CCR GROUNDWATER MONITORING SYSTEM DEMONSTRATION

BOTTOM ASH POND
MITCHELL POWER GENERATION PLANT
MARSHALL COUNTY, WEST VIRGINIA

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1.0 OBJECTIVE

This report has been prepared for the Mitchell Power Generation Plant, which is owned and operated by Kentucky Power Company, a public utility subsidiary of American Electric Power, Inc. (AEP), to demonstrate that the Mitchell Bottom Ash Pond, a Coal Combustion Residuals (CCR) Unit by definition of the United States Environmental Protection Agency (EPA) CCR Rule which has been published in the Federal Register (FR) on April 17, 2015 and is an extension of the current Code of Federal Rules (CFR) Title 40, Part 257 (§257), meets or exceeds the requirements for Groundwater Monitoring Systems (GMS) as defined in §257.91. Civil & Environmental Consultants, Inc. (CEC) has been contracted by AEP to provide a qualified Professional Engineer to certify compliance with the referenced GMS requirements.

2.0 BACKGROUND INFORMATION

Kentucky Power Company (KPC), a subsidiary of AEP, owns and operates the Mitchell Power Generation Plant. This facility is located along West Virginia Route 2 near the City of Cresap, West Virginia (WV) as shown on Figure 1 – Site Location Map. The mailing address of the Mitchell Power Generation Plant is P.O. Box K, Moundsville, WV 26041-0961.

The Mitchell Power Generation Plant uses bituminous coal as the primary fuel source for its two steam-turbine electric generating units. The total electric production capacity of this plant is 1,600 megawatts. Processes and equipment that control air emissions from the coal fired units generate CCRs comprised of fly ash, bottom ash and gypsum. Bottom ash produced at the Mitchell Plant is piped to the BAP and de-watered prior to beneficial reuse or transport and disposal at the Mitchell Landfill, which is located along Gatts Ridge Road (Marshall County Road 72), approximately 2 miles north of the intersection with County Road 74 (about 2 miles due east of the Mitchell Power Generation Plant).

The following subsections provide a summary of the Mitchell BAP CCR Unit.

2.1 CCR UNIT LOCATION

The Mitchell BAP is located on the southern portion of the Mitchell Power Generation Plant facility as depicted on Figure 2 – Plant and CCR Unit Location Map. The approximate center of the Mitchell BAP has the following coordinates:

- Latitude: 39 degrees 49 minutes 30.58 seconds North
- Longitude: 80 degrees 48 minutes 55.16 seconds West

2.2 DESCRIPTION OF THE CCR UNIT

The Mitchell BAP is an active CCR surface impoundment that is part of the Bottom Ash Complex at the facility. The Bottom Ash Complex is comprised of the BAP and the Clear Water Pond as shown on Figure 2 – Plant and CCR Unit Location Map. Within the Bottom Ash Complex, the BAP is positioned immediately north of the Clear Water Pond and the south dike of the BAP separates the two ponds. The BAP outlet structure, located in the southwest quadrant of the pond, is hydraulically connected to the Clear Water Pond. The Clear Water Pond is not considered part of the Mitchell BAP CCR Unit.

The Mitchell BAP was constructed utilizing dikes comprised of compacted local sandy soils for the north, west and south perimeters and is partially incised into a natural hillside along the east

side. The interior slopes of the BAP are lined with a polyvinyl chloride (PVC) liner which is overlain by 3 feet of composite soils. The exterior and interior pond/dike slopes are vegetated (above the pool level on the interior slopes) to minimize erosion.

The Mitchell BAP is divided into two primary areas for progressive settlement of the bottom ash that is sluiced into the CCR unit. Initially, the bottom ash is sluiced into the northeast corner of the eastern half of the pond for initial settling and primary excavation of the decanted material. The sluice water containing finer fractions of bottom ash flows toward the south end of the eastern half of the pond before flowing into the western half of the pond for final settlement of the suspended solids. A culvert pipe allows the sluice water to transition into the west half of the pond. The working bottom of the south half of the Mitchell BAP east side is above the normal operating pool level to allow excavation and load-out operations of the bottom ash collected within the eastern portion of the pond. The western half of the pond is separated from the east half by an interior "splitter" dike and is divided into four (4) individual containment areas separated by internal dikes that direct the flow of water into the containment areas and increase the retention time in order to promote further settling of the bottom ash. After the sluice water proceeds through the west half of the pond, the water is then released from the BAP through a 30-inch diameter reinforced concrete outlet pipe located at the southwest corner of the pond to the Clear Water Pond. The normal pool elevation in the west half of the pond is maintained at approximate elevation 676 feet above mean sea level (amsl).

2.2.1 Embankment and Liner System Configuration

The BAP is constructed with compacted soil dikes along the north, west and south perimeters. The east interior slope is incised within the natural hillside. The interior and exterior slopes are constructed to approximately 3 horizontal to 1 vertical (3H:1V). The crest of the dikes are 20 feet wide. The interior slopes are lined with a PVC liner that is covered with 3 feet of soil.

A summary of the BAP dike and pool operation details is provided below:

- Dike Crest Elevation: 690 feet amsl
- Maximum Dike Height: 28 feet
- Normal Operating Pool Level: 676 feet amsl
- Maximum Design Storm Level: 678.37 feet amsl
- Freeboard: 14 feet
- Liner Bottom Elevation: 657 to 660 feet amsl

2.2.2 Area/Volume

Mitchell BAP comprises a total area of approximately 11.9 acres (measured to the toe of the exterior dikes). Using the operating pool elevation of 676 feet amsl and the pond bottom elevation of 660 feet amsl, the maximum storage capacity of the BAP is approximately 123 acre-feet. However, the operating volume of water maintained in the pond is significantly less than the maximum capacity due to the relatively dry bottom ash load-out area, splitter dike and interior diversion dikes.

2.2.3 Construction and Operational History

The Mitchell BAP was constructed and began operation in the mid to late 1970's. The pond construction was approved by West Virginia Department of Environmental Protection (WVDEP) Division of Water and Waste Management, Dam Safety Section in 1975 as a Hazard Class 2 structure under Dam ID #05108. In addition, the BAP was granted operational approval from WVDEP, in conjunction with the Clear Water Pond, in 1977 under National Pollutant Discharge Elimination System (NPDES) Permit No. WV0005304.

The BAP receives approximately 27,000 tons of bottom ash per year that is transported from the Mitchell Power Station boilers to the pond via sluiced transport methods. The bottom ash that settles from the sluice water is regularly excavated from within the BAP and is either beneficially reused off-site or transported to Mitchell Landfill for disposal. The operational pool level is maintained and controlled at about elevation 676 feet amsl through the outlet structure located near the southwest corner of the pond.

The Bottom Ash Pond Complex, including the BAP, is regularly inspected and maintained in accordance with the Maintenance Plan that has been reviewed and approved by the WVDEP Division of Water and Waste Management, Dam Safety Section. As a minimum, Mitchell BAP is inspected monthly by AEP plant personnel from the Mitchell Power Station and annually by AEP engineering staff. The inspections focus on the various structural and operation items associated with the pond and include: 1) interior and exterior dike maintenance and stability; 2) maintenance and operation of the internal water conveyance structures; 3) maintenance and operation of the inlet and outlet structures; and, 4) monitoring of established instrumentation. In addition to the owner inspection program, the WVDEP, Division of Water and Waste Management, Dam Safety Section completed and inspection on October 15, 2014. Required site and/or appurtenance maintenance or repairs identified during the inspections are completed by AEP plant personnel.

2.2.4 Surface Water Control

The Mitchell BAP is primarily designed to handle the operational inflow of sluiced bottom ash from the Mitchell Power Generation Station. Surface water from within the surrounding drainage area for the BAP is included to determine the maximum required design storage capacity. For this purpose, the design storm used in the analyses is one-half of the 6-hour Probable Maximum Precipitation (PMP) event. Based on the maximum design storm level and the normal operating pool elevation of 676 feet amsl, the maximum pool level increase is 2.37 feet (Elevation 678.37 feet amsl). The normal pool elevation is maintained by the 30-inch diameter reinforced concrete pipe outlet structure located near the southwest corner of the pond. Overflow from the BAP is conveyed to the Clear Water Pond via a concrete overflow shaft and a 30-inch diameter perforated distribution pipe that extends into the Clear Water Pond. Overflow from the Clear Water Pond is conveyed through a 36-inch diameter corrugated metal pipe; where after, it is discharged into the Ohio River in accordance with the referenced NPDES permit.

2.2.5 Groundwater Monitoring

The Mitchell BAP GMS is designed to monitor the Ohio River alluvial aquifer, which is designated to be the uppermost aquifer at the Mitchell BAP as discussed in Sections 3.1.1.4 and 3.1.1.5. The BAP GMS was installed in October and November 2015 and consists of seven monitoring wells constructed at the locations shown on Figure 3 – CCR Unit and Monitoring Wells. Well construction details are provided in Table 1 – Monitoring Well Construction Summary. BAP GMS monitoring wells are designated with a MW15XX naming convention, where the follow abbreviations apply:

- MW = monitoring well;
- 15 = last two digits of the year the monitoring well was installed; and,
- XX = monitoring well number (varies).

Initially, monitoring wells MW1509 and MW1510 were designated as piezometers P-2 and P-1, respectively. Following the collection of static water levels in December 2015 and February 2016 (provided in Table 2 – Static Water Levels) the piezometers were re-designated as groundwater monitoring wells in the BAP GMS.

The BAP Monitoring Well Network Installation Report (February 2016) provides details of the BAP GMS installation, including descriptions of the following activities:

- Drilling and soil sampling;
- Monitoring well construction;

- Monitoring well development;
- Single well slug testing;
- Static water level measurement; and,
- Installation of dedicated pumps.

In addition, a Field Sampling and Analysis Plan (FSAP, April 2016) was completed which includes methods and procedures for background, detection, and assessment monitoring for compliance with the CCR rules in 40 CFR §257.93, §257.94, and §257.95, respectively.

The BAP Monitoring Well Network Installation Report (February 2016) and the FSAP (April 2016) have been added to the Mitchell BAP CCR Operating Record.

Additional information describing the Mitchell BAP GMS is provided in Section 3.1.1.6.

2.3 SUPPORTING INVESTIGATIONS AND DOCUMENTS

CEC has reviewed the following documents which are the most relevant for evaluation of compliance with the CCR GMS requirements:

1. Groundwater Quality at the Kammer and Mitchell Power Plants, Marshall County, West Virginia, EPRI Research Project 9106, Site Investigation Report, May 1999.
2. Response to WVDWWM Order Number DS2009-0002 (Item 2), Mitchell Bottom Ash Complex, Marshall County, West Virginia WVOWWM 1.0. No. 05108, GA File No. 09-379, Prepared For AEP Service Corporation, 1 Riverside Plaza, Columbus, Ohio 43215-2373, Prepared by Geo/Environmental Associates, Inc., 3502 Overlook Circle, Knoxville, Tennessee 37909, March 18, 2009.
3. CCW Impoundments Inspection Report (Draft), Mitchell Power Plant, Marshall County, West Virginia, Prepared for U.S. Environmental Protection Agency, Washington, D.C., Under Subcontract to Lockhead Martin, Edison, New Jersey, Prepared by Paul C. Rizzo Associates, Inc., 101 Westpark Boulevard, Columbia, South Carolina, USA 29210, Project No. 09-4157, October 2009.
4. Well Details from G. M. Baker & Son Co. Production Test of Well June 12, 2014.
5. State of West Virginia, Source Water Assessment and Protection Program, Source Water Assessment Report, Revised Report, Mitchell Plant, PWSID WV9925015, Marshall County, Prepared by: West Virginia Department of Health and Human Resources, Bureau for Public Health, Office of Environmental Health Services, Source Water Protection Unit, January 2014.

6. Monitoring Well Network Installation Work Plan, Revision #1, Bottom Ash Pond, Mitchell Power Generation Plant, Marshall County, West Virginia, Prepared for American Electric Power, Columbus, Ohio, Prepared by Civil & Environmental Consultants, Inc., Cincinnati, Ohio, CEC Project 110-416.7701, September 2015.
7. Monitoring Well Network Installation Report, Bottom Ash Pond, Mitchell Power Generation Plant, Marshall County, West Virginia, Prepared for American Electric Power, Prepared by Civil & Environmental Consultants, Inc., Cincinnati, Ohio, CEC Project 110-416.7709, February 2016
8. Field Sampling and Analysis Plan, Mitchell Power Generation Plant, Mitchell Landfill and Mitchell Bottom Ash Pond, Marshall County, West Virginia, Prepared for Kentucky Power Company, D/B/A American Electric Power, Inc., 1 Riverside Drive, Columbus, Ohio 43215, Prepared by Civil & Environmental Consultants, Inc., Worthington, Ohio, CEC Project 110-416.7608. April 2016.
9. BAP Piezometer and Pool Water Levels, September 2009 to December 2012 and May 2015, provided by Kentucky Power, Mitchell Power Generation Plant, Marshall County, West Virginia.

2.4 HYDROGEOLOGIC SETTING

Hydrogeologic conditions at the Mitchell BAP have been investigated, evaluated and reported in several documents including: 1) Groundwater Quality at the Kammer and Mitchell Power Plants by EPRI dated May 1999; 2) Response to WVOWWM Order Number DS2009-0002 (Item 2), Mitchell Bottom Ash Complex, Marshall County, West Virginia by Geo/Environmental Associates, Inc. (GA) dated March 18, 2009; and, 3) CCW Impoundments Inspection Report (Draft) by Paul C. Rizzo Associates, Inc. (PCR) dated October 2009. In addition, groundwater and pool level measurements recorded as part of the regular inspections were reviewed. Based on a review of the available information, the following sections provide a summary of the hydrogeologic conditions at the Mitchell BAP. Wells and/or piezometers installed for the investigations cited above are not incorporated into the Mitchell BAP GMS.

2.4.1 Climate

Climatic data for Mitchell BAP is summarized as follows:

Average monthly temperature:

Jan./July (degrees F)	Feb./Aug. (degrees F)	March/Sep. (degrees F)	April/Oct. (degrees F)	May/Nov. (degrees F)	June/Dec. (degrees F)
26.70	28.80	38.50	50.10	59.70	68.1
72.00	70.60	64.10	52.50	41.60	31.4

Average monthly precipitation:

Jan./July (inches)	Feb./Aug. (inches)	March/Sep. (inches)	April/Oct. (inches)	May/Nov. (inches)	June/Dec. (inches)
2.86	2.40	3.58	3.28	3.54	3.30
3.83	3.31	2.80	2.49	2.34	2.57

Evapotranspiration:

Jan./July (inches)	Feb./Aug. (inches)	March/Sep. (inches)	April/Oct. (inches)	May/Nov. (inches)	June/Dec. (inches)
0.603	0.467	1.022	2.826	2.477	2.315
2.485	2.087	1.607	1.633	1.349	0.896

2.4.2 Regional and Local Geologic Setting

2.4.2.1 Regional Geomorphology and Bedrock Geology

The Mitchell BAP site is located in the Ohio River valley and lies within the regional geologic area of West Virginia known as the Appalachian Plateau Province. The Ohio River Valley is a significant regional geomorphological feature in the region and is separated into the upper and lower parts. The upper Ohio River valley is entrenched in the unglaciated and dissected Allegheny Plateau and is characterized by valley walls incised commonly 200 feet below the regional upland surface. The valley is a remnant of the historic preglacial Teays Valley drainage system, which is an integral part of the history of the present Ohio River drainage basin. Dismemberment of the preglacial Teays Valley system and development of the present Ohio River valley began in the late Tertiary or early Pleistocene glacial age.

The width characteristics of the upper Ohio River valley upstream from Marietta, Ohio, indicates that at some time during the Pleistocene, the head of southwest-flowing drainage in the Ohio River valley originated in southern Marshall County, WV. Above this point, drainage flowed northeastward. Ray (1974) describes that somewhere near New Martinsville, WV there was a divide in the Ohio River valley between north- and south-flowing drainage. The north-flowing drainage followed the valley of Beaver Creek in Pennsylvania and was blocked by the advance of a continental glacier from the north. The glacial dam caused the formation of a lake in the valley of the Ohio River that rose high enough to overflow the divide. The divide was worn down rapidly by the overflow, and, when the glacial ice had finally melted back, the channel through the divide near New Martinsville was lower than the old north-heading channel at Beaver Creek, which had been filled with morainal debris. As a result, the present headwaters of the Ohio River above New Martinsville were diverted to their present course.

By Illinoian time, the present Ohio River was largely established in its present course. The bedrock valley was deepened and broadened and filled with glaciofluvial deposits during interglacial stages. Post-glacial activity has resulted in downgrading and cutting of terraces and floodplain surficial deposits. Alluvial sand, gravel and clay deposits in the Ohio River valley are more than 100 feet thick and more than one-half mile wide in some areas and are a significant regional groundwater resource. The alluvial sediments in the valley consist of a glaciofluvial fill of medium- to coarse-grained sand and gravel of Wisconsin age and postglacial terrace deposits mainly of the "point-bar" type of river sediment. Sedimentary structures are of the cut-and-fill type, characteristic of aggrading streams. The individual beds are highly lenticular, and there are abrupt changes in particle size both horizontally and vertically. Lower terraces are often covered by 20 to 30 feet of silty clay and clay which contain some channel-fill sand lenses. These are interpreted as normal flood-plain deposits, mainly of the point-bar type. Flood plains are commonly underlain by thick sections of silt, sand, and clay.

The existing Ohio River bedrock valley has the shape of a trench with a flat bottom and abrupt, steep walls with buried rock benches (Carlston, 1962). Based on the Geologic Map of West Virginia (WVGES Publication: Map 25A), the bedrock in Marshall County predominantly consists of sedimentary bedrock of the Pennsylvanian and Permian age Dunkard, Monogahela and Conemaugh Groups. Bedrock forming the valley walls is composed of cyclic sequences of sandstone, siltstone, claystone, shale, limy shale, shaly limestone, and minor coal beds. While limestone is present within the region, the beds are generally thin and discontinuous. Most of the limestone is non-marine and there are no known karst features noted in the region. The literature indicates that the bedrock was deposited in a wide fluvial-deltaic plain where sediment eroding from the Appalachian Mountains traveled west to be deposited in a large shallow sea in the interior of the continent (Martin, 1998).

The Mitchell BAP is located approximately five miles northwest of the Proctor Syncline which strikes to the northeast/southwest. No evidence of folding or faulting was observed during at the site during field investigations completed at the Mitchell Landfill located approximately 2 miles east of the Mitchell BAP. Additional regional folds identified on the West Virginia GIS Technical Center website (http://wvgis.wvu.edu/index.php) are present southeast of the BAP which include the New Martinsville Anticline, the Loudenville Syncline, the Washington Anticline and Nineveh Syncline all striking northeast/southwest.

2.4.2.2 Regional Groundwater Resources

The Ohio Department of Natural Resources (ODNR) has published the Groundwater Resource Map of Monroe County (1991), which is the neighboring county along the west side of the Ohio River across from the Mitchell Power Generation Plant. The ODNR map distinguishes

groundwater well yields in the county, including bedrock strata and the Ohio River alluvium. Mapped well yields in Monroe County, Ohio are considered to be representative of groundwater yield conditions in neighboring Marshall County, WV. The ODNR Monroe County map indicates that the Ohio River alluvial deposits, referenced herein as the Ohio River alluvial aquifer, can provide yields of several hundred gallons per minute that will support large industrial and municipal supplies from sand and gravel deposits ranging from 55 to 75 feet thick which are hydraulically connected to the Ohio River. Comparatively, bedrock strata, positioned below and confining the lateral boundaries of the Ohio River alluvium, yield very limited groundwater supplies, typically less than 2 gpm. ODNR describes the bedrock strata groundwater resource potential as "very limited and often inadequate".

CEC interprets that the Ohio River acts as a discharge boundary for the alluvial aquifer during low river flow and a recharge boundary during seasonal high river stage conditions. Seasonal water levels in the Ohio River are partially controlled by a series of locks and dams that are operated by the USACE. Thus, the seasonal high water elevation in the Ohio River alluvial aquifer is interpreted to be equal to the Ohio River Ordinary High Water Elevation published by the US Army Corp of Engineers (USACE).

2.4.2.3 Local Geology

The Mitchell BAP is constructed on the Ohio River floodplain and above the sand and gravel alluvial deposits. The saturated portion of these alluvial deposits, that are in direct hydraulic connection with the Ohio River, are the regional Ohio River alluvial aquifer. Ground surface elevations range from approximately 685 to 630 feet amsl at the Mitchell Power Generation Plant with surrounding hilltops reaching elevation 1,120 to 1,200 feet amsl. Local geologic conditions at the Mitchell BAP were primarily identified by the referenced EPRI report which included approximately 75 geotechnical borings and water level data from eight monitoring wells. These borings ranged in depth from about 36 feet below ground surface (bgs) to 116 feet bgs. Five of the borings were advanced into bedrock with core samples collected from depths of 98 feet bgs to 116 feet bgs. Additional boring data was developed as part of the referenced GA 2009 report that included 5 borings and installation of 4 piezometers. These supplemental borings were advanced through the constructed perimeter BAP dikes and the investigated depths were limited to about 50 feet below the original ground surface. GA field boring logs describe subsurface soils to be primarily classified as sand, with occasional, thin silt or clay intervals. There is no indication on the boring logs that organic soils or dredge materials were encountered in the BAP dike borings. Laboratory analysis of select soils samples verified these field classifications.

Site specific geologic cross sections from the referenced EPRI report are provided in Appendix A. The cross section locations are presented on Figure 3-3. Figures 3-4 and 3-5 present Sections A-A' and B-B', which are oriented approximately perpendicular to the Ohio River. Section C-C' is presented on Figure 3-6 and is aligned with the river. These cross sections show the variability in the natural unconsolidated soils and strata beneath the Mitchell Power Generation Plant and that the confining bedrock strata rise steeply to the east along the eastern portion of the plant boundary. Generally, the stratigraphy of unconsolidated soil deposits consists of a surficial fill layer underlain by natural silts and clays, then sand and interbedded sand and gravel deposits. EPRI identified four generalized textural zones were within the alluvial deposits. Significant variability was noted with respect to both zone thickness and textural characteristics. The referenced EPRI textural zones and their thickness ranges are as follows:

Textural Zone	Thickness (ft.)
Clay	0-17
Sand	0-30
Gravel	0-97
Gravel lenses	0-50

Fill was used extensively for establishing the required land surface grade of about elevation 667 feet amsl at the BAP site. The fill is composed of light brown silts and clays with minor amounts of coal, sand, and gravel. The fill is up to 25 feet thick and covers the western portion of the site, where it was used to extend an upper river terrace toward the river and establish the required land surface grade of about 667 feet amsl for the Mitchell Power Generation Plant. Between the Ohio River and the eastern portion of the Mitchell Power Generation Plant, including most of the BAP, the bedrock is near level at about elevations 570 feet amsl or about 100 feet below the original ground surface as shown on Figures 3-4 and 3-5 in Appendix A.

Subsurface data collected during installation of the Mitchell BAP GMS in October and November 2015 are presented in Section 3.1.1 and are consistent with hydrogeologic conditions described in the GA and EPRI investigations, completed in 2009 and 1999, respectively.

2.4.3 Local Groundwater Use

The Mitchell Power Generating Plant withdrawals water from the Ohio River alluvial aquifer that serves as a source of potable water for the plant. Currently, there are two groundwater supply wells operating at the plant. Information provided by AEP indicates that the supply wells produced an approximate average of 628,000 gallons per month in 2014. The influence of the supply wells is shown on the EPRI Water Table Contour Map for the Mitchell Plant site (August 20, 1996) on Figure 3-7 in Appendix A. Water levels collected on May 20, 2015 from

six of the eight original monitoring wells at the plant are similar to those recorded during the EPRI study and also reflect the pumping well influence. A summary of the supply wells is provided below.

Supply Well #2

- Total Well Depth 92.6 feet
- Screen Length 15 feet with Top of Screen at 77 feet
- Well Diameter 10 inches
- Static Water Level 43.6 feet on 6/12/14 Step Test
- Step Test performed – specific capacity at 163 GPM = 233 GPM/FT
- End of Step Test 224 GPM = 1.10 feet drawdown

Supply Well #3

- Total Well Depth 91.6 feet
- Screen Length 20 feet with Top of Screen at 71 feet
- Well Diameter 14 inches
- Static Water Level 41.2 feet on 5/30/14 Step Test
- Step Test performed – specific capacity at 172 GPM = 82 GPM/FT
- End of Step Test 231 GPM = 2.70 feet drawdown

3.0 §257.91 GROUNDWATER MONITORING SYSTEM

3.1 §257.91(A) THROUGH §257.91(C) RULE DESCRIPTION

40 CFR 257.91(a) through (c) states:

(a) Performance standard. The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

- ***(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where:***
  - ***(i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or,***
  - ***(ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and,***
- ***(2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.***

(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of:

- ***(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and,***
- ***(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.***

(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a)

of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain:

(1) A minimum of one upgradient and three downgradient monitoring wells; and,

(2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

3.1.1 Information Supporting Rule Compliance

3.1.1.1 Hydrostratigraphic Units

The Mitchell BAP is constructed on the Ohio River floodplain and above the sand and gravel alluvial deposits. The saturated portion of these alluvial deposits that are in direct hydraulic connection with the Ohio River are the regional Ohio River alluvial aquifer, which is a prolific aquifer capable of supplying hundreds of gallons per minute. Bedrock forming the Ohio River valley, which contains the Ohio River alluvial aquifer, is composed of cyclic sequences of sandstone, siltstone, claystone, shale, limy shale, shaly limestone, and minor coal beds. While limestone is present within the region, the beds are generally thin and discontinuous and there are no known karst features in the vicinity. Comparatively, bedrock strata yield very limited groundwater supplies, typically less than 2 gpm. ODNR describes the bedrock strata groundwater resource potential as “very limited and often inadequate”.

As stated in Section 2.4.2.3, GA field boring logs describe subsurface soils below the Mitchell BAP to be primarily classified as sand, with occasional, thin silt or clay intervals. There is no indication on the boring logs that organic soils or dredge materials were encountered in the BAP dike borings. Laboratory analysis of select soils samples verified these field classifications. This was further confirmed by the 2015 GMS borings described in Section 3.1.1.6.

