2018 ANNUAL CCR GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

McELROY's RUN COAL COMBUSTION BYPRODUCT DISPOSAL FACILITY

Pleasants Power Station
Pleasants County, West Virginia

Prepared for:

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Tetra Tech Project No. 212C-SW-00070

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1.0 INTRODUCTION

This 2018 Annual Coal Combustion Residuals (CCR) Groundwater Monitoring and Corrective Action Report was prepared by Tetra Tech, Inc. (Tetra Tech) on behalf of FirstEnergy (FE), for the McElroy's Run Coal Combustion Byproduct Disposal Facility (CCBDF or "CCR units") at the Pleasants Power Station (hereinafter referred to as the "Station"). The Station is located in Pleasants County, West Virginia. The report was developed to comply with requirements of 40 CFR § 257.90(e).

1.1 BACKGROUND AND SITE CHARACTERISTICS

CCRs produced at the Station are placed in the facility's captive CCBDF, which is located approximately one mile east-southeast of the Station. The facility consists of both a wet disposal area (impoundment) and dry disposal area (landfill) developed in the McElroy's Run watershed. Taken together, the landfill and impoundment are regulated under West Virginia Department of Environmental Protection (WVDEP) Solid Waste/National Pollutant Discharge Elimination System (NPDES) Water Pollution Control Permit No. WV0079171. A WVDEP groundwater monitoring program for the facility has been in effect since 1994 and a separate CCR Rule groundwater monitoring program has been in effect since 2017. As per the CCR Rule, the landfill and impoundment are considered two separate, existing CCR units that share a common boundary (i.e., the impoundment dam). As provided by the CCR Rule, a multiunit groundwater monitoring system has been established for the CCBDF.

The impoundment is situated in the upper portion of the watershed, is unlined, and has been in continuous use since the late 1970s. The landfill is situated in the lower portion of the watershed (adjacent to, and overlying, the impoundment dam), is lined, and has been in continuous use since the early 1990s. At the current water level, the surface impoundment area is about 250 acres. The impoundment dam was constructed with a clay-filled cutoff trench at the upstream toe and with a clay blanket on the upstream slope for a low permeability seepage barrier. The downstream portion of the dam was constructed using compacted fly ash and periodic layers of bottom ash for blanket drains connected to sloping chimney drains that collect and convey seepage to discharge pipes for monitoring. The downstream face of the dam is covered by the landfill facility which WVDEP considers to be a buttress for the dam.

The landfill consists of three primary development stages (I, II, and III in the original WVDEP permit drawings and now referred to as 1, 2, and 3) which are further subdivided into construction subareas (e.g., Stage 1G, 2A, etc.). At this time, development and disposal operations have only been performed in the Stage 1 and 2 areas while the Stage 3 area remains undeveloped. Up until 2009, all of the landfill subareas were constructed with a compacted clay liner system that included an underlying combined groundwater underdrain/leak detection system and overlying leachate collection system. However, since 2009 (in subareas 1G and 2B), a composite geosynthetic liner system (geosynthetic clay liner and geomembrane) has been utilized that also includes an underlying combined groundwater underdrain/leak detection system and overlying leachate collection system. For all portions of the landfill that overlie the downstream face of the impoundment dam, a bottom ash blanket drain layer has also been installed. Leachate and contact stormwater runoff from the Stage 1 and 2 disposal areas are managed in Sedimentation Pond Nos. 1 and 2, which are lined impoundments located immediately down-valley of the future Stage 3 landfill development area.

Groundwater in the CCBDF area occurs primarily within fractured bedrock, principally in the following sandstone units (in descending order): the Morgantown sandstone, Grafton sandstone, Jane Lew sandstone, and the Saltsburg sandstone. Groundwater has also been identified in the Ames limestone and Harlem Coal (in association with the Jane Lew sandstone), and, to a lesser extent, the redbed units at the site. Generally, the fine-grained rock units (e.g., redbeds) typically serve as aquitards to limit vertical groundwater migration, while the coarser grained rock units (e.g., sandstones) typically have more well-developed and open fracture systems and are the primary conduits for groundwater migration. The fractured bedrock of multiple sandstone units, including the Morgantown sandstone, Grafton sandstone, Jane Lew sandstone, and Saltsburg sandstone, has been collectively identified as the uppermost aquifer for CCR Rule groundwater monitoring for the combined landfill and impoundment units.

Historic and recent groundwater level data indicate groundwater flow at the CCBDF as being primarily controlled by topography (more important for vertical migration across groundwater flow units along the valley margins near where the units outcrop) with limited, secondary control by orientation (strike and dip) of the rock units (i.e. migration down-dip within a groundwater flow unit). Groundwater is interpreted to flow north from the topographically higher areas located to the south and southeast of the impoundments. West and northwest of the impoundment dam, topography may be the dominant influence on groundwater flow, as the multiple sandstone units underlying the site are eroded and discontinuous across the valley. Groundwater flow northwest of the dam and under the landfill is in the downstream direction of McElroy's Run toward the west. Flow in all of the rock units exhibit very little seasonal and temporal fluctuations. A representative set of water level data from the current reporting period (2018) were used for contouring groundwater flow patterns at the site as shown on Figure 2-1. A more detailed discussion of the site's geologic and hydrogeologic characteristics is provided in Section 2.0 of this report.

1.2 REGULATORY BASIS

As required by § 257.90(e), of the CCR Rule, Owners or Operators of existing CCR landfills and surface impoundments must prepare an Annual Groundwater Monitoring and Corrective Action Report no later than January 31, 2018 and annually thereafter. According to the subject section, "For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year."

This report has been developed to meet the general requirements above and the specific requirements of § 257.90(e)(1) through (5), which include:

"(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit (see Figure 2-1);

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken (see Section 2.1.1);

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs (see Sections 3.0 and 4.0 and Tables 3-2a and 3-2b);

(4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels) (see Section 2.3); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98."

In addition, the Owner and Operator must place the report in the facility's operating record as required by § 257.105(h)(1), provide notification of the report's availability to the appropriate State Director within 30 days of placement in operating record as required by § 257.106(h)(1), and place the report on the facility's publically accessible website, also within 30 days of placing the report in the operating record.

1.3 OVERVIEW OF REPORT CONTENTS

Section 1.0 of this report provided an overview of the CCR unit characteristics, regulatory basis, and a summary of the requirements for CCR Annual Groundwater Monitoring and Corrective Action Reports. Section 2.0 summarizes the status of key actions pertaining to CCR groundwater monitoring completed during 2018 for the CCBDF and plans for the upcoming year. Section 3.0 presents Detection Monitoring (DM) statistical evaluations completed in 2018 from groundwater sampling events completed in 2017 and presents DM results from groundwater sampling events completed in 2018. Section 4.0 presents Assessment Monitoring (AM) results from groundwater sampling events completed in 2018.

2.0 GENERAL INFORMATION

This section provides an overview of the status of the CCR groundwater monitoring program through 2018 and key activities planned for 2019.

2.1 STATUS OF THE CCR GROUNDWATER MONITORING AND CORRECTIVE ACTION PROGRAM

During calendar year 2018, the following key actions were completed with regard to the CCR groundwater monitoring program for the CCBDF.

2.1.1 Groundwater Monitoring Well System

As detailed in the facility's 2017 Annual CCR Groundwater Monitoring and Corrective Action Report ("2017 AGWMCA Report", accessible at http://ccrdocs.firstenergycorp.com/), the certified CCR monitoring well network consists of three upgradient (background) wells (GW-7, -21, and -22), seven downgradient wells to monitor the northern side of the combined CCR units (GW-9, -19, -20, -23, -24, -25, and -26), and three downgradient wells to monitor the western side of the combined CCR units (GW-27, -28, and -29), as summarized in attached Table 2-1 and shown on attached Figure 2-1.

It was originally intended that upgradient wells GW-21 and GW-22, which are both screened in the Morgantown sandstone, would be grouped for statistical evaluation purposes. However, after both the background and the initial detection monitoring sampling events were completed, it was determined that the two wells did not have the level of statistical similarity needed for grouping and that the availability of sufficient volumes of recoverable water was a recurring problem for GW-21. As such, it was decided that only GW-22 would be used to establish background chemistry for the northern side of the CCR units since it exhibited lower concentrations of all the Appendix III parameters than those measured in GW-21 and it also provided a reliable water yield while GW-21 did not. GW-21 was left in place (i.e., it was not abandoned) and it has been sampled when sufficient volumes of recoverable water were available. GW-21's water levels have also continued to be used to verify groundwater flow patterns at the site. The current intent is to keep GW-21 as a part of the CCR monitoring network until a sufficiently-sized data set can be compiled and used to determine whether or not it's statistically appropriate to group its results with the data set for GW-22. No other changes to the monitoring well network (i.e., new wells added or existing wells abandoned) occurred during 2018.

2.1.2 Groundwater Monitoring Plan

Consistent with the work performed and summarized in the 2017 AGWMCA Report, the CCR units' Groundwater Monitoring Plan (GWMP) was followed during all 2018 field sampling and laboratory analysis activities and for statistically evaluating groundwater monitoring data developed from the CCR sampling and analysis program. No changes to the facility's GWMP occurred during 2018.

2.1.3 Background Groundwater Sampling

As discussed in the 2017 AGWMCA Report, eight independent rounds of background groundwater samples for analyzing all Appendix III and IV parameters from each of the CCR monitoring wells were collected prior to initiating the facility's CCR Detection Monitoring program in October 2017. No modifications to this background data set occurred during 2018.

2.1.4 Statistical Methods

As presented in the 2017 AGWMCA Report, the background data set discussed in Section 2.1.3 was used to select the appropriate statistical evaluation method for each CCR groundwater monitoring parameter to identify any Statistically Significant Increases (SSIs) over background concentrations. These statistical methods are available on the facility's publicly accessible website and no changes were made to them during 2018.

2.2 PROBLEMS ENCOUNTERED/RESOLVED

As discussed in the 2017 AGWMCA Report, having sufficient recoverable volumes of groundwater from one of the CCR monitoring network's upgradient wells (GW-21) and four of its downgradient wells (GW-23, -24, -25, and -26) were found to be problematic during both the background and initial DM sampling events that occurred in 2016 and 2017. This low yield issue was anticipated given that historical well borings drilled at the site under the WVDEP groundwater monitoring program were abandoned over time due to a lack of water in the same rock units. The lack of sufficient recoverable water in these low-yield wells was believed to be from overstressing them due to the large number of samples that had to be obtained prior to the required CCR groundwater detection monitoring startup date of October 2017. Since the remaining CCR monitoring network still met the minimum required number of downgradient wells, one of the key activities listed in the 2017 AGWMCA Report was to obtain quarterly water levels in GW-21, -23, -24, -25 and -26 to determine if one or more of them would be viable for use in the CCR groundwater monitoring network, and if they would require a sampling frequency of between six months and one year, as allowed for in 40 CFR § 257.94(d). Water levels were measured during the first three quarters of 2018 and are presented below:

Well	Date	Depth to Water (ft)	Total Well Depth (ft)	Total Standing Water Depth (ft)
GW-21	2/5/2018	NM	236.40	NM
	5/15/2018	228.35	236.40	8.05
	8/6/2018	229.06	236.40	7.34
GW-23	2/5/2018	376.62	395.20	18.58
	5/15/2018	371.48	395.20	23.72
	8/6/2018	368.15	395.20	27.05
GW-24	2/5/2018	262.84	273.50	10.66
	5/15/2018	261.25	273.50	12.25
	8/6/2018	260.57	273.50	12.93
GW-25	2/5/2018	300.56	306.00	5.44
	5/15/2018	299.23	306.00	6.77
	8/6/2018	300.15	306.00	5.85
GW-26	2/5/2018	275.57	290.50	14.93
	5/15/2018	275.43	290.50	15.07
	5/22/2018	276.89	290.50	13.61
	8/6/2018	276.55	290.50	13.95

Note: "NM" indicates not measured due to impassibility of the well access road during the sampling event.

The February, May, and August dates listed above correspond to the DM-2, AM-1, and AM-2 sampling events that are discussed in Sections 3.0 and 4.0 of this report. During those events, there were a total of five instances where samples could not be recovered:

- Sampling Event DM-2: Wells GW-21, GW-25, and -26. The inability to recover a sample in GW-21 was due to the impassibility of the monitoring well access road at the site, not insufficient available water. However, for GW-25 and -26, the inability to recover a sample was attributed to insufficient available water.

- Sampling Event AM-1: Well GW-26. The inability to recover a sample was attributed to insufficient available water.

- Sampling Event AM-2: Well GW-26. The inability to recover a sample was attributed to insufficient available water.

Based on the water level measurements presented above and the ability to successfully obtain a combined total of ten samples from GW-21, -23, -24, and -25 (out of a total of eleven possible samples), it was determined that using an alternative sampling frequency in accordance with 40 CFR § 257.94(d) should not be necessary for these wells and they should remain a part of the CCR monitoring network. However, upgradient well GW-21 was still not used for any of the statistical evaluation work performed in 2018 as its background data set is still not complete – it currently has only six rounds of data available and not the eight rounds needed to provide sufficient statistical power for use. With respect to GW-26, the water level data indicates that sample recovery should be feasible but, in the field, this well consistently exhibits low flow return even though its pump has been checked and cleared of potential mechanical problems. Due to its favorable positioning along the northern end of the site it's preferable to keep it as part of the CCR groundwater monitoring network. As such, GW-26 will be re-examined for potential mechanical or structural issues in early 2019. Should this examination fail to provide resolution to the on-going sampling issues, FirstEnergy will make a determination as to the viability of relocating GW-26 to a location as close as practical to its existing position or the need to eliminate it from the CCR monitoring network.

Other than the issues noted above, there were no other significant problems (e.g., quality control issues) encountered during 2018 with regard to the CCR groundwater monitoring program.

2.3 TRANSITION BETWEEN MONITORING PROGRAMS

As discussed in the 2017 AGWMCA Report, the CCR Detection Monitoring program was initiated with the collection of the first DM samples in September and October of 2017 (referred to hereafter as sampling event DM-1). Laboratory analysis and validation of the DM-1 sample data were completed in October of 2017 and the data were included in the 2017 AGWMCA Report. Statistical evaluation of the DM-1 data was subsequently completed in January of 2018 within the 90-day period allowed by the CCR Rule, and it was determined that SSIs existed as detailed in Section 3.1 of this Report. Based on the parameters for which SSIs were identified, an Appendix III Alternative Source Demonstration (ASD) was undertaken as discussed in Section 3.2 of this Report. However, all of the Appendix III SSIs that were identified for DM-1 could not be attributed to alternative sources. As such, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule occurred and are discussed in Section 4.0 of this report. Pursuant to §§ 257.94(e)(3), 257.105(h)(5), and 257.106(h)(4), a notice was prepared and posted to the facility's Operating Record and issued to the relevant State Director on August 15, 2018, to provide notification that a groundwater Assessment Monitoring program for the CCR unit had been established. Pursuant to § 257.107(h)(4) the subject notice was posted to the facility's publicly accessible website on September 7, 2018.

