

# McElroy's Run Impoundment Location Restrictions Demonstration

Allegheny Energy Supply Company, LLC, A FirstEnergy Company  
Pleasants Power Station  
Pleasants County, West Virginia

October 2018

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## Certification/Statement of Professional Opinion

The Location Restrictions Demonstration (Demonstration) for the Pleasants Power Station McElroy's Impoundment was prepared by GAI Consultants, Inc. (GAI). The Demonstration was based on certain information that, other than for information GAI originally prepared, GAI has relied on but not independently verified. Therefore, this Certification/Statement of Professional Opinion is limited to the information available to GAI at the time the Demonstration was written. On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the State of West Virginia that the Demonstration has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances and at the time and in the same locale. It is my professional opinion that the Demonstration was prepared consistent with the requirements of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015, §§ 257.61, 257.62, 257.63, and 257.64.

The use of the words "certification" and/or "certify" in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not be interpreted or construed as a guarantee, warranty or legal opinion.



Charles F. Straley, PE, PS  
Senior Engineering Manager



## 1.0 Introduction

The McElroy's Run Impoundment (Impoundment) is located approximately one-half mile east-southeast of the Pleasants Power Station (Station), a coal-fired electric generating station located near the community of Willow Island in Pleasants County, West Virginia (WV). The Impoundment is permitted as a solid waste facility according to the WV Department of Environmental Protection (WVDEP) Permit No. 0079171. The Impoundment receives coal combustion residuals (CCR) in the form of flue gas desulfurization (FGD) scrubber by-product.

The embankment is permitted separately under WV Dam Safety Regulations by the Office of Water Resources. The embankment is currently permitted for operations under Certificate of Approval No. 07302.

This Demonstration was prepared in accordance with the applicable requirements [§§ 257.60(a), 257.61(a), 257.62(a), 257.63(a), and 257.64(a)] of the United States Environmental Protection Agency's 40 Code of Federal Regulations (CFR) Part 257, Criteria for Classification of Solid Waste Disposal Facilities and Practices (CCR Rule).

## 2.0 Placement above Uppermost Aquifer

Pursuant to 40 CFR § 257.60, new CCR landfills, existing and new surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than five feet above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations.

Certification and information relating to placement above the uppermost aquifer is included in Appendix A.

## 3.0 Wetlands

Pursuant to 40 CFR § 257.61, new CCR landfills; existing and new surface impoundments; and all lateral expansion of CCR units must not be located in wetlands unless the owner or operator demonstrates that the CCR unit meets the following requirements:

- ▶ No alternative location to place the CCR unit is reasonably available that does not involve wetlands.
- ▶ The construction and operation of the CCR unit will not cause or contribute to violating applicable state or federal water quality standards, violating applicable toxic applicable toxic effluent standard or prohibition, or jeopardizing the continued existence of endangered or threatened species, or violating the protection of a marine sanctuary.
- ▶ The CCR unit will not cause or contribute to significant degradation of wetlands.
- ▶ No net loss of wetlands has occurred due to the placement of the CCR unit.
- ▶ Sufficient information is available to make a reasoned determination with respect to the demonstrations required above.

A review of the information contained in the March 1997 Allegheny Power Pleasant's Power Station McElroy's Run Solid Waste Disposal Facility Solid Waste/NPDES Water Pollution Control Permit No. WV0079171 indicates that no wetlands occur within or adjacent to the project site. This determination was expressed in a letter provided from the WV Division of Natural Resources, Wildlife Resources Section (1990).

## 4.0 Fault Areas

Pursuant to 40 CFR § 257.62, new CCR landfills; existing and new surface impoundments; and all lateral expansion of CCR units must not be located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time (<11,700 years ago) unless the owner demonstrates that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the CCR unit.

A review of the United States Geological Survey (USGS), Earthquake Hazards Program, Quaternary Faults interactive map reveals that the Impoundment does not reside within 200 feet of a Holocene aged fault area.

## 5.0 Seismic Impact Zones

Pursuant to 40 CFR § 257.63, new CCR landfills; existing and new surface impoundments; and all lateral expansion of CCR units must not be located in seismic impact zones unless the owner demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

A seismic impact zone is defined as an area having a two percent or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years. A review of the 2014 Long-term Model, USGS, Earthquake Hazards Program, Seismic Hazard Maps and Site-Specific Data reveals that the Impoundment does not reside within a seismic impact zone. The peak ground acceleration at the site is 0.049 g for the same probability and time period (two percent in 50 years).

## 6.0 Unstable Areas Demonstration

Pursuant to 40 CFR § 257.64, existing or new CCR landfills and surface impoundments; or any lateral expansion of a CCR unit, must not be located in an unstable area unless the owner demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

### 6.1 Demonstration Overview

The Demonstration includes descriptions of the following factors used to determine that the CCR unit is not located in an unstable area:

- the soil use limitations for pipeline construction and the associated aboveground facilities;
- on-site or local soil conditions that may result in significant differential settling;
- on-site or local geologic or geomorphic features; and
- on-site or local human-made features or events (both surface and subsurface).

These factors were evaluated based on the following information:

- USGS topographic maps (current and historic);
- landslide maps;
- geologic maps;
- mine maps;
- coal resource maps;

- United States Department of Agriculture (USDA) soil reports;
- karst maps;
- aerial photographs (current and historic); and
- as-built construction and permit documents.

The documents were reviewed to determine if the CCR unit is located in an unstable area.