Geologic cross sections were prepared from monitoring well borings completed at the periphery of the Mitchell BAP in October 2015 at the locations shown on Figure 4 – Geologic Cross Section Location Map. Based on the data collected from these monitoring well borings, unconsolidated soils and bedrock underlying the Mitchell BAP are depicted on Figure 5 – Geologic Cross Sections A-A’ and Figure 6 – Geologic Cross Section B-B’. The saturated portion of the sand and gravel deposits comprises the Ohio River alluvial aquifer. Unconsolidated deposits comprising the Ohio River alluvial aquifer at the Mitchell BAP monitoring wells locations consist of sand and gravel, classified as well graded sand (SP), poorly graded sand with gravel (SP), well graded sand (SW), and well graded sand with gravel (SW).

As depicted on Figure 5 – Geologic Cross Section A-A' the Ohio River alluvial aquifer ranges in thickness due to the confining bedrock strata that rises to the east along the eastern portion of the plant boundary. Beneath the Mitchell BAP, the saturated aquifer ranges in thickness from approximately 47 feet to the west to 27 feet to the east.

The Mitchell BAP monitoring wells were constructed with well screens that monitor the phreatic surface (water table) in the Ohio River alluvial aquifer. Monitoring well screened intervals range from approximate elevations 616 feet amsl to 596 feet amsl as indicated in Table 1 – Monitoring Well Construction Summary. Further description of the Mitchell BAP monitoring wells is provided in Section 3.1.1.6.

3.1.1.2 Hydraulic Conductivity

Groundwater flow in the Ohio River alluvial aquifer is through primary porosity in the sand and gravel deposits that comprise the aquifer. In-situ hydraulic conductivity tests (slug tests) were completed at each of the Mitchell BAP monitoring wells installed in October 2015. Slug testing was completed five days following the completion of well development activities for the Mitchell BAP monitoring wells. Slug test data were collected with In-Situ Level Troll 700™ electronic data transducers. Downloaded data were analyzed using AQTESOLV™ software. Hydraulic conductivity (K) values calculated from the Mitchell BAP monitoring wells are summarized as follows:

- Highest K value: MW1505 1.43 x 10^{-2} centimeters per second (cm/s);
- Lowest K value: MW1508 5.61 x 10^{-3} cm/s; and,
- Average K value: 4.62 x 10^{-2} cm/s.

These hydraulic conductivity values are representative of the Ohio River alluvial aquifer at the Mitchell BAP.

3.1.1.3 Groundwater Flow

Groundwater flow in the Ohio River alluvial aquifer in the vicinity of the Mitchell BAP was initially determined by the referenced EPRI report to be toward the Ohio River with some influence from the Mitchell Generation Power Station water supply wells as shown in Figure 3-7 in Appendix A. Figure 7 – Ohio River Alluvial Aquifer Potentiometric Map, December 10, 2015 and Figure 8 – Ohio River Alluvial Aquifer Potentiometric Map, February 8, 2016 were prepared using static water levels from the recently installed Mitchell BAP monitoring wells and the remaining EPRI wells. The potentiometric surface maps are comparable to those reported by EPRI in 1999. Groundwater flow at the Mitchell BAP is influenced by the on-site pumping wells to the north, bedrock confining beds to the east, and the Ohio River discharge boundary to the

west. The potentiometric surface beneath the Mitchell BAP is relatively flat, exhibiting only 0.14 feet difference between the highest and lowest static water level measurement on December 10, 2015 and 0.37 feet difference on February 8, 2016. Based on the December 2015 and February 2016 water level data, monitoring well MW1508 is upgradient and wells MW1504 and MW1510 are sidegradient of the Mitchell BAP. The remaining BAP monitoring wells are downgradient wells as indicated in Table 1 – Monitoring Well Construction Summary.

Groundwater flow velocities in the alluvial aquifer were calculated using monitoring well water level data recorded on December 10, 2015 and corresponding potentiometric contours and flow lines depicted in Figure 7–Ohio River Alluvial Aquifer Potentiometric Map, December 10, 2015. Groundwater flow velocities were calculated using Darcy's Law, average hydraulic conductivity from slug tests, a referenced effective porosity for the aquifer deposits, and the change in potentiometric head along two representative flow lines, one toward the Mitchell Plant groundwater supply wells north of the BAP and the other from monitoring well MW1508 to EPRI well MW-8 to the south of the BAP. The calculated groundwater flow velocities along these flow paths are:

- Flow line from BAP toward the supply well: 0.87 feet per day (ft./day); 319 feet per year (ft./yr.)
- Flow line from MW1508 to MW-8: 0.26 ft./day; 94 ft./yr.

Based on these groundwater flow velocities, the approximate travel time from the BAP to the Mitchell Plant supply well is approximately three years and travel time from the BAP to the Ohio River is approximately eight years. The BAP Monitoring Well Network Installation Report (February 2016) provides the groundwater flow velocity calculations.

3.1.1.4 CCR Rule Definition of Uppermost Aquifer

The CCR Rule definition of the uppermost aquifer is found in 40 CFR §257.53 and is provided below:

> *Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.*

As further discussed in Section 3.1.1.5, the Ohio River alluvial aquifer meets the CCR rule criteria for being the uppermost aquifer at the Mitchell BAP.

3.1.1.5 Identified On-site Uppermost Aquifer

The referenced EPRI report identifies that the Mitchell Power Generation Station and subject BAP are positioned over Ohio River alluvial deposits consisting of 40 to 50 feet of lenticular sand and gravel overlain by a layer of fine grained material, consisting of approximately 20 feet of clay and clayey silt and 10 to 20 feet of clayey sand. The unconsolidated alluvial deposits pinch out against the confining bedrock strata that contain the Ohio River channel and form the adjacent ridges positioned east of the subject site and west of the Ohio River.

The Ohio River alluvial aquifer, which consists of the saturated portion of the sand and gravel alluvial deposits that are in direct hydraulic connection with the Ohio River, is appropriately defined as the uppermost aquifer beneath the Mitchell BAP. Water elevations in Mitchell BAP monitoring wells and remaining EPRI wells on December 10, 2015 are presented in Table 2 – Static Water Levels. Comparison of the remaining EPRI well water elevation measured December 10, 2015 to EPRI monitoring well elevations included in the referenced EPRI report are comparable, as summarized below:

EPRI Well No.	December 10, 2015 Static Water Level feet amsl	November 1996 Static Water Level feet amsl
MW-4	623.00	622.57
MW-5	623.05	622.60
MW-6	623.11	622.51
MW-7	623.33	623.15
MW-8	623.87	624.32

EPRI Figure 3-8 in Appendix A provides temporal variations in groundwater elevations in the Ohio River alluvial aquifer which vary less than one foot during two monitoring events in August and November 1996. Water levels and are expected to fluctuate slightly due to seasonal conditions. Additional static water levels collected in February 2016 are presented in Section 3.1.1.3 and are consistent with groundwater levels recorded during the EPRI investigation in 1999.

The seasonal high water elevation in the Ohio River alluvial aquifer is equal to the Ohio River Ordinary High Water Elevation, which is elevation 627.3 feet amsl in the vicinity of the Mitchell BAP.

3.1.1.6 Monitoring Well Network

The BAP CCR groundwater monitoring system was installed from October 5 to November 12, 2015 and consists of seven groundwater monitoring wells installed in the Ohio River alluvial aquifer at the locations shown on Figure 3 – Bottom Ash Pond Monitoring Well Network. The well locations were selected to provide potential upgradient and downgradient monitoring positions relative to the Mitchell BAP based on the influence of the water supply wells at the Mitchell Power Plant, the Ohio River, surrounding bedrock hydraulic boundaries, and drill rig access constraints. EPRI monitoring wells also provide additional water levels for potentiometric mapping.

Table 1 – Monitoring Well Construction Summary provides construction details for the Mitchell BAP GMS. The wells monitor the uppermost aquifer, defined in Section 3.1.1.5 as the Ohio River alluvial aquifer. Boring logs and as-built well diagrams provided in Appendix B describe the monitored unconsolidated deposit characteristics. Graphic representations of the alluvial deposits penetrated by the Mitchell BAP monitoring well borings and well construction details are shown on Figure 5 – Geologic Cross Section A-A' and Figure 6 – Geologic Cross Section B-B'. Static water levels measured in December 2015 are also included on these geologic cross sections.

Subsequent to monitoring well installation and development, AEP installed dedicated bladder pumps in the five BAP monitoring wells (MW1504 through MW1508) on December 19, 2015. AEP selected and installed Geotech stainless steel bladder pumps, model 1.66, 36-inch length. The dedicated pumps were set approximately 1 to 2 feet above each well bottom. Subsequently, AEP installed dedicated Geotech bladder pumps in BAP monitoring wells MW1509 and MW1510 on April 8, 2016.

A summary of the Mitchell BAP monitoring well bottom depths measured from ground surface and elevations is provided below:

<u>Ohio River Alluvial Aquifer Monitoring Well Depths/Elevations (measured from ground surface)</u>

- MW1504: 93.5 ft. bgs/598.40 ft. amsl
- MW1505: 94.0 ft. bgs/597.05 ft. amsl
- MW1506: 95.0 ft. bgs/596.36 ft. amsl
- MW1507: 94.0 ft. bgs/598.08 ft. amsl
- MW1508: 87.0 ft. bgs/595.72 ft. amsl

- MW1509 (P-2): 94.0 ft. bgs/597.86 ft. amsl
- MW1510 (P-1): 81.0 ft. bgs/597.01 ft. amsl

As stated previously, static water levels measured in December 2015 and February 2016 are presented on Figure 7 – Ohio River Alluvial Aquifer Potentiometric Map, December 10, 2015 and Figure 8 – Ohio River Alluvial Aquifer Potentiometric Map, February 8, 2016. Based on the initial water elevation data from the Mitchell BAP GMS, there is 0.14 feet of variation in groundwater elevations in December 2015 and 0.37 feet of variation in February 2016 (Table 2 – Static Water Levels). Interpreted groundwater flow lines based on the December 2015 and February 2016 water level data indicate that monitoring well MW1508 is upgradient of the Mitchell BAP and wells MW1504 and MW1510 are sidegradient. The remaining monitoring wells are downgradient of the Mitchell BAP as indicated in Table 1 – Monitoring Well Construction Summary.

3.1.1.7 BAP CCR Background, Detection, and Assessment Monitoring

There will be a total of eight background sampling events beginning in late May 2016 and will be completed by October 17, 2017 for compliance with 40 CFR §257.93. BAP CCR background monitoring will include all of the parameters listed in Appendix III and Appendix IV of the CCR rules. Detection monitoring is required by the CCR rules in 40 CFR §257.94 to be semi-annual (twice yearly) and will begin after the October 17, 2017 deadline for background monitoring. BAP detection monitoring will include the parameters listed in Appendix III of the CCR rules and will occur every six months (semi-annually).

Within 90 days of determining a statistically significant increase (SSI) over background for an Appendix III parameter during semi-annual detection monitoring events, it may be demonstrated that the SSI is a result of error in sampling, analysis, statistical analysis or natural variation in groundwater quality. If a successful demonstration is completed within the 90-day period, detection monitoring may continue. If a successful demonstration is not completed within the 90-day period, as assessment monitoring program must be initiated as required by 40 CFR §257.95, which includes sampling each well for Appendix III and IV parameters.

3.1.2 Compliance with §257.91(a) through §257.91(c) Requirements

The Mitchell BAP GMS, as described in the Monitoring Well Network Installation Report (February 2016) and summarized in Section 3.1.1.6, consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples that: 1) accurately represent the quality of background groundwater that has not been affected by leakage from the Mitchell BAP CCR unit; 2) accurately represent the quality of groundwater passing the waste

boundary of the Mitchell BAP CCR unit; and, 3) the monitoring well network consists of appropriate number, spacing, and depths of monitoring wells based upon site-specific technical information (summarized in Section 3.1.1) that included thorough characterization of the saturated and unsaturated geologic units, aquifer thicknesses, groundwater flow rates, groundwater flow directions, and seasonal/temporal fluctuations in groundwater flow. Thus, the Mitchell BAP GMS complies with 40 CFR 257.91(a) through 40 CFR 257.91(c) requirements.

3.2 §257.91(D) RULE DESCRIPTION

40 CFR 257.91(d) states:

(d) The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit.

> ***(1) The multiunit groundwater monitoring system must be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system specified in paragraphs (a) through (c) of this section for each CCR unit based on the following factors:***
>
> ***(i) Number, spacing, and orientation of each CCR unit;***
>
> ***(ii) Hydrogeologic setting;***
>
> ***(iii) Site history; and,***
>
> ***(iv) Engineering design of the CCR unit.***
>
> ***(2) If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by § 257.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under § 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under § 257.101(a) to retrofit or close.***

3.2.1 Compliance With §257.91(D)

AEP is not proposing to install a multi-unit groundwater monitoring system; therefore, this rule does not apply to Mitchell Landfill.

3.3 §257.91(E) AND §257.91(F) RULE DESCRIPTION

40 CFR 257.91(e) and (f) states:

(e) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

(1) The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section.

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring program.

(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

3.3.1 Information Supporting Rule Compliance

The Mitchell BAP monitoring wells were installed following the procedures and materials specified in the Monitoring Well Network Installation Work Plan (September 2015), including:

- Monitoring well locations
- Drilling and soil sampling methods
- Annulus sealing methods
- Monitoring well materials
- Well development procedure

- Well testing procedures

The BAP Monitoring Well Network Installation Report (February 2016) documents completed drilling and well installation procedures and materials, well development activities, and well testing details.

Figure 3 – CCR Unit and Monitoring Wells identifies the locations of the Mitchell BAP monitoring wells. Table 1 – Monitoring Well Construction Summary provides construction details for the Mitchell BAP GMS. Boring logs and as-built well diagrams are provided in Appendix B. Monitoring well development records are included in Appendix C. Final turbidity levels following well development ranged as follows:

Well Development Results

Well No.	Final Turbidity (NTUs)	Well Volumes Removed	Gallons Removed
MW1504	9.7	156.9	687.5
MW1505	736.0	161.4	785
MW1506	16.9	106.7	525
MW1507	20.8	82.0	362.5
MW1508	23.8	180.1	836.3
MW1509 (P-2)	85.8	96.4	431.5
MW1510 (P-1)	4.7	121.4	552.5

Note that well volumes vary depending on the height of the water column in the individual well and that well volumes do not equal gallons of water removed from a well.

Interpreted groundwater flow lines based on the December 2015 and February 2016 water level data indicate that monitoring well MW1508 is upgradient of the Mitchell BAP and wells MW1504 and MW1510 are sidegradient. The remaining monitoring wells are downgradient of the Mitchell BAP as indicated in Table 1 – Monitoring Well Construction Summary. Groundwater flow lines relative to the Mitchell BAP are depicted on Figure 7 – Ohio River Alluvial Aquifer Potentiometric Map, December 10, 2015 and Figure 8 – Ohio River Alluvial Aquifer Potentiometric Map, February 8, 2016.

3.3.2 Compliance with §257.91(e) and §257.91(f) Requirements

As described in the Monitoring Well Network Installation Report (February 2016) and summarized in Section 3.1.1.6, the Mitchell BAP groundwater monitoring wells were constructed and cased in a manner that maintains the integrity of the monitoring well borehole for the collection of groundwater samples, including: 1) the annular space above each well's sampling depth is sealed with bentonite to prevent contamination of samples and the groundwater; and 2) wells are constructed with slotted well screens surrounded by silica sand filter packs that reduce suspended solids and turbidity in the groundwater samples. Well design, installation, and development of monitoring wells is contained in the BAP Monitoring Well Network Installation Report (February 2016) as summarized in Section 3.1.1.6. The developed data is maintained in the Mitchell BAP CCR Operating Record. The measurement, sampling, and analytical device maintenance and operation are documented in the FSAP (April 2016) which is also maintained in the CCR Operating Record.

A CEC Certified Professional Geologist (CPG), under the supervision and direction of the certifying Professional Engineer, has been directly involved with the design of the BAP GMS, data collection, site characterization, well installation, and well development, and has reviewed applicable information recorded in the Operating Record. The information referenced in Section 3.3.1 demonstrates that the Mitchell BAP GMS complies with 40 CFR 257.91(e) and 40 CFR 257.91(f) requirements.

4.0 SUMMARY AND PROFESSIONAL ENGINEER'S CERTIFICATION

This CCR Groundwater Monitoring System Demonstration describes the Mitchell Bottom Ash Pond CCR unit, site geology and groundwater monitoring system in support of demonstrating compliance with 40 CFR §257.91 Groundwater Monitoring Systems. Section 3.0 of this report provides supporting information and conclusions demonstrating that the applicable Groundwater Monitoring System requirements have been met.

The following certification statement provides confirmation that this report was prepared by a qualified professional engineer and that there is sufficient information to demonstrate that the existing Mitchell Bottom Ash Pond meets the Groundwater Monitoring System requirements stated in 40 CFR §257.91.

Professional Engineer's Certification

By means of this certification, I certify that I have reviewed this CCR Groundwater Monitoring System Demonstration Report, Mitchell Bottom Ash Pond, Mitchell Power Generation Plant, and the design, construction, operation, and maintenance of Mitchell Bottom Ash Pond Groundwater Monitoring System meets the requirements of Section 40 CFR §257.91.

Anthony P. Amicon
Printed Name of Professional Engineer

Signature

19206	West Virginia	06-23-2011
Registration No.	Registration State	Date

5.0 BIBLIOGRAPHY

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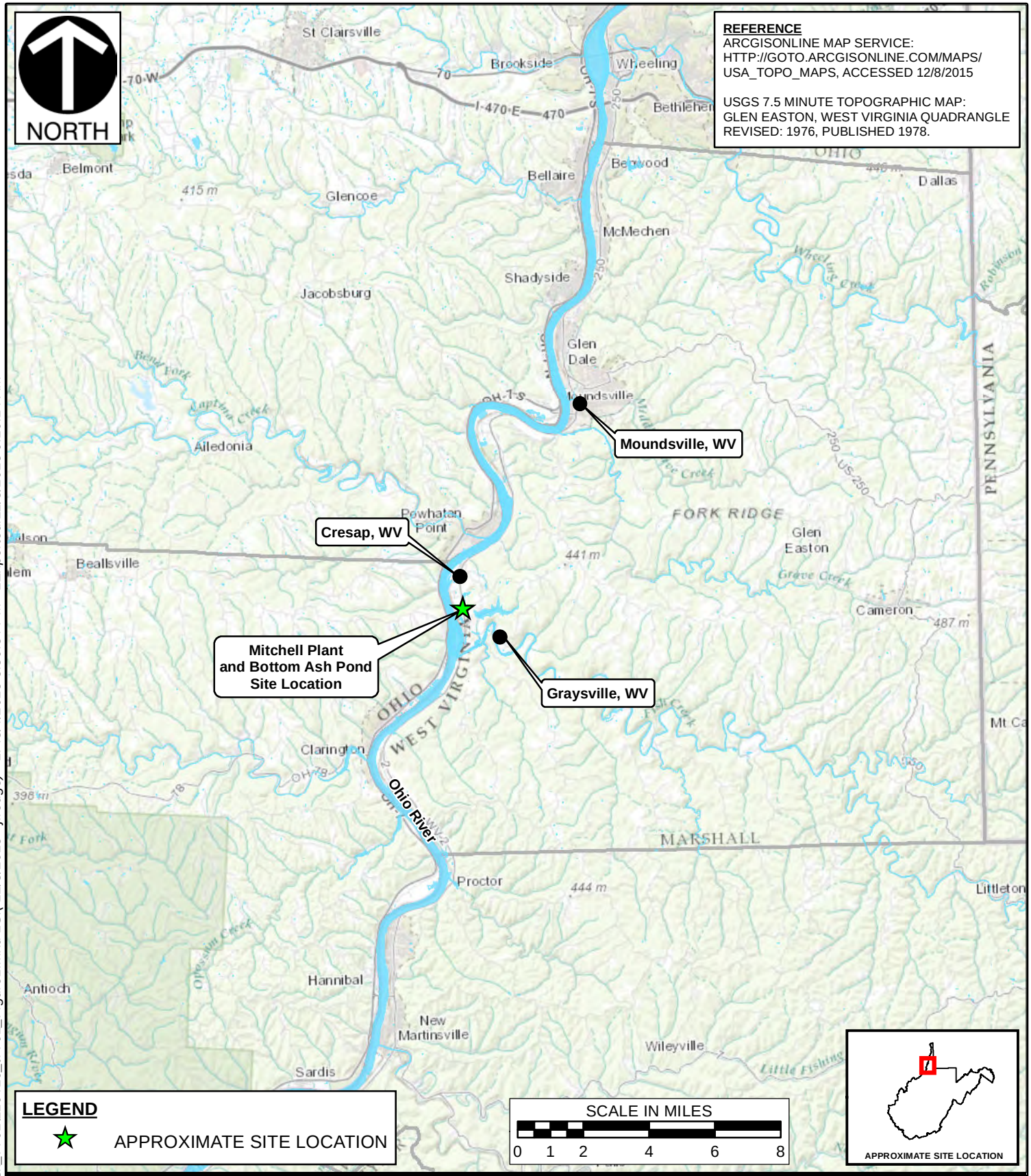
Web: www.wvgs.wvnet.edu, Map: Original 1968/1969 map revised, March 2011, Map Date: May 16, 2011.

FIGURES



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GROUNDWATER MONITORING SYSTEM DEMONSTRATION
SITE LOCATION MAP

DRAWN BY:	MAD	CHECKED BY:	RAS	APPROVED BY:	APA*	FIGURE:	1
DATE:	12/8/2015	MAP SCALE:	1 " = 4 miles	PROJECT NO:	110-416-7701		

*Hand signature on file

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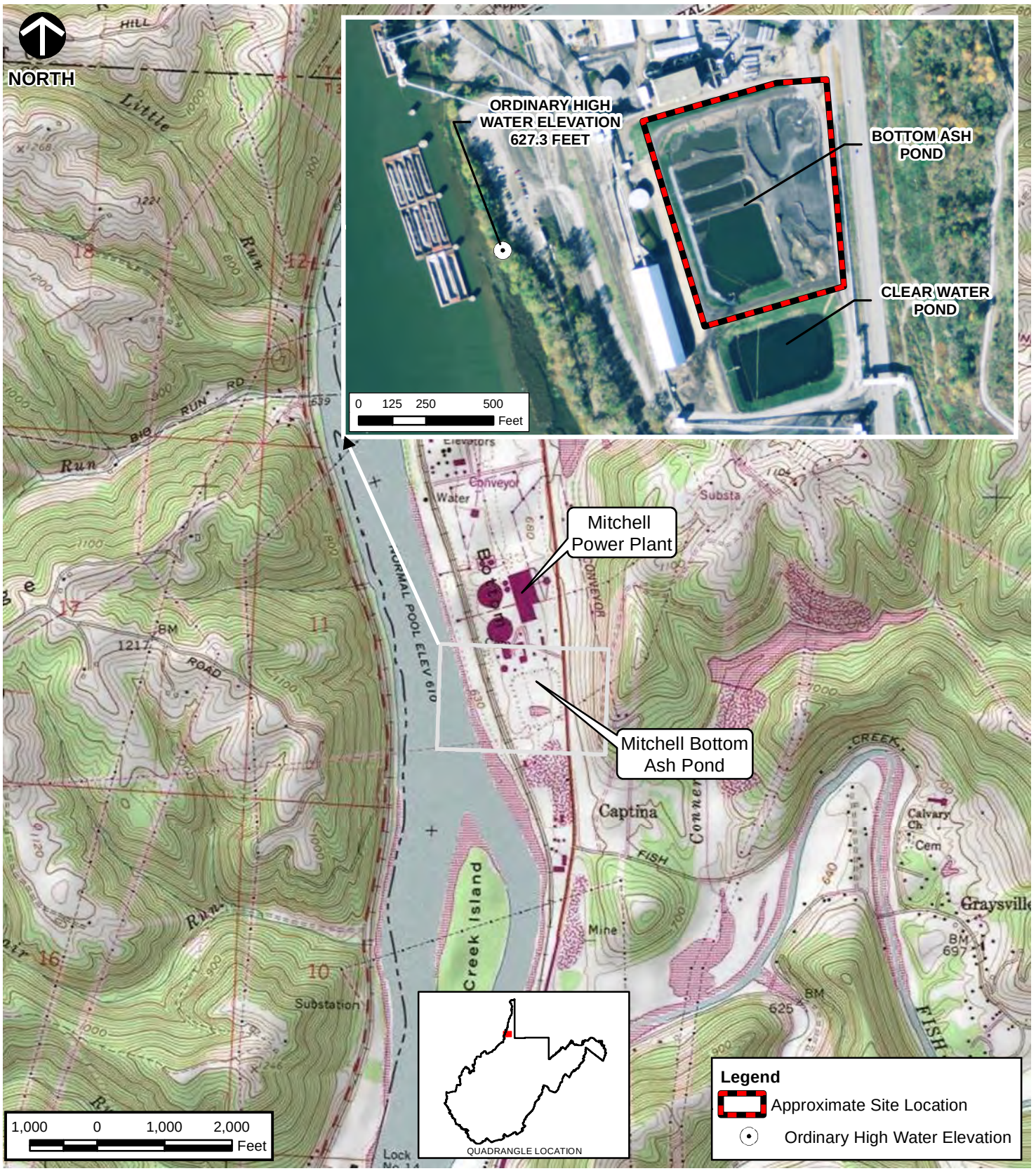

SOURCE: PORTION OF THE USGS 7.5-MINUTE SERIES TOPOGRAPHIC QUADRANGLE MAP - GLEN EASTON, WV - 1978 AND POWHATAN POINT, WV - 1978.
SOURCE; AERIAL PHOTOGRAPH - ARCGISONLINE MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY, ACCESSED 12/8/2015 IMAGERY DATE 10/24/2014

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GROUNDWATER MONITORING SYSTEM DEMONSTRATION
PLANT AND CCR UNIT LOCATION MAP

DRAWN BY:	JBF	CHECKED BY:	RAS	APPROVED BY:	APA*	FIGURE NO:	2
DATE:	DECEMBER 08, 2015	DWG SCALE:	1 " = 2,000 '	PROJECT NO:	110-416-7701		

