

MW-1508 Well # An - 7505 DP Diameter (in): 61. Initial Static DTW (ft): Total Depth (ft): Casing Volume (g):

Date: 12/8//5 Developed By: -53/14-14 Purge Method: Disposable Bailer /Grundfos Total Gallons Removed: 806.25 Well Volumes Removed: 733

Time	Purged	рН	(°C)	(uS)	Turb.	DTW	Comments
0913	IHU	7.12	15.1	1959	71000	61.34	Punpon Rate 1.5 GPM, punp set at 80
035	27.0	7.11	15.	148	159	61.70	Punpset at 78
1000	64.5	7.18	14.9	1503	91.5	61.20	Punpset at 73' Role 2.25 6.PM
<u>645</u>	165.75	2.15	14.6	1499	154	61.82	
1175	360.75	7.16	14.7	1499	15 32.3		Punp set at 85
1245	435.0	7.13	[5.3	1327		61.85	Punp set al 85
1305	480.0	7.16	15.7	1574	44.1	61.89	Punp set at 85
1405	015.0	7.1(15.8	1515		61.89	Punp set ut 80
1440	693.75	7.14	[5.4	1248			Pupset +75"
1520	763.75	30.5	15.4	1516		61.89	
1525	795.0	7-06	15,4	1523	37.0	61.89	
1530	806.25	7.05	15.4	1527	2.3.8	61.59	Punp off
16-000F						· · ·	
- and the second							

X See P-2 12.8-15 For calinfo

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Well # Diameter (in): Initial Static DTW (ft): Total Depth (ft): Casing Volume (g):

Date: R 8 15 - 12-9-15 Developed By: <u>Chelses Flewing</u> Dave Follett Purge Method: <u>Disposable Bailer</u> / Grundlo 552.5 Total Gallons Removed: -121.43 Well Volumes Removed:

	Time	Purged	рĦ	([*] C)	(uS)	Turb.	DTW	Comments
	1115	Intia	7.09	12.6	1871	21000	S6.34	
	130	5.0	7.09	17.4	1765	71000	56.70	End Beil, TD = 84.75
12/9/15	0755	5.0	7.04	14.2	1860	71060	56.40	Punp Set at 80.6' Rate 1.5GPM
	0825	50.0	7.06	14.3	1885	30.5	56.62	Set pup at 79.0
	0855	95.0	7.08	4.5	170	9.44	56.59	Set Purp at 78".
	0915	110.0	7.06	14.3	1865	11.8	56.60	Set mind to 77'
2	0940	147.5	J.91	14.4	1850	16.8	56.60	set pump to Fis
	1 <u>0</u> i0	192.5	7.23	14.3	1840	4.7	56.61	
	1040	237.5	7.24	14.3	1846	3.7	56.60	set une to 74
	1120	297.5	7.26	14,3	1830	3.6	56.60	
÷.	1300	357.5	3.32	14.4	1888	4.9	56.60	setting to Fd
	1235	410	3.18	14.3	1890	5.1	56.61	set pump to 71
	1315	470	7.18	14.4	1880	5.3	56.60	set pring to 67
	1400	537.5	3,19	14.4	1900	5.7	56.60	1 '
	1405	545	316	14.4	1338	6. <u>9</u>	56.60	2
	1410	5535	7.18	14.3	1880	4.2	56.60	punp off

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P3 Admér Strative DocumentsURandy FormsWell Development Form Rev Black -----



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: 45 1/0-1	
Purge Method: Disposable	Bailery Grundfos
Total Gallons Removed:	20
Well Volumes Removed:	4.33

[Time	Purged	pH	(°C)	(uS)	Turb.	DTW	Comments
11/11/5	155	Intal				71000	70.58	Boyin Boil from Bottom Fine sigt & section Boiler
	1996	5				71000	70,90	Fine silt & sel in Boiler
	12571	10	-	-		71000	70.75	NV //
	1330	15	-		-	71000	70.71	× 7/
	140T	20	-			71000	70.68	TD=97.82 E-0 Bcil
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Well # P-2 Diameter (in): Initial Static DTW (ft): Total Depth (ft): Casing Volume (g): PH 401=401 7.0=7.0 10.01=10.61 1417as 1417as 10.01+=10.5 ntu

Date: 12/8/15	
Developed By: Dave F	lett LChelse Flem
Purge Method:Disposabl	e Bailer Grundlos
Total Gallons Removed:	411.5
Well Volumes Removed:	92.06

Time	Purged	pН	(°C)	(uS)	Turb.	DTW	Comments
816	Intel	6.89	16.9	2120	71000		Punpon Grufos Rule 1.0 GPM
0840	24	7.05	18.4	2390	Ri Z	70.75	Pupper of gor
0355	39	7:11	18.3	2510	363	70.35	•
0915	59	3.12	18.6	3480	168	70.35	molepunp up 5 FL
0930	74	7.10	18.7	2510	>1000	70.35	
0945	89	7.07	17.9	2520		70.35	
1015	119.	7.03	18.5	2180	154	70.40	Pungsot at 80- Rite 1.56PM
1055	13179	7.04	18.7	2390	71000	70.40	Move pump down 25 33 0
1125	22.4	7.10	13.3	JUYEL	71000	70.40	mying suns plus new 88
1 3-30	306.5	7.10	18.3	2.410	8:1.00	70.40	110 F 9 9 10 More 10 10 89.75 (10P)
1300	2665	687	183	2.220	35.7	10.70	por
1340	38.5	7.11	18.	2250	153	70.40	18 ·
1320	796.5	7-10	<u> 8.</u> 8.	2280	118	70.40	
1325	411.5	7.11	18.	2290	85.8	70.40	Punpot TD = 97.80
			_	N		**	

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Well # Mh--8 Diameter (in): 34.35 Initial Static DTW (ft): Total Depth (ft): Casing Volume (g):

89.00

111.5

156.5

194

204

2.11.5

126.5

1515

1530

1600

1625

11.34

1650

0750

Date: 12-8/9-15 Developed By: Chelse Flemmy Dave Fillett Purge Method: Disposable Bailer / Grundfos 354 Total Gallons Removed: ~45.68 Well Volumes Removed:

pize lof2

1	Time	Purged	pН	(⁶ C)	(uS)	Turb.	DTW	Γ
12-8-15-	1215 1	ZA.ul	7.22	14.3	2360	71000	39.35	
	1230	4.0	7.04	14.3	2310	1000	39.40	
	1405	4.0	7.09	15.9	2870	7 1000	39.40	
	1410	9.00	7.08	159	2930	71000	31.70	
	1415	14.00	3.02	15.9	2980	467	39.70	
	1424	3.4.00	7.04	16.1	2 ? 80	146	39.70	
	1435	34.00	7.08	16.0	2409	96,2	39.20	-
	1445	44.00	7.00	162.3	3780	12.01	42:15,70	
	1500	106.5	7.00	16.3	2900	Ac.U	34:70	

7.08

7.06

7.07

7.08

7.04

7.06

7.20

16.3

16.3

16.3

16.1

16.3

15.6

la.

2980

2440

1890

1890

2840

2880

2400

24.8

1091,00

120.1

34.1

1.70

1.39

123

12-9-15

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34. HU

24.7

03470

40.45

40.12

¥ See P-2 12-8:5 for calinto

12-9-15 calibration info: FH: 7.00=7.06 4.00=4.04 Spec Cond : 61 Annansirative Buddhenistianay Forms Well Development Form Rev 9.3/0 tub: 20.00 = 19.83 10 00- 10.13

Comments

install pump; start purse e 16 pm (255.55 Tep)

switched to 1.5 yrm

5 gam

allow per met

Bejin Lal Then Butter End Bcit TD=62.27

surgedupl

Screed mell

Sirgent

1,5 60m

AUX42

End AUFER

Start

Stread_

page 20fz



.

Well# MW-8	
Diameter (in):	3
Initial Static DTW (ft):	39.35
Total Depth (ft):	<u>ind. 37</u>
Casing Volume (g):	3.70

12-9-15

Date: 12-8-15/12-9-15 Developed By: Chalse Floms/Dave Fallott Purge Method: Disposable Bailer / Grundfos Total Gallons Removed:354Well Volumes Removed:\$-95.68

Time	Purged	pН	(°C)	(uS)	Turb.	DTW	Comments
0820	371.5	6.98	15.00	2900	2.41	40.21	1.5 gain
0840	301.5	2.01	15.4	2890	2.14	40.71	
6 900	331.5	7.04	15.3	2900	1.17	40.21	
0905	339	701	15.3	2360	0.92	40.71	
0910	34Ka 5	7.04	19.3	1370	0.63	16-21	
0915	354.0	7.02	15.3	2500	0.59	40.71	fine all
							$\mathbf{h} = \mathbf{f}$

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¥ See p-2 12-8-15 fir cal info

CCR GROUNDWATER MONITORING SYSTEM DEMONSTRATION

MITCHELL LANDFILL MITCHELL POWER GENERATION PLANT MARSHALL COUNTY, WEST VIRGINIA

Prepared For: KENTUCKY POWER COMPANY d/b/a AMERICAN ELECTRIC POWER, INC. COLUMBUS, OHIO

Prepared By: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. CINCINNATI, OHIO

CEC Project 110-416

MARCH 2016



Civil & Environmental Consultants, Inc.

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1.0 OBJECTIVE

This report has been prepared for Kentucky Power Company d/b/a American Electric Power, Inc. (AEP) to demonstrate that the Mitchell Landfill, a Coal Combustion Residuals (CCR) Unit by definition of the United States Environmental Protection Agency (USEPA) 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 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 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 Flue Gas Desulfurization (FGD) gypsum. CCRs that are not beneficially used, primarily fly ash, are disposed of at an off plant site CCR Unit identified as the Mitchell Landfill, which is a solid waste landfill that is owned and operated by KPC. Mitchell Landfill is classified as a Class F Industrial Landfill Facility by the West Virginia Department of Environmental Protection (WVDEP) Division of Water and Waste Management (DWWM). The landfill was designed, permitted and operates in accordance with the WV Code of State Rules, Title 33, Series 1-Solid Waste Management Rule (33CSR1) and a Solid Waste/National Pollutant Discharge Elimination System (SW/NPDES) Permit that was approved by the WVDEP on May 29, 2013 (Permit No. WV0116742). In addition, the WVDEP issued a State 401 Water Quality Certification (No. 12011) on January 10, 2013 and the United States Army Corps of Engineers (USACE) issued a Clean Water Act Section 404 permit (No. 2011-1499) on February 25, 2013. These permits provide the regulatory authority to impact aquatic resources including wetlands, streams and a pond.

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

2.1 CCR UNIT LOCATION

Mitchell Landfill 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 approximate location of Mitchell Landfill is depicted on Figure 1 – Site Location Map and Figure 2 – Plant and CCR Unit Location Map. The center of Mitchell Landfill is located at the following coordinates:

- Latitude: 39 degrees 49 minutes 37 seconds North
- Longitude: 80 degrees 46 minutes 32 seconds West

2.2 DESCRIPTION OF CCR UNIT

Mitchell Landfill provides a maximum disposal capacity of about 10 million cubic yards of excess CCR produced from the Mitchell Power Generating Plant that is not beneficially reused.

The overall landfill boundary comprises about 169.6 acres with CCR being placed within a footprint of 57.6 acres (the CCR Unit disposal area is depicted on Figure 2 – Plant and CCR Unit Location Map). The landfill will be operated in 5 Phases with Phases 1 through 4 completing the maximum CCR Unit disposal footprint and Phase 5 comprising CCR placement atop the first four phases. Figure 3 – CCR Unit and Monitoring Wells, depicts the approximate boundary of the 5 Phases. Each phase of the landfill has an estimated design life that varies from about 4 to 8 years. The expected life of the landfill is 24 years, based on the current estimated average yearly CCR production rates and beneficial use quantities.

In addition to the CCR disposal footprint, the CCR Unit includes several appurtenant structures that include: 1) a perimeter haul road; 2) a leachate storage pond; 3) three stormwater ponds (identified as South, West and North Ponds); and, 4) a Maintenance Building. Figure 3 - CCR Unit and Monitoring Wells, depicts the CCR Unit boundary, the landfill disposal footprint and the appurtenant structures.

2.2.1 Engineering Systems

The landfill was designed and constructed to protect the environment in accordance with the WVDEP Class F Industrial Landfill requirements. To meet these requirements, Mitchell Landfill includes several engineering controls which consist of: 1) a groundwater interceptor drainage system; 2) a composite liner system; 3) a leachate collection system; and, 4) a surface water management system. These engineering systems are summarized below.

2.2.1.1 Groundwater Interceptor Drainage System

The groundwater interceptor drainage system for the landfill is a combination of pipes and aggregate drains that collect and direct groundwater from beneath the liner system to a discharge point beyond the landfill limits. This system is designed to accommodate natural groundwater volumes and the potential increased groundwater volume that may result from future hydrostatic conditions associated with future pool level increases for the Conner Run Impoundment, owned by Coal Consolidation Company and operated by Murray Energy, that is positioned in the adjacent valley west of the landfill.

2.2.1.2 Composite Liner System

An impermeable barrier is constructed at the base of the Mitchell Landfill CCR Unit that is protective of groundwater and complies with the applicable WVDEP performance standards for a Class F Industrial Landfill Facility. The bottom elevations of the impermeable barrier/composite liner provide the required separation from bedrock, the seasonal high water table and the uppermost significant aquifer.

The composite liner system is comprised of the following (from top to bottom):

- 30-mil PVC geomembrane;
- Geosynthetic Clay Liner (GCL);
- A minimum 6-inch thick layer of compacted subbase soil; and,
- Structural fill or isolation soil as needed to provide the minimum separation from groundwater and bedrock.

2.2.1.3 Leachate Collection System

Mitchell Landfill has been constructed to include a leachate collection system that conveys leachate collected above the composite liner system via gravity flow to a lift station that pumps the leachate to a storage pond (denoted as the Leachate Storage Pond) via a force main. Stormwater runoff from within active landfill areas is directed to the leachate collection layer within the landfill via vertical aggregate drains (denoted as chimney drains). The leachate collection layer conveys both stormwater from the chimney drains and leachate that seeps through the CCR placed in the landfill and transports the combined flow to the lift station. The leachate collection system is designed to maintain a leachate head on the composite liner system of one-foot or less. The locations of the lift station and Leachate Storage Pond are identified on Figure 3 - CCR Unit and Monitoring Wells.

The leachate collection system within the waste placement limits (leachate collection layer) consists of the following:

- Geocomposite Drainage Net (GDN) covers the entire bottom of the landfill and is constructed directly above the composite liner system;
- Granular Drainage Layer non-carbonate, open graded, aggregate material constructed to a depth of 18-inches across the bottom of the landfill within the main valley axis; and,
- Leachate Collection Pipes perforated HDPE pipes, surrounded by non-calcareous coarse aggregate and nonwoven, needle-punched geotextile, are constructed within the Granular Drainage Layer. These leachate collection pipes convey leachate collected at the base of the landfill to the lift station via gravity drainage, which is then pumped (via a force main) to the Leachate Storage Pond.

Leachate collected and transferred to the Leachate Storage Pond is beneficially reused for dust suppression within landfill waste limits, moisture conditioning of fly ash during compaction procedures or moisture conditioning at the fly ash silo storage facility. Any leachate that is not beneficially reused is transported to the Mitchell Plant Wastewater Treatment Bottom Ash Pond Complex for treatment prior to discharge into the Ohio River.

2.2.1.4 Surface Water Management System

Management of surface water that is not in contact with CCR placed in the landfill is accomplished by collection and conveyance of runoff to three stormwater detention basins: 1) South Pond; 2) West Pond; and, 3) North Pond. The South and West Ponds are utilized through all phases of the landfill life and the North Pond is utilized in Phase 3 through Phase 5. The three ponds are depicted on Figure 3 – CCR Unit and Monitoring Wells.

Site runoff generated from both un-stabilized and stabilized constructed areas (i.e., construction areas, stockpiles, temporary landfill cover and permanent landfill cover) is conveyed to the ponds via drainage channels and pipes. The collection, conveyance and ponds are designed to meet the required criteria in the referenced WVDEP regulations. The stormwater conveyed to the ponds is detained and released through a non-clogging dewatering skimmer device that allows settling of suspended solids and evacuation of the stored volume of water within a seven to eight day period.

2.2.2 Construction and Operational History

2.2.2.1 Landfill Construction

Construction of Mitchell Landfill was initiated in 2013 and Phases 1A, 1B, 2A and 2B have been completed. The landfill construction was performed in accordance with the SW/NPDES Permit (May 29, 2013), the construction drawings, technical specifications and the Quality Assurance and Quality Control Plan. Certification Reports were prepared and submitted to WVDEP in 2014 and 2015 that provide confirmation and documentation that the construction was performed in accordance with the design and permit requirements.

Construction of Phase 3 is tentatively scheduled to begin in 2018.

2.2.2.2 Landfill Operations

Mitchell Landfill began operation in July 2014 and is currently receiving CCRs from Mitchell Power Generation Plant. Landfill operations, construction and monitoring are being performed in accordance with the SW/NPDES Permit.

2.2.2.3 Groundwater Monitoring

The initial groundwater monitoring well network at Mitchell Landfill was installed in 2011 and consisted of 12 wells. Figure 3 – CCR Unit and Monitoring Wells identifies the original monitoring well network with MW1100X well names. Background groundwater quality monitoring for the 2011 wells began in February 2012 and was completed in December 2014. Sampling and analysis procedures for the background sampling program followed the Field Sampling and Analysis Plan (FSAP), dated February 2012. Operational groundwater monitoring

is conducted semi-annually in accordance with the WVDEP SW/NPDES permit requirements. Groundwater quality results are statistical analyzed as part of each semi-annual groundwater monitoring event and included as part of the Operating Record. Five additional groundwater monitoring wells were installed in a southern area of the landfill facility in July 2015 to represent downgradient monitoring positions in the Rush Run Sandstone and Fish Creek Sandstone units. The approximate locations of the additional monitoring wells are depicted on Figure 3 – CCR Unit and Monitoring Wells and are denoted by MW1500X well names. Background sampling from these additional wells will be completed by October 2017 per 40 CFR §257.94. Additional information describing the Mitchell Landfill groundwater monitoring network is provided in Sections 3.1.1.7 and 3.1.1.8.

2.3 SUPPORTING INVESTIGATIONS AND DOCUMENTS

CEC has reviewed the following documents for evaluation of compliance with the CCR GMS:

- SW/NPDES Permit Application, Mitchell Landfill, Mitchell Plant, Cresap, West Virginia, Prepared for American Electric Power, Prepared by Civil & Environmental Consultants, Inc., CEC Project 110-416, April 12, 2012.
- SW/NPDES Permit Number WV0116742, May 29, 2013. West Virginia Department of Environmental Protection, 601 57th Street, Charleston, West Virginia 25304.
- Hydrogeologic and Geotechnical Subsurface Investigation Report, Mitchell Landfill, Marshall County, West Virginia, Prepared for American Electric Power, Prepared By Civil & Environmental Consultants, February 2012.
- Field Sampling and Analysis Plan, American Electric Power, Proposed Mitchell Landfill, Moundsville, West Virginia, Prepared for American Electric Power, 1 Riverside Drive, Columbus, Ohio, Prepared by Civil & Environmental Consultants, Inc., Cincinnati, Ohio, CEC Project 110-416, February 2012.
- Background Groundwater Monitoring Report, Mitchell Landfill, Mitchell Electric Generating Plant, Marshall County, West Virginia, Prepared for American Electric Power, Prepared By Civil & Environmental Consultants, Inc., February 2014.
- Kentucky Power Company, Mitchell Plant Landfill, SW/NPDES Permit No. WV0116742, Semi-Annual Groundwater Sampling Event. Letter report to Scott Mandirola, Director, Division of Water and Waste Management, West Virginia Department of Environmental Protection, 601 57th Street, Charleston, West Virginia 25304, October 23, 2015.
- Mine Subsidence Analysis, Mitchell Landfill, Marshall County, West Virginia, Report to American Electric Power, 1 Riverside Plaza, Columbus, Ohio 43215, Prepared by Civil & Environmental Consultants, Inc., 4274 Glendale Milford Road, Cincinnati, Ohio 45242, CEC Project 110-416-2000, February 2012.

• Operating Record, Mitchell Landfill, Mitchell Plant, Cresap, West Virginia, Prepared for AEP, Kentucky Power, Prepared by AEP Environmental Services, Land Environment & Remediation Services, August 2014.

In addition to review of the documents above, hydrogeologic information was considered from the completion of three additional core borings and the installation of five additional monitoring wells at the Mitchell Landfill in June and July 2015 (refer to Section 2.2.2.3). CEC provided oversight services to AEP for the 2015 drilling and well installation project. The wells were installed to improve the landfill monitoring well network by providing additional monitoring locations downgradient of the limits of waste in the Rush Run Sandstone and Fish Creek Sandstone units. The 2015 core borings include B-1501, B-1502 and B-1503 installed at the locations shown on Figure 3 – CCR Unit and Monitoring Wells in the southern landfill area. Nested Rush Run Sandstone and Fish Creek Sandstone is incised and not present at the B-1502 boring location; thus, only a Rush Run Sandstone monitoring well was installed at B-1502. Monitoring well boring logs and well as-built information for both the 2011 and 2015 well installation projects are provided in Appendix A. Additional information describing the current Mitchell Landfill groundwater monitoring network is provided in Section 3.1.1.7.

2.4 HYDROGEOLOGIC SETTING

A site-specific subsurface investigation was conducted in the area of the Mitchell Landfill to support the Class F Industrial Landfill Facility Application, submitted and approved by WVDEP, as well as to support the various engineering analyses and design of the landfill. The hydrogeologic and geotechnical subsurface investigation was completed to meet the requirements of 33CSR1, subsection 3.8 of Rule 33-1-3 Solid Waste Facility Permitting Requirements. The corresponding summary report is identified as the Hydrogeologic and Geotechnical Subsurface Investigation Report (HGSIR), Mitchell Landfill, dated February 2012.

The purpose of the subsurface investigation was to characterize the in-situ soil and bedrock types and properties, as well as determine the hydrogeologic features and conditions within the planned landfill limits. The investigation was comprised of site reconnaissance, soil and rock borings, test pits, monitoring well installation and development, geophysical logging, pressure packer testing, in-situ hydraulic conductivity testing and laboratory testing of selected soil and rock samples. The information developed from the field and laboratory programs associated with the subsurface investigation provided the basis for conclusions regarding the subsurface soil and bedrock profile characterizations, the hydrogeologic evaluation and geotechnical engineering properties associated with the in-situ soils/bedrock, recompacted borrow soils and CCR materials. Subsurface boring information from the supplemental monitoring well borings B-1501, B-1502, and, B-1503 confirmed previous hydrogeologic data contained in the HGSIR as summarized in Section 3.1.1.

2.4.1 Climate

Climatic data for Mitchell Landfill is summarized as follows:

Average monthly temperature											
Jan./July	Feb./Aug.	March/Sep.	April/Oct.	May/Nov.	June/Dec.						
(degrees F)	(degrees F)	(degrees F)	(degrees F)	(degrees F)	(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						
	A	verage month	ly precipitatio	n							
Jan./July (inches) 2.86	Feb./Aug. (inches) 2.40	March/Sep. (inches) 3.58	April/Oct. (inches) 3.28	May/Nov. (inches) 3.54	June/Dec. (inches) 3.30						
3.83	3.31	2.80	2.49	2.34	2.57						
		Evapotrar	ispiration								
Jan./July	Feb./Aug.	March/Sep.	April/Oct.	May/Nov.	June/Dec.						
(inches)	(inches)	(inches)	(inches)	(inches)	(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 Geology

The Mitchell Landfill site lies within the regional geologic area of West Virginia known as the Appalachian Plateau Province. This region comprises the western two-thirds of the state and is characterized by relatively flat-lying bedrock containing minable coal seams. 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. Based on the Geologic Map of West Virginia (WVGES Publication: Map 25A), the bedrock in Marshall County predominantly consists of Permian age sedimentary bedrock composed of a cyclic sequences of sandstone, siltstone, claystone, shale, limestone and coal. 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 bedrock units mapped within the vicinity of Mitchell Landfill are of Pennsylvanian/Permian age Dunkard, Monongahela and Conemaugh Groups.

The Mitchell Landfill site is located approximately 3.5 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. Additional regional folds identified on the West Virginia GIS Technical Center website (http://wvgis.wvu.edu/index.php) are present southeast of the landfill site which include the New Martinsville Anticline, the Loudenville Syncline, the Washington Anticline and Nineveh Syncline all striking northeast/southwest.

According the Mine Subsidence Analysis Report (February 2012) included in the Mitchell Landfill Permit Application, the Pittsburgh coal formation rests in an elevation between approximately 420 to 460 feet above mean sea level (amsl). Ground surface elevations at Mitchell Landfill range from approximately 960 to 1,320 feet amsl; therefore, the Pittsburgh coal formation is approximately 500 to 800 feet below the ground surface.

2.4.2.2 Local Geology

The bedrock geology of the site consists of shale, claystone, siltstone, sandstone and occasional limestone and coal deposits of the Permian Age, Dunkard Group, Greene and Washington Formations. The deposits are typical of cyclothemic sedimentation common throughout the region. The predominant lithologies are shale (which accounts for approximately 47 percent) and sandstone plus siltstone (which accounts for 44 percent of the deposits), based on the bedrock encountered in borings drilled to at least 300 feet below ground surface (ft. bgs), or between approximate elevations of 1,228 to 930 amsl. Claystone, coal, limestone and soil make up less than 10 percent of the deposits. This is a much different lithology than that presented by Cross and Schemel (1956) and Barlow (1975) which suggests sandstone as the dominant lithology throughout the Greene Formation.

Site specific geologic cross sections were developed as part of the HGSIR for Mitchell Landfill. Two of these cross sections, Geologic Cross Sections C-C' and D-D', identified on Figure 4 – Geologic Cross Section Location Map, represent the typical hydrogeologic strata and include subsurface information from the additional monitoring well borings completed in June and July 2015. These two cross sections are depicted on Figure 5 – Geologic Cross Section D-D', which extends west to east in the southern site area and Figure 6 – Geologic Cross Section C-C', which extends south to north along the central valley. These cross sections identify that facies changes occur across the landfill site making it difficult to correlate bedrock units. However, a relatively persistent black and dark gray limestone bed and a black shale bed were documented at numerous locations. Therefore, these units are considered to be "marker beds" and are sufficient to identify specific bedrock units. Moreover, several thin coal seams are present which can be used to identify units. Overall, the position of the sandstone units with respect to each other and the approximate elevation of the marker beds shown on Figure 5 – Geologic Cross Section D-D' have been used to identify the bedrock units at the Mitchell Landfill site. While several sandstone units occur across the site, they are not continuous due to the incised topography, as depicted in the referenced cross sections.

Sandstone was described as gray in color, fine to medium grained and micaceous with occasional limestone inclusions. Most of the sandstone was well cemented with calcite cement and on occasion contained calcite filled fractures. The rock was hard and fresh at depth. Some zones contained interbedded sequences of sandstone and shale, or siltstone and shale.

The other predominant bedrock lithology at the site was shale. Shale unit thicknesses range from 1 to 23 feet. Small, less than ¼ inch, pyrite nodules were observed in 10 of the 22 rock cores, occurring 69 percent of the time in shale, followed by siltstone and sandstone. Pyrite occurrence was generally below an elevation of 1,180 feet amsl. Plant fossils were also observed in 15 of the 22 rock cores, occurring in shale units 81 percent of the time, the remainder being observed in siltstone.

The named sandstone units include (from bottom to top): the Hundred Sandstone; the Jollytown Sandstone; the Rush Run Sandstone; the Fish Creek Sandstone; and, the Burton Sandstone. The contacts between the sandstone units generally consist of sharp contacts to underlying dark gray and black shale with coals seams noted in the case of the Hundred and Jollytown Sandstone units. Note that the Hundred and Jollytown Sandstone units are not continuous beneath the Mitchell Landfill site. A black shale marker bed is present near the base of the Fish Creek Sandstone unit.

Based on the marker beds, bedrock appears to dip slightly to the south and southeast. Fracture and joint mapping was conducted on bedrock outcrops within and surrounding the Mitchell Landfill site. Overall, joints and fractures are oriented predominantly to the northeast between 10 and 90 degrees.

No faults were observed at or near the Mitchell Landfill site, nor are faults present according to available geologic information. As noted previously, a series of anticlines and synclines are located as near as 3.5 miles southeast of the site.

2.4.3 Uppermost Significant Aquifer

WV 33CSR1-Definitions(§33-1-2), Subsection 2.135 defines an Uppermost Aquifer to mean "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 permit boundary." Subsection 2.136 defines the Uppermost Significant Aquifer (USA) as "the first, uppermost aquifer encountered that is laterally persistent under the entire site and is free flowing

throughout the year. This defines the aquifer that flows all twelve (12) months of the year and can be encountered under any given point on the permitted site." Based on information developed from site investigations, it has been concluded that the Rush Run Sandstone is the uppermost aquifer which meets the referenced definitions: 1) is below the landfill composite liner system; and, 2) extends laterally beyond the permitted limits of waste. Further, by definition, the Rush Run Sandstone is designated as the USA at Mitchell Landfill, as described in the referenced and approved SW/NPDES Permit issued by WVDEP. This USA designation is based on site-wide occurrence and elevation of the unit. Additional information describing the Rush Run Sandstone is provided in Section 3.1.1.

2.4.4 Surface Water and Surface Water-Groundwater Interactions

Groundwater at the site follows surface topography and bedrock bedding planes where there is a lower permeability rock type, such as a shale underlying a sandstone. Groundwater recharge is along the hilltop ridges and percolates slowly through shallow fractured bedrock into the central valley. Groundwater discharges at meager springs and seeps along the incised channels and the valley walls where bedrock subcrops are typically covered with a veneer of residual soils. Seeps within streambeds were observed during the surface water delineation and additional locations were observed during other site reconnaissance. Locations of these features were mapped using a handheld Global Position System (GPS) unit, or mapped using the site topographic map and surficial features where the GPS could not receive signals (e.g., within steep portions of the valleys). Groundwater discharging as seeps and springs, flows downslope to the unnamed tributary to Fish Creek that is at the base of the incised valley.

2.4.5 Water Users

A private water well and an abandoned hand dug well were located at the 146 Gatts Ridge Road and located within about 300 feet of Mitchell Landfill waste limits. These two wells were sealed by a WV licensed well driller on December 27, 2011 in accordance with the guidelines provided by the Marshall County Health Department. Water Well Abandonment Reports (Well Abandonment Permit No. DW-25-2011-06) were subsequently submitted to the Marshall County Health Department. Therefore, the Mitchell Landfill disposal area is not located within 1,200 feet of any public or private water well supply.

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

Water-bearing units at the Mitchell Landfill site include from deepest to shallowest; the Hundred Sandstone, Rush Run Sandstone, the Fish Creek Sandstone and the shallow bedrock combined with the Burton Sandstone. Shale and claystone beds and minor beds of limestone, are interspersed with the sandstone units and act as confining beds. The Fish Creek Sandstone and the Burton Sandstone are discontinuous, naturally incised sandstones which subcrop along the valley side slopes where they discharge as seeps and minor springs. Groundwater was not encountered in the Burton Sandstone above the Fish Creek Sandstone unit north and northwest of the limits of waste. The Burton Sandstone has been determined to be an inadequate monitoring unit because the unit is not water-bearing upgradient of the landfill and is naturally incised and absent downgradient of the landfill. The Burton Sandstone is not included in monitoring requirements in the WVDEP SW/NPDES Permit (May 29, 2013). Thus, this unit is not applicable for further discussion. The Fish Creek Sandstone extends downgradient of the Mitchell Landfill limits of waste in some areas; however, the unit is dissected along the centerline of the valley within the southern portion of the limits of waste. The Rush Run Sandstone is positioned below the base elevation of the Mitchell Landfill composite liner system and is designated as the USA as described in Section 2.4.3. The Hundred Sandstone is below the Rush Run Sandstone uppermost aquifer and is also naturally incised down valley from the landfill boundary. The Hundred Sandstone is not required to be monitored in compliance with the CCR Rules because it occurs below the designated uppermost aquifer, the Rush Run Sandstone; therefore, this unit will not be discussed further in this report. Additional information describing the Rush Run Sandstone and Fish Creek Sandstone hydrogeologic characteristics area provided below.

The Rush Run Sandstone is laterally persistent at the site but is naturally incised in a localized area down valley of the Mitchell Landfill limits of waste, where the unit subcrops along the

central valley side slopes. The Rush Run Sandstone is a fine to medium grained, gray sandstone. The top elevation of the unit ranges from approximately 1,025 feet amsl to the south and 1,048 feet amsl to the north as shown on Figure 7 – Top of Rush Run Sandstone Contours. The bottom elevation ranges from approximately 1,009 feet amsl to the south and 1,039 feet amsl to the north and dips gently to the south. Figure 8 - Rush Run Sandstone Isopach Contours, depicts the thickness of the unit which ranges from approximately 9 feet to 32 feet. The Rush Run Sandstone at the site is positioned approximately 370 to 400 feet above the downgradient Fish Creek valley bottom; thus, groundwater discharge from the unit occurs at subcrop positions along the incised terrain in the area. Seeps and springs mapped at the Mitchell Landfill site demonstrate this condition. Shale beds above the Rush Run Sandstone provide confining aquitards that separate the unit from the landfill composite liner system. Where the upper confining aguitards have been naturally incised or removed during landfill construction in the southern portion of the central valley, structural fill and geologic isolation material have been constructed which provide the required separation between groundwater and the landfill's composite liner system. Recharge to the Rush Run Sandstone unit occurs along the hilltop ridges in the area and from leakage through the shale aquitards from overlying sandstone aquifers.

The Fish Creek Sandstone, while bisected by the valley at the landfill, has a unit thickness that ranges from 9 to 47 feet. The top elevation of the Fish Creek Sandstone ranges from approximately 1,059 feet amsl to 1,112 feet amsl. The bottom elevation ranges from approximately 1,050 feet amsl to 1,072 feet amsl dipping to the south as shown on Figure 9 – Base of Fish Creek Sandstone Contours. Figure 10 – Fish Creek Sandstone Isopach Contours, depicts the thickness of the unit which ranges from approximately 9 feet to 47 feet. The contact between the Fish Creek Sandstone and underlying deposits is marked by the presence of a dark gray and sometime black, shale occurring between approximately 1,046 and 1,052 feet amsl.

3.1.1.2 Hydraulic Conductivity

Groundwater flow through the Rush Run Sandstone and Fish Creek Sandstone units is primary through secondary porosity (fractures), especially in shallow bedrock and to a lesser extent through primary porosity. Hydraulic conductivity values generally decreased with increasing depth. This pattern of decreasing hydraulic conductivity with depth has been observed in areas where unloading of bedrock by overburden removal results in stress relief fracturing of shallower units creating secondary porosity (e.g., fractures).

A mean K value developed from the pressure packer tests within each sandstone unit was calculated and summarized below:

- Rush Run 7.48 x 10⁻⁸ centimeters per second (cm/sec)
- Fish Creek 1.37×10^{-7} cm/sec

Recovery and rising head/falling head tests were conducted in groundwater monitoring wells. A summary of the geometric means of K for each monitored unit are summarized below:

- Rush Run 1.07×10^{-6} cm/sec
- Fish Creek 1.24×10^{-7} cm/sec

Shale units, which act as aquitards limiting flow between the sandstone units, were determined to have a mean K value of 1.93×10^{-7} cm/sec based on packer tests completed at the site.

3.1.1.3 Groundwater Flow

The following paragraphs provide a general summary of the groundwater flow corresponding to each referenced sandstone unit. Groundwater elevations measured in the Rush Run Sandstone monitoring wells generally decrease from north to south at the Mitchell Landfill site. The base of this sandstone unit is marked by low permeability shale and dips to the south-southwest. Stress relief fracturing in the shallow bedrock within the valley, in conjunction with thin colluvium, provides a preferential pathway for groundwater to discharge into the valley. Based on this information, the groundwater flow direction in the Rush Run Sandstone is likely down slope with respect to local surface topography, as well as down dip on the underlying bedrock. The groundwater flow direction is likely to mimic surface topography; therefore, flowing into the central valley and generally south as depicted on Figure 11 – Rush Run Sandstone Potentiometric Surface Map.

An inward hydraulic gradient (groundwater flow toward the landfill) in the Rush Run Sandstone and overlying bedrock strata, is created by the incised bedrock topography causing groundwater to discharge as seeps and springs along the valley side slopes. The landfill underdrain system, discussed below, has been installed to collect this inward flow and subsequently improve slope stability beneath the landfill liner. Thus, most Rush Run Sandstone monitoring positions at the periphery of the site are positioned upgradient of the landfill. A relatively narrow portion of the Rush Run Sandstone that extends down slope in the central valley is downgradient of Mitchell Landfill.

The Rush Run Sandstone is a low-yield aquifer characterized by groundwater flow primarily through open fractures and joints and secondarily through interstitial pore space in the sandstone matrix. Borings completed at the site indicate that open fractures and joints are sparsely distributed in the bedrock units encountered; thus, monitoring wells installed in the Rush Run Sandstone typically yield meager quantities of groundwater that require low-flow or passive sampling techniques.

Groundwater flow in the Fish Creek Sandstone is likely to be similar to the Rush Run Sandstone where it follows surface topography into the central valley as depicted on Figure 12 – Fish Creek

Sandstone Potentiometric Surface Map. Recharge to the Fish Creek Sandstone is from leakage through the overlying shale and clay units beneath the ridges surrounding the landfill site. A portion of the groundwater likely percolates slowly and deeper into the Rush Run Sandstone.

Groundwater discharge in the landfill area occurs at the Rush Run Sandstone and Fish Creek Sandstone subcrop position in the central valley as springs and seeps along the stream channels and the valley walls. As described in Section 2.2.1.1, Mitchell Landfill is constructed with a groundwater interceptor underdrain system designed to collect seepage along the interbedded sandstone subcrop positions located below structural fill and isolation fill materials that are constructed beneath the landfill composite liner system. The underdrain system provides an engineered, non-mechanical (gravity drained) hydraulic control that assures separation between groundwater and the composite liner system. In the central valley area near the southern limits of waste, the underdrain system collects groundwater from the Rush Run Sandstone and Fish Creek Sandstone subcrops.

Initial water levels collected from Mitchell Landfill monitoring wells may be unreliable due to the low yield nature of most of the wells and may represent inflow of water that was used for pressure testing during well drilling in November and December 2011. Other than the initial two rounds of measurements, the remaining water level data appear to be representative of seasonal variations due to recharge and discharge characteristics at the Mitchell Landfill site. However, two anomalies are noted: 1) the Fish Creek Sandstone well MW1101F where there was a steep decline of approximately 49 feet from elevation 1,106 to 1,056 feet amsl, then a rebound to a relatively stable elevation of approximately 1,094 to 1,082 feet amsl, followed by a steep increase to elevation 1,122 feet amsl in April 2015 and a gentle decline to elevation 1,097 feet amsl as of November 2015; and, 2) the Rush Run Sandstone well MW1102R exhibits a steady increase in groundwater level elevation of approximately 25 feet from June 2012 to September 2013, reaching an elevation of 1054 feet amsl, followed by a decline to elevation 1,030 feet amsl and fluctuations between 1,030 and 1,040 feet amsl since October 2014. Overall, the monitoring well data indicates relatively consistent downward gradients between each of the referenced hydrostratigraphic units at the Mitchell Landfill site. The corresponding hydrographs that present water elevations from wells monitoring the Rush Run Sandstone and Fish Creek Sandstone are presented in Appendix B.

Site specific information collected during the HGSIR completed at the Mitchell Landfill site were used to calculate groundwater flow rates within the two referenced sandstone units. The calculations require median porosity values for each sandstone unit, which were determined from the neutron porosity logs and mean hydraulic conductivity values, which were derived from field testing (pressure packer, slug tests and recovery tests).

The calculated flow rates, in feet per year (ft/yr), are summarized below:

- Rush Run $1.11 \ge 10^{-2}$ feet per year (ft/yr)
- Fish Creek 1.23×10^{-2} ft/yr

3.1.1.4 CCR Rule Definition of Uppermost Aquifer

The CCR Rule definition of the Uppermost Aquifer (UA) 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.

The CCR Rule definition of the UA is equivalent to the WV CSR definition (presented in Section 2.4.3). However, the WV CSR definition of the USA more specifically includes the laterally persistence characteristic, which is applicable to upland, naturally incised sandstone aquifers that occur at Mitchell Landfill. To comply with the GMS requirements in 40 CFR §257.91(a)(2), a laterally persistent UA must be monitored in order to accurately represent the quality of groundwater passing the waste boundary of the CCR unit. As further discussed in the following section (Section 3.1.1.5), the USA (Rush Run Sandstone) established for the Mitchell Landfill meets the criteria for being the UA at the site.

3.1.1.5 Identified On-site Uppermost Aquifer

Sandstone aquifers overlying the Rush Run Sandstone are naturally incised and are not laterally persistent below the Mitchell Landfill composite liner system. Therefore, the Rush Run Sandstone was identified in the HGSIR as the USA at Mitchell Landfill and meets the CCR Rule definition of the UA, as discussed above. The Rush Run Sandstone is laterally persistent beneath the Mitchell Landfill composite liner system with the exception of a small, localized area down valley of the Mitchell Landfill limits of waste, where the unit subcrops along the lower side slopes, near the central valley axis. This relatively small incised area does not preclude the availability to monitor the Rush Run Sandstone downgradient of the limits of waste. As depicted on Figure 11 – Rush Run Sandstone Potentiometric Surface Map, supplemental groundwater monitoring wells MW1501, MW1502 and MW1503, were installed in the Rush Run Sandstone downgradient of the Mitchell Landfill in 2015 to meet 40 CFR §257.91 requirements. The Rush Run Sandstone is a low-yield aquifer; thus, monitoring wells installed in the unit typically yield meager quantities of groundwater that require low-flow or passive sampling techniques.

3.1.1.6 Landfill Separation from the Uppermost Aquifer

The base of the Mitchell Landfill composite liner system ranges from 1,290 feet amsl in the northwestern limits to 1,038.5 feet amsl in the southern limits. Seasonal high water elevations in the Rush Run Sandstone correspondingly range from approximately 1,045 feet amsl in the northern and eastern areas to 1,010 feet amsl near the southern limits of waste placement. Separation between the landfill liner system and the top of the UA is provided by natural shale aquitards, or where the shales are incised by the placement of structural fill and geologic isolation material. Furthermore, the Groundwater Interceptor Drain System (refer to Section 2.2.1.1) provides a non-mechanical (gravity) drain at the Rush Run Sandstone subcrop position which serves as hydraulic discharge control in the southern central valley area. This underdrain system provides effective control of the seasonal fluctuations in potentiometric head beneath the composite liner including the UA. Natural shale aquitards, construction of isolation materials and the use of underdrains demonstrate that the base of the composite liner system is constructed greater than 1.52 meters (5 feet) above the Rush Run Sandstone at the Mitchell Landfill as depicted on Figure 13 – Isolation from Uppermost Aquifer Isopach.