#### **6.1.1 On-Site or Local Soil Conditions**

No unanticipated settlement nor significant differential settlement of the Impoundment's embankment was observed during the annual (2015 and 2017) and weekly (April 2016 through September 2018) inspections, both of which are required by the CCR Rule. The structural stability and factor of safety assessments, discussed below, served in lieu of an annual inspection in 2016 and were reviewed accordingly. Five survey monuments installed in the upstream slope of the embankment are surveyed annually. The majority of survey monument movement was observed within four to six years after completing construction, and minimal movement has occurred since then. Historically, no unanticipated settlement nor significant differential settlement has been reported in past documented Impoundment inspections. A structural stability assessment (2016) concluded the design, construction, and operations and maintenance are consistent with good engineering practices. A factor of safety assessment (2016) on the embankment cross-section concluded the Impoundments meets or exceeds the factors of safety required by the CCR Rule. CCR placement techniques typically used reduce the likelihood of differential settlement.

The on-site presence of landslide-prone soils was researched by reviewing available USDA Soil Reports. The USDA Soils Report for Pleasants County, WV defines the existing on-site soils by origin. The majority of the existing site soils are residual in nature. Residual soils are soils that form in-situ by weathering of bedrock. One on-site soil was classified as an alluvial deposit which was formed by stream deposition. Another on-site soil was classified as an eolian deposit which was formed by wind deposition. One on-site soil was classified as colluvium, which was formed by down slope movement of existing soils via landslides, soil creep, etc., and can generally be considered slide-prone. According to the USDA Soils Report, the colluvium accounted for nearly seven percent of the total site soil. However, the colluvium was located higher in elevation and along the southeastern slopes away from the embankment, thus having no impact on the impoundment.

Pleasant's Landfill is constructed against the downstream face of the McElroy's Impoundment. Landslide-prone soils were encountered in the design and construction of the landfill as discussed in the Pleasants Landfill Location Restriction Demonstration (2018). The impoundment embankment geotechnical design and stability analysis was performed in 1977, and the design and construction took existing site soils into account and the stability of the impoundment embankment is independent of the landfill.

The Impoundment was designed based on the results geologic investigation and stability analyses performed for site-specific conditions. Calculations for overall embankment stability are located in the McElroy's Run Disposal Site Slope Stability Analyses, Drawing 101-6514-137 (1977). Additional investigations and analyses have been performed based on regulatory review and changes as documented in responses to the 2010 Assessment of Dam Safety Coal Combustion Surface Impoundments and the CCR Rule-related analyses mentioned earlier in this section.

### 6.1.2 On-Site or Local Geologic or Geomorphologic Features

A review of the August 2016 *West Virginia Tax Districts Containing Karst Terrain* map reveals that the Impoundment resides in an area with no sinkholes, subsidence, caverns, nor karstic rock formations. Furthermore, the *Geologic Map of West Virginia* shows that the rocks below the Impoundment are comprised of the Monongahela and Dunkard Groups, both of which do not contain rocks associated with karst terrain formation.

Current and historic topographic maps and aerial photographs were reviewed to determine whether on-site or local geomorphic features exist or existed in the past that could create an unstable area. The documents evaluated did not identify any of these features.

### 6.1.3 On-Site or Local Human-Made Features or Events (both Surface and Subsurface)

Geologic maps, USGS topographic maps, mine maps, and coal resources maps were reviewed for evidence of surface and deep mining. Mine maps from the WV Geologic and Economic Survey indicate that no mining has occurred below the Impoundment.

## 7.0 Conclusion

Recognized and generally accepted good engineering practices have been incorporated into the design and construction of the Impoundment to reduce the potential for disruption of the structural components of the Impoundment. GAI reviewed the available documents to determine if the existing Impoundment was constructed in an unstable area. The soil, geologic, geomorphologic, and human-made features evaluated show that the Impoundment is not located in an unstable area, or were addressed as part of the engineering design and construction of the Impoundment. Available documents were also reviewed and it was determined that the Impoundment does not reside within a wetland, fault area, or a seismic impact zone. Additional documentation on location placement above aquifers is included in Appendix A.

## 8.0 References

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- West Virginia Geologic and Economic Survey. 2016. *West Virginia Tax Districts Containing Karst Terrain*. [http://www.wvgs.wvnet.edu/www/geology/Karst\\_Terrain\\_Potential.html](http://www.wvgs.wvnet.edu/www/geology/Karst_Terrain_Potential.html); August 18, 2016.
- West Virginia Geologic and Economic Survey. 2011. Geologic Map of West Virginia.



## **APPENDIX A**

### **Placement Above Uppermost Aquifer**

# PLACEMENT ABOVE UPPERMOST AQUIFER – LOCATION RESTRICTION DEMONSTRATION REPORT

CCR Rule §257.60

McElroy's Run Coal Combustion Byproduct Disposal Facility

WVDEP Solid Waste/NPDES Permit No. WV0079171

Pleasants Power Station

Pleasants County, WV

212C-SW-00170

October 16, 2018

## PRESENTED TO

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10/16/2018

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Date

Reviewed by:



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## EXECUTIVE SUMMARY

In accordance with 40 CFR, Part 257, Subpart D, §257.60 of the United States Environmental Protection Agency's (USEPA's) *Disposal of Coal Combustion Residuals from Electric Utilities* rule ("CCR Rule"), Tetra Tech, Inc. (Tetra Tech) has prepared this Location Restriction Demonstration Report (the "Report") for the McElroy's Run Coal Combustion Byproduct Disposal Facility ("CCBDF" or "CCR unit") at the Pleasants Power Station ("Station") located in Pleasants County, West Virginia (WV). The CCBDF consists of both a wet disposal area (impoundment) and dry disposal area (landfill) developed in the McElroy's Run watershed. As per the CCR Rule, the landfill and impoundment are considered two separate, existing CCR units that share a common boundary (the impoundment dam).