2.4 KEY ACTIVITIES PLANNED FOR THE UPCOMING YEAR

The following are the key CCR groundwater compliance activities planned for 2019:

- Complete the statistical evaluation of the two AM sampling events that occurred in 2018 to determine if there are any Appendix IV constituent concentrations in the downgradient wells that are at Statistically Significant Levels (SSLs) above applicable Groundwater Protection Standards (GWPS).
- If there are no SSLs, then continue with Assessment Monitoring by conducting the annual and semi-annual rounds of sampling and analysis for applicable Appendix III and Appendix IV constituents [per § 257.95(f)].
- If any SSLs are identified, provide appropriate notification [per § 257.95(g)] then potentially conduct an Appendix IV ASD [per § 257.95(g)(3)(ii)] to determine if a source other than the CCR unit may be causing the SSLs. Concurrent with undertaking an Appendix IV ASD, characterize the Nature and Extent (N&E) of the Appendix IV release and provide appropriate notification depending on the findings [per § 257.95(g)(1) and (2), respectively].
- If any SSL's are identified and an ASD is either not undertaken, indicates that an alternative source is not responsible for all the SSL's identified, or is not completed within 90 days of identifying there are SSL's, then initiate and perform an Assessment of Corrective Measures (ACM) in accordance with § 257.96.
- Re-examine GW-26 for potential mechanical or structural issues in early 2019. Should this examination fail to provide resolution to the on-going sampling issues, FirstEnergy will make a determination as to the viability of relocating GW-26 to a location as close as practical to its existing position or the need to eliminate it from the CCR monitoring network.

3.0 DETECTION MONITORING INFORMATION

3.1 GROUNDWATER ANALYTICAL RESULTS SUMMARY

As previously noted in Section 2.3, laboratory analysis and validation of the DM-1 sample data were completed in October of 2017 and the data were included in the 2017 AGWMCA Report. A statistical evaluation of the data set was performed using the approach and methods referenced in Section 2.1.4. The evaluation for DM-1 used nine rounds of data for the Appendix III parameters in the upgradient (background) wells and the September/October 2017 Appendix III data for the downgradient wells. These results are summarized in Table 3-1 and indicate that the following Appendix III parameters were identified as exhibiting SSIs in the downgradient monitoring wells (labeled “GW-#”) as summarized below:

	Northern Boundary (Upgradient Well GW-22)					Western Boundary (Upgradient Well GW-7)		
Appendix III Parameters	**GW-9**	**GW-19**	**GW-20**	**GW-23**	**GW-24**	**GW-27**	**GW-28**	**GW-29**
Boron (B)		SSI	SSI		SSI			
Calcium (Ca)				SSI	SSI	SSI	SSI	SSI
Chloride (Cl)		SSI	SSI	SSI	SSI	SSI	SSI	SSI
Fluoride (F)			SSI					
pH				SSI	SSI	SSI	SSI	SSI
Sulfate (SO_4)	SSI					SSI		SSI
TDS		SSI	SSI	SSI	SSI		SSI	SSI

Note: Northern Boundary wells GW-25 and -26 were not sampled during the initial Detection Monitoring event due to insufficient water.

Based on the various parameters for which SSIs were identified, an Appendix III ASD was undertaken as discussed in Section 3.2 of this Report.

During the transition period between completing the statistical evaluation of the DM-1 data and performing the Appendix III ASD, FirstEnergy performed another round of DM sampling (event DM-2) in order to have data available should the ASD prove to be successful and the facility remained in the DM program. DM-2 sampling occurred between February 5 and 15, 2018, with laboratory analysis and data validation completed by April 24, 2018. However, before statistical evaluation of the DM-2 data commenced, it was determined that a transition to Assessment Monitoring was required which precluded the need to statistically evaluate the DM-2 data. This data has been retained and is presented in Table 3-2a with the intent to add to the background data set, thereby increasing the statistical power of future statistical analysis.

3.2 APPENDIX III ALTERNATIVE SOURCE DEMONSTRATION

40 CFR § 257.94(e)(2) allows the owner or operator of a CCR unit 90 days from the date of determining that an SSI has occurred to demonstrate that a source other than the CCR unit caused the SSI or that the apparent SSI was from a source other than the CCR unit or resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.94(e)(2), an ASD was undertaken to assess if the Appendix III SSIs determined for DM-1 were attributable to a release from the CCR unit or from a demonstrable alternative source(s). A copy of the report that documents the Appendix III ASD activities and findings is included as Attachment A of this Report.

For the Appendix III ASD a multiple Line of Evidence (LOE) approach was followed. This approach divides LOEs into five separate categories (types): Sampling causes (ASD Type I); Laboratory causes (ASD Type II); Statistical evaluation causes (ASD Type III); Natural variation not accounted for in the basic DM statistics (ASD Type IV); and Potential natural or anthropogenic sources (ASD Type V). As detailed in Attachment A, LOE Types I through IV were assessed along with the following site-specific Type V LOEs: Regional groundwater chemistry studies/reports; Potential existing and historic oil and/or gas extraction well effects; and Potential off-site sources.

Based on the information and data included in Attachment A, it was determined that there may be natural levels of Chloride and TDS in the site area that could have resulted in some, but not all, of the SSIs identified for those constituents. It was also determined that potential impacts to groundwater by the numerous historical and existing oil and gas wells on the site and in nearby upgradient areas appears to be significant, with the most likely Appendix III parameters to reflect these impacts also being Chloride and TDS. However, the other Appendix III SSIs determined at the site (Boron, Calcium, Fluoride, pH, and Sulfate) have a moderate to low probability of being related to oil and gas impacts. Therefore, since all of the Appendix III SSIs that were identified for DM-1 could not be attributed to sources other than the CCR unit, to errors in sampling, analysis, or statistical evaluation, or to natural variation in groundwater quality, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule occurred and are discussed in Section 4.0 of this report.

4.0 ASSESSMENT MONITORING INFORMATION

4.1 GROUNDWATER ANALYTICAL RESULTS SUMMARY

In accordance with 40 CFR § 257.95(b) and (d)(1), the CCR groundwater sampling and analysis program implemented during 2018 consisted of two AM sampling events (AM-1 and AM-2) performed between May 15 and 24, 2018 and between August 6 and 16, 2018, respectively. For AM-1, all Appendix IV constituents were analyzed while, for AM-2, analyses included all Appendix III parameters and only those Appendix IV constituents that were detected during AM-1. Laboratory analysis and validation of the sample data were completed on July 11, 2018 and October 12, 2018 for AM-1 and AM-2, respectively. Table 3-2b presents the validated analytical results for these events.

Statistical evaluation of the AM data in Table 3-2b remains in-progress as of the end of the 2018 reporting period since receipt of validated AM-2 data occurred in the fourth quarter of 2018 and a 90-day period is allowed by the CCR Rule for statistical evaluation, which falls in the first quarter of 2019. If any Appendix IV SSLs are identified, ASD, N&E, and/or ACM activities will be undertaken as outlined in Section 2.4 of this Report, and the associated recordkeeping, notification, and reporting will be performed in accordance with the applicable requirements of 40 CFR §§ 257.95, 96, 105, 106, and 10.

4.2 GROUNDWATER PROTECTION STANDARDS

In accordance with 40 CFR § 257.95(h), as amended by the United States Environmental Protection Agency (USEPA) in July of 2018, GWPS for Appendix IV constituents at the site were established based on either the prescribed limits in the CCR Rule or on the Upper Prediction Limits (UPLs) determined for the two upgradient (background) monitoring wells at the site (GW-7 and GW-22) during the eight background sampling rounds conducted between September 2016 and August 2017. In accordance with the CCR Rule requirements, GWPSs are set at the higher of the federal Maximum Contaminant Level (MCL) or UPL. For those constituents that don't have MCLs, the GWPSs are set at the higher of the EPA Risk Screening Level (RSL) or the UPL. The site-specific Appendix IV GWPSs are as follows:

			Northern Boundary (GW-22)		Western Boundary (GW-7)	
Appendix IV Constituents	Units	CCR Rule Limit	UPL	GWPS	UPL	GWPS
Antimony	mg/L	0.006	0.00241	0.006	0.00133	0.006
Arsenic	mg/L	0.01	0.300239	0.300239	0.00682	0.01
Barium	mg/L	2	0.093799	2	0.0934	2
Beryllium	mg/L	0.004	0.00157	0.004	NA	0.004
Cadmium	mg/L	0.005	0.00139	0.005	NA	0.005
T. Chromium	mg/L	0.1	0.00825	0.1	NA	0.1
Cobalt	mg/L	0.006	0.0076	0.0076	NA	0.006
Fluoride	mg/L	4	3.108	4	9.291	9.291
Lead	mg/L	0.015	0.00391	0.015	NA	0.015
Lithium	mg/L	0.04	0.016562	0.04	0.023374	0.04
Mercury	mg/L	0.002	0.00032	0.002	0.00031	0.002
Molybdenum	mg/L	0.1	0.125025	0.125025	0.006805	0.1
Selenium	mg/L	0.5	NA	0.5	NA	0.5
Thallium	mg/L	0.002	NA	0.002	NA	0.002
Ra226+Ra228	pCi/L	5	1.38	5	0.58	5

Note: "NA" indicates not applicable because constituent was not detected during the eight rounds of background sampling and analysis.

The GWPS listed above will be used to evaluate potential Appendix IV SSLs for the AM-1 and AM-2 data sets as noted in Section 4.1 of this Report.

4.3 APPENDIX IV ALTERNATIVE SOURCE DEMONSTRATION

FirstEnergy will determine whether it may be appropriate to perform an ASD for any Appendix IV constituents that may be identified as being at SSLs above applicable GWPS. As per the CCR Rule timeframe allowance (90-days), this determination will be made during the first quarter of 2019. Whatever determination is made, the associated recordkeeping, notification, and reporting will be performed in accordance with the applicable requirements of 40 CFR §§ 257.95, 96, 105, 106, and 107.

TABLES

TABLE 2-1
CCR RULE GROUNDWATER MONITORING SYSTEM WELL SUMMARY
McELROY's RUN CCB DISPOSAL FACILITY – 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

Well	Year Installed	Formation Monitored	Ground Surface Elevation (ft MSL)	Total Well Depth (ft bgs)	Monitored Interval (ft bgs)	Monitored Interval (ft MSL)	Casing ID and Material
Upgradient (Background)							
GW-7	1994	Grafton SS, Ames LS	918.40	101.2	75.7 – 100.7	817.70 – 842.70	4" - Sch. 40 PVC
GW-21*	2016	Morgantown SS	1033.01	234.2	214.2 – 234.2	798.77 – 818.77	2" - Sch. 40 PVC
GW-22	2016	Morgantown SS	1045.18	370.2	350.2 – 370.2	675.02 – 695.02	2.5" - Sch. 80 PVC
Downgradient							
GW-9	1994	Ames LS, Jane Lew SS, Pittsburgh RB	797.42	177.7	137.2 – 177.2	620.22 – 660.22	4" - Sch. 40 PVC
GW-19	1995	Birmingham RB, Grafton SS, Ames LS	920.64	238.9	198.9 – 238.9	681.74 – 721.74	2" - Sch. 40 PVC
GW-20	1995	Lower Clarksburg RB	923.00	150.5	100.5 – 150.5	772.50 – 822.50	2" - Sch. 40 PVC
GW-23	2016	Grafton SS	974.40	392.9	372.9 – 392.9	581.53 – 601.53	2.5" - Sch. 80 PVC
GW-24	2016	Grafton SS	941.55	271.1	251.1 – 271.1	670.50 – 690.50	2" - Sch. 40 PVC
GW-25	2016	Grafton SS	1006.22	303.7	283.7 – 303.7	702.53 – 722.53	2" - Sch. 40 PVC
GW-26*	2016	Grafton SS	984.16	288.2	268.2 – 288.2	695.95 – 715.95	2" - Sch. 40 PVC
GW-27	2016	Saltsburg SS	675.30	48.3	38.3 – 48.3	626.96 – 636.96	2" - Sch. 40 PVC
GW-28	2016	Saltsburg SS	801.95	175.6	165.6 – 175.6	626.38 – 636.38	2" - Sch. 40 PVC
GW-29	2016	Grafton SS	928.49	166.0	156.0 – 166.0	762.45 – 772.45	2" - Sch. 40 PVC

Notes: SS = sandstone LS = limestone RB = red beds MSL = mean sea level bgs = below ground surface ID = inside diameter
PVC = polyvinyl chloride * = currently used only for water level measurements

TABLE 3-1
CCR RULE GROUNDWATER DETECTION MONITORING STATISTICAL EVALUATION SUMMARY
McELROY'S RUN CCB DISPOSAL FACILITY - CCR SAMPLING EVENT DM-1

Northern Boundary				Downgradient Wells						
Parameter	Units	Data Distribution for Upgradient Well GW-22	UPL[a]	GW-9	GW-19	GW-20	GW-23	GW-24	GW-25[c]	GW-26[c]
Boron	mg/L	Normal	0.222	0.0945	0.226	0.229	0.178	0.292		
Calcium	mg/L	Normal	16.832	15.3	10.1	5.38	620	270		
Chloride	mg/L	Normal	380.891	7.54	571	490	11600	5520		
Fluoride	mg/L	Normal	3.108	0.221	1.47	4.8	0.0125	0.0125		
pH	S.U.	Normal	8.965 (7.400)[b]	7.68	7.63	8.11	6.84 (< LPL)	6.95 (< LPL)		
Sulfate	mg/L	Normal	85.395	119	0.14	28.6	0.079	7.24		
TDS	mg/L	Normal	1404.824	744	2320	1785	46100	19400		

Western Boundary				Downgradient Wells		
Parameter	Units	Data Distribution for Upgradient Well GW-7	UPL[a]	GW-27	GW-28	GW-29
Boron	mg/L	Normal	0.387	0.09015	0.215	0.301
Calcium	mg/L	Non-Parametric	3.08	45.9	5.91	11.5
Chloride	mg/L	Non-Parametric	104	107	631	910
Fluoride	mg/L	Normal	9.291	0.2655	1.95	1.14
pH	S.U.	Normal	8.451 (7.844)[b]	7.336 (< LPL)	7.66 (< LPL)	7.66 (< LPL)
Sulfate	mg/L	Log-Normal	0.537	8.645	0.263	0.654
TDS	mg/L	Non-Parametric	1260	522	2093.33333	2980

[a] Prediction Limits calculated using 5% alpha; Upper Prediction Limit used for all parameters, except pH where both upper and lower prediction limits were calculated.