3.1.1.7 CCR Groundwater Monitoring System

The Mitchell Landfill WVDEP SW/NPDES permit and CCR GMS groundwater monitoring well locations are shown on Figure 3 – CCR Unit and Monitoring Wells. The Mitchell Landfill CCR GMS includes only wells monitoring the Rush Run Sandstone (UA) and the overlying Fish Creek Sandstone, which were installed during completion of the HGSIR for the WVDEP SW/NPDES permit application and additional wells which were installed in June and July 2015 at downgradient monitoring locations, including three in the Rush Run Sandstone and two in the Fish Creek Sandstone. Table 1 – Summary of Monitoring Well and Piezometer Construction provides monitoring well construction details (2011 and 2015 well installations) and the upgradient and downgradient hydraulic positions relative to the limits of waste. A summary of the Mitchell Landfill CCR GMS, comprised of the Rush Run Sandstone and the overlying Fish Creek Sandstone monitoring wells is provided below:

Rush Run Sandstone Monitoring Wells and Depths/Elevations (measured from ground surface)

- MW1101R: 212 ft. bgs/1006.7 ft. amsl
- MW1102R: 204 ft. bgs/1022.7 ft. amsl
- MW1103R: 198 ft. bgs/1040.1 ft. amsl
- MW1104R: 212 ft. bgs/1016.7 ft. amsl
- MW1501R: 150 ft. bgs/1008.8 ft. amsl
- MW1502R: 33 ft. bgs/1012.2 ft. amsl
- MW1503R: 99 ft. bgs/1009.3 ft. amsl

Fish Creek Sandstone Monitoring Wells and Depths/Elevations (measured from ground surface)

- MW1101F: 169 ft. bgs/1050.0 ft. amsl
- MW1102F: 177 ft. bgs/1049.8 ft. amsl
- MW1103F: 179 ft. bgs/1057.4 ft. amsl
- MW1104F: 172 ft. bgs/1056.5 ft. amsl
- MW1501F: 150 ft. bgs/1052.8 ft. amsl
- MW1503F: 99 ft. bgs/1045.2 ft. amsl

Table 2 – Summary of Monitoring Well Water Levels provides seasonal water level fluctuations in the Mitchell Landfill WVDEP SW/NPDES and CCR GMS monitoring wells between October 30, 2014 and November 4, 2015. The hydraulic position of the Rush Run Sandstone and Fish Creek Sandstone monitoring wells relative to the limits of waste are provided in Figure 11 – Rush Run Sandstone Potentiometric Surface Map and Figure 12 – Fish Creek Sandstone Potentiometric Surface Map, respectively. Hydrographs of the Mitchell Landfill CCR GMS water level data are provided in Appendix B.

3.1.1.8 Background Groundwater Monitoring

At the request of AEP, CEC completed background groundwater monitoring in 2012 and 2013, which included 10 background sampling events from the 12 groundwater monitoring wells installed in 2011 for analytes required by WVDEP. Background monitoring for these wells was completed prior to acceptance of waste at the Mitchell Landfill. The objective of the background groundwater monitoring project was to develop and maintain a laboratory analytical database and perform appropriate groundwater statistical analyses to determine baseline background groundwater quality characteristics for future compliance monitoring of the landfill. Sampling and analysis procedures followed the FSAP. Background groundwater monitoring began in February 2012 and was completed in December 2013. The Mitchell Landfill construction began in November 2012 and began accepting waste in July 2014.

The Mitchell Landfill background groundwater monitoring program consisted of the following activities:

- Collection of 10 rounds of background groundwater samples from the monitoring well network prior to waste placement.
- Review and quality control evaluation of analytical data for the groundwater analytical results.

• Developed preliminary statistical evaluation of the background analytical results, including removal of data for outliers, determination of statistical trends and generation of intra-well prediction limits for the background data.

The Background Groundwater Monitoring Report (BGMR), dated February 2014, provides a summary of groundwater sampling procedures, field sampling data sheets, laboratory analytical results and statistical analyses used to evaluate background groundwater quality at the Mitchell Landfill in compliance with the WVDEP SW/NPDES permit, including the WVDEP groundwater analytical parameter list. Evaluation of the background groundwater quality data and geology of the site resulted in a recommendation for intra-well statistical analysis of future compliance groundwater monitoring data based on the variability (inter-bedding) of the rock types monitored in the monitoring wells, the discontinuous (incised) nature of the bedrock strata and the natural/spatial variation of groundwater quality at the Mitchell Landfill site. Intra-well statistical methods, which compare pre-operational, background groundwater quality data to post-operational, compliance monitoring data from individual monitoring wells, are as representative, or more representative, than that provided by upgradient wells. For the Mitchell Landfill GMS, intra-well statistical evaluation accurately represents the quality of groundwater passing the waste boundary of the CCR unit.

Additional background groundwater quality data, which will include the CCR groundwater analytes in Appendix III and IV, will be collected by October 2017 per 40 CFR §257.94 from the Mitchell GMS. Pre-operational background data are not available for the CCR analytes that are not included in the WVDEP SW/NPDES permit. However, based on the groundwater flow velocities included in Section 3.1.1.3, a potential leachate release from the southern-most limit of Phase 1 will not impact the nearest downgradient monitoring well, MW1502R (located approximately 1,000 feet south of Phase 1), prior to the completion of background monitoring of the Mitchell Landfill GMS by October 2017 per 40 CFR §257.94. Otherwise, there is the option to evaluate background data from downgradient wells using inter-well comparisons for the Rush Run Sandstone.

3.1.2 Compliance With §257.91(a) Through §257.91(c) Requirements

The Mitchell Landfill groundwater monitoring system 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 Landfill CCR unit; 2) accurately represent the quality of groundwater passing the waste boundary of the Mitchell Landfill CCR unit; and, 3) the monitoring well network consists of an appropriate number, spacing and depths of monitoring wells based on 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 Landfill groundwater monitoring system 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 Information Supporting Rule Compliance

AEP is not proposing to install a multiunit 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 Landfill HGSIR describes the site hydrogeologic investigation, monitoring well installation field activities and the design, installation and development of the groundwater monitoring wells installed in 2011. Boring logs and as-built well diagrams for wells installed in 2011 and additional monitoring wells installed in 2015 are provided in Appendix A. Table 1 – Summary of Monitoring Well and Piezometer Construction provides monitoring well construction details (2011 and 2015 well installations) and the upgradient and downgradient hydraulic positions relative to the limits of waste. The Mitchell Landfill FSAP provides detailed sampling and analysis procedures for the collection and analysis of groundwater samples from the Mitchell Landfill GMS. Groundwater analytical parameters, sampling frequency and statistical evaluation procedures are prescribed in the WVDEP SW/NPDES Permit. The Mitchell Landfill BGMR provides sampling procedures, background groundwater monitoring data and initial statistical evaluations that apply to the Mitchell Landfill under the WVDEP SW/NPDES requirements, including the groundwater analytical parameter list. Additional background groundwater monitoring for the CCR analytes in Appendix III and IV will be completed by October 2017 per 40 CFR §257.94.

The Mitchell Landfill HGSIR and BGMR include detailed descriptions of the following investigations completed at the Mitchell Landfill, as summarized below.

Hydrogeologic and Geotechnical Subsurface Investigation Report

- Subsurface Exploration and Sampling Procedures
- Auger Drilling
- Rock Coring
- Test Pit Excavations
- Boring and Test Pit Logs
- Geophysical Logging
- Packer Testing
- Monitoring Well and Piezometer Installation
- Well Development
- Hydraulic Conductivity Testing
- Laboratory Testing
- Classification and Characterization of Subsurface Conditions
- Overburden Soil
- Bedrock
- Bedrock Outcrops
- Geologic Structure
- Hydrogeology
- Hydraulic Conductivity
- Groundwater Flow Direction
- Groundwater Flow Rate
- Surface Water Occurrence and Flow
- Conclusions

Background Groundwater Monitoring Report

- Groundwater Monitoring Network
- Monitoring Well Hydrographs
- Field and Laboratory Analytes
- Sample Collection Procedures

- Sampling Equipment
- Groundwater Purging and Sample Collection
- Documentation of Sampling Activities
- Field and Laboratory Analytical Results
- Statistical Evaluations
- Establishment of Background Data
- Outliers Removed
- Trend Analysis
- Burton Sandstone Trend Analysis
- Fish Creek Sandstone Trend Analysis
- Rush Run Sandstone Trend Analysis
- Hundred Sandstone Trend Analysis
- Intra-well Analysis

The FSAP provides detailed procedures for groundwater sampling and analysis at the Mitchell Landfill, as summarized below.

Field Sampling and Analysis Plan

- Data Quality Objectives Process
- Project Objectives and Intended Data Usage
- Field Parameters
- Laboratory Parameters
- Quality Assurance Objectives for Measurement Data
- Groundwater Sampling Procedures
- Sampling Equipment
- Equipment Calibration
- Decontamination
- Monitoring Well Inspection and Maintenance
- Water Level Monitoring
- Groundwater Sample Collection
- Sample Packaging and Transport
- Chain of Custody Procedures

- Quality Assurance/Quality Control Samples
- Laboratory Analytical Procedures
- Data Reduction, Validation and Reporting

3.3.2 Compliance With §257.91(e) And §257.91(f) Requirements

Mitchell Landfill 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, development and decommissioning of monitoring wells and piezometers and measurement, sampling and analytical devices are well documented in the HGSIR, FSAP, BGMR; and descriptions of additional monitoring wells installed in 2015 are documented in this report.

A CEC Certified Professional Geologist (CPG), under the supervision and direction of the certifying Professional Engineer, has been directly involved with the data collection, site characterization, well installation, and, background groundwater monitoring and has reviewed applicable information in the Operating Record. The information provided in Section 3.3.1 demonstrates that the Mitchell Landfill 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 Landfill 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 Landfill and future expansion phases, meet 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 Landfill, Mitchell Power Generation Plant and the design, construction, operation and maintenance of Mitchell Landfill Groundwater Monitoring System meets the requirements of Section 40 CFR §257.91.

Anthony P. Amicon	199810000 B	10,
Printed Name of Profess	ional Engineer	Mich
Capitory Cu Signature	icon B HA 19206 3/16/16 Sional	
19206	West Virginia	06-23-2011
Registration No.	Registration State	Date

5.0 **BIBLIOGRAPHY**

Background Groundwater Monitoring Report, Mitchell Landfill, Mitchell Electric Generating Plant, Marshall County, West Virginia, Prepared for American Electric Power, Prepared By Civil & Environmental Consultants, Inc., February 2014.

Field Sampling and Analysis Plan, American Electric Power, Proposed Mitchell Landfill, Moundsville, West Virginia, Prepared for American Electric Power, 1 Riverside Drive, Columbus, Ohio, Prepared by Civil & Environmental Consultants, Inc., Cincinnati, Ohio, CEC Project 110-416, February 2012.

"Geology of the Dunkard Group (Upper Pennsylvanian – Lower Permian) in Ohio, West Virginia and Pennsylvania", Bulletin 73, Wayne D. Martin, 1998

Hydrogeologic and Geotechnical Subsurface Investigation Report, Mitchell Landfill, Marshall County, West Virginia, Prepared for American Electric Power, Prepared By Civil & Environmental Consultants, February 2012.

Mine Subsidence Analysis, Mitchell Landfill, Marshall County, West Virginia, Report to American Electric Power, 1 Riverside Plaza, Columbus, Ohio 43215, Prepared by Civil & Environmental Consultants, Inc., 4274 Glendale Milford Road, Cincinnati, Ohio 45242, CEC Project 110-416-2000, February 2012.

"Proceedings of the First I.C. White Memorial symposium, The Age of the Dunkard" James A. Barlow, Editor, 1975

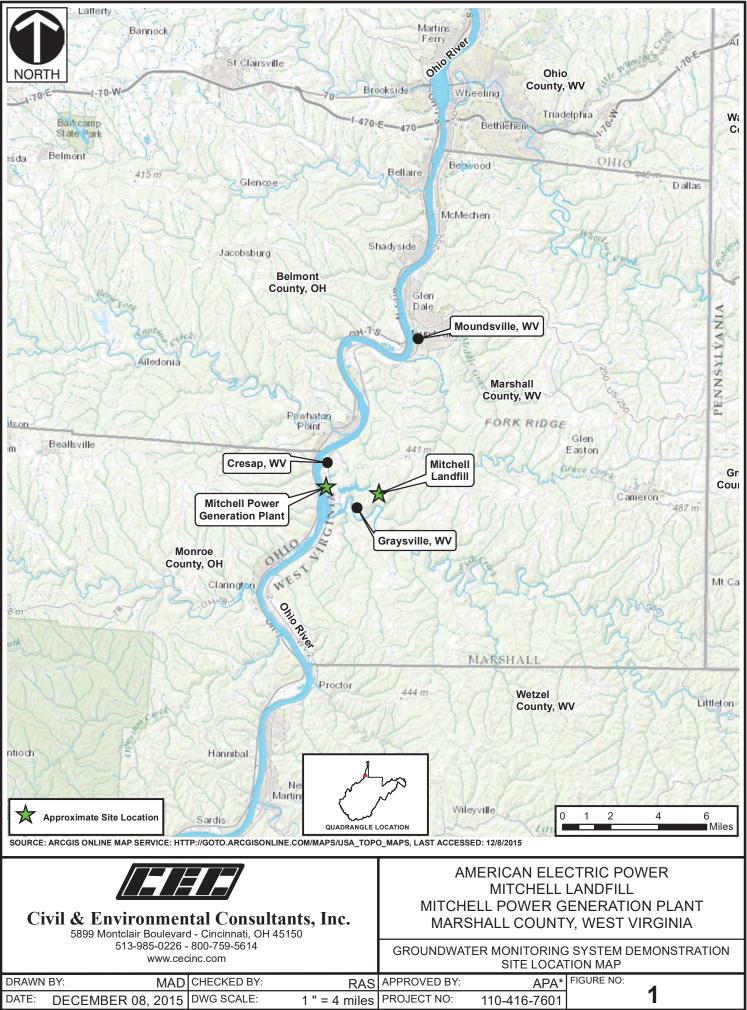
Solid Waste/NPDES Permit Application, Mitchell Landfill, Mitchell Plant, Cresap, West Virginia, Prepared for American Electric Power, Prepared by Civil & Environmental Consultants, Inc., CEC Project 110-416, April 12, 2012.

Solid Waste/NPDES Permit Number WV0116742, May 29, 2013. West Virginia Department of Environmental Protection, 601 57th Street, Charleston, West Virginia 25304.

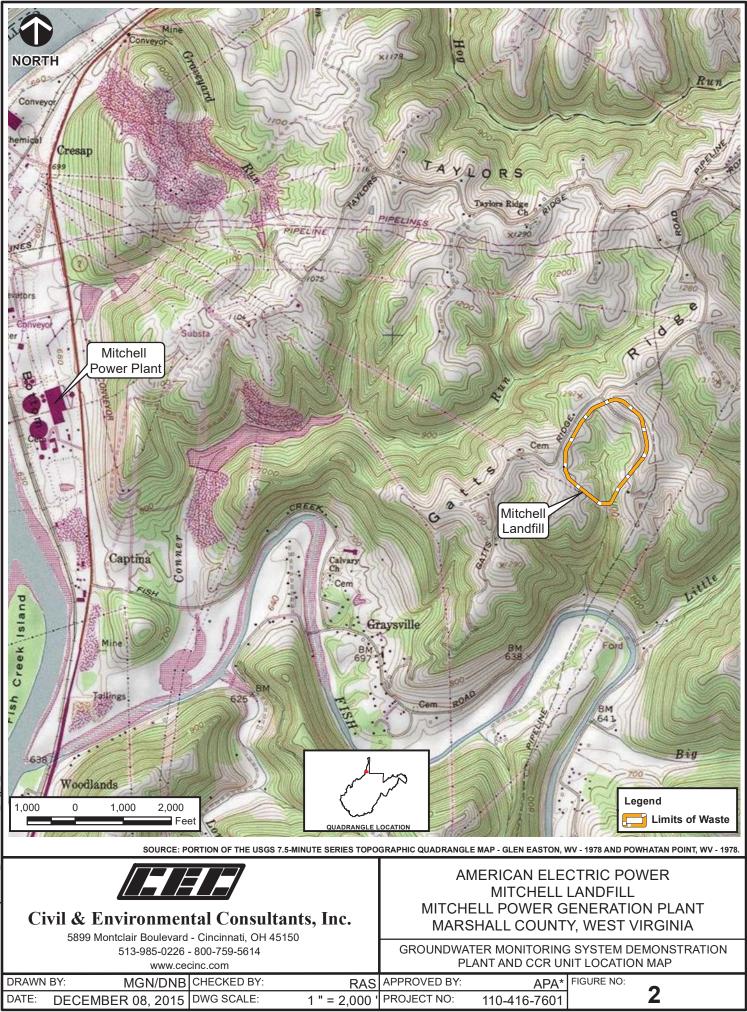
West Virginia Geological Survey, Volume XXII-A, Geology and Economic Resources of the Ohio River Valley in West Virginia, Part I, Geology of the Ohio River Valley in West Virginia", Aurel T. Cross and Mart P. Schemel, 1956

WVGES Publication: Map 25A, West Virginia Geological and Economic Survey Mont Chateau Research Center 1 Mont Chateau Road Morgantown, WV 26508-8079 Phone: (304) 594-2331 Web: www.wvgs.wvnet.edu, Map: Original 1968/1969 map revised, March 2011, Map Date: May 16, 2011

FIGURES

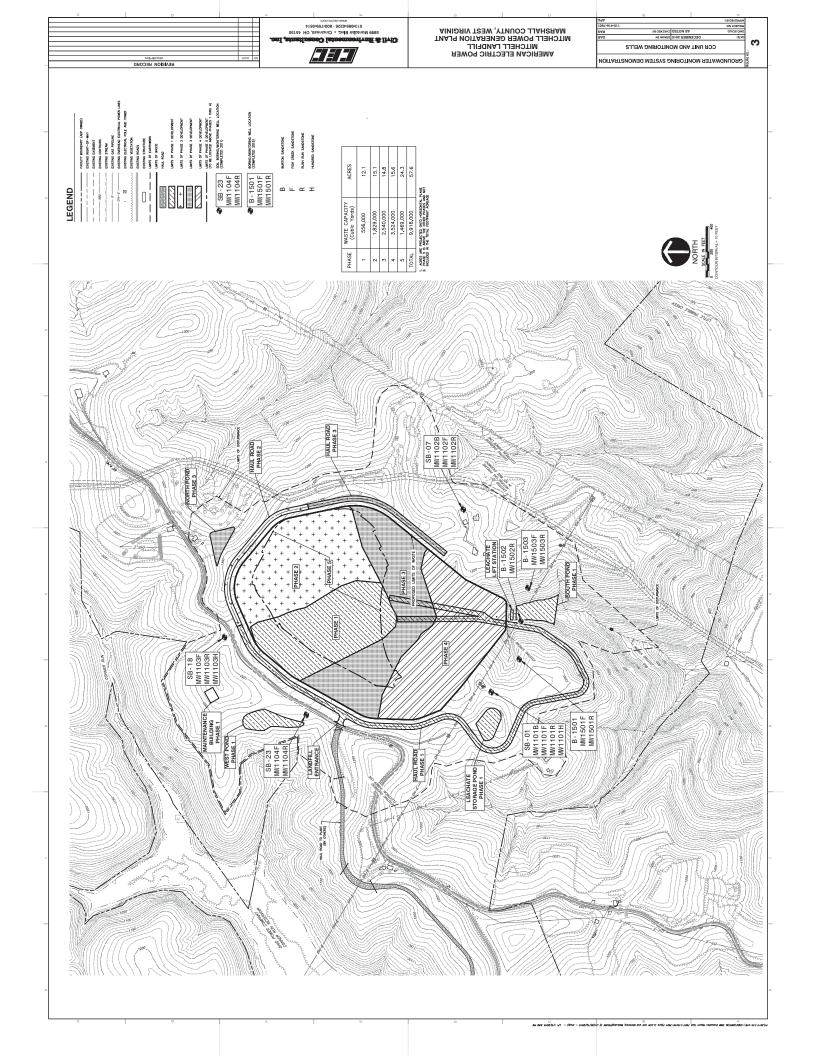


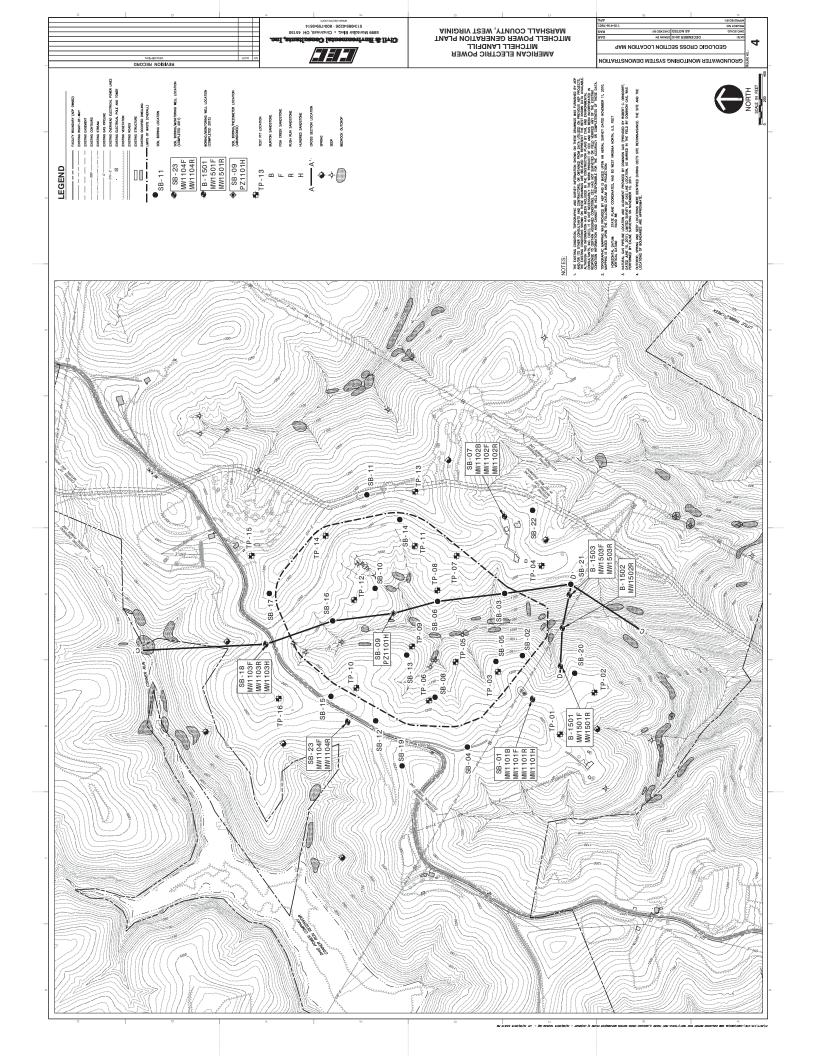
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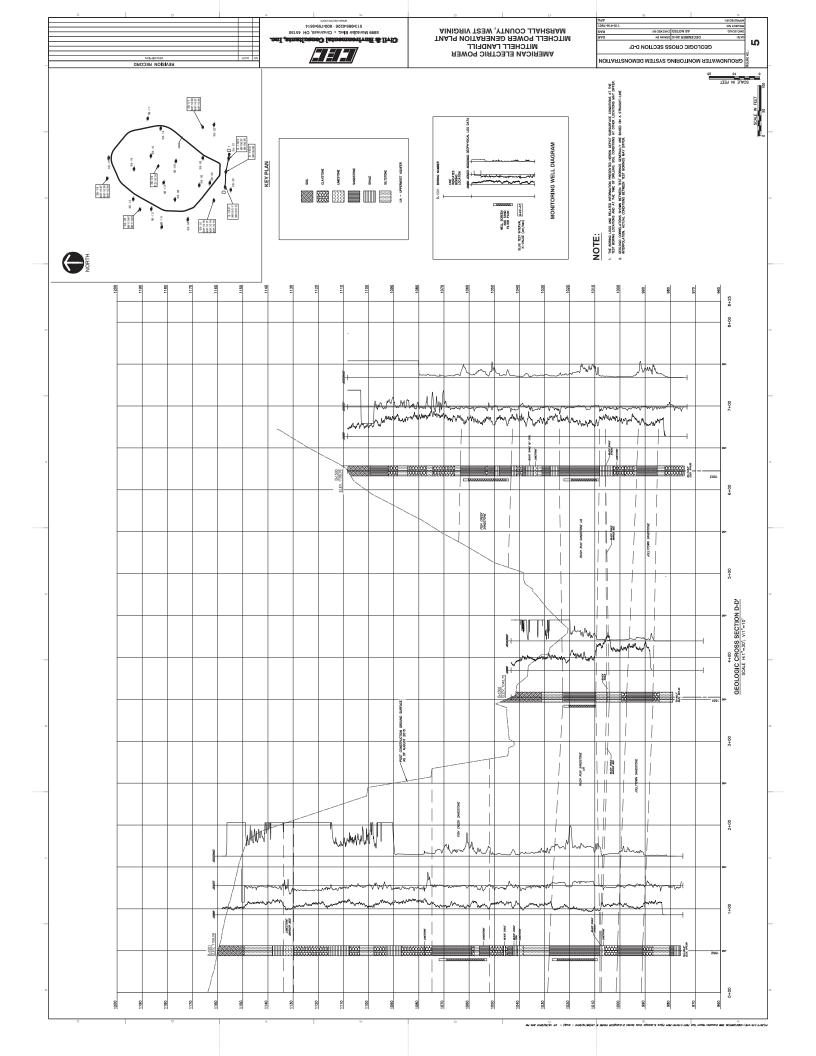


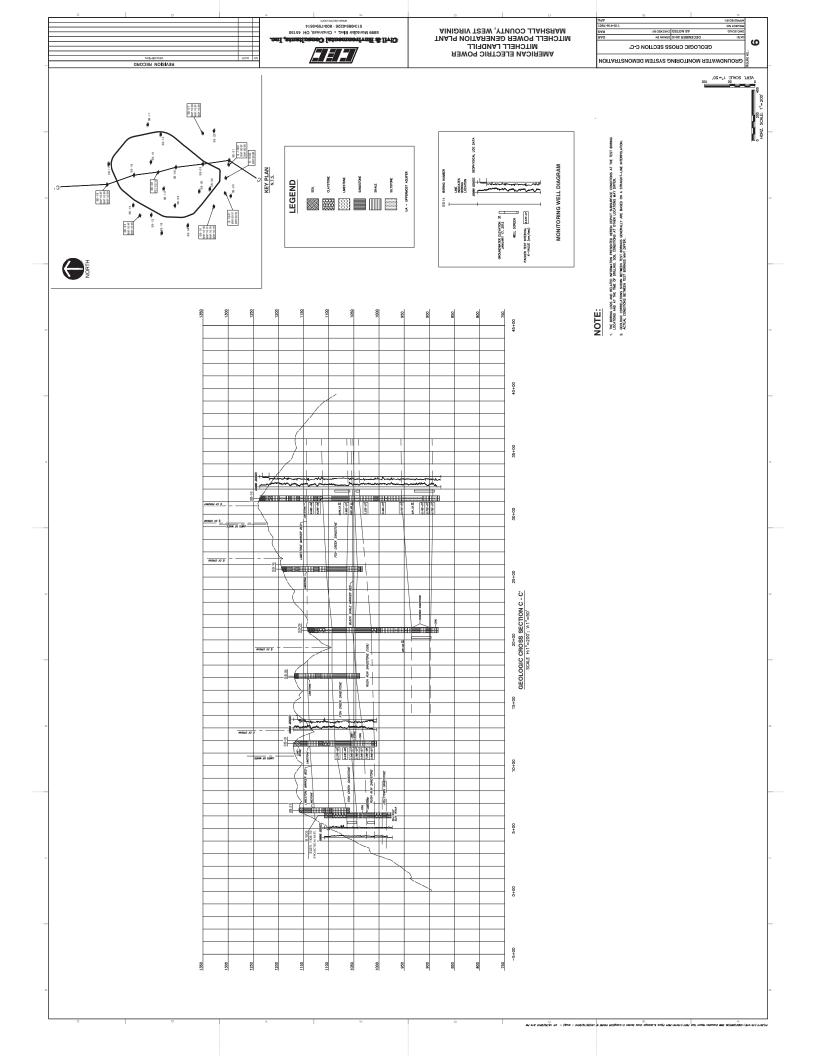
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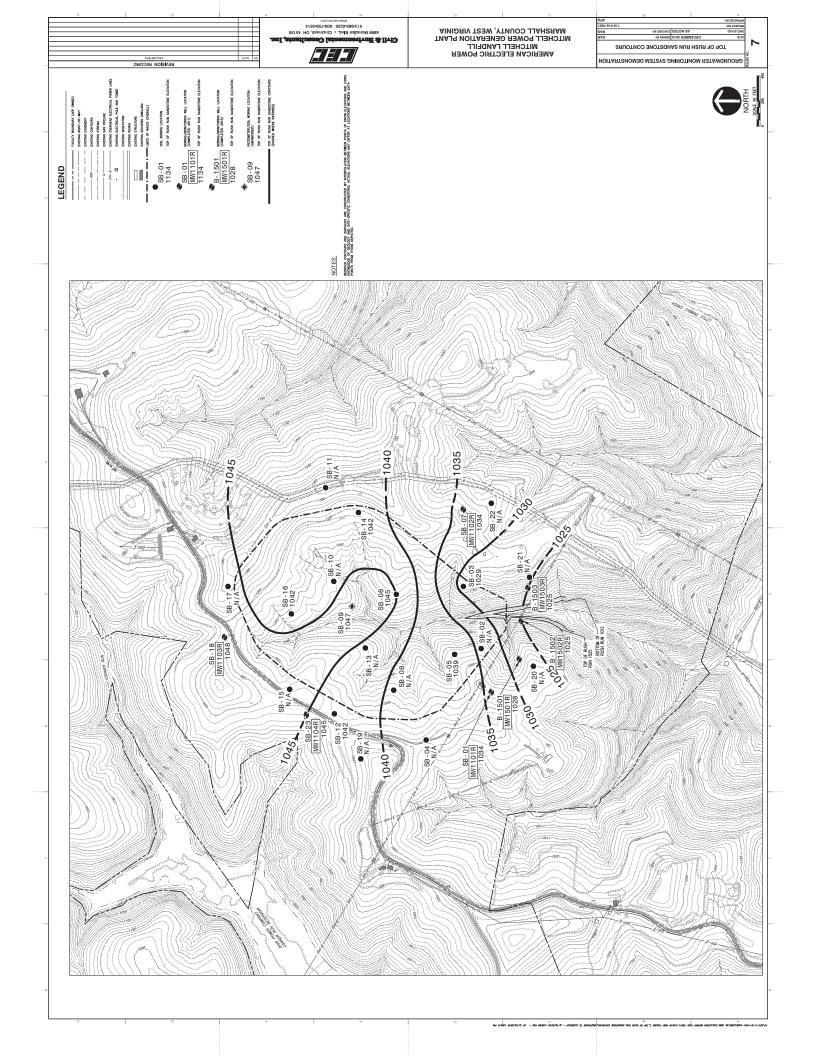
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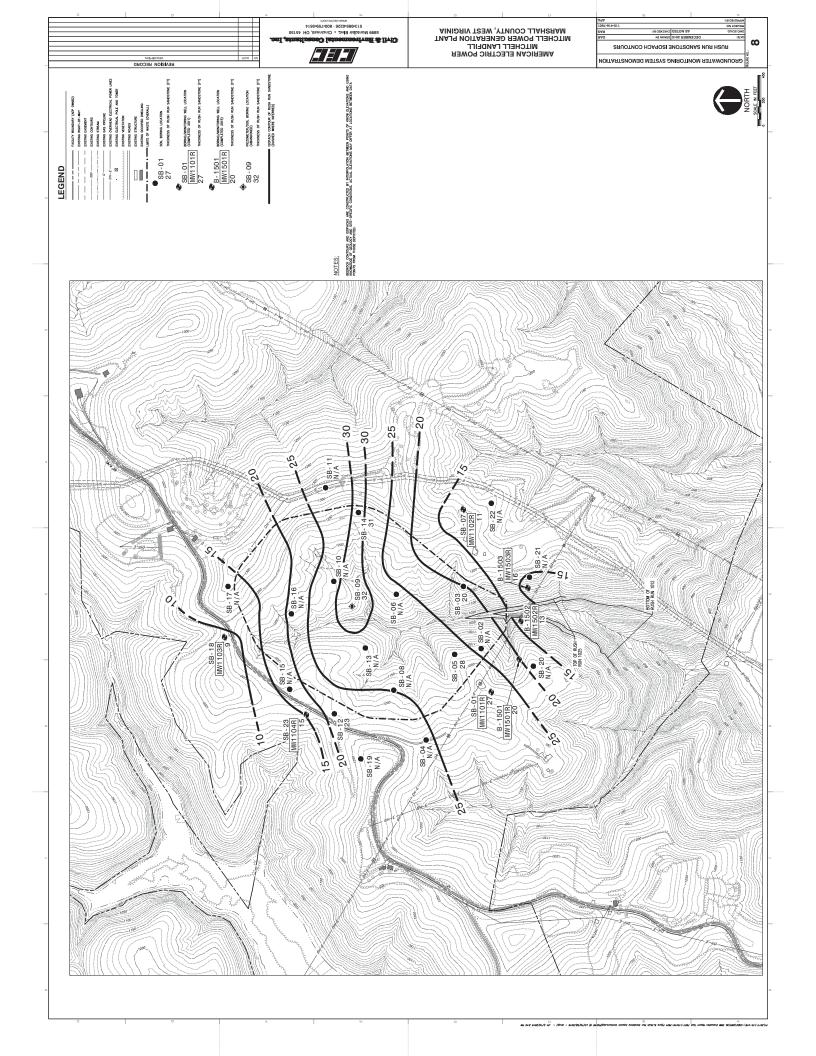




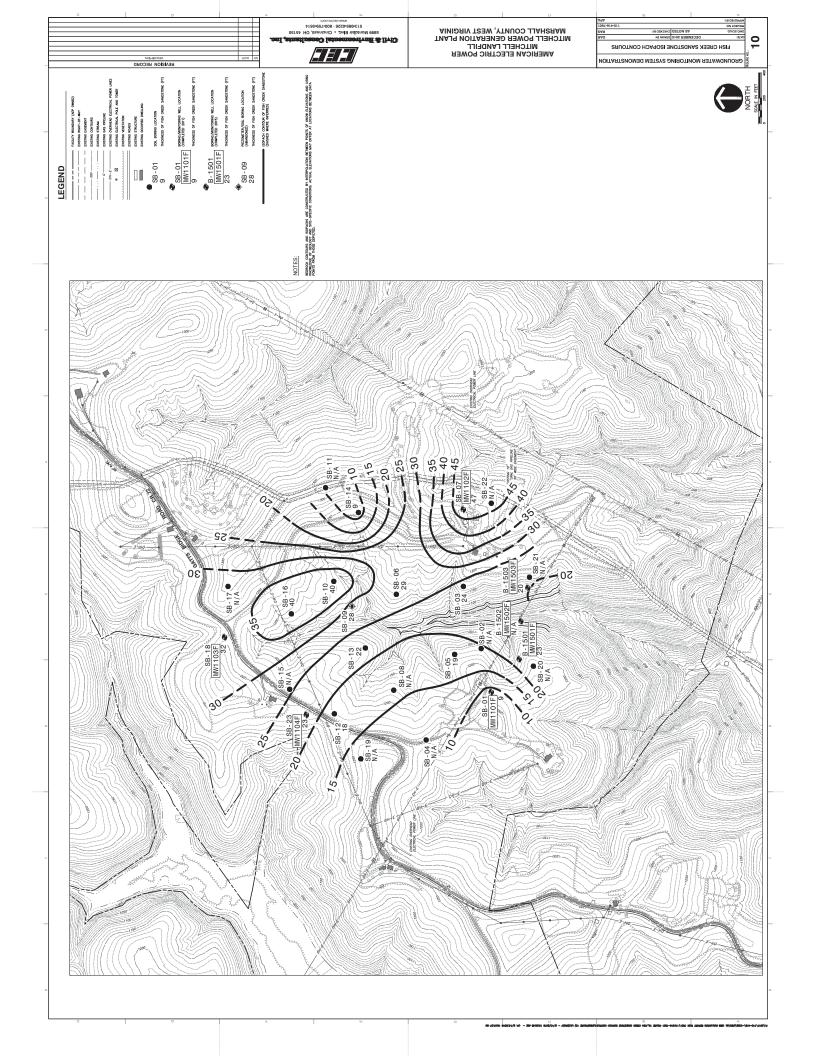


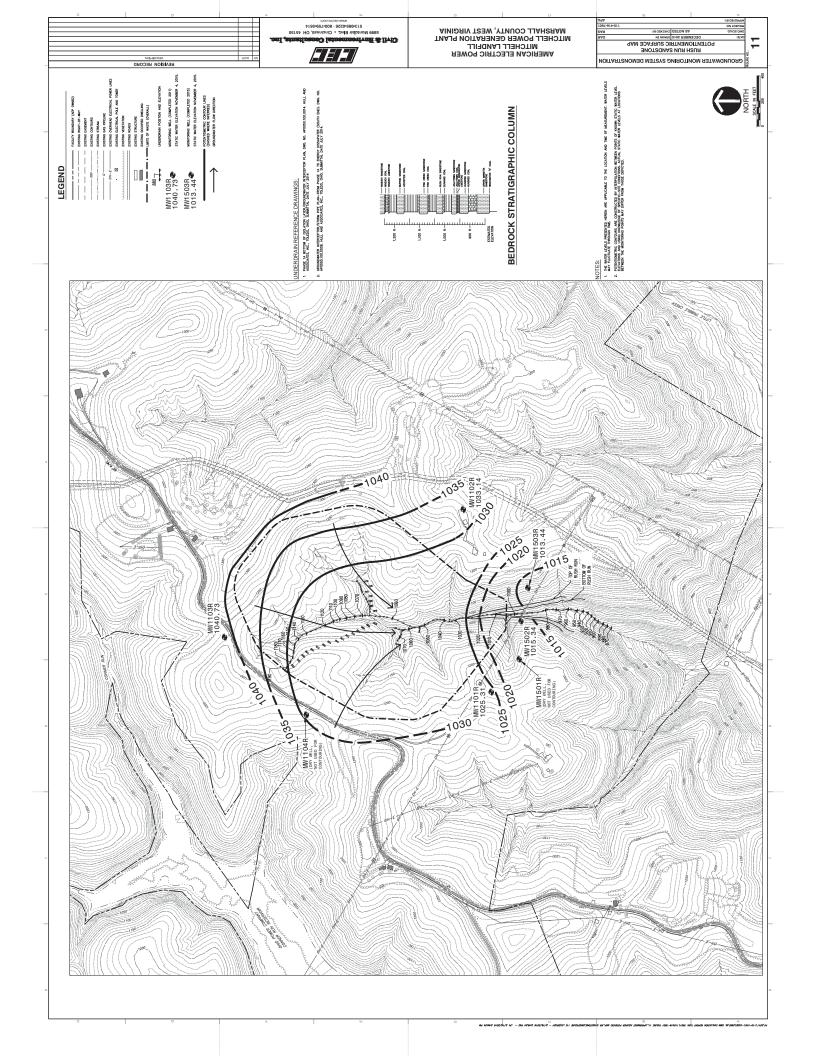


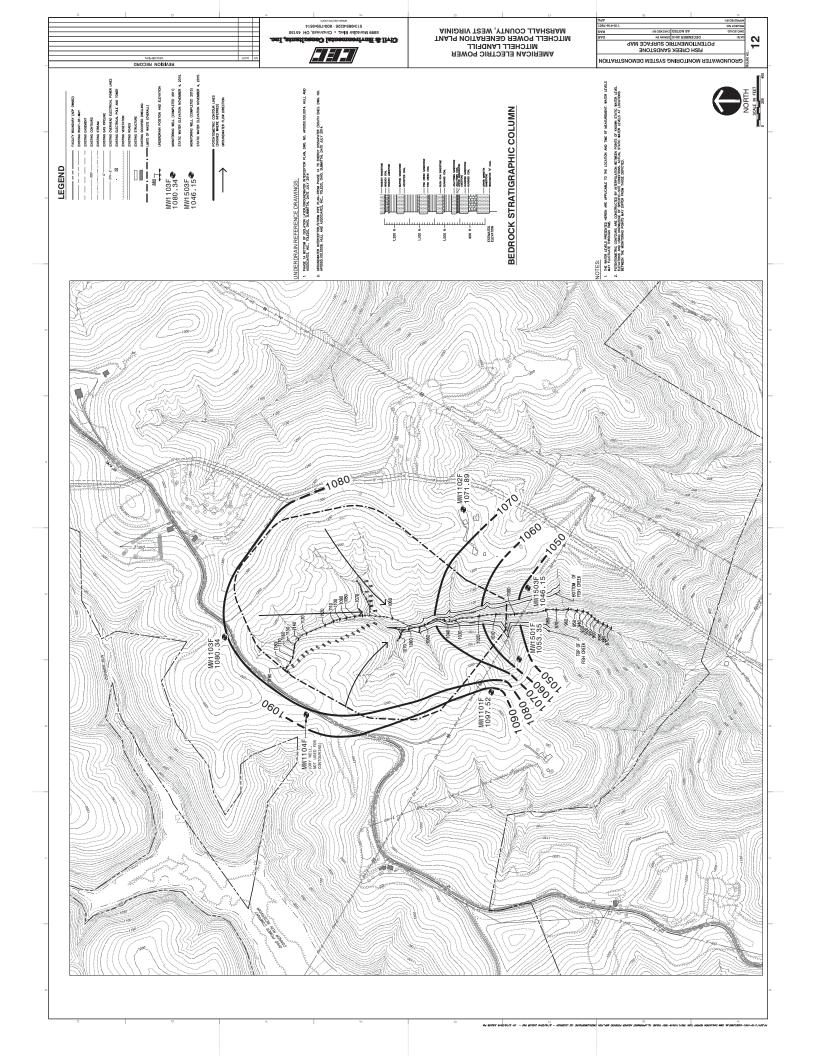


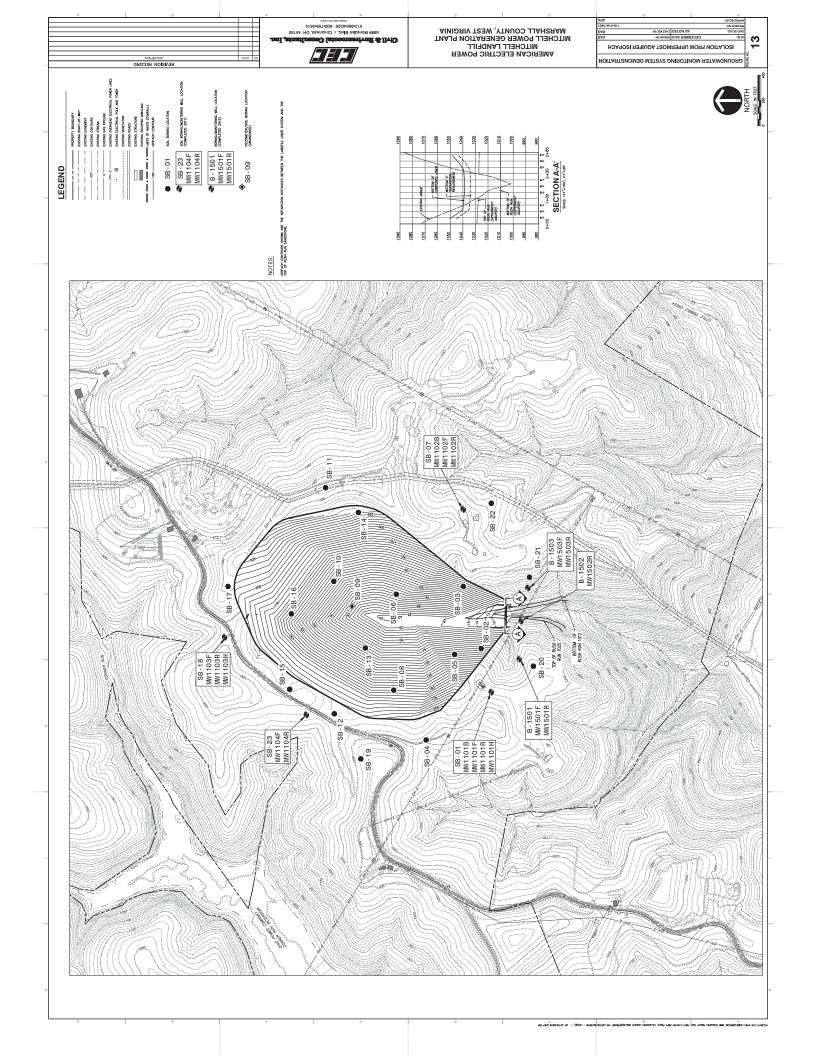












TABLES

Table 1 - Summary of Monitoring Well and Plezometer Construction CCR Groundwater Monitoring System Demonstration Mitchell Landfill American Electric Power - Mitchell Generating Plant