There are multiple Location Restrictions (LRs) outlined in CCR Rule §257.60 to §257.64 that apply to either (a) new CCR landfills; (b) existing or new CCR surface impoundments; or (c) all lateral expansions of CCR units. The applicability of these LRs vary for the CCBDF impoundment and landfill as both are considered existing CCR units under the Rule but only the landfill will potentially be laterally expanded in the future. FirstEnergy (FE) has engaged Tetra Tech to evaluate if the CCR units comply with §257.60 of the CCR Rule, which focuses on minimum separation requirements between the Rule-defined uppermost aquifer and the base of the overlying CCR unit. Demonstration of compliance with the remaining CCR Rule LRs (i.e., §257.61 to §257.64) is being performed by others and is not addressed herein.

Based on our document and data reviews, it is Tetra Tech's professional opinion and engineering judgment that the proposed future lateral expansion of the CCBDF landfill complies with the requirements of CCR Rule §257.60, but that no evidence exists or can be developed to demonstrate that the existing CCBDF impoundment complies with §257.60.

## 1.0 INTRODUCTION

In accordance with 40 CFR, Part 257, Subpart D, §257.60 to §257.64 of the USEPA's CCR Rule, the following Location Restrictions must be applied to new, existing, or lateral expansions of existing CCR units, as noted:

§257.60(a) – New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).

§257.61(a) – New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates ... that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

§257.62(a) – New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates ... that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

§257.63(a) – New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates ... that all structural components, including liners, leachate collection and

removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

§257.64(a) – An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates ... that recognized and generally accepted, good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

Of the five Location Restriction criteria listed above, FirstEnergy has engaged Tetra Tech to evaluate compliance with only the uppermost aquifer separation criterion (§257.60) for both the CCBDF landfill and impoundment. Demonstration of compliance with the remaining CCR Rule LRs (i.e., §257.61 to §257.64) is being performed by others and is not addressed herein.

Preparation of this Report included review of the documents and data available in the CCBDF's operating record and other background information available regarding the facility design, construction, operation and maintenance (e.g., public-domain permit applications, construction certification documents, and inspection records).

The subsequent sections of this Report describe the CCR unit, expand on the CCR Rule requirements pertinent to uppermost aquifer separation requirements affecting or potentially affecting the existing CCR units, and summarize the scope, bases, and findings from our assessments.

## 2.0 BACKGROUND

The Station is located in Pleasants County, WV, along the Ohio River. 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, situated as shown on attached Figure 1. 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 landfill has been in effect since 1994. 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.

The impoundment is situated in the upper portion of the watershed, is unlined, and has been in continuous use since the late 1970s. At the current water level, the surface impoundment area is approximately 250 acres. The landfill is situated in the lower portion of the watershed (both adjacent to and overlying the impoundment dam), is lined, and has been in continuous use since the early 1990s. The landfill consists of three primary development stages (I, II, and III in the original 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 utilized.

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.

As presented in the *CCR Rule Groundwater Monitoring System Evaluation Report* ("GMS Evaluation Report" - Tetra Tech, 2017), which is part of the facility's Operating Record, groundwater at the CCBDF 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 of the combined landfill and impoundment units. The Saltsburg sandstone (also referred to as the Cow Run sandstone) is the uppermost unit that is laterally continuous beneath the CCBDF. The aforementioned sandstone units are separated by fine-grained rock units (redbeds) that typically serve as aquitards to limit vertical groundwater migration.

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 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 impoundment. 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, as depicted on Figure 2. 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 the rock units exhibit very little seasonal and temporal fluctuations. A representative set of water level data from the last annual reporting period (2017) were used for contouring groundwater flow patterns at the site as shown on attached Figure 1.

A more detailed discussion of the site's geologic and hydrogeologic characteristics is available in the aforementioned 2017 GMS Evaluation Report and is not provided herein to avoid duplication.

### 3.0 UPPERMOST AQUIFER SEPARATION - LANDFILL

As previously noted, over its operating life the Landfill has been developed in a series of contiguous construction subareas. All the combined subareas that have been constructed and operated to date are considered an existing landfill under the CCR Rule and, as such, are not subject to the requirements of §257.60. However, the next subarea that will potentially be constructed, referred to as Stage 1H, is considered a lateral expansion of an existing landfill under the CCR Rule and, as such, is subject to the requirements of §257.60.

The proposed Stage 1H subgrade (base of liner) contours are depicted on attached FirstEnergy Drawing No. C79508869 and indicate that the lowest point of subgrade development will extend down to approximately elevation 878 feet along the southern end of the subarea (adjacent to the eastern abutment of the impoundment dam). Typical groundwater contours across the site and their relationship to the Stage 1H subarea are depicted on attached Figure 1. Referring to Figure 1 it can be seen that the highest observed groundwater levels in the lowest proposed Stage 1H subgrade development area are encountered at approximately elevation 780 feet. Therefore, the vertical separation between the upper limit of the uppermost aquifer and the proposed base of the Stage 1H landfill subarea is on the order of 100 feet which exceeds the minimum five foot (1.52 meter) requirement of §257.60(a).

