FROM LAWRENCE COUNTY, KENTUCKY PVA.
5. WITHDRAWAL WELL LOCATIONS FROM WORK PERFORMED BY KGS IN 2005 BASED ON INFORMATION PROVIDED TO URS BY AEP.
6. WELLS AND SPRINGS LOCATIONS FROM WORK PERFORMED BY FMSM ENGINEERS IN 2006 BASED ON INFORMATION PROVIDED TO URS BY AEP.
7. OIL AND GAS WELL LOCATIONS FROM WORK PERFORMED BY KGS IN 2005 BASED ON INFORMATION PROVIDED TO URS BY AEP.

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

AMERICAN ELECTRIC POWER

BIG SANDY PLANT

LOUISA KENTUCKY

USGS 7.5 MINUTE
EXISTING SITE MAP
ATTACHMENT 15

DWG. NO. 13-30102-A

URS PROJECT NO. 13815151

URS
Cleveland•Columbus•Akron

URS Corporation
1375 Euclid Avenue, Suite 600
Cleveland, Ohio 44115

SCALE: 1" = 400' CIVIL ENGINEERING DIVISION
DR: KMC
CH: XXX
ENGR: XXX
PROJ ENGR: XXX
DATE: 05-01-13
APPROVED BY

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE- DD-MM-YYYY
SYSTEM TIME- HOUR:MINUTE