[b] For pH, lower prediction limit shown in parantheses, both used for comparison.

[c] Downgradient wells GW-25 and -26 had insufficent recoverable volumes of water for sampling.

[green box] = Appendix III Parameter SSI

TETRA TECH

TABLE 3-2a
CCR RULE GROUNDWATER DETECTION MONITORING ANALYTICAL RESULTS SUMMARY
McELROY'S RUN CCB DISPOSAL FACILITY - 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

			APPENDIX III (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]						
SAMPLING EVENT NO.[2]	WELL ID[3]	SAMPLE DATE	BORON METALS MG/L	CALCIUM METALS MG/L	CHLORIDE MISC MG/L	FLUORIDE MISC MG/L	PH MISC S.U.	SULFATE MISC MG/L	TDS MISC MG/L
10 (DM-2)	GW-7	2/6/2018	0.284	2.68	101	7.67	8.28	0.083 J	1555
10 (DM-2)	GW-9 (D)	2/15/2018	0.0909 J	16.4	7.78	0.177	7.83	127	764
10 (DM-2)	GW-9	2/15/2018	0.0948 J	16.7	7.78	0.186	7.81	126	764
10 (DM-2)	GW-19	2/13/2018	0.231	9.62	609	1.65	7.64	0.049 J	2320
10 (DM-2)	GW-20	2/14/2018	0.238	5.22	472	5.67	8.05	29.7	1620
10 (DM-2)	GW-21	NS[4]							
10 (DM-2)	GW-22	2/15/2018	0.185 J	3.61	297	2.08	8.58	43	1180
10 (DM-2)	GW-23	2/8/2018	0.178 J	912	12300	0.422 J	6.88	0.031 UJ	24510
10 (DM-2)	GW-24	2/8/2018	0.331 J	357	6770	2.9 J	6.94	0.031 UJ	12500
10 (DM-2)	GW-25	NS[4]							
10 (DM-2)	GW-26	NS[4]							
10 (DM-2)	GW-27	2/12/2018	0.0857 J	50.7	113	0.26	7.61	5.76	520
10 (DM-2)	GW-28	2/6/2018	0.216	7.64	639	0.025 U	7.75	0.122 J	2100
10 (DM-2)	GW-29	2/12/2018	0.319	14	841	1.09	7.87	0.158 J	2870

			APPENDIX IV (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]													
SAMPLING EVENT NO.[2]	WELL ID[3]	SAMPLE DATE	ANTIMONY METALS MG/L	ARSENIC METALS MG/L	BARIUM METALS MG/L	BERYLLIUM METALS MG/L	CADMIUM METALS MG/L	CHROMIUM METALS MG/L	COBALT METALS MG/L	LEAD METALS MG/L	LITHIUM METALS MG/L	MERCURY METALS MG/L	MOLYBDENUM METALS MG/L	SELENIUM METALS MG/L	THALLIUM METALS MG/L	RADIUM-226 RADIOCHEM PCI/L	RADIUM-228 RADIOCHEM PCI/L
10 (DM-2)	GW-7	2/6/2018	0.00017 U	0.0006 J	0.07751 J-	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01983 J	0.00004 U	0.00041 J	0.0011 U	0.00017 U	0.0665 U	0.609
10 (DM-2)	GW-9 (D)	2/15/2018	0.00017 U	0.00039 J	0.05788	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01492 J	0.00004 U	0.00028 U	0.0011 UJ	0.00017 U	0.139	-0.0488 U
10 (DM-2)	GW-9	2/15/2018	0.00017 U	0.00071 J	0.06033	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01526 J	0.00004 U	0.00042 J	0.0011 UJ	0.00017 U	0.149	0.322 U
10 (DM-2)	GW-19	2/13/2018	0.00017 U	0.15238	1.07665	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01277 J	0.00004 U	0.00028 U	0.0022 UJ	0.00017 U	1.03	0.665
10 (DM-2)	GW-20	2/14/2018	0.0004 J	0.00202	0.20765	0.00022 U	0.0003 J	0.00073 J	0.00047 U	0.00054 J	0.01283 J	0.00004 U	0.09339	0.01775 J-	0.00017 U	0.293	0.205 U
10 (DM-2)	GW-21	NS[4]															
10 (DM-2)	GW-22	2/15/2018	0.00026 J	0.09507	0.03502	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00084 J	0.005 U	0.00004 U	0.09406	0.0011 UJ	0.00017 U	0.219	0.262 U
10 (DM-2)	GW-23	2/8/2018	0.00044 J	0.02801	10.48185 J-	0.00044 U	0.00035 U	0.0009 U	0.00257 J	0.00104 U	0.13749	0.00004 U	0.00748 J	0.00733 J	0.00035 U	22.6 J	49.8 J
10 (DM-2)	GW-24	2/8/2018	0.00053 J	0.03176	8.13099 J-	0.00044 U	0.00017 U	0.0009 U	0.00214 J	0.00052 U	0.0399 J	0.00004 U	0.01169	0.00264 J	0.00017 U	9.71	22.9
10 (DM-2)	GW-25	NS[4]															
10 (DM-2)	GW-26	NS[4]															
10 (DM-2)	GW-27	2/12/2018	0.00017 U	0.00027 J	0.81089 J-	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01435 J	0.00004 U	0.00407 J	0.0011 U	0.00017 U	0.467	0.377 U
10 (DM-2)	GW-28	2/6/2018	0.00017 U	0.00587	0.24682 J-	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01639 J	0.00004 U	0.03295	0.0011 U	0.00017 U	0.297	0.888
10 (DM-2)	GW-29	2/12/2018	0.00017 U	0.02115	1.04374 J-	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.03238	0.00004 U	0.00541	0.0011 U	0.00017 U	0.568	0.513

NOTES:

[1] Lab analyses were completed by Beta Lab and TestAmerica Laboratories, Inc., both of which are accredited/certified laboratories: Beta Lab ISO/IEC 17025 Cert No. 2489.01 (Exp. 11-30-20) and ISO/IEC 9001 Cert. No. 83761-IS7 (Exp. 01-16-21) and TestAmerica NELAP Identification Number: 02-00416, EPA Region: 3, Expiration Date: 04-30-19.

[2] Event No. 10 corresponds to Detection Monitoring (DM) sampling event DM-2.

[3] Field duplicate samples that were taken for Quality Control purposes are noted with a (D).

[4] NS = not sampled. For GW-21 this occurred due to impassibility of the well access road. For GW-25 and -26 this occurred due to an insufficient volume of recoverable water in each well.

DATA QUALIFER DEFINITIONS:

The following definitions provide brief explanations of the validation qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted method detection limit for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the reporting limit).
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for, but was not detected. The reported detection limit is approximate and may be inaccurate or imprecise.
R	The sample result (detected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample
UR	The sample result (nondetected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample.

TABLE 3-2b

CCR RULE GROUNDWATER ASSESSMENT MONITORING ANALYTICAL RESULTS SUMMARY

McELROY'S RUN CCB DISPOSAL FACILITY - 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

			APPENDIX III (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]							APPENDIX IV (all Chemical Constituents reported as TOTAL RECOVERABLE)[1]														
SAMPLING EVENT NO.[2]	WELL ID[3]	SAMPLE DATE	BORON METALS MG/L	CALCIUM METALS MG/L	CHLORIDE MISC MG/L	FLUORIDE MISC MG/L	PH MISC S.U.	SULFATE MISC MG/L	TDS MISC MG/L	ANTIMONY METALS MG/L	ARSENIC METALS MG/L	BARIUM METALS MG/L	BERYLLIUM METALS MG/L	CADMIUM METALS MG/L	CHROMIUM METALS MG/L	COBALT METALS MG/L	LEAD METALS MG/L	LITHIUM METALS MG/L	MERCURY METALS MG/L	MOLYBDENUM METALS MG/L	SELENIUM METALS MG/L	THALLIUM METALS MG/L	RADIUM-226 RADIOCHEM PCI/L	RADIUM-228 RADIOCHEM PCI/L
11 (AM-1)	GW-7	5/22/2018	0.2872	2.62	105	7.89 J-	8.33	0.093 J	1300	0.00017 U	0.00075 U	0.0811	0.00022 UJ	0.00017 UJ	0.00045 U	0.00047 UJ	0.00052 UJ	0.02062 J	0.00004 UJ	0.00028 U	0.0055 UJ	0.00017 UJ	0.232 U	0.0518 U
12 (AM-2)	GW-7	8/6/2018	0.306	2.48	107	7.61 J-	8.22	0.132 J	1340	0.00017 U	0.0006 U	0.07365	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01916 J	0.00004 U	0.00028 U	0.0044 U	0.00017 U	1 U	-0.0483 U
11 (AM-1)	GW-9	5/17/2018	0.0865 J	15.582	7.94	0.224	7.76	127	752	0.00017 U	0.00033 J	0.05607	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01629 J	0.00004 U	0.00033 J	0.0011 U	0.00017 U	0.147	0.0343 U
12 (AM-2)	GW-9	8/16/2018	0.0862 J	15.506	7.98	0.139	7.79	117	812	0.00017 U	0.00068 J	0.05274	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01462 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	1 U	0.616 J+
11 (AM-1)	GW-19	5/17/2018	0.2257	10.117	594	1.59	7.54	0.031 U	2246.667	0.00017 U	0.12848 J-	1.11921	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01403 J	0.00004 U	0.00028 U	0.0044 U	0.00017 U	1.11	0.447
12 (AM-2)	GW-19	8/14/2018	0.2183	9.57	546	1.71	7.59	0.031 U	2353.333	0.00017 U	0.08846	1.08458	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01314 J	0.00004 U	0.00028 U	0.0011 U	0.00017 U	1.6	0.486 U
11 (AM-1)	GW-20	5/24/2018	0.2162	5.31	475	5.58 J-	8.1	29.1 J-	1860	0.00022 U	0.00208	0.18475	0.00022 UJ	0.00017 UJ	0.00188 J	0.00047 UJ	0.00052 UJ	0.01344 J	0.00004 UJ	0.09681	0.01997 J-	0.00017 UJ	0.0617 U	1.542 U
12 (AM-2)	GW-20	8/14/2018	0.2181	9.73	484	5.61	8.1	28.8	1826.667	0.00024 U	0.00235	0.18929	0.00022 U	0.00021 J	0.00138 J	0.00047 U	0.00052 U	0.01361 J	0.00004 U	0.09825	0.01718	0.00017 U	1 U	0.345 U
11 (AM-1)	GW-21	5/21/2018	0.1144 J	10.365	523	2.91 J-	8.42	263	2053.333	0.00107	0.0189 J-	0.09837	0.00022 U	0.00017 U	0.00092 J	0.00067 J	0.00058 J	0.00554 J	0.00004 U	0.25122	0.11488 J-	0.00017 U	0.354	1.542 U
12 (AM-2)	GW-21	8/13/2018	0.1322 J	8.61	579	2.86	8.38	264	2140	0.00117 U	0.01932	0.09648	0.00022 U	0.00033 J	0.00097 J	0.00063 J	0.00052 U	0.00569 J	0.00004 U	0.25685	0.11687	0.00017 U	1 U	1 U
11 (AM-1)	GW-22	5/24/2018	0.1768 J	3.83	365	2.32 J-	8.08	41.1 J-	1365	0.00017 U	0.10861	0.03841	0.00022 UJ	0.00017 UJ	0.00045 U	0.00047 UJ	0.00052 UJ	0.005 UJ	0.00004 UJ	0.10859	0.0011 UJ	0.00017 UJ	0.554	0.557 U
12 (AM-2)	GW-22	8/15/2018	0.1848 J	4.07	467	2.2	8.39	37.7	1415	0.00039 U	0.12013	0.03547	0.00022 U	0.00017 U	0.00049 J	0.00047 U	0.00168 J	0.005 U	0.00004 U	0.11226	0.0011 U	0.00017 U	1 U	0.163 UJ
11 (AM-1)	GW-23	5/22/2018	0.2351 J	925	12600	0.025 UJ	6.88	0.079 J	46300	0.00089 U	0.02904	10.40809	0.00022 UJ	0.00017 UJ	0.0009 U	0.00217 J	0.00052 UJ	0.1054 J-	0.00004 UJ	0.00568	0.00279 J	0.00017 UJ	31.7 J	54.9 J
12 (AM-2)	GW-23	8/8/2018	0.2177	709	13000	0.062 J	6.86	0.399 J-	49700	0.00068 J	0.02875	10.51039	0.00022 U	0.00017 U	0.00045 U	0.00211 J	0.00052 U	0.11306	0.00004 U	0.00481 J	0.0022 U	0.00017 U	27.3 J	58.3 J
11 (AM-1)	GW-24	5/21/2018	0.3097	306	7590	0.025 UJ	6.87	0.031 U	25300	0.00045 J	0.02311 J	8.53453	0.00022 U	0.00017 U	0.0005 J	0.00184 J	0.00052 U	0.03662	0.00004 U	0.00711	0.0011 U	0.00017 U	17.2 J	32 J
12 (AM-2)	GW-24	8/8/2018	0.3303	310	9490	0.25 U	6.9	0.089 J	26400	0.00045 J	0.02401	10.27638	0.00022 U	0.00017 U	0.00045 U	0.00162 J	0.00052 U	0.03499	0.00004 U	0.00658	0.0011 U	0.00017 U	13.4	25.5
11 (AM-1)	GW-25	5/22/2018	0.1522 J	304	6220	0.025 UJ	7.45	0.091 J	23800	0.00025 U	0.04674	6.69065	0.00024 J	0.00017 UJ	0.00947	0.00213 J	0.00599 J-	0.02067 J	0.00004 UJ	0.01146	0.0011 UJ	0.00017 UJ	10.9	13.3 J
12 (AM-2)	GW-25	8/9/2018	0.1519 J	277	6880	0.536 J	7.34	0.361 J-	24300	0.00041 J	0.04887	7.03146	0.00022 U	0.00017 U	0.00464 J	0.00143 J	0.00306	0.02258 J	0.00004 U	0.01186	0.0011 U	0.00017 U	11.5	16.9
11 (AM-1)	GW-26	NS[4]																						
12 (AM-2)	GW-26	NS[4]																						
11 (AM-1)	GW-27 (D)	5/21/2018	0.0679 J	49.197	123	0.26 J-	7.57	6.63	540	0.00017 U	0.00042 J	0.83016	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01333 J	0.00004 U	0.00457 J	0.0011 U	0.00017 U	0.448	0.207 U
11 (AM-1)	GW-27	5/21/2018	0.0716 J	50.052	123	0.281 J-	7.58	6.87	532	0.00017 U	0.0003 J	0.80552	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01288 J	0.00004 U	0.00472 J	0.0011 U	0.00017 U	0.599	1.542 U
12 (AM-2)	GW-27 (D)	8/13/2018	0.0855 J	51.093	122	0.251	7.51	6.99	540	0.00017 U	0.00048 J	0.84273	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01274 J	0.00013 J	0.00376 J	0.0011 U	0.00017 U	1 U	1 U
12 (AM-2)	GW-27	8/13/2018	0.0812 J	48.141	122	0.296	7.5	7.15	552	0.00017 U	0.00046 J	0.85732	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01264 J	0.00004 U	0.00546	0.0011 U	0.00017 U	1 U	1 U
11 (AM-1)	GW-28	5/16/2018	0.2103	6.89	680	1.91	7.71	0.079 J	2093.333	0.00017 U	0.00494 J-	0.23483	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01558 J	0.00004 U	0.03037	0.0011 U	0.00017 U	0.304	1 U
12 (AM-2)	GW-28	8/7/2018	0.2362	6.57	756	2.06	7.66	0.065 J	2220	0.00017 U	0.00512	0.2713	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.01811 J	0.00004 U	0.03482	0.0011 U	0.00017 U	1 U	0.0411 U
11 (AM-1)	GW-29	5/16/2018	0.3126	13.881	964	1.1	7.79	1.06	3000	0.00017 U	0.01792 J-	1.01725	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.03304	0.00004 U	0.00421 J	0.0011 U	0.00017 U	0.631	0.35 U
12 (AM-2)	GW-29	8/7/2018	0.3122	10.999	1060	1.23	7.62	0.402	3170	0.00017 U	0.01337	0.94805	0.00022 U	0.00017 U	0.00045 U	0.00047 U	0.00052 U	0.03224	0.00004 U	0.0039 J	0.0011 U	0.00017 U	1 U	0.393 U