### 4.0 UPPERMOST AQUIFER SEPARATION - IMPOUNDMENT

The existing impoundment at the CCBDF was developed in late 1970's by constructing a dam across McElroy's Run at the location depicted on Figures 1 and 2, and then filling the upstream portion of the

valley with slurried CCRs and other process flows produced by the Station. The crest elevation of the dam is 900 feet and the maximum permitted storage volume elevation is 887 feet, which is also the current approximate pool elevation.

As previously noted, the CCR Rule-defined uppermost aquifer at the site is a collection of multiple sandstone units that are hydraulically connected since the units above the Saltsburg sandstone are eroded out to varying degrees and are, thus, discontinuous throughout the CCBDF area. Estimated outcrop traces of the various sandstone units developed in the 2017 GMS Evaluation Report are shown on attached Figure 2. Referring to Figure 2 it's seen that the Morgantown sandstone is estimated to outcrop in the upper (eastern) half of the impoundment and is eroded from the western two-thirds of the site, while the Grafton and Jane Lew sandstones underlie most of the impoundment. Between the upvalley trace of the Grafton sandstone and the estimated crop line of the Morgantown sandstone, and in the uppermost (southeast) portion of the site, rebeds (Birmingham and Clarksburg) underlie the impoundment. All of these rock units, and particularly the sandstone units, were very likely to have some exposed crop lines along the valley margins before development of the impoundment occurred.

As presented in Section 1.0 of this Report, §257.60(a) of the CCR Rule states that existing CCR impoundments "...must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table)." To assess if these requirements have been met, Tetra Tech reviewed the available design, construction, and operations records for the impoundment to try and determine if any exposed outcrops of the sandstone units that comprise the uppermost aquifer were covered with added geologic material (soil or rock) at any point during the development and operational life of the facility. If a sufficient amount of such material were placed it could possibly provide the required separation between the uppermost aquifer and the impounded CCRs. However, no such supporting information was identified during our review. In the absence of historical documentation, Tetra Tech also assessed if any currently available subsurface investigation methods could be safely implemented to develop reliable information and data that would demonstrate compliance with §257.60(a), but it was determined that no such methods currently exist. As such, no evidence exists or can be developed at this time to demonstrate that the existing CCBDF impoundment meets the uppermost aquifer separation requirements of the CCR Rule.

## **5.0 CONCLUSION**


Based on our document and data reviews as summarized herein, it is Tetra Tech's professional opinion and engineering judgment that the proposed future lateral expansion of the CCBDF landfill complies with the requirements of CCR Rule §257.60, but that no evidence exists or can be developed to demonstrate that the existing CCBDF impoundment complies with §257.60.

## **6.0 CLOSING**

In preparing this Report, the professional services of Tetra Tech, Inc. have been performed, findings obtained, and recommendations prepared in accordance with generally accepted engineering principles and practices, based on the references, information and statements of understanding presented herein. This statement is in lieu of all warranties and guarantees, expressed or implied.