Signature on File *

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STATE ROUTE 2

MW1504

MW1505

MW1506

MW1507

MW1508

MW1509

MW1510

BAP LIMITS

BOTTOM ASH POND (BAP)

CLEAR WATER POND (CWP)

MITCHELL POWER PLANT

MW-8

ORDINARY HIGH WATER ELEVATION 627.3 FEET

OHIO RIVER

LEGEND

MW1506 BAP MONITORING WELL (INSTALLED 2015)

MW-8 EPRI MONITORING WELL (INSTALLED 1999)

NORTH

SCALE IN FEET

0 100 200

REVISION RECORD

NO	DATE	DESCRIPTION

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GROUNDWATER MONITORING SYSTEM DEMONSTRATION

CCR UNIT AND MONITORING WELLS

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:		110-416-7701	
APPROVED BY:		(HAND SIGNATURE ON FILE)	*APA

FIGURE NO.: 3

STATE ROUTE 2

MW1508

MW1504

A'

B'

MW1510

CLEAR WATER POND (CWP)

BAP LIMITS

BOTTOM ASH POND (BAP)

MW1505

MW1509

MW1507

B

MW1506

MW-8

MITCHELL POWER PLANT

ORDINARY HIGH WATER ELEVATION 627.3 FEET

OHIO RIVER

A

LEGEND

B B' CROSS SECTION LOCATION

MW1506 BAP MONITORING WELL (INSTALLED 2015)

MW-8 EPRI MONITORING WELL (INSTALLED 1999)

NORTH

SCALE IN FEET

0 100 200

REVISION RECORD

NO	DATE	DESCRIPTION

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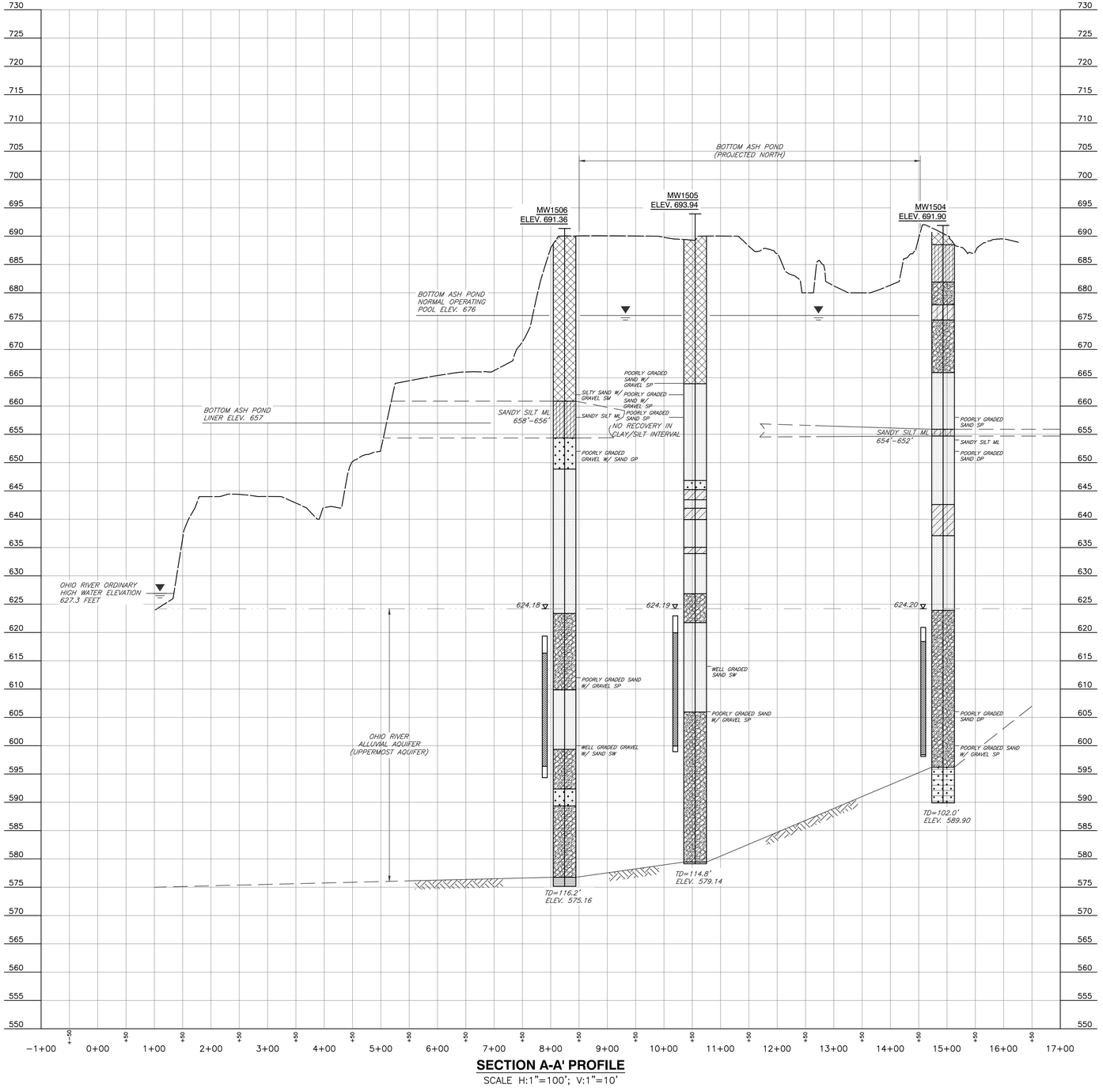
GROUNDWATER MONITORING SYSTEM DEMONSTRATION

GEOLOGIC CROSS SECTION LOCATION MAP

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:		110-416-7701	
APPROVED BY:		(HAND SIGNATURE ON FILE)	*APA

FIGURE NO.: **4**

P:\2017\110-416\-CAD\GWC\BAP Evaluation Report Task 7701\110416-7701 Figure 4 Geologic Cross Section Location Map.dwg[FIGURE 4] LS:4/13/2018 - dhuq) - LP: 6/8/2018 2:04 PM



SECTION A-A' PROFILE

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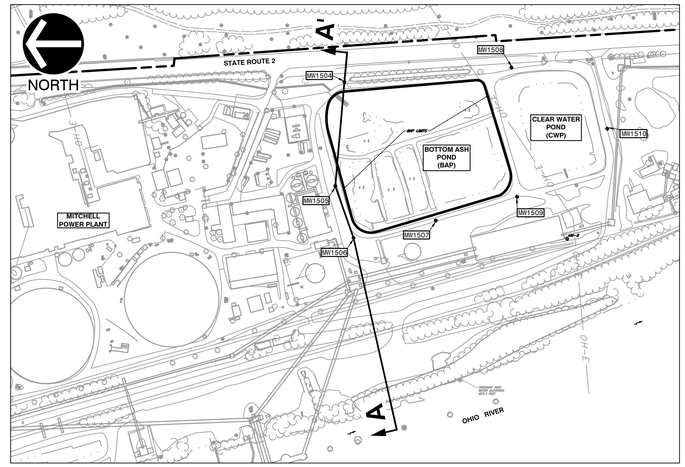
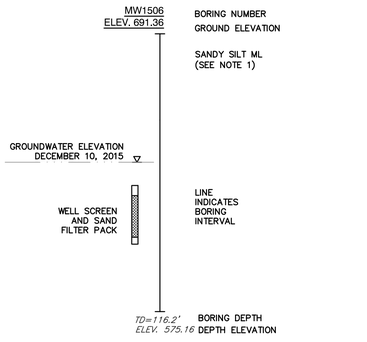


KEY PLAN

SCALE: 1"=300'

- FILL
- CLAY TO SILT
- SANDY CLAY OR SANDY SILT
- CLAYEY SAND
- FINE TO COARSE SAND
- SAND AND GRAVEL
- GRAVELLY SAND
- CLAYSTONE/SILTSTONE
- SANDSTONE
- LIMESTONE
- TOP OF BEDROCK (DASHED WHERE INFERRED)



MONITORING WELL DIAGRAM

NOTE:

1. NOTED SOIL DESCRIPTIONS FROM GEOTECHNICAL LABORATORY TESTING RESULTS PROVIDED BY AEP DOLAN LABORATORY.

SCALE IN FEET
0 100 200

SCALE IN FEET
0 10 20

REVISION RECORD		
NO	DATE	DESCRIPTION

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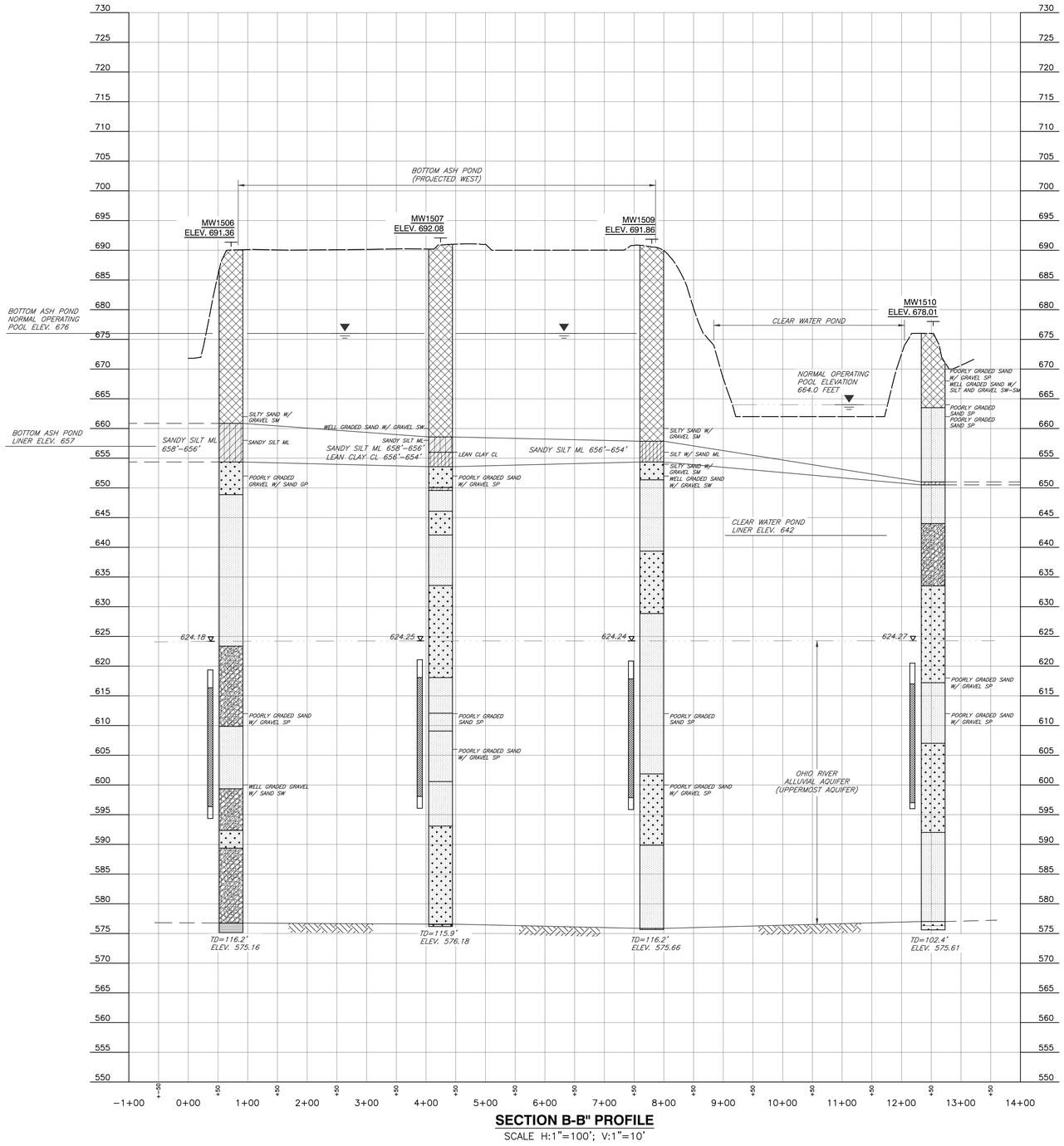
GROUNDWATER MONITORING SYSTEM DEMONSTRATION

GEOLOGIC CROSS SECTION A-A'

DATE:	DECEMBER 2015
DRAWN BY:	DAR
DWG SCALE:	AS NOTED
CHECKED BY:	RAS
PROJECT NO:	110-416-7701
APPROVED BY:	(HAND SIGNATURE ON FILE) *APA

FIGURE NO.: 5

P:\2011\110-416\-0400\DWG\BAP Evaluation Report Task 7701\110416-7701 Figure 5 Geologic Cross Section A-A.dwg[FIGURE 5] LS:[5/3/2016 - drudy] - LP: 6/8/2016 2:06 PM



SECTION B-B" PROFILE

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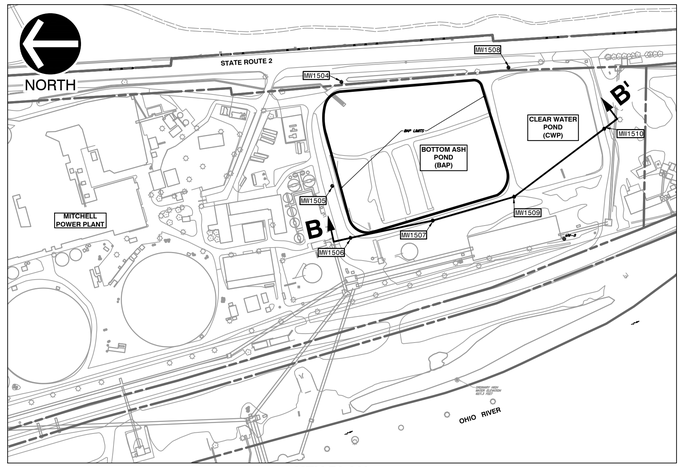

KEY PLAN

SCALE: 1"=300'

- FILL
- CLAY TO SILT
- SANDY CLAY OR SANDY SILT
- CLAYEY SAND
- FINE TO COARSE SAND
- SAND AND GRAVEL
- GRAVELLY SAND
- CLAYSTONE/SILTSTONE
- SANDSTONE
- LIMESTONE
- TOP OF BEDROCK (DASHED WHERE INFERRED)

MONITORING WELL DIAGRAM

NOTE:

1. NOTED SOIL DESCRIPTIONS FROM GEOTECHNICAL LABORATORY TESTING RESULTS PROVIDED BY AEP DOLAN LABORATORY.

SCALE IN FEET
0 100 200

SCALE IN FEET
0 10 20

REVISION RECORD

NO	DATE	DESCRIPTION

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513-985-0226 · 800-759-5614
www.cecinc.com

AMERICAN ELECTRIC POWER
MITCHELL BOTTOM ASH POND
MITCHELL POWER GENERATION PLANT
MARSHALL COUNTY, WEST VIRGINIA

GROUNDWATER MONITORING SYSTEM DEMONSTRATION

GEOLOGIC CROSS SECTION B-B'

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:		110-416-7701	
APPROVED BY:	(HAND SIGNATURE ON FILE)		*APA

FIGURE NO.: 6

P:\2011\110-416\-CADD\DWG\BAP Evaluation Report Task 7\2011110416-7701 Figure 6 Geologic Cross Section B-B.dwg[FIGURE 6] LS(6/8/2018 - drvdp) - LP: 6/8/2018 2:07 PM

STATE ROUTE 2

MITCHELL POWER PLANT

BOTTOM ASH POND (BAP)

CLEAR WATER POND (CWP)

BAP LIMITS

MW1504 624.20

MW1505 624.19

MW1506 624.18

MW1507 624.25

MW1508 624.32

MW1509 624.24

MW1510 624.27

MW-4 623.00

MW-5 623.05

MW-6 623.11

MW-7 623.33

MW-8 623.87

624

623

622

ORDINARY HIGH WATER ELEVATION 627.3 FEET

OHIO RIVER

LEGEND

MW1506 624.18 — BAP MONITORING WELL AND STATIC WATER ELEVATION DECEMBER 10, 2015

MW-7 623.33 — EPRI MONITORING WELL AND STATIC WATER ELEVATION DECEMBER 10, 2015

POTENTIOMETRIC CONTOUR LINES

POTENTIOMETRIC CONTOUR LINES (SUPPLY WELL PUMPING INFLUENCE)

GROUNDWATER FLOW DIRECTION

NORTH

SCALE IN FEET

0 150 300

REVISION RECORD

NO	DATE	DESCRIPTION

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MITCHELL POWER GENERATION PLANT
MARSHALL COUNTY, WEST VIRGINIA

GROUNDWATER MONITORING SYSTEM DEMONSTRATION

OHIO RIVER ALLUVIAL AQUIFER
POTENTIOMETRIC MAP, DECEMBER 10, 2015

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:			110-416-7701
APPROVED BY:	(HAND SIGNATURE ON FILE)		*APA

FIGURE NO.: 7

STATE ROUTE 2

MITCHELL POWER PLANT

BOTTOM ASH POND (BAP)

BAP LIMITS

CLEAR WATER POND (CWP)

MW1504 624.74

MW1505 624.71

MW1506 624.69

MW1507 624.78

MW1508 624.89

MW1509 624.97

MW1510 625.06

MW-4 623.80

MW-5 623.90

MW-6 623.98

MW-7 624.07

MW-8 624.57

624

625

623

622

ORDINARY HIGH WATER ELEVATION 627.3 FEET

OHIO RIVER

LEGEND

MW1506 624.69 — BAP MONITORING WELL AND STATIC WATER ELEVATION FEBRUARY 8, 2016

MW-7 624.07 — EPRI MONITORING WELL AND STATIC WATER ELEVATION FEBRUARY 8, 2016

POTENTIOMETRIC CONTOUR LINES

POTENTIOMETRIC CONTOUR LINES (SUPPLY WELL PUMPING INFLUENCE)

GROUNDWATER FLOW DIRECTION

NORTH

SCALE IN FEET

0 150 300

REVISION RECORD

NO	DATE	DESCRIPTION

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MARSHALL COUNTY, WEST VIRGINIA

GROUNDWATER MONITORING SYSTEM DEMONSTRATION

OHIO RIVER ALLUVIAL AQUIFER
POTENTIOMETRIC MAP, FEBRUARY 8, 2016

DATE:	FEBRUARY 2016	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:		110-416-7701	
APPROVED BY:		(HAND SIGNATURE ON FILE)	*APA

FIGURE NO.: 8

P:\2011\110-416\-CADD\DWG\BAP Evaluation Report Task 7701\110416-7701 Figure 8 Ohio River Alluvial Aquifer Potentiometric Map.dwg[FIGURE 8] LS:(5/13/2016 - dlaw) - LP: 6/8/2016 3:11 PM

TABLES

TABLE 1
MONITORING WELL CONSTRUCTION SUMMARY
MITCHELL BOTTOM ASH POND GROUNDWATER MONITORING SYSTEM DEMONSTRATION
MITCHELL POWER GENERATION PLANT
AMERICAN ELECTRIC POWER
CEC PROJECT 110-416.7701

Well No.	Date Installed	Northing	Easting	Ground Elevation (ft. MSL)	Boring Total Depth (ft. BGS)	Top of Riser Elevation (ft. MSL)	Screen Interval* (ft. MSL)		Screen Interval* (ft. BGS)		Screen Interval** (ft. BGS)		Sand Pack Interval* (ft. MSL)		Sand Pack Interval* (ft. BGS)		Stratigraphic Unit	Hydraulic Position Relative to BAP
							Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom		
Ohio River Alluvial Aquifer Monitoring Wells & Piezometers																		
MW1504	10/14/15	485671.78	1599370.81	691.90	102.00	694.79	618.40	598.40	73.5	93.5	76.4	96.4	620.90	598.1	71.0	93.8	Sand & Gravel	Sidegradient
MW1505	10/26/15	485699.10	1598929.25	691.05	114.80	693.94	617.05	597.05	74.0	94.0	76.9	96.9	620.05	596.1	71.0	95.0	Sand & Gravel	Downgradient
MW1506	10/23/15	485633.39	1598717.14	691.36	116.20	694.26	616.36	596.36	75.0	95.0	77.9	97.9	619.36	594.4	72.0	97.0	Sand & Gravel	Downgradient
MW1507	10/30/15	485288.61	1598790.27	692.08	115.90	694.98	618.08	598.08	74.0	94.0	76.9	96.9	621.08	596.1	71.0	96.0	Sand & Gravel	Downgradient
MW1508	10/08/15	484971.27	1599431.57	682.72	106.80	685.77	615.72	595.72	67.0	87.0	70.1	90.1	618.12	594.7	64.6	88.0	Sand & Gravel	Upgradient
MW1509 (P-2)	11/06/15	484947.44	1598889.64	691.86	116.40	694.63	617.86	597.86	74.0	94.0	76.8	96.8	620.86	595.9	71.0	96.0	Sand & Gravel	Downgradient
MW1510 (P-1)	11/12/15	484569.80	1599175.22	678.01	102.40	680.77	617.01	597.01	61.0	81.0	63.8	83.8	620.41	596.0	57.6	82.0	Sand & Gravel	Sidegradient

Notes:
* Measured from ground surface
** Measured from top of casing
ft. MSL = feet above mean sea level
ft. BGS = feet below ground surface
Monitoring Wells MW1504 through MW1508 have dedicated Geotech® bladder pumps installed approximately 2 feet above the screen bottoms

TABLE 2

STATIC WATER LEVELS

MITCHELL BOTTOM ASH POND GROUNDWATER MONITORING SYSTEM DEMONSTRATION

MITCHELL POWER GENERATION PLANT

AMERICAN ELECTRIC POWER

CEC PROJECT 110-416.7701

Well No.	Northing	Easting	Ground Elevation (ft. MSL)	Top of Casing Elevation (ft. MSL)	Screen Interval (ft. MSL)		Screen Interval (ft. BGS)		Depth to Water 12/10/15 (ft. TOC)	Groundwater Elevation 12/10/15 (ft. MSL)	Depth to Water 2/8/16 (ft. TOC)	Groundwater Elevation 2/8/16 (ft. MSL)
					Top	Bottom	Top	Bottom				
Bottom Ash Pond Monitoring Well/Piezometers Network												
MW1504	485671.78	1599370.81	691.90	694.79	618.40	598.40	73.5	93.5	70.59	624.20	70.05	624.74
MW1505	485699.10	1598929.25	691.05	693.94	617.05	597.05	74.0	94.0	69.75	624.19	69.23	624.71
MW1506	485633.39	1598717.14	691.36	694.26	616.36	596.36	75.0	95.0	70.08	624.18	69.57	624.69
MW1507	485288.61	1598790.27	692.08	694.98	618.08	598.08	74.0	94.0	70.73	624.25	70.20	624.78
MW1508	484971.27	1599431.57	682.72	685.77	615.72	595.72	67.0	87.0	61.45	624.32	60.88	624.89
MW1509	484947.44	1598889.64	691.86	694.63	617.86	597.86	74.0	94.0	70.39	624.24	69.66	624.97
MW1510	484569.80	1599175.22	678.01	680.77	617.01	597.01	61.0	81.0	56.50	624.27	55.71	625.06
EPRI Piezometers												
MW-4	488310.90	1598152.80	NA	668.02	NA	NA	NA	NA	45.02	623.00	44.22	623.80
MW-5	488304.80	1598152.10	NA	667.88	NA	NA	NA	NA	44.83	623.05	43.98	623.90
MW-6	488930.20	1598267.50	NA	663.40	NA	NA	NA	NA	40.29	623.11	39.42	623.98
MW-7	487595.80	1597656.50	NA	640.26	NA	NA	NA	NA	16.93	623.33	16.19	624.07
MW-8	484737.60	1598712.90	NA	663.34	NA	NA	NA	NA	39.47	623.87	38.77	624.57

Notes:

Static water levels were collected December 10, 2015 and February 8, 2016

ft. MSL = feet above mean sea level

ft. BGS = feet below ground surface

ft. TOC = feet below top of casing (top of PVC riser pipe)

APPENDIX A

EPRI DRAWINGS

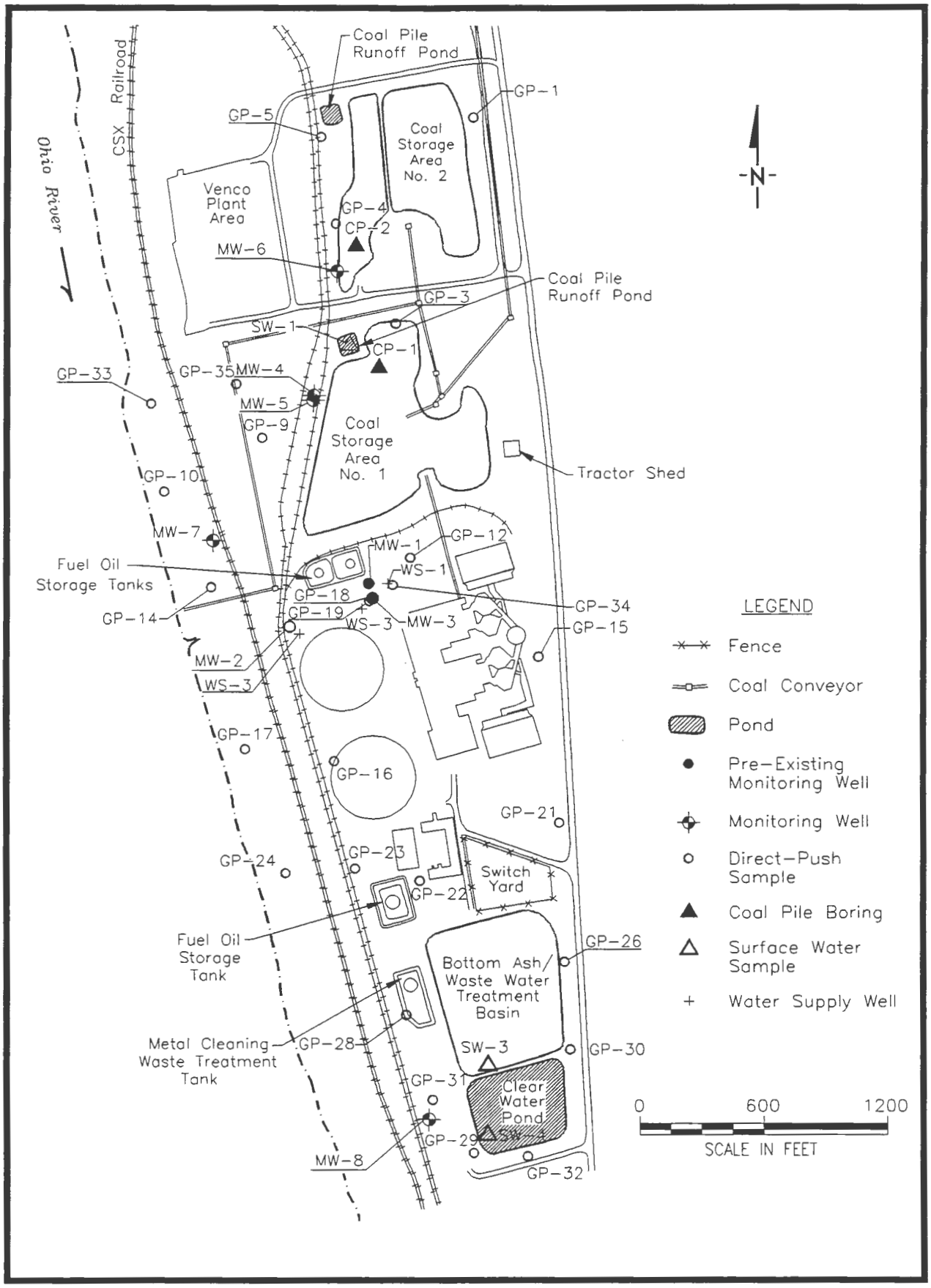

Figure 3-1 Mitchell Plant site.