NOTES:

[1] Lab analyses were completed by Beta Lab and TestAmerica Laboratories, Inc., both of which are accredited/certified laboratories: Beta Lab ISO/IEC 17025 Cert No. 2489.01 (Exp. 11-30-20) and ISO/IEC 9001 Cert. No. 83761-IS7 (Exp. 01-16-21) and TestAmerica NELAP Identification Number: 02-00416, EPA Region: 3, Expiration Date: 04-30-19.

[2] Event Nos. 11 and 12 correspond to Assessment Monitoring (AM) sampling events AM-1 and AM-2, respectively.

[3] Field duplicate samples that were taken for Quality Control purposes are noted with a (D).

[4] NS = not sampled. For GW-26 this occurred due to an insufficient volume of recoverable water in well.

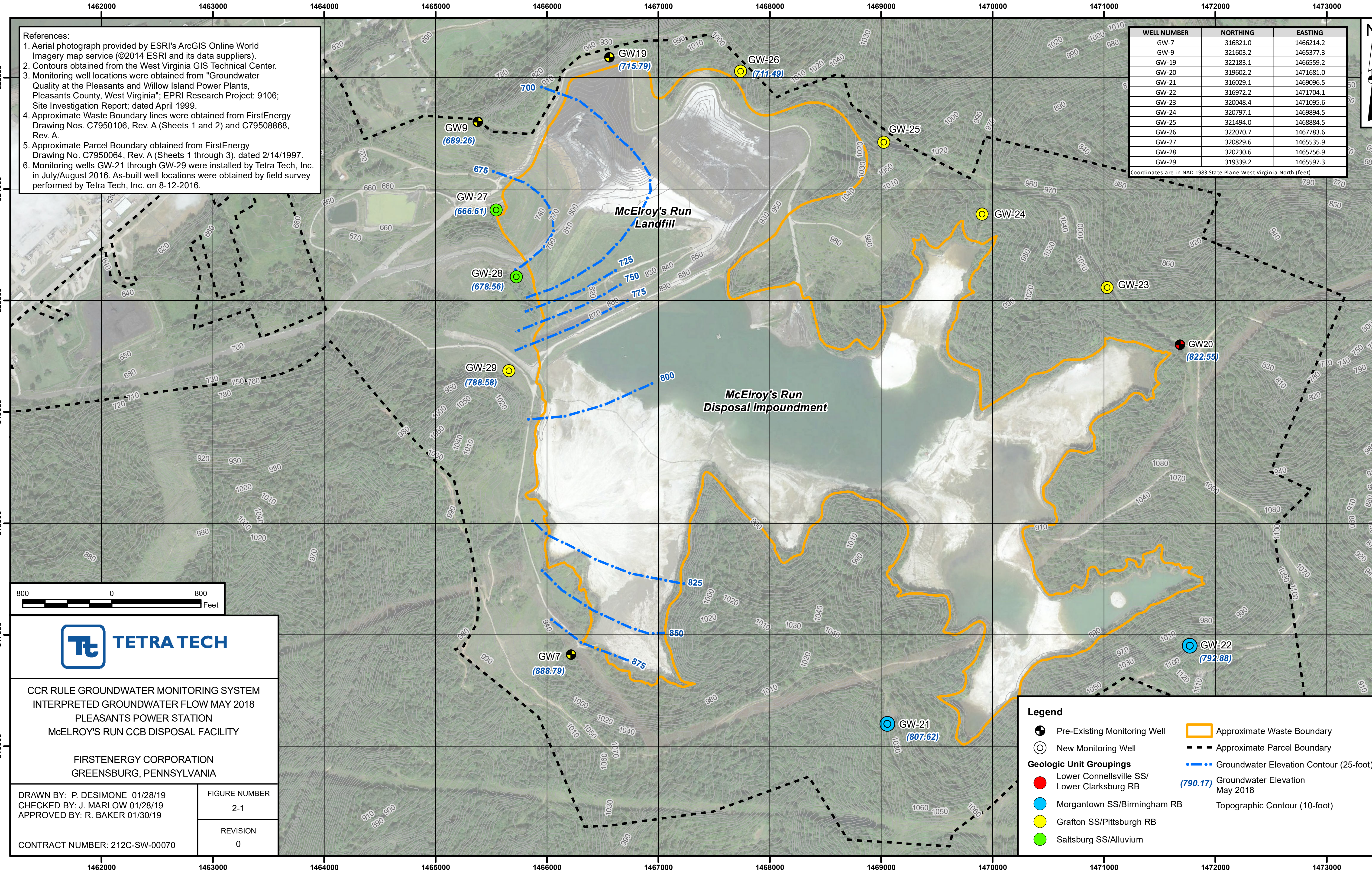
DATA QUALIFER DEFINITIONS:

The following definitions provide brief explanations of the validation qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted method detection limit for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the reporting limit).
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for, but was not detected. The reported detection limit is approximate and may be inaccurate or imprecise.
R	The sample result (detected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample
UR	The sample result (nondetected) is unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in sample.

FIGURES

PGH P:\GIS\FIRST_ENERGY\MAPDOCS\PLEASANTS_POWERSTATION_PROPOSED_MAY2018_CCR.MXD 01/30/19 PD



References:

1. Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (©2014 ESRI and its data suppliers).
2. Contours obtained from the West Virginia GIS Technical Center.
3. Monitoring well locations were obtained from "Groundwater Quality at the Pleasants and Willow Island Power Plants, Pleasants County, West Virginia"; EPRI Research Project: 9106; Site Investigation Report; dated April 1999.
4. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C7950106, Rev. A (Sheets 1 and 2) and C79508868, Rev. A.
5. Approximate Parcel Boundary obtained from FirstEnergy Drawing No. C7950064, Rev. A (Sheets 1 through 3), dated 2/14/1997.
6. Monitoring wells GW-21 through GW-29 were installed by Tetra Tech, Inc. in July/August 2016. As-built well locations were obtained by field survey performed by Tetra Tech, Inc. on 8-12-2016.

WELL NUMBER	NORTHING	EASTING
GW-7	316821.0	1466214.2
GW-9	321603.2	1465377.3
GW-19	322183.1	1466559.2
GW-20	319602.2	1471681.0
GW-21	316029.1	1469096.5
GW-22	316972.2	1471704.1
GW-23	320048.4	1471095.6
GW-24	320797.1	1469894.5
GW-25	321494.0	1468884.5
GW-26	322070.7	1467783.6
GW-27	320829.6	1465535.9
GW-28	320230.6	1465756.9
GW-29	319339.2	1465597.3

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

- Pre-Existing Monitoring Well
- New Monitoring Well
- Approximate Waste Boundary
- Approximate Parcel Boundary
- Groundwater Elevation Contour (25-foot)
- (790.17) Groundwater Elevation May 2018
- Topographic Contour (10-foot)

Geologic Unit Groupings

- Lower Connellsville SS/ Lower Clarksburg RB
- Morgantown SS/Birmingham RB
- Grafton SS/Pittsburgh RB
- Saltsburg SS/Alluvium

TETRA TECH

CCR RULE GROUNDWATER MONITORING SYSTEM
INTERPRETED GROUNDWATER FLOW MAY 2018
PLEASANTS POWER STATION
McELROY'S RUN CCB DISPOSAL FACILITY

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: P. DESIMONE 01/28/19
CHECKED BY: J. MARLOW 01/28/19
APPROVED BY: R. BAKER 01/30/19

CONTRACT NUMBER: 212C-SW-00070

FIGURE NUMBER 2-1

REVISION 0

ATTACHMENT A

CCR Appendix III Alternative Source Demonstration Report – 2017 Detection Monitoring

McElroy's Run Coal Combustion Byproduct Disposal Facility

Pleasants Power Station
Pleasants County, West Virginia

Prepared for:

FirstEnergy

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Greensburg, PA 15601

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Tetra Tech Project No. 212C-SW-00070

April 16, 2018

CCR APPENDIX III ALTERNATIVE SOURCE DEMONSTRATION REPORT
2017 DETECTION MONITORING

McELROY'S RUN COAL COMBUSTION BYPRODUCT DISPOSAL FACILITY

PLEASANTS POWER STATION
PLEASANTS COUNTY, WEST VIRGINIA

Prepared for:

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Tetra Tech Project No. 212C-SW-00070

April 16, 2018

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1.0 INTRODUCTION/BACKGROUND

FirstEnergy (FE) owns and operates the coal-fired Pleasants Power Station (hereinafter referred to as the "Station") located in Pleasants County, West Virginia. Coal Combustion Residuals (CCRs) produced at the Station are placed in the facility's Coal Combustion Byproduct Disposal Facility (CCBDF or "CCR unit"), which is located approximately one mile east-southeast of the Station. The facility consists of both a wet disposal area (impoundment) and dry disposal area (landfill) developed in the McElroy's Run watershed. Taken together, the landfill and impoundment are regulated under West Virginia Department of Environmental Protection (WVDEP) Solid Waste/National Pollutant Discharge Elimination System (NPDES) Water Pollution Control Permit No. WV0079171, and the United States Environmental Protection Agency (USEPA) Disposal of Coal Combustion Residuals from Electric Utilities rule (40 CFR Part 257, hereinafter referred to as the "CCR Rule" or "Rule"). As per the CCR Rule, the landfill and impoundment are considered two separate, existing CCR units that share a common boundary (the impoundment dam). As provided by the CCR Rule, a multiunit groundwater monitoring system has been established for the CCBDF.

In accordance with § 257.94 of the Rule, the initial Detection Monitoring (DM) sampling and analysis event for the CCR unit was completed in October 2017, and the statistical evaluation of the resulting data was completed in January 2018. As required by § 257.90(e), results and findings from the 2017 groundwater monitoring program were documented in an Annual Groundwater Monitoring and Corrective Action Report that was posted in both the CCR unit's operating record and on its publicly accessible website in January 2018 (Tetra Tech, 2018). Subsequent to the monitoring period documented in that report, Statistically Significant Increases (SSIs) for the following CCR Rule Appendix III parameters were determined in the downgradient monitoring wells (labeled "GW-#") as summarized in the following table:

	Northern Boundary (Upgradient Well GW-22)					Western Boundary (Upgradient Well GW-7)		
Appendix III Parameters	**GW-9**	**GW-19**	**GW-20**	**GW-23**	**GW-24**	**GW-27**	**GW-28**	**GW-29**
Boron (B)		SSI	SSI		SSI			
Calcium (Ca)				SSI	SSI	SSI	SSI	SSI
Chloride (Cl)		SSI	SSI	SSI	SSI	SSI	SSI	SSI
Fluoride (F)			SSI					
pH				SSI	SSI	SSI	SSI	SSI
Sulfate (SO_4)	SSI					SSI		SSI
TDS		SSI	SSI	SSI	SSI		SSI	SSI

Note: Northern Boundary wells GW-25 and -26 were not sampled during the initial Detection Monitoring event due to insufficient water.

40 CFR § 257.94(e)(2) allows the owner or operator of a CCR unit 90 days from the date of determining that an SSI has occurred to demonstrate that a source other than the CCR unit caused the SSI or that the apparent SSI was from a source other than the CCR unit or resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to § 257.94(e)(2), this Alternative Source Demonstration (ASD) report has been prepared to assess if the Appendix III SSIs determined for the October 2017 DM event are attributable to a release from the CCR unit or from a demonstrable alternative source(s).

2.0 APPROACH

For this ASD, a multiple Line of Evidence (LOE) approach as presented in *Guidance for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites* (EPRI, 2017) was followed. This approach divides LOEs into five separate ASD categories (types):

- Sampling causes (ASD Type I);
- Laboratory causes (ASD Type II);
- Statistical evaluation causes (ASD Type III);
- Natural variation not accounted for in the basic DM statistics (ASD Type IV); and
- Potential natural or anthropogenic sources (ASD Type V).

EPRI (2017) includes detailed checklists that provide a standardized, incremental approach that is followed to determine whether additional LOE evaluations are warranted or not. These checklists include:

- Checklist 1: Sampling, Laboratory, or Statistical Causes (ASD Types I, II, and III);
- Checklist 2: LOEs Associated with the CCR Unit (ASD Type IV); and
- Checklist 3: LOEs Associated with Alternative Natural or Anthropogenic Sources (ASD Type V).

For this ASD only Checklists 1 and 2 were completed. Based on indications from these checklists as well as the CCR unit's topographic and geologic setting, development and operational history, and currently available information and data, it was determined that most of the LOEs in Checklist 3 were either not applicable, indeterminate, or that defensible demonstrations could not be made. However, additional evaluations of the following site-specific LOEs were performed:

- Regional groundwater chemistry studies/reports;
- Potential existing and historic oil and/or gas extraction well effects; and
- Potential off-site sources.