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IBJ 1220.71 935.7 930.7 IBJ 1221.23 1038.7 1033.7 IBJ 1221.23 1038.7 1033.7 IBJ 1220.35 1036.0 1039.0 IBS 1220.35 1037.7 1032.7 IBB 1220.35 1037.7 1032.7 IBS 1220.35 1037.7 1032.7 IBS 1228.67 1037.7 1032.7 IBS 1228.67 1037.4 1032.7 IBS 1228.67 1058.1 1049.1 IBS 1228.67 1053.1 1049.1 IBS 1229.06 1053.1 1049.1 IBS 1230.49 1033.1 1043.7 IBS 1230.49 1033.1 1026.1 IBS 1230.30 1083.5 1033.2 IBS 1230.30 1083.5 1026.1 IBS 1230.30 1033.3 1026.1 IBS 1230.30 1033.3 1026.1	Top of Sand (ft amsl)	Screen Elevation (ft bgs)	Screen Bas Length Scr (ft amsl) (ft t	Cepting Measured Screen Depth ⁽⁴⁾ (ft bgs) (feet)	(ft ams)	Bottom of Sand/Top of Bentonite Back Fill (ft amsf)	Top of Dedicated Pump ⁽⁵⁾ (ft bgs)	Diameter Soil/Rock (inches)	Casing D Type (Casing Diameter (inches)	Monitored Geologic Material	Monitored Stratigraphic Unit	Position Relative to Waste
IR7 1221.23 1038.7 1033.7 190 1220.86 1066.0 1059.0 188 1220.73 1136.8 1131.8 26.7 1228.36 1037.7 1032.7 26.8 1228.36 1034.7 1032.7 26.9 1228.46 1084.8 1131.8 26.1 1228.46 1095.4 922.4 26.1 1228.46 1053.1 1049.1 26.1 1239.42 937.4 92.4 38.1 1239.42 1069.4 1069.4 38.1 1239.42 1063.5 1078.5 38.4 1239.43 1069.4 1069.4 38.4 1230.30 1083.5 1078.5 38.4 1161.78 1033.1 1026.1 38.8 1161.83 1033.4 1024.2 38.8 1111.95 1033.6 1024.2 38.8 1111.95 1037.6 1024.2 38.8 1111.95 1030.6 1024.2		928.7	50.0 34	340.0 342.9	878.7	877.7	:	8.0/6.0	SCH 40 PVC	2:0	Very Fine ID Fine, Micarceus SS w LIS inclusions & Interbedded ST Seams 287: "Dr7: Very Fine ID And, Micarceus SS w LIS inclusions 247:301 Similar Interbedded Sighthy Micarceus ST Seams 310'237): ST withinterbedded, Sighthy Micarceus SS Seams 237:248; SH withinterbedded ST 124:247: Very Fine ID Micd. Micarceus SS 277:330'519pht Micarceus ST 334:332-333'51 (Strategione 3382:347): State 338:338:338'5; Calcurence ST 334:345 (Finelsone 3382:347):	H and Interval Below	Down Gradient
90 1220 36 10660 10590 188 1220 73 1136 8 1131 8 267 1228 36 10377 1031 7 268 1228 46 1195 9 1051 8 269 1228 46 1195 9 1051 8 269 1228 46 1195 9 1040 1 269 1228 46 1195 9 1049 1 37.4 1239 42 937 4 922 4 36.1 1239 42 1049 1 1049 1 36.1 1239 40 1063 1 1049 1 36.1 1230 46 1063 3 1043 1 36.1 1230 36 1083 3 1018 1 36.1 1230 36 1083 1 102 1 36.1 1230 36 1083 1 102 1 36.8 1161 38 103 31 102 1 36.8 1161 38 103 31 102 3 36.8 1161 38 103 31 102 3 36.8 1111 36 103 31 102 3		1031.7	25.0 21	212.0 214.5	1006.7	1004.7	206.5	8.0/6.0	SCH 40 PVC	2.0	Very Fine b Medium Micaceous SS w/ few limestone inclusions; few ST seams 184.3' - 186.9'; Very fine to medium micaceous SS, very hard 186.9' - 211.0'; CT w/ few shale seams and limestone inclusions 211 - 214'.	R and Interval Below	Side Gradient
88 1220.73 1136.8 1131.8 26.7 1228.36 103.77 103.77 26.8 728.67 1086.8 1081.8 26.8 1228.67 1086.8 1081.8 26.8 1228.67 1086.8 1087.6 26.9 1238.67 1086.8 1156.9 37.4 1239.82 937.4 92.4 38.1 1239.10 1069.4 1089.4 38.1 1239.10 1083.5 1078.5 38.4 1230.30 1083.5 1078.5 38.4 1143.59 934.3 931.3 41.3 1083.5 1078.5 1024.7 38.8 1161.78 1033.1 1024.1 38.8 1161.83 1033.3 1024.3 41.3 1027.5 1024.3 34.3 38.8 1111.93 1020.6 1024.3 38.8 1111.93 1030.6 1024.3 38.8 1111.93 1030.6 106.2 <		1057.0	7.0 16	171.1	1050.0	1049.0	167.5	8.0/6.0	SCH 40 PVC	2.0	SH thinly laminated to laminated 160°- 160.5; ST w few LS inclusions, broken 160.5° - 161.3 Very Free to Mord SSS will imissione inclusions, interbedded ST and SH 161.3°- 1.68.5; Signithy Miczecous ST, few interbedded SH 168.5°- 169°; SH w few CT seams 168.5°- 170°.	F and Interval Above	Side Gradient
2.6.7 12.8.3.6 103.7.7 103.7.7 103.2.7 2.8.8 12.8.6.7 108.6.8 108.1.8 108.1.8 2.6.9 12.2.8.6.4 1186.9 1156.9 1156.9 3.7.4 12.3.9.22 93.7.4 92.4.4 3.8.1 12.40.01 105.3.1 1049.1 3.8.1 12.40.01 105.3.1 1049.1 3.8.1 12.30.6.6 1046.7 1043.7 2.8.7 1230.3.0 1083.5 1043.7 2.8.1 1230.3.0 1083.5 1043.7 2.8.1 1230.3.0 1083.5 1043.7 2.8.1 1230.3.0 1083.5 1043.7 2.8.5 1230.3.0 1083.5 1028.5 41.3 1161.7.8 1033.1 1026.1 8.8.0 1161.8.8 1077.6 1024.3 8.8.6 1111.9.6 1020.8 1023.3 8.8.6 1111.9.6 1020.6 1023.3 8.8.6 1111.90 1020.6 1023.3		1129.8	18.0 10	107.0 109.2	1111.8	1110.8	101.5	8.0/6.0	SCH 40 PVC	2.0	Iron Stained LS 86 - 89°; Calcareous SH wifew blocky CT seams 89° - 94.3; CT wi few shale seams, iron stained 94.3 - 103.3; Calcareous SS, few ST seams 103.3' - 106.4'; Calcareous SH wifew ST seams 106.4' - 108;	Unnamed Unit Above F	Undetermined
2.8 1.28.6/ 108.68 108.18 3.7 1.23.84 1159.9 1156.9 3.7 1.23.84 1159.9 1156.9 3.7 1.23.82 93.74 92.4 3.8.1 123.92 93.74 92.4 3.8.1 123.92 1069.4 1069.4 3.8.1 123.92 1064.7 1069.4 3.8.1 123.93 1064.3 1069.4 3.8.1 123.03 1083.5 1078.5 3.8.2 1230.30 1083.5 1078.5 3.8.3 1161.78 1033.1 1024.1 3.8.4 1161.83 1033.4 1024.1 3.8.4 1161.83 1033.5 1024.1 3.8.4 1161.83 1033.6 1024.2 3.8.4 1161.83 1033.6 1024.2 3.8.4 1111.95 1037.5 1024.2 3.8.8 1111.93 1030.6 1024.2		1030.7	8.0 20	204.0 205.8	1022.7	1021.7	:	8.0/6.0	SCH 40 PVC	2.0	ST w LS and calcile veins 194". 197"; ST w/LS interbeds and calcile veins 197". 204.1; Calcareous SH w/few CT seams, some iron staining 204.1' - 205;	2	Side Gradient
26.9 12.8 8.4 1159.9 1156.9 37.4 12.3 8.6 93.7 4 92.4 38.1 12.4 0.01 1063.1 1049.1 38.1 12.3 9.05 1064.7 1083.4 38.4 1239.19 1064.7 1043.7 38.4 1230.40 1064.7 1043.7 38.4 1230.30 1083.5 1078.5 38.5 1230.30 1083.5 1078.5 38.6 1161.78 1033.1 1026.1 41.3 1043.4 1024.1 1024.1 38.6 1161.78 1033.1 1024.1 38.4 1161.43 1033.1 1024.1 38.8 1111.96 1030.8 1024.3 38.8 1111.93 1070.6 1023.3 38.8 1111.93 1070.6 1024.3		1079.8	30.0 17	177.0 180.0	1049.8	1048.8	170.0	8.0/6.0	SCH 40 PVC	2.0	Micaceous Fine to Medium SS 145' - 147'. Micaceous Fine to Medium SS, few Calcite filled fractures 147' - 174.2'. SH 174.2' - 178'.	E and Interval Below	Side Gradient
37.4 1239.82 937.4 922.4 38.1 1240.01 1083.1 1049.1 38.1 1240.01 1083.1 1049.1 36.4 1230.49 1084.4 1089.4 38.1 1230.50 1046.7 1078.5 28.7 1230.30 1083.5 1078.5 28.1 1230.30 1083.5 1078.5 28.1 1230.30 1083.5 1078.5 28.1 1230.30 1083.5 1078.5 41.3 1143.59 934.3 931.3 41.3 1161.78 1033.1 1026.1 88.0 1161.48 1037.5 1024.2 88.6 1111.96 1030.8 1023.3 88.8 1111.93 1077.6 1023.3 88.8 1111.93 1070.6 1062.8		1154.9	17.0 89	89.0 90.9	1137.9	1136.9	83.0	8.0/6.0	SCH 40 PVC	2.0	8H few CT seams 70 70 2; ST w LS inclusions 70.2 - 73.3' Micaceous Fine to Med SS 73.3 - 76.1' Micaceous Fine to Medium SS 76.1' - 89.1' 90'	Unnamed Unit Above F / Above Limestone	Undetermined
8.1 12.40.01 106.3.1 104.9.1 36.4 12.39.10 1063.4 1049.4 26.7 1230.66 1046.7 1043.7 28.7 1230.66 1046.7 1043.7 28.6 1230.66 1046.7 1043.7 28.5 1230.30 1063.5 1078.5 28.6 1143.59 934.3 931.3 41.3 1143.59 934.3 931.3 8.80 1161.76 1033.1 1026.1 8.80 1161.86 1071.2 1021.3 8.81 1047.41 1027.5 1024.2 8.81 1111.96 1030.8 1023.3 8.86 1111.97 1020.6 1023.3 8.86 1111.97 1020.6 1023.3 8.88 1111.93 1070.6 1023.3	4	930.4	40.0 34	347.0 349.4	890.4	889.4	:	8.0/6.0	SCH 40 PVC	2.0	ST 305-308: Very Fine to Med. SS 308-312: ST 312-317; Very Fine to Med. Slightly Macaous SS 317:337: Spithly Macaous ST 317-324: 323-327: SH & Interbedded ST W. LS Industons 327-337: SH & Interbedded STS 3373-347: SH Mcathonaceous Sheak 317-347: Interbedded LS and Cataraous SH 345-347;	k H and Interval Below	Up Gradient
36.4 1239.19 1099.4 1089.4 1043.7 23.7 1230.56 1046.7 1043.7 28.5 1230.56 1046.7 1078.5 28.5 1230.30 1083.5 1078.5 28.5 1230.30 1083.5 1078.5 8.64 1161.78 1033.1 1026.1 8.80 1161.83 1033.3 1024.2 8.84 1161.83 1037.6 1024.2 8.84 1161.83 1037.6 1024.2 8.84 1161.83 1037.6 1024.2 8.84 1111.96 1027.5 1024.2 8.84 1111.96 1020.8 1024.2 8.84 1111.96 1020.6 1024.2	191	1047.1	7.0 19	198.0 200.3	1040.1	1039.1	:	8.0/6.0	SCH 40 PVC	2.0	ST slightly micaceous w/few limestone inclusions 189' - 193'. Micaceous Very Fine to Medium SS w/ few ST seams. 193' - 195.5'. ST w/few LS inclusions, few SS seams 195.5' - 198''SH 199''.	~	Up Gradient
28.7 1230.66 1046.7 1043.7 28.5 1230.30 1083.5 1043.5 28.5 1230.30 1083.5 1078.5 41.3 1141.59 93.4.3 931.3 8.80 1161.78 1033.1 1026.1 8.80 1161.78 1078.6 1071.2 8.80 1161.81 1078.6 1071.2 8.80 1161.81 1078.6 1071.2 8.80 111.93 1023.3 1023.3 8.80 1111.93 1070.6 1023.3 8.80 1111.93 1070.6 1023.3		1087.4	30.0 17	179.0 181.6	1057.4	1056.4	173.5	8.0/6.0	SCH 40 PVC	2.0	Micaceous Very Fine to Med: SS w interbedded ST 147" - 176.2" SH W/ COAL seam 0.042" thick 176.2" - 177", SH w/ few CT seams 177" - 180"	F and Interval Below	Up Gradient
28.5 12.30.30 108.35 1078.5 41.3 1143.59 934.3 931.3 88.0 1161.78 1033.1 1026.1 88.8 1161.78 1033.1 1024.2 88.8 1161.78 1033.1 1024.2 88.8 1161.83 1077.5 1024.2 88.8 1111.96 1030.8 1023.3 88.8 1111.90 1030.8 1023.3 88.8 1111.90 1070.6 1023.3		1041.7	25.0 21	212.0 213.8	1016.7	1015.7	:	8.0/6.0	SCH 40 PVC	2.0	Micaceous Very Fine to Med. SS, Calcareous 185 - 189: Micaceous Very Fine to Med. SS w/rew LS inclusions 189' - 195.8'; ST few interbedded SH and few LS inclusions 195.8' 199'; SH w/rew LS inclusions 199' - 203.2'	R and Interval Below	Up Gradient
41.3 1143.59 934.3 931.3 880 1161.78 1033.1 1026.1 884 1161.48 1033.2 1024.2 884 1161.48 1071.2 1024.2 884 1161.48 1077.5 1024.2 884 1111.96 1027.5 1024.2 888 1111.96 1030.8 1023.3 888 1111.98 1070.6 1023.3		1076.5	20.0 17	172.0 174.1	1056.5	1055.5	:	8.0/6.0	SCH 40 PVC	2.0	Str. More interbedied S. and St. Sams 150. St. Maczeokowy Fire to Med. St. 150.8 - 154.4: 75 w Interbedied SS seams 154.4 - 159.5 : Catareous lew interbedded S1 and SS seams 159.1. 405.5. Micracous Very Fire Ib Med. W interbedded S1 and S3 - 31.14.5 : W Jiew S1 and LS seams 171.4 - 1725; SH, catareous w Interbedded SS and LS 172.5 - 173	F and Interval Below	Up Gradient
8.80 1161.78 1033.1 102.6.1 8.84 1161.83 10718.6 1071.2 8.82 1047.41 1027.5 1024.2 8.86 1111.96 1020.8 1023.3 8.86 1111.96 1030.8 1023.3 8.86 1111.93 1070.6 1023.3	ri,	929.3	35.0 24	247.0 247.5	894.3	893.3	:	5.0	SCH 40 PVC	0.1	Micraceous Interbedded SS and SH trace Calcle Inclusions 206 - 2114': Fine 10 Medlum Microson SS some S1 interleved S11, 1-2238': SH where LS housels 222.8': 2298': SH wi trace calcle inclusions 2298': -3258 if Microsous SS and SH interbeds. Itera Pinnestone indications 2358': -3258 if Microsous SF and SH interbeds. Itera Pinnestone indications 2358': -329.8': Microsous SH medlum SS 239.8': -344.8': SH wi some S5 metods 244.8': -247': -Microsous Fine to Medlum SS 241': -244.8': SH wi some plant totskis. 247.2': -248'	т	Abandoned
884 1161.83 1078.6 1071.2 15.23 1047.41 1027.5 1024.2 886 1111.96 1030.8 1023.3 888 1111.96 1030.6 1023.3 08.8 1111.93 1070.6 1042.8	-	1023.4	14.6 15	150.0 153.5	1008.8	1007.8	;	8.0/6.0	SCH 40 PVC	4.0	Micaceous SS, well sorted, well cemented, slightly fractured to unfractured.	Я	Down Gradient
15.23 1047.41 1027.5 1024.2 88.66 1111.96 1030.8 1023.3 08.86 1111.96 1070.6 1042.8	7	1067.4	14.6 10	106.0 109.7	1052.8	1051.84	:	8.0/6.0	SCH 40 PVC	4.0	Micaceous SS, very fine grained, thinly bedded, competent, well cemented, sightly to moderately fractured. CT near bottom of monitored interval, approximately 8 inches, underlain by approximately 14 inches of silistone.	Ŀ	Down Gradient
8.86 1111.96 1030.8 1023.3 08.8 1111.93 1070.6 1062.8		1021.83	9.6 33	33.0 36.0	1012.2	1011.6	:	6.0	SCH 40 PVC	4.0	Micaceous SS, well sorted, moderately fractured, iron-stained vertical fracture, sub- vertical fractures and horizontal fractures noted, interbedded ST zone noted, color change from gray to light brown.	Ľ	Down Gradient
08.8 1111.93 1070.6 1062.8		1019.5	56 9:6	99.0 101.9	9 1009.3	1007.9	:	8.0/6.0	SCH 40 PVC	4.0	Micacous SS, medium to thick bedded near top, very hard and finer gained in lower portion of monitred interval. Tace pythe motel, catacouss center, signity to moderately fractured; some beccated stitistomes and mudstone hiteheds over 18 inch hiterval, inor stained working and sub-weitigal fractures noted.	٣	Down Gradient
		1060.4	14.6 63	63.0 66.3	1045.2	1044.8	:	8.0/6.0	SCH 40 PVC	4.0	Micaceous SS very fine grained, thin to thick beds, competent, well cemented, trace calcareous modules, slightly fractured to unfractured. Interbedded SH, CT and SS in lower portion of monitored interval.	Ŀ	Down Gradient
(3) Pecometer Abandoned in June 2013 due to encoaching landill construction. One inch dameter plezometer. (4) Mecaward from her lop of refer. (5) Dedicated backer pumps installed Occurber 2013.	Bedrock Unit H = Hundred R = Rush Rur F = Fish Cree B = Burron Ss	Bedrock Unit Legend: Hurdrock Sanskone R. Rush Run Sanskone F. Fish Creek Sanskone B. Burton SanskoneShallon Bedrock	fock								Reck Type Symbol Legent CL + CJy CL + CJy the Symbol Legent CL + CJy the State CL + CJy the CL + CJy the State CL + CJy the CL + CJy the State S - Sardstone		

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Table 2 - Summary of Monitoring Well Water Levels	CCR Groundwater Monitoring System Demonstration	Mitchell Landfill	American Electric Power - Mitchell Generating Plant
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4/24/2015 5/20/2015	vel Elevation Water Level Elevation	894.19 325.80 894.91	5 1025.67 195.69 1025.54	1122.54 99.11 1121.75	1132.53 89.10 1131.63	7 1040.49 187.11 1041.25	0 1072.47 156.44 1072.23	1169.30 61.96 1166.88	3 916.54 323.04 916.78	3 1042.38 197.56 1042.45	9 1081.50 157.22 1081.97	2 1026.34 204.20 1026.46	3 1056.57 173.68 1056.62						
7	Elevation Water Level TOC	893.15 326.52	1025.54 195.56	109.29 98.32	1133.24 88.20	1039.14 187.87	1072.03 156.20	1170.59 59.54	916.07 323.28	1042.26 197.63	157.69	1026.16 204.32	1056.58 173.73						
3/19/2015	Water Level Elev TOC	327.56 89.	195.69 102	111.57 110	87.49 113	189.22 103	156.64 107	58.25 117	323.75 91	197.75 104	157.95 106	204.50 102	173.72 105						
015	Elevation	891.61	1025.53	1080.31	1132.29	1035.63	1072.54	1167.41		1041.69	1081.19	1026.15	1056.57						
2/19/2015	Water Level TOC	329.10	195.70	140.55	88.44	192.73	156.13	61.43		198.32	158.00	204.51	173.73						
1/22/2015	Elevation	891.58	1025.55	1080.26	1132.08	1035.47	1072.00	1167.29		1041.60	1081.16	1025.89	1056.56						ſ
1/22	Water Level TOC	329.13	195.68	140.60	88.65	192.89	156.67	61.55		198.41	158.03	204.77	173.74						
12/4/2014	el Elevation	890.10	1025.39	1080.55	1130.79	1032.19	1071.75	1163.52	908.67	1041.50	1080.82	1025.74	1056.57						
1	n Water Level TOC	330.61	195.84	140.31	89.94	196.17	156.92	65.32	331.15	198.51	158.37	204.92	173.73						
11/11/2014	evel Elevation	1 889.47	3 1025.60	6 1080.90	1130.82	3 1030.53	1 1072.06	1164.01	0 907.72	9 1041.42	0 1080.59	5 1025.61	5 1056.55						
	ion Water Level TOC	331.24	58 195.63	.00 139.96	90 89.91	72 197.83	.99 156.61	48 64.83	7 332.10	41 198.59	98 158.60	36 205.05	57 173.75						
10/30/2014	evel Elevation	54 889.07	65 1025.58	1081	3 1130.90	64 1029.72	1071	6 1164.48	05 906.77	60 1041.41	21 1079.98	30 1025.36	73 1056.57						
Measured Total	Depth ⁽⁴⁾ (feet) Water Level TOC	342.9 331.64	214.5 195.65	171.1 139.86	109.2 89.83	205.8 198.64	180 156.68	90.9 64.36	349.4 333.05	200.3 198.60	181.6 159.21	213.8 205.30	174.1 173.73	247.5	153.5	109.7	36.0	101.9	
Screen Length Measu	(ft ams()	50 3/	25 21	7 15	18 10	8 20	30 1	17 9	40 34	7 20	30 18	25 21	20 15	35 24	14.6 11	14.6 10	9.6 3	9.6	
Depth to Top of Screen	(ft amsI) (ft	290	187	162	68	196	147	72	307	191	149	187	152	212	135.4	91.4	23.4	89.4	
Casing Dept		2	2	2	2	2	2	2	2	2	2	2	2	-	4	4	4	4	
Top of Riser Elevation	(ft amst)	1220.71	1221.23	1220.86	1220.73	1228.36	1228.67	1228.84	1239.82	1240.01	1239.19	1230.66	1230.3	1143.59	1161.78	1161.83	1047.41	1111.96	
	Easting	1609657.8	1609656.4	1609651.4	1609653.8	1611103.3	1611110.1	1611096.9	1610094	1610097.2	1610102.2	1609471.2	1609469.3	1610339.5	1609913.5	1609917.5	1610218.1	1610487.6	Ī
Coordinates ⁽¹⁾	Northing	484883.9	484877.8	484864.5	484870.8	485101.7	485106.1	485097.4	487005.3	486998.5	487011.2	486345.1	486352.3	485990.9	484663.0	484662.0	484648.8	484596.7	
Date Well	Installed	10/7/2011	10/28/2011	12/20/2011	12/19/2011	12/14/2011	10/25/2011	12/15/2011	9/27/2011	12/16/2011	10/26/2011	12/22/2011	12/21/2011	9/19/2011	8/5/2015	8/6/2015	8/6/2015	8/15/2015	ſ
Monit	Number	0491-0003-2011	0491-0006-2011	0402-0006-2011	0402-0005-2011	0402-0002-2011	0491-0004-2011	0402-0003-2011	0491-0002-2011	0402-0004-2011	0491-0005-2011	0402-0008-2011	0402-0007-2011	0402-0001-2011					
Monite	Q	MW1101H	MW1101R	MW1101F	MW1101B	MW1102R	MW1102F	MW1102B	MW1103H	MW1103R	MW1103F	MW1104R	MW1104F	PZ1101H ⁽³⁾	MW1501R	MW1501F	MW1502R	MW1503R	
Soil Boring	Q		10 13	In-ac			SB-07			SB-18		50 U.J	\$7-9C	SB-09	D 1501	1001-Q	B-1502	0 4600	B-1505

Survey conclusions are US State Reven 1980. Waythin Narth.
 annis - a warge much sea lovel. Varical Daumite. NAVD 1988, GCDOD 03.
 Precommiser Annihomat in June 2013 due la encroaching landilli construction. One loch damiles piezamilos.
 Massured from the log of fear.

Bedrock Unit Legend:	H = Hundred Sandstone	R = Rush Run Sandstone	F = Rsh Creek Sandstone	B = Burton Sandstone/Shatow Bedrock
Bedrock	H - Hund	R = Rush	F = Hsh (B = Burtor

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Table 2 - Summary of Monitoring Well Water Levels	CCR Groundwater Monitoring System Demonstration	Mitchell Landfill	American Electric Power - Mitchell Generating Plant
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	ition	.93	1025.31	1097.52	1131.80			1163.35	902.05	1040.73	1080.34	1019.14	1056.88		1009.64	1053.35	1015.34	1013.44	1046.15
11/4/2015	evel Elevation	889.93																	
	Water Level TOC	330.78	195.92	123.34	88.93			65.49	337.77	199.28	158.85	211.52	173.42		152.14	108.48	32.07	98.52	65.78
11/3/2015	Elevation					1033.14	1071.89												
11/	Water Level TOC					195.22	156.78												
10/13/2015	Elevation	889.39	1025.13	1098.03	1131.65	1031.38	1072.05	1163.65	901.40	1040.72	1078.90	1018.94	1056.82		1009.68	1053.38	1014.80	1013.75	1046.18
10/13	Water Level TOC	331.32	196.10	122.83	80.68	196.98	156.62	65.19	338.42	199.29	160.29	211.72	173.48		152.10	108.45	32.61	98.21	65.75
9/30/2015	Elevation														1009.71	1053.36	1022.16	1013.90	1046.19
/08/6	Water Level TOC														152.07	108.47	25.25	98.06	65.74
2015	Elevation	895.41	1025.40	1110.69	1130.91	1035.56	1071.89	1163.61	906.63	1040.87	1081.23	1019.90	1056.84						
9/15/2015	Water Level TOC	325.30	195.83	110.17	89.82	192.80	156.78	65.23	333.19	199.14	157.96	210.76	173.46						
:015	Elevation	894.89	1025.45	1111.79	1131.14	1034.99	1071.98	1164.60	906.24	1040.69	1081.00	1019.79	1056.81						
8/26/2015	Water Level TOC	325.82	195.78	109.07	89.59	193.37	156.69	64.24	333.58	199.32	158.19	210.87	173.49						
:015	Elevation	894.19	1025.56	1113.65	1131.71	1034.01	1072.03	1167.57	906.02	1040.66	1080.59	1019.62	1056.75						
7/29/2015	Water Level TOC	326.52	195.67	107.21	89.02	194.35	156.64	61.27	333.80	199.35	158.60	211.04	173.55						
015	Elevation	895.61	1025.64	1118.79		1041.78	1072.14		916.87	1042.52	1081.49	1026.56	1056.68						
6/15/2015	Water Level TOC	325.10	195.59	102.07		186.58	156.53		322.95	197.49	157.70	204.10	173.62						
Measured Total	Depth ⁽⁴⁾ (feet)	342.9	214.5	171.1	109.2	205.8	180	6:06	349.4	200.3	181.6	213.8	174.1	247.5	153.5	109.7	36.0	101.9	66.3
Screen Length	(ft amst)	50	25	7	18	80	30	17	40	7	30	25	20	35	14.6	14.6	9.6	9.6	14.6
Depth to Top of Screen	(ft amsI)	290	187	162	89	196	147	72	307	191	149	187	152	212	135.4	91.4	23.4	89.4	48.4
Casing	(inches)	2	2	2	2	2	2	2	2	2	2	2	2	1	4	4	4	4	4
Top of Riser Elevation	(ft ams!)	1220.71	1221.23	1220.86	1220.73	1228.36	1228.67	1228.84	1239.82	1240.01	1239.19	1230.66	1230.3	1143.59	1161.78	1161.83	1047.41	1111.96	1111.93
ates ⁽¹⁾	Easting	1609657.8	1609656.4	1609651.4	1609653.8	1611103.3	1611110.1	1611096.9	1610094	1610097.2	1610102.2	1609471.2	1609469.3	1610339.5	1609913.5	1609917.5	1610218.1	1610487.6	1610488.5
Coordinates ⁽¹⁾	Northing	484883.9	484877.8	484864.5	484870.8	485101.7	485106.1	4 85097.4	487005.3	486998.5	487011.2	486345.1	486352.3	485990.9	484663.0	484662.0	484648.8	484596.7	484591.4
Date Well	Installed	10/7/2011	10/28/2011	12/20/2011	12/19/2011	12/14/2011	10/25/2011	12/15/2011	9/27/2011	12/16/2011	10/26/2011	12/22/2011	12/21/2011	9/19/2011	8/5/2015	8/6/2015	8/6/2015	8/15/2015	8/15/2015
Monitoring Well Tag	Number	0491-0003-2011	0491-0006-2011	0402-0006-2011	0402-0005-2011	0402-0002-2011	0491-0004-2011	0402-0003-2011	0491-0002-2011	0402-0004-2011	0491-0005-2011	0402-0008-2011	0402-0007-2011	0402-0001-2011					
nitoring Well	Q	MW1101H	MW1101R	MW1101F	MW1101B	MW1102R	MW1102F	MW1102B	MW1103H	MW1103R	MW1103F	MW1104R	MW1104F	PZ1101H ⁽³⁾	MW1501R	MW1501F	MW1502R	MW1503R	MW1503F
Soil Boring Mc	QI		10 00	10-90			SB-07			SB-18		60 JJ	C2-0C	SB-09	D 1501	1061-0	B-1502	D 1EM3	C001-0
		1																	

Bedrock lune Logned H - Hundrad Sandsane R - Ruch Rund Sandsane F - Folo cons Sandsane B - Burnt Sandstron Sandsre B - Burnt Sandsre B - B

Showy coordinates are US State Paper 1983. West Vogelin North.
 Tand - average mean solutest. Variend Damine NAVO 1988, GECOD 03.
 Recommeter Mannbord in June 2013 due to eroconding landilli construction. One inch damidie picometer.
 Messured from the top of fest.

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APPENDIX A

								ndfill, Mitch					
								Ridge Roa					~
						-		7 ft	HOLE	SIZE	0.5	5 ft	
			ROUN				-						
		ETHOD 4.25" I.D. HSA: Auto Hammer & Air Rotary Rock Core						Refer to n					
		R. Mahle / M. McCoy CHECKED BY M. McCoy					-	Refer to no			om of	loc	9
LOCA		N 484883.9, E 1609657.8	13	nours		-IEK I		NG Well	Installe	d			
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		o DEPTH (ft)		SAMPLE IYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WE	:LL 	DIAGRAM - 2.0' Stickuţ
218.7		Brown LEAN CLAY (CL), trace roots, moist, medium stiff (RESIDUAL)			X	SS 1	47	0-2-3 (5)	1.25-2		4	4	- Concrete
217.2		Brown LEAN CLAY WITH SAND (CL), trace roots, noted iro oxide concretions, moist, medium stiff to stiff (RESIDUAL)	n		\mathbb{A}	SS 2	80	3-3-2 (5)	0.5-2.25	^م _4	4	⊿⊿₄	Seal
					\mathbb{N}	SS 3	87	3-5-3 (8)	1.25				
213.8		Light brown and gray LEAN CLAY WITH SAND (CL), trace r	oots,	5.0	$\overline{\mathbb{N}}$	SS 4	87	6-5-8 (13)	1.25- 2.25				
212.7		few interbedded reddish-brown lean clay seams, moist, stiff (RESIDUAL)			\mathbb{N}	SS 5	20	3-6-5 (11)	2.5- 3.75 1.25-				
210.8		Shelby Tube sample obtained from 4'-6' (Recovery = 20") Brown LEAN CLAY (CL), moist, stiff (RESIDUAL)			\mathbb{R}	SS 6	87	6-7-6 (13)	2.25 1-1.25 2.75				
209.2		Shelby Tube sample obtained from 6'-8' (Recovery = 22")		 10.0	\mathbb{R}	SS 7	100	49-38- 50/3"	-4.5+ 4.5+				Q Jack Cal
200.2		Gray, light gray and reddish-brown LEAN CLAY (CL), few th (less than 1/8" thick) sandy silt seams, moist, stiff to hard	in			SS 8	100	41-50/3"	4.5+				2-Inch Soli PVC Riser Sealed wit
		(RESIDUAL) Reddish-brown, gray and grayish-brown SHALE, completely highly weathered, very broken, very soft, thinly laminated to	to		×	SS 9	100	43-50/1"	4.5+				Bentonite Grout
205.2		 laminated Reddish-brown CLAYSTONE, highly weathered, very broker 	٦,		$\overline{\mathbb{X}}$	SS 10	71	16-41- 50/5"	4.5+				
		very soft		_15.0	Þ	SS \ 11	100	18-50/3"	4.5+				
202.2		Gray SHALE, highly weathered, very broken, very soft, lamir	nated		×	SS 12	100	50/5"					
200.7		Dark burgundy to gray CLAYSTONE, becomes harder with or calcite filled fractures from 18.5' to 18.8', slickensides at 19.3' 19.7' and 21.5', mottled below 20.2' to dark gray below 21.6' moderately weathered to highly weathered, very broken, moderately soft	3',			RC 1	62 (9)						
		0.1' thick seam of black shale at 28.6'. Fracture with iron sta from 29' to 29.3'. Iron stained below 31.6'.	aining	 									



BORING NUMBER SB-01/ MW1101H PAGE 2 OF 9

						ndfill, Mitch Ridge Roa			
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	<u> </u>	_ DIAGRAM
1182.1 × × × × × × × × × × × × × × × × × × ×	Gray to orangish-brown SANDSTONE, noted calcite, cemer very fine to medium grained, noted iron staining and iron sta fractures, micaceous, moderately weathered, moderately br to slightly broken, hard, very thin bedded to medium bedded <i>(continued)</i> Orangish-brown SILTSTONE, noted iron staining, some calc inclusions, moderately weathered, very broken at top to moderately broken, very thin bedded Groundwater level reading = dry (borehole depth =38' bgs) o 9/30/2011 at 7:35 AM. Very fine to fine sandstone from 40.3' to 40.7' and 44.6' to 4	ained roken d cite on	35.0 40.0 40.0 40.0 45.0	RC 3	99 (35)				2-Inch Solid PVC Riser
1172.7 1168.7 1166.2	Sandstone from 44.3' to 45.9'. Iron stained vertical fracture f 44.6' to 45'. Burgundy and gray SHALE, few claystone seams, pyrite from and 47' and 49.9' to 50', vertical fracture from 49.1' to 49.3', slickenside at 48', vertical fracture and iron stained at 49', moderately weathered, very broken at top, laminated Gray and orange SANDSTONE, very fine to fine grained, py from 50' to 50.3', vertical fractures and iron stains from 50.5 50.9' and from 51.8' to 52.5', slightly weathered, moderately broken, hard, very thin bedded Gray SHALE, few siltstone seams, iron stained fractures at 53.9' and 54.4', slightly weathered, slightly broken, hard, laminated	yrite		RC 4	98 (50)				Sealed with Bentonite Grout
1157.9	Very brown from 56' to 58.5' and 60.3' to 60.8'. Pyrite from 5 to 58.5'. Burgundy to gray CLAYSTONE, few shale laminations, moderately weathered, broken, moderately soft	56.6'	 	RC 5	62 (21)				
1152.7 1151.7 1150.9 1150.9 1150.7 1149.7 × × >	Dark gray to light gray LIMESTONE, slightly weathered, moderately broken, hard, thick bedded Black SHALE, slightly weathered, broken, soft, laminated Gray SHALE, slightly weathered, very broken, soft, laminated Gray SANDSTONE, fine to medium grained, slightly weather hard, very thin bedded Gray SILTSTONE, calcareous, calcite veins, occasional sha laminations, slightly weathered, moderately broken, medium to hard, very thin bedded	ered, ale	 	RC 6	80 (39)				

	1F	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		_	,				/	PAGE 3 OF
										erating Plant
CEC P	PROJEC	CT NUMBER F	PROJEC	I LOC	ATION	Gatts	Ridge Roa	d, Cres	sap, West	Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		H DEPTH	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WE	LL DIAGRAM
		Gray SHALE, calcareous, siltstone interbeds, very brown fro to 79.5', calcite lined vertical fracture from 77.6' to 78', slight weathered, moderately broken, hard, laminated <i>(continued)</i>	om 76'	<u>75.0</u> - -						
			-	- 80.0 - -	RC 7	87 (32)				
1133.3		Black and gray LIMESTONE, black shale interbeds at 87.7',	, 88.3'	_ 85.0_						2-Inch Solid PVC Riser
- - -		and 88.8', iron stained horizontal fractures at 86.5', 86.8' and 88.1', slightly weathered, medium bedded, hard, broken to moderately broken Water at 88.7'.	d -	_						Sealed with Bentonite Grout
1129.7		Gray SHALE, few blocky claystone seams, calcareous, iron stained vertical fractures at 89.5', 90.1', 90.7', and 91.2' to 9 slightly weathered to fresh, broken, moderately hard, lamina	1.7', 🕇	<u>90.0</u> - -	RC 8	66 (8)				
1124.4		Burgundy CLAYSTONE, few shale seams, iron stained fract fresh, slightly broken, hard	-	<u>95.0</u> - - 100.0	RC 9	100 (64)				
1115.4		Gray SANDSTONE, very fine to fine grained, calcareous, iro stained, fresh, slightly broken, hard, very thin bedded	Г	- - 1 <u>05.0</u> -						
1112.3		Gray SHALE, few siltstone seams, calcareous infills, fresh, moderately broken, very broken from 106.4' to 107.4' and fro 109.4' to 109.7', moderately hard, thinly laminated to lamina	ited -	- - 1 <u>10.0</u>	RC					
1107.7		Burgundy to gray CLAYSTONE, fresh, moderately broken, moderately hard	-	- - 115.0	10	(41)				



BORING NUMBER SB-01/ MW1101H PAGE 4 OF 9

							ndfill, Mitch Ridge Roa				
				. 200/		Jails	nuye nua		ap, W	σοι ν	ryinia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HLd U HLd U HLd U HLd U HLd U (#)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	,	WELI	. DIAGRAM
		Burgundy to gray CLAYSTONE, fresh, moderately broken,									
1102.3		moderately hard <i>(continued)</i> Gray SANDSTONE, iron stained vertical fractures from 116.4' 117.4', fresh, moderately broken, hard, very thin bedded	to	-							
1099.7		Gray and burgundy SHALE, few claystone seams, iron stained vertical fracture from 119.5' to 120', fresh, slightly to moderate broken, hard, laminated	d . ely	120.0 - -	RC 11	64 (25)					
1094.5		Gray SILTSTONE, few claystone seams, fresh, moderately broken, moderately hard, thin bedded		125.0							2-Inch Solid PVC Riser
1092.2		Gray and burgundy SHALE, few claystone seams, transitioning claystone with depth, occasional thin siltstone interbeds, fresh moderately broken, moderately hard, thinly laminated to laminated	ig to _	-							Sealed with Bentonite Grout
			-	<u>130.0</u> - -	RC 12	90 (66)					
1083.2				_ 135.0_							
1063.2		Gray and burgundy CLAYSTONE, occasional thin siltstone and shale interbeds, iron stained fracture at 140.1', fresh, very brok moderately hard	ken,	- - _ 140.0							
1078.6	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, fresh, moderately broken, hard, thin bedder medium bedded Limestone interbeds from 142.5' to 142.8'			RC 13	70 (38)					
1074.2	$\times \times \times$	Gray LIMESTONE, fresh, moderately broken, hard, thick bedd	ded	145.0 _	RC						
1071.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusion from 147' to 147.4', interbedded shale from 151.3' to 152.4', fresh, moderately broken, moderately hard to hard, thin bedde	ed	- - 1 <u>50.0</u>	14	,					
1066.3	^			-	RC 15	82 (61)					
			<u> </u>	155.0							



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CEC	ROJE	CT NUMBER 110-416 PRC	JECT LO	CA		Gatts	Ridge Roa	d, Cres	sap, V	Nest V	lirginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd U 155.		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
		Gray SHALE, interbedded siltstone from 155.4' to 155.8', slightl reddish-gray from 155.4' to 156.7' with claystone seams, interbedded slightly micaceous siltstone seams less than 1/8" thick from 157' to 160.5, fresh, moderately broken, moderately hard, thinly laminated to laminated <i>(continued)</i>	у _ _ _	-							
1058.2	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, few limestone inclusions, fresh, moderately broken to broken, hard, medium bedded Gray SANDSTONE, very fine to medium grained, limestone inclusions, interbedded siltstone seams throughout less than 1/16" thick, interbedded shale and siltstone layers from 163.6' t 164', fresh, moderately broken to slightly broken, hard, thin bedded to medium bedded	160. - - - - - - -	-	RC 16	100 (84)					2-Inch Solid PVC Riser Sealed with Bentonite Grout
1050.2 1049.7	× × × ×	Gray SILTSTONE, slightly micaceous, few interbedded shale seams throughout less than 1/8" thick, fresh, moderately broken hard, very thin bedded Gray becoming reddish-gray and dark gray SHALE, few claystone seams, interbedded siltstone seams throughout less than 1/8" thick, pyrite specks observed at 170.3', iron staining from 171' to 171.1', fresh, moderately broken, moderately hard, thinly laminated to laminated		_ 0_ - -	RC 17	90 (58)					
1044.9		Gray becoming dark gray SANDSTONE, micaceous, very fine t medium grained, interbedded with siltstone seams throughout less than 1/8" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded becoming thick bedded Dark gray SHALE, fresh, moderately broken to broken, hard,	175.	_ 0_ _						l	
1041.2		 laminated Gray to slightly reddish-gray SHALE, few claystone and siltston seams, calcareous, few limestone inclusions, fresh, broken, ha laminated 		- - 0						l	
1037.9	× ×	Gray SILTSTONE, slightly micaceous, calcareous, few limestor inclusions, few shale seams throughout less than 1/8" thick, fresh, broken, hard, very thin bedded to thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, fe limestone inclusions, few interbedded siltstone seams less than 1/10" birth few first the start of the birth birth the bare bare to the start of the birth of the bare bare to the start of the birth of the bare bare bare to the bare bare bare bare bare bare bare bar	- - ew <u>185.</u>	- - - 0	RC 18	98 (84)					
1031.8		 1/16" thick, fresh, moderately broken to slightly broken, hard, very thin bedded to thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, for limestone inclusions, dark gray fine to coarse grained seams le than 1/8" thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded 	ew _	- - - 0							
			-		RC 19	100 (76)					

	H E	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		BC	DRIN	G N	UMBE	RS	B-01/ I	MW1101F PAGE 6 OF
									ctric Gener ap, West \	ating Plant /irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(1) (1) 95.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
		Gray SANDSTONE, micaceous, very fine to medium graine limestone inclusions, dark gray fine to coarse grained seams than 1/8" thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded <i>(continued)</i>	s less - o _ -	- - - <u>00.0</u>		100				
			- - - 20	- - <u>-</u> <u>05.0</u> -	RC 20	100 (74)			l	2-Inch Solid PVC Riser Sealed with Bentonite Grout
1007.7		Gray becoming reddish-gray CLAYSTONE, few shale seam limestone inclusions, fresh, moderately broken, moderately to hard	ns, hard - -	- 1 <u>0.0</u> - - 1 <u>5.0</u>	RC 21	88 (60)			l	
001.7		Reddish-brown CLAYSTONE, gray seam from 220.1' to 220 0.5" thick dark gray lens at 221.7', fresh, moderately broken	I, hard - - 22	- - 2 <u>0.0</u> -	RC	87			l	
996.9	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusi interbedded shale seams less than 1/16" thick from 221.8' to 222.2', fresh, moderately broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium graine limestone inclusions throughout, fresh, slightly broken, very very thin bedded	o ed, few	- - 2 <u>5.0</u> -	22	(71)				
991.7	× × × ×	Gray and reddish-brown CLAYSTONE, blocky, fresh, moder broken, hard Gray SILTSTONE, slightly micaceous, interbedded shale se	eams 23	- - 30.0						
	× × × × × × × × × × × × × × × × × × ×	less than 1/8" thick, few limestone inclusions, fresh, modera broken, hard, very thin bedded to thin bedded	ately _		RC 23	77 (56)				
984.7	× × ×			_ 35.0						