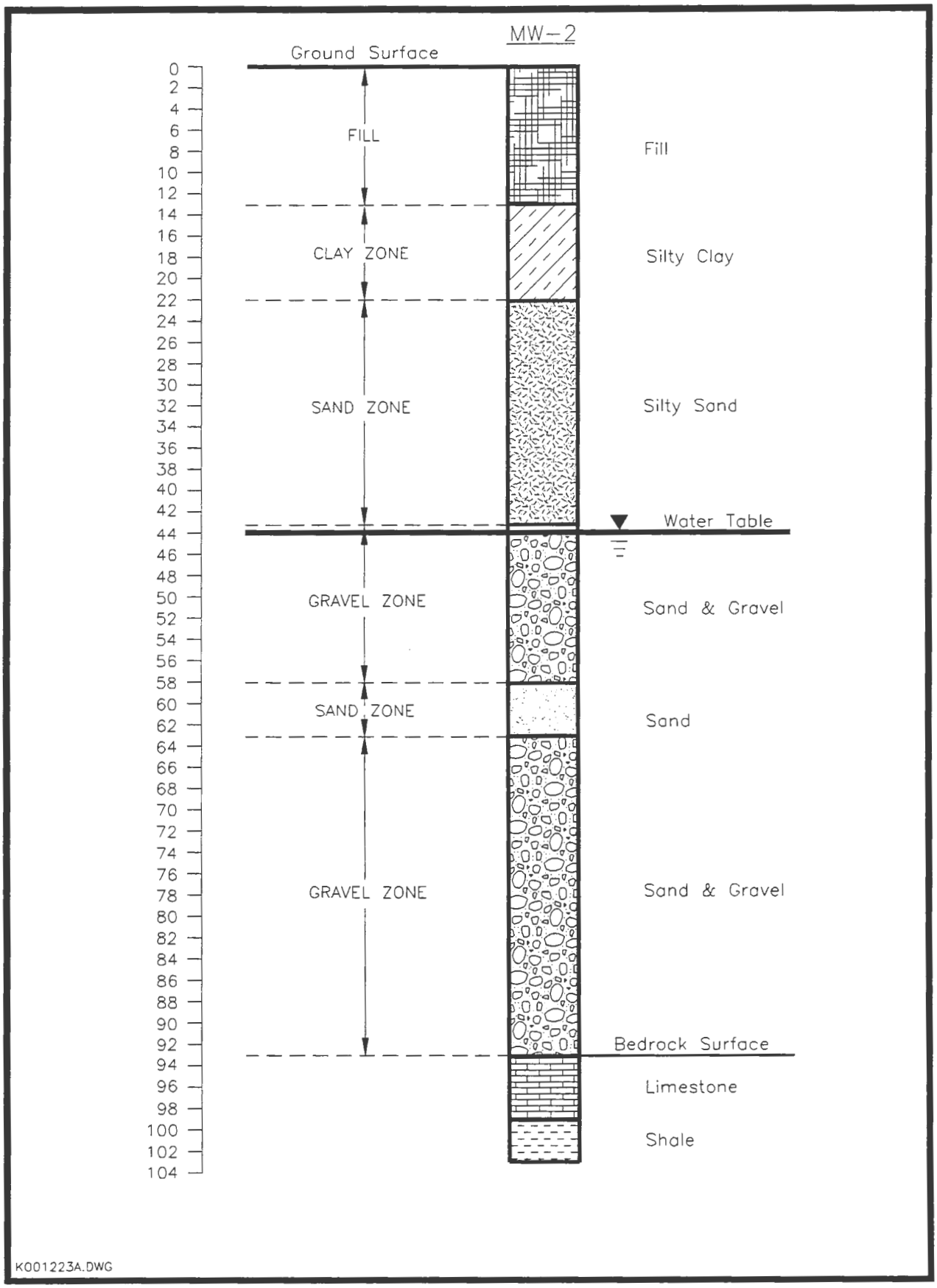

Figure 3-2 Lithologic log for monitoring well MW-2 at the Mitchell Plant site.

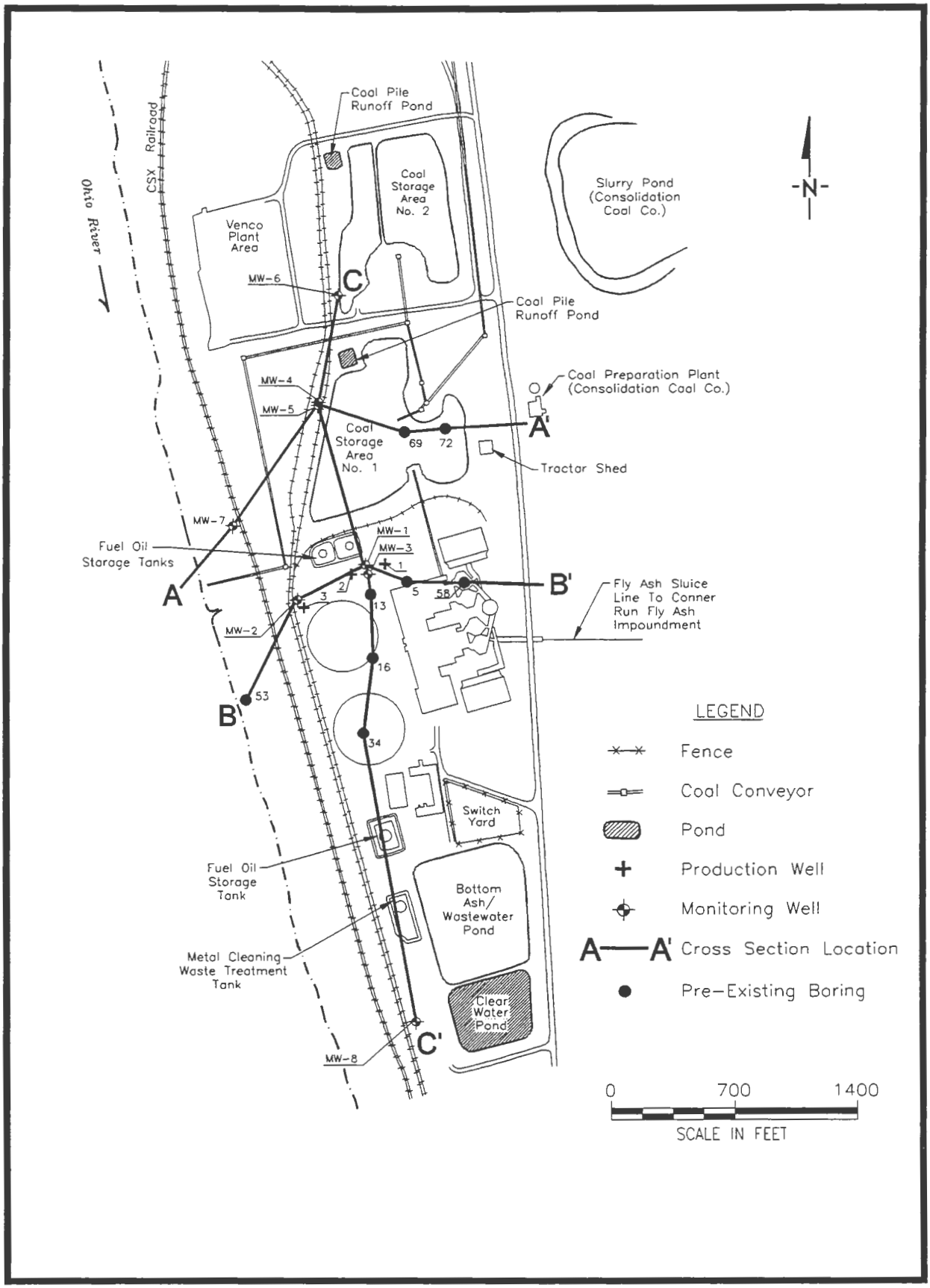

Figure 3-3 Locations of geologic cross-sections at the Mitchell Plant site.

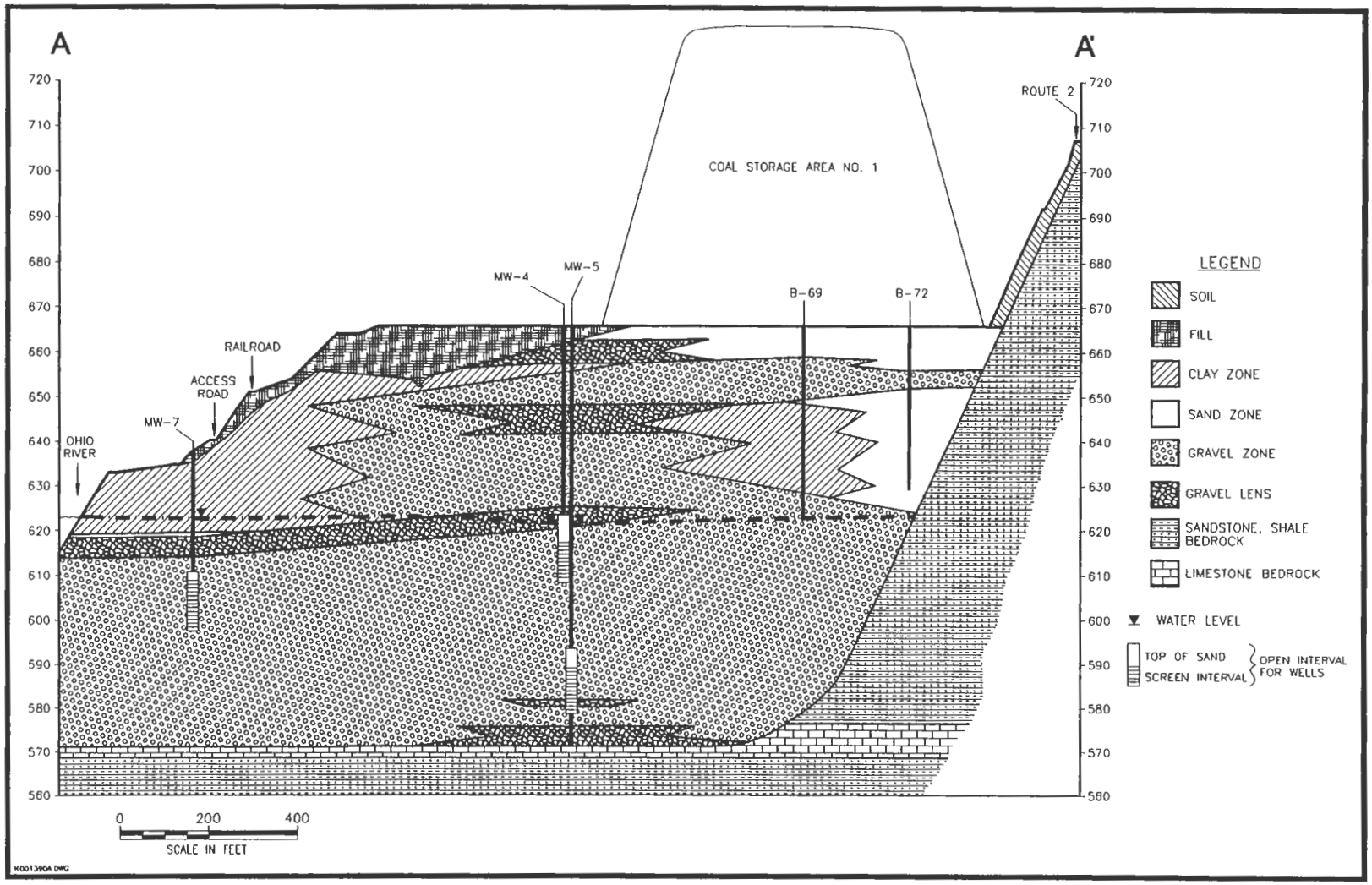

Figure 3-4 Geologic cross-section A-A' at the Mitchell Plant site.

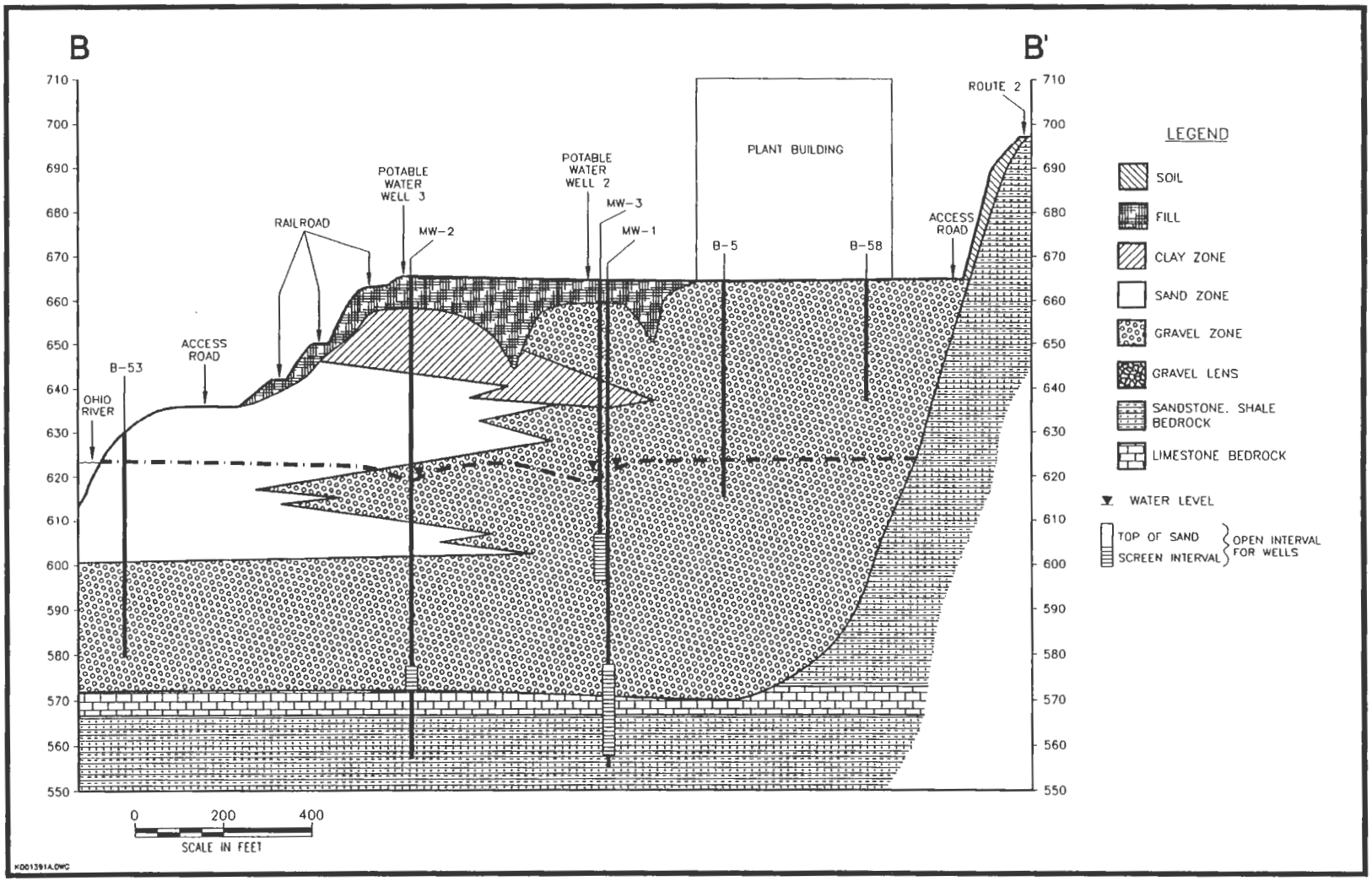

Figure 3-5 Geologic cross-section B-B' at the Mitchell Plant site.

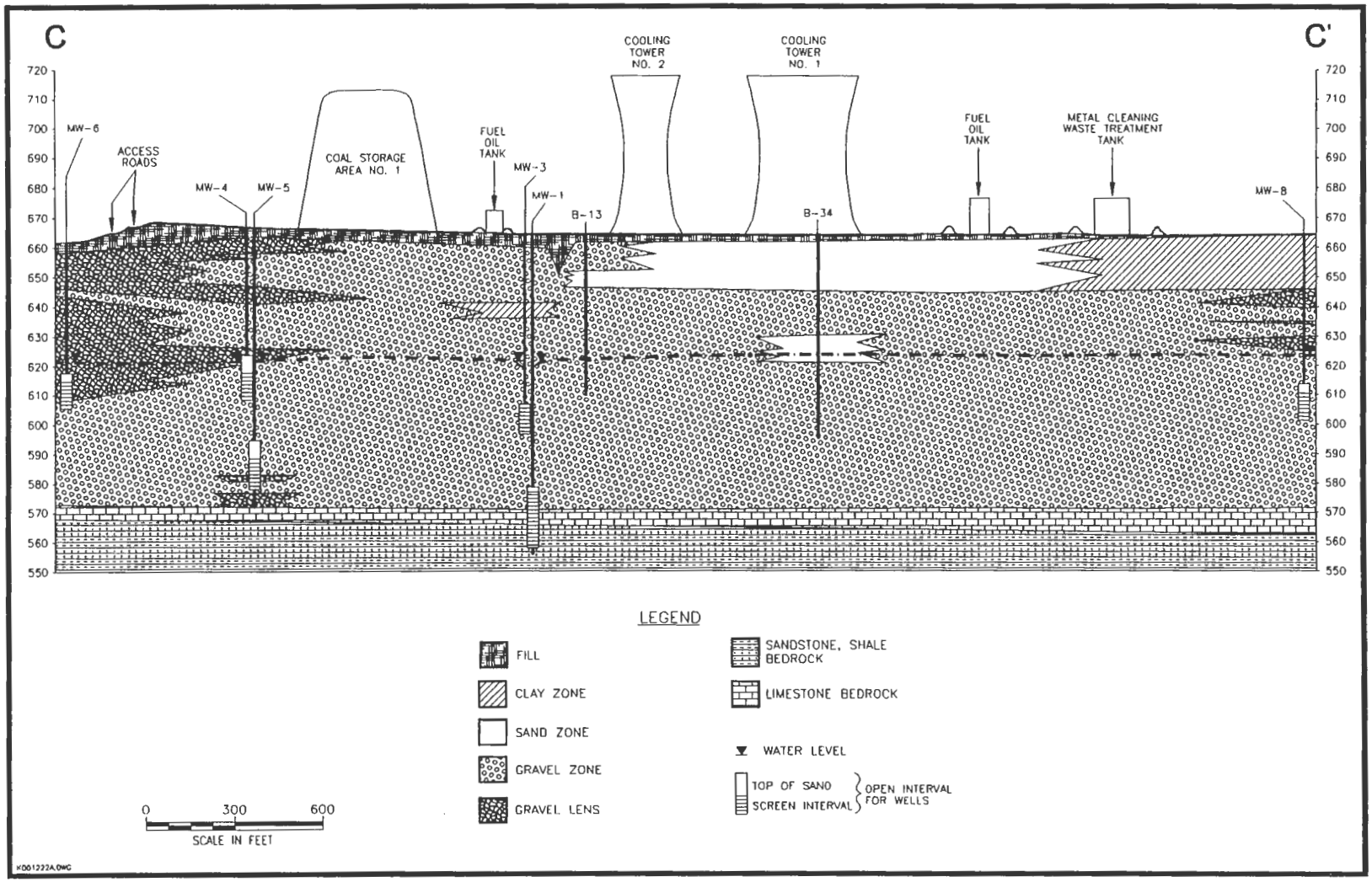

Figure 3-6 Geologic cross-section C-C' at the Mitchell Plant site.

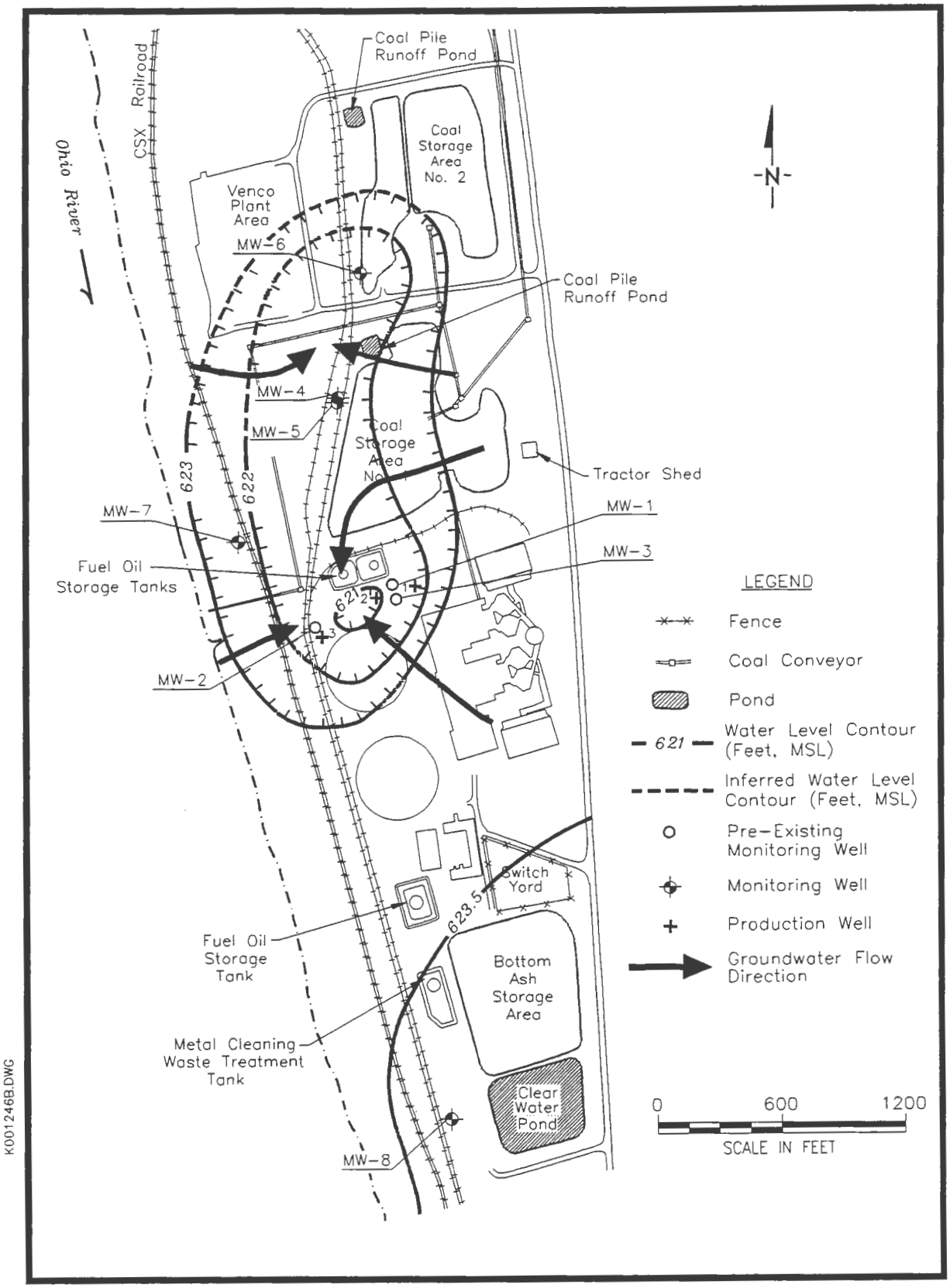

Figure 3-7 Water table contour map for the Mitchell Plant site (August 20, 1996).