The findings from the checklist completion activities and site-specific LOE evaluations are summarized in Section 3.0.

3.0 SUMMARY OF FINDINGS

3.1 ASD CHECKLIST 1

ASD Checklist 1 is attached as Table 1 of this report. The checklist evaluations were performed by re-reviewing the CCR groundwater monitoring program's field sampling notes and chain-of-custody forms, laboratory data validation (Level 2) reports, statistical evaluation spreadsheets, and results from field-filtered duplicate samples that were obtained during events where turbid unfiltered samples had been obtained. Referring to Table 1 it's seen that for many potential sampling, laboratory, or statistical evaluation causes, no instances/issues/indications were identified. Turbidity may be a contributing factor for all the Appendix III SSIs (especially Chloride) in GW-20 since turbidity was elevated (>10 NTU) in Event 9, and potential petroleum and/or brine contamination from on-site oil and gas production activities could be a contributing factor to the SSIs for Calcium, Chloride, and TDS in GW-23 -24, and -25. For other potential causes where some issues were identified, it was determined that they most likely did not contribute to the Appendix III SSIs. Based on these LOE findings, sampling, laboratory analysis, and statistical evaluations are not demonstrable alternative sources of all the Appendix III SSIs determined for the October 2017 DM event.

3.2 ASD CHECKLIST 2

ASD Checklist 2 is attached as Table 2 of this report. The checklist evaluations were performed by re-reviewing the groundwater analytical results (background and DM) for both Appendix III and IV parameters provided in Tetra Tech (2018), leachate data for the CCR unit provided by FE (summarized in attached Table 3), and hydrogeologic and design information and data included in *CCR Rule Groundwater Monitoring System Evaluation Report for the Pleasants Power Station* (Tetra Tech, 2017). For the LOEs in Checklist 2, the following evaluation criteria were used:

- Primary Indicators – As per Table A-1 in EPRI (2017), primary indicator constituents for CCRs include the CCR Rule parameters Boron (Appendix III), Calcium (Appendix III), Chloride (Appendix III), Fluoride (Appendix III and IV), Lithium (Appendix IV), Molybdenum (Appendix IV), and Sulfate (Appendix III), as well as Bromide, Potassium, and Sodium, which are parameters that are not listed in the CCR Rule.
- Secondary Indicators – For this ASD, secondary indicator constituents for CCRs include those Appendix III and IV constituents that are not considered primary indicators.

- Leachate Data – Analytical results from the October 2017 sampling event at the CCR unit (three locations – LM1, LM5, and LM7) were used for comparison to the October 2017 DM results. These results and associated comparisons are attached as Table 3 of this report.
- Site Hydrogeology - As discussed in in the *CCR Rule Groundwater Monitoring System Evaluation Report* (Tetra Tech, 2017), groundwater in the CCBDF area occurs primarily within the fractured bedrock of multiple Conemaugh Group sandstone units including the Morgantown, Grafton, Jane Lew, and Saltsburg, which have been collectively identified as the uppermost aquifer for CCR Rule groundwater monitoring for the combined landfill and impoundment units. Historic and recent groundwater level data indicate groundwater flow at the site as flowing north from the topographically higher areas located to the south and southeast of the impoundment. Groundwater flow northwest of the dam and under the landfill is in the downstream direction of McElroy's Run toward the west. Flow in all of the rock units exhibit very little seasonal and temporal fluctuations. The CCR groundwater monitoring well network at the site is shown on Figure 1 and consists of three upgradient (background) wells (GW-7, -21, and -22), six downgradient wells to monitor the northern side of the combined CCR units (GW-19, -20, -23, -24, -25, and -26), and four downgradient wells to monitor the western side of the combined CCR units (GW-9, -27, -28, and -29).

  Having sufficient recoverable volumes of groundwater from one of the new upgradient (GW-21) and three of the new downgradient (GW-23, -24, and -25) wells was found to be problematic during both the background and initial Detection Monitoring sampling events. These four wells were noted to have low to very low yields during their installation and development which was anticipated given that historical well borings drilled at the site under the WVDEP groundwater monitoring program were abandoned over time due to a lack of water in the same rock units. During the initial Detection Monitoring sampling event, sufficient recoverable groundwater volumes were found to be available in GW-23 and -24 but not in GW-21, -25, or in an additional downgradient well, GW-26. Geologic and hydrogeologic characteristics of the site, the monitoring well network, and the initial Detection Monitoring results are discussed in greater detail in both Tetra Tech 2017 and 2018.
- CCR Unit Design - As shown on Figure 1, the CCR unit consists of two conterminous disposal areas, an impoundment and a landfill, that share a common boundary (i.e., the impoundment dam). The majority of the CCR material that has been disposed of at the

site is managed in an unlined impoundment created by a dam constructed across McElroy's Run. The dam was constructed with a clay-filled cutoff trench at the upstream toe and a clay blanket on the upstream face to function as a low permeability barrier. The downstream portion of the dam was constructed using compacted fly ash and periodic layers of bottom ash for blanket drains connected to sloping chimney drains that collect seepage to discharge pipes for monitoring. The downstream face of the dam is covered by the landfill facility which WVDEP considers to be a buttress to the dam.

The landfill consists of three primary development stages which are further subdivided into construction subareas. At this time, development and disposal operations have only been performed in Stages 1 and 2 and the Stage 3 area remains undeveloped. Up until 2009 all of the landfill subareas were constructed with a compacted clay liner system that included an underlying combined groundwater underdrain/leak detection system and an overlying leachate collection system. Since 2009 a composite geosynthetic liner system (geosynthetic clay liner and geomembrane) has been utilized that also includes an underlying combined groundwater underdrain/leak detection system and an overlying leachate collection system. For all portions of the landfill that overlie the downstream face of the impoundment dam, a bottom ash blanket drain layer has also been utilized. Leachate and contact stormwater runoff from the landfill disposal areas are managed in Sedimentation Pond Nos. 1 and 2, which are lined impoundments located immediately down-valley of the future Stage 3 landfill development area. These impoundments also accept flows from the groundwater underdrain/leak detection zones and stormwater runoff from portions of the landfill's South Haul Road. Discharges from Sedimentation Pond Nos. 1 and 2 are pumped up to the CCR disposal impoundment and, ultimately, routed through the impoundment's dewatering system.

Based on the various LOE findings presented in Table 2, at least one or more of the Appendix III SSIs determined for the October 2017 DM event can most likely be attributed to a release from the CCR unit.

3.3 REGIONAL GROUNDWATER STUDY

In an effort to evaluate the natural variation in groundwater quality in the various water producing units of the Conemaugh Group (e.g., Morgantown, Grafton, Jane Lew, and Saltsburg sandstones) which comprise the CCR Rule uppermost aquifer, *Ground-Water Hydrology of the Minor Tributary Basins of the Ohio River, West Virginia* (USGS, 1984) was reviewed. Table 1 of the subject report includes concentration data for three Appendix III constituents for which there were SSIs at the site: Chloride, Sulfate and TDS. It is noted that the study results were reported as dissolved concentrations while the CCR analytical results are reported as total (unfiltered) concentrations. In general, total (unfiltered) concentrations for the same sample would be expected to be higher than dissolved concentrations. The following table presents the range and mean concentrations reported for these constituents in Conemaugh Group wells:

	Dissolved Chloride (mg/L)	Dissolved Sulfate (mg/L)	TDS (mg/L)
No. of Wells	6	6	6
Range	2.6 - 130	10 - 88	241 - 589
Mean	31	37	371

Based on these reported values, the following observations were made:

- **Chloride -** The reported mean concentration of 31 mg/L is below the upper prediction limits (UPLs) for both upgradient wells GW-22 (381 mg/L) and GW-7 (104 mg/L). The reported maximum concentration of 130 mg/L is also below the GW-22 UPL and slightly higher than the GW-7 UPL. With respect to downgradient wells with SSIs, the reported maximum concentration of 130 mg/L is slightly higher than the concentration for GW-27 (107 mg/L) and well below the concentrations for GW-19 (571 mg/L), GW-20 (490 mg/L), GW-23 (11,600 mg/L), GW-24 (5,520 mg/L), GW-28 (631 mg/L), and GW-29 (910 mg/L).
- **Sulfate** – The reported mean concentration of 37 mg/L is below the GW-22 UPL of 85 mg/L and significantly higher than the GW-7 UPL of 0.5 mg/L. The reported maximum sulfate concentration of 88 mg/L is essentially equal to the GW-22 UPL and much higher than the GW-7 UPL. With respect to downgradient wells with SSIs, the reported maximum concentration of 88 mg/L is higher than the concentrations for GW-27 (8.6 mg/L) and GW-28 (0.7 mg/7) and below the concentration for GW-9 (119 mg/L).
- **TDS** – The reported mean concentration of 371 mg/L is well below the UPLs for both GW-22 (1,481 mg/L) and GW-7 (1,260 mg/L). The reported maximum TDS concentration of 589 mg/L is also well below both the GW-22 and GW-7 UPLs. With respect to downgradient wells with SSIs, the reported maximum concentration of 589 mg/L is well below the concentrations for GW-19 (2,320 mg/L), GW-20 (1,785 mg/L), GW-23 (46,100 mg/L), GW-24 (19,400 mg/L), GW-9 (744 mg/L), GW-28 (2,093 mg/L), and GW-29 (2,980 mg/L).

The comparisons noted above indicate that upgradient Chloride and TDS concentrations at the site appear to be higher than the concentrations measured in regional Conemaugh Group groundwater during the USGS study period, while upgradient Sulfate concentrations appear to be within the range of or below the concentrations measured in the study. However, comparing the maximum reported study results to the corresponding downgradient SSI concentrations indicates that almost all of the SSI concentrations are higher to much higher than those for regional groundwater. Taken together and given the limited information on the natural variation of the SSI constituents that was identified under the scope of this ASD, there may be natural levels of Chloride and TDS in the site area that could have resulted in some, but not all, of the SSIs identified for those constituents.

3.4 POTENTIAL FOR OIL AND GAS WELL IMPACTS

In an effort to evaluate the potential for oil and gas well development on and near the site to impact groundwater quality for the SSI constituents, particularly chloride and TDS, the locations of oil and gas wells and basic information on the wells (e.g., total depth, date drilled, status, etc.) were obtained from the West Virginia Geologic and Economic Survey (WVGES) online oil and gas well database (http://ims.wvgs.wvnet.edu/WVOG/viewer.htm). Figure 2 presents the locations of these wells relative to the CCR monitoring well network. A total of more than 100 existing or plugged/abandoned oil and gas wells were identified as shown on Figure 2. The table below summarizes key information for these wells obtained from the database records:

API #	Completion Year	Well Type	Operator	Total Depth (ft)	Deepest Formation
4707300005		Oil	Oper in Min.owner fld,no code assgn(Orphan well proj)	1052	Undiff Price below Big Injun
4707300008		Oil	Oper in Min.owner fld,no code assgn(Orphan well proj)	512	Undetermined unit
4707300043	1935	Dry w/ Oil Show	All In One Producing & Refining Co., The	71	Big Injun (Price & equivs)
4707300069	1936	Oil w/ Gas Show	Feeney Oil & Gas	1600	Squaw
4707300069	1941	Dry w/ O&G Show	Feeney Oil & Gas	3379	Berea Sandstone
4707300073		Dry	Love, C. E.	1903	
4707300124	1939	Oil w/ Gas Show	Columbian Carbon Co.	5311	Oriskany Sandstone
4707300170	1940	Oil w/ Gas Show	Columbian Carbon Co.	2280	Up Devonian undiff:Berea to Lo Huron
4707300179	1940	Dry w/ Gas Show	Columbian Carbon Co.	2930	Berea Sandstone
4707300183	1940	Dry	Columbian Carbon Co.	2930	Berea Sandstone
4707300192	1941	Dry w/ Oil Show	Faith Oil Co.	430	Buffalo Ss (Lit Dunkard)/1st Cow Run
4707300578	1959	Dry w/ O&G Show	Smellie & Myers	2527	Up Devonian undiff:Berea to Lo Huron

API #	Completion Year	Well Type	Operator	Total Depth (ft)	Deepest Formation
4707300588	1960	Dry	Daugherty, John	1217	Maxton
4707300611	1962	Dry w/ O&G Show	Quaker State Oil Refining Co.	1727	Berea Sandstone
4707300646	1968	Dry	Holton, Harry A.	5684	Salina
4707300682	1974	Gas	McDuff, Inc.	3297	Up Devonian undiff:Berea to Lo Huron
4707300684	1974	Gas	McDuff, Inc.	3179	Up Devonian undiff:Berea to Lo Huron
4707300913	1980	Oil and Gas	Haught, Inc.	3911	Lower Huron (undifferentiated)
4707300914	1980	Oil and Gas	Haught, Inc.	4011	Lower Huron (undifferentiated)
4707300915	1980	Oil and Gas	Haught, Inc.	4286	Lower Huron (undifferentiated)
4707300975	1980	Oil and Gas	Prior, Ferrell L.	3906	Java Formation
4707300976	1980	Oil and Gas	Prior, Ferrell L.	3646	Java Formation
4707300976	1989	Gas w/ Oil Show	Dupke, Roger	3646	Lower Huron (undifferentiated)
4707300996	1980	Oil and Gas	Prior, Ferrell L.	4129	Java Formation
4707301025	1980	Oil and Gas	Prior, Ferrell L.	3100	Lower Huron (undifferentiated)
4707301026	1981	Oil and Gas	Prior, Ferrell L.	3557	Lower Huron (undifferentiated)
4707301033	1980	Oil and Gas	Haught, Inc.	3990	Angola Formation
4707301087	1981	Oil and Gas	Prior, Ferrell L.	4050	Java Formation
4707301368	1981	Gas	Shafer Oil & Gas Corp.	4350	Rhinestreet Shale
4707301594	1983	Gas w/ Oil Show	Jenkins Energy Corp. & H. Davis Jenkins	4761	Rhinestreet Shale
4707301595	1983	Gas w/ Oil Show	Jenkins Energy Corp. & H. Davis Jenkins	4940	Rhinestreet Shale
4707301595	2011	not available	Ritchie Petroleum Corp., Inc.		
4707301596	1983	Gas w/ Oil Show	Jenkins Energy Corp. & H. Davis Jenkins	4769	Rhinestreet Shale
4707301597	1984	Dry w/ O&G Show	Stalnaker, Gene, Inc.	5059	Angola Formation
4707301604	1983	Oil and Gas	Jenkins Energy Corp. & H. Davis Jenkins	2038	Up Devonian undiff:Berea to Lo Huron
4707301630	1983	Dry w/ O&G Show	Stalnaker, Gene, Inc.	5050	Rhinestreet Shale
4707301635	1983	Dry w/ O&G Show	Stalnaker, Gene, Inc.	5060	Middlesex Shale
4707302514	2009	Gas w/ Oil Show	Patchwork Oil & Gas, LLC	2514	Up Devonian undiff:Berea to Lo Huron
4707302514	2009	Dry w/ Oil Show	Patchwork Oil & Gas, LLC	2125	Up Devonian undiff:Berea to Lo Huron
4707330089		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330090		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330113		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330115		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330127		not available	Faith Oil Co.		