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CEC F	PROJEC	CT NUMBER _110-416 P	ROJEC	T LOC	ATION _	Gatts	Ridge Roa	d, Cres	sap, V	/est V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) DEPTH 235.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELI	_ DIAGRAM
		Gray SANDSTONE, micaceous, very fine to medium grained interbedded siltstone seams throughout less than 1/8" thick, fresh, slightly broken, very hard, very thin bedded (continued	d,								
981.7	× × × × × × × × × × × × × × × × × × ×	Gray SHALE, few siltstone seams, slightly micaceous, interbedded shale lenses throughout less than 1/8" thick, interbedded sandstone layer, reddish-brown seams from 237 237.9', from 238.7' to 238.8', from 239' to 239.3', and from 2 to 241.4', pyrite at 238.1', fresh, moderately broken, hard, thi laminated to laminated	7.8' to 41.3'	- – - – <u>240.0</u>	RC	88					
976.8		Gray and reddish-brown SHALE, few interbedded slightly micaceous siltstone seams throughout less than 1/16" thick, fresh, slightly broken, hard, thinly laminated to laminated	-	 <u>245.0</u>	24	(50)					2-Inch Solid PVC Riser
71.7		Reddish-brown becoming gray SHALE, few claystone seams fresh, broken, moderately hard to hard, thinly laminated to laminated	-	 							Sealed with Bentonite Grout
68		Black COAL, fresh, broken, moderately hard, thinly laminate		250.0							
)67.4	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, calcareous, interbedo shale seams throughout less than 1/8" thick, limestone inclu- throughout, fresh, slightly broken, hard, very thin bedded	sions	 <u>255.0</u> 	RC 25	84 (59)					
61.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, calcareous, limestone inclusions, interbedded shale seams throughout less than 1/ thick, gray and reddish-brown and gray claystone seams fror 264.4' to 267' and 270.1' to 276', fresh, moderately broken to slightly broken, hard to very hard, medium bedded	'8" - m o -	- – - – <u>260.0</u> - –	RC 26	92 (77)					
	****		-	 <u>265.0</u> 							
	× × × × × × × × × × × × × × × × × × ×		-	 	RC	78					
	<pre></pre>		-	275.0	27	(42)					



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									Il Electric Generating Plant , Cresap, West Virginia					
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(‡)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	W	ELL DIAGRAM				
941.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusic throughout, few shale seams from 285.8' to 287' less than 1/ thick, few interbedded sandstone seams from 287.8' to 288.4 fresh, moderately broken, hard to very hard, very thin bedded thin bedded	'16" – 4', – d to – – – –	- - - - - - - - - - - - - - - - - - -	RC 28	99 (72)				– Hole Plug (Bentonite Chips)				
930.3		Gray SANDSTONE, micaceous, very fine to fine grained, few limestone inclusions throughout, interbedded siltstone seams throughout ranging from 1/8" to 1" thick, few interbedded sha seams less than 1/8" thick from 292.8' to 293.1' and 293.8' to 294.3', interbedded dark gray very fine to medium grained se less than 1/16" thick from 291' to 296.3', fresh, moderately broken, very hard, very thin bedded to thin bedded	s 29 ale - eams - -	-) <u>0.0</u> - - - 9 <u>5.0</u> -	RC 29	100 (96)				- Filter Sand				
921.7		Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions throughout, few interbedded siltstone se less than 1/8" thick from 297.3' to 298.6', fresh, moderately broken, very hard, very thin bedded to thin bedded	eams - - 30 - - - -	- - - - - - - - - - - - - - - - - - -	RC 30	100 (63)				2-Inch Slotted Screen				
909.2		Gray SHALE, interbedded slightly micaceous siltstone seams less than 1/8" thick from 309.5' to 314.6', decreasing percent of siltstone with depth, gray and reddish-gray layers from 315 to 315.4' and 316.2' to 317', fresh, moderately broken, hard becoming moderately hard, thinly laminated to laminated	5.2' - -	- 0.0 - - - 5.0	RC 31	96 (70)								



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	merican Electric Power PRC	PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia									
CEC PROJ	ECT NUMBER _110-416 PRC	JECT L	oc	ATION	Gat	ts Ridge Roa	ud, Cre	sap, West Virginia			
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	HLd JO 315	(#) 5.0	SAMPLE TYPE NUMBER	RECOVERY %	(HQU) BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM			
901.7 898.1 X × X 898.1 X × X 892 X × X 888.7 X × X 888.7 X × X 888.7 X × X 888.8 880.5 880.2 881.7 881.1 882.8 880.2 881.7 881.7 X × X 880.5 880.2 881.7 881.7 882.8 880.5 880.2 881.7 881.7 882.8 880.5 880.2 881.7 881.7 882.8 880.1 880.2 881.7 882.8 881.7 882.8 882.8 882.8 882.8 882.8 882.8 883.9 883.9 </td <td>Reddish-gray becoming gray SHALE, few claystone seams, interbedded silistone from 318.4' to 320.6', percentage of siltstone increasing with depth, 1/8' thick dark gray seams at 318.8', fresh, moderately broken, moderately hard to hard, thinl laminated to laminated Gray SILTSTONE, few interbedded sandstone seams, slightly micaceous, interbedded calcareous limestone throughout, fresh slightly broken, very thin bedded to thin bedded Gray SHALE, interbedded siltstone seams less than 0.5" thick throughout, fresh, moderately broken, hard, thinly laminated to laminated Gray SANDSTONE, micaceous, very fine to medium grained, filmestone inclusions from 329.8' to 330', fresh, broken, very hard, very thin bedded Gray SILTSTONE, slightly micaceous interbedded shale seams less than 1/16" thick from 330' to 331.5', interbedded sandstone from 331.5' to 332.9', fresh, moderately broken, hard, very thin bedded Gray SHALE, few limestone inclusions, pyrite specks observed 336.7', fresh, moderately broken, hard, thinly laminated to laminated Black COAL, fresh, broken, moderately hard, thinly laminated to laminated Black COAL, fresh, broken, moderately hard, thinly laminated to laminated Gray SHALE, nany limestone inclusions, calcareous from 333.5' to 341.6' and 342.3' to 347', fresh, moderately broken, hard, thinly laminated to laminated Geophysical logging and packer testing were performed upon completion. The following groundwater level readings were tak for geophysical logging and packer testing were performed upon completion, 10/4/2011 7:15 PM 95.19' bgs At completion, 10/4/2011 7:15 PM 95.19' bgs Bottom of hole at 347.0 feet. <t< td=""><td>- - - - - - - - - - - - - - - - - - -</td><td></td><td>R0 32 R0 33</td><td></td><td>55)</td><td></td><td>2-Inch Slotted Screen</td></t<></td>	Reddish-gray becoming gray SHALE, few claystone seams, interbedded silistone from 318.4' to 320.6', percentage of siltstone increasing with depth, 1/8' thick dark gray seams at 318.8', fresh, moderately broken, moderately hard to hard, thinl laminated to laminated Gray SILTSTONE, few interbedded sandstone seams, slightly micaceous, interbedded calcareous limestone throughout, fresh slightly broken, very thin bedded to thin bedded Gray SHALE, interbedded siltstone seams less than 0.5" thick throughout, fresh, moderately broken, hard, thinly laminated to laminated Gray SANDSTONE, micaceous, very fine to medium grained, filmestone inclusions from 329.8' to 330', fresh, broken, very hard, very thin bedded Gray SILTSTONE, slightly micaceous interbedded shale seams less than 1/16" thick from 330' to 331.5', interbedded sandstone from 331.5' to 332.9', fresh, moderately broken, hard, very thin bedded Gray SHALE, few limestone inclusions, pyrite specks observed 336.7', fresh, moderately broken, hard, thinly laminated to laminated Black COAL, fresh, broken, moderately hard, thinly laminated to laminated Black COAL, fresh, broken, moderately hard, thinly laminated to laminated Gray SHALE, nany limestone inclusions, calcareous from 333.5' to 341.6' and 342.3' to 347', fresh, moderately broken, hard, thinly laminated to laminated Geophysical logging and packer testing were performed upon completion. The following groundwater level readings were tak for geophysical logging and packer testing were performed upon completion, 10/4/2011 7:15 PM 95.19' bgs At completion, 10/4/2011 7:15 PM 95.19' bgs Bottom of hole at 347.0 feet. <t< td=""><td>- - - - - - - - - - - - - - - - - - -</td><td></td><td>R0 32 R0 33</td><td></td><td>55)</td><td></td><td>2-Inch Slotted Screen</td></t<>	- - - - - - - - - - - - - - - - - - -		R0 32 R0 33		55)		2-Inch Slotted Screen			
EC CUST											

-		erican Electric Power		PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plan PROJECT LOCATION Gatts Bidge Boad Cresan West Virginia										0
		CT NUMBER 110-416		PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia										ginia
		ED <u>9/16/11</u>	COMPLETED 10/4/11	GROUND ELEVATION <u>1218.7 ft</u> HOLE SIZE <u>0.5 ft</u>										
ORILLIN	G CC	DNTRACTOR Frontz Dri	lling, Inc.	GROUN	ID WAT	ER	LEVE	LS:						
			Auto Hammer & Air Rotary Rock C	ore A	T TIME	OF	DRIL	LING	Refer to r	iotes th	iroug	hout l	og	
OGGED) BY	R. Mahle / M. McCoy	CHECKED BY M. McCoy	. A	T END	OF	DRILL	_ING _	Refer to n	otes at	botto	m of	log	
	_ NC	N 484877.8, E 1609656.4	1	. 1	3 hours	S AF	TERI	DRILLI	NG Well	installe	d			
ELEVATION (ft) GRAPHIC	LOG	MAT	ERIAL DESCRIPTION		0.0 DEPTH (ft)		SAMPLE IYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WE	. 1	DIAGRAM 2.5' Stickup
218.7		Brown LEAN CLAY (C (RESIDUAL)	L), trace roots, moist, medium stif			X	SS 1	47	0-2-3 (5)	1.25-2	4 1			Concrete
217.2			ITH SAND (CL), trace roots, notec ist, medium stiff to stiff (RESIDUA			\mathbb{X}	SS 2	80	3-3-2 (5)	0.5- 2.25	∆ 4 ⁴	<u>م</u>	_4"	Seal
						X	SS 3	87	3-5-3 (8)	1.25 -2.5				
213.8			EAN CLAY WITH SAND (CL), tra		5.0	\mathbb{X}	SS 4	87	6-5-8 (13)	1.25- 2.25 2.5-				
212.7		(RESIDUAL)	showin lean day seams, moist, s			X	SS 5	20	3-6-5 (11)	3.75 1.25- 2.25				
210.8			bbtained from 4'-6' (Recovery = 20" CL), moist, stiff (RESIDUAL))		\mathbb{X}	SS 6	87	6-7-6 (13)	1-1.25 2.75				
209.2			btained from 6'-8' (Recovery = 22"		10.0	X	SS 7	100	49-38- 50/3"	4.5+ 4.5+ 4.5+				2-Inch Solid
		Gray, light gray and re (less than 1/8" thick) s (RESIDUAL)	ddish-brown LEAN CLAY (CL), fev andy silt seams, moist, stiff to hard	v thin d		Ā	SS 8	100	41-50/3"	4.5+				PVC Riser Sealed with
		highly weathered, very	and grayish-brown SHALE, comple v broken, very soft, thinly laminated	tely to I to			SS 9	100	43-50/1"	4.5+				Bentonite Grout
205.2		 laminated Reddish-brown CLAY: very soft 	STONE, highly weathered, very bro	oken,	 15.0	\mathbb{X}	SS 10	71	16-41- 50/5"	4.5+				
						X	SS 11	100	18-50/3"	4.5+				
202.2		Gray SHALE, highly w	eathered, very broken, very soft, la	aminated			SS 12	100	50/5"	1				
200.7		calcite filled fractures 19.7' and 21.5', mottle	CLAYSTONE, becomes harder w from 18.5' to 18.8', slickensides at d below 20.2' to dark gray below 2 to highly weathered, very broken,	19.3',	 20.0 25.0	-	RC 1	62 (9)						
		0.1' thick seam of blac from 29' to 29.3'. Iron	k shale at 28.6'. Fracture with iror stained below 31.6'.	n staining	 <u>- 30.0</u>									



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CEC PRC	JECT NUMBER 110-416 1	PROJECT LOCATIO						ATION Gatts Ridge Road, Cresap, West Virginia							
ELEVATION (ft) GRAPHIC	MATERIAL DESCRIPTION		(tt) (tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	,	WELI	_ DIAGRAM					
1182.1 × × × × × × × × × × × × × × × × × × ×	 (continued) Orangish-brown SILTSTONE, noted iron staining, some cal inclusions, moderately weathered, very broken at top to moderately broken, very thin bedded Groundwater level reading = dry (borehole depth =38' bgs) 9/30/2011 at 7:35 AM. Very fine to fine sandstone from 40.3' to 40.7' and 44.6' to 4 	ained oroken d lcite	40.0	RC 3	99 (35)					2-Inch Solid PVC Riser					
1172.7 1168.7	Sandstone from 44.3' to 45.9'. Iron stained vertical fracture 44.6' to 45'. Burgundy and gray SHALE, few claystone seams, pyrite fro and 47' and 49.9' to 50', vertical fracture from 49.1' to 49.3', slickenside at 48', vertical fracture and iron stained at 49', moderately weathered, very broken at top, laminated Gray and orange SANDSTONE, very fine to fine grained, p from 50' to 50.3', vertical fractures and iron stains from 50.5 50.9' and from 51.8' to 52.5', slightly weathered, moderately broken, hard very thin bedded Gray SHALE, few siltstone seams, iron stained fractures at 53.9' and 54.4', slightly weathered, slightly broken, hard, laminated	om 46' , , , , , , , , , , , , , , , , , , ,	 	RC 4	98 (50)					PVC Hiser Sealed with Bentonite Grout					
1157.9	Very brown from 56' to 58.5' and 60.3' to 60.8'. Pyrite from to 58.5'. Burgundy to gray CLAYSTONE, few shale laminations, moderately weathered, broken, moderately soft	56.6'		RC 5	62 (21)										
1152.7 1151 1150.9 1150 1149.7 × × × × ×	 Gray SANDSTONE, fine to medium grained, slightly weather hard, very thin bedded Gray SILTSTONE, calcareous, calcite veins, occasional sh laminations, slightly weathered, moderately broken, medium to hard, very thin bedded 	ered, ale		RC 6	80 (39)										

	HE	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road		BC	ORIN	G N	UMBE	RS	B-01	/ MW1101F PAGE 3 OF
		Cincinnati, Ohio 45242				boll	odfill Mit-L		otria Ca	poroting Plant
							Ridge Roa			nerating Plant
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	(ET PEN (tsf)	 	/ELL DIAGRAM
ELEV	GR			ਠੋ 75.0	SAMP	RECO (F	SCO NO NO NO	POCKET I (tsf)		
		Gray SHALE, calcareous, siltstone interbeds, very brown fro to 79.5', calcite lined vertical fracture from 77.6' to 78', slight weathered, moderately broken, hard, laminated <i>(continued)</i>	tly –	-						
				- 80.0 -	RC 7	87 (32)				
1133.3		Black and gray LIMESTONE, black shale interbeds at 87.7',	, 88.3'	- 85.0_						2-Inch Solid PVC Riser
1129.7		and 88.8', iron stained horizontal fractures at 86.5', 86.8' and 88.1', slightly weathered, medium bedded, hard, broken to moderately broken Water at 88.7'. Gray SHALE, few blocky claystone seams, calcareous, iron		- - 90.0						Sealed with Bentonite Grout
1124.4		stained vertical fractures at 89.5', 90.1', 90.7', and 91.2' to 9 slightly weathered to fresh, broken, moderately hard, lamina Burgundy CLAYSTONE, few shale seams, iron stained fract	ated	_ _ 	RC 8	66 (8)				
		fresh, slightly broken, hard	- - - - - -	- - - 1 <u>00.0</u> - -	RC 9	100 (64)				
115.4		Gray SANDSTONE, very fine to fine grained, calcareous, irc stained, fresh, slightly broken, hard, very thin bedded	Г	_ 05.0 _						
1112.3		Gray SHALE, few siltstone seams, calcareous infills, fresh, moderately broken, very broken from 106.4' to 107.4' and fro 109.4' to 109.7', moderately hard, thinly laminated to lamina	ated –	- - 10.0						
1107.7		Burgundy to gray CLAYSTONE, fresh, moderately hard, moderately broken	-	-	RC 10	80 (41)				
		(Continued Next Page)	1	15.0						



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							ndfill, Mitch Ridge Roa				ating Plant /irginia
									- ~p, 1		
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HLdad D 115.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
		Burgundy to gray CLAYSTONE, fresh, moderately hard,		110.0							
1102.3		moderately broken <i>(continued)</i> Gray SANDSTONE, iron stained vertical fractures from 116.4 117.4', fresh, moderately broken, hard, very thin bedded	' to	-							
1099.7		Gray and burgundy SHALE, few claystone seams, iron staine vertical fracture from 119.5' to 120', fresh, slightly to moderate broken, hard, laminated	ed . ely _	_ 120.0 _ _	RC 11	64 (25)				l	
1094.5		Gray SILTSTONE, few claystone seams, fresh, moderately broken, moderately hard, thin bedded		125.0							2-Inch Solid PVC Riser
1092.2		Gray and burgundy SHALE, few claystone seams, transitionir claystone with depth, occasional thin siltstone interbeds, fresh moderately broken, moderately hard, thinly laminated to laminated	n, 	-							Sealed with Bentonite Grout
			-	<u>130.0</u> – –	RC 12	90 (66)				l	
1083.2		Gray and burgundy CLAYSTONE, occasional thin siltstone ar		_ 135.0_							
		shale interbeds, iron stained fracture at 140.1', fresh, very bro moderately hard	oken,	- - 140.0						l	
1078.6	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, fresh, moderately broken, hard, thin bedde medium bedded Limestone interbeds from 142.5' to 142.8'	ed to		RC 13	70 (38)				l	
1074.2	$\times \times \times$	Gray LIMESTONE, fresh, moderately broken, hard, thick bed	ded	145.0 -	RC						
1071.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusion from 147' to 147.4', interbedded shale from 151.3' to 152.4', fresh, moderately broken, moderately hard to hard, thin bedde	ed	- - 1 <u>50.0</u>	14_	<u>}</u>					
1066.3	× × × × × × ×			-	RC 15	82 (61)					
			-	- 155.0							



BORING NUMBER SB-01/ MW1101R PAGE 5 OF 9

						Ridge Roa				iting Plant irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd3D 155.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	١	WEL	_ DIAGRAM
		Gray SHALE, interbedded siltstone from 155.4' to 155.8', slightly reddish-gray from 155.4' to 156.7' with claystone seams, interbedded slightly micaceous siltstone seams less than 1/8" thick from 157' to 160.5, fresh, moderately broken, moderately hard, thinly laminated to laminated <i>(continued)</i>								
1058.2	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, few limestone inclusions, fresh, moderately broken to broken, hard, medium bedded Gray SANDSTONE, very fine to medium grained, limestone inclusions, interbedded siltstone seams throughout less than 1/16" thick, interbedded shale and siltstone layers from 163.6' to 164', fresh, moderately broken to slightly broken, hard, thin bedded to medium bedded	 160.0 165.0 	RC 16	100 (84)					2-Inch Solid PVC Riser Sealed with Bentonite Grout
1050.2 1049.7	× × ×	Gray SILTSTONE, slightly micaceous, few interbedded shale seams throughout less than 1/8" thick, fresh, moderately broken hard, very thin bedded Gray becoming reddish-gray and dark gray SHALE, few claystone seams, interbedded siltstone seams throughout less than 1/8" thick, pyrite specks observed at 170.3', iron staining from 171' to 171.1', fresh, moderately broken, moderately hard, thinly laminated to laminated	 <u>170.0</u> 	RC 17	90 (58)					
1044.9		Gray becoming dark gray SANDSTONE, micaceous, very fine to medium grained, interbedded with siltstone seams throughout less than 1/8" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded becoming thick bedded	 <u>175.0</u> 							
042.2		Dark gray SHALE, fresh, moderately broken to broken, hard, laminated Gray to slightly reddish-gray SHALE, few claystone and siltstone seams, calcareous, few limestone inclusions, fresh, broken, hard, laminated	 <u>180.0</u>							
1037.9	× ×	Gray SILTSTONE, slightly micaceous, calcareous, few limestone inclusions, few shale seams throughout less than 1/8" thick, fresh, broken, hard, very thin bedded to thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, few interbedded siltstone seams less than	 185.0	RC 18	98 (84)					– Hole Plug (Bentonite Chips)
1031.8		 1/16" thick, fresh, moderately broken to slightly broken, hard, very thin bedded to thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8" thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded 	, -							- Filter Sand
				RC 19	100 (76)					

	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia	
CRIPTION HLdgd (1) HLdgd (1) 195.0 HLdgd (1) 195.0 Well Diagram	
e to coarse grained seams less	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8" thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded <i>(continued)</i>
Arron Review shale seams, rately broken, moderately hard 	Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard 215.0
y seam from 220.1' to 220.4', fresh, moderately broken, hard 220.0 RC 87	Reddish-brown CLAYSTONE, gray seam from 220.1' to 220.4', 0.5" thick dark gray lens at 221.7', fresh, moderately broken, hard 220.0
ous, few limestone inclusions, n 1/16" thick from 221.8' to nard, very thin bedded	Gray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/16" thick from 221.8' to 222.2', fresh, moderately broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded
DNE, blocky, fresh, moderately	Gray and reddish-brown CLAYSTONE, blocky, fresh, moderately broken, hard
inclusions, fresh, moderately	Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded to thin bedded
235.0	(Continued Next Page)



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CEC F	PROJE	CT NUMBER <u>110-416</u> PRC	JECT L	.00/	ATION _	Gatts	Ridge Roa	d, Cres	sap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
81.7	× × × × × × × × × × × × × × × × × × ×	Gray SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams throughout less than 1/8" thick, fresh, slightly broken, very hard, very thin bedded <i>(continued)</i> Gray SHALE, few siltstone seams, slightly micaceous, interbedded shale lenses throughout less than 1/8" thick, interbedded sandstone layer, reddish-brown seams from 237.8 237.9', from 238.7' to 238.8', from 239' to 239.3', and from 241.	- 	-					
076.8	× × × × × × × × × × × × × × × × × × ×	to 241.4', pyrite at 238.1', fresh, moderately broken, hard, thinly laminated to laminated Gray and reddish-brown SHALE, few interbedded slightly micaceous siltstone seams throughout less than 1/16" thick,		<u>).0</u> - -	RC 24	88 (50)			
		fresh, slightly broken, hard, thinly laminated to laminated	_ 	_ 5.0 _					
071.7		Reddish-brown becoming gray SHALE, few claystone seams, fresh, broken, moderately hard to hard, thinly laminated to laminated	- - 25	_ _ <u>).0</u>					
<u>68</u> 67.4		Black COAL, fresh, broken, moderately hard, thinly laminated Gray SILTSTONE, slightly micaceous, calcareous, interbedded shale seams throughout less than 1/8" thick, limestone inclusio throughout, fresh, slightly broken, hard, very thin bedded	 ns 	- - 5.0 -	RC 25	84 (59)			
61.7	*************	Gray SILTSTONE, slightly micaceous, calcareous, limestone inclusions, interbedded shale seams throughout less than 1/8" thick, gray and reddish-brown and gray claystone seams from 264.4' to 267' and 270.1' to 276', fresh, moderately broken to slightly broken, hard to very hard, medium bedded	- _ _ _ _ _ _ _	- - <u>).0</u> - -	RC 26	92 (77)			
	*****		_ _26! _ _	_ 5.0 _ _					
	*****		- - 27(- -	- - <u>).0</u> -	RC 27	78 (42)			
	× × × × × × × × × × × ×		- - 27:						



BORING NUMBER SB-01/ MW1101R PAGE 8 OF 9

				111	0		_	
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd HLd 275.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
41.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusions throughout, few shale seams from 285.8' to 287' less than 1/16 thick, few interbedded sandstone seams from 287.8' to 288.4', fresh, moderately broken, hard to very hard, very thin bedded to thin bedded	'	RC 28	99 (72)			
30.3	× × × ×	Gray SANDSTONE, micaceous, very fine to fine grained, few limestone inclusions throughout, interbedded siltstone seams throughout ranging from 1/8" to 1" thick, few interbedded shale seams less than 1/8" thick from 292.8' to 293.1' and 293.8' to 294.3', interbedded dark gray very fine to medium grained sear less than 1/16" thick from 291' to 296.3', fresh, moderately broken, very hard, very thin bedded to thin bedded	 290.0 295.0 	RC 29	100 (96)			
21.7		Gray SANDSTONE, micaceous, very fine to medium grained, f limestone inclusions throughout, few interbedded siltstone sear less than 1/8" thick from 297.3' to 298.6', fresh, moderately broken, very hard, very thin bedded to thin bedded		RC 30	100 (63)			
)9.2		Gray SHALE, interbedded slightly micaceous siltstone seams less than 1/8" thick from 309.5' to 314.6', decreasing percentag of siltstone with depth, gray and reddish-gray layers from 315.2 to 315.4' and 316.2' to 317', fresh, moderately broken, hard becoming moderately hard, thinly laminated to laminated	 <u>310.0</u> e 	RC 31	96 (70)			



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CEC	PROJE	CT NUMBER 110-416 PROJ				Gatts	Ridge Roa	d, Cres	sap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	(#) HLd3O 315.		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
			-	-					
901.7		Reddish-gray becoming gray SHALE, few claystone seams, interbedded siltstone from 318.4' to 320.6', percentage of siltstone increasing with depth, 1/8" thick dark gray seams at 318.8', fresh, moderately broken, moderately hard to hard, thinly laminated to laminated	 	- - 0					
898.1	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, few interbedded sandstone seams, slightly micaceous, interbedded calcareous limestone throughout, fresh, slightly broken, very hard, very thin bedded to thin bedded	-	-	RC 32	100 (87)			
894.4		Gray SHALE, interbedded siltstone seams less than 0.5" thick throughout, fresh, moderately broken, hard, thinly laminated to laminated	<u>325.</u>	0					
892		Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions from 329.8' to 330', fresh, broken, very hard, very thin bedded	-		t				
888.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous interbedded shale seams less than 1/16" thick from 330' to 331.5', interbedded sandstone from 331.5' to 332.9', fresh, moderately broken, hard, very thin bedded	<u>330.</u> - -	-	RC 33	85 (46)			
885.8		Gray SHALE, few limestone inclusions, pyrite specks observed a 336.7', fresh, moderately broken, hard, thinly laminated to laminated	 <u>335.</u> 	- 0 -					
880.5 880.2		Black COAL, fresh, broken, moderately hard, thinly laminated Dark gray SHALE, many limestone inclusions, calcareous from 338.5' to 341.6' and 342.3' to 347' with the exception of a dark gray lens from 343.3' to 343.5', noted increased percentage of limestone inclusions from 343.5' to 347', fresh, moderately broken, hard to very hard, thinly laminated to laminated	 	_ _ 0 _	RC	93			
		Geophysical logging and packer testing were performed upon completion. The following groundwater level readings were taken for geophysical logging after filling borehole with water (note: borehole would not fill completely): Before logging, 10/4/2011 4:43 PM 52.03' bgs After first tooling, 10/4/2011 5:41 PM 62.85' bgs At completion, 10/4/2011 7:15 PM 95.19' bgs	_ _ _345. _	- 0 -	34	(63)			
871.7		Bottom of hole at 347.0 feet. Approximate 0.5' bench cut for access. Cut soil described as 0.2 of topsoil over 0.3' of brown lean clay with sand (CL).			_				
		The following groundwater level reading was taken after drilling: $10/5/2011 8:44 \text{ AM}$ at 96.4' bgs (borehole depth = 347' bgs) prior to well installation							
		Well MW1101R installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB-01. The ground elevation for MW1101R = 1218.7 ft.							

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		B	O	RIN	G N	UMBE	:RS	5B-(01/	MW1101F PAGE 1 OF 9
CLIEI	NT An	nerican Electric Power PF	ROJEC		ЛE	Mitch	iell La	ndfill, Mitch	nell Ele	ctric	Gener	ating Plant
CEC	PROJE	CT NUMBER 110-416 PF	ROJEC		CAT	ION	Gatts	Ridge Roa	d, Cres	sap, N	Nest \	/irginia
DATE	STAR	TED 9/16/11 COMPLETED 10/4/11 GF	ROUN	D ELE	VA		1218.	7 ft	HOLE	SIZE	0.5	ft
						LEVE						
		ETHOD 4.25" I.D. HSA: Auto Hammer & Air Rotary Rock Core					-	Refer to n	intes th	nona	hout la)a
		R. Mahle / M. McCoy CHECKED BY M. McCoy						Refer to no				0
		N 484864.5, E 1609651.4					_	NG Well				og
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		o (ft)		SAMPLE 17PE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1218.7		Brown LEAN CLAY (CL), trace roots, moist, medium stiff (RESIDUAL)	-		X	SS 1	47	0-2-3 (5)	1.25-2	1		Concrete
1217.2		Brown LEAN CLAY WITH SAND (CL), trace roots, noted iron oxide concretions, moist, medium stiff to stiff (RESIDUAL)			\mathbb{X}	SS 2	80	3-3-2 (5)	0.5- 2.25		<u>م</u>	⁴ Seal
			-			SS 3	87	3-5-3 (8)	1.25 -2.5			
1213.8		Light brown and gray LEAN CLAY WITH SAND (CL), trace ro	oots,	5.0	$\overline{\mathbb{X}}$	SS 4	87	6-5-8 (13)	1.25- 2.25 2.5-			
1212.7		(RESIDUAL)			X	SS 5	20	3-6-5 (11)	3.75 1.25- 2.25			
1210.8		Shelby Tube sample obtained from 4'-6' (Recovery = 20") Brown LEAN CLAY (CL), moist, stiff (RESIDUAL)			K	SS 6	87	6-7-6 (13)	1-1.25 2.75			
1209.2		Shelby Tube sample obtained from 6'-8' (Recovery = 22")		10.0	X	SS 7	100	49-38- 50/3"	4.5+ 4.5+ 4.5+			2-Inch Solid
		Gray, light gray and reddish-brown LEAN CLAY (CL), few thir (less than 1/8" thick) sandy silt seams, moist, stiff to hard (RESIDUAL)	1			SS 8	100	41-50/3"	4.5+			PVC Riser Sealed with Bentonite
		Reddish-brown, gray and grayish-brown SHALE, completely t highly weathered, very broken, very soft, thinly laminated to laminated	:0			SS 9	100	43-50/1"	4.5+			Grout
1205.2		Reddish-brown CLAYSTONE, highly weathered, very broken, very soft	/ '	 15.0	X	SS 10	71	16-41- 50/5"	4.5+			
					X	SS 11	100	18-50/3"	4.5+			
1202.2		Gray SHALE, highly weathered, very broken, very soft, lamina	ated			SS 12	100	50/5"	1			
1202.2		Dark burgundy to gray CLAYSTONE, becomes harder with de calcite filled fractures from 18.5' to 18.8', slickensides at 19.3 19.7' and 21.5', mottled below 20.2' to dark gray below 21.6', moderately weathered to highly weathered, very broken, moderately soft	epth, ',	 	-	RC 1	62 (9)					
		0.1' thick seam of black shale at 28.6'. Fracture with iron stai from 29' to 29.3'. Iron stained below 31.6'. Silty with vertical fracture from 32.2' to 33.9', iron stained, par healed		30.0		RC	71					
1185						2	(31)					
	1			35.0								



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							andfill, Mitcl				0
CEC PF	ROJE	CT NUMBER PF	ROJE		ATION	Gatts	Ridge Roa	d, Cres	sap, V	Vest V	'irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) (tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Gray to orangish-brown SANDSTONE, noted calcite, cement very fine to medium grained, noted iron staining and iron stain fractures, micaceous, moderately weathered, moderately bro to slightly broken, hard, very thin bedded to medium bedded <i>(continued)</i> Orangish-brown SILTSTONE, noted iron staining, some calci inclusions, moderately weathered, very broken at top to	ned ken				_				
	× × × × × × × × × × × × ×	moderately broken, very thin bedded Groundwater level reading = dry (borehole depth =38' bgs) or 9/30/2011 at 7:35 AM. Very fine to fine sandstone from 40.3' to 40.7' and 44.6' to 44		40.0 45.0	R(3) 99 (35)					2-Inch Solid
× 1172.7	× × > × × >	Sandstone from 44.3' to 45.9'. Iron stained vertical fracture from 44.6' to 45'. Burgundy and gray SHALE, few claystone seams, pyrite from and 47' and 49.9' to 50', vertical fracture from 49.1' to 49.3', slickenside at 48', vertical fracture and iron stained at 49', moderately weathered, very broken at top, laminated		 50.0			_			l	PVC Riser Sealed with Bentonite Grout
1168.7		Gray and orange SANDSTONE, very fine to fine grained, pyr from 50' to 50.3', vertical fractures and iron stains from 50.5' 50.9' and from 51.8' to 52.5', slightly weathered, moderately broken, hard very thin bedded	to		R(4						
1166.2		Gray SHALE, few siltstone seams, iron stained fractures at 5 53.9' and 54.4', slightly weathered, slightly broken, hard, laminated	3.3',	 55.0							
		Very brown from 56' to 58.5' and 60.3' to 60.8'. Pyrite from 56 to 58.5'.	6.6'	 			_			l	
1157.9		Burgundy to gray CLAYSTONE, few shale laminations, moderately weathered, broken, moderately soft		 _65.0	R(5	(21)				l	
1152.7		Dark gray to light gray LIMESTONE, slightly weathered, moderately broken, hard, thick bedded Black SHALE, slightly weathered, broken, soft, laminated									
1150.9 1150 1149.7 ××××××××××××××××××××××××××××××××××××		Gray SHALE, slightly weathered, very broken, soft, laminated Gray SANDSTONE, fine to medium grained, slightly weather hard, very thin bedded Gray SILTSTONE, calcareous, calcite veins, occasional shal laminations, slightly weathered, moderately broken, medium to hard, very thin bedded	ed, e	 	R(6	C 80 (39)					
1144.7	× × × • × ×			 75.0							
		(Continued Next Page)		75.0			1				

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road		B	ORIN	G N	UMBE	RS	B-01 /	MW1101F PAGE 3 OF 9
	NT Am	Cincinnati, Ohio 45242 erican Electric Power	ROJECT		IE Mito	hell I a	ndfill. Mitch	nell Fle	ctric Gene	rating Plant
									sap, West	
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WE	LL DIAGRAM
		Gray SHALE, calcareous, siltstone interbeds, very brown fro to 79.5', calcite lined vertical fracture from 77.6' to 78', slight weathered, moderately broken, hard, laminated <i>(continued)</i>	om 76'	75.0 - -						
			-	- 80.0 - -	RC 7	87 (32)				
1133.3		Black and gray LIMESTONE, black shale interbeds at 87.7',	, 88.3'	- 85.0_						2-Inch Solid PVC Riser
1129.7		and 88.8', iron stained horizontal fractures at 86.5', 86.8' and 88.1', slightly weathered, medium bedded, hard, broken to moderately broken Water at 88.7'. Gray SHALE, few blocky claystone seams, calcareous, iron stained vertical fractures at 89.5', 90.1', 90.7', and 91.2' to 9 slightly weathered to fresh, broken, moderately hard, lamina	-	- - 9 <u>0.0</u> - -	RC 8	66 (8)				Sealed with Bentonite Grout
1124.4		Burgundy CLAYSTONE, few shale seams, iron stained fract fresh, slightly broken, hard	-	_ 9 <u>5.0</u> _ _ _ _ 00.0						
1115.4		Gray SANDSTONE, very fine to fine grained, calcareous, iro stained, fresh, slightly broken, hard, very thin bedded	- - - - -	05.0	RC 9	100 (64)				
1112.3		Gray SHALE, few siltstone seams, calcareous infills, fresh, moderately broken, very broken from 106.4' to 107.4' and fro 109.4' to 109.7', moderately hard, thinly laminated to lamina Burgundy to gray CLAYSTONE, fresh, moderately hard,	ited –	- - 10.0	RC 10	80 (41)				
		(Continued Next Page)		- - 15.0	10	(+1)				



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											ating Plant
CEC I	PROJE	CT NUMBER <u>110-416</u> PF	ROJEC		ATION	Gatts	Ridge Roa	d, Cres	sap, \	Nest \	/irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (#) DED 115.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
		Burgundy to gray CLAYSTONE, fresh, moderately hard, moderately broken (continued)									
1102.3		Gray SANDSTONE, iron stained vertical fractures from 116.4 117.4', fresh, moderately broken, hard, very thin bedded	l' to								
1099.7		Gray and burgundy SHALE, few claystone seams, iron staine vertical fracture from 119.5' to 120', fresh, slightly to moderate broken, hard, laminated	ed ely	 <u>120.0</u> 	RC 11	64 (25)				l	
1094.5		Gray SILTSTONE, few claystone seams, fresh, moderately broken, moderately hard, thin bedded		 125.0							2-Inch Solid PVC Riser
1092.2		Gray and burgundy SHALE, few claystone seams, transitionin claystone with depth, occasional thin siltstone interbeds, fresh moderately broken, moderately hard, thinly laminated to laminated								l	Sealed with Bentonite Grout
				<u>130.0</u> 	RC 12	90 (66)					
1083.2		Gray and burgundy CLAYSTONE, occasional thin siltstone a	nd	 _135.0							
1000.2		shale interbeds, iron stained fracture at 140.1', fresh, very bro moderately hard		 							
1078.6		Gray SILTSTONE, fresh, moderately broken, hard, thin bedd medium bedded	ed to	<u>140.0</u> 	RC 13	70 (38)					
1074.2		Limestone interbeds from 142.5' to 142.8' Gray LIMESTONE, fresh, moderately broken, hard, thick bed	ded	 _145.0							
					RC						
1071.7	* * * * * * * * * * * * * * * * * * *	Gray SILTSTONE, slightly micaceous, few limestone inclusio from 147' to 147.4', interbedded shale from 151.3' to 152.4', fresh, moderately broken, moderately hard to hard, thin bedd		 <u>150.0</u>	RC	82					
1066.3				 155.0	15	(61)					



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									ectric Genera sap, West V	
_	GRAPHIC LOG	MATERIAL DESCRIPTION		HLdad (#) 155.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		L DIAGRAM
		Gray SHALE, interbedded siltstone from 155.4' to 155.8', slig reddish-gray from 155.4' to 156.7' with claystone seams, interbedded slightly micaceous siltstone seams less than 1/8 thick from 157' to 160.5, fresh, moderately broken, moderately hard, thinly laminated to laminated <i>(continued)</i>	"							– Hole Plug (Bentonite Chips)
1058.2	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, few limestone inclusions, fresh, moderate broken to broken, hard, medium bedded Gray SANDSTONE, very fine to medium grained, limestone inclusions, interbedded siltstone seams throughout less than 1/16" thick, interbedded shale and siltstone layers from 163.6 164', fresh, moderately broken to slightly broken, hard, thin bedded to medium bedded	ily 5' to	<u>160.0</u> <u>-</u> <u>165.0</u> 	RC 16	100 (84)				- Filter Sand 2-Inch Slotted Screen
1050.2	× × >	Gray SILTSTONE, slightly micaceous, few interbedded shale seams throughout less than 1/8" thick, fresh, moderately brok hard, very thin bedded Gray becoming reddish-gray and dark gray SHALE, few claystone seams, interbedded siltstone seams throughout less than 1/8" thick, pyrite specks observed at 170.3', iron staining from 171' to 171.1', fresh, moderately broken, moderately has thinly laminated to laminated	ken, ss	 <u>170.0</u> 	RC 17	90 (58)				Filter Sand
1044.9		Gray becoming dark gray SANDSTONE, micaceous, very fin medium grained, interbedded with siltstone seams throughou less than 1/8" thick, few limestone inclusions, fresh, moderate broken, hard, very thin bedded becoming thick bedded	ıt ely	 <u>175.0</u> 						
1041.2		Dark gray SHALE, fresh, moderately broken to broken, hard, laminated Gray to slightly reddish-gray SHALE, few claystone and siltst seams, calcareous, few limestone inclusions, fresh, broken, I laminated	one hard,	 <u>180.0</u>						
>		Gray SILTSTONE, slightly micaceous, calcareous, few limes inclusions, few shale seams throughout less than 1/8" thick, fresh, broken, hard, very thin bedded to thin bedded Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions, few interbedded siltstone seams less th 1/16" thick, fresh, moderately broken to slightly broken, hard, thin bedded to thin bedded	, few an	- – - – <u>185.0</u>	RC 18	98 (84)				
1031.8		Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions, dark gray fine to coarse grained seams than 1/8" thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded	less -	 <u>190.0</u> 	RC 19	100 (76)				
			-	 195.0						