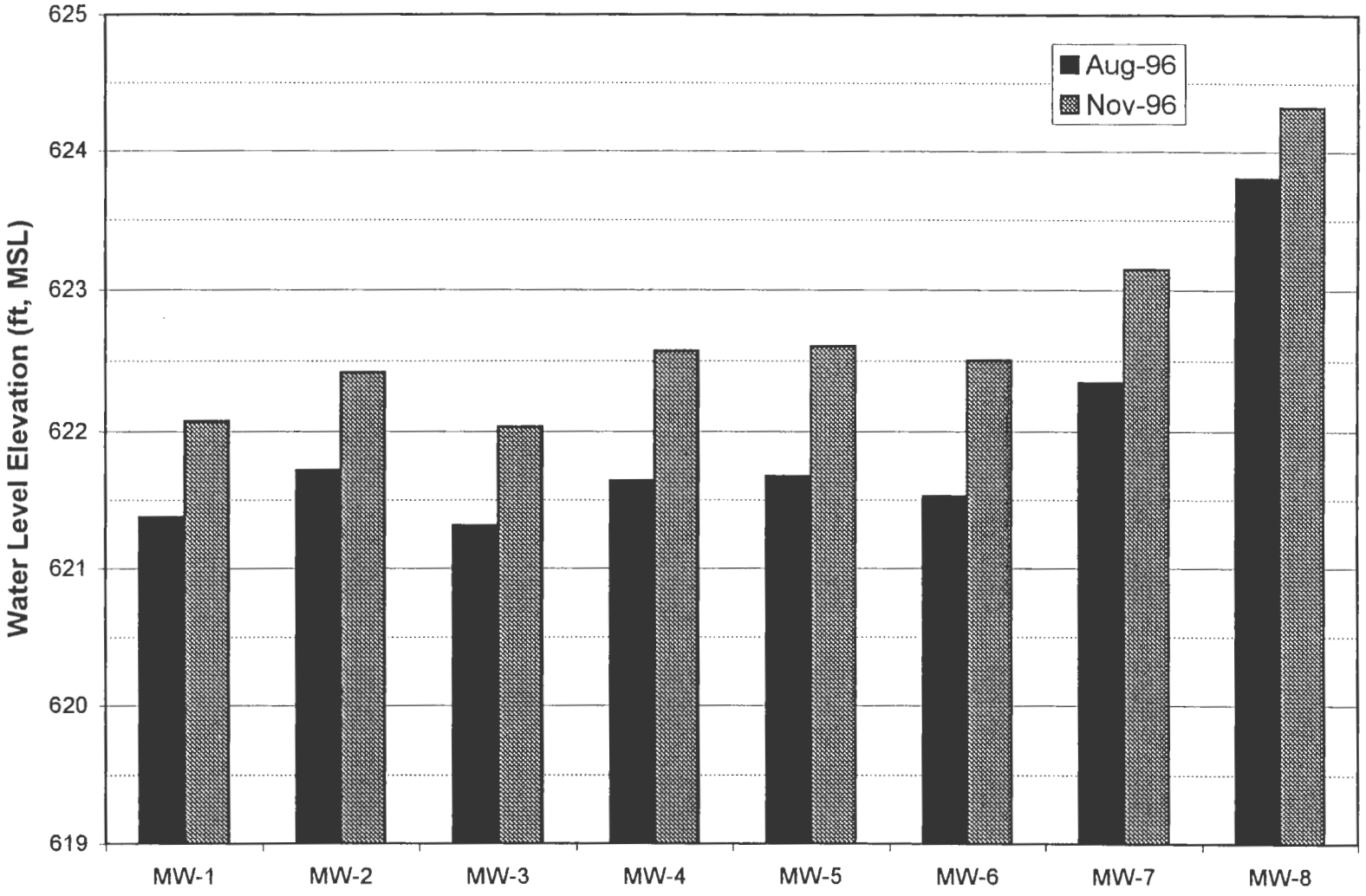

Figure 3-8 Temporal variations in groundwater elevations in monitoring wells at the Mitchell Plant site.

APPENDIX B

MONITORING WELL AND PIEZOMETER BORING LOGS AND AS-BUILT DIAGRAMS

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1504

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 10/9/15 **COMPLETED** 10/14/15
GROUND ELEVATION 691.90 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 694.79 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY B. Bashore **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 485671.78 Easting: 1599370.81

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	75	16-20-25-27 (45)		Dark Gray to Brown SILTY GRAVEL (FILL), dry, dense, some clay and fine sand.	Total Depth of BAP-1 offset boring 93.8'
	SS 2	100	3-8-9-12 (17)		Below 2', loose.	
					3.4 — 688.5	
					Gray to Brown SILTY CLAY (CL - ML), dry, stiff, low plasticity, some roots.	
					4.4 — 687.5	
5	SS 3	83	4-15-20-28 (35)		Dark Gray to Brown SILTY SAND (SM), dry, dense, medium grained, trace fine gravel, trace clay, trace coal fragments.	Bentonite Grout
					6.4 — 685.5	
	SS 4	96	3-5-5-7 (10)		Brown SANDY CLAY (CLS), moist, medium stiff, low to medium plasticity, some fine gravel.	
					7.4 — 684.5	
					Gray SILTY CLAY (CL - ML), moist, medium stiff, high plasticity, some fine sand and gravel.	
					8.0 — 683.9	
	SS 5	83	3-6-14-22 (20)		Orange - Brown SILTY SAND (SM), moist, loose to medium dense, fine to medium grained, some fine gravel, trace clay.	
10					10.0 — 681.9	
	SS 6	79	7-11-9-18 (20)		Brown CLAYEY SAND w/ GRAVEL (SC), moist, loose to medium dense, medium to coarse grained sand, fine to coarse gravel.	
	SS 7	96	5-14-16-13 (30)		13.4 — 678.5	
					Gray SILTY SAND & GRAVEL (SM, GM), moist to wet, medium dense, medium grained sand, fine gravel, trace clay.	
					14.0 — 677.9	
15	SS 8	75	4-6-10-18 (16)		Gray SILTY CLAY (CL - ML), dry to moist, medium stiff to stiff, low plasticity, trace fine gravel.	
					15.5 — 676.4	
					Orange - Brown SANDY CLAY (CLS), dry to moist, very stiff, low plasticity.	
					16.0 — 675.9	
	SS 9	100	3-7-11-18 (18)		Gray SILTY CLAY (CL - ML), dry to moist, soft to medium stiff, low to medium plasticity, trace fine gravel.	2-Inch Solid PVC Riser
					16.7 — 675.2	
					Orange - Brown CLAYEY SAND & GRAVEL (SC, GC), moist, medium dense, medium to coarse grained sand, fine gravel.	
					Below 18', loose to medium dense, clay content decreasing.	
20	SS 10	67	3-7-9-12 (16)			

(Continued Next Page)

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WELL NUMBER MW1504

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
20	SS 11	75	5-6-6-7 (12)		Orange - Brown CLAYEY SAND & GRAVEL (SC, GC), moist, medium dense, medium to coarse grained sand, fine gravel. *(continued)* Below 20', loose.	
	SS 12	54	5-8-9-7 (17)			
25	SS 13	71	2-5-4-6 (9)			
	SS 14	58	0-2-3-7 (5)		25.5' to 26', moist to wet.	
	SS 15	83	4-4-4-11 (8)		26.0 — 665.9 Orange - Brown SANDY GRAVEL (GWS), wet, very loose to loose, fine to coarse, fine to medium grained sand, some clay.	
30	SS 16	92	7-8-8-7 (16)		28.8 — 663.1 Orange - Brown GRAVELLY SAND (SWG), wet, loose, coarse to medium grained, fine to coarse gravel, trace clay	2-Inch Solid PVC Riser
	SS 17	79	3-4-7-11 (11)		30.7 — 661.2 Orange - Brown SAND (SP), moist, loose, fine to medium grained, trace fine gravel.	
35	SS 18	75	4-6-6-8 (12)		Below 34', moist to wet.	
	SS 19	100	2-2-3-11 (5)		36.0 — 655.9 Orange - Brown CLAYEY SAND (SC), wet, very loose, fine grained.	
	SS 20	71	0-4-4-10 (8)		36.6 — 655.3 Orange - Brown SANDY CLAY (CLS), moist, soft, low plasticity, fine grained sand.	
40	SS 21	63	0-4-8-17 (12)		37.2 — 654.7 Orange - Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel.	Bentonite Grout
					At 39.1', coal stringer <0.05" thick.	
					Below 40', no gravel.	

P-12S TEMPLATE 110-416 BOTTOM ASH POND (REV 12-1-15).GPJ GOOD TEMPLATE.GDT 12/1/15

(Continued Next Page)

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WELL NUMBER MW1504

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	88	3-8-7-12 (15)		Orange - Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel. *(continued)*	
					44.0 647.9	
45	SS 23	75	2-4-6-11 (10)		Brown SAND (SP), moist, very loose to loose, fine to medium grained, some coal fragments at 45.5'.	
					46.5 645.4	
	SS 24	75	0-2-5-10 (7)		46.9 Brown SANDY CLAY (CLS), moist, soft, low plasticity, fine grained sand. 645.0	
					Brown SAND (SP), moist, loose, fine to medium grained.	
					47.4' to 47.5', coal seam.	
	SS 25	83	3-5-4-5 (9)		48.5' to 49.3', laminated coal , wet.	
					49.3 642.6	
50					Orange - Brown CLAYEY SAND (SC), moist, loose, fine grained.	
	SS 26	71	2-1-3-9 (4)		Below 50', very loose.	
					51.2 640.7	
					Brown SAND (SP), moist, loose to very loose, fine grained.	
					52.0 639.9	
	SS 27	75	0-3-1-5 (4)		Brown CLAYEY SAND (SC), moist to wet, very loose to loose, fine grained.	
					54.8 637.1	
55	SS 28	83	0-2-4-8 (6)		Brown to Orange - Brown SAND (SP), moist to wet, loose, fine grained.	2-Inch Solid PVC Riser
					56.0 635.9	
	SS 29	75	0-2-4-7 (6)		Orange - Brown SAND (SP), moist to wet, very loose to loose, fine grained, trace to some clay.	
					Below 58', some to trace clay.	
	SS 30	71	1-2-3-8 (5)			
60					60.0 631.9	Bentonite Grout
	SS 31	92	5-6-7-10 (13)		Orange - Brown SAND (SP), moist, loose, fine grained.	
					62.0 629.9	
	SS 32	71	5-5-7-12 (12)		Orange - Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel.	
65	SS 33	75	5-6-9-17 (15)			

(Continued Next Page)

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WELL NUMBER MW1504

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 34	67	5-7-9-13 (16)		Orange - Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel. *(continued)* Below 66', moist to wet.	Bentonite Pellets
					68.0 623.9	
	SS 35	67	5-5-7-13 (12)		Brown GRAVELLY SAND (SWG), wet, loose, medium to fine grained, fine gravel.	
					68.8 623.1 Brown SAND (SP), wet, loose to medium dense, medium to fine grained, trace fine gravel.	
70					70.0 621.9	
	SS 36	100	11-10-12-15 (22)		Brown GRAVELLY SAND (SWG), wet, medium dense, fine to coarse grained, fine to coarse gravel, some silt.	
					72.4 619.5	
	SS 37	75	9-11-14-19 (25)		Brown SANDY GRAVEL (GWS), wet, medium dense, fine to coarse, medium to coarse grained sand, trace silt	
75	SS 38	54	10-10-13-14 (23)		Below 74', sand medium to coarse grained.	#5 Filter Sand
					76.0 615.9	
	SS 39	50	8-9-11-16 (20)		Brown SAND (SP), wet, loose to medium dense, medium to coarse grained, trace fine gravel.	
					78.0 613.9	
	SS 40	58	6-7-8-10 (15)		Brown SANDY GRAVEL (GPS), wet, loose, fine, medium to coarse sand, trace silt.	
80	SS 41	58	7-6-7-11 (13)		Below 80', coarse to fine gravel.	2-Inch, 0.010-Inch Slotted Screen
					Below 82', loose.	
	SS 42	63	8-8-10-13 (18)		82.8 609.1 Brown SAND (SP), wet, medium dense, medium to coarse grained, some fine gravel, trace silt.	
					Below 84', loose to medium dense, fine to medium grained.	
85	SS 43	67	7-9-11-12 (20)		86.0 605.9	
	SS 44	67	10-8-7-9 (15)		Brown GRAVELLY SAND (SPG), wet, loose, medium to coarse grained, fine to coarse gravel, trace coal fragments.	
					Below 88', loose to medium dense.	

(Continued Next Page)

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250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1504

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
90	SS 45	96	9-8-10-15 (18)		Highly weather coal seam 89.4' to 89.5'. Brown GRAVELLY SAND (SPG), wet, loose, medium to coarse grained, fine to coarse gravel, trace coal fragments. *(continued)*		#5 Filter Sand
					90.0	601.9	
					90.3 Black COAL, wet, soft, highly weathered, some fine sand.	601.6	
	SS 46	63	10-11-11-14 (22)		Brown GRAVELLY SAND (SPG), wet, loose, medium to coarse grained, fine to coarse gravel, trace coal fragments.		
					92.0	599.9	
	SS 47	114	23-50/1"		Brown SANDY GRAVEL (GWS), wet, medium dense, coarse to fine, medium to coarse grained sand. Sandstone boulder at bottom of spoon (93.7')		2-Inch, 0.010-Inch Slotted Screen
					94.6	597.3	
95	SS 48	88	21-18-23-42 (41)		Gray SAND (SP), moist to wet, medium dense to dense, fine to medium grained, trace fine to coarse gravel.		
					95.7	596.2	
	SS 49	54	12-33-13-32 (46)		Gray SANDSTONE (BEDROCK), moderate hard to weak, moderately cemented, fine to medium grained, moderately to highly weathered, micaceous.		
	SS 50	25	12-12-16-44 (28)				
100					100.0	591.9	
	SS 51	50	23-16-33-36 (49)		100.9 Gray SHALE (BEDROCK), very weak, trace interbedded fine sand, soft and moderately plastic when wet (clayey).	591.0	
					102.0 Gray SANDSTONE (BEDROCK), moderate hard to weak, moderately cemented, fine to medium grained, moderately to highly weathered, micaceous.	589.9	

Bottom of hole at 102.0 feet

Boring grouted to surface and monitoring well installed on 10/14/2015 in offset boring.

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1505

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 10/15/15 **COMPLETED** 10/26/15
GROUND ELEVATION 691.05 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 693.94 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY B. Bashore **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 485699.10 Easting: 1598929.25

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	88	21-24-29-41 (53)		Brown to Dark Gray SILTY SAND & GRAVEL (FILL), dry, medium dense to dense, fine to medium grained sand, fine to coarse gravel, some clay.	Total Depth of BAP-2 offset boring 95'
	SS 2	100	2-10-14-15 (24)		Below 2', loose to medium dense.	
5	SS 3	88	1-5-6-5 (11)		Below 4', very loose to loose, trace clay.	Bentonite Grout
	SS 4	75	2-1-5-22 (6)		Below 6', very loose to medium dense, wet. 6.7' to 7.1', trace coal and limestone fragments.	
10	SS 5	83	4-20-32-31 (52)		Below 8', loose to dense. 10.0 681.1	
	SS 6	100	2-9-25-45 (34)		Brown to Dark Gray SILTY SAND & GRAVEL (FILL), dry, loose to dense, some clay, trace limestone and coal fragments.	
	SS 7	83	3-9-17-36 (26)		Below 12', no coal fragments.	
15	SS 8	100	5-15-22-29 (37)		Below 14', dry to moist, loose to medium dense.	
	SS 9	100	4-15-11-16 (26)		Below 16', moist, loose to medium dense, some shale fragments.	2-Inch Solid PVC Riser
20	SS 10	100	6-13-9-15 (22)		Wet at 19.6'. 19.6 671.5	

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Worthington, OH 43085

WELL NUMBER MW1505

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
20	SS 11	100	6-7-10-20 (17)		Dark Gray to Brown CLAYEY SAND (FILL), moist, medium dense, fine to medium grained, some shale fragments, trace coal. *(continued)* Below 20', loose to medium dense.	
					22.0 669.1	
	SS 12	50	3-12-13-14 (25)		Orange - Brown to Dark Gray CLAYEY SAND (FILL), moist to dry, loose to medium dense, medium to fine grained, some silt, some sandstone boulder fragments, trace shale fragments.	
25	SS 13	42	3-5-6-7 (11)		Below 24', loose.	
	SS 14	33	0-4-5-7 (9)		Below 26', very loose to loose.	
30	SS 15	4	3-5-4-5 (9)		30.0 661.1	Bentonite Grout
	SS 16	54	0-2-3-5 (5)		Orange - Brown SAND (SP), moist to wet, very loose to loose, medium to coarse grained, trace fine gravel. Wet at 30'.	
	SS 17	63	0-2-2-4 (4)		Below 32', moist, very loose, no gravel. 33.0 658.1 Orange - Brown SAND (SP), moist, very loose, medium to fine grained.	
35	SS 18	58	0-2-4-8 (6)		Below 34', very loose to loose, trace fine gravel. 36.0 655.1	
	SS 19	75	0-2-2-4 (4)		Orange - Brown SAND (SP), moist, very loose, fine to medium grained.	
	SS 20	75	0-2-3-6 (5)		Below 38', orange - brown to brown, very loose to loose.	
40	SS 21	75	0-0-5-8 (5)		Below 40', moist to dry. 42.0 649.1	Bentonite Grout
					Brown SAND (SP), moist to dry, very loose to loose, fine to medium grained.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1505

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	79	0-4-4-5 (8)		Brown SAND (SP), moist to dry, very loose to loose, fine to medium grained. *(continued)*	
45	SS 23	96	4-4-5-9 (9)		Below 44', moist. Coal stringer at 45.5', 0.25" thick.	
	SS 24	71	2-5-5-8 (10)		Below 46', moist to wet.	
					47.1 644.0 Brown GRAVELLY SAND (SWG), moist, loose, fine to coarse grained, fine to coarse gravel.	
	SS 25	71	0-3-5-5 (8)		Below 48', very loose. 48.7 642.4 Orange - Brown CLAYEY SAND (SC), moist, loose, fine grained.	
50					Below 50', very loose. 50.5 640.6	
	SS 26	71	0-4-5-8 (9)		Brown SAND (SP), moist to wet, loose, fine to medium grained. 52.0 639.1	
	SS 27	75	0-2-5-7 (7)		Brown CLAYEY SAND (SC), moist, very loose to loose, fine grained. 54.0 637.1	
55	SS 28	83	0-3-7-9 (10)		Brown SAND (SP), moist, very loose to loose, fine grained. 56.0 635.1	2-Inch Solid PVC Riser
	SS 29	79	0-2-5-8 (7)		Brown SAND (SP), moist to wet, very loose, fine grained. 57.2 633.9 Orange - Brown SAND (SP), moist, loose, fine to medium grained.	
	SS 30	71	2-4-7-9 (11)		Below 58', very loose. 58.9 632.2 Orange - Brown CLAYEY SAND (SC), moist, loose, fine grained.	
60					60.0 631.1	Bentonite Grout
	SS 31	75	2-3-3-4 (6)		Orange - Brown SAND (SP), moist to wet, very loose, fine grained, trace to some clay.	
	SS 32	29	0-6-16-14 (22)		Below 62', wet to moist, loose to medium dense. 64.0 627.1	
65	SS 33	79	0-4-10-15 (14)		Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel.	

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WELL NUMBER MW1505

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 34	67	2-5-7-11 (12)	Brown SAND (SP), moist, loose to medium dense, fine to medium grained, trace fine gravel. *(continued)* Below 66', loose.	
				67.1 / 624.0	Bentonite Pellets
				Brown GRAVELLY SAND (SPG), wet, loose to medium dense, medium to coarse grained, fine gravel.	
				68.0 / 623.1	
	SS 35	46	2-3-6-11 (9)	Brown SANDY GRAVEL (GWS), wet, very loose to medium dense, medium to coarse, fine to coarse grained sand, some silt.	
70	SS 36	71	5-6-8-13 (14)		
				72.2 / 618.9	
	SS 37	67	7-7-10-18 (17)	Below 72', loose. Brown SAND (SP), wet, loose to medium dense, medium to coarse grained, trace fine gravel.	#5 Filter Sand
75	SS 38	75	11-17-19-26 (36)	Below 74', medium dense, less coarse sand.	
				76.0 / 615.1	
	SS 39	100	9-17-20-28 (37)	Brown SAND (SP), wet, loose to medium dense, medium to coarse grained, some fine to coarse gravel.	
				79.0 / 612.1	
80	SS 40	46	10-17-18-21 (35)	Brown SAND (SP), wet, medium dense, fine to medium grained, some fine to coarse gravel.	
	SS 41	71	13-16-16-24 (32)	Below 80', gravel content increasing.	2-Inch, 0.010-Inch Slotted Screen
				82.0 / 609.1	
	SS 42	75	13-12-11-17 (23)	Brown SAND (SP), wet, medium dense, medium to coarse grained, trace silt, trace fine gravel.	
85	SS 43	71	6-10-13-21 (23)	Below 84', loose to medium dense, some fine to coarse gravel.	
	SS 44	75	11-19-17-20 (36)	Below 86', medium dense, some silt. Note: Sandstone boulder lodged at bottom of SS-44 spoon.	
				88.0 / 603.1	

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WELL NUMBER MW1505

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
90	SS 45	100	9-14-12-19 (26)		Brown SANDY GRAVEL (GWS), wet, loose to medium dense, fine to coarse, medium to coarse grained sand, some silt, trace coal fragments. *(continued)*	#5 Filter Sand
					Below 90', dense.	
	SS 46	83	35-39-38-45 (77)		90.8 600.3 Brown SILTY GRAVEL w/ SAND (GM), wet, dense, fine to coarse, medium to coarse grained sand.	
					92.0 599.1 Brown CLAYEY SAND (SC), moist to wet, loose to medium dense, fine to medium grained, some fine to coarse gravel, silty	
	SS 47	75	6-22-30-46 (52)		92.7 598.4 Brown GRAVELLY SAND (SWG), wet, dense, fine to medium grained, some fine gravel.	
95	SS 48	88	18-25-21-25 (46)		Below 94', medium dense, medium to coarse grained.	
					96.0 595.1	
	SS 49	83	25-25-18-20 (43)		Brown SANDY GRAVEL (GPS), wet, medium dense, coarse to fine, fine to coarse grained sand, some silt.	
	SS 50	71	25-18-20-28 (38)		Below 98', sand content increasing. Note: Sandstone boulder at 98.5'	
100					100.0 591.1	
	SS 51	75	26-24-26-36 (50)		Brown GRAVELLY SAND (SWG), wet, medium dense to dense, medium to coarse grained, fine to coarse gravel, trace silt.	
					102.4 588.7	
	SS 52	71	23-17-15-24 (32)		Brown SAND (SP), wet, medium dense, medium to coarse grained, some to trace fine gravel.	
					104.0 587.1	
105	SS 53	58	23-22-19-17 (41)		Brown GRAVELLY SAND (SWG), wet, medium dense, medium to coarse grained, fine to coarse gravel, some silt.	
					106.3 584.8	
	SS 54	92	13-19-21-35 (40)		Brown SAND (SP), wet, medium dense to dense, medium to coarse grained, some fine gravel, some silt.	
	SS 55	67	17-19-20-36 (39)		Below 108', trace coal fragments.	
110						
	SS 56	71	12-16-16-27		Below 110', medium dense.	

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WELL NUMBER MW1505

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
			(32)		112.0 579.1	
	SS 57	54	18-19-21-22 (40)		Brown GRAVELLY SAND (SWG), wet, medium dense, medium to coarse grained, fine to coarse gravel. Note: Limestone fragments at bottom of SS-57 spoon.	
	SS 58	111	11-50/3"		114.5 576.6 114.8 576.3 Brown LIMESTONE (BEDROCK), moderate hard, moderately weathered, high reaction to HCL. Note: Hard to very hard at 114.8'. Bottom of hole at 114.8 feet	

Boring grouted to surface and monitoring well installed on 10/26/2015 in offset boring.