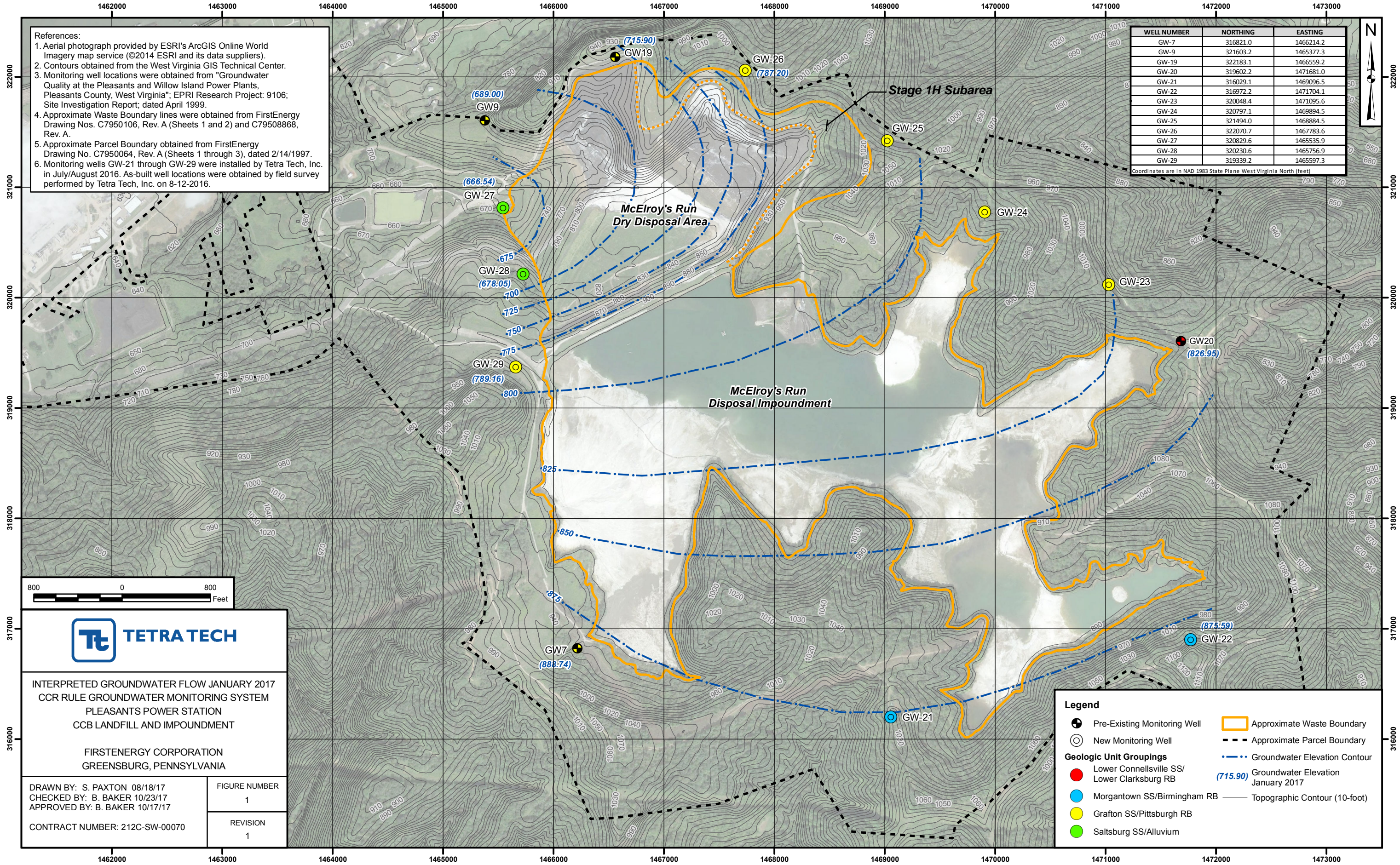
## CERTIFICATION

I, Thomas A. Gray, being a Registered Professional Engineer in accordance with the West Virginia Professional Engineer's Registration Law, do hereby certify to the best of my knowledge, information, and belief that the information contained herein has been reviewed and prepared in accordance with accepted professional practice, is true and correct, and has been properly applied to determine compliance with the requirements of §257.60 of the USEPA's *Disposal of Coal Combustion Residuals from Electric Utilities* rule (40 CFR, Part 257, Subpart D).

Signature:   
Printed Name: Thomas A. Gray, PE  
Certification Date: 10/16/18  
License Number: 010523  
License Expiration: December 31, 2018  
Company/Contact: Tetra Tech, Inc.  
661 Anderson Drive, Foster Plaza 7  
Pittsburgh, PA 15220  
Tel: 412.921.7090







**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	1465559.2
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)



INTERPRETED GROUNDWATER FLOW JANUARY 2017  
 CCR RULE GROUNDWATER MONITORING SYSTEM  
 PLEASANTS POWER STATION  
 CCB LANDFILL AND IMPOUNDMENT

FIRSTENERGY CORPORATION  
 GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 08/18/17  
 CHECKED BY: B. BAKER 10/23/17  
 APPROVED BY: B. BAKER 10/17/17