T Am								PAGE 6 OF
ROJEC								ctric Generating Plant ap, West Virginia
GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH	(ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)		POCKET PEN (tsf)	WELL DIAGRAM
	limestone inclusions, dark gray fine to coarse grained seams	d, few s less – – –			100	_		
		- - <u>20</u> - -	- - <u>5.0</u> -			_		
	Gray becoming reddish-gray CLAYSTONE, few shale seams limestone inclusions, fresh, moderately broken, moderately h to hard	s, hard - -	-					
	0.5" thick dark gray lens at 221.7', fresh, moderately broken,	hard - - <u>22</u> -	_ _ 0.0			-		
× × × × × × × × × × × × × × × × × × ×	interbedded shale seams less than 1/16" thick from 221.8' to 222.2', fresh, moderately broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions throughout, fresh, slightly broken, very h very thin bedded	d, few – nard, <u>22</u>	 5.0	22	(71)			
	broken, hard Gray SILTSTONE, slightly micaceous, interbedded shale sea	ams 23	_ _ 0.0 _ _ _					
		Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions, dark gray fine to coarse grained seams than 1/8' thick from 197' to 207', fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) Gray becoming reddish-gray CLAYSTONE, few shale seams limestone inclusions, fresh, moderately broken, moderately broken, moderately broken to hard Reddish-brown CLAYSTONE, gray seam from 220.1' to 220 0.5" thick dark gray lens at 221.7", fresh, moderately broken, employed and the seams limestone inclusions, fresh, moderately broken, and 22.2.?, fresh, moderately broken, hard, very thin bedded Gray SILTSTONE, slightly micaceous, few limestone inclusion interbedded shale seams less than 1/16" thick from 221.8' to 222.2.?, fresh, moderately broken, hard, very thin bedded Gray SANDSTONE, micaceous, few limestone inclusion interbedded shale seams less than 1/16" thick from 221.8' to 222.2.?, fresh, moderately broken, hard, very thin bedded Gray SANDSTONE, slightly micaceous, few limestone inclusions throughout, fresh, slightly broken, very livery thin bedded Gray and reddish-brown CLAYSTONE, blocky, fresh, moderately broken, hard Gray and reddish-brown CLAYSTONE, blocky, fresh, moderately broken, hard Gray SILTSTONE, slightly micaceous, interbedded shale sea less than 1/8" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8" thick from 197 to 207, fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) 20 20 20 31 20 32 20 33 20 43 20 44 20 44 20 45 20 46 20 46 20 47 20 48 20 49 20 49 20 40 20 40 20 41 20 42 20 42 20 44 21 45 21 46 21 47 21 48 21 49 21 40 21 40 21 41 21 42 22 42 22 42 22 <t< td=""><td>Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8" thick from 197 to 207; fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) - 200.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 210.0 - - 210.0 - - 215.0 - - 215.0 - - 215.0 - - 215.0 - - 220.0 - - 22</td><td>Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8' thick from 197' to 227, fresh, moderately broken, noderately broken, hard, very thin bedded to thick bedded (continued) Gray becoming reddish-gray CLAYSTONE, few shale seams. limestone inclusions, firesh, moderately broken, moderately hard to hard 200.0 Gray becoming reddish-gray CLAYSTONE, few shale seams. limestone inclusions, firesh, moderately broken, moderately hard to hard 210.0 Reddish-brown CLAYSTONE, gray seam from 220.1' to 220.4', 0.5'' thick dark gray lens at 221.7', fresh, moderately broken, hard very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/6' thick from 221.8' to 222.2', fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/6' thick, few limestone inclusions, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/6' thick, few limestone inclusions, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately brok</td><td>Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams, less than 1/8" thick from 19" to 20", fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard Gray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 11/16" thick from 221.8" to 222.2", fresh, moderately broken, hard Gray SANDSTONE, micaceous, rev fine to medium grained, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SANDSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 225.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 230.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 225.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick</td><td>Gray SANDSTONE, micaceous, very fine to medium grained, few fime store inclusions, dark gray fine to coarse grained seams less than 11% thick from 10% 10.20%. Fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) PC Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Caray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/16" thick from 221.3" to 220.0 PC 87 Caray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/16" thick from 221.3" to 220.0 PC 87 Caray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions fresh, moderately broken, hard 220.0 PC 87 Caray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, fresh, moderately broken, hard 225.0 PC 87 Caray SALTSTONE, slightly micaceous, interbedded shale seams less than 1/16" thick from 221.3" to 225.0 220.0 PC 77 Caray SILTSTONE, slightly micaceous, interbedded shale seams lesis than 1/8" thick, few limestone inclusions</td><td>Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to carse grained seams less than 1/8' thick from 10 a 20, fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) 200.0 </td></t<>	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8" thick from 197 to 207; fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) - 200.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 201.0 - - 210.0 - - 210.0 - - 215.0 - - 215.0 - - 215.0 - - 215.0 - - 220.0 - - 22	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams less than 1/8' thick from 197' to 227, fresh, moderately broken, noderately broken, hard, very thin bedded to thick bedded (continued) Gray becoming reddish-gray CLAYSTONE, few shale seams. limestone inclusions, firesh, moderately broken, moderately hard to hard 200.0 Gray becoming reddish-gray CLAYSTONE, few shale seams. limestone inclusions, firesh, moderately broken, moderately hard to hard 210.0 Reddish-brown CLAYSTONE, gray seam from 220.1' to 220.4', 0.5'' thick dark gray lens at 221.7', fresh, moderately broken, hard very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/6' thick from 221.8' to 222.2', fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/6' thick, few limestone inclusions, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/6' thick, few limestone inclusions, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded 220.0 Gray SILTSTONE, slightly micaceous, interbedded shale seams less than 1/8' thick, few limestone inclusions, fresh, moderately brok	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to coarse grained seams, less than 1/8" thick from 19" to 20", fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard Gray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 11/16" thick from 221.8" to 222.2", fresh, moderately broken, hard Gray SANDSTONE, micaceous, rev fine to medium grained, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SANDSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 225.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 230.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 225.0 Gray SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick from 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 11/16" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick form 221.8" to 230.0 Reg SULTSTONE, slightly micaceous, interbedded shale seams less than 116" thick	Gray SANDSTONE, micaceous, very fine to medium grained, few fime store inclusions, dark gray fine to coarse grained seams less than 11% thick from 10% 10.20%. Fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) PC Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Gray becoming reddish-gray CLAYSTONE, few shale seams, limestone inclusions, fresh, moderately broken, moderately hard to hard PC 88 Caray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/16" thick from 221.3" to 220.0 PC 87 Caray SILTSTONE, slightly micaceous, few limestone inclusions, interbedded shale seams less than 1/16" thick from 221.3" to 220.0 PC 87 Caray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions fresh, moderately broken, hard 220.0 PC 87 Caray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, fresh, moderately broken, hard 225.0 PC 87 Caray SALTSTONE, slightly micaceous, interbedded shale seams less than 1/16" thick from 221.3" to 225.0 220.0 PC 77 Caray SILTSTONE, slightly micaceous, interbedded shale seams lesis than 1/8" thick, few limestone inclusions	Gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, dark gray fine to carse grained seams less than 1/8' thick from 10 a 20, fresh, moderately broken to slightly broken, very hard, very thin bedded to thick bedded (continued) 200.0



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CEC	PROJE	CT NUMBER 110-416 PR	ROJEC	T LOC	ATION _	Gatts	Ridge Roa	d, Cres	ap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) (tt) 235.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
		Gray SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams throughout less than 1/8" thick, fresh, slightly broken, very hard, very thin bedded (continued)	,						
981.7	× × × × × × × × × × × × × × × × × × ×	Gray SHALE, few siltstone seams, slightly micaceous, interbedded shale lenses throughout less than 1/8" thick, interbedded sandstone layer, reddish-brown seams from 237. 237.9', from 238.7' to 238.8', from 239' to 239.3', and from 24' to 241.4', pyrite at 238.1', fresh, moderately broken, hard, thin laminated to laminated	.8' to 1.3'	- - 240.0 -	RC	88			
976.8		Gray and reddish-brown SHALE, few interbedded slightly micaceous siltstone seams throughout less than 1/16" thick, fresh, slightly broken, hard, thinly laminated to laminated	-	- - 245.0	24	(50)			
971.7		Reddish-brown becoming gray SHALE, few claystone seams, fresh, broken, moderately hard to hard, thinly laminated to laminated	,	-					
968 967.4		Black COAL, fresh, broken, moderately hard, thinly laminated Gray SILTSTONE, slightly micaceous, calcareous, interbedde shale seams throughout less than 1/8" thick, limestone inclusi	ed	<u>250.0</u> _ _	RC 25	84 (59)			
	****	throughout, fresh, slightly broken, hard, very thin bedded	-	_ _ 2 <u>55.0</u>					
961.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, calcareous, limestone inclusions, interbedded shale seams throughout less than 1/8 thick, gray and reddish-brown and gray claystone seams from 264.4' to 267' and 270.1' to 276', fresh, moderately broken to slightly broken, hard to very hard, medium bedded	" _ 1 _	- - 2 <u>60.0</u> - - -	RC 26	92 (77)			
	· · · · · · · · · · · · · · · · · · ·		-	<u>265.0</u> - -					
	· · · · · · · · · · · · · · · · · · ·			_ 270.0 _	RC	78			
	× × × × × × × × × × × × × × × × × × ×			_ _ 275.0	27	(42)			



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0.3 11.7	Gray SILTSTONE, slightly micaceous, few limestone inclus throughout, few shale seams from 285.8' to 287' less than thick, few interbedded sandstone seams from 287.8' to 288 fresh, moderately broken, hard to very hard, very thin bedd thin bedded	sions 1/16" - 3.4',	[] ⁽ ₽) 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
11.7 × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclus throughout, few shale seams from 285.8' to 287' less than thick, few interbedded sandstone seams from 287.8' to 288 fresh, moderately broken, hard to very hard, very thin bedd thin bedded	1/16" – 3.4',						
××× 10.3	× × × × × × × × × × × × × × × × × × ×	<u>28</u> - - - -	_ 3 <u>0.0</u> _ _ 3 <u>5.0</u> _ _ _	RC 28	99 (72)			
	Gray SANDSTONE, micaceous, very fine to fine grained, fr limestone inclusions throughout, interbedded siltstone sear throughout ranging from 1/8" to 1" thick, few interbedded si seams less than 1/8" thick from 292.8' to 293.1' and 293.8' 294.3', interbedded dark gray very fine to medium grained less than 1/16" thick from 291' to 296.3', fresh, moderately broken, very hard, very thin bedded to thin bedded	ns 29 hale 5 seams - - -	- 90.0 - - - 95.0 -	RC 29	100 (96)			
	Gray SANDSTONE, micaceous, very fine to medium grain limestone inclusions throughout, few interbedded siltstone less than 1/8" thick from 297.3' to 298.6', fresh, moderately broken, very hard, very thin bedded to thin bedded	seams - 30 - - - -	- -)0.0 - - - - -)5.0 - - - - - - - - - - - - - - - - - - -	RC 30	100 (63)			
9.2	Gray SHALE, interbedded slightly micaceous siltstone sea less than 1/8" thick from 309.5' to 314.6', decreasing perce of siltstone with depth, gray and reddish-gray layers from 3 to 315.4' and 316.2' to 317', fresh, moderately broken, hard becoming moderately hard, thinly laminated to laminated	ntage 15.2' -	_ _ 0.0 _ _ _ _	RC 31	96 (70)			



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CEC	PROJE	CT NUMBER 110-416 PROJ	ECT LO	CA		Gatts	Ridge Roa	d, Cres	ap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd DE 315		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
				1					
901.7		Reddish-gray becoming gray SHALE, few claystone seams, interbedded siltstone from 318.4' to 320.6', percentage of siltstone increasing with depth, 1/8" thick dark gray seams at 318.8', fresh, moderately broken, moderately hard to hard, thinly laminated to laminated	- - 320	_ _ 0_					
398.1	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, few interbedded sandstone seams, slightly micaceous, interbedded calcareous limestone throughout, fresh, slightly broken, very hard, very thin bedded to thin bedded	-	-	RC 32	100 (87)			
394.4		Gray SHALE, interbedded siltstone seams less than 0.5" thick throughout, fresh, moderately broken, hard, thinly laminated to laminated	325	0					
392		Gray SANDSTONE, micaceous, very fine to medium grained, fer limestone inclusions from 329.8' to 330', fresh, broken, very hard, very thin bedded	- - - 330						
388.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous interbedded shale seams less than 1/16" thick from 330' to 331.5', interbedded sandstone from 331.5' to 332.9', fresh, moderately broken, hard, very thin bedded		-	RC 33	85 (46)			
885.8		Gray SHALE, few limestone inclusions, pyrite specks observed a 336.7', fresh, moderately broken, hard, thinly laminated to laminated	it	- 0 -					
880.5 880.2		Black COAL, fresh, broken, moderately hard, thinly laminated Dark gray SHALE, many limestone inclusions, calcareous from 338.5' to 341.6' and 342.3' to 347' with the exception of a dark gray lens from 343.3' to 343.5', noted increased percentage of limestone inclusions from 343.5' to 347', fresh, moderately broken, hard to very hard, thinly laminated to laminated	 	 	RC	93			
		Geophysical logging and packer testing were performed upon completion. The following groundwater level readings were take for geophysical logging after filling borehole with water (note: borehole would not fill completely): Before logging, 10/4/2011 4:43 PM 52.03' bgs After first tooling, 10/4/2011 5:41 PM 62.85' bgs At completion, 10/4/2011 7:15 PM 95.19' bgs	n	- 0 -	34	(63)			
871.7		Bottom of hole at 347.0 feet. Approximate 0.5' bench cut for access. Cut soil described as 0.2 of topsoil over 0.3' of brown lean clay with sand (CL).	2'						
		The following groundwater level reading was taken after drilling: 10/5/2011 8:44 AM at 96.4' bgs (borehole depth = 347' bgs) prior to well installation							
		Well MW1101F installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB-01. The ground elevation for MW1101F = 1219.0 ft.							

	4	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road		B	OF	RINO	G N	UMBE	RS	B-0	-	W1102
								ndfill, Mitch				
								Ridge Roa				
						-		8 ft	HOLE	SIZE	0.5 ft	
			GROUN									
		ETHOD HSA: Auto Hammer & Air Rotary Rock Core						Refer to n				
		M. McCoy CHECKED BY A. Amicon	Α	T END	OF	DRILL	ING _	Refer to no	otes at	botton	n of lo	g
LOCA	TION	N 485101.7, E 1611103.3	A	FTER D	DRIL	LING	Well	installed				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)		SAMPLE I TPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELL	. DIAGRAM – 1.7' Stickup
1226.8		Brown and dark brown LEAN CLAY (CL), trace roots, mois to medium stiff (RESIDUAL)	t, soft	0.0		SS 1	67	3-3-3 (6)	1			– Concrete Seal
		Noted hard fine grained sandstone fragments in shoe of SS and SS-2.	S-1			SS 2 SS	27 27	2-3-2 (5) 3-2-2	-		Δ	
222.5		Brown LEAN CLAY (CL), few shale fragments, noted iron staining, moist, medium stiff (RESIDUAL)		5.0	$\left \right\rangle$	3 SS 4	67	(4) 1-2-4 (6)	1			
220.5 219.4	///// × × × × × × <i>X × ×</i>	Light brownish-gray SILTSTONE, completely weathered, v broken, very soft, very thin bedded, slightly micaceous Reddish-brown CLAYSTONE, highly weathered, very broke	·		A	SS 5 SS	80	4-19-29 (48) 12-16-18	2.5			
218.1		 very soft, interbedded shale Reddish-brown CLAYSTONE, highly weathered, very broke very soft, blocky, fracture fills, few shale seams 	_	10.0	$\left \right\rangle$	6 SS	53 73	(34) 15-22-25	1.5			0 Inch Colic
216.5		Light olive gray CLAYSTONE, moderately weathered, very broken, moderately soft, friable, noted hard drilling at 12' Gray SHALE, moderately weathered, very broken, modera	_			7 SS 8	100	(47) 50/4"				2-Inch Solid PVC Riser Sealed with Bentonite
		Gray SHALE, moderately weathered, very broken, modera hard, laminated	tely			SS 9	60	50/2"				Grout
				15.0								
	× × × × × × × × × × × × × × ×	Brown and orange SILTSTONE, iron stained, moderately weathered, very broken, hard, very thin bedded										
1208.2		Gray to burgundy CLAYSTONE, iron stained, slickenside a vertical fracture at 19.4', vertical fracture and iron stained a moderately weathered, broken, very broken from 19.4' to 2 moderately soft	t 20.2',			RC	28					
						1	(6)					
198.8	· · · · · · · · · · · · · · · · · · ·	Brown SANDSTONE, fine grained, iron stained, with iron s fractures, moderately weathered, moderately broken, hard, medium bedded	tained	30.0								
195.8		Bluish-gray SHALE, some iron stains, moderately weather moderately broken, moderately hard, thinly laminated to laminated	ed,			RC 2	35 (5)					
		(Continued Next Page)		35.0		-						



BORING NUMBER SB-07/ MW1102R

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CEC F	PROJE	CT NUMBER <u>110-416</u> P	ROJEC	T LOC		Gatts	Ridge Roa	d, Cres	sap, W	est V	irginia
66 ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Gray SHALE, some iron stains, moderately weathered,		HL (#) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELI	_ DIAGRAM
186.2		moderately broken, very broken from 40.2' to 40.6', hard, laminated <i>(continued)</i>		- - 40.0							
186		laminated Black to gray SHALE, few claystone seams, moderately weathered, moderately hard to soft, very broken from 40.8' t 41.2', moderately broken below 41.2', laminated	o -	- - 4 <u>5.0</u> - -	RC 3	41 (16)					2-Inch Solid PVC Riser Sealed with Bentonite Grout
178.2 177.6 175.2	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly weathered, moderately broken, h very thin bedded Gray and orange SANDSTONE, micaceous, fine grained, iro staining with fractures from 50.4' to 52', moderately weather moderately broken to very broken zones, moderately hard, medium bedded Gray SHALE, few claystone and siltstone seams, calcareous burgundy mottling below 54.2', moderately weathered, moderately broken, moderately hard, laminated	 ed, s,	 55.0	RC 4	83 (57)					
		Gray SHALE, few siltstone seams, burgundy mottling, calcitveins, pyrite, moderately weathered, slightly broken, moderately hard, laminated Gray SILTSTONE, iron stained below 60.5' with fractures, sliweathered, slightly broken to moderately broken, hard, very bedded to thin bedded Gray and burgundy SHALE, few claystone seams, slightly weathered, moderately to very broken, moderately hard, laminated	ately iightly thin -	- - 60.0 - - 65.0 - -	RC 5	32 (11)					
	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, limestone inclusions at 70.3' and 71.1', s weathered, slightly to moderately broken, hard, medium bed	lightly		RC	71					
153.5	× × ×			-	6	(39)					



BORING NUMBER SB-07/ MW1102R PAGE 3 OF 9

CEC P	PROJEC	CT NUMBER <u>110-416</u> PF	ROJECT I	_OC	ATION _	Gatts	Ridge Roa	d, Cres	ap, W	/est V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(#)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELI	L DIAGRAM
150.7		Gray SANDSTONE, few interbedded siltstone seams, micaceous, fine grained, slightly weathered, slightly broken, h very thin bedded <i>(continued)</i> Gray SANDSTONE, micaceous, very fine to fine grained, slig weathered, moderately broken, hard, very thin bedded		-							
			_ 	-).0 - -							
	· · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · · ·	Shaley interbeds from 82' to 82.5' and from 84.5' to 85.5'.	85	- 5.0_	RC 7	100 (76)					2-Inch Solid PVC Riser
137.7		Very broken from 88.4' to 89.1'.	-	-	_						Sealed with Bentonite Grout
57.7		Gray SHALE, slightly fissile, slightly weathered, moderately broken, medium hard, laminated	_ <u>90</u> _ _).0 - -	RC 8	97 (53)					
132.4		Gray and dark gray LIMESTONE, slightly weathered, broken, moderately broken from 94.4' to 95', hard, thick bedded	, <u>95</u> _	5.0							
28.3		Dark red SHALE, few claystone seams, calcite veins, noted i staining, fractures with iron stains at 100.3', 101.3', 102.5' and 102.9', slightly weathered, moderately broken, moderately ha laminated	d 10	_ 0.0							
		Water at 102'.	-	-	RC 9	70 (38)					
			-	<u>5.0</u> – –							
115.6		Very broken from 107' to 109'. Mottled brown and gray from 1 to 111.2'. RQD length not measured for RC-10. Sample recovered from barrel after tripping rods.	11 1	_ 0.0 _							
115.6		Gray SANDSTONE, micaceous, fine to medium grained, fres slightly broken, hard, very thin bedded to thin bedded Gray SHALE, few interbedded siltstone seams, broken to ver		-	RC 10	95					



BORING NUMBER SB-07/ MW1102R PAGE 4 OF 9

CEC I	PROJEC		ROJECT NAM							
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd∃Q 115.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	W	VELL	_ DIAGRAM
		Gray SHALE, few interbedded siltstone seams, broken to ver broken, laminated <i>(continued)</i>								
1109.8		Gray and red SHALE, few claystone seams, calcareous, fissi occasional siltstone interbeds between 0.1' and 0.3' thick, fre very broken to moderately broken, soft, thinly laminated to laminated Some iron mottling between 121' and 125'.	sh, – – <u>120.0</u> – – – – – – – –	RC 11	87 (51)					
1099.8		Gray SANDSTONE, micaceous, very fine to medium grained	125.0							2-Inch Solid PVC Riser Sealed with Bentonite Grout
		well cemented, some calcite inclusions, few thin shale parting 0.1' thick, fresh, slightly broken, hard, very thin bedded to thir bedded Very broken zone from 130.4' to 131.8'.	gs – – 1 <u>– –</u> <u>130.0</u> – – – –	RC 12	90 (59)					
1090.3		Gray SANDSTONE, micaceous, fine to medium grained, wel cemented, fresh, slightly to moderately broken, hard, very thi bedded to thin bedded	 <u>135.0</u> I n 							
			 	RC 13	100 (65)					
		Trace pyrite at 145.5'.	 							
1079.8		Gray SANDSTONE, micaceous, fine to medium grained, thin shale partings, well cemented, few calcite filled fractures, micaceous partings, calcite veins from 162' to 162.7', fresh, moderately broken, very broken from 157' to 167', slightly bro to moderately broken near bottom, hard, very thin bedded to bedded	 ken	RC 14	100 (66)					

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									<u>ctric Genera</u> ap, West V	
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(1)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
		Gray SANDSTONE, micaceous, fine to medium grained, th shale partings, well cemented, few calcite filled fractures, micaceous partings, calcite veins from 162' to 162.7', fresh, moderately broken, very broken from 157' to 167', slightly b to moderately broken near bottom, hard, very thin bedded to bedded <i>(continued)</i>	in	- - - - - - - - - - - - - - - - - - -	RC 15	100 (62)				2-Inch Solid PVC Riser Sealed with Bentonite Grout
1052.6		Gray SHALE, fresh, slightly broken, very broken from 177' t 178', hard, thinly laminated to laminated	- - - - -	- 7 <u>5.0</u> -						
1048.8		Gray SILTSTONE, few interbedded sandstone seams, micaceous, fresh, moderately broken, hard, very thin bedde Gray SHALE, silty, siltstone interbeds at 186', fresh, modera broken, hard, laminated	ately 18 - - -	- 30.0 - - 35.0	RC 17	91 (23)				
1038.8	××,	Blue, green and black and very broken from 187' to 188'. Gray SILTSTONE, few interbedded sandstone seams,	-	-						
1036.3		calcareous at 190.5', fresh, very broken, hard, very thin bed Black and gray SHALE, grades to siltstone, fresh, moderate broken, hard, thinly laminated	19	- 90.0 - -	RC 18	100 (58)				– Hole Plug (Bentonite
033.8	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, calcite veins, limestone interbeds, fresh, slightly broken, hard, very thin bedded	-	- _ 95.0						Ċhips)



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CEC F	PROJEC	CT NUMBER PRC	JECT LO	ATION	Gatts	Ridge Roa	d, Cre	sap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd30 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
	× × × × × × × × ×	Gray SILTSTONE, calcite veins, limestone interbeds, fresh, slightly broken, hard, very thin bedded <i>(continued)</i>						
1029.8	***************************************	Gray SILTSTONE, interbedded shale and limestone, limestone 197.6', from 198.3' to 198.5', 199.8', 201.4', 202', 203' and 204' fresh, moderately to very broken, hard, very thin bedded to thin bedded	at	RC 19	100 (60)			2-Inch Slotter Screen
1022.7	× × × × × ×	Gray SHALE, few claystone seams, calcareous, black zones 0, thick, some iron staining, fresh, moderately broken, hard, laminated	2' <u>205.0</u>					Filter Sand
		Very hard near 207'. Very broken from 207' to 212'. Fissile be below 208.5'	ds 					
014.8	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, micaceous, trace calcite, fresh, moderately broken, hard, very thin bedded		RC 20	87 (50)			
010.4		Dark gray SHALE, very few claystone seams, fissile, few limestone inclusions, fresh, broken, moderately hard, thinly laminated to laminated						
		Black from 222' to 224'.	220.0 225.0	RC 21	100 (34)			
998.1		Burgundy and gray claystone from 227' to 228.7', very broken. Gray SILTSTONE, calcareous, calcite veins, fresh, moderately broken, hard, very thin bedded						
995.4	× × × × × ×	Gray SHALE, fissile, fresh, moderately broken, hard, thinly laminated to laminated Light gray SANDSTONE, micaceous, fine to medium grained, fine grained from 238' to 241.7', well cemented, fresh, moderat broken, very broken from 237' to 241.7', hard, very thin bedded		RC 22	100 (67)			



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z								ap, West Virginia
ELEVATION (ft) GRAPHIC	MATERIAL DESCRIPTION	HLd30 235.0)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
85.1	thin bedded Light gray SANDSTONE, micaceous, fine to medium grained, fine grained from 238' to 241.7', well cemented, fresh, modera broken, very broken from 237' to 241.7', hard, very thin beddee thin bedded (continued) Gray and dark red SHALE, few claystone seams, fissile, iron stained from 244.3' to 247' and at 252.1', fresh, moderately	ately	- - -) -	RC 23	100 (19)			
	broken to very broken, moderately hard, thinly laminated to laminated Burgundy, calcareous and silty between 247' and 248.7' with claystone and siltstone seams.	_ _ <u>245.0</u> _ _ _ _ _ 	-					
73.5	Thin limestone beds from 251.5' to 253'. Gray SANDSTONE, very fine to fine grained, well cemented, interbedded siltstone seams, fresh, moderately broken, hard, thin bedded Burgundy and gray SHALE, fissile, iron stained bands throughout, fresh, very broken, moderately hard, thinly lamina	very 255.0	- - -) -	RC 24	74 (38)			
63.8	to laminated May have rock in borehole from Runs 24 and 25. Black SHALE, few coal seams, fresh, very broken, moderatel hard to hard, thinly laminated to laminated	- 	-	RC 25	81 (11)			
×	Dark gray SILTSTONE, few interbedded shale and sandstone seams, micaceous, fresh, moderately broken, hard, very thin bedded Dark gray SHALE, few interbedded siltstone seams, micaceo fresh, moderately broken, moderately hard, laminated			RC 26	95 (45)			



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B B Gray SILTSTONE, fresh, moderately broken, hard, thick bedded B Cray SHLTSTONE, fresh, moderately broken, hard, thick bedded B Burgundy and gray CLAYSTONE, fresh, moderately broken, hard SH8.8 Cray SHALE, few burgundy claystone seams, moderately Sickensides at 279' and 280.5'. 280.0 Sickensides at 279' and 280.5'. 280.0 Sickensides at 279' and 280.5'. 280.0 Gray VLMESTONE, fresh, moderately broken, hard 280.0 Sickensides at 279' and 280.5'. 280.0 Gray VLMESTONE, calcareous, micaceous, lresh, slightly broken 280.0 Sickensides at 279' and 280.5'. 280.0 Gray VLMESTONE, calcareous, micaceous, lresh, slightly broken 280.0 Sickensides at 279' and 280.5'. 280.0 Gray LIMESTONE, calcareous, micaceous, lresh, slightly broken 290.0 Becoming moderately broken, hard 290.0 Gray SHALE, few interbedded slitstone seams, calcareous, fresh, moderately broken, hard, think bedded to medium bedded Bedded Gray SHALE, few interbedded slitstone seams, calcareous, fresh, resh wery broken, kery thard, medium bedded Gray SHALE, few interbedded slitstone seams, calcareous, fresh, moderately broken, very thard, think between, kery thard, medium bedded Gray	CEC	PROJE	CT NUMBER <u>110-416</u> PR	OJECT	LOC		Gatts	Ridge Roa	d, Cres	sap, West Virginia
State Gray SILTSTONE, fresh, moderately broken, hard, thick bedded	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION			SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
941.8 Gray to redisk-brown CLAYSTONE, few shale seams, calcareous, well-cemented, trace pyrite less than 1 mm thick, fresh, moderately broken, hard -		$ \times \times $	(continued) Burgundy and gray CLAYSTONE, fresh, moderately broken, h Gray SHALE, few burgundy claystone seams, moderately broken, moderately hard, laminated	ed nard	-	RC 27				
Becoming moderately broken, nard, thick bedded 290.0 RC 98 290.0 RC 98 300.8 Gray LIMESTONE, few interbedded siltstone seams, shaley at top, fresh, moderately broken, hard, thin bedded to medium bedded - - 926.8 Gray SHALE, few interbedded siltstone seams, calcareous, fresh, slightly broken, very hard, thinly laminated to laminated - - - 926.3 Gray SHALE, few interbedded siltstone seams, calcareous, fresh, slightly broken, very hard, thinly laminated to laminated - - - 926.3 Gray SHALE, frew interbedded siltstone seams, calcareous, fresh, slightly broken, very hard, thinly laminated to laminated - - - 921.8 Gray SANDSTONE, micaceous, some thin shale interbeds increasing with depth, fresh, slightly broken, very hard, medium bedded - - - 919.4 Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very hard, medium bedded - - -	941.8		calcareous, well-cemented, trace pyrite less than 1 mm thick,	2	<u>85.0</u> - -					
x × 3 Gray LIMESTONE, few interbedded siltstone seams, shaley at top, fresh, moderately broken, hard, thin bedded to medium bedded -	938.8	*****	Gray SILTSTONE, calcareous, micaceous, fresh, slightly brok becoming moderately broken, hard, thick bedded	- 2 - - -	-					
926.8 Gray SHALE, few interbedded siltstone seams, calcareous, fresh, slightly broken, very hard, thinly laminated to laminated 29 (39) 925.3 Gray LIMESTONE, micaceous, some thin shale interbeds increasing with depth, fresh, slightly broken, very hard, medium bedded - - - 925.3 Gray SANDSTONE, micaceous, some thin shale interbeds increasing with depth, fresh, slightly broken, very hard, medium bedded - - - 921.8 Gray SANDSTONE, micaceous, fine grained, many shale partings increasing with depth, fresh, very broken, hard, very thin bedded to thin bedded - - - 919.4 Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very hard, medium bedded - - - 919.4 Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very hard, medium bedded - - -	930.8	$ \times \times \times $	top, fresh, moderately broken, hard, thin bedded to medium	t	-					
partings increasing with depth, fresh, very broken, hard, very thin bedded to thin bedded 919.4 Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very hard, medium bedded Rec 100 30 (54)	925.3		slightly broken, very hard, thinly laminated to laminated Gray LIMESTONE, micaceous, some thin shale interbeds increasing with depth, fresh, slightly broken, very hard, mediur bedded	esh, m	-	RC 29	90 (39)			
			partings increasing with depth, fresh, very broken, hard, very the bedded to thin bedded Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very h	hin ard,	-					



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								ctric Generating Plant ap, West Virginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
911.8	Gray SHALE, few interbedded siltstone seams, calcareous, occasional limestone interbeds, trace pyrite less than 1 mm t fresh, moderately broken, hard, thinly laminated to laminated 4 feet of Run 31 fell into hole, unable to retrieve. Few reddish-brown and gray claystone seams beginning at 3	- - <u>32(</u>	- - - <u>-</u> <u>0.0</u>	RC 31	60 (35)			
	Dark red and very broken from 325' to 328'.	- - <u>32</u> ! -	- <u>5.0</u> - -	RC 32	100 (27)			
898.8	Bottom of hole at 328.0 feet. Soil sampling completed on 9/7/2011. Boring offset on 10/10/2011 for rock coring. Augered to 18' to begin rock core sampling. The following groundwater level readings were taken during drilling: 9/7/2011 3:30 PM, Dry (borehole depth = 12.2') 10/11/2011 7:45 AM at approximately 38' bgs 10/13/2011 7:20 AM at approximately 35' bgs Geophysical logging and packer testing were performed upor completion. Well MW1102R installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB- The ground elevation for MW1102R = 1226.7 ft.	1						

	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		B	ORIN	ig n	IUMBE	RS	6B-0		/W1102F PAGE 1 OF 9
-						ndfill, Mitch				
						Ridge Roa				
						.8 ft	HOLE	SIZE	0.5 ft	
		GROUN			-					
	G METHOD HSA: Auto Hammer & Air Rotary Rock Core					Refer to r				
	DBY M. McCoy CHECKED BY A. Amicon DN N 485106.1, E 1611110.1				-	Refer to no	otes at	botton		g
ELEVATION (ft) GRAPHIC	MATERIAL DESCRIPTION		0. DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELL	. DIAGRAM – 1.9' Stickup
1226.8	Brown and dark brown LEAN CLAY (CL), trace roots, mois	t, soft	0.0	V ss	07	3-3-3				
	to medium stiff (RESIDUAL)			1	67	(6)	1			 Concrete Seal
	Noted hard fine grained sandstone fragments in shoe of St and SS-2.	S-1			27	2-3-2 (5)			Δ	000
	and 33-2.			ss 🗸	27	3-2-2	1			
1222.5	Brown LEAN CLAY (CL), few shale fragments, noted iron		 5.0	3		(4)	-			
	staining, moist, medium stiff (RESIDUAL)			SS 4	67	1-2-4 (6)	1			
1220.5 ×	\sim 1 Eight brownian gray of for the, completely weathered, v	ery	[-	SS 5	80	4-19-29	2.5			
1219.4	broken, very soft, very thin bedded, slightly micaceous Reddish-brown CLAYSTONE, highly weathered, very brok		[]	s s		(48) 12-16-18	1.5			
1218.1	very soft, interbedded shale	_		6	53	(34)	1.5			
1210.1	Reddish-brown CLAYSTONE, highly weathered, very brok- very soft, blocky, fracture fills, few shale seams	en,	10.0		73	15-22-25	3.5-4			2-Inch Solid
1216.5	Light olive gray CLAYSTONE, moderately weathered, very		- 	ss 🖉	100	50/4"				PVC Riser
1215.3	broken, moderately soft, friable, noted hard drilling at 12 Gray SHALE, moderately weathered, very broken, modera	telv		8						Sealed with Bentonite
	hard, laminated	,	L -	SS 9	60	50/2"	1			Grout
			15.0							
1210.8 × × × × ×	 × > weathered, very broken, hard, very thin bedded × > 					-				
1208.2	Gray to burgundy CLAYSTONE, iron stained, slickenside a vertical fracture at 19.4', vertical fracture and iron stained a moderately weathered, broken, very broken from 19.4' to 2 moderately soft	at 20.2',	 							
			 _25.0 	RC 1	28 (6)					
1198.8	Brown SANDSTONE, fine grained, iron stained, with iron s fractures, moderately weathered, moderately broken, hard medium bedded		30.0							
1195.8	Bluish-gray SHALE, some iron stains, moderately weather moderately broken, moderately hard, thinly laminated to laminated	ed,		RC 2	35 (5)					
			35.0							



BORING NUMBER SB-07/ MW1102F

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CEC F	PROJE	CT NUMBER 110-416 PR	ROJECT		ATION	Gatts	Ridge Roa	d, Cres	sap, V	/est V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		H1 (ff) (ff) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	_ DIAGRAM
192		Gray SHALE, some iron stains, moderately weathered, moderately broken, very broken from 40.2' to 40.6', hard, laminated <i>(continued)</i>	-	_ _ _ 40.0							
186.2 186		Black COAL, moderately weathered, slightly broken, hard, laminated Black to gray SHALE, few claystone seams, moderately weathered, moderately hard to soft, very broken from 40.8' to 41.2', moderately broken below 41.2', laminated	-	- - 4 <u>5.0</u> - -	RC 3	41 (16)					2-Inch Solid PVC Riser Sealed with Bentonite Grout
178.2 177.6 175.2	× × ×	Gray SILTSTONE, slightly weathered, moderately broken, have very thin bedded Gray and orange SANDSTONE, micaceous, fine grained, iror staining with fractures from 50.4' to 52', moderately weathered moderately broken to very broken zones, moderately hard, medium bedded Gray SHALE, few claystone and siltstone seams, calcareous,	 n d,	_ 50.0_ _ _	RC	83					
169.6		burgundy mottling below 54.2', moderately weathered, moderately broken, moderately hard, laminated Gray SHALE, few siltstone seams, burgundy mottling, calcite	-	_ 55.0	4	(57)					
168.2		veins, pyrite, moderately weathered, slightly broken, moderate hard, laminated Gray SILTSTONE, iron stained below 60.5' with fractures, slig weathered, slightly broken to moderately broken, hard, very th bedded to thin bedded	ely – ghtly nin – –	- 60.0 - - -	RC 5	32 (11)					
162.2		Gray and burgundy SHALE, few claystone seams, slightly weathered, moderately to very broken, moderately hard, laminated	-	<u>65.0</u> - -							
156.6	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, limestone inclusions at 70.3' and 71.1', slig weathered, slightly to moderately broken, hard, medium bedd	ghtly	- 70.0 - -	RC	71					
153.5	× × ×			_	6	(39)					



BORING NUMBER SB-07/ MW1102F

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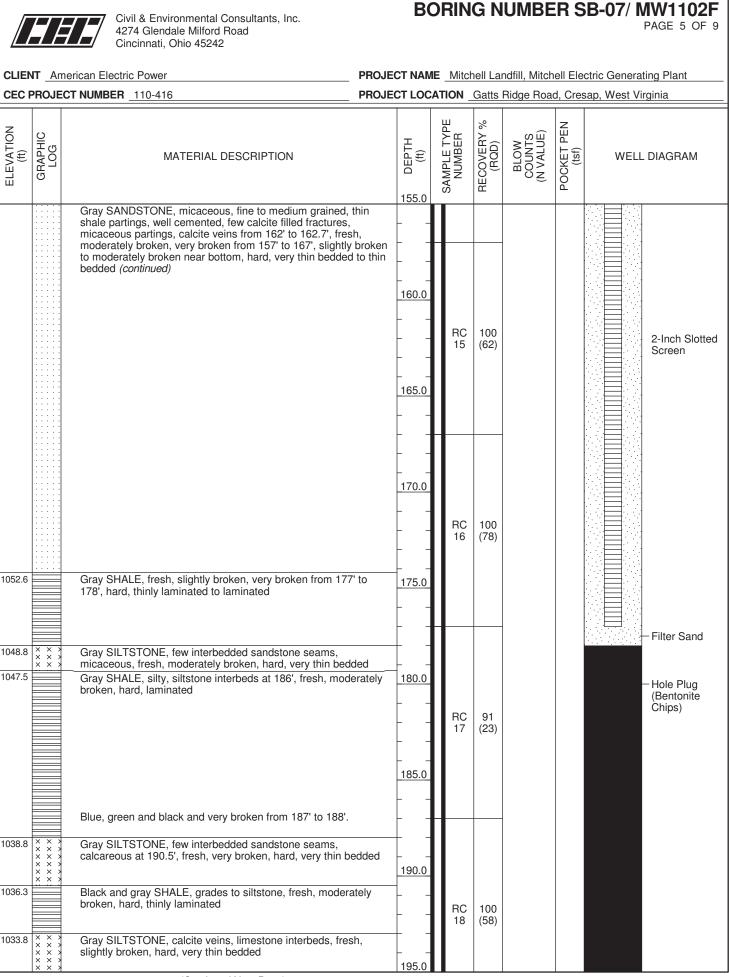
-						ndfill, Mitch Ridge Roa			
ELEVATION (ft) GRAPHIC	MATERIAL DESCRIPTION		(1) 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELI	- DIAGRAM
1150.7	Gray SANDSTONE, few interbedded siltstone seams, micaceous, fine grained, slightly weathered, slightly broken very thin bedded <i>(continued)</i> Gray SANDSTONE, micaceous, very fine to fine grained, sl weathered, moderately broken, hard, very thin bedded	i, hard, lightly	-						
	Shaley interbeds from 82' to 82.5' and from 84.5' to 85.5'.	-	3 <u>0.0</u> - - - 3 <u>5.0</u> -	RC 7	100 (76)				2-Inch Solid PVC Riser Sealed with Bentonite
1137.7	Very broken from 88.4' to 89.1'. Gray SHALE, slightly fissile, slightly weathered, moderately broken, medium hard, laminated	/ <u>g</u>	- - 00.0_ -						Grout
1132.4	Gray and dark gray LIMESTONE, slightly weathered, broke moderately broken from 94.4' to 95', hard, thick bedded	- - - - - - - - - - - - - - - - - - -	- - 9 <u>5.0</u> -	RC 8	97 (53)				
1128.3 1128.3	Dark red SHALE, few claystone seams, calcite veins, notec staining, fractures with iron stains at 100.3', 101.3', 102.5' a 102.9', slightly weathered, moderately broken, moderately h laminated	and 1	- - 0 <u>0.0</u> -						
	Water at 102'.	- - <u>1(</u>	- _ 0 <u>5.0</u> _	RC 9	70 (38)				
	Very broken from 107' to 109'. Mottled brown and gray from to 111.2'. RQD length not measured for RC-10. Sample recovered fro barrel after tripping rods.	om	- - <u>10.0</u> -						
1115.6	Gray SANDSTONE, micaceous, fine to medium grained, fre slightly broken, hard, very thin bedded to thin bedded Gray SHALE, few interbedded siltstone seams, broken to v broken, laminated	rery	- - 15.0	RC 10	95				



BORING NUMBER SB-07/ MW1102F

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CEC P	ROJEC		ROJECT NAM						
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HL (J) 115.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	W	ELL DIAGRAM
		Gray SHALE, few interbedded siltstone seams, broken to ver broken, laminated <i>(continued)</i>	у						
1109.8		Gray and red SHALE, few claystone seams, calcareous, fissi occasional siltstone interbeds between 0.1' and 0.3' thick, free very broken to moderately broken, soft, thinly laminated to laminated Some iron mottling between 121' and 125'.	le, sh, – – – – 120.0 – – – –	RC 11	87 (51)				
			 125.0 						2-Inch Solid PVC Riser Sealed with
1099.8		Gray SANDSTONE, micaceous, very fine to medium grained well cemented, some calcite inclusions, few thin shale parting 0.1' thick, fresh, slightly broken, hard, very thin bedded to thin bedded Very broken zone from 130.4' to 131.8'.	ys – –	RC 12	90 (59)			l	Bentonite Grout
1090.3		Gray SANDSTONE, micaceous, fine to medium grained, well cemented, fresh, slightly to moderately broken, hard, very thin	 135.0 					l	
		bedded to thin bedded	 	RC	100			ł	
		Trace pyrite at 145.5'.	 _ <u>145.0</u> _	13	(65)				- Hole Plug (Bentonite Chips)
1079.8		Gray SANDSTONE, micaceous, fine to medium grained, thin shale partings, well cemented, few calcite filled fractures, micaceous partings, calcite veins from 162' to 162.7', fresh, moderately broken, very broken from 157' to 167', slightly bro to moderately broken near bottom, hard, very thin bedded to bedded	ken – –	RC 14	100 (66)				- Filter Sand



(Continued Next Page)

CEC CUSTOM LOG WITH WELL 110-416 MITCHELL LANDFILL.GPJ GOOD TEMPLATE.GDT 1/30/12



BORING NUMBER SB-07/ MW1102F PAGE 6 OF 9

			PROJECT NAME Mitchell Landfill, Mitchell Electric Gr PROJECT LOCATION Gatts Ridge Road, Cresap, W.							
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (‡) 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
1029.8	× × × × × × × × × × × × × × ×	Gray SILTSTONE, calcite veins, limestone interbeds, fresh, slightly broken, hard, very thin bedded <i>(continued)</i> Gray SILTSTONE, interbedded shale and limestone, limeston								
	x x	197.6', from 198.3' to 198.5', 199.8', 201.4', 202', 203' and 204 fresh, moderately to very broken, hard, very thin bedded to thi bedded	4', – in	_ _ 200.0 _ _ _	RC 19	100 (60)				
1022.7		Gray SHALE, few claystone seams, calcareous, black zones (thick, some iron staining, fresh, moderately broken, hard, laminated	0.2'	_ 205.0 _						
		Very hard near 207'. Very broken from 207' to 212'. Fissile be below 208.5'	-	- - 2 <u>10.0</u>						
1014.8		Gray SILTSTONE, micaceous, trace calcite, fresh, moderately broken, hard, very thin bedded		- - 2 <u>15.0</u> -	RC 20	87 (50)				
010.4		Dark gray SHALE, very few claystone seams, fissile, few limestone inclusions, fresh, broken, moderately hard, thinly laminated to laminated	-	-						
		Black from 222' to 224'.	-	<u>220.0</u> - - 2 <u>225.0</u> -	RC 21	100 (34)				– Hole Plug (Bentonite Chips)
998.1	× × >	Burgundy and gray claystone from 227' to 228.7', very broken. Gray SILTSTONE, calcareous, calcite veins, fresh, moderatel		-						
	× × × × × × × × × × × × × × ×	broken, hard, very thin bedded		<u>230.0</u> _						
995.4 994.3		Gray SHALE, fissile, fresh, moderately broken, hard, thinly laminated to laminated Light gray SANDSTONE, micaceous, fine to medium grained, fine grained from 238' to 241.7', well cemented, fresh, modera broken, very broken from 237' to 241.7', hard, very thin bedde	ately	- - 235.0	RC 22	100 (67)				



BORING NUMBER SB-07/ MW1102F

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CEC F	PROJE	CT NUMBER _ 110-416 PRO	JECT L	oc		Gatts	Ridge Roa	d, Cres	ap, West V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLdJQ 235		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
985.1		thin bedded Light gray SANDSTONE, micaceous, fine to medium grained, fine grained from 238' to 241.7', well cemented, fresh, moderate broken, very broken from 237' to 241.7', hard, very thin bedded thin bedded <i>(continued)</i> Gray and dark red SHALE, few claystone seams, fissile, iron stained from 244.3' to 247' and at 252.1', fresh, moderately	ly - - - - - - - - - - -	- - - - - -	RC 23	100 (19)				
		broken to very broken, moderately hard, thinly laminated to laminated Burgundy, calcareous and silty between 247' and 248.7' with claystone and siltstone seams.	- 245 - - - 250	-						
973.5 971.1		Thin limestone beds from 251.5' to 253'. Gray SANDSTONE, very fine to fine grained, well cemented, few interbedded siltstone seams, fresh, moderately broken, hard, ve thin bedded Burgundy and gray SHALE, fissile, iron stained bands throughout, fresh, very broken, moderately hard, thinly laminate to laminated	ry	- - - .0 -	RC 24	74 (38)				
963.8		May have rock in borehole from Runs 24 and 25. Black SHALE, few coal seams, fresh, very broken, moderately hard to hard, thinly laminated to laminated	- - - - - - - 265	-	RC 25	81 (11)				– Hole Plug (Bentonite Chips)
961.7		Dark gray SILTSTONE, few interbedded shale and sandstone seams, micaceous, fresh, moderately broken, hard, very thin bedded Dark gray SHALE, few interbedded siltstone seams, micaceous fresh, moderately broken, moderately hard, laminated		-	RC 26	95 (45)				
953.4	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, fresh, moderately broken, hard, thick beddeo	- I 275	-						



BORING NUMBER SB-07/ MW1102F PAGE 8 OF 9

		PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia							
CEC PROJECT	NUMBER <u>110-416</u>	PROJEC	TLOC	ATION _	Gatts	Ridge Roa	d, Cres	sap, West V	irginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION		(#) (#) 275.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	_ DIAGRAM
949.8	Gray SILTSTONE, fresh, moderately broken, hard, thick be (continued) Burgundy and gray CLAYSTONE, fresh, moderately broken Gray SHALE, few burgundy claystone seams, moderately broken, moderately hard, laminated Slickensides at 279' and 280.5'.	edded n, hard	 280.0	RC 27	100 (66)				
941.8	Gray to reddish-brown CLAYSTONE, few shale seams,		 <u>285.0</u>						
938.8 × × × × × × × × × × × × × × × × × ×	calcareous, well-cemented, trace pyrite less than 1 mm thic fresh, moderately broken, hard Gray SILTSTONE, calcareous, micaceous, fresh, slightly be becoming moderately broken, hard, thick bedded	roken	 2 <u>290.0</u> 	RC 28	98 (81)				
930.8	Gray LIMESTONE, few interbedded siltstone seams, shale top, fresh, moderately broken, hard, thin bedded to medium bedded	y at n -	<u>295.0</u> - – - – - –						
925.3	Gray SHALE, few interbedded siltstone seams, calcareous, slightly broken, very hard, thinly laminated to laminated Gray LIMESTONE, micaceous, some thin shale interbeds increasing with depth, fresh, slightly broken, very hard, med bedded	, fresh, dium	<u>300.0</u> - – - – 305.0	RC 29	90 (39)				– Hole Plug (Bentonite Chips)
921.8	Gray SANDSTONE, micaceous, fine grained, many shale partings increasing with depth, fresh, very broken, hard, ver bedded to thin bedded Gray LIMESTONE, calcareous, shaley at bottom with interbedded siltstone seams, fresh, moderately broken, very medium bedded Black at 310.2'	ry thin	 3 <u>10.0</u> 	RC 30	100 (54)				
		-	 315.0						



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							ctric Generating Plant sap, West Virginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	HLd3D 315.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
11.8	Gray SHALE, few interbedded siltstone seams, calcareous, occasional limestone interbeds, trace pyrite less than 1 mm th fresh, moderately broken, hard, thinly laminated to laminated 4 feet of Run 31 fell into hole, unable to retrieve. Few reddish-brown and gray claystone seams beginning at 32	 320.0	RC 31	60 (35)			
	Dark red and very broken from 325' to 328'.	<u>325.0</u> 	RC 32	100 (27)			− Hole Plug (Bentonite Chips)
98.8	Bottom of hole at 328.0 feet. Soil sampling completed on 9/7/2011. Boring offset on 10/10/2011 for rock coring. Augered to 18' to begin rock core sampling. The following groundwater level readings were taken during drilling: 9/7/2011 3:30 PM, Dry (borehole depth = 12.2') 10/11/2011 7:45 AM at approximately 38' bgs 10/12/2011 7:50 AM at approximately 39' bgs 10/13/2011 7:20 AM at approximately 35' bgs Geophysical logging and packer testing were performed upon completion. Well MW1102F installed following geophysical logging and packer testing.						