Civil & Environmental Consultants, Inc.
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WELL NUMBER MW1506

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 10/20/15 **COMPLETED** 10/23/15
GROUND ELEVATION 691.36 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 694.26 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 485633.39 Easting: 1598717.14

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	100	7-8-12-23 (20)		Dark Brown SAND (FILL), dry, loose to medium dense, fine to medium grained, few gravel, trace silt, trace iron stained.	Total Depth of BAP-3 offset boring 96'
					2.5 688.9	
	SS 2	92	5-29-23-37 (52)		Light Brown to Brown SAND & GRAVEL (FILL), dry, loose to dense, fine to medium grained sand, subrounded to subangular, subrounded to well rounded gravel.	
5	SS 3	88	6-13-18-34 (31)		Below 4', dark brown to brown.	
					5.0 686.4	
					5.4 Brown SILT (FILL), dry, firm, few subrounded gravel. 686.0	Bentonite Grout
	SS 4	83	1-12-30-30 (42)		Dark Brown to Brown SAND & GRAVEL (FILL), dry, loose to dense, fine to medium grained sand, subrounded to subangular, subrounded to well rounded gravel.	
					6'-6.5', silty.	
					8.5 682.9	
10	SS 5	96	6-18-21-32 (39)		Brown SANDY SILT (FILL), dry to moist, loose to medium dense, trace subrounded gravel, trace coal, moist around gravel clasts.	
					11.0 680.4	
	SS 6	96	6-14-23-33 (37)		11.5 Dark Brown CLAYEY GRAVEL (FILL), dry, medium dense, subrounded, some subrounded coarse sand, some coal. 679.9	
	SS 7	96	4-19-28-34 (47)		Dark Brown to Brown SAND & GRAVEL (FILL), dry, loose to dense, fine to medium grained sand, subrounded to subangular, subrounded to well rounded gravel.	
					Below 13', moist.	
15	SS 8	96	4-15-19-33 (34)		Below 14', no coal fragments.	
					Below 16', some coal ash.	
	SS 9	100	4-20-24-35 (44)			2-Inch Solid PVC Riser
	SS 10	96	9-16-14-17 (30)		19.6 671.8	
20						

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Civil & Environmental Consultants, Inc.
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WELL NUMBER MW1506

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	MATERIAL DESCRIPTION		WELL DIAGRAM
20	SS 11	88	7-20-21-16 (41)	Dark Brown to Dark Gray SILT (FILL), dry, medium dense, trace subrounded gravel. *(continued)*		
				22.0 Below 21.8', dry to moist, few coarse sand, some subrounded gravel.	669.4	
	SS 12	71	3-12-20-21 (32)	22.5 Dark Brown to Brown SAND & GRAVEL (FILL), wet, loose to dense, fine to medium grained sand, subrounded to subangular, subrounded to well rounded gravel.	668.9	
				23.0 Dark Brown to Dark Gray SILT (FILL), moist, medium dense, coarse sand, some gravel.	668.4	
25	SS 13	88	4-12-20-21 (32)	Dark Brown to Brown SAND & GRAVEL (FILL), wet, medium dense, fine to coarse grained sand, subrounded to subangular, poorly sorted, subrounded gravel.		
				25.0 Below 24', moist to wet.	666.4	
				26.0 Gray SANDY CLAY (FILL), moist to dry, medium dense, subrounded coarse sand, some subrounded gravel, trace coal fragments.	665.4	
	SS 14	37	9-10-24-50/1"	27.0 Dark Brown to Brown SAND & GRAVEL (FILL), wet, medium dense, fine to coarse grained sand, subrounded to subangular, poorly sorted, subrounded gravel.	664.4	
				28.0 Gray SANDY CLAY (FILL), moist to dry, medium dense, subrounded coarse sand, some subrounded gravel, trace coal fragments.	663.4	
	SS 15	71	5-26-36-31 (62)	28.5 Dark Brown to Brown SAND & GRAVEL (FILL), wet to moist, medium dense, fine to coarse grained sand, subrounded to subangular, poorly	662.9	
				29.0 sorted, subrounded gravel.	662.4	
30				Black SAND (FILL), moist, medium dense, fine to medium grained, some coal.		◄Bentonite Grout
	SS 16	88	4-8-12-22 (20)	30.5 Orange - Brown GRAVELLY SAND (FILL), moist, dense, fine to coarse grained, subrounded, subrounded gravel, trace coal.	660.9	
				Below 30', moist to wet.		
				Brown SILTY CLAY (CL - ML), dry to moist, medium dense, few fine to coarse subrounded sand, few subrounded gravel.		
				32.5	658.9	
	SS 17	67	7-10-11-18 (21)	33.0 Brown CLAYEY SILT (MH), dry, soft to firm, non cohesive, few gray silty laminations.	658.4	
				34.0 Gray SILT (ML), dry to moist, firm, non cohesive, trace subrounded gravel, trace coarse sand.	657.4	
35	SS 18	58	4-10-12-21 (22)	34.5 Dark Brown to Brown SANDY CLAY (CLS), moist, soft to firm, fine to coarse grained sand.	656.9	
				Brown SILTY CLAY (CL - ML), dry to moist, soft to firm, low platicity, few subrounded gravel.		
				36.0	655.4	
	SS 19	83	5-6-8-7 (14)	Gray CLAY (CL), dry, soft to firm, medium plasticity, trace organics, trace silt, cohesive.		
				37.0	654.4	
	SS 20	67	5-6-8-7 (14)	Orange - Brown GRAVELLY SAND (SPG), moist to dry, loose, medium grained, subrounded gravel.		
40						◄2-Inch Solid PVC Riser
	SS 21	88	0-0-6-7 (6)	40' to 41', dark brown to brown.		
				41' to 42' orange to brown, few clay.		
				42.0	649.4	
				42.5 Brown GRAVELLY SAND (SPG), dry to moist, loose, subrounded gravel.	648.9	

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Civil & Environmental Consultants, Inc.
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Worthington, OH 43085

WELL NUMBER MW1506

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	71	3-4-4-6 (8)		Orange - Brown SAND (SP), moist, loose, very fine to coarse grained, poorly sorted, few subrounded gravel. *(continued)*	
					Below 44', wet, fine gravel, some silt.	
45	SS 23	17	7-9-9-12 (18)			
	SS 24	54	2-3-4-6 (7)		Below 46', moist, no silt.	
					48.0 643.4	
	SS 25	46	0-4-5-8 (9)		48.2 643.2 Brown SANDY CLAY (CLS), moist to wet, soft, medium plastic, trace subrounded gravel.	
50					Orange - Brown SAND (SP), dry to moist, loose, very fine to coarse grained, poorly sorted, few subrounded gravel.	
	SS 26	46	0-5-7-9 (12)		Below 50' trace coal.	
	SS 27	17	0-6-10-17 (16)			
55	SS 28	46	0-7-11-19 (18)			2-Inch Solid PVC Riser
	SS 29	50	3-2-10-7 (12)			
					58.0 633.4	
	SS 30	75	5-6-9-11 (15)		58.2 633.2 Dark Gray SANDY CLAY (CLS), moist to wet, soft, medium plastic, cohesive, subrounded fine to medium grained sand, trace gravel.	
60					Orange - Brown SAND (SP), dry to moist, loose to medium dense, very fine to coarse grained, poorly sorted, few subrounded gravel.	Bentonite Grout
	SS 31	38	4-8-11-10 (19)			
	SS 32	63	5-8-19-21 (27)		Below 60', moist to wet, coarse gravel, trace silt.	
					Below 64', fine to medium grained.	
65	SS 33	67	8-10-10-12 (20)			Bentonite Pellets

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Civil & Environmental Consultants, Inc.
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Worthington, OH 43085

WELL NUMBER MW1506

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 34	50	5-6-7-6 (13)		Orange - Brown SAND (SP), dry to moist, loose to medium dense, very fine to coarse grained, poorly sorted, few subrounded gravel. *(continued)* Below 67', moist.	Bentonite Pellets
70	SS 35	46	4-3-11-8 (14)		68.0 623.4 Brown GRAVELLY SAND (SWG), wet, loose to medium dense, fine to coarse grained, subrounded, poorly sorted, fine to coarse subround gravel, trace silt.	
	SS 36	63	7-6-6-10 (12)		72.0 619.4	
	SS 37	79	0-9-9-16 (18)		72.4 619.0 Brown SAND (SW), wet, very loose, fine grained, well sorted, trace silt. Brown SANDY GRAVEL (GPS), wet, medium dense, fine, subrounded, fine to coarse sand. Coal stringer at 73'. 74.0 617.4	
75	SS 38	83	9-9-8-16 (17)		74.4 617.0 Brown SAND (SW), wet, medium dense, very fine to coarse grained, poorly sorted, trace silt. 75.4 616.0 Brown SANDY GRAVEL (SWG), wet, medium dense, fine, subrounded, fine to coarse sand, grades to brown SAND. Brown SAND (SP), wet, medium dense, fine grained, well sorted, trace coal stringers, no silt, grades to poorly sorted brown sand at 77'.	#5 Filter Sand
	SS 39	79	9-8-9-14 (17)		77.0 614.4 Brown SAND (SW), wet, medium dense, fine to coarse grained, poorly sorted, trace subrounded gravel.	
80	SS 40	58	16-11-14-18 (25)		78'-78.5', increased gravel. 80.0 611.4	2-Inch, 0.010-Inch Slotted Screen
	SS 41	100	10-12-15-25 (27)		Brown GRAVELLY SAND (SPG), wet, medium dense, medium to coarse grained, subrounded, fine subrounded gravel. 81.5 609.9 Brown SAND (SW), wet, medium dense, medium to coarse grained, moderately sorted, trace subrounded gravel.	
	SS 42	100	10-14-15-22 (29)		83.5' to 83.75', some gravel.	
85	SS 43	67	14-16-18-29 (34)		Below 84', trace to few gravel.	
	SS 44	63	11-14-11-15 (25)			

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WELL NUMBER MW1506

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
90	SS 45	71	15-17-15-16 (32)		89.0 / 602.4 89.1 / 602.3 Dark Brown to Black GRAVELLY CLAY (CL - CH), moist to wet, soft to firm, medium to high plasticity, fine to coarse subrounded gravel.	
	SS 46	42	21-19-23-44 (42)		Brown SAND (SW), wet, medium dense, medium to coarse grained, moderately sorted, trace subrounded gravel. At 92', white sandstone cobble in bottom of spoon, fine grained, friable. 92.0 / 599.4	
	SS 47	83	24-21-18-36 (39)		Brown SANDY CLAY (CLS), moist, firm, medium plastic, very fine to fine sand, few fine subrounded gravel. 93.0 / 598.4	2-Inch, 0.010-Inch Slotted Screen
95	SS 48	83	13-29-39-50/5"		Brown SAND (SW), wet, medium dense to dense, fine to coarse grained, subrounded to subangular, poorly sorted, some fine subrounded gravel. 94.5 / 596.9 Brown to Dark Brown CLAYEY GRAVEL (GC), wet, dense to very dense, subrounded, coarse, some fine to coarse sand, some sandstone fragments.	#5 Filter Sand
	SS 49	79	11-36-38-43 (74)			
100	SS 50	71	12-24-40-36 (64)		99.0 / 592.4 Brown GRAVELLY SAND (SPG), wet, dense, fine to coarse grained, fine to coarse subrounded gravel.	
	SS 51	71	24-25-18-30 (43)		At 101', orange-brown sand seam, 1" thick, fine grained, subrounded, well sorted. 102.0 / 589.4	
	SS 52	63	19-14-16-22 (30)		Brown SAND (SW), wet, medium dense, fine to coarse grained, subrounded, poorly sorted, little fine gravel. 104.0 / 587.4	
105	SS 53	63	15-17-20-34 (37)		104.2 / 587.2 Gray SAND (SW), wet, medium dense, coarse grained, moderately sorted, graded, subangular to subrounded, trace silt. Brown SAND (SW), moist to wet, medium dense, fine to medium grained, subrounded, moderately sorted, trace fine subrounded gravel.	
	SS 54	67	10-20-24-22 (44)		Below 106', trace fine to coarse gravel, coarse gravel clasts composed of micaceous fine grained sandstone.	
110	SS 55	63	19-12-20-34 (32)		Below 108', brown to gray.	
	SS 56	63	12-27-25-30		111' to 111.1' Tan sandstone cobble, weak, medium grained, friable, moderately decomposed, subangular to subrounded grains.	

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1506

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
			(52)		Brown SAND (SW), moist to wet, medium dense, fine to medium grained, subrounded, moderately sorted, trace fine subrounded gravel. *(continued)* Below 112', medium grained, well sorted.	
	SS 57	75	14-15-19-29 (34)			
115	SS 58	58	25-40-31-36 (71)		114.5 576.9 114.8 576.8 Orange-Brown SILT (ML) w/ COAL, dry to moist, soft, iron stained. Gray Brown SILTSTONE (BEDROCK), wet, weak, trace mica.	
	SS 59	75	50/4"		116.0 575.4 116.2 575.2 Dark Gray CLAYSTONE (BEDROCK), dry, weak. Bottom of hole at 116.2 feet	

Boring grouted to surface and monitoring well installed on 10/23/2015 in offset boring.

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 10/27/15 **COMPLETED** 10/30/15
GROUND ELEVATION 692.08 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 694.98 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 485288.61 Easting: 1598790.27

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEV	WELL DIAGRAM
0							
	SS 1	79	14-19-25-33 (44)		Gray SANDY SILT (FILL), dry, medium hard, few subangular gravel.	691.6	Total Depth of BAP-4 offset boring 96'
					0.5 Brown SANDY SILT (FILL), dry, medium hard to hard, some subrounded gravel, trace clay, trace coal.		
	SS 2	104	12-20-25-50/5"		2.0 Dark Brown to Brown SILTY SAND (FILL), dry, medium dense to very dense, fine to medium grained, moderately sorted, some fine subrounded gravel.	690.1	
5	SS 3	79	5-23-30-45 (53)		5.0 Brown SAND (FILL), dry, dense, medium grained, subrounded to subangular, well sorted, coarse subangular limestone gravel.	687.1	Bentonite Grout
	SS 4	96	5-19-29-45 (48)		6.0 Dark Brown to Brown SANDY SILT (FILL), dry to moist, firm to hard, few subrounded to subangular fine to coarse grained sand, little fine subrounded gravel, trace clay.	686.1	
					7.0 Brown to Reddish Brown SAND (FILL), moist, dense, medium grained, well sorted, subrounded to subangular, trace subrounded coarse sand.	685.1	
	SS 5	71	1-11-26-36 (37)		9.0 Brown to Dark Brown SILTY SAND (FILL), moist, medium dense to dense, medium to coarse grained, subrounded, moderately sorted, trace fine subrounded gravel.	683.1	
10					10.0 Dark Brown to Reddish Brown CLAYEY SAND (FILL), medium dense to very dense, coarse grained, subrounded, poorly sorted, few fine to coarse subrounded gravel, trace coal.	682.1	
	SS 6	104	11-13-19-50/5"		12.0 Dark Brown to Brown SAND (FILL), moist, medium dense to dense, medium grained, subrounded, moderately sorted, trace fine subrounded gravel.	680.1	
	SS 7	95	7-21-34-50/4"		Below 14', fine to coarse gravel.		
15	SS 8	100	18-23-20-48 (43)		15.5 Gray to Brown SILTY CLAY (FILL), dry to moist, very hard, medium plastic, few subrounded coarse sand, trace coal.	676.6	
					16.0 Dark Brown to Brown SAND (FILL), dry to moist, loose to dense, subrounded, poorly to moderately sorted, few fine to coarse subrounded gravel, trace silt.	676.1	2-Inch Solid PVC Riser
	SS 9	79	3-23-29-40 (52)		18.0 Gray SANDY CLAY (FILL), moist, firm, moderate plastic, subrounded medium to coarse grained sand, trace subrounded gravel.	674.1	
	SS 10	100	8-12-28-34 (40)		19.0 Dark Brown SAND (FILL), dry to moist, dense, medium to coarse grained, moderately sorted, subrounded, few fine subrounded gravel.	673.1	
20					20.0	672.1	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
20							
	SS 11	92	3-11-13-18 (24)		Gray SANDY CLAY (FILL), moist, firm, moderate plastic, subrounded medium to coarse grained sand, trace subrounded gravel.		
					21.0	671.1	
					Brown CLAYEY SAND (FILL), moist to dry, medium dense, medium to coarse grained, poorly sorted, few fine subrounded gravel.		
					22.0	670.1	
	SS 12	100	2-11-20-24 (31)		Gray CLAY (FILL), moist, very soft to firm, highly plastic, few subrounded coarse grained sand, trace subrounded fine to coarse gravel, moist to wet around clasts.		
					23.0	669.1	
					Brown SILTY SAND (FILL), moist, medium dense, medium to coarse grained, subrounded, poorly sorted, few fine subrounded gravel.		
					24.5	667.6	
25	SS 13	100	16-19-23-44 (42)		25.0 Brown SAND (FILL), moist, medium dense, medium grained, subrounded, well sorted, trace fine gravel.	667.1	
					Brown CLAYEY SAND (FILL), moist, medium dense to dense, fine to coarse grained, subrounded, trace subrounded gravel.		
	SS 14	71	2-12-24-43 (36)		At 27', wet.		
	SS 15	58	0-6-29-40 (35)		Below 28', moist to wet.		
30							Bentonite Grout
	SS 16	78	2-8-18-50/5"		Below 30', gray, wet.		
					31.5	660.6	
					32.0 Dark Gray CLAYEY SILT (FILL), wet, hard, few coarse subrounded sand, trace fine subrounded gravel.	660.1	
	SS 17	79	6-24-31-38 (55)		Dark Gray GRAVELIY CLAY (FILL), moist, firm, moderately plastic, subrounded gravel , few coarse grained sand.		
					33.5	658.6	
					34.0 Reddish Brown to Brown SILT (ML), dry, very hard, few gray silt laminations with desiccation cracks throughout, trace roots, trace subrounded coarse grained sand.	658.1	
35	SS 18	100	4-6-9-12 (15)		35.0 Gray to Dark Gray SILT (ML), dry to moist, soft to firm, trace roots, trace subrounded fine to medium grained sand.	657.1	
					36.0 Reddish Brown to Brown SILT (ML), dry, firm, trace roots, trace fine grained sand.	656.1	
	SS 19	79	2-5-10-13 (15)		36.5 Gray to Dark Gray SANDY CLAY (CLS), moist, soft to firm, medium plastic, subrounded fine to coarse grained sand,	655.6	
					Reddish Brown SILT (ML), dry, soft to firm, trace fine to coarse grained sand.		
					38.0	654.1	
					38.5 At 37.5', grades to GRAVELIY SILT (MLG), dry, firm, subrounded gravel.	653.6	
	SS 20	63	7-7-6-7 (13)		Brown to Reddish Brown SILT (ML), dry, firm, dark gray vertical desiccation cracks 1/2" width throughout, trace coarse subrounded sand.		
40					Orange-Brown GRAVELLY SAND (SWG), dry to moist, loose, fine to coarse grained, subangular, poorly sorted, fine subrounded gravel.		2-Inch Solid PVC Riser
	SS 21	8	8-7-9-10 (16)				
					42.0	650.1	
					42.5 Brown SANDY CLAY (CLS), moist, soft to firm, few subrounded coarse sand, trace subrounded gravel.	649.6	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	67	5-5-6-8 (11)		Grayish Brown SAND (SW), dry to moist, very loose to loose, medium grained, subrounded, well sorted, few subrounded coarse grained sand, trace subrounded gravel. *(continued)*	
45	SS 23	71	3-3-5-6 (8)		45.5' to 45.8', few coarse subrounded gravel, trace coal.	
	SS 24	67	4-5-5-6 (10)		46.0 646.1 Orange-Brown to Brown GRAVELLY SAND (SWG), dry to moist, very loose to loose, fine to coarse grained, subrounded, moderately sorted, fine subrounded gravel, few coal stringers <1/4" thick throughout.	
	SS 25	63	0-3-6-6 (9)			
50					50.0 642.1	
	SS 26	67	0-2-4-7 (6)		Orange-Brown SAND (SW), moist, very loose to loose, medium grained, subrounded, well sorted, trace subrounded coarse sand.	
	SS 27	63	0-3-3-5 (6)		52'-54', few thinly bedded coal stringers.	
55	SS 28	63	0-3-6-9 (9)			2-Inch Solid PVC Riser
	SS 29	58	0-5-7-9 (12)		56.5 635.6 Dark Gray to Black COAL, dry soft. 57.0 635.1 Orange-Brown SAND (SW), moist, very loose to loose, medium grained, subrounded, well sorted, trace subrounded coarse sand. 58.0 634.1	
	SS 30	79	3-9-13-23 (22)		58.3 633.8 Gray CLAY (CL), moist, firm, high plasticity, few subrounded fine to coarse grained sand. 58.5 633.6 Dark Gray to Black COAL, dry to moist, soft. Brown GRAVELLY SAND (SWG), moist, very loose to medium dense, medium grained, subrounded, moderately sorted, fine to coarse subrounded gravel.	
60						Bentonite Grout
	SS 31	50	0-6-9-12 (15)		61'-61.25', increased clay.	
	SS 32	54	0-7-10-20 (17)		62.5'-62.75', increased clay.	
	SS 33	54	11-23-14-19 (37)		64'-66', few cobbles	
65						

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					66.0 626.1	
	SS 34	46	0-17-17-15 (34)		66.3 625.8 Brown to Dark Brown SAND (SP), dry to moist, very loose, fine grained, well sorted, subrounded. Brown GRAVELLY SAND (SWG), moist, very loose to medium dense, medium grained, subrounded, moderately sorted, fine to coarse subrounded gravel. 68.0 624.1	Bentonite Pellets
70	SS 35	54	5-7-5-10 (12)		Gray SANDY GRAVEL (GWS), wet, loose to medium dense, subrounded, medium to coarse subrounded sand, trace silt. 70.0 622.1	
	SS 36	67	9-13-14-15 (27)		Gray SAND (SP), wet, loose to medium dense, coarse grained, subrounded, well sorted, subvertical 1/2" thick coal seam throughout, few silt. 71.0 621.1 Brown GRAVELLY SAND (SWG), wet, medium dense, fine to coarse grained, subrounded, poorly sorted, fine to coarse subrounded gravel.	
	SS 37	63	15-14-12-19 (26)		74.0 618.1	#5 Filter Sand
75	SS 38	58	10-13-16-24 (29)		Brown SAND (SP), wet, medium dense, very fine to fine grained, subrounded, well sorted, trace fine subrounded gravel.	
	SS 39	71	10-18-20-25 (38)		Below 77', very fine to fine sand grades to medium to coarse sand, well sorted to moderately sorted, bedded, trace subrounded coarse gravel.	
80	SS 40	58	12-11-15-21 (26)		80.0 612.1	
	SS 41	100	14-15-16-22 (31)		Brown SILTY SAND (SM), wet, medium dense, fine to medium grained, subrounded, moderate to poorly sorted, trace subrounded gravel, grades to brown SAND. 81.5 610.6 Brown SAND (SW), wet, medium dense, fine to coarse grained, subrounded, poorly sorted, few fine to coarse subrounded gravel, trace silt. 82.0 610.1	2-Inch, 0.010-Inch Slotted Screen
	SS 42	83	9-14-13-18 (27)		Gray SILTY SAND (SM), wet, medium dense, fine to coarse grained, subrounded, poorly sorted, trace silt, grades to brown SAND. 83.0 609.1 Brown SAND (SW), wet, medium dense, fine to medium grained, moderately sorted, trace fine subrounded gravel, trace silt.	
85	SS 43	79	10-16-21-24 (37)		Below 84', medium to coarse grained, no silt.	
	SS 44	63	13-13-15-16 (28)		Below 87', trace fine to coarse gravel.	
					88'-89', gray.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
90	SS 45	71	13-12-15-20 (27)		Brown SAND (SW), wet, medium dense, fine to medium grained, moderately sorted, trace fine subrounded gravel, trace silt. *(continued)*	#5 Filter Sand
	SS 46	75	18-19-27-37 (46)		91.5 600.6	
	SS 47	83	29-27-19-21 (46)		Brown SILTY SAND (SM), wet, medium dense to dense, very fine to fine grained, subrounded, moderately sorted. Below 93', little fine to coarse subrounded gravel.	2-Inch, 0.010-Inch Slotted Screen
95	SS 48	83	33-38-35-30 (73)			
	SS 49	87	32-37-42-50/5"		At 97', some orange-brown silt around gravel clasts.	
	SS 50	67	19-27-28-38 (55)		99.0 593.1	
100	SS 51	58	17-28-27-33 (55)		Gray to Brown GRAVELLY SAND (SWG), wet, medium dense to dense, fine to coarse grained, subrounded, poorly sorted, fine to coarse subrounded gravel, trace to little silt, trace coal.	
	SS 52	67	14-23-22-25 (45)		Below 103', decreased silt, fine gravel.	
					104.0 588.1	
	SS 53	71	21-30-22-21 (52)		104.5 Gray SAND (SW), wet, medium dense, medium to coarse grained, subrounded, poorly sorted, little gravel. 587.6 Brown SAND (SP), wet, medium dense, medium grained, subrounded, well sorted, trace fine subrounded gravel.	
105	SS 54	71	13-17-13-17 (30)		107.5 584.6	
					Gray GRAVELLY SAND (SWG), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, fine subrounded gravel.	
	SS 55	75	13-13-16-21 (29)		108.5 583.6 Brown SAND (SP), wet, medium dense, fine to medium grained, subrounded, well sorted, few fine subrounded gravel.	
110	SS 56	79	15-18-18-23			

P-12S TEMPLATE 110-416 BOTTOM ASH POND (REV 12-1-15).GPJ GOOD TEMPLATE.GDT 12/1/15

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1507

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
			(36)		111.5 Dark Gray to Black COAL, wet, soft. 580.6 111.8 Brown SAND (SP), wet, medium dense to dense, fine to medium grained, subrounded, well sorted, few fine subrounded gravel. 580.3	
	SS 57	67	32-29-27-41 (56)			
115	SS 58	83	18-23-29-50/5"		115.5 576.6 115.9 Tan to Brown SANDSTONE (BEDROCK), wet, hard, very fine to fine grained, subrounded to subangular grains, moderately cemented. 576.2 Bottom of hole at 115.9 feet	

Boring grouted to surface and monitoring well installed on 10/30/2015 in offset boring.