API #	Completion Year	Well Type	Operator	Total Depth (ft)	Deepest Formation
4707330196		not available	Delong, J. R.		
4707330250		Oil and Gas	Oper in Min.owner fld,no code assgn(Orphan well proj)	884	Big Injun (undifferentiated)
4707330251		Oil and Gas	Oper in Min.owner fld,no code assgn(Orphan well proj)	820	Maxton
4707330258		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330270		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330271		not available	Oper in Min.owner fld,no code assgn(Orphan well proj)		
4707330593		not available	Dinsmoor & Co.		
4707330596		not available	Dinsmoor & Co.		
4707330597		not available	Dinsmoor & Co.		
4707330831		not available	Daugherty, John		
4707330885		not available	Daugherty, John		
4707331095		not available	WV Department of Mines, Oil & Gas Division		
4707331114		not available	Monongahela Power Company		
4707331115		not available	Monongahela Power Company		
4707331116		not available	Monongahela Power Company		
4707331117		not available	Monongahela Power Company		
4707331118		not available	Monongahela Power Company		
4707331119		not available	Monongahela Power Company		
4707331120		not available	Monongahela Power Company		
4707331121		not available	Monongahela Power Company		
4707331122		not available	Monongahela Power Company		
4707331123		not available	Monongahela Power Company		
4707331124		not available	Monongahela Power Company		
4707331125		not available	Monongahela Power Company		
4707331126		not available	Monongahela Power Company		
4707331127		not available	Monongahela Power Company		
4707331128		not available	Monongahela Power Company		
4707331129		not available	Monongahela Power Company		
4707331130		not available	Monongahela Power Company		
4707331131		not available	Monongahela Power Company		
4707331132		not available	Monongahela Power Company		
4707331133		not available	Monongahela Power Company		
4707331135		not available	Monongahela Power Company		
4707331136		not available	Monongahela Power Company		
4707331137		not available	Monongahela Power Company		
4707331138		not available	Monongahela Power Company		
4707331139		not available	Monongahela Power Company		
4707331141		not available	Lauderman Oil & Gas Drilling		

API #	Completion Year	Well Type	Operator	Total Depth (ft)	Deepest Formation
4707370016		not available	---------- unknown ----------		
4707370048		not available	Jennings Brothers, E. H., Company		
4707301119	1981	Dry w/ Gas Show	Vessel Resources Corp.	4000	Lower Huron (undifferentiated)
4707301606	1983	Gas w/ Oil Show	Beacon Resources Corp.	4110	Lower Huron (undifferentiated)
4707302524	2010		WVDEP Office Of Oil & Gas		
4707390126					
4707391316					

Note: Wells having API #s from 4707390041 through 4707390140 are also listed but have no associated information.

The completion dates for most of the wells are unknown, implying they were drilled as part of historic oil and gas well exploration in the area and potentially could have been drilled in the early 1900s or possibly in the late 1800s. A review of data for the other wells indicates they were drilled between 1935 and 2011. The total depths of the wells range from 71 ft to 5,684 ft and they've produced from formations including undifferentiated Upper Devonian Sandstone units. Many of the wells are reported as orphan wells and some have little or no information provided. As indicated on Figure 2, the wells are distributed throughout much of the site. Considering the age of the wells there would seem to be potential for groundwater impacts from corroded/damaged well casing, degrading seals, etc. which could result in out-of-interval migration of oil and gas and formation brine. Any leaking oil and gas gathering lines/pipelines and well head brine storage tanks at currently producing locations could be another potential source of releases. Potential constituents known to be associated with oil and gas wells include Barium, Chloride, Sodium and elevated TDS levels. At this point in time, insufficient information is available to specifically link the petroleum sheens/odors observed in MW-23, MW-24, and MW-25 to specific oil/gas wells or pipelines.

In March 2004, Hydrosystems Management, Inc. prepared a report for Allegheny Power Supply Company (a predecessor company of FirstEnergy) which evaluated increased Barium concentrations in groundwater samples from monitoring well GW-4. GW-4 is part of the state Solid Waste/NPDES groundwater monitoring system, is located in the northeastern portion of the site (as shown on Figure 2), is 255 feet deep and has a screen that's 55 feet long. Barium concentrations in in the well consistently exceeded the Ground-Water Quality Standard (GWQS) established in the facility's Solid Waste/NPDES permit. The HMI report concluded that leakage of brine from surrounding oil and gas wells was the most probable cause of the Barium GWQS exceedances. GW-4 also showed increases in sodium and chloride levels. The HMI report indicated two known oil and gas wells were within 1,000 feet of GW-4 and referenced the existence of numerous orphaned wells in the area. The boring log for GW-4 indicated oil and gas odors, some oil associated with groundwater, and oil sheen were all present during well installation and development.

In summary, the potential for impacts to groundwater by oil and gas wells on the site and in nearby upgradient areas appears to be significant, particularly in light of the well-documented oil and gas well impacts at GW-4. The most likely Appendix III parameters to reflect these impacts are Chloride and TDS. However, the other Appendix III SSIs determined at the site (Boron, Calcium, Fluoride, pH, and Sulfate) have a moderate to very low probability of being related to oil and gas impacts. It should also be noted that the potential exists for significant impacts to groundwater by Barium, Sodium and other constituents associated with the historical and ongoing oil and gas well operations.

3.5 SURROUNDING LAND USE REVIEW

To identify potential offsite anthropologic source areas, currently available GoogleEarth aerial photo imagery for the site area was reviewed. This review found that most of the land use in the upgradient site area appears to be forested with some farming. Two buildings of unknown use were identified along a road near the southeastern edge of the site as shown on Figure 3. The buildings appear to have flat roofs and be of similar design. Lumber or some other material can be seen laying on the ground surface near one of the buildings. It also appears that a cell tower is located in the southern upgradient area along with power transmission lines. However, other than these features, it does not appear there are any readily identifiable upgradient source areas (e.g., coal refuse disposal sites) that could contribute to Appendix III SSIs.

4.0 CERTIFICATION STATEMENT

In accordance with § 257.94(e)(2) of the CCR Rule, an ASD for Appendix IIII constituents was undertaken for the CCR unit identified herein. Based on the information and data that were available for review, all of the Appendix III SSIs that were identified for the October 2017 Detection Monitoring event could not be attributed to sources other than the CCR unit, to errors in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality. As such, a transition to the applicable requirements of Assessment Monitoring per § 257.95 of the CCR Rule appears to be warranted.

5.0 REFERENCES

USGS, 1984. *Ward, P.E., and Wilmoth, B.M., Ground-Water Hydrology of the Minor Tributary Basins of the Ohio River, West Virginia. West Virginia Geological and Economic Survey Basic Data Report 1.*

EPRI, 2017. *Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites*. EPRI, Palo Alto, CA: 2017. 3002010920.

Tetra Tech, 2017. *Coal Combustion Residuals (CCR) Rule Groundwater Monitoring System Evaluation Report, Pleasants Power Station, Coal Combustion Byproduct Landfill and Impoundment*. Tetra Tech, Inc., Pittsburgh, PA, October 2017.

Tetra Tech, 2018. *2017 Annual CCR Groundwater Monitoring and Corrective Action Report, McElroy's Run Coal Combustion Byproduct Disposal Facility, Pleasants Power Station*. Tetra Tech, Inc., Pittsburgh, PA, January 2018. http://ccrdocs.firstenergycorp.com/

TABLES

Table 1 - ASD Checklist 1: Sampling, Laboratory, or Statistical Causes

ASD Type	Potential Cause	Evaluation Summary
Sampling Causes (ASD Type I)	Sample mislabeling	No mislabeling found by comparing all COCs and lab data identifiers.
	Contamination	Field notes identified sheens and petroleum odors in GW-23 for Events 4 through 9, GW-24 for Events 6 through 9, and GW-25 for Events 4 through 6 (well was dry and not sampled in Events 7 through 9). Petroleum contamination could be contributing factor for SSIs in these wells for Ca, Cl, and TDS.
	Sampling technique	HydraSleeves™ used instead of bladder pumps on some dates in wells GW-21 (upgradient), -23, -24, and -25 due to limited available water.
	Turbidity	High turbidity (> 10 NTU) in GW-19 (Events 1 and 2), GW-20 (Events 1 and 4 through 9), GW-22 (Events 1 and 8 through 9), GW-26 (Events 1 through 7), GW-28 (Event 1), and GW-29 (Event 1); When HydraSleeves™ used, turbidity not reported. Turbidity may be contributing factor to SSIs in GW-20, especially Cl.
	Sampling anomalies	Insufficient water for sampling in GW-21 (upgradient) for Events 5 through 9, GW-24 for Events 3 and 4, GW-25 for Events 1 and 7 through 9, and GW-26 for Events 8 through 9.
Laboratory Causes (ASD Type II)	Calibration	No comments on lab calibration in Data Validation Reports for Appendix III parameters.
	Contamination	No Appendix III parameters in lab blanks.
	Digestion methods	No differences for Appendix III parameters.
	Dilution corrections	Dilution factors in some events different for Ca, Cl, and F between wells in same event and for Cl for same well in different events. Dilution factors high for Cl in some events in wells GW-23, -24, and -25. All Appendix III parameters detected in upgradient wells and in downgradient wells for Event 9, except GW-23 and -24 for F, but dilution factor was 1 for F in both wells, so no errors in detection limit calculations.
	Interference	No concerns mentioned in Data Validation Reports, unlikely for Appendix III parameters.
	Analytical methods	Methods same as in CCR GW Monitoring Plan.
	Laboratory technique / qualifier flags	Had low recovery for MS/MSD for F in Event 1 (GW-27, -28, -29 and duplicate), Event 4 (GW-9, -19, -26), Event 5 (GW-9, -19, -25), Event 6 (GW-26), and Event 7 (GW-22, -26, -28 and -29). Had low recovery for MS/MSD for SO_4 in Event 1 (GW-20 and -26), Event 4 (GW-27), and Event 9 (GW-22 and -24). Had high recovery for SO_4 in Event 2 (GW-29). Qualifier flags added appropriately. Had SSI for SO_4 in GW-9, where all values greater than for upgradient well GW-22 and Event 9 value in GW-22 not lowest, so not contributing reason for SSI. Other SSIs for SO_4 were in GW-27 and -29 where GW-7 is upgradient well, no issues in GW-7 or Event 9 for GW-29, so not contributing reasons for SSI. Only SSI for F was in GW-20 where all values higher than in upgradient well GW-22 and Event 9 value in GW-22 not lowest, so not contributing reason for SSI.
	Transcription error(s)	None identified.
Statistical Evaluation Causes (ASD Type III)	Lack of statistical independence	Sampling interval was at least 4-5 weeks in upgradient wells GW-22 and GW-7 which are 2.5-inch and 4-inch diameter, respectively, wells in fractured bedrock, so not likely to be a concern.
	Outliers	Outlier identified for SO_4 in GW-25 in Event 5. Downward trend for SO_4 in GW-29 and Event 9 value was slightly above UPL. Possible outlier for Cl in GW-23 in Event 9, although other Cl values higher than upgradient well GW-7.
	False positives	In general, for the case of small sample sizes (e.g., n < 10-20), there is no mathematical algorithm to statistically prove a false positive result without resampling.
	Non-detect processing	Appendix III parameters had all detected values in upgradient wells GW-22 and GW-7, and in all 8 downgradient wells for Event 9 used for Detection Monitoring 1, except for GW-23 and -24 which had non-detect values for F.
	Background data / change in normality	No new background data used for Detection Monitoring 1.