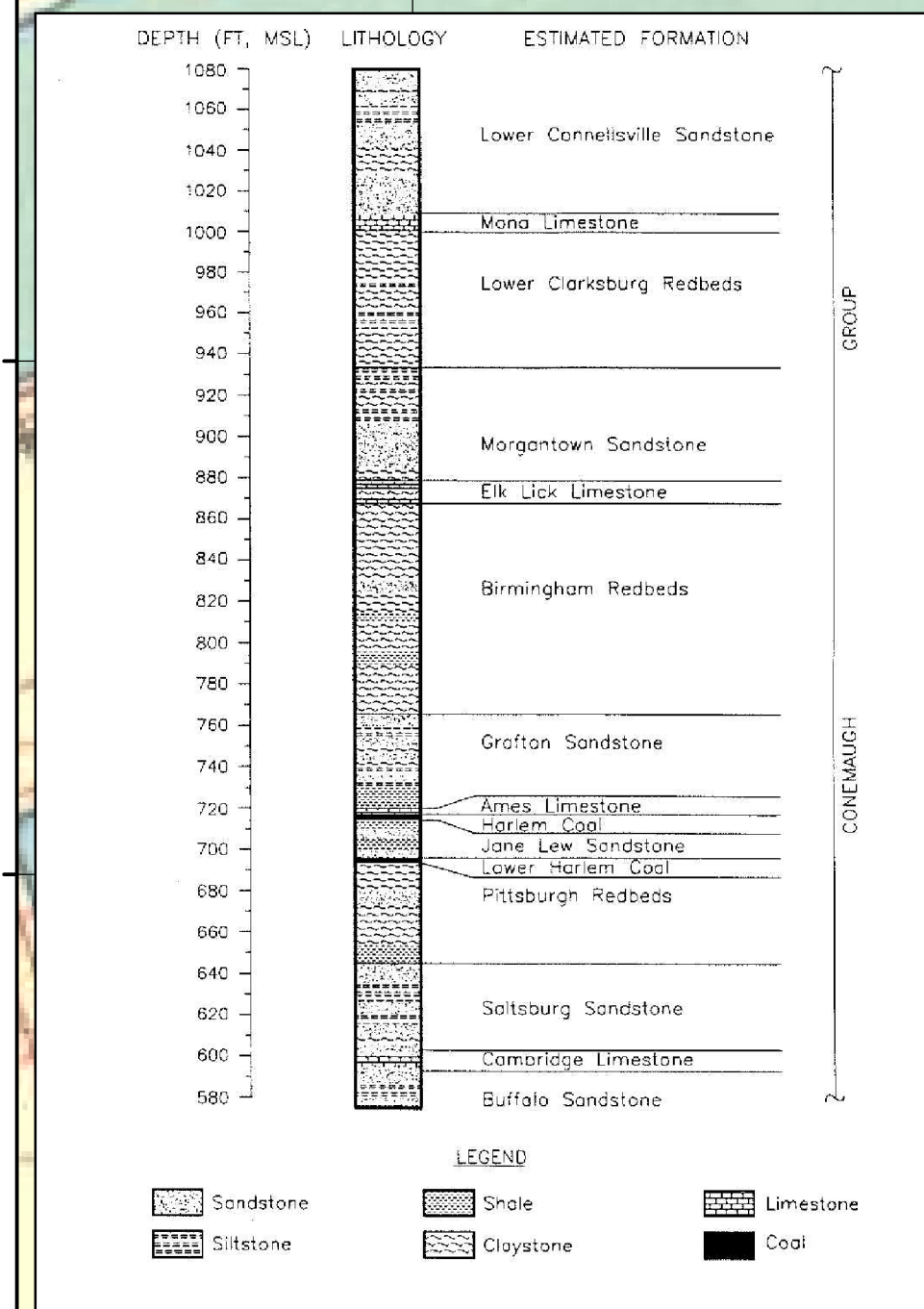
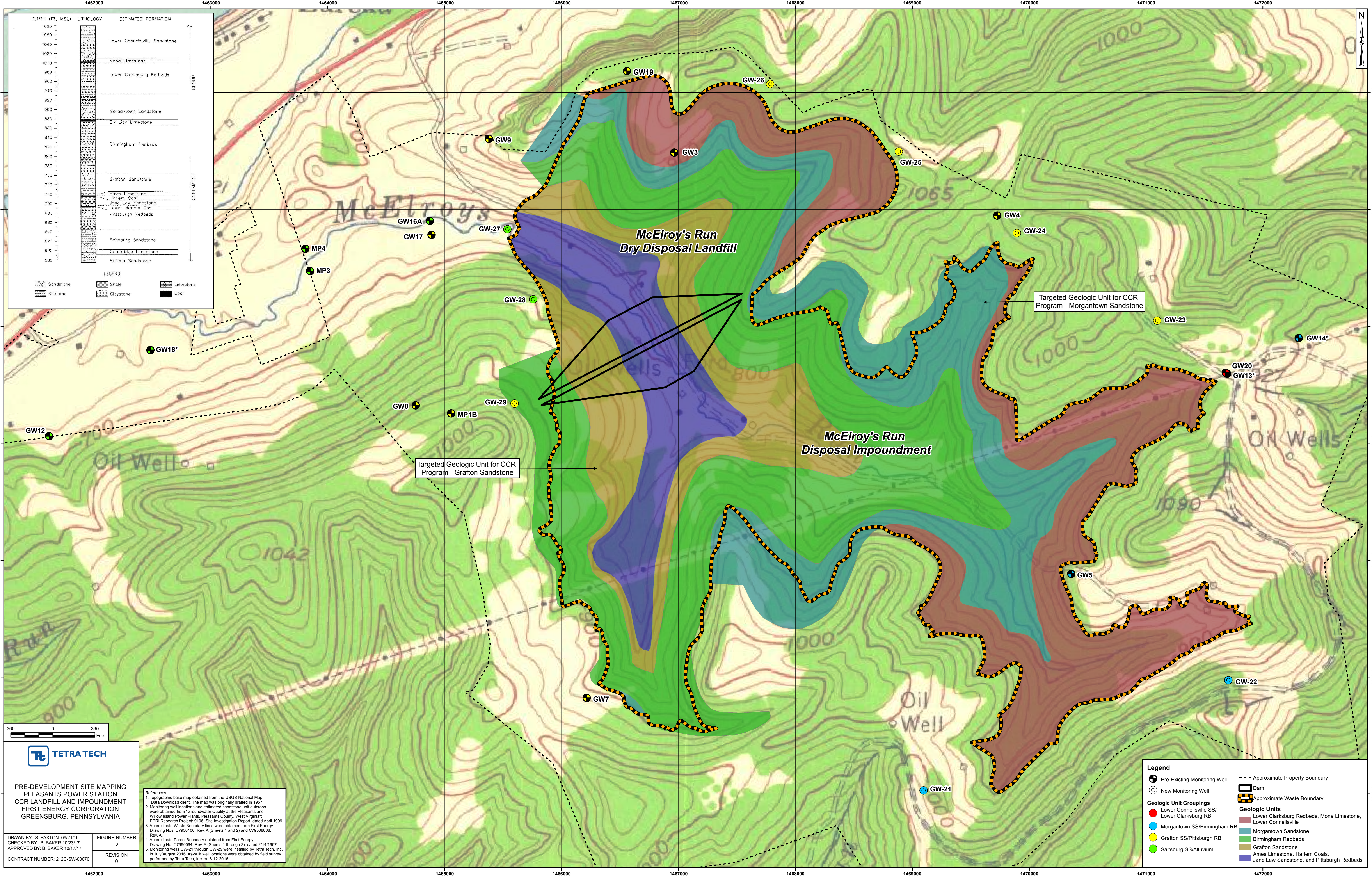
FIGURE NUMBER  
1