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1508

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 10/5/15 **COMPLETED** 10/8/15
GROUND ELEVATION 682.72 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 685.77 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY B. Bashore / R. Stanley **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 484971.27 Easting: 1598790.27

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	94	16-22-32 (54)		Gray SILTY SAND & GRAVEL (FILL), dry, very dense.	Total Depth of BAP-5 offset boring 88'
2.0					680.7	
	SS 2	92	2-9-11-15 (20)		Orange-Brown SILT & CLAY (ML), moist to dry, medium stiff, trace fine sand.	
5	SS 3	63	3-3-3-4 (6)			Bentonite Grout
	SS 4	33	1-2-3-6 (5)			
8.0					674.7	
	SS 5	71	3-5-5-6 (10)		Orange-Brown SILTY SAND (SM), moist, loose, fine to medium grained, trace clay.	
10					10.0 672.7	
	SS 6	63	3-5-4-7 (9)		Orange-Brown SILTY SAND & GRAVEL (SW), moist, loose.	
	SS 7	63	4-4-4-5 (8)			
15	SS 8	75	2-3-4-7 (7)		Below 14', more sand, less gravel.	
	SS 9	54	2-3-3-6 (6)		Below 16', moist to wet, more gravel.	2-Inch Solid PVC Riser
	SS 10	63	3-2-3-3 (5)		Below 20', wet, very loose. Note: Wet at bottom of sample SS-10.	
20						

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1508

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
20	SS 11	50	3-2-2-2 (4)		Orange-Brown SILTY SAND & GRAVEL (SW), moist, loose. *(continued)*	
	SS 12	63	1-3-3-3 (6)		Below 22', fine to coarse sand with gravel, silty, trace clay, loose.	
25	SS 13	50	0-2-3-3 (5)		Below 24', slightly more silty clay, less gravel, loose wet.	
					26.0 656.7	
	SS 14	83	1-1-2-3 (3)		Orange-Brown SILTY SAND (SM), wet, loose, fine to coarse grained, trace clay, trace gravel, slightly cohesive.	
	SS 15	54	2-3-3-4 (6)			
30	SS 16	63	3-3-5-5 (8)		Below 31', less silt and clay.	Bentonite Grout
					32.0 650.7	
	SS 17	88	1-2-3-5 (5)		Orange-Brown SAND (SP), wet, loose, fine to medium grained, some silt.	
35	SS 18	75	0-3-3-5 (6)		Below 34', medium to fine sand, no gravel, clean.	
	SS 19	75	0-3-4-7 (7)		Below 36', wet to moist.	
	SS 20	88	3-3-5-8 (8)			
40	SS 21	96	0-4-5-9 (9)		Below 40', some to trace silt, no clay.	Bentonite Grout
					Below 42', medium dense, moist.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1508

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	71	0-6-7-11 (13)		Orange-Brown SAND (SP), wet, loose, fine to medium grained, some silt. *(continued)*	
45	SS 23	88	3-3-5-7 (8)		Below 44', loose.	
	SS 24	100	4-6-7-10 (13)		Below 46', medium dense.	
50	SS 25	104	4-5-5-9 (10)			
	SS 26	75	4-4-6-10 (10)		Below 50', loose, trace silt.	Bentonite Grout
	SS 27	96	4-5-6-11 (11)		Below 52', loose to medium dense, becoming more fine.	
55	SS 28	92	4-5-6-9 (11)		Below 54', loose.	2-Inch Solid PVC Riser
	SS 29	92	5-5-3-7 (8)		Below 56.5', some fine to coarse gravel.	
					57.1 625.6	
					Orange-Brown SANDY CLAY (CL), moist, medium stiff, medium plastic.	
					57.6 625.1	
					Orange-Brown SAND (SP), wet, loose, fine to medium grained, some fine gravel, trace silt.	
					58.0 624.7	
	SS 30	100	2-4-6-12 (10)		Brown CLAYEY SILT (MH), moist, very loose, very fine.	
					58.7 624.0	
					Brown SAND & GRAVEL (SP, GW), wet, loose, medium to fine grained, fine to coarse gravel, some silt.	
60					59.6 623.1	
					Brown CLAYEY SILT (MH), moist, medium dense, very fine.	Bentonite Pellets
					60.0 622.7	
	SS 31	100	5-3-6-9 (9)		Brown SANDY GRAVEL (GWS), wet, loose, fine to coarse, fine to medium sand, some silt.	
					62.0 620.7	
	SS 32	88	5-5-4-6 (9)		Brown GRAVELLY SAND (SWG), wet, loose, fine to medium grained, fine gravel, trace silt.	
					62.9 619.8	
					Brown SANDY GRAVEL (GWS), wet, loose, fine to coarse, fine to medium sand, trace silt.	
					64.0 618.7	
65	SS 33	88	5-5-6-9 (11)		Brown GRAVELLY SAND (SWG), wet, loose, fine to medium grained, fine gravel.	
					65.0 617.7	#5 Filter Sand
					65.3 Black COAL, wet, soft, highly weathered, some sand, no odor. 617.4	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1508

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 34	33	7-6-7-10 (13)		66.0 Brown GRAVELLY SAND (SWG), wet, loose, fine to medium grained, fine gravel. *(continued)* 616.7 Brown SAND (SP), wet, loose, medium to coarse grained.	
	SS 35	42	9-9-10-13 (19)		Below 68', loose to medium dense, trace silt, trace fine gravel.	
70	SS 36	100	7-10-8-12 (18)		71.4 70.9' to 71', coal seam, highly weathered. 611.3	2-Inch, 0.020-Inch Slotted Screen
	SS 37	100	6-9-12-17 (21)		Brown GRAVELLY SAND (SWG), wet, loose to medium dense, fine to medium grained, fine to coarse gravel. Below 72', some silt. Note: 0.2" coal stringer at 73.4'	
75	SS 38	67	8-8-11-13 (19)		73.4 609.3 Orange-Brown GRAVELLY SAND (SWG), wet, medium dense, fine to medium grained, fine gravel. 76.0 606.7	
	SS 39	100	7-10-7-13 (17)		Orange-Brown SAND (SP), wet, loose to medium dense, fine to medium grained, some fine gravel. 78.0 604.7	
80	SS 40	83	7-7-31-49 (38)		Orange-Brown SANDY CLAY (CLS), moist, medium stiff, low plasticity, trace fine gravel. 78.9 603.8 Orange-Brown SANDY GRAVEL (GWS), wet, dense, fine to coarse, medium to coarse sand.	
	SS 41	88	15-21-25-31 (46)		Below 80', medium dense to dense.	
	SS 42	71	13-28-32-35 (60)		Below 82', medium dense. 83.0 Note: 82.2'-82.3', completely weathered coal fragments. 599.7 Orange-Brown SANDY GRAVEL (GWS), wet, dense, fine to coarse, medium to coarse sand.	
85	SS 43	83	7-24-18-35 (42)		Below 84', medium dense to dense, some to trace clay. 86.0 596.7	
	SS 44	79	25-31-25-25 (56)		Orange-Brown SANDY GRAVEL (GWS), wet to moist, medium dense, fine to coarse, medium to coarse sand, trace clay, trace sandstone fragments. Note: 0.1" thick highly weathered coal stringer at 87.6'. 88.2 594.5	#5 Filter Sand

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1508

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
90	SS 45	75	18-25-22-26 (47)		Orange-Brown GRAVELLY SAND (SWG), wet to moist, medium dense, fine to coarse grained, fine to coarse gravel, trace medium grained moderately cemented sandstone gravel. *(continued)*		
	SS 46	71	11-21-35-43 (56)		Below 90', medium dense to dense, medium to coarse grained, trace siltstone fragments.		
	SS 47	75	21-30-40-42 (70)		Below 92', wet to moist, dense, trace sandstone fragments.		
					94.0	588.7	
95	SS 48	83	14-17-25-40 (42)		Brown to Orange-Brown GRAVELLY SAND (SWG), wet, medium dense to dense, medium to coarse grained, fine gravel.		
	SS 49	75	10-25-28-38 (53)		Below 96', wet to moist.		
					98.0	584.7	
100	SS 50	75	14-22-26-42 (48)		Brown SAND (SP), wet to moist, medium dense to dense, fine to medium grained, some fine gravel.		
	SS 51	75	11-18-25-42 (43)		Below 100', moist to wet, trace fine gravel.		
	SS 52	100	13-22-50/5"		102.6	580.1	
					Brown SAND (SP), moist, medium dense, fine grained. Note: coarse gravel at bottom of sample SS-52.		
					104.0	578.7	
105	SS 53	71	27-34-50/2"		104.3 Gray to Brown CLAYEY SAND w/ GRAVEL (SC), moist to wet, dense, fine grained, fine gravel. 104.6	578.4 578.1	
					Gray SILTSTONE (BEDROCK), dry, weak, highly weathered, micaceous. Brown to Gray SANDSTONE (BEDROCK), moderate strong to strong, fine to medium grained, moderate to well cemented.		
	SS 54	107	24-50/3"		106.8	575.9	
					Bottom of hole at 106.8 feet		

Boring grouted to surface and monitoring well installed on 10/8/2015 in offset boring.

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 11/3/15 **COMPLETED** 11/6/15
GROUND ELEVATION 691.86 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 694.63 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 484947.44 Easting: 1598889.64

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	83	8-14-13-22 (27)		Dark Brown SILTY SAND (FILL), dry, loose to medium dense, medium to coarse grained, subrounded, moderately sorted, little subrounded gravel.	Total Depth of P-2 offset boring 96'
	SS 2	83	7-16-23-33 (39)			
5	SS 3	88	3-16-14-24 (30)			Bentonite Grout
	SS 4	83	5-14-18-24 (32)		6.0 685.9 6.5 Dark Brown SILT (FILL), dry to moist, firm, few medium grained sand, subrounded, trace subrouned gravel, trace iron. 685.4 Dark Brown SILTY SAND (FILL), dry, loose to medium dense, medium to coarse grained, subrounded, moderately sorted, little subrounded gravel. 8.0 683.9	
10	SS 5	83	3-13-19-36 (32)		Brown SAND (FILL), dry, loose to dense, subrounded, well sorted, trace subrounded gravel. 10.0 681.9 10.5 Dark Brown CLAYEY SAND (FILL), moist, loose, medium grained, moderately sorted, subrounded, trace gravel. 681.4	
	SS 6	92	7-17-28-45 (45)		Brown SAND (FILL), dry, loose to dense, subrounded, well sorted, trace subrounded gravel. 12.0 679.9	
	SS 7	92	4-21-27-40 (48)		Dark Brown SANDY SILT (FILL), dry to moist, firm to hard, nonplastic, medium subrounded sand, trace fine to coarse subrounded gravel. 13.0 678.9 Brown SAND (FILL), dry, loose to dense, subrounded, well sorted, trace subrounded gravel. 14.0 677.9	
15	SS 8	88	2-14-18-21 (32)		Dark Brown SANDY SILT (FILL), dry to moist, firm to hard, nonplastic, medium subrounded sand, trace coarse subrounded gravel. 15.0 676.9 15.5 Brown SAND (FILL), dry, loose to dense, subrounded, well sorted, trace subrounded gravel. 676.4	
	SS 9	100	3-12-14-36 (26)		Dark Brown SANDY SILT (FILL), dry to moist, firm to hard, nonplastic, medium subrounded sand, trace coarse subrounded gravel. 17.5 674.4 18.0 Brown SAND (FILL), dry, loose to dense, subrounded, well sorted, trace subrounded gravel. 673.9	2-Inch Solid PVC Riser
	SS 10	100	8-23-28-30 (51)		18.5 Dark Brown SANDY SILT (FILL), dry to moist, firm to hard, nonplastic, medium subrounded sand, trace coarse subrounded gravel. 673.4 Brown SAND (FILL), moist, medium dense to dense, subrounded, well sorted, few fine to coarse subrounded gravel. 20.0 671.9	
20						

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
20	SS 11	92	6-10-10-15 (20)		21.0 (670.9) Dark Brown SANDY SILT (FILL), dry to moist, firm to hard, nonplastic, medium subrounded sand, trace coarse subrounded gravel.	
					Dark Gray SILTY CLAY (FILL), dry to moist, firm, moderate plasitic, trace fine subrounded gravel.	
	SS 12	79	3-12-16-30 (28)		22.5 (669.4) 23.0 (668.9) Brown SAND (FILL), wet, loose, subrounded, well sorted, few fine to coarse subrounded gravel.	
					24.0 (667.9) Dark Brown GRAVELLY SAND (FILL), moist, medium dense to dense, medium to coarse grained, poorly sorted, fine subrounded gravel, some silt.	
25	SS 13	100	6-19-25-40 (44)		24.5 (667.4) Dark Gray SILTY CLAY (FILL), dry to moist, firm, moderate plastic, trace fine to coarse subrounded gravel.	
					Dark Brown GRAVELLY SAND (FILL), moist, medium dense to dense, medium to coarse grained, poorly sorted, fine subrounded gravel, some silt, trace coal.	
	SS 14	88	13-25-28-29 (53)		Wet at 26'	
					27.0 (664.9) 27.2 (664.7) Dark Brown SANDY CLAY (FILL), moist, firm, moderate plastic, subrounded fine to coarse grained sand, trace subrounded gravel.	
	SS 15	92	4-14-27-40 (41)		28.0 (663.9) Dark Brown GRAVELLY SAND (FILL), moist, medium dense to dense, medium to coarse grained, poorly sorted, fine subrounded gravel, some silt, trace coal.	
30					28.9 (663.0) Dark Brown SILT (FILL), dry to moist, firm, some fine grained sand, trace subrounded gravel.	
	SS 16	96	10-14-27-45 (41)		Brown SAND (FILL), moist, medium dense to dense, fine to coarse grained, moderately sorted, trace fine subrounded fine gravel.	2-Inch Solid PVC Riser
					31.0 (660.9) Wet at 30'	
					Dark Brown SANDY SILT (FILL), dry to moist, hard to very hard, subrounded medium grained sand, few coarse subrounded gravel.	
	SS 17	55	26-50/5"		32.0 (659.9) Dark Brown SANDY CLAY (FILL), moist, hard, moderate plastic, fine grained sand, trace gravel.	
					Dark Gray SILTSTONE cobble stuck in bottom of spoon.	
					34.0 (657.9)	
35	SS 18	100	5-14-12-17 (26)		Light Brown to Dark Gray SILT (ML), dry, firm, light colored laminations, below 35' grades to dark gray silt, few coal stringers, some roots, trace clay, trace fine subrounded gravel.	
					36.5 (655.4)	
	SS 19	96	3-10-19-21 (29)		Tan SILTY CLAY (CL-ML), dry, hard, laminated with light gray silt, low plasticity, gradational contact.	
					37.5 (654.4)	
					38.0 (653.9) Orange-Brown GRAVELLY SAND (SWG), dry, medium dense, fine to coarse grained, poorly sorted, subrounded, fine to coarse subrounded gravel, some clay.	
	SS 20	67	5-7-7-9 (14)		38.5 (653.4) Dark Brown SILTY CLAY (CL-ML), dry, firm, low plasticity, trace subrounded coarse sand, trace subrounded gravel.	
40					Orange-Brown GRAVELLY SAND (SWG), moist, loose, coarse grained, subrounded, moderately sorted, trace silt, few gray sandstone cobbles. 40.0 (651.9)	Bentonite Grout
	SS 21	92	2-7-8-11 (15)		40.5 (651.4) Brown SILTY CLAY (CL-ML), dry to moist, firm, low plasticity, some subrounded coarse grained sand, trace subrounded gravel.	
					Orange-Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted.	
					At 42', little fine to coarse subrounded gravel.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	75	5-6-7-8 (13)		Orange-Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted. *(continued)*	
					At 44', color change to brown.	
45	SS 23	83	3-4-6-8 (10)		44.9 (647.0) Dark Gray COAL, dry, hard, fissile, moist along fractures, trace plant fossils 45.1 (646.8)	
					Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted. 46.0 (645.9)	
	SS 24	92	2-2-4-5 (6)		46.3 (645.6) Dark Brown SILTY SAND (SM), dry, loose, medium grained, subrounded.	
					Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted, coal stringers throughout.	
	SS 25	92	4-2-4-7 (6)		48.2 (643.7) 48.4 (643.5) Dark Gray COAL, moist, soft.	
					49.0 (642.9) Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted, coal stringers throughout. 49.4 (642.5)	
50					Dark Gray COAL, moist, soft.	
	SS 26	79	5-4-5-10 (9)		50.0 (641.9) Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted, coal stringers throughout. 50.3 (641.6)	
					50.6 (641.3) 50.8 (641.1) Dark Gray COAL, moist, soft.	
					Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted, coal stringers throughout.	
	SS 27	67	2-3-5-12 (8)		Dark Gray COAL, moist, soft.	
					52.5 (639.4) Brown SAND (SW), moist, loose to medium dense, medium grained, subrounded, well sorted, coal stringers throughout. Below 52', wet, very loose.	
					Brown SANDY GRAVEL (GWS), moist, loose to medium dense, subrounded, poorly sorted, some clay.	
55	SS 28	92	7-11-18-35 (29)			2-Inch Solid PVC Riser
	SS 29	92	13-25-19-21 (44)		At 56', some coarse gravel.	
	SS 30	75	5-16-22-42 (38)		At 58', loose to dense, fine to coarse gravel.	
60					60.0 (631.9)	Bentonite Grout
	SS 31	92	15-18-27-28 (45)		Brown GRAVELLY SAND (SWG), dry to moist, medium dense, subrounded to subangular, medium to coarse grained, moderately sorted, fine to coarse subrounded gravel.	
	SS 32	88	9-10-8-20 (18)		63.0 (628.9) 63.4 (628.5) Light Brown SILT (ML), wet, firm, trace fine sand.	
					Brown SAND (SW), moist, loose to medium dense, fine to coarse grained, subrounded, poorly sorted, few fine subrounded gravel.	
65	SS 33	88	8-6-7-9 (13)		64.5 (627.4) Brown SAND (SW), moist, loose, medium grained, well sorted. 65.0 (626.9)	
					Brown GRAVELLY SAND (SWG), moist, loose, subrounded, medium to coarse grained, moderately sorted, trace silt.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					66.0 625.9	
	SS 34	67	6-6-10-4 (16)		Light Brown SAND (SW) interbedded with GRAVELY SAND (SWG), moist, loose to medium dense, medium grained, well sorted, fine to coarse subrounded gravel intebeds 0.25' thick.	Bentonite Pellets
					68.0 623.9	
	SS 35	67	5-5-5-8 (10)		Brown SAND (SW), wet, loose, fine to coarse grained, poorly sorted, grades to little subrounded gravel below 69', trace silt.	
70					70.0 621.9	
	SS 36	67	3-4-7-11 (11)		Brown GRAVEL (GW), wet, loose, subrounded, few subrounded coarse grained sand, few silt.	
					71.0 620.9	
					Brown SAND (SW), wet, loose, fine grained, well sorted, subrounded, trace coarse grained sand.	
					72.0 619.9	
	SS 37	67	6-3-3-6 (6)		72.5 619.4 Brown GRAVEL (GW), wet, subrounded, few, subrounded, coarse grained, sand, few silt. Brown SAND (SW), wet, loose, medium to coarse grained, subrounded, moderately sorted, trace silt.	
					74.2' to 74.4', coarse grained.	
75	SS 38	67	4-4-5-9 (9)			#5 Filter Sand
	SS 39	67	10-7-10-16 (17)		76.5' to 76.75', coarse grained.	
	SS 40	100	11-7-9-13 (16)			
80					Below 80', medium grained.	2-Inch, 0.010-Inch Slotted Screen
	SS 41	54	11-7-13-21 (20)			
	SS 42	71	7-8-14-26 (22)			
					Below 84', fine to medium grained, poorly sorted, trace fine to coarse gravel.	
85	SS 43	58	10-9-14-14 (23)			
	SS 44	67	8-7-13-19 (20)			
					At 88', limestone cobble.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
90	SS 45	50	12-8-8-12 (16)		Brown SAND (SW), wet, loose, medium to coarse grained, subrounded, moderately sorted, trace silt. *(continued)*	#5 Filter Sand
					90.0 601.9	
	SS 46	75	15-14-18-35 (32)		Brown GRAVELLY SAND (SWG), wet, medium dense to dense, fine to coarse grained, poorly sorted, subrounded, fine to coarse subrounded gravel, grades to fine grained sand.	
	SS 47	75	18-17-17-33 (34)			2-Inch, 0.010-Inch Slotted Screen
95	SS 48	71	20-26-29-30 (55)			
	SS 49	92	21-23-28-28 (51)		Below 96', coarse gravel, increased silt.	
100	SS 50	67	8-10-18-30 (28)			
	SS 51	71	14-13-16-46 (29)		Below 100', decreased silt.	
					102.0 589.9	
	SS 52	83	5-9-14-23 (23)		Light Brown SAND (SW), wet, loose, very fine to fine grained, well sorted, subrounded.	
					103.0 588.9	
					Gray SAND (SW), wet, medium dense, medium to coarse grained, moderately sorted, subrounded, trace subrounded gravel, gradational	
					104.0 contact. 587.9	
105	SS 53	63	8-11-16-25 (27)		Light Brown SAND (SW), wet, loose, very fine to fine grained, well sorted, subrounded.	
					105.0 586.9	
					Gray SAND (SW), wet, medium dense, coarse grained, well sorted, subrounded, trace subrounded gravel, gradational contact.	
					106.0 585.9	
	SS 54	21	22-17-13-15 (30)		Light Brown SAND (SW), wet, loose, very fine to fine grained, well sorted, subrounded.	
110	SS 55	54	6-9-14-20 (23)		109' to 110', grades medium to coarse gained, trace gravel.	
	SS 56	88	6-11-13-30 (24)		111' to 112', grades medium to coarse gained, trace gravel.	

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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1509 (P-2)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					Light Brown SAND (SW), wet, loose, very fine to fine grained, well sorted, subrounded. *(continued)*	
	SS 57	54	4-7-11-20 (18)		112' to 114', loose to medium dense.	
115	SS 58	88	5-14-39-30 (53)			
					115.5 576.4	
					Light Brown SILTY CLAY (CL-ML), moist, hard, low plasticity, trace subrounded gravel, limestone cobble in bottom of spoon. 116.0 575.9	
	SS 59	175	50/4"		116.2 575.7	
					Gray LIMESTONE (BEDROCK), wet, hard.	
					Bottom of hole at 116.4 feet	

Boring grouted to surface and monitoringwell installed on 11/6/2015 in offset boring.

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1510 (P-1)

CLIENT American Electric Power
PROJECT NAME Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Bottom Ash Pond, Cresap, West Virginia
DATE STARTED 11/9/15 **COMPLETED** 11/12/15
GROUND ELEVATION 678.01 ft **HOLE SIZE** 8.25"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 680.77 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Split Spoon
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION Northing: 484569.80 Easting: 1599175.22

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	50	6-5-9-30 (14)		Gray to Brown SILTY GRAVEL (FILL), dry, loose to dense, subangular to angular.	Total Depth of P-1 offset boring 82'
	SS 2	83	15-12-19-33 (31)		3.0 675.0 Brown SILTY SAND (FILL), dry, medium dense to dense, fine grained, subrounded, little subrounded gravel.	
5	SS 3	71	9-16-20-28 (36)		5.0 673.0 Brown SAND (FILL), dry, medium dense, very fine to fine grained, subangular, well sorted, thinly bedded, trace fine subrounded gravel, trace coal. 6.0 672.0	Bentonite Grout
	SS 4	100	8-13-16-23 (29)		Dark Brown SILTY SAND (FILL), dry, loose to medium dense, fine to medium grained, subrounded, poorly sorted, trace subrounded gravel.	
	SS 5	96	6-10-15-26 (25)		9.0 669.0 9.1 668.9 Dark Brown SILTY CLAY (FILL), moist, firm, low plasticity, trace coal, moist to wet at 9'.	
10	SS 6	100	10-11-14-12 (25)		Dark Brown SILTY SAND (FILL), dry, loose to medium dense, fine to medium grained, subrounded, poorly sorted, trace subrounded gravel. 11.0 667.0 Gray SAND (FILL), wet, medium dense, fine grained, subrounded, well sorted, trace subrounded gravel. 11.8 666.2	
	SS 7	75	2-4-8-10 (12)		12.0 666.0 Dark Gray COAL (FILL), moist, soft. 12.5 665.5 Gray SAND (FILL), moist, loose, fine grained, well sorted, subrounded. 13.0 665.0 Gray CLAYEY SAND (FILL), moist, loose, fine grained, trace coal, trace brick. 14.0 664.0 Light Brown to Brown SAND (FILL), dry to moist, loose to medium dense, fine to coarse grained, subrounded to subangular, poorly sorted. 14.5 663.5 Gray to Dark Gray SILTY SAND (FILL), moist, loose, fine to medium grained, subrounded, moderately sorted, some wood.	
15	SS 8	79	4-5-5-8 (10)		Light Brown SAND (SW), moist, loose, fine grained, subrounded, well sorted, trace fine subrounded gravel.	
	SS 9	83	3-3-4-6 (7)			2-Inch Solid PVC Riser
	SS 10	88	3-4-3-5 (7)		Below 18', light brown to brown, dry to moist, bedded.	
20						

P-12S TEMPLATE 110-416 BOTTOM ASH POND (REV 4-13-16).GPJ GOOD TEMPLATE.GDT 4/13/16

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

WELL NUMBER MW1510 (P-1)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
20	SS 11	88	4-2-3-5 (5)		Light Brown SAND (SW), moist, loose, fine grained, subrounded, well sorted, trace fine subrounded gravel. *(continued)*	
	SS 12	83	2-3-2-5 (5)			
25	SS 13	88	2-3-4-5 (7)		Below 25', coal stringers.	
	SS 14	96	3-3-5-6 (8)		27.0 651.0	
					27.5 Light Brown SILT (ML), dry, soft, trace sand. 650.5	
	SS 15	79	3-3-5-7 (8)		Light Brown SAND (SW), moist, loose, fine grained, subrounded, well sorted, trace fine subrounded gravel. 28.2' to 28.4', increased silt.	
30	SS 16	38	4-5-6-9 (11)			Bentonite Grout
	SS 17	75	3-4-8-22 (12)		33.5 644.5	
					34.0 Brown SILTY SAND (SM), dry to moist, loose to medium dense, fine grained, moderately sorted, little fine to coarse subrounded gravel. 644.0	
35	SS 18	75	12-22-31-38 (53)		Light Brown GRAVELLY SAND (SPG), dry to moist , medium dense to dense, medium grained, subrounded, well sorted, fine to coarse subrounded gravel.	
	SS 19	88	11-17-31-40 (48)			
	SS 20	88	10-24-29-47 (53)			
40	SS 21	96	19-27-33-45 (60)			2-Inch Solid PVC Riser
			10-17-15-			

(Continued Next Page)

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WELL NUMBER MW1510 (P-1)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 22	79	22 (32)		43.5 / 634.5 Light Brown SANDY GRAVEL (GWS), dry to moist, medium dense, fine, subrounded, medium grained sand.	
45	SS 23	83	5-3-13-23 (16)		44.5 / 633.5 Below 44', coarse gravel. 45.5 / 632.5 Brown SILT (ML), moist to wet, soft, trace mica.	
	SS 24	83	10-9-17-22 (26)		46.0 / 632.0 Light Brown SAND (SW), dry to moist, medium dense, medium grained, subangular to subrounded, well sorted. 47.0 / 631.0 Light Brown GRAVELLY SAND (SPG), dry to moist, loose to medium dense, subangular to subrounded, medium to coarse grained, modertaley sorted, fine to coarse gravel. 47.4 / 630.6 Brown SILT (ML), moist, firm, bedded, trace mica.	
50	SS 25	83	7-11-12-17 (23)		49.0 / 629.0 Light Brown GRAVELLY SAND (SPG), dry to moist, loose to medium dense, subangular to subrounded, medium to coarse grained, modertaley sorted, fine to coarse gravel. Light Brown SAND (SW), dry, medium dense, medium grained, subrounded to subangular, well sorted, bedded, trace fine subrounded gravel.	
	SS 26	88	6-5-9-29 (14)		51.2 / 626.8 Brown SILT (ML), moist, firm, trace mica. 51.6 / 626.4 Light Brown SAND (SW), dry, medium dense, medium grained, subrounded to subangular, well sorted, bedded, trace fine subrounded gravel.	Bentonite Grout
	SS 27	88	6-3-15-22 (18)		52.5 / 625.5 Brown SILT (ML), moist to wet, firm, trace mica. 53.0 / 625.0 Brown SAND (SW), moist to wet, medium dense, medium to coarse grained, subrounded, moderately sorted, trace fine subrounded gravel.	Bentonite Pellets
55	SS 28	83	9-12-16-25 (28)		54.3 / 623.8 Brown GRAVELLY SAND (SPG), moist, loose to medium dense, fine to medium grained, subrounded, moderately sorted. 55.0 / 623.0 Gray SANDY GRAVEL (GWS), wet, medium dense, fine to coarse, subrounded, coarse grained sand.	2-Inch Solid PVC Riser
	SS 29	92	7-14-17-18 (31)		57.0 / 621.0 Brown SAND (SW), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, few fine gravel.	
	SS 30	88	10-8-9-13 (17)		58.0 / 620.0 Gray SANDY GRAVEL (GWS), wet, medium dense, fine, subrounded, coarse sand. 59.0 / 619.0 Brown SAND (SW), wet, medium dense, medium grained, subrounded, well sorted. 59.5 / 618.5	
60					60.2 / 617.8 Brown SILT (ML), wet, firm, trace mica.	#5 Filter Sand
	SS 31	100	8-10-12-26 (22)		60.5 / 617.5 Gray SAND (SW), wet, loose, fine to coarse grained, poorly sorted, subrounded, trace subrounded gravel. 60.8 / 617.3 Brown SILT (ML), wet, firm, trace mica. Brown SAND (SW), wet, medium dense, medium to coarse grained, subrounded, moderately sorted.	
	SS 32	100	15-8-13-14 (21)			2-Inch, 0.010-Inch Slotted Screen
65	SS 33	100	12-7-7-10 (14)		64.7 / 613.3 65.0 / 613.0 Gray SANDY GRAVEL (SPG), wet, loose, subrounded, coarse grained sand, gradational contact.	