Table 2 - ASD Checklist 2: Lines of Evidence Associated with the CCR Unit

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Primary CCR Indicators						
1a	If the CCR unit contains fly ash, is there an SSI/SSL for boron and sulfate?	Yes	CCR Release	Key	Monitoring Point	Northern Boundary: Boron SSIs in GW-19, -20, and -24; No Sulfate SSIs. Western Boundary: No Boron SSIs; Sulfate SSIs in GW-9, -27, and -29.
1b	If the CCR unit contains FGD gypsum (only) is there an SSI/SSL for sulfate?	Yes	CCR Release	Key	Monitoring Point	Northern Boundary: No. Western Boundary: Sulfate SSIs in GW-9, -27, and -29.
1c	Are there other constituents in the groundwater that represent primary indicators? List the applicable constituents.	Yes	CCR Release	Supporting	Monitoring Point	Northern Boundary: Calcium, Chloride, Fluoride, Lithium, and Molybdenum are all found at detectible levels in multiple downgradient monitoring wells. Western Boundary: Calcium, Chloride, Fluoride, Lithium, and Molybdenum are all found at detectible levels in multiple downgradient monitoring wells.
1d	Is there an SSI/SSL for any of the other primary indicators?	Yes	CCR Release	Key if No	Monitoring Point	Northern Boundary: Calcium (GW-23 and -24), Chloride (GW-19, -20, -23, and -24), and Fluoride (GW-20) have exhibited SSIs. Lithium (GW-23 and -24) has exhibited elevated downgradient concentrations as compared to upgradient concentrations. No statistical evaluations of Lithium data have been performed as no assessment monitoring sampling has been required to date. Western Boundary: Calcium (GW-27, -28, and -29) and Chloride (GW-27, -28, and -29) have exhibited SSIs. Lithium (GW-29) and Molybdenum (GW-28) have exhibited elevated downgradient concentrations as compared to upgradient concentrations. No statistical evaluations of Lithium or Molybdenum data have been performed as no assessment monitoring sampling has been required to date.
1e	Is the leachate concentration for any of the primary indicators (including boron and sulfate) with an SSI/SSL statistically higher than background? List the applicable constituents.	Yes	CCR Release	Key if No	Constituent	Northern Boundary: Boron, Calcium, and Chloride – Yes; Fluoride - No. It is noted that statistical analysis has not been performed on leachate results -- evaluation based on the October 2017 leachate sampling event. Western Boundary: Calcium, Chloride, and Sulfate – Yes. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the October 2017 leachate sampling event.
1f	Are concentrations for the primary indicators increasing?	No	Uncertain	Supporting	Monitoring Point	Northern Boundary: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis. Western Boundary: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis.
Secondary Indicators						
2a	Are there other SSI(s) or SSL(s) of Appendix III or IV parameters?	Yes	CCR Release	Supporting	Monitoring Point	Northern Boundary: SSIs for pH (GW-23 and -24) and TDS (GW-19, -20, -23, and -24). Barium (GW-19, -20, -23, and -24) and Radium 226+228 (GW-19, -23, and -24) have exhibited elevated downgradient concentrations as compared to upgradient concentrations. No statistical evaluations of these Appendix IV constituents have been performed as no assessment monitoring sampling has been required to date.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Secondary Indicators (Continued)						
2a (con't)	(These are potential secondary indicators. List the applicable constituents.)					Western Boundary: SSIs for pH (GW-27, -28, and -29) and TDS (GW-28 and -29). Arsenic (GW-29), Barium (GW-27, -28, and -29) and Radium 226+228 (GW-27 and -29) have exhibited elevated downgradient concentrations as compared to upgradient concentrations. No statistical evaluations of these Appendix IV constituents have been performed as no assessment monitoring sampling has been required to date.
2b	Are the constituents identified in 2a present in leachate in concentrations statistically higher than background?	Yes / No	Uncertain	Key if No	Constituent	Northern Boundary: TDS – Yes; pH and Barium – No; Radium 226+228 not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the October 2017 leachate sampling event. Western Boundary: TDS and Arsenic – Yes; pH and Barium – No; Radium 226+228 not analyzed in leachate sampling program. It is noted that statistical analysis has not been performed on leachate results; evaluation based on the October 2017 leachate sampling event.
2c	Are concentrations for any of the secondary indicators increasing? List the applicable constituents.	No	Uncertain	Supporting	Monitoring Point	Northern Boundary: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis. Western Boundary: No. It should be noted that the CCR dataset covers a very limited time range (~1 year) for trend analysis.
Other Chemistry						
3a	Are organic constituents present in concentrations statistically higher than background?	N/A	-----	Supporting	Monitoring Point	Organics not analyzed as part of groundwater testing program at site.
3b	Is major ion chemistry similar to leachate?	ND	-----	Key	Monitoring Point	Based on primary and secondary indicator LOE's listed above, major chemistry analysis was not performed as part of Appendix III ASD.
3c	Does major ion chemistry suggest a mixture of leachate and background groundwater?	ND	-----			Based on primary and secondary indicator LOE's listed above, major chemistry analysis was not performed as part of Appendix III ASD.
3d	Does tritium age dating indicate that the groundwater was recharged after the facility was first used?	N/A	-----	Key if No	Monitoring Point	Disposal site development initiated in the late 1970's.
3e	Does isotopic analysis show evidence of mixing with CCR leachate?	ND	-----	Key	Monitoring Point	Based on primary and secondary indicator LOE's listed above, isotopic analysis was not performed as part of Appendix III ASD.
Hydrogeology						
4a	Is the monitoring well with an SSI/SSL downgradient from CCR unit at any point during year?	Yes	CCR Release	Key if No	Monitoring Point	Multiple SSIs were identified in the downgradient wells, all of which are positioned downgradient of the disposal site during all times of the year.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
Hydrogeology (Continued)						
4b	Review the Hydrogeological vs Leachate Scenario Table (EPRI, Table A-2) and identify the most representative scenario for each SSI or SSL case. List cases and scenario numbers.	-----	-----	Key	Monitoring Point	**Northern Boundary** Boron - CCR Leachate Release (Row c) Calcium - CCR Leachate Release + Possible Alternative Source (Row b) Chloride - CCR Leachate Release + Possible Alternative Source (Row c) Fluoride – Alternative Source Release (Row b) pH – Alternative Source Release (Row a) TDS - CCR Leachate Release + Possible Alternative Source (Row b) **Western Boundary** Calcium - CCR Leachate Release (Row a) Chloride - CCR Leachate Release + Possible Alternative Source (Row b) pH – CCR Leachate Release (Row a) Sulfate - CCR Leachate Release (Row a) TDS - CCR Leachate Release (Row a)
4c	Is the CCR unit immediately underlain by clay, shale, or other geologic media with low hydraulic conductivity?	Varies	Uncertain	Supporting	Unit	Some areas of site are underlain by clayey colluvial soils, mostly along what were the lower portions of tributary valleys.
4d	Is the monitoring point distant from the facility AND does the constituent with an SSI/SSL have low mobility in groundwater given the hydrogeologic environment at the monitoring location (EPRI, Table A-3)?	No	CCR Release	Supporting	Case	All downgradient monitoring wells are located at the waste boundary except for GW-23 (Northern Boundary) and GW-9 (Western Boundary).
4e	Are the background monitoring wells screened in the same hydrostratigraphic unit, and along the same groundwater flow path, as the monitoring location with the SSI?	No / Yes	CCR Release	Supporting	Monitoring Point	The CCR Rule-defined uppermost aquifer at the site is comprised of multiple water-bearing strata that are hydraulically connected. Both of the site's upgradient wells (GW-7 and GW-22) are located along the appropriate groundwater flow paths to their corresponding downgradient wells, however, they are also positioned stratigraphically higher than the downgradient wells.

	Line of Evidence (LOE)	Determination[1] (Yes, No, ND, N/A)	Indication	LOE Type[2]	Applies to[3]	Weight of Evidence Determination / Basis
CCR Unit Design						
5a	Does the entire footprint of the monitored CCR unit have a liner?	Yes / No	Potential Alternate Source / CCR Release	Supporting	Unit	The landfill area does have a liner system while the impoundment area (including the dam) does not.
5b	If the facility is lined, is it a composite liner?	Yes / No	Potential Alternate Source / CCR Release	Supporting	Unit	A portion of the landfill area is lined with only 24-inches of compacted clay, while the remainder utilizes a composite system comprised of a geosynthetic clay liner (GCL) overlain by a high density polyethylene (HDPE) geomembrane.
5c	Does the entire footprint of the CCR unit have a leachate collection system?	Yes / No	Potential Alternate Source / CCR Release	Supporting	Unit	The entire footprint of the landfill area does have a leachate collection system. The impoundment area does not have a leachate collection system.
5d	If the CCR unit is unlined, is it known to have or is it likely to have groundwater intersecting the CCR?	Yes	CCR Release	Supporting	Unit	Both the landfill and impoundment areas are situated within a valley (the impoundment at the head and the landfill at the mouth) and the CCR Rule-defined uppermost aquifer at the site is comprised of multiple water-bearing strata that are hydraulically connected. The uppermost aquifer rock strata all outcropped within the valley before the disposal site was developed so it is very likely that groundwater intersects the CCR, particularly in the impoundment area.

Table Notes:

1. ND (not determined) indicates that this line of evidence was not tested or there are insufficient data to make a determination; N/A means lines of evidence not applicable to the CCR unit.
2. Line of Evidence (LOE) Types:
   Key lines of evidence are based on relationships that must be observed in order for an SSI/SSL to be due to a release from a CCR unit. If these relationships are not observed, then they are critical to establishing an ASD. It is difficult to build a strong ASD without any key lines of evidence. It may be possible to build an ASD with a single key line of evidence, but the ASD will be stronger with additional key or supporting lines of evidence.
   Supporting lines of evidence provide additional information that supports the ASD. Supporting lines of evidence are generally not sufficient to build an ASD unless there is at least one key line of evidence, although it may be possible if there are many supporting lines of evidence.
3. This LOE applies to:
   Constituent: An SSI/SSL for that constituent at any monitoring point
   Monitoring Point: All SSIs/SSLs at a specific monitoring point
   Case: An SSI/SSL for a specific constituent at a specific monitoring point
   Unit: All SSIs/SSLs at the monitored unit

Table 3 - Leachate Data Summary

	Leachate Concentrations (mg/L)								GW Concentrations (mg/L) Northern Boundary											
Parameters	**LM1**	**LM2**	**LM3**	**LM4**	**LM5**	**LM6**	**LM7**	**Leachate Avg.**	**UG UPL (GW-22)**	**GW-19**	**GW-20**	**GW-23**	**GW-24**	**DG Avg.**	**Leachate Avg. > UG UPL?**	**DG Avg. > UG UPL?**	**GW-19 < Leachate Avg.?**	**GW-20 < Leachate Avg.?**	**GW-23 < Leachate Avg.?**	**GW-24 < Leachate Avg.?**
Boron	56.8	0.207	3.62	0.327	188	0.16	86.7	47.97	0.222	0.226	0.229	0.178	0.292	0.231	Yes	Yes	Yes	Yes	Yes	Yes
Calcium	515	243	220	2.58	574	105	244	272	16.832	10.1	5.38	620	270	226.37	Yes	Yes	Yes	Yes	No	Yes
Chloride	356	26	78.5	18.4	2,220	49.5	1,040	541	380.89	571	490	11,600	5,520	4,545.3	Yes	Yes	No	Yes	No	No
Fluoride	0.313	0.159	0.18	0.299	2.57	0.213	5.42	1.308	3.108	1.47	4.8	0.0125	0.0125	1.57	No	No	No	No	Yes	Yes
pH	8.09	7.43	6.96	7.8	8.67	7.25	8.36	7.79	8.965 (7.40)	7.63	8.11	6.84	6.95	7.38	In Range	< LPL	In Range	In Range	< LPL	< LPL
Sulfate	4,950	495	587	324	26,800	203	14,000	6,766	85.395	0.14	28.6	0.079	7.24	9.01	Yes	No	Yes	Yes	Yes	Yes
TDS	11,200	1,426.7	1,440	980	88,500	716	47,300	21,652	1,404.82	2,320	1,785	46,100	19,400	17,401	Yes	Yes	Yes	Yes	No	Yes
Barium	0.014952	0.033836	0.03367	0.033595	0.014577	0.045466	0.02769	0.029112	0.093799	1.24456	0.21416	4.22522	2.46586	2.03745	No	Yes	No	No	No	No
Lithium	----	----	----	----	----	----	----	----	0.016562	0.01397	0.01417	0.0321	0.02754	0.02195	----	Yes	----	----	----	----
Radium (226+228)	----	----	----	----	----	----	----	----	1.38	3.48	0.816	48.7	10.8	15.949	----	----	----	----	----	----

	Leachate Concentrations (mg/L)								GW Concentrations (mg/L) Western Boundary											
Parameters	**LM1**	**LM2**	**LM3**	**LM4**	**LM5**	**LM6**	**LM7**	**Leachate Avg.**	**UG UPL (GW-7)**	**GW-9**	**GW-27**	**GW-28**	**GW-29**	**DG Avg.**	**Leachate Avg. > UG UPL?**	**DG Avg. > UG UPL?**	**GW-9 < Leachate Avg.?**	**GW-27 < Leachate Avg.?**	**GW-28 < Leachate Avg.?**	**GW-29 < Leachate Avg.?**
Calcium	515	243	220	2.58	574	105	244	272	3.08	0.0945	45.9	5.91	11.5	15.85	Yes	Yes	Yes	Yes	Yes	Yes
Chloride	356	26	78.5	18.4	2220	49.5	1040	541	104	15.3	107	631	910	416	Yes	Yes	Yes	Yes	No	No
pH	8.09	7.43	6.96	7.8	8.67	7.25	8.36	7.79	8.451 (7.844)	7.54	7.34	7.66	7.66	7.55	< LPL	< LPL	< LPL	< LPL	< LPL	< LPL
Sulfate	4,950	495	587	324	26,800	203	14,000	6,766	0.537	0.221	8.645	0.263	0.654	2.446	Yes	Yes	Yes	Yes	Yes	Yes
TDS	11,200	1,426.7	1,440	980	88,500	716	47,300	21,652	1,260	7.68	522	2,093	2,980	1,401	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	0.056298	0.000282	0.000713	0.001005	0.076662	0.000434	0.399924	0.076474	0.00682	119	0.00058	0.00377	0.01646	29.75520	Yes	Yes	No	Yes	Yes	Yes
Barium	0.014952	0.033836	0.033670	0.033595	0.014577	0.045466	0.027690	0.029112	0.0934	744	0.82439	0.2038	0.86084	186.47226	No	Yes	No	No	No	No
Lithium	----	----	----	----	----	----	----	----	0.023374	0.06068	0.01186	0.01669	0.03182	0.03026	----	----	----	----	----	----
Molybdenum	10.75847	0.010788	0.14269	0.148449	15.6257	0.000898	4.72505	4.48744	0.006805	0.01523	0.00478	0.03071	0.00432	0.01376	Yes	Yes	Yes	Yes	Yes	Yes
Radium (226+228)	----	----	----	----	----	----	----	----	0.58	0.3455	1.197	0.5242	0.921	0.747	----	----	----	----	----	----

Notes: DG -Downgradient; GW - Groundwater; UG - Upgradient; UPL - Upper Prediction Limit
Leachate Concentrations from sampling performed in October 2017.
GW Concentrations of App. III parameters from sampling and analysis completed in October 2017.
GW Concentrations of App. IV parameters from sampling and analysis completed in August 2017.
UG UPL's based on 8 baseline sampling events.
Two-sided comparison (upper and lower) performed for pH. Comparisons to the UG UPL must fall within the PL range to be considered "No".