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		B	OF	RIN	g n	UMBE	RS	B-1		MW1103H PAGE 1 OF 10
CLIEN	NT An	nerican Electric Power	PROJE		ME	Mitch	nell La	ndfill, Mitch	ell Ele	ectric C	Genera	ating Plant
CEC I	PROJE	CT NUMBER 110-416	PROJEC		CAT		Gatts	Ridge Roa	d, Cre	sap, V	Vest V	irginia
DATE	STAR	TED _9/6/11 COMPLETED _9/23/11	GROUND ELEVATION 1237.4 ft HOLE SIZE 0.5 ft									
DRILL	ING C	ONTRACTOR Frontz Drilling, Inc.	GROUN		FER	LEVE	LS:					
DRILL	ING M	ETHOD HSA: Auto Hammer & Air Rotary Rock Core (NX)	A	Т ТІМЕ	OF	DRIL	LING	Refer to n	otes a	t botto	om of l	og
LOGO	ED BY	M. McCoy / R. Mahle CHECKED BY A. Amicon	A	T END	OF	DRILL	ING	Refer to no	otes at	botto	m of lo	og
LOCA		N 487005.3, E 1610094.0	A	FTER [DRIL	LING	Wel	l installed				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)		NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1237.4		Brown LEAN CLAY WITH SAND (CL), trace roots, noted in oxide concretions, moist, medium stiff to stiff (RESIDUAL)	on	<u>0.0</u> 		SS 1	93	3-4-5 (9)	2			Concrete Seal
					1X	SS 2	73	2-2-3 (5)	2			
1234.4		Light olive gray and reddish-brown to olive brown LEAN CL (CL), few shale fragments, slightly fissile to fissile, moist, m			M	SS 3	60	3-3-4 (7)	1			
		stiff to very stiff (RESIDUAL)		5.0		SS 4	53	(7) 5-10-11 (21)	1.5			
					M	SS 5	47	12-10-14 (24)	1.5			
1229.9		Reddish-brown CLAYSTONE, completely to highly weather very broken, very soft, few limestone seams, blocky, few gr blocky siltstone partings	red, ray			SS 6	60	(24) 11-12-26 (38)	1-2.25			
		biolity dilatono partingo		10.0	X	SS 7 SS	80 100	8-11-33 (44) 50/5"	3-3.5 1			2-Inch Solid PVC Riser Sealed with
1225.9		Light gray to brown SHALE, highly weathered, very broken soft, laminated, very fissile	, very	 		8 SS 9	60	31-22-25 (47)	1			Bentonite Grout
					-X	SS 10	100	14-50/5"	1			
1222.6 1221.9	× × × × × ×	Light gray SILTSTONE, highly weathered, very broken, ver very thin bedded Reddish-brown to light brown SHALE, highly weathered, very			X	SS 11	93	25-34-36 (70)	-			
10100		broken, very soft, laminated, fissile	-			SS 12	100	50/5"				
1219.9		Reddish-brown CLAYSTONE, few interbedded shale seam highly weathered to moderately weathered, slightly broken, soft to moderately soft		 20.0 		RC 1	72 (65)					
1212.6		Gray SHALE, few interbedded slightly micaceous siltstone seams, reddish brown and gray from 27.3' to 28' with clays seams, moderately weathered, slightly broken, moderately laminated	tone	 								
1209.4		Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams througho limestone inclusions, highly to moderately weathered, mod broken, moderately soft, laminated		 								
				 		RC 2	80 (43)					
		(Continued Next Page)		35.0								



BORING NUMBER SB-18/ MW1103H PAGE 2 OF 10

		PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia								
CEC PROJEC	CT NUMBER PR	OJEC	TLOC	ATION	Gatts	Ridge Roa	d, Cres	ap, W	lest V	rginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) (tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELI	_ DIAGRAM
	Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams throughout, limestone inclusions, highly to moderately weathered, modera broken, moderately soft, laminated <i>(continued)</i>									
1199.4	Gray and reddish brown CLAYSTONE, few discontinuous slig micaceous siltstone seams, few limestone inclusions, modera weathered, moderately broken, moderately soft		40.0							
1197.7 × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few discontinuous shal and sandstone seams, noted pyritic specs at 31.6', increasing grain size with depth, iron stained fractures from 39.7' to 41.4' moderately weathered, moderately broken, moderately hard, w thin bedded	in ,	- – - – 45.0	RC 3	97 (76)					2 Jack Solid
1192.1	Gray SANDSTONE, moderately weathered, moderately broke moderately hard, very thin bedded to thin bedded, micaceous very fine to fine grained, few limestone inclusions, few discontinuous siltstone seams, brownish-gray from 46.4' to 4'	,								2-Inch Solid PVC Riser Sealed with Bentonite Grout
1189.6 × × × × × × × × × × × × × × × × × × ×	vertical iron stained fracturing from 46.6' to 47' Gray to brownish-gray SANDSTONE, micaceous, very fine to grained, few limestone inclusions, few discontinuous siltstone seams, vertical iron stained fracture from 47' to 47.3', modera weathered, moderately broken, moderately hard, very thin bedded to thin bedded	fine	 _50.0		70					
1185.4	Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams throughout, few limestone inclusions, sandstone lens from 49.2' to 50.1', moderately weathered, moderately broken, moderately soft to moderately hard, very t bedded to thin bedded Gray SHALE, discontinuous and slightly micaceous siltstone	him .	 _ 55.0	RC 4	79 (46)				l	
1180.4 × × ×	seams throughout, reddish-brown from 52.5' to 53.2' with claystone seams and limestone inclusions, pyritic specs observed, highly to moderately weathered, moderately broken moderately soft, thinly laminated to laminated	ı,	· ·							
× × × 1178.9	Gray SILTSTONE, slightly micaceous, interbedded sandstone seams throughout, few limestone inclusions, pyritic specs observed, moderately weathered, moderately broken, modera hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, slightly weathered, moderately broken, moderately hard, very	itely	 _60.0_	RC	93				l	
1174.6	bedded Gray SHALE, few limestone inclusions, interbedded slightly micaceous siltstone throughout, pyritic specs observed, moderately to slightly weathered, moderately broken, moderately soft, thinly laminated to laminated	tely	- – - – 	5	(29)					
1170.4	Gray SHALE, discontinuous slightly micaceous siltstone sean throughout, few limestone inbeds, pyritic specs observed throughout, reddish brown claystone seams from 67.9' to 68.2 68.4' to 68.7', 69.3' to 70.1', and 71.3' to 71.6', moderately weathered, moderately broken, moderately soft, thinly laminat to laminated	2',	 <u>70.0</u>							
1165.3	Light gray LIMESTONE, calcareous, few shale inclusions, slig weathered, moderately broken, hard, thick bedded	ihtly	 	RC 6	93 (64)					
			75.0							



BORING NUMBER SB-18/ MW1103H

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	American Electric Power				Mitchell Landfill, Mitchell Electric Generating Plant						
_	MATERIAL DESCRIPTION		HLd3D 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)			_ DIAGRAM	
	Gray SANDSTONE, very fine to medium grained, micace interbedded limestone, slightly weathered, slightly broken broken, hard, very thin bedded to thin bedded <i>(continued)</i>	to									
1157.9 × × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams, interbedded limestone, slightly weather moderately broken, moderately hard, very thin bedded	ered,	80.0 85.0	RC 7	100 (7)					2-Inch Solid PVC Riser Sealed with	
1150.4 × 1149.5	seams, interbedded limestone, slightly weathered, moder broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated	rately	 _90.0 	RC 8	100					Bentonite Grout	
1143.6	Reddish-gray discoloration from 92.2' to 92.4'. Pyritic spe observed at 93.7'. Gray to dark gray LIMESTONE, calcareous, slightly weat moderately broken, hard, medium bedded	hered,	95.0	8	(30)						
1140.4	Gray SHALE, with calcareous limestone inclusions, slight weathered, moderately broken, moderately soft, laminate Gray and reddish-gray from 101.6' to 107' with few clayste	ď	 _ 100.0	RC	100						
	seams.		 _105.0	9	(56)						
××	Gray SILTSTONE, moderately to slightly micaceous, fres moderately broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grai interbedded calcareous limestone, fresh, moderately brok hard, very thin bedded	ned,	 _110.0 	RC 10	88 (68)						
	(Continued Next Page)		 115.0								



BORING NUMBER SB-18/ MW1103H PAGE 4 OF 10

								hell Electric Generating Plant					
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HLd HLd HL HL H HL H H H H H H H H H H H	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM		
1122.1		Gray SHALE, few interbedded siltstone seams, fresh, mode broken, moderately soft, thinly laminated to laminated	erately							l			
1117.1		Reddish-brown and gray CLAYSTONE, few interbedded sha seams, fresh, moderately broken, moderately soft	ale	<u>120.0</u> - – - – <u>125.0</u>	RC 11	74 (33)				l	2-Inch Solid		
		Gray SILTSTONE, interbedded limestone, fresh, slightly bro moderately hard, very thin bedded Gray SILTSTONE, slightly micaceous, interbedded througho with sandstone seams less than 1/8" thick, limestone inclusi throughout, fresh, moderately broken, moderately hard, very bedded	out ions / thin	 1 <u>30.0</u>	RC	100				l	PVC Riser Sealed with Bentonite Grout		
?	· · · · · · · · · · · · · · · · · · ·	Gray SILTSTONE, slightly micaceous, discontinuous sands seams less than 1/10" thick, sporadic limestone inclusions	tone	- – - – <u>135.0</u> - –	12	(83)				l			
	<pre></pre>	throughout, fresh, moderately broken, moderately hard, very bedded Gray SANDSTONE, micaceous, very fine to medium graine		 <u>140.0</u> 	RC 13	100 (50)							
		interbedded throughout with siltstone seams which decrease frequency with depth and are less than 1/10" thick, fresh, moderately broken, moderately hard to hard, very thin bedde thin bedded Gray SANDSTONE, micaceous, very fine to medium graine	e in ed to	<u>145.0</u> 									
1090.4		Gray SANDSTONE, micaceous, very fine to medium grane interbedded with siltstone lenses less than 1/16" thick from to 152.3', siltstone seam approximately 1/16" thick at 159.5', discontinuous siltstone lenses from 174.5' to 176.2', fresh, s broken, hard, thick bedded	147' , slightly	 <u>150.0</u> 	RC 14	100 (90)							
		(Continued Next Page)	-	155.0									

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242	B	80	RIN	g N	UMBE	RS		MW1103 PAGE 5 OF			
			PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plan PROJECT LOCATIONGatts Ridge Road, Cresap, West Virginia										
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd3O 155.	(51)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		L DIAGRAM			
		Gray SANDSTONE, micaceous, very fine to medium graine interbedded with siltstone lenses less than 1/16" thick from to 152.3', siltstone seam approximately 1/16" thick at 159.5 discontinuous siltstone lenses from 174.5' to 176.2', fresh, s broken, hard, thick bedded <i>(continued)</i>	147' – ',	-	RC 15	100 (100)				2-Inch Solic PVC Riser Sealed with Bentonite			
061.2		Gray SHALE, 0.5" coal seam at 176.5', hairline coal fracture	- - - - - - - - - - - - - - - - - - -	-	RC 16	100 (68)				Grout			
056.1 055.1 053.4		Gray SANDSTONE, micaceous, very fine to medium graine interbedded siltstone seams throughout, noted calcareous limestone inclusions throughout, fresh, moderately broken, very thin bedded		-	RC 17	87 (59)							
050.4	× × × × × × × × × × × × × × × × × × ×	Black SHALE, few limestone inclusions, gray shale from 18 184.2' and 186.7' to 186.9', fresh, moderately broken, mode soft, thinly laminated to laminated Dark gray SHALE, calcareous with limestone inclusions, fre slightly broken, hard, laminated Gray SILSTONE, slightly micaceous, few limestone inclusion sandstone layer from 191.7' to 192', fresh, moderately brok moderately hard to hard, very thin bedded	erately esh, -	- - - 0 -		100							
044.4	× × × × × × × × × × × × × × × × × × ×	Gray SANDSTONE, very fine to medium grained, micaceou interbedded siltstone seams throughout, fresh, moderately broken, hard, very thin bedded	- us, few - 195.	- - 0	RC 18	100 (56)							



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			PROJECT NAME Mitchell Landfill, Mitchell PROJECT LOCATION Gatts Ridge Road,												
CEC F	ROJE	CT NUMBER F	PROJEC		ATION	Gatts	Ridge Roa	d, Cres	sap, v	vest v	irginia				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) (14) 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM				
1041.9	× × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, limestone inclusions, interbedded sandstone seams throughout, fresh, moderately broken to broken, hard, very thin bedded	, few y												
1039.4		Gray SHALE, fresh, moderately broken, moderately soft to moderately hard, thinly laminated to laminated	-	 <u>200.0</u> 	RC 19										
1033.1	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few discontinuous sandstone and shale lenses less than 1/10" thick, fresh, moderately broken, hard, very thin bedded		 <u>205.0</u> 							2-Inch Solid PVC Riser Sealed with Bentonite				
1029.8		Gray SHALE, few limestone inclusions, interbedded slightly micaceous siltstone seams less than 1/8" in thickness, sligh micaceous siltstone layer from 210.7' to 211.2', fresh, broke moderately soft, thinly laminated to laminated	ntly en,	 <u>210.0</u> 							Grout				
		Few pyritic specks observed from 212' to 214'.		 <u>215.0</u>	RC 20										
1021.7		Gray and reddish-gray to reddish-brown SHALE, fresh, brok moderately hard, thinly laminated to laminated Gray becoming reddish-brown and gray SHALE, few claysto	-	 											
		seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated	Г	 220.0 	RC 21	75 (60)									
			-	 225.0 											
1010.4 1009.6		Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone inclus fresh, moderately broken, very hard, very thin bedded	sions,	 <u>230.0</u>											
1006.7 1004.6	× × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded throughd with sandstone seams less than about 1/8" thick, fresh, brok moderately hard, very thin bedded		 	RC 22	93 (59)									
		(Continued Next Page)		235.0											



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						II Electric Generating Plant , Cresap, West Virginia					
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION		HLdag 235.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELI	- DIAGRAM	
1002.1	Gray SANDSTONE, micaceous, very fine to medium graine limestone inclusions, interbedded siltstone seams throughd which decrease in frequency with depth, fresh, moderately broken, hard, very thin bedded <i>(continued)</i> Gray SHALE, fresh, broken, moderately hard, thinly lamina laminated Gray SHALE, few claystone seams, gray and light reddish- from 240.8' to 243.2', fresh, broken, moderately broken fror 240.8' to 247', moderately hard, thinly laminated to laminate	ed, few but ted to gray m ed	 240.0 245.0 	RC 23	85 (48)					2-Inch Solid PVC Riser Sealed with Bentonite	
989.1 × × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded sandsto seams generally less than 1/8" thick, fresh, very thin bedde	be be	 <u>250.0</u> 	RC 24	92 (36)			l		Grout	
983.1	Gray and reddish-brown SHALE, few claystone seams, thir laminated to laminated, few interbedded siltstone seams fru 254.3' to 254.9', fresh, moderately broken to broken, moder hard	om	<u>255.0</u> 								
979.3 × × × × × × × × × × × × × × × × × × ×	Coal seam at 258'. Gray SILTSTONE, slightly micaceous, fresh, moderately be hard, very thin bedded Gray SHALE, calcareous, interbedded slightly micaceous siltstone throughout, few limestone inclusions throughout, v hard shale from 263.6' to 267' with limestone, fresh, moder broken, moderately hard to hard, thinly laminated to lamina	very rately ited	 260.0 265.0 	RC 25	87 (62)						
977.9	Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282. fresh, moderately broken, hard to very hard, thinly laminate laminated	5',	 270.0 275.0	RC 26	93 (56)						



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		ROJECT NAI							
							- up, 11	551 V	
GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	,	WEL	L DIAGRAM
	interbedded claystone seams, very calcareous throughout wi limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282.5'	, – .							
				00					
	Gray SILTSTONE, slightly micaceous, few limestone inclusion throughout, fresh, slightly broken, very hard, very thin bedded	d	27	(74)					
× × ×	fresh, slightly broken, very hard, thin bedded	1,							2-Inch Solid PVC Riser Sealed with Bentonite
× × × × × × × × × × × × × × × × × × ×		', – ·							Grout
$ \times \times$		 _ <u>295.0</u> 	RC 28	97 (76)					
× × × × × × × × × × × ×	pyritic specks observed at 298.2' and 298.5', fresh, broken, h $-\!$	nard, - ·							
× × × ×	micaceous, pyritic specks observed at 298.7', fresh, slightly broken, hard to very hard, very thin bedded	300.0						ľ	
× × × × × × × × × × × × × × × × × × ×	interbedded siltstone seams less than 1/16" thick, fresh, sligh broken, very hard, thin bedded Gray SILTSTONE, few limestone inclusions throughout, sligh	htly	29	96 (79)					 Hole Plug (Bentonite Chips)
× × × × × × × × × × × ×									- Filter Sand
× × ×	few interbedded sandstone seams less than 1/16" in thickness from 307.6' to 307.8', fresh, broken, hard, very thin bedded Gray SANDSTONE, very fine to medium grained, interbedde	ss							· · · · ·
× × × × × × × × × × × × × × × × × × ×			RC 30	55 (11)					
		OPPOD MATERIAL DESCRIPTION Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout wi imestone inclusions, pyritic specks observed at 275.7; predominantly reddish-brown claystone from 280.5' to 282.5' fresh, moderately broken, hard to very hard, thinly laminated laminated (continued) Karay SILTSTONE, slightly micaceous, few limestone inclusisi throughout, fresh, slightly broken, very hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained fresh, slightly broken, very hard, thin bedded Gray SILTSTONE, few limestone inclusions, slightly micaceous interbedded sandstone seams 1/16' thick from 291.4 to 297 fresh, slightly broken, hard to very hard, very thin bedded Gray SILTSTONE, micaceous, interbedded with shal pyritic specks observed at 298.2' and 298.5', fresh, broken, 1 very thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, pyritic specks observed at 298.7', fresh, slightly broken, hard to very hard, very thin bedded Gray SILTSTONE, few limestone inclusions throughout, slight micaceous, pyritic specks observed at 298.7', fresh, slightly broken, hard to very hard, very thin bedded Gray SILTSTONE, few limestone inclusions throughout, slight micaceous, pyritic specks observed at 298.7' fresh, slightly broken, very hard, thin bedded Gray SILTSTONE, slightly micaceous, few limestone inclusions flew interbedded sandstore seams less than 1/16' thick, fresh, slightly broken, very thin bedded Gray SILTSTONE, slightly micaceous, few limestone inclusions flew interbedded sandstore seams less than 1/16' thick, fresh, slightly	OPEGO MATERIAL DESCRIPTION E Gray becoming gray and reddish-brown SHALE, many interbedded daystone seams, very calcareous throughout with limestone inclusions, pyrilic specks observed at 275.7; predominantly reddish-brown Classione from 280.5 to 282.5; fresh, moderately broken, hard to very hard, thinly laminated to laminated (continued) 280.0 Cray SILTSTONE, slightly micaceous, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded 285.0 Cray SILTSTONE, few limestone inclusions, slightly micaceous, fresh, slightly broken, very hard, very thin bedded 285.0 Cray SILTSTONE, few limestone inclusions, slightly micaceous, interbedded sandstone seam 1/6" thick from 291.4" to 297. fresh, slightly broken, hard to very hard, very thin bedded 290.0 Cray SILTSTONE, few limestone inclusions throughout, slightly micaceous, pyritic specks observed at 298.7, fresh, slightly micaceous, fresh, slightly broken, hard very thin bedded 300.0 Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, fresh, slightly broken, hard very thin bedded 300.0 Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, fresh, slightly broken, hard very thin bedded 305.0 <	Or ended MATERIAL DESCRIPTION Image: Construct of the second	Order MATERIAL DESCRIPTION The set of the sears set of the search sears set of the search sears set of the search search set of the search search search set of the search search set of the search search search search search search set of the search se	Orag 0 MATERIAL DESCRIPTION Image: Construct of the second s	OP of OP MATERIAL DESCRIPTION Image: Construction of the sears of the sear	Orgen MATERIAL DESCRIPTION	Original MATERIAL DESCRIPTION Image: State Stat



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CEC I	PROJE	CT NUMBER PRO PRO	JECT LO	CATION	Gatts	Ridge Roa	d, Cre	sap, West V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd T 315.0	SAMI	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
920.4 919.6 918.5 914.4		Gray SILTSTONE, slightly micaceous, interbedded sandstone and shale seams throughout less than 1/16" thick, fresh, broken hard, very thin bedded <i>(continued)</i> Gray SANDSTONE, slightly micaceous, few interbedded sandstone seams less than 1/16" thick, fresh, broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium coarse grained, few limestone inclusions, interbedded siltstone seams less than 1/8" thick, fresh, moderately broken, very hard, thin bedded Gray SILTSTONE, slightly micaceous, interbedded throughout with shale seams less than 1/8" thick, fresh, moderately broken, hard to very hard, very thin bedded Gray SHALE, dark gray shale zone from 325.8' to 326', fresh, moderately broken, hard becoming moderately hard, thinly laminated to laminated	, _ 	RC 31	98 (77)				
910.4		Gray to dark gray SHALE, interbedded siltstone throughout, few limestone inclusions, fresh, moderately broken, hard, laminated	- - - - - - - - - - - 335.0	- RC 32	100 (55)				2-Inch Slotte Screen
900.4 397.4 396.2 392.8		Gray SHALE, interbedded siltstone and sandstone seams throughout, interbedded hard siltstone layers with micaceous sandstone inclusions from 337.4' to 338.1' and 339' to 339.2', fresh, broken, moderately hard to hard, laminated Gray SANDSTONE, interbedded siltstone seams througout less than 1/16" thick, micaceous, very fine to medium grained, interbedded limestone, fresh, moderately broken, hard, very thin bedded Gray SHALE, black shale lens 3/4" thick at 344.5', fresh, moderately hard, broken, thinly laminated to laminated Gray and dark gray LIMESTONE, calcareous, fresh, moderately broken, very hard, thick bedded	-	- RC 33	100 (50)				
390.4 388.5		Gray and dark gray SHALE, calcareous, limestone seam 3/4" thick at 347.8', fresh, broken, moderately hard, laminated Gray LIMESTONE, calcareous, shale inclusions throughout, fresh, moderately broken, very hard, thick bedded	 	RC	96				Filter Sand
885.7 883.6		Gray and dark gray SHALE, calcareous, interbedded limestone seams throughout less than 1/8" thick, few limestone inclusions, fresh, moderately broken, moderately hard to hard, thinly laminated to laminated Gray LIMESTONE, calcareous, shale inclusions throughout,	- - - - - 355.0	34	(50)				 Hole Plug (Bentonite Chips)



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	CT NUMBER 110-416			Gatts	Ridge Roa	d, Cres	sap, West Virginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	HLdJ G 355.	SAN	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
380.4	fresh, moderately broken, very hard, medium bedded Gray and dark gray SHALE, calcareous, interbedded limest seams throughout less than 1/8" thick, few limestone inclu- fresh, moderately broken, moderately hard to hard, thinly laminated to laminated <i>(continued)</i> Bottom of hole at 357.0 feet. Soil sampling completed on 9/6/11. Boring offset on 9/20/1 rock coring. Augered to 17.5' to begin rock core sampling. The following groundwater level readings were taken during drilling: 9/21/2011 7:45 AM at 91.2' bgs (borehole depth = 107' bgs) 9/22/2011 8:25 AM at 233.1' bgs (borehole depth = 227' bgs 9/23/2011 7:45 AM at 333.1' bgs (borehole depth = 347' bg Geophysical logging and packer testing were performed up completion. Well MW1103H installed following geophysical logging and packer testing.	1 for (5) (5) (5) (5) (5) (5) (5) (5) (5) (5)					

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		B	OF	RIN	g N	UMBE	RS	B-1		MW1103R PAGE 1 OF 10
CLIE	NT An	nerican Electric Power	PROJE		ME	Mitch	nell La	ndfill, Mitch	ell Ele	ctric C	Genera	ating Plant
CEC	PROJE	CT NUMBER	PROJE		CAT		Gatts	Ridge Roa	d, Cre	sap, V	/est V	irginia
DATE	STAR	TED9/6/11 COMPLETED9/23/11	GROUN	D ELE	VAT		1237.	4 ft	HOLE	SIZE	0.5 f	ït
DRILI	LING C	ONTRACTOR Frontz Drilling, Inc.	GROUN		ER	LEVE	LS:					
DRILI	LING M	ETHOD HSA: Auto Hammer & Air Rotary Rock Core (NX)	A	T TIME	OF	DRIL	LING	Refer to n	otes a	t botto	m of I	og
LOGO	GED B	M. McCoy / R. Mahle CHECKED BY A. Amicon	A	T END	OF	DRILL	ING	Refer to no	otes at	botto	n of lo	bg
LOCA	TION	N 486998.5, E 1610097.2	Α	FTER [DRIL	LING	Wel	l installed				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)		NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1237.4		Brown LEAN CLAY WITH SAND (CL), trace roots, noted	iron	0.0								
.201.4		oxide concretions, moist, medium stiff to stiff (RESIDUAL)		X	SS 1	93	3-4-5 (9)	2			Concrete
					M	SS	73	2-2-3	2		۵ م ۵	⁴ Seal
1234.4		Light olive gray and reddish-brown to olive brown LEAN C	LAY	+ -	$\left\{ \right\}$	2 SS		(5) 3-3-4				
-		(CL), few shale fragments, slightly fissile to fissile, moist, stiff to very stiff (RESIDUAL)			M	3	60	(7)	1			
		Sun to very Sun (RESIDORE)		5.0	М	SS 4	53	5-10-11 (21)	1.5			
					\mathbb{R}	4 SS		12-10-14	- - -			
					Ш	5	47	(24)	1.5			
1229.9		Reddish-brown CLAYSTONE, completely to highly weath very broken, very soft, few limestone seams, blocky, few g	ered, grav		M	SS 6	60	11-12-26 (38)	1-2.25			
		blocky siltstone partings		 10.0	M	SS	80	8-11-33	3-3.5			
				10.0	\square	7 SS	100	(44) 50/5"	1			2-Inch Solid PVC Riser
1005.0		Light gravite burning OLALE, bight use standing the second s			P	8	100	50/5	1 '			Sealed with Bentonite
1225.9		Light gray to brown SHALE, highly weathered, very broke soft, laminated, very fissile	n, very		М	SS	60	31-22-25	1			Grout
					\mathbb{A}	9 SS		(47)	-			
				15.0	А	10	100	14-50/5"	1			
1222.6 1221.9	× × × × × ×	Light gray SILTSTONE, highly weathered, very broken, ve	ery soft,		М	SS	93	25-34-36				
		Reddish-brown to light brown SHALE, highly weathered, v	very		\square	11 SS	100	(70)	}			
1219.9		broken, very soft, laminated, fissile Reddish-brown CLAYSTONE, few interbedded shale sear	ms.			12	<u> </u>		1			
		highly weathered to moderately weathered, slightly broker soft to moderately soft	n, very	 		RC 1	72 (65)					
1212.6		Gray SHALE, few interbedded slightly micaceous siltstone seams, reddish brown and gray from 27.3' to 28' with clay										
		seams, moderately weathered, slightly broken, moderatel laminated										
1209.4		Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams through limestone inclusions, highly to moderately weathered, mo broken, moderately soft, laminated		30.0								
				 		RC 2	80 (43)					
		(Continued Next Page)		35.0								



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			PROJECT NAME <u>Mitchell Landfill, Mitchel</u> PROJECT LOCATION Gatts Ridge Road										
		CT NUMBER _110-416 P	nUJE(ATION	Gatts	niuge Koa		ap, v	vest V	irgifila		
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(#) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	_ DIAGRAM		
		Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams throughout limestone inclusions, highly to moderately weathered, moder broken, moderately soft, laminated (continued)	t, few rately										
1199.4		Gray and reddish brown CLAYSTONE, few discontinuous sli micaceous siltstone seams, few limestone inclusions, moder weathered, moderately broken, moderately soft		 40.0									
1197.7	*****	Gray SILTSTONE, slightly micaceous, few discontinuous sha and sandstone seams, noted pyritic specs at 31.6', increasin grain size with depth, iron stained fractures from 39.7' to 41.4 moderately weathered, moderately broken, moderately hard, thin bedded	ig in 4',	 45.0	RC 3	97 (76)					2-Inch Solid		
1192.1		Gray SANDSTONE, moderately weathered, moderately brok moderately hard, very thin bedded to thin bedded, micaceous very fine to fine grained, few limestone inclusions, few discontinuous siltstone seams, brownish-gray from 46.4' to 4	s,								PVC Riser Sealed with Bentonite Grout		
1189.6	· · · · · · · · · · · · · · · · · · ·	vertical iron stained fracturing from 46.6' to 47' Gray to brownish-gray SANDSTONE, micaceous, very fine to grained, few limestone inclusions, few discontinuous siltstone seams, vertical iron stained fracture from 47' to 47.3', moder weathered, moderately broken, moderately hard, very thin bedded to thin bedded	o fine e	 									
1185.4	× × × × × ×	Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams throughout, few limestone inclusions, sandstone lens from 49.2' to 50.1', moderately weathered, moderately broken, moderately soft to moderately hard, very bedded to thin bedded Gray SHALE, discontinuous and slightly micaceous siltstone		 _55.0	RC 4	79 (46)							
1180.4		seams throughout, reddish-brown from 52.5' to 53.2' with claystone seams and limestone inclusions, pyritic specs observed, highly to moderately weathered, moderately broke moderately soft, thinly laminated to laminated											
1178.9	× × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded sandston seams throughout, few limestone inclusions, pyritic specs observed, moderately weathered, moderately broken, moder hard, very thin bedded	ately	60.0									
		Gray SANDSTONE, micaceous, very fine to medium grained slightly weathered, moderately broken, moderately hard, very bedded			RC 5	93 (29)							
1174.6		Gray SHALE, few limestone inclusions, interbedded slightly micaceous siltstone throughout, pyritic specs observed, moderately to slightly weathered, moderately broken, modera soft, thinly laminated to laminated	ately	 65.0 									
1170.4		Gray SHALE, discontinuous slightly micaceous siltstone sea throughout, few limestone inbeds, pyritic specs observed throughout, reddish brown claystone seams from 67.9' to 68. 68.4' to 68.7', 69.3' to 70.1', and 71.3' to 71.6', moderately weathered, moderately broken, moderately soft, thinly lamina to laminated	.2',	 <u>70.0</u>		02							
1165.3 1164.3		Light gray LIMESTONE, calcareous, few shale inclusions, sli weathered, moderately broken, hard, thick bedded	ightly		RC 6	93 (64)							
		(Continued Next Page)		75.0									



BORING NUMBER SB-18/ MW1103R

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	American Electric Power ROJECT NUMBER 110-416					ndfill, Mitch Ridge Roa			
_	MATERIAL DESCRIPTION		HLd30 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		_ DIAGRAM
	Gray SANDSTONE, very fine to medium grained, micace interbedded limestone, slightly weathered, slightly broken broken, hard, very thin bedded to thin bedded <i>(continued)</i>	to							
1157.9 × × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams, interbedded limestone, slightly weathe moderately broken, moderately hard, very thin bedded	ered,	 	RC 7	100 (7)				2-Inch Solid PVC Riser Sealed with
1150.4 × 1149.5	seams, interbedded limestone, slightly weathered, moder broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated	rately	 _90.0 	RC 8	100				Bentonite Grout
1143.6	Reddish-gray discoloration from 92.2' to 92.4'. Pyritic spe observed at 93.7'. Gray to dark gray LIMESTONE, calcareous, slightly weath moderately broken, hard, medium bedded	hered,	95.0	8	(30)				
1140.4	Gray SHALE, with calcareous limestone inclusions, slight weathered, moderately broken, moderately soft, laminate Gray and reddish-gray from 101.6' to 107' with few claysto	ď	 _ <u>100.0</u> 	RC	100				
	seams.		 _105.0	9	(56)				
××	Gray SILTSTONE, moderately to slightly micaceous, fres moderately broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grai interbedded calcareous limestone, fresh, moderately brok hard, very thin bedded	ned,	 _110.0 	RC 10	88 (68)				
	(Continued Next Page)		 115.0						



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							ndfill, Mitch Ridge Roa			
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HLd HLd HL H H H H H H H H H H H H H H H	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
1122.1		Gray SHALE, few interbedded siltstone seams, fresh, mode broken, moderately soft, thinly laminated to laminated	erately						l	
1117.1		Reddish-brown and gray CLAYSTONE, few interbedded sha seams, fresh, moderately broken, moderately soft	ale	<u>120.0</u> <u>125.0</u>	RC 11	74 (33)			l	2-Inch Solid
		Gray SILTSTONE, interbedded limestone, fresh, slightly bro moderately hard, very thin bedded Gray SILTSTONE, slightly micaceous, interbedded througho with sandstone seams less than 1/8" thick, limestone inclusi throughout, fresh, moderately broken, moderately hard, very bedded	out ions / thin	 1 <u>30.0</u>	RC	100			l	PVC Riser Sealed with Bentonite Grout
?	· · · · · · · · · · · · · · · · · · ·	Gray SILTSTONE, slightly micaceous, discontinuous sands seams less than 1/10" thick, sporadic limestone inclusions	tone	- – - – <u>135.0</u> - –	12	(83)			l	
	<pre></pre>	throughout, fresh, moderately broken, moderately hard, very bedded Gray SANDSTONE, micaceous, very fine to medium graine		 <u>140.0</u> 	RC 13	100 (50)				
		interbedded throughout with siltstone seams which decrease frequency with depth and are less than 1/10" thick, fresh, moderately broken, moderately hard to hard, very thin bedde thin bedded Gray SANDSTONE, micaceous, very fine to medium graine	e in ed to	<u>145.0</u> 						
1090.4		Gray SANDSTONE, micaceous, very fine to medium grane interbedded with siltstone lenses less than 1/16" thick from to 152.3', siltstone seam approximately 1/16" thick at 159.5', discontinuous siltstone lenses from 174.5' to 176.2', fresh, s broken, hard, thick bedded	147' , slightly	 <u>150.0</u> 	RC 14	100 (90)				
		(Continued Next Page)	-	155.0						

CLIEN	T Am	erican Electric Power PR	DJECT NA	ME Mit	chell La	ndfill, Mitch	nell Ele	ctric Gene	rating Plant
CEC I	PROJE	CT NUMBER <u>110-416</u> PR	DJECT LO	CATION	Gatts	Ridge Roa	d, Cres	sap, West	Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HL (#) 155.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WE	LL DIAGRAM
		Gray SANDSTONE, micaceous, very fine to medium grained, interbedded with siltstone lenses less than 1/16" thick from 14 to 152.3', siltstone seam approximately 1/16" thick at 159.5', discontinuous siltstone lenses from 174.5' to 176.2', fresh, slig broken, hard, thick bedded <i>(continued)</i>	7'	RC 15					2-Inch Solic PVC Riser Sealed with Bentonite
061.2		Gray SHALE 0.5" coal coam at 176.5' bairling coal fractures		- RC 16					Grout
061.2 060.4 056.1 054.1 053.4		Gray SHALE, 0.5" coal seam at 176.5', hairline coal fractures 176.3' and 178.4', fresh, broken, moderately hard, thinly laminated to laminated Gray and dark gray SHALE, few claystone seams, fresh, moderately broken, moderately soft, laminated to thinly lamina Gray SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams throughout, noted calcareous limestone inclusions throughout, fresh, moderately broken, ha very thin bedded Gray SILTSTONE, interbedded with sandstone and shale sea less than 1/16" thick, fresh, moderately broken, hard, very thin bedded Black SHALE, few limestone inclusions, gray shale from 184' 184.2' and 186.7' to 186.9' fresh, moderately broken, moderately	d,	- RC 17					
050.4	××××××××××××××××××××××××××××××××××××××	184.2' and 186.7' to 186.9', fresh, moderately broken, moderately broken, moderately broken, moderately broken, hard, laminated Dark gray SHALE, calcareous with limestone inclusions, fresh slightly broken, hard, laminated Gray SILSTONE, slightly micaceous, few limestone inclusions sandstone layer from 191.7' to 192', fresh, moderately broken, moderately hard to hard, very thin bedded		- - - - - - - - - - - - - - - - - - -					- Hole Plug (Bentonite Chips) - Filter Sand 2-Inch Slott Screen

(Continued Next Page)