REVISION  
1

CONTRACT NUMBER: 212C-SW-00070

**Legend**

- Pre-Existing Monitoring Well
- New Monitoring Well
- Lower Connellsville SS/ Lower Clarksburg RB
- Morgantown SS/Birmingham RB
- Grafton SS/Pittsburgh RB
- Saltsburg SS/Alluvium
- Approximate Waste Boundary
- - - Approximate Parcel Boundary
- · - · - Groundwater Elevation Contour
- (715.90) Groundwater Elevation January 2017
- Topographic Contour (10-foot)



**TETRA TECH**

PRE-DEVELOPMENT SITE MAPPING  
PLEASANTS POWER STATION  
CCR LANDFILL AND IMPOUNDMENT  
FIRST ENERGY CORPORATION  
GREENSBURG, PENNSYLVANIA

DRAWN BY: S. PAXTON 09/21/16  
CHECKED BY: B. BAKER 10/23/17  
APPROVED BY: B. BAKER 10/17/17  
CONTRACT NUMBER: 212C-SW-00070

FIGURE NUMBER: 2  
REVISION: 0

References:  
1. Topographic base map obtained from the USGS National Map Data Download client. The map was originally drafted in 1957.  
2. Monitoring well locations and estimated sandstone unit outcrops were obtained from "Groundwater Quality at the Pleasants and Willow Island Power Plants, Pleasants County, West Virginia", EPRI Research Project: 9100, Site Investigation Report, dated April 1999.  
3. Approximate Waste Boundary lines were obtained from First Energy Drawing Nos. C7950106, Rev. A (Sheets 1 and 2) and C79508868, Rev. A.  
4. Approximate Parcel Boundary obtained from First Energy Drawing No. C7950064, Rev. A (Sheets 1 through 3), dated 2/14/1997.  
5. 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.

**Legend**

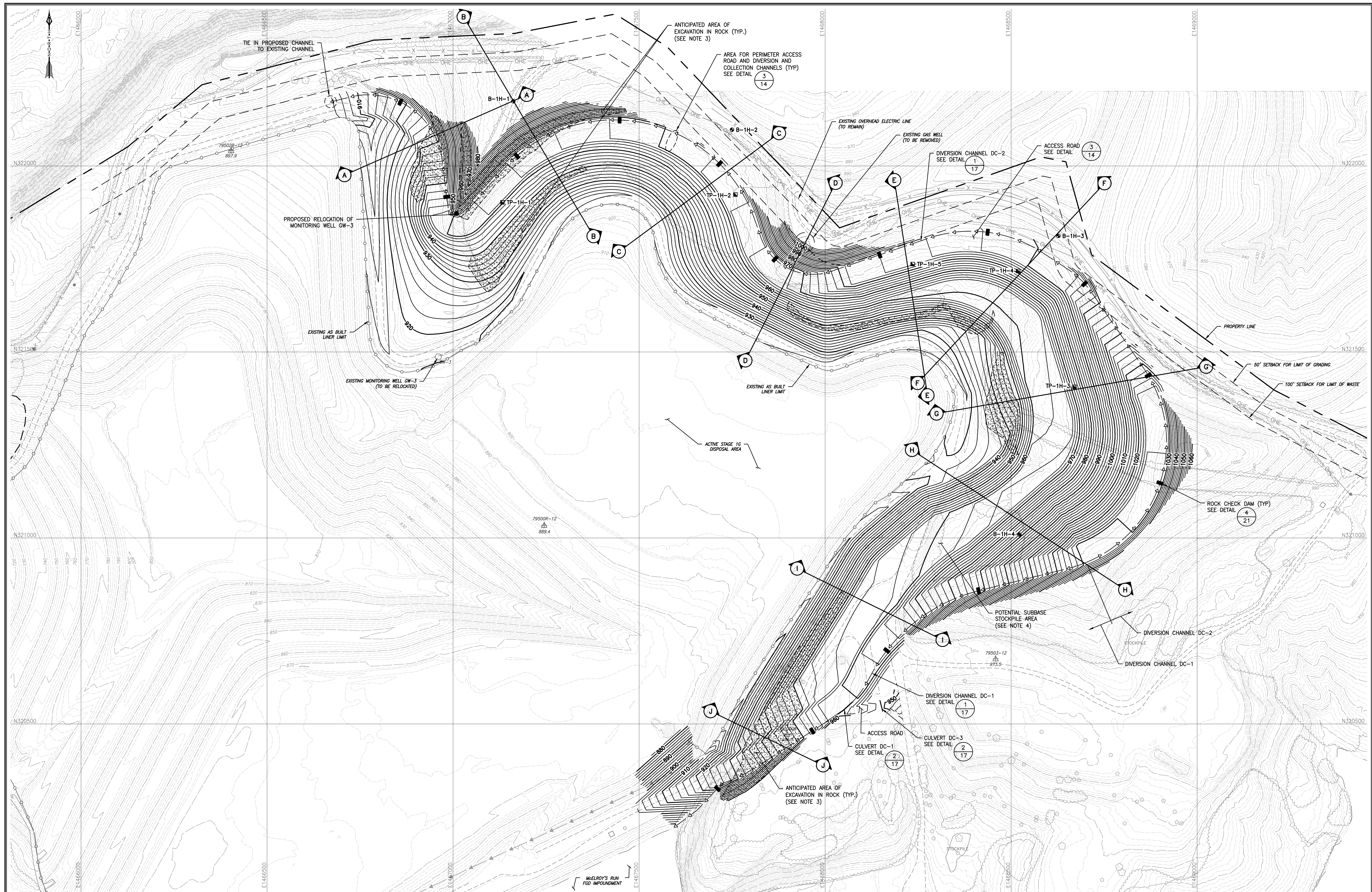
- Pre-Existing Monitoring Well
- New Monitoring Well
- Approximate Property Boundary
- Dam
- Approximate Waste Boundary