(Continued Next Page)

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WELL NUMBER MW1510 (P-1)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 34	67	7-6-13-22 (19)		Brown SAND (SW), wet, loose to medium dense, medium grained, subrounded, well sorted. *(continued)*	
	SS 35	75	10-12-14-23 (26)		Below 68', trace coarse subrounded gravel.	
70	SS 36	83	10-14-16-18 (30)		71.0 607.0	
	SS 37	83	9-14-23-37 (37)		Brown GRAVELLY SAND (SWG), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, fine subrounded gravel. Below 73', increased silt.	2-Inch, 0.010-Inch Slotted Screen
					74.0 604.0	
75	SS 38	75	7-18-23-35 (41)		74.4 Dark Brown SILTY GRAVEL (GM), wet, loose, fine, subrounded. 603.6	
	SS 39	63	31-33-23-17 (56)		Brown GRAVELLY SAND (SWG), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, fine subrounded gravel. Below 76', trace coal.	
80	SS 40	96	14-17-20-28 (37)			#5 Filter Sand
	SS 41	79	16-19-18-21 (37)			
	SS 42	87	14-18-22-50/5"		82' to 84', coarse gravel, sandstone fragments.	
85	SS 43	71	24-15-10-15 (25)		86.0 592.0	
	SS 44	71	11-12-16-24 (28)		Gray SAND (SW), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, trace subrounded gravel. Below 88', brown to gray.	

(Continued Next Page)

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WELL NUMBER MW1510 (P-1)

CLIENT American Electric Power **PROJECT NAME** Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416 **PROJECT LOCATION** Bottom Ash Pond, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 45	54	10-7-11-15 (18)		Gray SAND (SW), wet, medium dense, medium to coarse grained, subrounded, moderately sorted, trace subrounded gravel. *(continued)*	
90						
	SS 46	75	11-8-12-21 (20)		90' to 91', brown, medium to coarse grained.	
					91' to 92', brown, medium to coarse grained.	
	SS 47	92	12-12-19-26 (31)		Below 92', medium grained, well sorted.	
					94' to 94.5', coarse grained.	
95	SS 48	83	32-11-11-23 (22)		94.5' to 94.75', few silt.	
	SS 49	100	20-14-19-31 (33)		96' to 98', medium grained, well sorted, trace subrounded gravel.	
	SS 50	100	20-15-22-34 (37)		98' to 101', grades to fine to medium grained, some silt lens.	
100						
	SS 51	100	16-28-50/5"		101.0 577.0	
					Gray SANDSTONE (BEDROCK), wet, hard, very fine grained.	
	SS 52	0	50/4"		102.4 575.6	
					Bottom of hole at 102.4 feet	
					Boring grouted to surface and monitoring well installed on 11/12/2015 in offset boring.	

APPENDIX C

WELL DEVELOPMENT FIELD FORMS

WELL DEVELOPMENT FORM

MW-1504

Well # ~~BAP-1 OF~~

Diameter (in): 2

Initial Static DTW (ft): 70.69

Total Depth (ft): 96.98 surv

Casing Volume (g): 4.47

Date: 10/22/15 - 10/23/15

Developed By: ~~Folleth~~ Stainless steel

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 20

Well Volumes Removed: 4.47

	Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
10/22/15	1330	Init	—	—	—	>1000	70.69	Begin Bail from Bottom, Surge w/ Bailer
	1405	5	—	—	—	>1000	71.07	Silt & fine sand in purge water
	1445	10	—	—	—	>1000	71.07	End Bail TD = 97.26. Silt & fine sand in Purge water
10/23/15	1040	10	—	—	—	>1000	70.72	TD = 97.26, begin Bail & Surge from Bottom
	1120	15	—	—	—	>1000	71.02	Silt & fine sand in purge water
	1152	20	—	—	—	>1000	71.03	TD = 97.42 End Bail

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WELL DEVELOPMENT FORM

MW-1504

Well #~~MW-1501 DA~~

Diameter (in): 2

Initial Static DTW (ft): 70.48

Total Depth (ft): 97.32

Casing Volume (g): 4.38

Date: 12/8/15 - 12/9/15

Developed By: Chelsea Fleming / Dave Follett

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 667.5

Well Volumes Removed: ~152.40

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
12/8/15 1420	Initial	7.21	15.9	1565	>1000	70.48	Pump On Rate 1.5 GPM Pump set at 92'
1500	45	7.10	16.1	1259	117	70.68	Pump set at 88'
1600	135	7.06	15.9	1236	30.0	70.70	Pump set at 89'
1640	195	7.07	15.8	1225	64.9	70.74	Pump off
12/9/15 0815	195	7.13	15.1	1241	>1000	70.51	Pump on, Rate 1.5 GPM, Pump set at 91'
0845	240	7.14	15.0	1259	170	70.69	Rate 2.0 GPM
0930	307.5	7.14	14.6	1203	31.9	70.65	set pump @ 88'
0950	337.5	7.23	14.5	1215	12.7	70.65	set pump to 87'
1030	397.5	7.29	14.4	1220	11.2	70.65	set pump to 86'
1110	457.5	7.28	14.3	1230	9.1	70.65	set pump to 85'
1140	502.5	7.29	14.2	1245	25.2	70.65	set pump to 84'
1320	652.5	7.20	14.3	1250	11.1	70.65	Set pump to 87'
1325	660.0	7.18	14.3	1245	8.1	70.65	
1330	667.5	7.22	14.3	1240	9.7	70.65	pump off
		7			~~8.8~~		

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* See MW-8 12-9-15 for cal info

x See P-2 12-8-15 for cal. info

WELL DEVELOPMENT FORM

MW-1505

Well # ~~MW-1502~~ OA

Diameter (in): 2

Initial Static DTW (ft): 69.67

Total Depth (ft): 98.29

Casing Volume (g): 4.87

Cal
pH: 4.01 = 4.01
7.0 = 7.00
10.01 = 10.01
1413 µs = 1413 µs
100 mV = 9.5 mV

Date: 12/7/15

Developed By: Follett

Purge Method: ~~Disposable Bailer~~ / Grundfos

Total Gallons Removed: ~~585.0~~ 765.0

Well Volumes Removed: ~~120.2~~ 157.1

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
0928	22.5	6.96	18.3	1862	>1000	69.67	Pump In / Pump On Rate 1.5 gal/min
0943	22.5	6.96	18.6	2020	601	69.68	Surge A / Pump
0958	45.0	-	-	-	-	-	Pump Off
1041	45.0	7.00	18.3	1839	>1000	69.75	Pump On Rate 1.5 gal/min Pump top of Screen
1056	67.5	7.00	18.9	1885	927	69.87	
1126	112.5	7.00	18.8	1995	378	69.81	Rate 1.25 gal/min
1140	130.0	-	-	-	-	-	Pump placed middle of Screen / Pump Off
1240	130.0	7.10	18.6	1994	>1000	~~71.69~~ 69.81	Grundfos Pump Installed, Pump on 1.25 GPM
1310	167.5	6.99	19.4	1981	382	69.81	Rate 1.75 GPM Pump set @ 90' TOC
1400	255.0	7.12	19.3	1987	332	69.84	Rate 2.0 GPM Pump set @ 93' TOC
1430	315.0	7.04	19.3	1994	590	69.87	Pump set at 86' TOC
1445	345.0	7.05	19.5	2010	>1000	69.87	
1500	405.0	7.04	19.8	1996	35	69.87	Pump set at 90'
1515	465.0	7.06	20.0	2000	>1000	69.87	
1530	525.0	7.04	19.7	2000	258	69.87	Pump set at 93'
1545	585.0	7.05	19.8	2000	>1000	69.87	

WELL DEVELOPMENT FORM

Well # MW-1505 ~~MW-1502~~ DP

Diameter (in): 2

Initial Static DTW (ft): 69.67

Total Depth (ft): 98.29

Casing Volume (g): 4.87

Date: 12/7/15

Developed By: Follett

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 765.0

Well Volumes Removed: 157.1

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
1600	645.0	7.04	19.9	2010	379	69.88	Pump @ 90' TOC
1615	705.0	7.04	19.9	1996	617	69.88	Pump set @ 85' TOC
1630	765.0	7.05	19.8	1995	736	69.88	Pump off

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WELL DEVELOPMENT FORM

Well # ~~BAP-2 DP~~ MW-1505

Diameter (in): 2

Initial Static DTW (ft): 69.88

Total Depth (ft): 97.77 soft

Casing Volume (g): 4.74

Date: 10/30/15

Developed By: ~~Follett~~

Purge Method: Stainless Steel Disposable Bailer / Grundfos

Total Gallons Removed: 20

Well Volumes Removed: 4.22

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
10/30/15 0900	Init	—	—	—	>1000	69.88	Beg Bail from Bottom/Surge w/ Bailer
0928	5	—	—	—	>1000	70.45	Silt & Fine Sand in Purge, end Bail
1153	5	—	—	—	>1000	69.91	Beg Bail from Bottom, Surge w/ Bailer
1226	10	—	—	—	>1000	70.14	Silt & Fine Sand in Purge
1253	15	—	—	—	>1000	70.08	" "
1320	20	—	—	—	>1000	70.05	End Bail

12-7-15 Calibration @ 0845

pH: 7.00 = 7.06
4.00 = 4.00
10.00 = 10.10
Specond: 1413 = 1415
Turb: 20.00 = 19.00

WELL DEVELOPMENT FORM

MW-1506
Well # ~~MW-1503~~ DA

Diameter (in): 2
Initial Static DTW (ft): 70.02
Total Depth (ft): 99.02
Casing Volume (g): 4.93

29 x 0.17 = 4.93

Date: 12/7/15
Developed By: Chelsea Fleming
Purge Method: Disposable Bailer / Grundfos / Hurricane
Total Gallons Removed: 505
Well Volumes Removed: ~~~154~~ ~102.43

Time	Gallons Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
0925	Initial	7.58	17.0	1860	>1000	70.02	surged pump 1.25 gpm
0929	5.00	7.21	19.9	2400	>1000	70.13	
0934	10.00	7.16	19.3	1845	>1000	"	
0939	15.00	7.14	19.9	1754	>1000	"	
0944	20.00	7.15	20.0	1828	>1000	"	
0949	25.00	7.16	20.0	1840	>1000	"	pump stopped working; changed meter
~~1000~~ 1020	~~30.00~~ ~~40.00~~	4.70	18.0	15.3	>1000	"	start pump again 1.00 gpm
1043	48.00	7.01	18.8	1819	533	"	
1055	60.00	7.03	18.6	2050	219	"	surge pump
1110	75.00	7.10	18.3	1818	87.0	"	surge pump
1125	90.00	7.12	18.9	2300	78.5	"	"
1140	105.00	7.13	18.9	1789	377	"	
1200	125.00	7.12	19.1	1787	20.8	"	
1220	165.00	7.12	18.8	1788	14.88	"	
1300	185.00	7.12	18.9	1791	7.88	"	remove Monsoon pump / install grundfos
1320	185.00	7.12	18.9	1800	>1000	"	

WELL DEVELOPMENT FORM

Well # MW-1506 ~~MW-1503~~ DP

Diameter (in): 2

Initial Static DTW (ft): 70.02

Total Depth (ft): 99.02

Casing Volume (g): 4.93

29 x 0.17 = 4.93

Date: 12-7-15

Developed By: Chris Glenn

Purge Method: Disposable Bailer / Grundfos ~~Hurricane~~

Total Gallons Removed: 505

Well Volumes Removed: ~102.43

Gallons

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
1355	220	7.14	19.8	1780	31.2	70.13	
1410	235	7.14	19.9	1798	54.7	"	changed to 2 gallons
1420	255	7.11	19.8	1815	~~5~~540	"	
1450	315	7.14	19.8	1816	671	"	moved pump down 5'
1505	345	7.14	20.0	1791	281	"	
1525	385	7.14	20.0	1791	11.80	"	moved pump down 5'
1540	415	7.13	20.1	1793	>1000	"	lower pump 5'
1600	455	7.16	20.1	1787	196	"	
1610	475	7.14	20.1	1790	17.38	"	
1625	505	7.11	20.2	1791	16.99	"	pump off

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WELL DEVELOPMENT FORM

Well # ~~BAP-3~~ MW-1506

Diameter (in): 2

Initial Static DTW (ft): 70.23

Total Depth (ft): 98.11 soft

Casing Volume (g): 4.74

Date: 10/26/15 - 11/5/15

Developed By: Follett

Purge Method: ~~Stainless Steel~~ Disposable Bailer / Grundfos

Total Gallons Removed: 20

Well Volumes Removed: 4.22

	Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
10/26/15	1205	Intal	—	—	—	>1000	70.23	Begin Bail from Bottom, Surge w/ Bailer
	1256	5	—	—	—	>1000	70.51	Silt & Sand in Purge Water
	1325	10	—	—	—	>1000	70.64	End Bail TD = 99.07
11/5/15	1115	10	—	—	—	>1000	70.24	TD = 99.06, Begin Bail from Bottom
	1142	15	—	—	—	>1000	70.51	
	1214	20	—	—	—	>1000	70.50	TD = 99.08, End Bail

WELL DEVELOPMENT FORM

Well # ~~BAR-4~~ MW-1507

Diameter (in): 2

Initial Static DTW (ft): 70.91

Total Depth (ft): 97.17 soft

Casing Volume (g): 4.46

Date: 11/6/15

Developed By: Follett

Purge Method: ~~Stainless Steel~~ Disposable Bailer / Grundfos

Total Gallons Removed: 20

Well Volumes Removed: 4.48

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
11/6/15 0825	Initial	—	—	—	>1000	70.91	Begin Bail From Bottom, Surge w/ Bailer
0900	5	—	—	—	>1000	71.15	
0944	10	—	—	—	>1000	71.08	
1017	15	—	—	—	>1000	71.06	
1051	20	—	—	—	>1000	71.03	End Bail TD= 97.77

WELL DEVELOPMENT FORM

Well # ~~B~~ or MW-1507 ~~MW-1504~~

Diameter (in): 2

Initial Static DTW (ft): 70.69

Total Depth (ft): 97.78

Casing Volume (g): 4.42

97.78 end TD

Date: 12/8/15

Developed By: Chelsea Fleming / Dave Fillett

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 342.5

Well Volumes Removed: ~ 77.49

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
0870	Initial	6.87	17.6	2370	>1000	70.69	Pump on Rate 1.0 GPM
0840	10	7.04	18.2	2470	~~284~~ >1000	70.69	
0900	30	7.08	17.9	2390	>1000	70.69	
0910	40	7.05	18.0	2506	207	70.69	move pump up 5'
0930	60	7.06	18.1	2400	>1000	70.69	
0950	80	7.11	18.7	~~2490~~	370	7069	Pump off
1020	80	7.17	18.7	2460	586	70.69	Pump on, Rate 1.0 GPM
1100	120	7.08	18.3	2520	>1000	70.69	move pump down 5'
1135	155	7.07	18.4	2620	>1000	70.69	move pump down 5' (TOP 90.60)
1145	165	7.01	18.6	2620	187	70.69	turned pump up to 1.5 gpm
1225	225	7.03	18.4	2560	>1000	70.69	Move pump to 86'
1300	277.5	7.06	18.5	2580	43.9	70.69	
1315	300.0	7.04	18.5	2580	29.2	70.69	
1320	0327.5	7.07	18.6	2590	22.1	70.69	
1325	335	7.08	18.6	2590	21.9	70.69	
1330	342.5	7.06	18.6	2580	20.8	70.69	pump off

See P-2 for Cal. Info

WELL DEVELOPMENT FORM

Well # ~~BAR 5.DF~~ MW-1508

Diameter (in): 2

Initial Static DTW (ft): 61.57

Total Depth (ft): 87.78 s.d.t

Casing Volume (g): 4.46

Date: 10/22/15 - 11/11/15

Developed By: Follett

Purge Method: ~~Stainless Steel~~ Disposable Bailer / Grundfos

Total Gallons Removed: 70

Well Volumes Removed: 6.73

	Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
10/22/15	1530	Init.	—	—	—	>1000	61.57	Begin Bail From Bottom / Surge w/ Bailer
	1602	5	—	—	—	>1000	62.31	Fine Sand & Silt in Purge water
	1627	10	—	—	—	>1000	62.29	TD=89.12 End Bail
10/23/15	1222	10	—	—	—	>1000	61.57	TD=89.05 Begin Bail & Surge From Bottom
	1254	15	—	—	—	>1000	62.05	Fine Sand & Silt in purge water
	1321	20	—	—	—	>1000	62.07	TD=89.92 End Bail
11/11/15	1427	20	—	—	—	>1000	61.61	TD=89.82, Begin Bail From Bottom
	1455	25	—	—	—	>1000	62.03	
	1521	30	—	—	—	>1000	62.09	TD=89.95 End Bail

WELL DEVELOPMENT FORM

Well # ~~MW-1505DA~~ MW-1508

Diameter (in): 2

Initial Static DTW (ft): 61.34

Total Depth (ft): 89.85

Casing Volume (g): 4.65

Date: 12/8/15

Developed By: Follett

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 806.25

Well Volumes Removed: ~17339

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
0913	Init.	7.12	15.1	1959	71000	61.34	Pump On Rate 1.5 GPM, Pump set at 80'
0935	27.0	7.11	15.1	1481	159	61.70	Pump set at 78'
1000	64.5	7.18	14.9	1503	91.5	61.70	Pump set at 73' Rate 2.25 GPM
1045	165.75	7.15	14.6	1499	154	61.82	Pump set at 81'
1145	300.75	7.16	14.7	1499	~~15~~ 32.2	61.75	Pump set at 85'
1245	435.0	7.13	15.3	1524	27.0	61.85	Pump set at 86'
1305	480.0	7.16	15.3	1534	44.1	61.89	Pump set at 85'
1405	615.0	7.11	15.8	1515	85.8	61.89	Pump set at 80'
1440	693.75	7.14	15.4	1548	26.0	61.89	Pump set at 75'
1520	783.75	7.06	15.4	1516	43.5	61.89	
1525	795.0	7.06	15.4	1523	33.0	61.89	
1530	806.25	7.05	15.4	1527	23.8	61.89	Pump off
~~1600DF~~							

* See P-2 12-8-15 for cal info

WELL DEVELOPMENT FORM

Well # ~~R-20~~ P-1

Diameter (in): 2

Initial Static DTW (ft): 56.34

Total Depth (ft): 84.25

Casing Volume (g): 4.55

Date: 12/8/15 - 12-9-15

Developed By: Chelsea Fleming / Dave Follett

Purge Method: Disposable Bailer / Grundfos

Total Gallons Removed: 552.5

Well Volumes Removed: ~121.43

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
1115	Total	7.09	12.6	1874	>1000	56.34	Start Bail / Surge from Bottom
1130	5.0	7.09	12.4	1765	>1000	56.70	End Bail, TD = 84.75'
12/9/15 0755	5.0	7.04	14.2	1866	>1000	56.40	Pump Set at 80.6' Rate 1.5GPM
0825	50.0	7.06	14.3	1885	30.5	56.62	Set pump at 79.0'
0855	95.0	7.08	14.5	1901	9.44	56.59	Set Pump at 78'
0915	110.0	7.06	14.3	1865	11.8	56.60	Set pump to 77'
0940	147.5	7.21	14.4	1850	16.8	56.60	set pump to 76'
1010	192.5	7.23	14.3	1840	4.2	56.61	set pump to 75'
1040	237.5	7.24	14.3	1846	3.7	56.60	set pump to 74'
1120	297.5	7.26	14.3	1880	3.6	56.60	set pump to 73'
1200	357.5	7.22	14.4	1888	4.9	56.60	set pump to 72'
1235	410	7.18	14.3	1890	5.1	56.60	set pump to 71'
1315	470	7.18	14.4	1880	5.3	56.60	set pump to 67'
1400	537.5	7.19	14.4	1900	5.7	56.60	
1405	545	7.16	14.4	1888	6.9	56.60	
1410	552.5	7.18	14.3	1880	4.7	56.60	pump off

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~~* See R-2 12-8~~

See MW-8 12-9-15 for calibration

WELL DEVELOPMENT FORM

Well # P-2
Diameter (in): 2
Initial Static DTW (ft): 70.58
Total Depth (ft): 97.74
Casing Volume (g): 4.62

Date: 11/11/15
Developed By: Kolhoff
Purge Method: ~~Stainless Steel~~ Disposable Bailer / Grundfos
Total Gallons Removed: 20
Well Volumes Removed: 4.33

	Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
11/11/15	1155	Total	—	—	—	>1000	70.58	Begin Bail from Bottom
	1226	5	—	—	—	>1000	70.90	Fine silt & sand in Bailer
	1257	10	—	—	—	>1000	70.75	" "
	1330	15	—	—	—	>1000	70.71	" "
	1401	20	—	—	—	>1000	70.68	TD=97.82 End Bail

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WELL DEVELOPMENT FORM

Cal
pH 4.01 = 4.01
7.0 = 7.0
10.01 = 10.01
1413 us = 1413 us
10.0 ntu = 10.5 ntu

Well # P-2
Diameter (in): 2
Initial Static DTW (ft): 70.35
Total Depth (ft): 97.80
Casing Volume (g): 4.47

Date: 12/8/15
Developed By: Dave Follett / Chelsea Fleury
Purge Method: Disposable Bailer / Grundfos
Total Gallons Removed: 411.5
Well Volumes Removed: 92.06

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
816	Init.	6.89	16.9	2420	>1000	70.35	Pump on Grundfos Rate 1.0 GPM
0840	24	7.05	18.4	2390	867	70.35	Pump set at 90'
0855	39	7.11	18.3	2510	363	70.35	
0915	59	7.12	18.6	2480	168	70.35	move pump up 5 ft
0930	74	7.10	18.7	2510	>1000	70.35	
0945	89	7.07	17.9	2520	560	70.35	
1015	119	7.08	18.5	2180	154	70.40	Pump set at 80' Rate 1.5 GPM
1055	~~135~~ 179	7.04	18.7	2390	>1000	70.40	move pump down ~~85~~ 83'
1125	224	7.10	18.3	2400	>1000	70.40	move pump down ~~80~~ 88'
1220	306.5	7.10	18.3	2410	840	70.40	~~Move 89.9'~~ move pump to 89.75 (TOP)
1300	366.5	6.87	18.3	2220	252	70.40	
1310	381.5	7.11	18.1	2250	153	70.40	
1320	396.5	7.10	18.1	2280	118	70.40	
1325	411.5	7.11	18.1	2290	65.8	70.40	Pump off TD = 97.80'

WELL DEVELOPMENT FORM

Well # MW-8
Diameter (in): 2
Initial Static DTW (ft): 39.35
Total Depth (ft): 62.27
Casing Volume (g): 3.70

Date: 12-8/9-15
Developed By: Chelsea Fleming / Dave Follett
Purge Method: Disposable Bailer / Grundfos
Total Gallons Removed: 354
Well Volumes Removed: ~95.68

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
12-8-15							
1215	Initial	7.02	14.3	2360	>1000	39.35	Begin Bail Dave Bailer
1230	4.0	7.04	14.3	2310	>1000	39.40	End Bail TD=62.27
1405	4.0	7.09	15.9	2870	>1000	39.70	install pump; start purge @ 1 gpm @ 55.85' TOP
1410	9.00	7.08	15.9	2930	>1000	39.70	
1415	14.00	7.07	15.9	2980	467	39.70	
1425	24.00	7.09	16.1	2780	146	39.70	
1435	34.00	7.08	16.0	2609	96.2	39.70	surged well
1495	44.00	7.00	16.3	2780	12.01	~~39.70~~	~~surged well~~ switched to 1.5 gpm
1500	66.5	7.00	16.3	2900	20.0	~~39.70~~	surged well
1515	89.00	7.08	16.3	2980	24.8	~~39.70~~	~~surged well~~
1530	111.5	7.06	16.3	2940	691.00	~~39.70~~	surged well
1600	156.5	7.07	16.3	2890	120.1	~~39.70~~	
1625	194	7.08	16.1	2890	34.1	~~39.70~~	well started pumping @ 1 gallon per min
1635	204	7.04	16.3	2840	2.70	~~39.70~~	1.5 gpm
~~1650~~ 12-9-15	226.5	7.06	16.1	2880	1.89	40.45	end purge
0750	226.5	7.20	15.6	2900	273	40.12	start purge @ 1.5 gpm

¥ see P-2 12-8-15 for cal. info

12-9-15 calibration info:
pH: 7.00 = 7.06
4.00 = 4.04
10.00 = 10.13
Spec Cond: 1413 = 1420
turb: 20.00 = 19.88

WELL DEVELOPMENT FORM

Well # MW-8
Diameter (in): 2
Initial Static DTW (ft): 39.35
Total Depth (ft): 102.27
Casing Volume (g): 3.70

Date: 12-8-15 / 12-9-15
Developed By: Chelsea Flemy / Dave Folleth
Purge Method: Disposable Bailer / Grundfos
Total Gallons Removed: 354
Well Volumes Removed: ~95.68

Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
12-9-15							
0820	271.5	6.98	15.6	2900	2.41	40.21	1.5 gpm
0840	301.5	7.01	15.4	2890	2.14	40.21	
0900	331.5	7.04	15.3	2900	1.17	40.21	
0905	339	7.01	15.3	2860	0.97	40.21	
0910	346.5	7.01	15.3	2870	0.63	40.21	
0915	354.0	7.02	15.3	2860	0.59	40.21	pump off

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* See p-2 12-8-15 for cal info