BORING NUMBER SB-18/ MW1103R





BORING NUMBER SB-18/ MW1103R PAGE 6 OF 10

Image: Section of the section of th										ectric Generating Plant sap, West Virginia
Interesteded standstone seams throughout, fresh, moderately broken, had, very thin bedded 1038.4 Gray SHALE, fresh, moderately broken, moderately soft to moderately hard, thinly laminated to laminated 200.0 1033.1 Gray SILTSTONE, slightly micaceous, few discontinuous sandstone and shale lonses less than 11/10 'hick, fresh, moderately broken, hard, very thin bedded 205.0 1023.8 Gray SHALE, few limestone inclusions, interbedded slightly micaceous sitistone layer from 210.7 to 211.2, fresh, broken, moderately soft, thinly laminated to laminated 210.0 1021.7 Gray and reddish-gray to reddish-brown SHALE, feesh, broken, moderately broken, hard, laminated to laminated 210.0 1019.1 Gray SHLTSTONE, fresh, broken, moderately hard, very thin bedded 200.0 1019.1 Gray SHALE, fresh, broken, moderately hard, trey thin bedded 210.0 1019.1 Gray SHALE, fresh, broken, moderately hard, trey thin bedded 210.0 1019.1 Gray SHALE, fresh, broken, moderately hard, very thin bedded 220.0 1019.1 Gray SAUBTONE, fresh, broken, moderately hard, very thin bedded 220.0 1019.1 Gray SAUBTONE, fresh, broken, moderately hard, very thin bedded 220.0 1019.1 Gray SAUBTONE, fresh, broken, moderately hard, very thin bedded 220.0 1019.4 Cray SAUBTONE, fresh, broken, moderately hard, v	ELEVATION (ft)	C GRAPHIC LOG	MATERIAL DESCRIPTION			SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
10394 Gray SHALE, fresh, moderately borken, moderately soft to moderately hard, thinly laminated to laminated 200.0 10331 Gray SILTSTONE, slightly micaceous, few discontinuous sandstone and shale lenses less than 1/10° thick, fresh, moderately borken, hard, very thin bedded 205.0 10298 Gray SHALE, few limestone inclusions, interbedded slightly micaceous slittone saams less than 1/10° thick, fresh, moderately borken, hard, very thin bedded 210.0 10298 Gray SHALE, few limestone inclusions, interbedded slightly micaceous slittone layer from 21.0° to 211.2°, fresh, broken, moderately hard, tresh, moderately hard, tresh, moderately hard, tresh, moderately hard, thinky laminated to laminated 210.0 1021.7 Gray and reddish-gray to reddish-brown and gray SHALE, fresh, broken, moderately hard, hinky laminated to laminated 215.0 1019.1 Gray becoming reddish-brown and gray SHALE, fresh, broken, moderately hard, hinky laminated to laminated 210.0 1019.1 Gray becoming reddish-brown and gray SHALE, few claystone seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated 220.0 1019.1 Gray SLITSTONE, fresh, broken, moderately hard, very thin bedded 220.0 1019.1 Gray SLITSTONE, fresh, broken, moderately hard, very thin bedded 220.0 1019.1 Gray SLITSTONE, fresh, broken, moderately hard, very thin bedded 220.0 10104 2		× × × × × × × × ×	interbedded sandstone seams throughout, fresh, moderately		· -					
1023.8 Gray SHALE, few limestone inclusions, interbedded slightly micaceous siltstone seam less than 1/10 'thick, fresh, broken, moderately soft, thinly laminated to laminated 210.0 1021.7 Gray and reddish-gray to reddish-brown SHALE, fresh, broken, moderately hard, thinly laminated to laminated 215.0 1021.7 Gray and reddish-gray to reddish-brown SHALE, fresh, broken, moderately hard, thinly laminated to laminated 210.0 1019.1 Gray and reddish-brown and gray SHALE, fresh, broken, moderately hard, thinly laminated to laminated 210.0 1019.1 Gray SILTSTONE, fresh, broken, moderately hard, there the laminated 20.0 1019.4 X X Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded 1002.6 Gray SILTSTONE, micaceous, wery fine to fine grained, interbedded siltstone layers throughout, tresh, moderately broken, very thard, very thin bedded 1002.6 Gray SILTSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout 1/8" thick, fresh, broken, moderately broken, very fine to fine grained, interbedded siltstone layers throughout 1/8" thick, fresh, broken, with sandstone seam is than about 1/8" thick, fresh, broken, the limestone inclusions, fresh, moderately broken, very fine to fine grained, with sandstone seam is estiman 101.1" thick, fresh, broken, moderately fresh throughout to 1/8" thick, fresh, broken, the limestone inclusions, fresh, moderately broken, very fine to fine grained, with sandstone seam less than 101.1" thick, fresh, broken, the limestone inclusions, fresh, moderately broken, very thin bedded			Gray SHALE, fresh, moderately broken, moderately soft to moderately hard, thinly laminated to laminated	-	 200.0 	RC 19				Filter Sand
1029.8 Gray SHALE, few linestone inclusions, interbedded slightly micaceous silistone seams less than 1/8" in thickness, slightly micaceous silistone aver from 210.7 to 211.2', fresh, broken, moderately soft, thinly laminated to laminated 210.0 1021.7 Gray and reddish-gray to reddish-brown SHALE, fresh, broken, moderately hard, thinly laminated to laminated 215.0 1019.1 Gray becoming reddish-brown and gray SHALE, fresh, broken, moderately broken, hard, laminated 220.0 1019.1 Gray Secoming reddish-brown and gray SHALE, fresh, broken, moderately broken, hard, laminated 220.0 1019.1 Gray SULTSTONE, fresh, broken, moderately hard, very thin bedded 220.0 1010.4 2.2.3 Gray SULTSTONE, fresh, broken, moderately hard, very thin bedded 1006.7 X X X Gray SULTSTONE, sightly micaceous, interbedded throughout, interbedded slitstone layers throughout, fresh, moderately broken, very thin bedded 1006.7 X X X Gray SULTSTONE, sightly micaceous, interbedded throughout, interbedded slitstone layers throughout, fresh, moderately broken, very thin bedded 230.0 1006.7 X X X Gray SULTSTONE sightly micaceous, interbedded throughout, interbedded slitstone layers throughout, fresh, broken, interbedded slitstone layers throughout, fresh, b		× × × × × × × × × × × ×	sandstone and shale lenses less than 1/10" thick, fresh,		205.0 					
Few pyritic specks observed from 212' to 214'. 20 (56) 1021.7 Gray and reddish-gray to reddish-brown SHALE, fresh, broken, moderately hard, thinly laminated to laminated 215.0 20 1019.1 Gray becoming reddish-brown and gray SHALE, few claystone seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated 220.0 20 1019.1 Gray becoming reddish-brown and gray SHALE, few claystone seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated 220.0 221 600 1019.4 X X Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded 225.0 225.0 225.0 1009.6 Gray SANDSTONE, micaceous, very fine to fine grained, interbedded slitstone layers throughout, few limestone inclusions, fresh, moderately broken, very hard, very thin bedded 230.0 230.0 1006.7 X X Gray SILTSTONE, slightly micaceous, interbedded throughout /%" thick, fresh, broken, moderately hard, very thin bedded 280.0 220.0			micaceous siltstone seams less than 1/8" in thickness, sligh micaceous siltstone layer from 210.7' to 211.2', fresh, broke	ntly en,	 210.0					
1019.1 Gray becoming reddish-brown and gray SHALE, few claystone seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated 220.0 1019.1 Gray becoming reddish-brown and gray SHALE, few claystone seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated 220.0 1010.4 X × X Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded RC 75 21 (60) 1010.4 X × X Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone inclusions, fresh, moderately broken, very thin bedded 230.0 1006.7 X × X Gray SILTSTONE, slightly micaceous, interbedded throughout with sandstone seams less than about 1/8" thick, fresh, broken, moderately hard, very thin bedded RC 93 22 (59)					 215.0	RC 20				
1010.4 X × X Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded 1009.6 Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone inclusions, fresh, moderately broken, very hard, very thin bedded 230.0 1006.7 X × X Gray SILTSTONE, slightly micaceous, interbedded throughout with sandstone seams less than about 1/8" thick, fresh, broken, moderately hard, very thin bedded RC 93 225.0 FC 93 22 (59)			Gray becoming reddish-brown and gray SHALE, few claysto seams, calcareous, limestone inclusions throughout, fresh,	one	· – · – · –					
1009.6 bedded Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone inclusions, fresh, moderately broken, very hard, very thin bedded 230.0 1006.7 X × X × X × X × X × X × X × X × X × X ×			moderately broken, hard, laminated	-		RC 21				
$\begin{array}{c c} \times \times \\ \times \times \\ \times \times \end{array} & \text{with sandstone seams less than about 1/8" thick, fresh, broken,} \\ \text{moderately hard, very thin bedded} & RC 93 \\ 22 (59) \end{array}$		× × × × × ×	 bedded Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone incluse 		 230.0					
235.0	×	× × × × × ×	with sandstone seams less than about 1/8" thick, fresh, brok	ken,	· -	RC 22				



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CEC I	PROJE	CT NUMBER 110-416 PF	ROJEC	OJECT LOCATION _ Gatts Ridge Road, Cresap, West Vir						
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) DEDTH 235.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM	
1002.1		Gray SANDSTONE, micaceous, very fine to medium grained limestone inclusions, interbedded siltstone seams throughout which decrease in frequency with depth, fresh, moderately broken, hard, very thin bedded <i>(continued)</i> Gray SHALE, fresh, broken, moderately hard, thinly laminated	t							
		laminated Gray SHALE, few claystone seams, gray and light reddish-gr from 240.8' to 243.2', fresh, broken, moderately broken from 240.8' to 247', moderately hard, thinly laminated to laminated		<u>240.0</u> 245.0	RC 23	85 (48)				
989.1		Gray SILTSTONE, slightly micaceous, interbedded sandston seams generally less than 1/8" thick, fresh, very thin bedded	Г	 2 <u>250.0</u>	RC 24	92 (36)				
983.1	× × × × × ×	Gray and reddish-brown SHALE, few claystone seams, thinly laminated to laminated, few interbedded siltstone seams from 254.3' to 254.9', fresh, moderately broken to broken, moderat hard	n 🗌	 255.0						
979.3		Coal seam at 258'. Gray SILTSTONE, slightly micaceous, fresh, moderately brokhard, very thin bedded Gray SHALE, calcareous, interbedded slightly micaceous siltstone throughout, few limestone inclusions throughout, ver hard shale from 263.6' to 267' with limestone, fresh, moderate broken, moderately hard to hard, thinly laminated to laminate	ry	<u>260.0</u> - - - - 2 <u>265.0</u>	RC 25	87 (62)				
970.4		Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout wit limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282.5', fresh, moderately broken, hard to very hard, thinly laminated laminated	, to	270.0 - - - - - - - - - - - - - - - - - -	RC 26	93 (56)				



BORING NUMBER SB-18/ MW1103R

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								tchell Electric Generating Plant					
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH	(ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM				
		Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout with limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282.5', fresh, moderately broken, hard to very hard, thinly laminated to laminated <i>(continued)</i>	-	- - - 0.0									
954.9	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, fresh, slightly broken, very hard, thin bedded	-	- - 5.0	RC 27	99 (74)							
950.4		Gray SILTSTONE, few limestone inclusions, slightly micaceous interbedded sandstone seams 1/16" thick from 291.4' to 297', fresh, slightly broken, hard to very hard, very thin bedded	- _29 _ _ _ _ _	- - - - - 5.0	RC 28	97 (76)							
940.4 938.8 937.9 936		Gray SILTSTONE, slightly micaceous, interbedded with shale, pyritic specks observed at 298.2' and 298.5', fresh, broken, har very thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, pyritic specks observed at 298.7', fresh, slightly broken, hard to very hard, very thin bedded Gray SANDSTONE, micaceous, very fine to fine grained, few interbedded siltstone seams less than 1/16" thick, fresh, slightly broken, very hard, thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly broken, very hard, thin bedded		 0.0 5.0 	RC 29	96 (79)							
930.4 929.6 925.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusions few interbedded sandstone seams less than 1/16" in thickness from 307.6' to 307.8', fresh, broken, hard, very thin bedded Gray SANDSTONE, very fine to medium grained, interbedded siltstone seams throughout less than 1/4" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded Gray SILTSTONE, slightly micaceous, interbedded sandstone and shale seams throughout less than 1/16" thick, fresh, broken hard, very thin bedded	<u>31</u> 	 0.0 5.0	RC 30	55 (11)							



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CEC	PROJE	CT NUMBER _110-416 PROJ	ECT LOO	CATION	Gatts	Ridge Roa	d, Cres	ap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HL (#) 315.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
	× × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded sandstone and shale seams throughout less than 1/16" thick, fresh, broken, hard, very thin bedded (continued)						
920.4 919.6 918.5	× × × × × × × × × × × × × × × × × × ×	Gray SANDSTONE, slightly micaceous, few interbedded sandstone seams less than 1/16" thick, fresh, broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium coarse grained, few limestone inclusions, interbedded siltstone seams less than 1/8" thick, fresh, moderately broken, very hard, thin	 					
	× × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded throughout with shale seams less than 1/8" thick, fresh, moderately broken, hard to very hard, very thin bedded		RC 31	98 (77)			
914.4		Gray SHALE, dark gray shale zone from 325.8' to 326', fresh, moderately broken, hard becoming moderately hard, thinly laminated to laminated	 325.0					
910.4		Gray to dark gray SHALE, interbedded siltstone throughout, few limestone inclusions, fresh, moderately broken, hard, laminated	 					
			 <u>335.0</u>	RC 32	100 (55)			
000.4		Gray SHALE, interbedded siltstone and sandstone seams throughout, interbedded hard siltstone layers with micaceous sandstone inclusions from 337.4' to 338.1' and 339' to 339.2', fresh, broken, moderately hard to hard, laminated						
397.4 396.2		Gray SANDSTONE, interbedded siltstone seams througout less than 1/16" thick, micaceous, very fine to medium grained, interbedded limestone, fresh, moderately broken, hard, very thin bedded Gray SHALE, black shale lens 3/4" thick at 344.5', fresh, moderately hard, broken, thinly laminated to laminated		RC 33	100 (50)			
392.8		Gray and dark gray LIMESTONE, calcareous, fresh, moderately broken, very hard, thick bedded	345.0					
390.4		Gray and dark gray SHALE, calcareous, limestone seam 3/4" thick at 347.8', fresh, broken, moderately hard, laminated Gray LIMESTONE, calcareous, shale inclusions throughout,						
		fresh, moderately broken, very hard, thick bedded	350.0	RC	96			
885.7		Gray and dark gray SHALE, calcareous, interbedded limestone seams throughout less than 1/8" thick, few limestone inclusions, fresh, moderately broken, moderately hard to hard, thinly		34	(50)			



BORING NUMBER SB-18/ MW1103R PAGE 10 OF 10

					Gallo	Ridge Roa	a, Cres	sap, West Virginia
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION		(II) 355.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
80.4	Iresh, moderately broken, very hard, medium bedded Gray and dark gray SHALE, calcareous, interbedded limes seams throughout less than 1/8" thick, few limestone inclu fresh, moderately broken, moderately hard to hard, thinly larninated to larninated (continued) Bottom of hole at 357.0 feet. Soil sampling completed on 9/6/11. Boring offset on 9/20/ rock coring. Augered to 17.5' to begin rock core sampling The following groundwater level readings were taken durin drilling: 9/21/2011 7:45 AM at 91.2' bgs (borehole depth = 107' bg 9/22/2011 8:25 AM at 233.1' bgs (borehole depth = 227' bg 9/23/2011 7:45 AM at 333.1' bgs (borehole depth = 347' b Geophysical logging and packer testing were performed up completion. Well MW1103R installed after completion in an offset borin The above-noted ground elevation corresponds to the grou elevation at which soil and rock sampling was initiated at S The ground elevation for MW1103R = 1238.1 ft.	stone sions, 11 for g s) gs) gs) gs) pon ng. und						

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		B	OF	RIN	G N	UMBE	RS	B- 1		MW1103F PAGE 1 OF 10
CLIE	NT An	nerican Electric Power	PROJE		ME _	Mitch	nell La	ndfill, Mitch	ell Ele	ctric C	aenera	ating Plant
CEC	PROJE	CT NUMBER 110-416	PROJE		CATI	ON _	Gatts	Ridge Roa	d, Cre	sap, V	/est V	irginia
DATE	STAR	TED _9/6/11 COMPLETED _9/23/11	GROUN	D ELE	VAT	ION _	1237.	4 ft	HOLE	SIZE	0.5 f	t
DRILI	LING C	ONTRACTOR Frontz Drilling, Inc.	GROUN	D WAT	ER	LEVE	LS:					
DRILI	LING M	ETHOD HSA: Auto Hammer & Air Rotary Rock Core (NX)	A	T TIME	OF	DRIL	LING	Refer to n	otes a	t botto	m of l	og
LOGO	GED B	M. McCoy / R. Mahle CHECKED BY A. Amicon	A	t end	OF	DRILL	ING _	Refer to no	otes at	botto	n of lo	og
LOCA	TION	N 487011.2, E 1610102.2	Α	FTER [DRIL	LING	Wel	l installed				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)		NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1237.4		Brown LEAN CLAY WITH SAND (CL), trace roots, noted i	iron	0.0				245				
1207.4		oxide concretions, moist, medium stiff to stiff (RESIDUAL))		X	SS 1	93	3-4-5 (9)	2			Concrete
					M	SS	73	2-2-3	2	∆ 4 ⁴	4'	Seal
1234.4		Light olive gray and reddish-brown to olive brown LEAN C	ΙΑΥ		$\left\{ \right\}$	2 SS		(5) 3-3-4	-			
-		(CL), few shale fragments, slightly fissile to fissile, moist, r stiff to very stiff (RESIDUAL)			W	3	60	(7)	1			
		Sun to very Sun (RESIDOAL)		5.0	M	SS 4	53	5-10-11 (21)	1.5			
					\mathbb{R}	4 SS		12-10-14	- - -			
					Ш	5	47	(24)	1.5			
1229.9		Reddish-brown CLAYSTONE, completely to highly weather very broken, very soft, few limestone seams, blocky, few g	ered, grav		\mathbb{N}	SS 6	60	11-12-26 (38)	1-2.25			
		blocky siltstone partings	, ,	 10.0	M	SS	80	8-11-33	3-3.5			
				10.0	\square	7 SS	100	(44)	1			2-Inch Solid PVC Riser
1005.0		Light grouts because CLALE, bight use showed your busices			N	8	100		1 '			Sealed with Bentonite
1225.9		Light gray to brown SHALE, highly weathered, very broker soft, laminated, very fissile	n, very		М	SS	60	31-22-25	1			Grout
					\mathbb{A}	9 SS		(47)	-			
				15.0	А	10	100	14-50/5"	1			
1222.6 1221.9	× × × × × ×	Light gray SILTSTONE, highly weathered, very broken, ve	ery soft,		M	SS	93	25-34-36				
		Reddish-brown to light brown SHALE, highly weathered, v	ery		Ø	11 SS	100	(70)	}			
1219.9		broken, very soft, laminated, fissile Reddish-brown CLAYSTONE, few interbedded shale sear	ns,			12						
		highly weathered to moderately weathered, slightly broken soft to moderately soft	n, very	 		RC 1	72 (65)					
1212.6		Gray SHALE, few interbedded slightly micaceous siltstone seams, reddish brown and gray from 27.3' to 28' with clays										
		seams, moderately weathered, slightly broken, moderately laminated										
1209.4		Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams through limestone inclusions, highly to moderately weathered, mod broken, moderately soft, laminated		30.0								
						RC	80					
						2	(43)					
				35.0	11							
		(Continued Next Page)		00.0			I		1			



BORING NUMBER SB-18/ MW1103F PAGE 2 OF 10

							ndfill, Mitch Ridge Roa			ating Plant /irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) (tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WEL	L DIAGRAM
		Gray SHALE, many interbedded sandstone seams, few discontinuous slightly micaceous siltstone seams throughout, limestone inclusions, highly to moderately weathered, modera broken, moderately soft, laminated <i>(continued)</i>								
1199.4		Gray and reddish brown CLAYSTONE, few discontinuous slig micaceous siltstone seams, few limestone inclusions, modera weathered, moderately broken, moderately soft	tely	40.0						
	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few discontinuous shal and sandstone seams, noted pyritic specs at 31.6', increasing grain size with depth, iron stained fractures from 39.7' to 41.4' moderately weathered, moderately broken, moderately hard, w thin bedded	in ,	 45.0	RC 3	97 (76)				2-Inch Solid
1192.1		Gray SANDSTONE, micaceous, very fine to fine grained, few limestone inclusions, few discontinuous siltstone seams, brownish-gray from 46.4' to 47', vertical iron stained fracturing from 46.6' to 47', moderately weathered, moderately broken,								PVC Riser Sealed with Bentonite Grout
1189.6	× × × × × × × × × × × × × × × × × × ×	moderately hard, very thin bedded to thin bedded Gray to brownish-gray SANDSTONE, micaceous, very fine to grained, few limestone inclusions, few discontinuous siltstone seams, vertical iron stained fracture from 47' to 47.3', moderat weathered, moderately broken, moderately hard, very thin bedded to thin bedded		 		70				
1185.4		Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams throughout, few limestone inclusions, sandstone lens from 49.2' to 50.1', moderately weathered, moderately broken, moderately soft to moderately hard, very t bedded to thin bedded Gray SHALE, discontinuous and slightly micaceous siltstone	him	 _55.0_	RC 4	79 (46)				
1180.4		seams throughout, reddish-brown from 52.5' to 53.2' with claystone seams and limestone inclusions, pyritic specs observed, highly to moderately weathered, moderately broken moderately soft, thinly laminated to laminated								
1178.9	× × ×	Gray SILTSTONE, slightly micaceous, interbedded sandstone seams throughout, few limestone inclusions, pyritic specs observed, moderately weathered, moderately broken, modera hard, very thin bedded	tely	60.0						
1174.6		Gray SANDSTONE, micaceous, very fine to medium grained, slightly weathered, moderately broken, moderately hard, very bedded Gray SHALE, few limestone inclusions, interbedded slightly			RC 5	93 (29)				
1174.0		micaceous siltstone throughout, pyritic specs observed, moderately to slightly weathered, moderately broken, moderat soft, thinly laminated to laminated	ely	 						
1170.4		Gray SHALE, discontinuous slightly micaceous siltstone seam throughout, few limestone inbeds, pyritic specs observed throughout, reddish brown claystone seams from 67.9' to 68.2 68.4' to 68.7', 69.3' to 70.1', and 71.3' to 71.6', moderately weathered, moderately broken, moderately soft, thinly laminat to laminated	",	 _70.0						
1165.3 1164.3		Light gray LIMESTONE, calcareous, few shale inclusions, slig weathered, moderately broken, hard, thick bedded	htly		RC 6	93 (64)				
		(Continued Next Page)		75.0						



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O MATERIAL DESCRIPTION Gray SANDSTONE, very fine to medium grained, micaceo interbedded limestone, slightly weathered, slightly broken t broken, hard, very thin bedded to thin bedded (continued)	us 0 - -	H (#) 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Ridge Road BLOW COUNTS (N VALUE) (N VALUE)	POCKET PEN (tsf)			_ DIAGRAM
interbedded limestone, slightly weathered, slightly broken t broken, hard, very thin bedded to thin bedded <i>(continued)</i>	us o – –	-							
Gray SILTSTONE, slightly micaceous, few interbedded									
Gray SILTSTONE, slightly micaceous, few interbedded sandstone seams, interbedded limestone, slightly weathere moderately broken, moderately hard, very thin bedded	ed,	<u>30.0</u> - - 3 <u>5.0</u> -	RC 7	100 (7)					2-Inch Solid PVC Riser Sealed with Bentonite
seams, interbedded limestone, slightly weathered, modera broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated			RC 8	100 (30)					Grout
moderately broken, hard, medium bedded		_ 9 <u>5.0</u> _ _							
weathered, moderately broken, moderately soft, laminated	- - - - - - -	-	RC 9	100 (56)					
 moderately broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grain 	ed, 1	- - - <u>10.0</u> - - -	RC 10	88 (68)					
	 seams, interbedded limestone, slightly weathered, moderately broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated Reddish-gray discoloration from 92.2' to 92.4'. Pyritic spect observed at 93.7'. Gray to dark gray LIMESTONE, calcareous, slightly weather moderately broken, hard, medium bedded Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated Gray and reddish-gray from 101.6' to 107' with few claystor seams. Gray SILTSTONE, moderately to slightly micaceous, fresh moderately broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium graininterbedded calcareous limestone, fresh, moderately broken 	Seams, interbedded limestone, slightly weathered, moderately broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated Gray and reddish-gray from 101.6' to 107' with few claystone seams. Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded	seams, interbedded limestone, slightly weathered, moderately - broken, moderately hard, very thin bedded - Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated 90.0 Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. - Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded 95.0 Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated - Gray and reddish-gray from 101.6' to 107' with few claystone seams. - Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately hard, very thin bedded - Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded -	seams, interbedded limestone, slightly weathered, moderately broken, moderately hard, very thin bedded 90.0 Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated 90.0 Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. 95.0 Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded 95.0 Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated 95.0 Gray and reddish-gray from 101.6' to 107' with few claystone seams. 100.0 Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately broken, moderately broken, hard, very thin bedded 101.0 Rrc arg SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded 110.0	Seams, interbedded limestone, slightly weathered, moderately broken, moderately hard, very thin bedded 90.0 Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated 90.0 Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. 95.0 Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded 95.0 Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded 95.0 Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated 90.0 Gray and reddish-gray from 101.6' to 107' with few claystone seams. 100.0 Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately hard, very thin bedded 110.0 Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded 110.0 RC 88 10 (88)	seams, interbedded limestone, slightly weathered, moderately broken, moderately hard, very thin bedded Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated Gray and reddish-gray from 101.6' to 107' with few claystone seams. Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately broken, hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded	seams, interbedded limestone, slightly weathered, moderately	seams, interbedded limestone, slightly weathered, moderately - broken, moderately hard, very thin bedded 90.0 Gray SHALE, slightly to moderately weathered, broken, moderately soft, laminated to thinly laminated 90.0 Reddish-gray discoloration from 92.2' to 92.4'. Pyritic specks observed at 93.7'. 95.0 Gray to dark gray LIMESTONE, calcareous, slightly weathered, moderately broken, hard, medium bedded 95.0 Gray SHALE, with calcareous limestone inclusions, slightly weathered, moderately broken, moderately soft, laminated 95.0 Gray and reddish-gray from 101.6' to 107' with few claystone seams. 100.0 Gray SILTSTONE, moderately to slightly micaceous, fresh, moderately broken, moderately hard, very thin bedded 105.0 Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded 110.0 Gray SANDSTONE, micaceous, very fine to medium grained, interbedded calcareous limestone, fresh, moderately broken, hard, very thin bedded 110.0	seams, interbedded limestone, slightly weathered, moderately



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		PROJECT NA PROJECT LC								
								3ap, V	COL V	ngina
ELEVATION (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	HLd30 1115.		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1122.1	Gray SHALE, few interbedded siltstone seams, fresh, mode broken, moderately soft, thinly laminated to laminated	erately								
1117.1	Reddish-brown and gray CLAYSTONE, few interbedded sh seams, fresh, moderately broken, moderately soft	- _ 120. ale	_ _ 0	RC	74					
1111.6 × ×)	Gray SILTSTONE, interbedded limestone, fresh, slightly bro	- - - 125. oken, -	- - 0 -	11	(33)					2-Inch Solid PVC Riser Sealed with
× × × × × × × × × × × × × × × × × × ×	moderately hard, very thin bedded Gray SILTSTONE, slightly micaceous, interbedded through with sandstone seams less than 1/8" thick, limestone inclus throughout, fresh, moderately broken, moderately hard, ver bedded	sions 🕇	 0							Bentonite Grout
× × × × × × × × × × × × × × × × × × ×		- - - <u>135.</u> -	- - - 0 -	RC 12	100 (83)					
× × × 100.4 × × × × × × ×	Gray SILTSTONE, slightly micaceous, discontinuous sands seams less than 1/10" thick, sporadic limestone inclusions throughout, fresh, moderately broken, moderately hard, ver bedded	-		RC	100					
093.9	Gray SANDSTONE, micaceous, very fine to medium graine interbedded throughout with siltstone seams which decreas frequency with depth and are less than 1/10" thick, fresh, moderately broken, moderately hard to hard, very thin bedo thin bedded	e in 145.	_ _ _ _	13	(50)					– Hole Plug (Bentonite Chips)
1090.4	Gray SANDSTONE, micaceous, very fine to medium graine interbedded with siltstone lenses less than 1/16" thick from to 152.3', siltstone seam approximately 1/16" thick at 159.5 discontinuous siltstone lenses from 174.5' to 176.2', fresh, s broken, hard, thick bedded	147' – ',	 							- Filter Sand
		- - - 155.	-	RC 14	100 (90)					

	HE	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242	L						5B-18/ MW1103F PAGE 5 OF 10
									ectric Generating Plant sap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH	(c.)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
		Gray SANDSTONE, micaceous, very fine to medium grained, interbedded with siltstone lenses less than 1/16" thick from 147 to 152.3', siltstone seam approximately 1/16" thick at 159.5', discontinuous siltstone lenses from 174.5' to 176.2', fresh, sligh broken, hard, thick bedded <i>(continued)</i>							
			 	_ 0_ _	RC	100			
			_ 	_ _ 0 _	15	(100)			2-Inch Slotte Screen
			_ _ _170.0 _	_ _ 0_ _					
			_ _ _175.(_ _ 0_ _	RC 16	100 (68)			
061.2		Gray SHALE, 0.5" coal seam at 176.5', hairline coal fractures a 176.3' and 178.4', fresh, broken, moderately hard, thinly laminated to laminated Gray and dark gray SHALE, few claystone seams, fresh, moderately broken, moderately soft, laminated to thinly lamina		 0					- Filter Sand
056.1	· · · · · · · · · · · · · · · · · · ·	Gray SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams throughout, noted calcareous limestone inclusions throughout, fresh, moderately broken, har very thin bedded Gray SILTSTONE, interbedded with sandstone and shale sear			RC 17	87 (59)			
053.4		Black SHALE, few limestone inclusions, gray shale from 184' t 184.2' and 186.7' to 186.9', fresh, moderately broken, moderately soft, thinly laminated to laminated	<u>185.0</u> 	<u>0</u> -					
048.5	× × × × × × × × × × × × × × × × × × ×	Dark gray SHALE, calcareous with limestone inclusions, fresh, slightly broken, hard, laminated Gray SILSTONE, slightly micaceous, few limestone inclusions, sandstone layer from 191.7' to 192', fresh, moderately broken, moderately hard to hard, very thin bedded		- - 0 -					
044.4	× × × × × × × × ×	Gray SANDSTONE, very fine to medium grained, micaceous, i interbedded siltstone seams throughout, fresh, moderately broken, hard, very thin bedded	- ew	-	RC 18	100 (56)			

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			PROJEC [®] PROJEC [®]			Gatts Ridge Road, Cresap, West Virginia						
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (II) DEPTH 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM			
1041.9	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, limestone inclusions, interbedded sandstone seams throughout, fresh, moderately broken to broken, hard, very thin bedded		-								
1039.4		Gray SHALE, fresh, moderately broken, moderately soft to moderately hard, thinly laminated to laminated	-	_ 2 <u>00.0</u> _ _ _	RC 19	100 (86)						
1033.1		Gray SILTSTONE, slightly micaceous, few discontinuous sandstone and shale lenses less than 1/10" thick, fresh, moderately broken, hard, very thin bedded		_ 205.0 _								
1029.8		Gray SHALE, few limestone inclusions, interbedded slightly micaceous siltstone seams less than 1/8" in thickness, sligh micaceous siltstone layer from 210.7' to 211.2', fresh, broker moderately soft, thinly laminated to laminated	n.	- 2 <u>10.0</u> -	RC	95						
1021.7		Few pyritic specks observed from 212' to 214'. Gray and reddish-gray to reddish-brown SHALE, fresh, brok moderately hard, thinly laminated to laminated		- 2 <u>15.0</u> -	20	(56)						
1019.1		Gray becoming reddish-brown and gray SHALE, few claysto seams, calcareous, limestone inclusions throughout, fresh, moderately broken, hard, laminated	Г	- - 2 <u>20.0</u> - -	RC 21	75 (60)						
			-	_ 225.0 _								
1010.4	× × × ×	Gray SILTSTONE, fresh, broken, moderately hard, very thin bedded Gray SANDSTONE, micaceous, very fine to fine grained, interbedded siltstone layers throughout, few limestone inclus fresh, moderately broken, very hard, very thin bedded		- - 2 <u>30.0</u>								
1006.7	× × × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded througho with sandstone seams less than about 1/8" thick, fresh, brok moderately hard, very thin bedded	out ken,	-	RC 22	93 (59)						
	· · · · · · · · · · · · · · · · · · ·		-	_ 235.0								



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CEC P	ROJE	CT NUMBER _110-416 PR	OJECT L	.00/	CATION _Gatts Ridge Road, Cresap, West Virginia								
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLdBO 23	(1) 5.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM				
002.1		Gray SANDSTONE, micaceous, very fine to medium grained, limestone inclusions, interbedded siltstone seams throughout which decrease in frequency with depth, fresh, moderately broken, hard, very thin bedded <i>(continued)</i> Gray SHALE, fresh, broken, moderately hard, thinly laminated laminated Gray SHALE, few claystone seams, gray and light reddish-gra from 240.8' to 243.2', fresh, broken, moderately broken from 240.8' to 247', moderately hard, thinly laminated to laminated	few-	- - - - - - - -	RC 23	85 (48)							
		Gray SILTSTONE, slightly micaceous, interbedded sandstone seams generally less than 1/8" thick, fresh, very thin bedded		-	RC 24	92 (36)							
983.1		Gray and reddish-brown SHALE, few claystone seams, thinly laminated to laminated, few interbedded siltstone seams from 254.3' to 254.9', fresh, moderately broken to broken, moderate hard		<u>5.0</u> - -									
979.3 977.9 970.4		Coal seam at 258'. Gray SILTSTONE, slightly micaceous, fresh, moderately brok hard, very thin bedded Gray SHALE, calcareous, interbedded slightly micaceous siltstone throughout, few limestone inclusions throughout, very hard shale from 263.6' to 267' with limestone, fresh, moderate broken, moderately hard to hard, thinly laminated to laminated	<u>26</u> / ly		RC 25	87 (62)							
970.4		Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout with limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282.5', fresh, moderately broken, hard to very hard, thinly laminated to laminated	-		RC 26	93 (56)							



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CECI	PROJE	CT NUMBER PRO	IECT LOC	ATION	Gatts	ap, West Virginia		
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLd30 275.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
		Gray becoming gray and reddish-brown SHALE, many interbedded claystone seams, very calcareous throughout with limestone inclusions, pyritic specks observed at 275.7', predominantly reddish-brown claystone from 280.5' to 282.5', fresh, moderately broken, hard to very hard, thinly laminated to laminated <i>(continued)</i>	 <u>280.0</u>	RC	99			
54.9 52.2	× × × × × × × × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, few limestone inclusions throughout, fresh, slightly broken, very hard, very thin bedded Gray SANDSTONE, micaceous, very fine to medium grained, fresh, slightly broken, very hard, thin bedded	 	27	(74)			
950.4	X X	Gray SILTSTONE, few limestone inclusions, slightly micaceous, interbedded sandstone seams 1/16" thick from 291.4' to 297', fresh, slightly broken, hard to very hard, very thin bedded	 290.0 295.0 	RC 28	97 (76)			
40.4 38.8 37.9 36		Gray SILTSTONE, slightly micaceous, interbedded with shale, pyritic specks observed at 298.2' and 298.5', fresh, broken, hard very thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, pyritic specks observed at 298.7', fresh, slightly broken, hard to very hard, very thin bedded Gray SANDSTONE, micaceous, very fine to fine grained, few interbedded siltstone seams less than 1/16" thick, fresh, slightly broken, very hard, thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly broken, very hard, thin bedded Gray SILTSTONE, few limestone inclusions throughout, slightly micaceous, fresh, slightly broken, hard to very hard, very thin bedded		RC 29	96 (79)			
30.4 29.6 25.7		Gray SILTSTONE, slightly micaceous, few limestone inclusions, few interbedded sandstone seams less than 1/16" in thickness from 307.6' to 307.8', fresh, broken, hard, very thin bedded Gray SANDSTONE, very fine to medium grained, interbedded siltstone seams throughout less than 1/4" thick, few limestone inclusions, fresh, moderately broken, hard, very thin bedded Gray SILTSTONE, slightly micaceous, interbedded sandstone and shale seams throughout less than 1/16" thick, fresh, broken hard, very thin bedded	 310.0 	RC 30	55 (11)			



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CEC P	ROJE	CT NUMBER <u>110-416</u> P	ROJECT L	OCA	TION _	Gatts	Ridge Roa	d, Cres	ap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HL deg		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
	× × × × × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded sandstor and shale seams throughout less than 1/16" thick, fresh, bro hard, very thin bedded (continued)	ne	-					
920.4 919.6		Gray SANDSTONE, slightly micaceous, few interbedded sandstone seams less than 1/16" thick, fresh, broken, hard, thin bedded	very	ł					
918.5	× × × × × × × × × × × × × × × × × × ×	Gray SANDSTONE, micaceous, very fine to medium coarse grained, few limestone inclusions, interbedded siltstone sear less than 1/8" thick, fresh, moderately broken, very hard, thin bedded	ns <u>320</u> 1	.0 _		00			
914.4	× × × × × × × × ×	Gray SILTSTONE, slightly micaceous, interbedded througho with shale seams less than 1/8" thick, fresh, moderately brok hard to very hard, very thin bedded	ken,		RC 31	98 (77)			
		Gray SHALE, dark gray shale zone from 325.8' to 326', fresh moderately broken, hard becoming moderately hard, thinly laminated to laminated	n, _ <u>325</u> -	_ .0 _					
910.4		Gray to dark gray SHALE, interbedded siltstone throughout, limestone inclusions, fresh, moderately broken, hard, lamina							
			330	.0					
			- - <u>335</u>	- - .0	RC 32	100 (55)			
900.4		Gray SHALE, interbedded siltstone and sandstone seams throughout, interbedded hard siltstone layers with micaceous			⊢				
		sandstone inclusions from 337.4' to 338.1' and 339' to 339.2 fresh, broken, moderately hard to hard, laminated	',	.0					
397.4 396.2		Gray SANDSTONE, interbedded siltstone seams througout than 1/16" thick, micaceous, very fine to medium grained, interbedded limestone, fresh, moderately broken, hard, very bedded			RC 33	100 (50)			
00.0		Gray SHALE, black shale lens 3/4" thick at 344.5', fresh, moderately hard, broken, thinly laminated to laminated	- - - 345						
392.8		Gray and dark gray LIMESTONE, calcareous, fresh, modera broken, very hard, thick bedded							
390.4		Gray and dark gray SHALE, calcareous, limestone seam 3/4 thick at 347.8', fresh, broken, moderately hard, laminated							
88.5		Gray LIMESTONE, calcareous, shale inclusions throughout, fresh, moderately broken, very hard, thick bedded	350	.0					
385.7		Gray and dark gray SHALE, calcareous, interbedded limesto seams throughout less than 1/8" thick, few limestone inclusio fresh, moderately broken, moderately hard to hard, thinly			RC 34	96 (50)			



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(ft) GRAPHIC LOG	MATERIAL DESCRIPTION	HLd	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
0.4	resh, moderately broken, very hard, medium bedded Gray and dark gray SHALE, calcareous, interbedded limestone seams throughout less than 1/8" thick, few limestone inclusions fresh, moderately broken, moderately hard to hard, thinly laminated to laminated (continued) Bottom of hole at 357.0 feet. Soil sampling completed on 9/6/11. Boring offset on 9/20/11 fo rock coring. Augered to 17.5' to begin rock core sampling. The following groundwater level readings were taken during drilling: 9/21/2011 7:45 AM at 91.2' bgs (borehole depth = 107' bgs) 9/22/2011 8:25 AM at 223.1' bgs (borehole depth = 227' bgs) 9/23/2011 7:45 AM at 333.1' bgs (borehole depth = 347' bgs) Geophysical logging and packer testing were performed upon completion. Well MW1103F installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB-18 The ground elevation for MW1103F = 1236.4 ft.						

		Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		BC	DRIN	G N	UMBE	RS	B-23		W1104
		erican Electric Power CT NUMBER _110-416					ndfill, Mitch Ridge Roa				
		ED 10/31/11 COMPLETED 11/2/11					5 ft	HOLE	SIZE _	0.5 ft	İ
		DNTRACTOR Frontz Drilling, Inc.					D ()				
		ETHOD _Air Rotary Rock Core R. Mahle CHECKED BY _M. McCoy				-	Refer to n				
		N 486345.1, E 1609471.2					installed		bottom	0110	9
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	V	VELL	- DIAGRAM – 2.0' Stickup
		No. of the second state of the state of the second state of the se		0.0	S	Œ					2.0 01000
228.5		No soil sampling performed at boring location. Augered to begin rock coring.	0 19' to	_				4			- Concrete Seal
			-	5.0							
			-	-							
			-	10.0							2-Inch Solic PVC Riser Sealed with Bentonite Grout
			-	15.0							Ciout
			-	-							
209.5		Grayish-blue SANDSTONE, micaceous, very fine to medi grained, few limestone iclusions throughout, interbedded s seams less than 1/16' thick from 19' to 23.2', moderate oli brown staining from 19.5' to 20.3', 23.3' to 24', 25.5' to 26' 27.8' to 29' with few iron stains throughout, moderately weathered, moderately broken, hard, very fine bedded	siltstone – ive	<u>20.0</u> - -							
			-	- 	RC 1	100 (79)					
			-	-							
			-	30.0							
196.3	× × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, 1/8" thick iron stained fractures at 38 39', moderately weathered, slightly broken, moderately ha hard, very thin bedded	8.6' and ard to	- 35.0	RC 2	70 (54)					



BORING NUMBER SB-23/ MW1104R PAGE 2 OF 6

									0		
CECP	YROJEC	T NUMBER <u>110-416</u> PF	OJE		ATION	Gatts	Hidge Roa	d, Cres	sap, \	West \	lirginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		0.55 DEPTH	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, 1/8" thick iron stained fractures at 38.6' 39', moderately weathered, slightly broken, moderately hard to hard, very thin bedded <i>(continued)</i>									
1189.5		Grayish-blue SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions and siltstone seams (less th 1/8" thick) throughout, slightly weathered, moderately broken, hard, very fine bedded		40.0			-				
1186.1		Medium bluish-gray SHALE, few interbedded slightly micaced siltstone seams (less than 1/8" thick) from 42.4' to 43.8', grayish-red staining from 44' to 47.3' and 48.2' to 48.5', vertic: fracture from 45.8' to 46.3', moderately weathered, moderatel broken, moderately soft, thinly laminated to laminated	al	 	R(3	; 100 (79)					2-Inch Solid PVC Riser Sealed with
		Pyritic specks observed from 47.5' to 47.8'. Grayish-red claystone layer from 48.5' to 49.3'.					-				Bentonite Grout
1179.2 1178.2 1177.1	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray to grayish-red purple SILTSTONE, slightl micaceous, few interbedded shale seams (less than 1/8" thick throughout, moderately weathered, moderately broken, moderately soft, very thin bedded Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions throughout, few interbedded sandstone	y K)	50.0							
		seams (less than 1/8" thick) throughout, slightly weathered, moderately broken, very thin bedded Grayish-blue SANDSTONE, micaceous, very fine to medium grained, interbedded limestone throughout, slightly weathered slightly broken, hard, very thin bedded	d,	 	RC 4	63 (46)					
		Broken from 59' to 59.3'.					-				
1169.2	* * * * * * * * * * * * * * * * * * *	Medium bluish-gray SILTSTONE, interbedded shale and sandstone seams (less than 1/8" thick) throughout, pyritic spe observed throughout, slightly weathered, moderately broken, moderately hard, very thin bedded	ecks								
1166.7		Medium bluish-gray and grayish-red SHALE, few claystone lenses, pyritic specks from 61.8' to 62.1', slightly weathered, moderately broken, moderately hard, thinly laminated		65.0	RC 5	96 (75)					
1161.8		Dark gray SHALE, calcareous interbedded limestone through limestone layers from 66.7' to 67.1' and from 68.6' to 69', sligl weathered, moderately broken, moderately hard to hard, thinl laminated to thin bedded, thin bedded from 69' to 69.4'	htly	 							
1159.1	· · · · · · · · · · · · · · · · · · ·	Grayish-blue SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams from 69.4' to 69.7', few limestone inclusions, slightly weathered, moderately broken, hard, very thin bedded		70.0							
	· · · · · · · · · · · · · · · · · · ·	Medium bluish-gray SILTSTONE, slightly micaceous, interbed sandstone seams (less than 1/8" thick) from 74.6' to 79', limestone layer from 76.1' to 76.3', slightly weathered, modera broken, moderately hard, very thin bedded		 75.0	RC 6	; 98 (55)					



BORING NUMBER SB-23/ MW1104R

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							ndfill, Mitch Ridge Roa			ating Plant /irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (H) HL (H) T5.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		L DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, interbe sandstone seams (less than 1/8" thick) from 74.6' to 79', limestone layer from 76.1' to 76.3', slightly weathered, moder broken, moderately hard, very thin bedded <i>(continued)</i>	ŀ							
1149.5	· · · · · · · · · · · · · · · · · · ·	Medium bluish-gray SILTSTONE, slightly micaceous, interbe shale seams (less than 0.5" thick) throughout, slightly weathe moderately broken, moderately hard, very thin bedded	edded ered, -	 85.0	RC 7	88 (60)				2-Inch Solid PVC Riser Sealed with
141.7		Medium dark gray SHALE, slightly calcareous,limestone laye from 88.8' to 89', slightly weathered, moderately broken, moderately hard to hard, thinly laminated Olive gray LIMESTONE, calcareous, brownish-gray layer with	-	 						Bentonite Grout
		interbedded calcareous siltstone (slightly micaceous) from 90 to 90.8', slightly weathered, moderately broken, very hard, thi -> bedded	0.3'	90.0						
1137.3	× × × × × × × × × × × × × × × × × × ×	Dark gray to brownish-gray SILTSTONE, slightly micaceous, calcareous, interbedded limestone, few interbedded shale se (less than 1/16" thick) from 92.8' to 99', slightly weathered, moderately broken, hard, thin bedded		 <u>95.0</u> 	RC 8	45 (20)				
	· × × × × × × × × × × × × × × × × × × ×	Brownish-gray SILTSTONE, slightly micaceous, calcareous, interbedded limestone throughout, medium bluish-gray from 100.7' to 103.9', slightly weathered, moderately broken, hard, very thin bedded	- F	 100.0 	RC	87				
124.6		Medium bluish-gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, few siltstone sear (less than 1/8" thick), fresh, moderately broken, hard, very th bedded	110 F	 105.0 	9	(72)				
		Percentage of siltstone increasing with depth from 109' to 11	1.4'.	 110.0						
1117.1	· · · · · · · · · · · · · · · · · · ·	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, few discontinuous sandstone seams (let than 1/16" thick) from 111.4' to 114', few interbedded shale seams from 114' to 114.8', fresh, moderately broken, moderately b	ately	 115.0	RC 10	90 (65)				



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						ndfill, Mitch Ridge Roa			
ELEVATION (ff) GRAPHIC LOG	MATERIAL DESCRIPTION	DEDTL	(tt)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	 	. DIAGRAM
1113.7	Medium bluish-gray SHALE, dark reddish-brown lens from 1 to 115.9', few interbedded siltstone lenses (less than 1/8" thic from 114.8' to 115.8', fresh, moderately broken, moderately h thinly laminated to laminated <i>(continued)</i> Dark reddish-brown CLAYSTONE, fresh, moderately broken broken, moderately hard	15.8' ck) – hard, –	-						
1108.8 × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, interbe sandstone seams (less than 1/8" thick) from 119.7' to 126', fr moderately broken, hard, very thin bedded Interbedded shale seams (less than 1/10" thick) from 126' to	resh,	20.0 - - 25.0 - - -	RC 11	89 (50)				2-Inch Solid PVC Riser Sealed with Bentonite Grout
X X X X 1099.5 X X X X X X X X	Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded Few interbedded shale seams (less than 1/16" thick) from 13 to 139'.	- - - 1(_ 30.0 _ _ 35.0 _ _ _ _ _	RC 12	75 (64)				
	Olive gray becoming grayish-brown, medium bluish-gray and reddish-brown SHALE, few interbedded siltstone seams (less than 1/10" thick), few claystone seams, slightly micaceous, fr moderately broken, moderately hard, thinly laminated Dark reddish-brown from 144.7' to 147.3' with claystone sear	s resh, 	- 40.0 - - - 45.0 - - - -	RC 13	88 (67)				
1079.5 × × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few interbedded (less than 1/8" thick) sandstone seams, sandsto lens from 149.8' to 150.1', interbedded shale seams (less tha 1/16" thick) with grayish-brown staining from 150.3' to 150.8', fresh, moderately broken, hard to very hard, very thin bedded Medium bluish-gray SANDSTONE, micaceous, very fine to medium grained, fresh, moderately broken, very hard, very th bedded	hin -	_ 50.0 _ _ _ 55.0	RC 14	96 (72)				



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							ndfill, Mitch Ridge Roa				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(#) 55.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	W	'ELL	DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, interbed sandstone seams (less than 1" thick) throughout, fresh, moderately broken, hard to very hard, very thin bedded <i>(continued)</i>		-							
1069.5	x x	Medium bluish-gray SILTSTONE, slightly micaceous, calcarec few interbedded sandstone seams (less than 0.5" thick) throughout, few interbedded shale seams (less than 1/8" thick) throughout, interbedded limestone throughout, fresh, moderate broken, hard, very thin bedded	:) ely - - -		RC 15	95 (69)					2-Inch Solid PVC Riser Sealed with Bentonite Grout
	× × × × × × × × ×	Broken from 169' to 169.5'.		70.0							
1059		Medium gray SANDSTONE, micaceous, very fine to medium grained, interbedded limestone throughout, fresh, moderately broken, very hard, very thin bedded	-	70.0							
1057.1 1056		Medium gray SILTSTONE, slightly micaceous, calcareous, few interbedded (less than 1/16" thick) shale seams and limestone throughout, fresh, moderately broken, hard, very thin bedded Medium bluish-gray SHALE, calcareous, moderate brown from 173.4' to 174.1', interbedded sandstone from 174.1' to 176.5', interbedded limestone throughout, fresh, moderately broken,	e n	- - 75.0	RC 16	98 (68)					
1052		moderately hard to hard, thinly laminated to laminated Dark gray SILTSTONE, limestone lens from 176.5' to 176.6', limestone inclusions throughout, 1/8" grayish-black shale sean at 177.9' and 178', fresh, moderately broken, very hard, very th	ms hin -	-							
1050		bedded Light gray SANDSTONE, micaceous, very fine to medium grained, few siltstone seams (less that 1/16" thick) and broken from 179' to 181.2', fresh, moderately broken, very hard, thin bedded		- 80.0 -							
1047.3		Grayish-black SHALE, fresh, moderately broken, moderately hard, thinly laminated		-							
1044.9		Medium bluish-gray SANDSTONE, micaceous, very fine to fin grained, calcareous limestone inclusions from 175.5' to 178.6' fresh, moderately broken, hard to very hard, very thin bedded thin bedded	', 18	- 8 <u>5.0</u> - -	RC 17	98 (76)					- Hole Plug (Bentonite Chips) - Filter Sand
1039.5		Medium light gray SANDSTONE, micaceous, very fine to med grained, medium dark gray less than1/16" thick fine to medium grained seams throughout, few limestone inclusions, fresh, moderately broken, very hard, very thin bedded	dium 19	_ 90.0 _ _							
			-	_ _ 95.0	RC 18	97 (62)					



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CEC F	PROJEC	CT NUMBER 110-416 PR	ROJEC	T LOC	ATION	Gatts	Ridge Roa	d, Cre	sap, West Vir	rginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) DEDTH 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL	DIAGRAM
1032.7	· · · · · · · · · · · · · · · · · · ·	Medium bluish-gray SILTSTONE, slightly micaceous, few interbedded shale seams less than 1/4" thick throughout, few calcareous limestone inclusions, fresh, moderately broken, ha very thin bedded	ard,							
1029.5		Medium bluish-gray SHALE, some brownish-gray staining from about 201.5' to 202.5', few limestone inclusions, interbedded siltstone seams (less than 1/8" thick) from 199' to 201.3', fresh moderately broken, hard, thinly laminated	ŀ	200.0 						2-Inch Slotter Screen
1025.3		Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, few interbedded (less than 1/16" thick) v fine to fine grained sandstone seams, fresh, moderately broke hard, very thin bedded Medium gray SANDSTONE, micaceous, very fine to medium grained, interbedded limestone, interbedded siltstone lenses f 207.4' to 207.9', fresh, moderately broken, very hard, very thir bedded	en,	 205.0 	RC 19	96 (36)				
1020.1 1019.5	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, fresh, moderately broken, hard, very thir bedded Medium bluish-gray SILTSTONE, slightly micaceous, interbeo shale seams (increasing in percentage with depth) throughout few sandstone seams (less than 1/4" thick) from 210.2' to 210 fresh, moderately broken, hard, very thin bedded	dded t,	 210.0 						– Filter Sand
1015.7		Medium bluish-gray SHALE, few interbedded siltstone seams (less than 1/8" thick) from 212.8' to 214.8', grayish-blue stainin from 214.8' to 216.3', fresh, moderately broken, moderately has to hard, thinly laminated	ng	 215.0	RC 20	95 (47)			<u>[[]]]</u>	
1012.1		Medium gray becoming dark reddish-brown SHALE, calcareou interbedded limestone throughout, becoming dark reddish-bro starting at 217.3' with interbedded claystone, fresh, moderatel broken, very hard, laminated	own ly -							
1009.5		Dark reddish-brown to grayish-red CLAYSTONE, few interbec shale lenses, calcareous and becoming less calcareous with depth, fresh, moderately broken, very hard	-	<u>220.0</u> 225.0	RC 21	83 (61)				
1002.7		Medium bluish-gray SANDSTONE, micaceous, very fine to fir grained, few limestone inclusions, fresh, moderately broken, v hard, very thin bedded		· -						
999.5		Bottom of hole at 229.0 feet. The following groundwater level readings were taken during drilling: 11/1/2011 8:30 AM at 56.7' bgs (borehole depth = 59' bgs) 11/2/2011 9:36 AM at 173.3' bgs (borehole depth = 199' bgs) Well MW1104R installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB-2 The ground elevation for MW1104R = 1228.7 ft.	23.							

	4	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		BC	RIN	G N	UMBE	ERS	SB-2		/W1104F PAGE 1 OF
CLIEN	T Am		ROJECT	MAN	E Mitch	nell Lar	ndfill, Mitcl	nell Ele	ectric G	enera	ting Plant
CEC F	PROJE	CT NUMBER _110-416 P	ROJECT	.00/	ATION _	Gatts	Ridge Roa	ud, Cre	sap, W	est Vi	rginia
DATE	STAR	TED _10/31/11 COMPLETED _11/2/11 G	ROUND E	LEV	ATION	1228.	5 ft	HOLE	SIZE	0.5 ft	
DRILL	ING CO	ONTRACTOR Frontz Drilling, Inc. G		/ATE	R LEVE	LS:					
DRILL	ING MI	ETHOD _ Air Rotary Rock Core	AT T	ME (of Dril	LING	Refer to r	notes a	at bottor	n of lo	bg
LOGG	ED BY	R. Mahle CHECKED BY M. McCoy	AT E	ND C	of Drill	ING _	Refer to n	otes a	t botton	n of lo	g
LOCA		N 486352.3, E 1609469.3	AFTE	R DI	RILLING	Well	installed				
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WELL	- DIAGRAM – 1.8' Stickup
228.5		No soil sampling performed at boring location. Augered to 1		.0							
		begin rock coring.	_ _ _ _ _ _ _ _	- - - .0 - -							– Concrete Seal
			-	- - - - - 5.0							2-Inch Solid PVC Riser Sealed with Bentonite Grout
209.5		Grayish-blue SANDSTONE, micaceous, very fine to medium grained, few limestone iclusions throughout, interbedded silt seams less than 1/16' thick from 19' to 23.2', moderate olive brown staining from 19.5' to 20.3', 23.3' to 24', 25.5' to 26' ar 27.8' to 29' with few iron stains throughout, moderately	stone	- - - 0.0_ -							
		weathered, moderately broken, hard, very fine bedded	_ _ _ _ _ _	- 5 <u>.0</u> - -	RC 1	100 (79)					
196.3	× × ×	Medium bluich-gray SILTSTONE slightly missoogus for	3(_) <u>.0</u> _ _							
190.3	× × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, 1/8" thick iron stained fractures at 38.6 39', moderately weathered, slightly broken, moderately hard hard, very thin bedded	to	- - 5.0	RC 2	70 (54)					



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												erating Plant
	RUJEC	CT NUMBER 110-416 PRO	OJEC		ATION	Gat	IS KIDO	је Коа	u, Cres	sap,	vvest	Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) (tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY %	(HQU) BLOW	COUNTS (N VALUE)	POCKET PEN (tsf)		WE	ELL DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, 1/8" thick iron stained fractures at 38.6' a 39', moderately weathered, slightly broken, moderately hard to hard, very thin bedded <i>(continued)</i>										
189.5		Grayish-blue SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions and siltstone seams (less that 1/8" thick) throughout, slightly weathered, moderately broken, hard, very thin bedded	an -	40.0								
186.1		Medium bluish-gray SHALE, few interbedded slightly micaceou siltstone seams (less than 1/8" thick) from 42.4' to 43.8', grayish-red staining from 44' to 47.3' and 48.2' to 48.5', vertica fracture from 45.8' to 46.3', moderately weathered, moderately broken, moderately soft, thinly laminated to laminated	ıl –	 	Ri B							2-Inch Solid PVC Riser Sealed with
		Pyritic specks observed from 47.5' to 47.8'. Grayish-red claystone layer from 48.5' to 49.3'.		· -								Bentonite Grout
179.2 178.2 177.1	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray to grayish-red purple SILTSTONE, slightly micaceous, few interbedded shale seams (less than 1/8" thick) throughout, moderately weathered, moderately broken, moderately soft, very thin bedded Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions throughout, few interbedded sandstone seams (less than 1/8" thick) throughout, slightly weathered, moderately broken, very thin bedded		50.0	R							
		Grayish-blue SANDSTONE, micaceous, very fine to medium grained, interbedded limestone throughout, slightly weathered, slightly broken, hard, very thin bedded Broken from 59' to 59.3'.		 	4	. (46	5)					
169.2	× × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, interbedded shale and sandstone seams (less than 1/8" thick) throughout, pyritic spec observed throughout, slightly weathered, moderately broken, moderately hard, very thin bedded	cks	60.0								
166.7		Medium bluish-gray and grayish-red SHALE, few claystone lenses, pyritic specks from 61.8' to 62.1', slightly weathered, moderately broken, moderately hard, thinly laminated		 <u>65.0</u>	Ri 5							
161.8		Dark gray SHALE, calcareous interbedded limestone througho limestone layers from 66.7' to 67.1' and from 68.6' to 69', sligh weathered, moderately broken, moderately hard to hard, thinly laminated to thin bedded, thin bedded from 69' to 69.4'	tly	 								
159.1	· · · · · · · · · · · · · · · · · · ·	Grayish-blue SANDSTONE, micaceous, very fine to medium grained, interbedded siltstone seams from 69.4' to 69.7', few limestone inclusions, slightly weathered, moderately broken, hard, very thin bedded		70.0								
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, interbed sandstone seams (less than 1/8" thick) from 74.6' to 79', limestone layer from 76.1' to 76.3', slightly weathered, moderat broken, moderately hard, very thin bedded	-	 75.0	R							



BORING NUMBER SB-23/ MW1104F PAGE 3 OF 6

							ndfill, Mitch Ridge Roa			
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (t) (t) 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELI	_ DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, interba sandstone seams (less than 1/8" thick) from 74.6' to 79', limestone layer from 76.1' to 76.3', slightly weathered, mode broken, moderately hard, very thin bedded <i>(continued)</i>	edded	· _						
	<pre></pre>	Medium bluish-gray SILTSTONE, slightly micaceous, interbe shale seams (less than 0.5" thick) throughout, slightly weath moderately broken, moderately hard, very thin bedded	edded hered, - - - -	80.0 	RC 7	88 (60)				2-Inch Solid PVC Riser Sealed with
1141.7		Medium dark gray SHALE, slightly calcareous,limestone lay from 88.8' to 89', slightly weathered, moderately broken, moderately hard to hard, thinly laminated	_	· -						Bentonite Grout
1139.5		Olive gray LIMESTONE, calcareous, brownish-gray layer wit interbedded calcareous siltstone (slightly micaceous) from 9 to 90.8', slightly weathered, moderately broken, very hard, th bedded Dark gray to brownish-gray SILTSTONE, slightly micaceous calcareous, interbedded limestone, few interbedded shale se (less than 1/16" thick) from 92.8' to 99', slightly weathered, moderately broken, hard, thin bedded	90.3' - hin - s, - eams - - -	<u>90.0</u> <u>95.0</u> 	RC 8	45 (20)				
	· · · · · · · · · · · · · · · · · · ·	Brownish-gray SILTSTONE, slightly micaceous, calcareous, interbedded limestone throughout, medium bluish-gray from 100.7' to 103.9', slightly weathered, moderately broken, harc very thin bedded	i -	<u>100.0</u> - –	RC	87				
1124.6		Medium bluish-gray SANDSTONE, micaceous, very fine to medium grained, few limestone inclusions, few siltstone sea (less than 1/8" thick), fresh, moderately broken, hard, very th bedded		. – <u>105.0</u> . – . –	9	(72)				
		Percentage of siltstone increasing with depth from 109' to 11	11.4'.	<u>110.0</u>						
	× × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, few discontinuous sandstone seams (I than 1/16" thick) from 111.4' to 114', few interbedded shale seams from 114' to 114.8', fresh, moderately broken, moder hard to hard, very thin bedded	rately	 115.0	RC 10	90 (65)				



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1099.5 Interbedded shale seams (less than 1/10" thick) from 126' to 129'. -							ndfill, Mitch Ridge Roa				
10 115.97, few inferbedded silistione lenses (less than 1/8" thick) 11122 112.27 11122 112.27 11122 112.27 11122 112.27 11122 112.27 11122 112.20 11122 112.00 11122 112.00 11122 112.00 11122 112.00 1108.8 Medium bulish-gray SILTSTONE, slighty micaceous, interbedded 1108.8 Medium bulish-gray SILTSTONE, slighty micaceous, fresh, moderately broken, hard, very thin bedded 1108.8 Interbedded shale seams (less than 1/10" thick) from 126' to 129'. 1108.5 Medium bulish-gray SILTSTONE, slighty micaceous, fresh, alighty broken, moderately hard to hard, very thin bedded 1108.5 Olive gray becoming grayish-brown, medium bulish-gray and dark that 1/10" thick) from 137.8'. 1108.5 Olive gray becoming grayish-brown, medium bulish-gray and dark that 1/10" thick), few classione seams (less than 1/10" thick), few classione seams (less than 1/16" thick) from 137.8'. 1108.5 Olive gray becoming grayish-brown, medium bulish-gray and dark that 1/16" thick) from 144.7' to 147.3' with classione seams (less than 1/16" thick) from 144.7' to 147.3' with classione seams. 1107.7 Medium bulish-gray SULTSTONE, slighty micaceous, fresh	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	,	WEL	L DIAGRAM
Medium bluish-gray SILTSTONE, slightly micaceous, fresh, sightly broken, moderately hard to hard, very thin bedded 1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded 1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded 1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded 1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded			to 115.9', few interbedded siltstone lenses (less than 1/8" thick) from 114.8' to 115.8', fresh, moderately broken, moderately hard thinly laminated to laminated <i>(continued)</i> Dark reddish-brown CLAYSTONE, fresh, moderately broken to								
1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, slightly broken, moderately hard to hard, very thin bedded 130.0 1099.5 Few interbedded shale seams (less than 1/16" thick) from 137.8" 130.0 1099.5 Few interbedded shale seams (less than 1/16" thick) from 137.8" 130.0 1099.5 Olive gray becoming grayish-brown, medium bluish-gray and dark to 139'. 140.0 1099.5 Olive gray becoming grayish-brown, medium bluish-gray and dark than 1/10" thick), few claystone seams, slightly micaceous, fresh, moderately broken, moderately hard, thinly laminated 140.0 1099.5 Medium bluish-gray SILTSTONE, slightly micaceous, fresh, moderately broken, moderately hard, thinly laminated 145.0 1079.5 Medium bluish-gray SILTSTONE, slightly micaceous, few linterbedded (less than 1/8" thick) sandstone seams, sandstone lens from 144.7" to 147.3" with claystone seams, fees than 1/16" thick) with grayshorown stalaut from 150.8", fresh, moderately broken, thard to very hard, very thin bedded 150.0 1077.7 Medium bluish-gray SILTSTONE, slightly micaceous, few linterbedded (less than 1/8" thick) sandstone seams, sandstone lens from 149.8" to 150.1", interbedded shale seams (less than 1/16" thick) sandstone seams, sandstone lens from 149.8" to 150.1", interbedded shale seams (less than 1/16" thick) sandstone seams, sandstone lens from 149.8" to 150.1", interbedded shale seams (less than 1/16" thick) sandstone seams, sandstone lens from 149.8" to 150.1", interbedded shale seams (less than 1/16" thick) sandstone seams, sandstone lens from 149.8" to 150.1"	1108.8	× × × × × × × × × × × × × × × × × × ×	sandstone seams (less than 1/8" thick) from 119.7' to 126', fresl moderately broken, hard, very thin bedded	ed							2-Inch Solid PVC Riser
1089.5 Few interbedded shale seams (less than 1/16" thick) from 137.8' 135.0 RC 75 1089.5 Olive gray becoming grayish-brown, medium bluish-gray and dark reddish-brown SHALE, few interbedded slitstone seams (less than 1/10" thick), few claystone seams, slightly micaceous, fresh, moderately broken, moderately hard, thinly laminated 140.0 Dark reddish-brown from 144.7' to 147.3' with claystone seams. 145.0 RC 88 1079.5 Medium bluish-gray SILTSTONE, slightly micaceous, few interbedded (less than 1/8" thick) sandstone seams, sandstone lens from 149.8' to 150.1', interbedded shals easans (less than 1/8" thick) sandstone seams, sandstone lens from 149.8' to 150.1', interbedded shals easans (less than 1/8" thick) sandstone seams, sandstone means, sandstone lens from 149.8' to 150.1', interbedded shals easans (less than 1/8" thick) with grayish-brown staining from 150.3' to 150.8', fresh, moderately broken, hard to very hard, very thin bedded Medium bluish-gray SANDSTONE, micaceous, very fine to 150.0	1099.5	*****	Medium bluish-gray SILTSTONE, slightly micaceous, fresh,								Sealed with Bentonite Grout
089.5 Olive gray becoming grayish-brown, medium bluish-gray and dark reddish-brown SHALE, few interbedded siltstone seams (less than 1/10" thick), few claystone seams, slightly micaceous, fresh, moderately broken, moderately hard, thinly laminated 140.0 Dark reddish-brown from 144.7' to 147.3' with claystone seams. RC 88 13 (67) Dark reddish-brown from 144.7' to 147.3' with claystone seams. 145.0 079.5 X X X Medium bluish-gray SILTSTONE, slightly micaceous, few interbedded (less than 1/8" thick) sandstone seams, sandstone lens from 149.8' to 150.1', interbedded shale seams (less than 1/16" thick) with grayish-brown staining from 150.3' to 150.8', fresh, moderately broken, hard to very hard, very thin bedded Medium bluish-gray SANDSTONE, micaceous, very fine to 150.0		****									
Dark reddish-brown from 144.7' to 147.3' with claystone seams. Dark reddish-brown from 144.7' to 147.3' with claystone seams. Dark reddish-brown from 144.7' to 147.3' with claystone seams. Hole Plug (Bentonite Chips) 150.0 	089.5		reddish-brown SHALE, few interbedded siltstone seams (less than 1/10" thick), few claystone seams, slightly micaceous, fresi	140.0		00					
079.5 X × X X × X interbedded (less than 1/8" thick) sandstone seams, sandstone lens from 149.8' to 150.1', interbedded shale seams (less than 1/16" thick) with grayish-brown staining from 150.3' to 150.8', fresh, moderately broken, hard to very hard, very thin bedded 150.0 077.7 Medium bluish-gray SANDSTONE, micaceous, very fine to 150.0			Dark reddish-brown from 144.7' to 147.3' with claystone seams.	 	13						– Hole Plug (Bentonite
		$ \times \times \times $	interbedded (less than 1/8" thick) sandstone seams, sandstone lens from 149.8' to 150.1', interbedded shale seams (less than 1/16" thick) with grayish-brown staining from 150.3' to 150.8', fresh, moderately broken, hard to very hard, very thin bedded Medium bluish-gray SANDSTONE, micaceous, very fine to medium grained, fresh, moderately broken, very hard, very thin			96					Chips) — Filter Sand



BORING NUMBER SB-23/ MW1104F PAGE 5 OF 6

	IT An	nerican Electric Power PRO	PROJECT NAME <u>Mitchell Landfill, Mitchell Electric Generating Pla</u> PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia						
CEC	PROJE	CT NUMBER PR0	JECT L	C	ATION _	Gatts	Ridge Roa	d, Cre	sap, West Virginia
ELEVATION (ff)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLdJO 155		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
	******	Medium bluish-gray SILTSTONE, slightly micaceous, interbede sandstone seams (less than 1" thick) throughout, fresh, moderately broken, hard to very hard, very thin bedded (continued)	-	-					
1069.5	*****	Medium bluish-gray SILTSTONE, slightly micaceous, calcareo few interbedded sandstone seams (less than 0.5" thick) throughout, few interbedded shale seams (less than 1/8" thick) throughout, interbedded limestone throughout, fresh, moderate broken, hard, very thin bedded	160	<u>.0</u> - -	RC	95			2-Inch Slotted Screen
	*****	Broken from 169' to 169.5'.	 	.0 - -	15	(69)			
1059	<u>x x x</u>	Medium gray SANDSTONE, micaceous, very fine to medium	170	.0					
		grained, interbedded limestone throughout, fresh, moderately broken, very hard, very thin bedded							
1057.1 1056	× × × × × × × × ×	Medium gray SILTSTONE, slightly micaceous, calcareous, few interbedded (less than 1/16" thick) shale seams and limestone throughout, fresh, moderately broken, hard, very thin bedded		-					Filter Sand
30/12		Medium bluish-gray SHALE, calcareous, moderate brown from 173.4' to 174.1', interbedded sandstone from 174.1' to 176.5', interbedded limestone throughout, fresh, moderately broken, moderately hard to hard, thinly laminated to laminated	_ <u>175</u> _	- .0 -	RC 16	98 (68)			
TATE.GDT 1/ 1052 1050	× × × × × × × × × × × ×	Dark gray SILTSTONE, limestone lens from 176.5' to 176.6', limestone inclusions throughout, 1/8" grayish-black shale sean at 177.9' and 178', fresh, moderately broken, very hard, very th bedded	is in -	-					
0000 1047.3		Light gray SANDSTONE, micaceous, very fine to medium grained, few siltstone seams (less that 1/16" thick) and broken from 179' to 181.2', fresh, moderately broken, very hard, thin bedded	<u>180</u> 	.0 -					
ILL.GPJ		Grayish-black SHALE, fresh, moderately broken, moderately hard, thinly laminated							
1104418 MITCHELL LANDFILL.GPJ 6000 TEMPLATE.GDT 1/30/12 102418 MITCHELL LANDFILL.GPJ 10201 1044'8		Medium bluish-gray SANDSTONE, micaceous, very fine to fine grained, calcareous limestone inclusions from 175.5' to 178.6', fresh, moderately broken, hard to very hard, very thin bedded t thin bedded	185	_ .0 _	RC 17	98 (76)			
10-41(· · · · · ·		Ļ						
CEC CUSTOM LOG WITH WELL 11 9.66001		Medium light gray SANDSTONE, micaceous, very fine to medi grained, medium dark gray less than1/16" thick fine to medium grained seams throughout, few limestone inclusions, fresh, moderately broken, very hard, very thin bedded		_ .0 _ _					
CEC CUSTO			_ _ 195	- - .0	RC 18	97 (62)			



BORING NUMBER SB-23/ MW1104F PAGE 6 OF 6

CEC F	PROJE	CT NUMBER PF	ROJEC	T LOC	ATION	Gatts	Ridge Roa	d, Cres	ap, West Virginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HLdH (H) 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM
1032.7	× × × × × × × × × × × × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few interbedded shale seams less than 1/4" thick throughout, few calcareous limestone inclusions, fresh, moderately broken, have very thin bedded	/						
1029.5		Medium bluish-gray SHALE, some brownish-gray staining fro about 201.5' to 202.5', few limestone inclusions, interbedded siltstone seams (less than 1/8" thick) from 199' to 201.3', fres moderately broken, hard, thinly laminated	ŀ	 200.0 					
1025.3	× × × × × × × × ×	Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, few interbedded (less than 1/16" thick) v fine to fine grained sandstone seams, fresh, moderately brok hard, very thin bedded Medium gray SANDSTONE, micaceous, very fine to medium grained, interbedded limestone, interbedded siltstone lenses 207.4' to 207.9', fresh, moderately broken, very hard, very thi	from	 <u>205.0</u> 	RC 19	96 (36)			
<u>1020.1</u> 1019.5	× × × × × × × × × × × × × × × × × × ×	bedded Medium bluish-gray SILTSTONE, slightly micaceous, few limestone inclusions, fresh, moderately broken, hard, very thi bedded Medium bluish-gray SILTSTONE, slightly micaceous, interber shale seams (increasing in percentage with depth) throughou few sandstone seams (less than 1/4" thick) from 210.2' to 210	dded it,	 2 <u>10.0</u> 					
1015.7	× × >	fresh, moderately broken, hard, very thin bedded Medium bluish-gray SHALE, few interbedded siltstone seams (less than 1/8" thick) from 212.8' to 214.8', grayish-blue staini from 214.8' to 216.3', fresh, moderately broken, moderately h to hard, thinly laminated	ing	 	RC 20	95 (47)			
1012.1		Medium gray becoming dark reddish-brown SHALE, calcareo interbedded limestone throughout, becoming dark reddish-bro starting at 217.3' with interbedded claystone, fresh, moderate broken, very hard, laminated	own						
1009.5		Dark reddish-brown to grayish-red CLAYSTONE, few interbed shale lenses, calcareous and becoming less calcareous with depth, fresh, moderately broken, very hard	-	220.0 225.0	RC 21	83 (61)			
1002.7		Medium bluish-gray SANDSTONE, micaceous, very fine to fin grained, few limestone inclusions, fresh, moderately broken, w hard, very thin bedded	ne very	 					
999.5		Bottom of hole at 229.0 feet. The following groundwater level readings were taken during drilling: 11/1/2011 8:30 AM at 56.7' bgs (borehole depth = 59' bgs) 11/2/2011 9:36 AM at 173.3' bgs (borehole depth = 199' bgs) Well MW1104F installed after completion in an offset boring. The above-noted ground elevation corresponds to the ground elevation at which soil and rock sampling was initiated at SB- The ground elevation for MW1104F = 1228.5 ft.	d k						

	 	Civil & Environmental Consultants, Inc. 4274 Glendale Milford Road Cincinnati, Ohio 45242		E	BC	DRIN	NG I	NUMB	ER	SB	·09/	PZ1101H PAGE 1 OF 7
CLIEI	NT Ar	nerican Electric Power	PROJE		ΛE	Mitch	nell La	ndfill. Mitch	nell Ele	ctric (Gener	ating Plant
								Ridge Roa				
								3 ft				
			GROUN			-		0.11		. 0.22		
		IETHOD HSA: Auto Hammer & Air Rotary Rock Core					-	Refer to n	otoo o	t hott	om of	
			_					254.1 ft / E				log
		CHECKED BY M. McCoy					-					<i>t</i> i
		N 485990.9, E 1610339.5	<u> </u>	.75 no			R DRI	LLING 24	-0.7 π/	Elev	900.6	π
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		o DEPTH (ft)		SAMPLE IYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
1141.3		TOPSOIL			\mathbb{N}	SS	67	3-3-3	1.2-1.8			- Concrete
1141.2 1139.8	<u> </u>	Brown LEAN CLAY WITH SAND (CL), few shale fragments \roots, moist, medium stiff (RESIDUAL)	, trace		$ \rangle$	1		(6)		N N		Seal
1.03.0		Reddish-brown to brown FAT CLAY (CH), noted iron oxide	/		1X	SS 2	67	5-7-11 (18)	3.1-4.4			
1138.3		concretions, moist, very stiff (RESIDUAL)			M	SS	53	16-27-25	0.3-0.5	5		
1136.8		Shelby Tube sample obtained from 1'-3' (Recovery = 20")		5.0	\mathbb{H}	3		(52)	0.1			
1100.0		Grayish-brown SANDY LEAN CLAY (CL), few shale fragme hard, moist (RESIDUAL)	ents,		1X	SS 4	47	13-31-40 (71)	0.9			
		Grayish-brown to reddish-brown and brown SHALE, comple			×	SS	86	42-50/1"	1.5			
		becoming highly weathered, very broken, very soft, laminate	ed			_5 SS		47 50/0"	1.9			
					Þ	$\begin{pmatrix} 55\\ 6 \end{pmatrix}$	93	17-50/3"	0.2			
				10.0	\bigtriangledown	SS	60	33-31-36	0.1			
				10.0	\square	7		(67)	4.5+			1-Inch Solid PVC Riser
						SS 8	80	50/3"	1.2			Sealed with
					-	SS	0	50/1"				Bentonite Grout
						9						
1127.8		Gray to dark gray SANDSTONE, few calcite inclusions, trac shale laminations, fine to medium grained, micaceous, few stained fractures, moderately weathered, slightly broken, ha very hard, thick bedded	iron	 		RC 1	95 (94)				l	
1121												
				20.0	H							
		Dark gray SHALE, rough to smooth texture, vertical fracture iron staining from 20.3' to 22', moderately weathered, very broken, moderately hard, laminated	es with									
1119.3		Maroon CLAYSTONE, rough to smooth texture, highly weathered, very broken, soft to moderately hard				DO						
		Assuming highly weathered maroon claystone from 22.6' - 2 (No Recovery)	29.8'	_25.0_		RC 2	28 (5)					
1111 5				 								
1111.5		Dark gray SHALE, some limestone inclusions, some calcite inclusions, smooth to rough texture, moderately weathered, broken, soft, thinly laminated to laminated										
1106.9	× × >			35.0		RC	96					
	<u>. v v v</u>				_						and the second se	



BORING NUMBER SB-09/ PZ1101H

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							ndfill, Mitch Ridge Roa			
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		(tt) 35.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELI	_ DIAGRAM
	× × × × × × × × × × × × × × × × × × ×	Dark gray SILTSTONE, some calcite inclusions, few limestor inclusions, rough to smooth texture, micaceous, moderately weathered, moderately broken, moderately hard to hard, very bedded <i>(continued)</i>	ne -	<u></u>	3	(88)				
1101.5		Dark gray SILTSTONE, some sandstone seams and shale		40.0						
	· · · · · · · · · · · · · · · · · · ·	laminations, trace calcite inclusions, rough to smooth texture micaceous, slightly weathered, broken, moderately hard to ha very thin bedded	ard,	-					l	
1097.2		Dark gray SANDSTONE, some siltstone seams, fine to medi grained, micaceous, slightly weathered, moderately broken, h medium bedded	ium hard,	45.0_	RC 4	99 (93)				1-Inch Solid PVC Riser
1095.4	× × × × × × × × × × × × × × ×	Dark gray SILTSTONE, some sandstone seams, few calcite inclusions, rough to smooth texture, micaceous, slightly weathered, broken, moderately hard to hard, very thin bedde	F	-						Sealed with Bentonite Grout
1092.8	X X X	Gray SANDSTONE, some siltstone seams, very fine to medi grained, micaceous, slightly weathered, moderately to slightly broken, hard to very hard, very thin bedded		50.0						
			-	- - 55.0 - - - -	RC 5	100 (100)				
1081.5		Gray SANDSTONE, trace calcite inclusions, fine to medium grained, micaceous, slightly weathered, moderately broken, h very thin bedded to medium bedded		<u>60.0</u> - -						
				_ <u>65.0</u> _ _	RC 6	96 (93)				
				70.0						
1070.4 1069.7		note: sandstone interbedded w/ shale and intensely fractured from 70.9' - 71.6' Gray SANDSTONE, few shale laminations, fine to medium		-						
		grained, micaceous, slightly weathered, slightly broken, hard, bedded to thick bedded	-	_ 75.0	RC	93				



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CLIENT American Electric Power CEC PROJECT NUMBER 110-416	PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia								
NOTELING TO THE		HL(1) 75.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)			_ DIAGRAM
1065 Dark gray SHALE, smooth to rough texture, slightly weath broken, soft to moderately hard, thinly laminated to lamin	hered, lated		7	(74)					
1061.5 Dark gray SHALE, some calcite inclusions, few limestone inclusions, smooth to rough texture, slightly weathered, b moderately hard to soft, thinly laminated to laminated	e proken,	 80.0 							
1056.8 Dark gray to black SHALE, few claystone seams, some p fossils, some calcite inclusions, rough texture, fresh, mod broken, soft to moderately hard, thinly laminated to lamin 1054.3 Gray SANDSTONE, few shale inclusions, very fine to me	derately lated	 _ <u>85.0</u> 	RC 8	97 (72)					1-Inch Solid PVC Riser Sealed with Bentonite Grout
1051.5 Dark gray to black SHALE, few calcite inclusions, smooth fresh, broken, soft to hard, thinly laminated to laminated		 _90.0							
Completely black from 90.9' - 91.4', shale becomes intert with limestone at 91.4'. Dark gray to gray SANDSTONE, some shale laminations limestone inclusions, fine to medium grained, micaceous	s, some	 95.0_	RC 9	77 (58)					
slightly weathered, hard, thick bedded									
1041.5 Gray SANDSTONE, few coal inclusions, fine to medium g micaceous, fresh, slightly broken, hard, medium bedded bedded	grained, to thick	<u>100.0</u> 	RC	100					
		<u>105.0</u> 	10	(99)					
1031.5 Gray SANDSTONE, fine to medium grained, micaceous, slightly weathered, hard, medium bedded to thick beddec	fresh, d	<u>110.0</u> 							
		 115.0	RC	99					



BORING NUMBER SB-09/ PZ1101H

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			PROJECT NAMEMitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION _Gatts Ridge Road, Cresap, West Virginia								
CEC	PROJE	CT NUMBER110-416 P	ROJECT LOC	ap, Wes	st Vi	ginia					
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HLdad 115.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	W	'ELL	DIAGRAM	
		Gray SANDSTONE, fine to medium grained, micaceous, free slightly weathered, hard, medium bedded to thick bedded <i>(continued)</i>			(99)						
			 125.0	RC 12	87 (71)			l		1-Inch Solid PVC Riser	
015.4		Dark gray to red-brown CLAYSTONE, waxy texture, fresh, broken, moderately hard to soft	 130.0					l		Sealed with Bentonite Grout	
007.8		Highly weathered vertical fracture at 132.8'. Dark gray SHALE, interbedded siltstone seams throughout, s calcite inclusions, smooth to rough texture, fresh, moderately broken, soft to moderately hard, laminated	 some / <u>135.0</u>	RC 13	95 (81)			l			
003.8		Gray SANDSTONE, trace shale laminations, fine to medium grained, micaceous, fresh, moderately broken, hard, thin bed to medium bedded	dded					l			
					96			l			
996.7		Dark gray SHALE, smooth texture, fresh, broken, moderately hard to soft, thinly laminated to laminated	/ <u>145.0</u> 	RC 14	86 (85)						
991.5		Dark gray to maroon SHALE, few claystone seams, some pl fossils, trace calcite inclusions, smooth to waxy texture, fresh broken, soft to moderately hard, thinly laminated to laminated	n,								
			155.0	RC	75						



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CLIENT American Electric Power			PROJECT NAME _Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION _Gatts Ridge Road, Cresap, West Virginia								
CEC	CEC PROJECT NUMBER 110-416				ATION	Gatts	Ridge Roa	d, Cres	sap, V	vest V	rirginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) (1) 155.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
985.6		Dark gray to maroon SHALE, few claystone seams, some p fossils, trace calcite inclusions, smooth to waxy texture, fres broken, soft to moderately hard, thinly laminated to laminate <i>(continued)</i> note: siltstone layer from 155.7' - 156.7'	h,		15	(41)					
981.5		Dark gray to brown SHALE, some plant fossils, platy w/ hori bedding, smooth to rough texture, fresh, broken, soft to moderately hard, thinly laminated to laminated	zontal	 						l	
				 	RC 16	87 (73)				l	1-Inch Solid PVC Riser Sealed with
975		Dark gray to brown SHALE, some plant fossils, smooth to ro texture, fresh, broken, moderately hard, thinly laminated to laminated		 170.0						l	Bentonite Grout
971.5		Dark gray SHALE, some plant fossils, platy, smooth texture, fresh, broken, moderately hard to soft, thinly laminated to laminated	3								
968.1	× × × × × × × × × × × × × × × × × × ×	Dark gray to maroon SILTSTONE, few claystone seams throughout, trace calcite inclusions, slightly micaceous, roug texture, fresh, broken, soft, very thin bedded	gh	 175.0 	RC 17	90 (79)					
961.5		Dark gray to maroon SHALE, siltstone and claystone seams throughout, some plant fossils, smooth to rough texture, free broken, moderately hard to soft, laminated	sh,	<u>180.0</u> 						l	
				 185.0 	RC 18	78 (65)					
951.5		Dark gray to maroon CLAYSTONE, few shale and siltstone seams, trace plant fossils, platy, smooth to rough texture, fre broken, moderately hard to soft	esh,	<u>190.0</u> 							
948.1		Dark gray SILTSTONE, few sandstone seams, trace calcite inclusions, gritty texture, micaceous, fresh, slightly broken, h thick bedded	nard,	195.0	RC	95					

(Continued Next Page)



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			PROJECT NAMEMitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia								
CEC I	-ROJE(ILUC	ATION	Gatts	Ridge Koa	d, Cre	sap, W	est V	irginia
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (1) DED TH 195.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)		WEL	L DIAGRAM
943	× × × × × × × × × × × × × × × × × × ×	Dark gray SILTSTONE, few sandstone seams, trace calcite inclusions, gritty texture, micaceous, fresh, slightly broken, has thick bedded <i>(continued)</i> Dark gray SHALE, some limestone inclusions, trace plant foss	.rd,	 	19	(91)					
		trace sandstone and siltstone seams, rough to smooth texture fresh, broken, moderately hard to hard, laminated	_	 200.0 							
				205.0	RC 20	98 (95)					
935.3		Dark gray SANDSTONE, interbedded shale laminations increasing in percentage with depth, few siltstone seams, trac- calcite inclusions, micaceous, very fine to medium grained, free broken, moderately hard to hard, very thin bedded	esh,	· -							– Hole Plug (Bentonite
				210.0							Chips)
929.9		Gray SANDSTONE, some shale laminations, fine to medium grained, micaceous, fresh, moderately broken, hard, thin bedc to medium bedded note: sandstone interbedded w/ shale from 213.5' - 214.8'		· · - <u>-</u> · - <u>215.0</u> · -	RC 21	98 (97)					- Filter Sand
				 220.0							
918.5		Dark gray SHALE, some limestone inclusions, trace calcite inclusions, smooth to rough texture, fresh, broken, moderately hard to soft, thinly laminated to laminated		 225.0	RC 22	94 (89)					•
911.5		Dark gray to maroon SHALE, few claystone seams, trace calc		230.0							1-Inch Slotte
511.5		to soft, thinly laminated to laminated	ard _	· -							
			F		DO						
		(Continued Next Page)		235.0	RC	86					



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			PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia							
ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		HL (J) HL J J J 235.0	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN (tsf)	WELL DIAGRAM	
905.5		Dark gray SANDSTONE, interbedded shale laminations ar siltstone seams, trace limestone inclusions, micaceous, fre broken, moderately hard to hard, very thin bedded	nd esh,		23	(68)				
901.5		Gray SANDSTONE, some shale laminations, fine to mediu grained, micaceous, fresh, broken, hard, very thin bedded bedded	um to thin	<u>240.0</u> 245.0	RC	94				
396.5 394.1 393.5		Dark gray SHALE, some interbedded sandstone, platy, sm gritty texture, fresh, very broken, moderately hard, thinly laminated to laminated Gray SANDSTONE, few shale inclusions, fine to medium grained, micaceous, fresh, moderately broken, hard, very t bedded Dark gray SHALE, some plant fossils, platy, smooth textur fresh, broken, moderately hard, thinly laminated	hin	<u>243.0</u> - – - – <u>250.0</u>	24	(82)			- Filter Sand	
387.3 386.8 385.4		Black COAL, fresh, broken, laminated Dark gray SHALE, some plant fossils, platy, smooth textur fresh, broken, moderately hard, thinly laminated to laminat Brown to dark gray LIMESTONE, few coal inclusions, high reaction to HCI, fresh, slightly broken, very hard, thick bedo	e, ed	- – - – - – 2 <u>255.0</u> - – - –	RC 25	57 (35)			– Hole Plug (Bentonite Chips)	
881.5		Bottom of hole at 259.8 feet. The following groundwater level readings were taken durin drilling: 9/13/2011 6:00 PM at 129.4' bgs (borehole depth = 129.8' 9/14/2011 8:00 AM at 109.3' bgs (borehole depth = 129.8' 9/15/2011 8:15 AM at 114.2' bgs (borehole depth = 230' bg 9/19/2011 11:00 AM at 211.7' bgs (borehole depth = 230' bg 9/19/2011 2:40 PM at 254.1' bgs (borehole depth = 230' b 9/19/2011 2:40 PM at 254.1' bgs (borehole depth = 259.8' The following groundwater level readings were taken after 9/20/2011 8:30 AM at 240.7' bgs (borehole depth = 259.8' Piezometer PZ1101H installed upon completion.	bgs) bgs) bgs) gs) gs) bgs) bgs) drilling:							