**Geologic Unit Groupings**

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

**Geologic Units**

- Lower Clarksburg Redbeds, Mona Limestone, Lower Connellsville
- Morgantown Sandstone
- Grafton Sandstone
- Ames Limestone, Harlem Coals, Jane Lew Sandstone, and Pittsburgh Redbeds

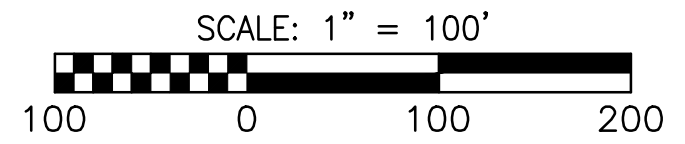


**NOTES:**

1. THIS GRADING PLAN REFLECTS THE SUBGRADE AS SHOWN IN DETAILS ON SHEETS 14 TO 16.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE PLACEMENT OF SUITABLE LINER SUBBASE MATERIAL. NOTE THAT FOR EXCAVATION SITUATIONS, SUITABLE IN-PLACE MATERIAL MAY EXIST BUT MUST BE VERIFIED OR THE 6" THICK SUBBASE (MIN) MUST BE CONSTRUCTED PER SPECIFICATION. FOR FILL SITUATIONS, THE FILL WILL BE COMPLETED TO SUBGRADE PER SPECIFICATION AND THE SUBBASE MATERIAL ADDED.
3. THE CONTRACTOR SHALL COMPLETE ALL NECESSARY EXCAVATION PER THIS DRAWING AND THE SUBGRADE ISOPACH PLAN. OVEREXCAVATION AREAS SHOWN ON THIS DRAWING (EG. ROCK OVEREXCAVATION), AND AS ENCOUNTERED IN THE FIELD (EG. WET UNSUITABLE SOILS) WILL BE ADDRESSED AS SPECIFIED IN THE GENERAL NOTES.
4. THE BENCH IN THE SUBGRADE IN THE EASTERN HALF OF STAGE 1H MAY BE USED FOR TEMPORARY SOIL AND SUBBASE MATERIAL STOCKPILES WITH OWNER APPROVAL.
5. REFER TO E&S CONTROL PLAN (SHEET 20) FOR CONTROL AND DISCHARGE OF STORMWATER DURING EARTHWORK ACTIVITIES.
6. REFER TO SHEET 16 AND RESPECTIVE DETAILS FOR INCORPORATION OF GROUNDWATER UNDERDRAINS AS NEEDED IN SUBGRADE.
7. REFER TO SHEET 2 (GENERAL NOTES) FOR ADDITIONAL INFORMATION.

**REFERENCE:**

1. THE GRID SHOWN ON THIS DRAWING IS APPROXIMATE AND IS BASED ON THE WEST VIRGINIA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, 1983 NORTH AMERICAN DATUM.
2. EXISTING TOPOGRAPHY HAS BEEN PROVIDED BY FIRSTENERGY GENERATION, LLC. (FE) IN THE FORM OF FE DRAWING NO. C79503322-1 "CCB ACTIVE LANDFILL 2013 TOPOGRAPHIC MAPPING", DATED JULY 22, 2013. THE SOURCE OF THE MAPPING IS KUCERA INTERNATIONAL INC. 2-FT CONTOUR INTERVAL AERIAL PHOTOGRAPHY, DATED MARCH 30, 2013. THE DRAWING MAY NOT REFLECT CURRENT SITE CONDITIONS.



<b>DRAWING TITLE</b>			<b>CLIENT</b>		
SUBGRADE PLAN			FIRSTENERGY GENERATION, LLC GREENSBURG, PENNSYLVANIA		
<b>PROJECT</b>			<b>ISSUING OFFICE</b>		
PLEASANTS POWER STATION McLROY'S RUN CCB DISPOSAL FACILITY STAGE 1H LINER AREA CONSTRUCTION			Murrysville   14200 Triangle Lane, Export, PA 15602-1288 ISSUING OFFICE: Murrysville   C:\Engineering\Projects\Drawings\2014\14-06-002-00-C-E1-004.dwg - FE 9/9/2015 8:43:41 PM - PLOTTED BY: Jeremy Shook PLotted on: 6/22/2015 8:43:41 AM - PLOTTED ON: 6/22/2015 8:43:41 AM - PLOTTED BY: Jeremy Shook		
<b>REVISION RECORD</b>			<b>DESCRIPTION:</b>		
NO.	DATE:	DWGN:	CHK:	APP:	
DRAWN BY: SLODOJD			CHECKED BY: MEDVEDL		
DWG TYPE: AS SHOWN			ISSUE DATE: 05/29/2015		
SHEET NO.: 4 OF 21			REVISION: A		
GAI FILE NUMBER: C121146-06-002-00-C-E1-004			ALT./CLIENT DRAWING NUMBER: C79508869		
GAI DRAWING NUMBER: E1-004			© 2015 GAI Consultants, Inc.		