LM1 - Leachate collection from dam underdrain
LM2 - Landfill leachate detection system
LM3 - Surface Impoundment No. 1 underdrain effluent
LM4 - Surface Impoundment No. 2 underdrain effluent
LM5 - Stage 1G LCS
LM6 - Stage 2B LDS
LM7 - Stage 2B LCS

FIGURES

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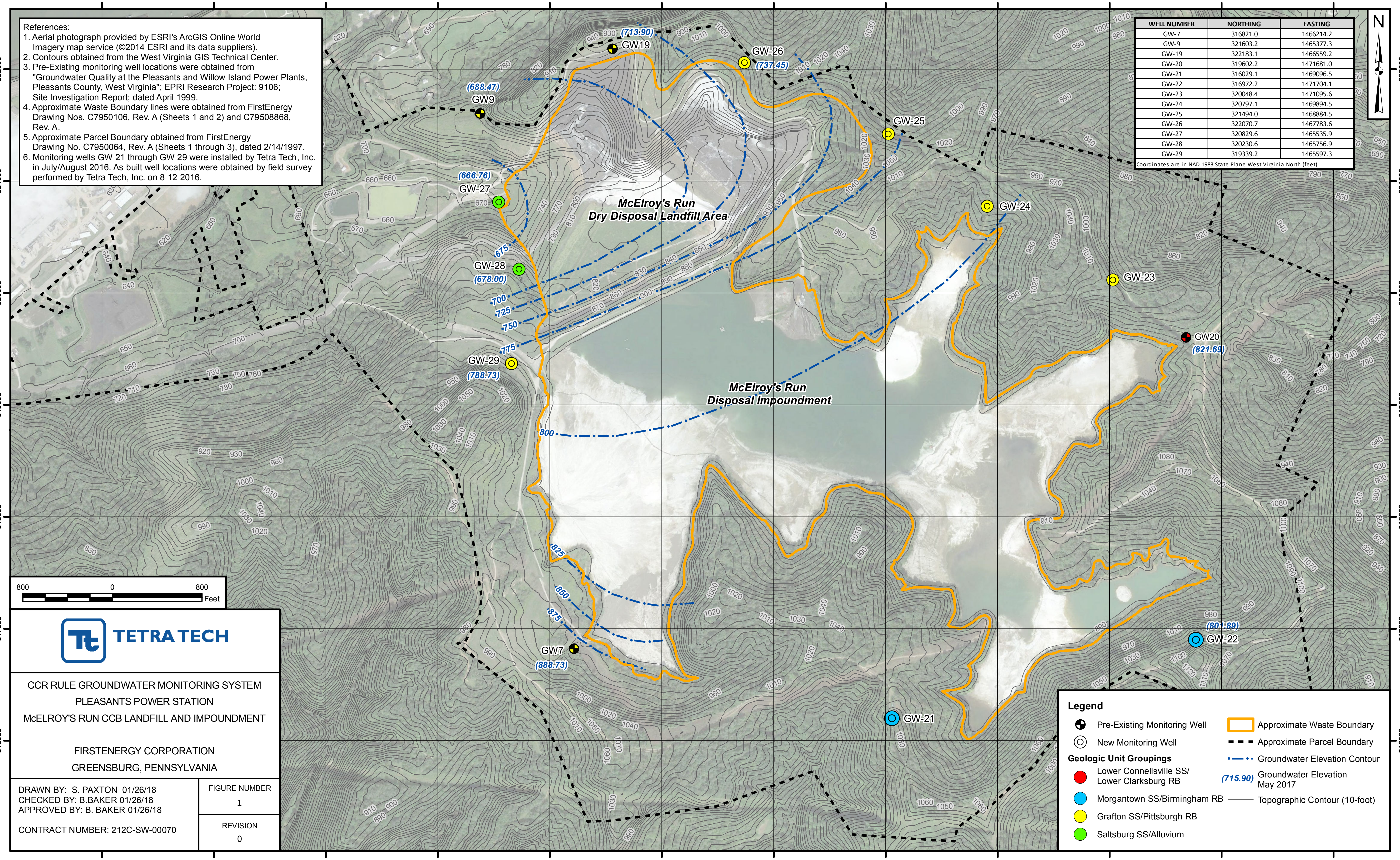

WELL NUMBER	NORTHING	EASTING
GW-7	316821.0	1466214.2
GW-9	321603.2	1465377.3
GW-19	322183.1	1466559.2
GW-20	319602.2	1471681.0
GW-21	316029.1	1469096.5
GW-22	316972.2	1471704.1
GW-23	320048.4	1471095.6
GW-24	320797.1	1469894.5
GW-25	321494.0	1468884.5
GW-26	322070.7	1467783.6
GW-27	320829.6	1465535.9
GW-28	320230.6	1465756.9
GW-29	319339.2	1465597.3

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

- Pre-Existing Monitoring Well
- New Monitoring Well
- Approximate Waste Boundary
- Approximate Parcel Boundary
- Groundwater Elevation Contour
- (715.90) Groundwater Elevation May 2017
- Topographic Contour (10-foot)

Geologic Unit Groupings

- Lower Connellsville SS/ Lower Clarksburg RB
- Morgantown SS/Birmingham RB
- Grafton SS/Pittsburgh RB
- Saltsburg SS/Alluvium

TETRA TECH

CCR RULE GROUNDWATER MONITORING SYSTEM
PLEASANTS POWER STATION
McELROY'S RUN CCB LANDFILL AND IMPOUNDMENT

FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 01/26/18
CHECKED BY: B.BAKER 01/26/18
APPROVED BY: B. BAKER 01/26/18

CONTRACT NUMBER: 212C-SW-00070

FIGURE NUMBER 1

REVISION 0

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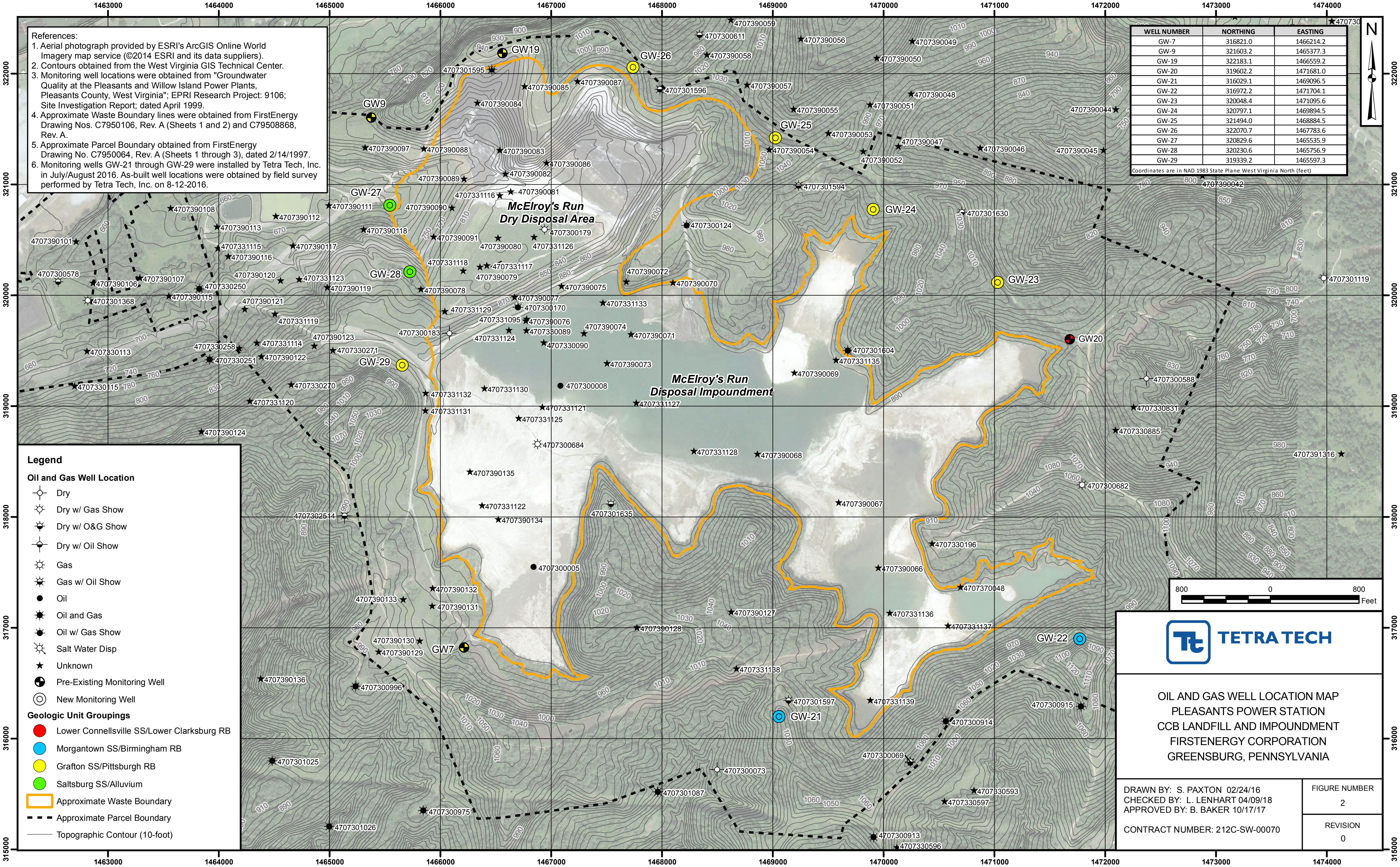

References:
1. Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (©2014 ESRI and its data suppliers).
2. Contours obtained from the West Virginia GIS Technical Center.
3. Monitoring well locations were obtained from "Groundwater Quality at the Pleasants and Willow Island Power Plants, Pleasants County, West Virginia"; EPRI Research Project: 9106; Site Investigation Report; dated April 1999.
4. Approximate Waste Boundary lines were obtained from FirstEnergy Drawing Nos. C7950106, Rev. A (Sheets 1 and 2) and C79508868, Rev. A.
5. Approximate Parcel Boundary obtained from FirstEnergy Drawing No. C7950064, Rev. A (Sheets 1 through 3), dated 2/14/1997.
6. Monitoring wells GW-21 through GW-29 were installed by Tetra Tech, Inc. in July/August 2016. As-built well locations were obtained by field survey performed by Tetra Tech, Inc. on 8-12-2016.

WELL NUMBER	NORTHING	EASTING
GW-7	316821.0	1466214.2
GW-9	321603.2	1465377.3
GW-19	322183.1	1466559.2
GW-20	319602.2	1471681.0
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GW-26	322070.7	1467783.6
GW-27	320829.6	1465535.9
GW-28	320230.6	1465756.9
GW-29	319339.2	1465597.3

Coordinates are in NAD 1983 State Plane West Virginia North (feet)

Legend

Oil and Gas Well Location
- Dry
- Dry w/ Gas Show
- Dry w/ O&G Show
- Dry w/ Oil Show
- Gas
- Gas w/ Oil Show
- Oil
- Oil and Gas
- Oil w/ Gas Show
- Salt Water Disp
- Unknown
- Pre-Existing Monitoring Well
- New Monitoring Well

Geologic Unit Groupings
- Lower Connellsville SS/Lower Clarksburg RB
- Morgantown SS/Birmingham RB
- Grafton SS/Pittsburgh RB
- Saltsburg SS/Alluvium
- Approximate Waste Boundary
- Approximate Parcel Boundary
- Topographic Contour (10-foot)

TETRA TECH

OIL AND GAS WELL LOCATION MAP
PLEASANTS POWER STATION
CCB LANDFILL AND IMPOUNDMENT
FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

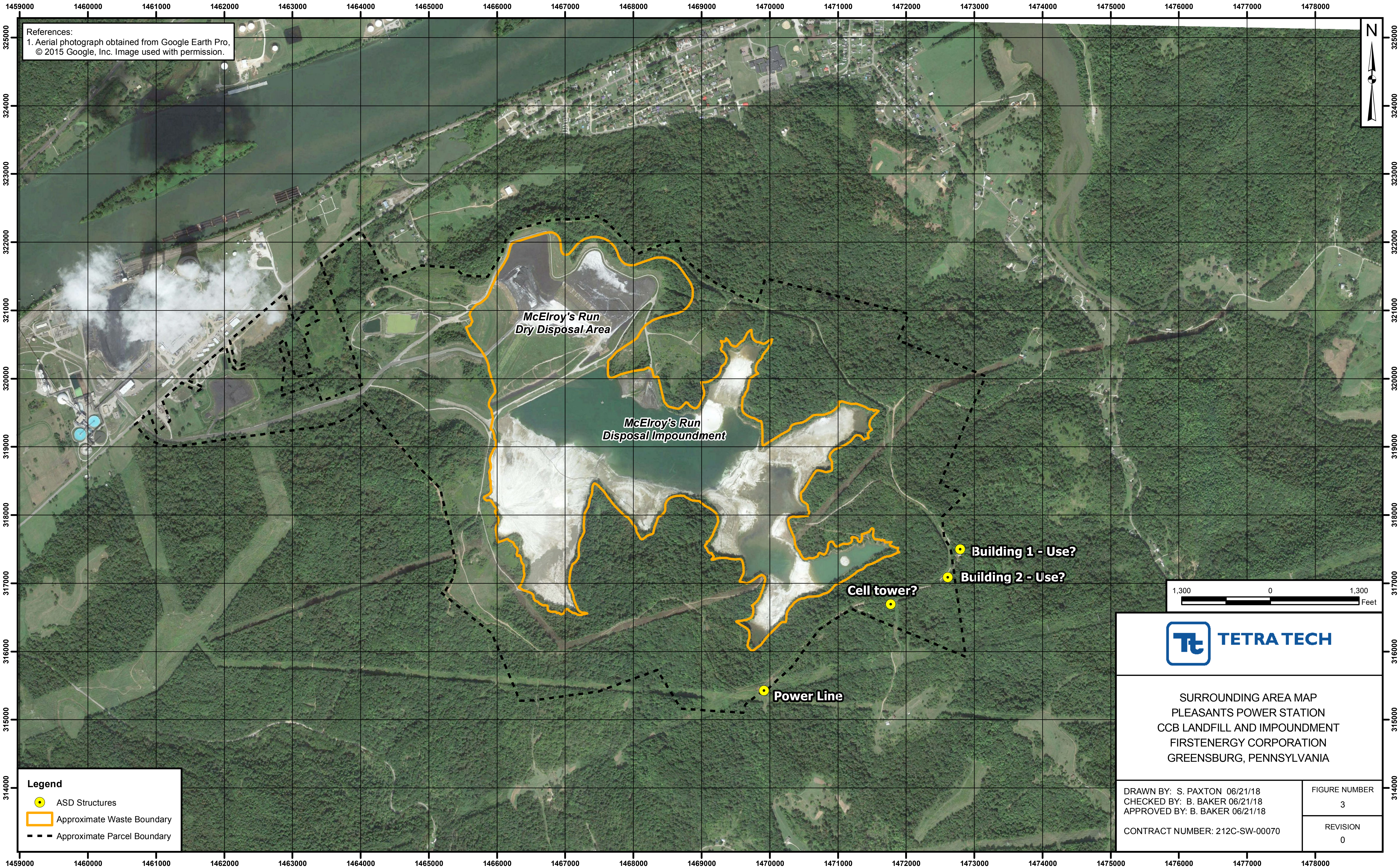
DRAWN BY: S. PAXTON 02/24/16
CHECKED BY: L. LENHART 04/09/18
APPROVED BY: B. BAKER 10/17/17

CONTRACT NUMBER: 212C-SW-00070

FIGURE NUMBER 2

REVISION 0

PGH P:\GIS\FIRST_ENERGY\MAPDOCS\PLEASANTS_ASD_STRUCTURES.MXD 06/21/18 SP



TETRA TECH

SURROUNDING AREA MAP
PLEASANTS POWER STATION
CCB LANDFILL AND IMPOUNDMENT
FIRSTENERGY CORPORATION
GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 06/21/18 CHECKED BY: B. BAKER 06/21/18 APPROVED BY: B. BAKER 06/21/18	FIGURE NUMBER 3
CONTRACT NUMBER: 212C-SW-00070	REVISION 0