Low Volume Waste Settling Ponds
Location Restrictions Demonstrations

Mount Storm Power Station
Mount Storm, West Virginia

March 2018

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Prepared For
Virginia Electric and Power Company

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REGISTERED
3/19/18
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STATE OF
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PROFESSIONAL ENGINEER

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Certification

I, the undersigned West Virginia Professional Engineer, hereby certify that I am familiar with the technical requirements of Title 40 Code of Federal Regulations Part 257 Subpart D (§257). I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, that the information in this demonstration is in accordance with current good and accepted engineering practice(s) and standard(s), and meets the requirements of §257.60 through §257.64.

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion." The certification is understood and intended to be an expression of my professional opinion as a West Virginia Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

R. KENT NILSSON

R. Kent Nilsson, P.E.

21543

West Virginia License Number

Signature of Professional Engineer

3/19/18

Date

Section 1
Background

The purpose of this document is to demonstrate the compliance of the retrofitted and new low volume waste settling ponds (LVWSP) at the Mount Storm Power Station (Station) with the location restrictions outlined in the Environmental Protection Agency's (EPA) final coal combustion residuals (CCR) rule (Title 40 Code of Federal Regulations Parts 257 and 261) Subpart D - "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" (§257.60 through §257.64, federal rule). The LVWSP are considered CCR surface impoundments according to the federal rule (§257.53). This document includes information from a desktop study, site work, and engineering calculations to demonstrate that the LVWSP are in compliance with placement above the uppermost aquifer (§257.60), and location with respect to wetlands (§257.61), fault areas (§257.62), seismic impact zones (§257.63), and unstable areas (§257.64).

Supporting documents are provided in appendices to this demonstration.

1.1 Site Setting

The Station is located in Union District, Grant County, West Virginia. The Station is located at approximately latitude 39°11′52″N, longitude 79°15′54″W.

The United States Geological Survey (USGS) Mount Storm Lake Quadrangle, West Virginia 7.5 Minute Series topographic maps from 1983 and 2011 were reviewed to evaluate site setting and conditions (Figures 1 and 2; Appendix A). The 1983 topographic map shows the Mount Storm Lake water surface elevation at 3244 feet National Geodetic Vertical Datum of 1929 (NGVD29) (there is 0.3 foot shift between North American Vertical Datum of 1988 (NAVD88) and NGVD29 based on a conversion from Vertcon (NGS 2003)). Ground surface elevations near the LVWSP in the 2011 map range from 3240 to 3280 feet NAVD88. A 2011 aerial photo showing the location of the LVWSP is presented in Figure 3 of Appendix A.

The LVWSP are located within the High segment of the Allegheny Plateau physiographic province which comprises the west central portion of the Allegheny Mountain Range (TRC 2016).

The attached geologic map for the state (WVGES 2011; Appendix B) indicates the Station is underlain by cyclic sedimentary rock sequences of sandstone, shale, clay, coal, and limestone of the Pennsylvanian Period (318 – 299 million years ago). The Station is underlain by the Glenshaw formation, which is predominantly a shale and sandstone unit with sequences of thin limestone and coal, As described by Martino, R.L. (*Sequence Stratigraphy of the Glenshaw Formation (Middle-Late Pennsylvanian) in the Central Appalachian Basin*, 2004). Structural geologic features surrounding the Station are the Blackwater Anticline to the west and the Stony River Syncline to the east of the LVWSP (TRC 2016; Matchen, et. al 2008; Appendix B).

A soil map (Soil Map) of the area surrounding the LVWSP that was downloaded from the Natural Resources Conservation Service (NRCS) Web-Soil Survey is included in Appendix C. NRCS has mapped Udorthents, smoothed as the soil type in the area surrounding the LVWSP. Udorthents are soils that have been disturbed by excavation and/or filling, and that may include soils borrowed from other areas and redeposited in the mapped area. NRCS describes this soil type as not being subject to either frequent flooding or ponding, and this is not a hydric soil. Bedrock is typically encountered within 64 inches of the ground surface in the soil units surrounding the LVWSP (the Cavode, Clymer, and Wharton units). Therefore, the Soil Map indicates that shallow bedrock is anticipated throughout the LVWSP area.

A geotechnical exploration was performed at the LVWSP in March of 2015 to evaluate site specific subsurface conditions (Civil Tech Engineering, Inc. 2015). Data from the exploration is included in Appendix D. Generally, the soil conditions were described as gravel and sand fill with bedrock fragments overlying medium dense native sand and very stiff native sandy clay. The soils occur above soft to hard shale and sandstone bedrock. Bedrock was observed at depths varying from 7 feet to greater than 36 feet below ground surface. Actual depths to bedrock encountered at the LVWSP area were greater than those predicted by the Soil Map, in part due to the historical placement of fill for construction of the LVWSP.

1.2 Existing and Future Conditions

Historically, five LVWSP have been used to manage CCR at the Station (Ponds A, B, C, D, and the Pyrite Pond). The LVWSP are located on the southern side of the Station, north and west of Mount Storm Lake (Figure 3; Appendix A). The following activities have or will occur for retrofitting, closure and reconstruction of the LVWSP:

- Phase I (2016): The existing Pyrite Pond was closed and retrofitted.
- Phase II (2017): Ponds B and C were closed by removing accumulated solids. Pond B was reconstructed.
- Phase III (2018): Ponds A and D will be closed by removing accumulated solids. Pond A will be reconstructed.

The LVWSP were or will be retrofitted/reconstructed in compliance with §257.102(k)(1) or §257.102(c) through the removal of CCR materials, and subsoils, and installation of a composite liner system compliant with §257.72. The reconstructed LVWSP will be located within the former boundaries of historic Ponds A through D and the Pyrite Pond. Refer to Appendix E for the retrofit and reconstruction designs.

Section 2
Location Restrictions

The location restrictions designated in the federal CCR rule are presented below with a corresponding demonstration to show compliance with each restriction. The location restrictions include placement above the uppermost aquifer, wetlands, fault areas, seismic impact zones, and unstable areas. Supporting information for the demonstrations is included in the appendices.

2.1 §257.60 – Placement above the Uppermost Aquifer

The federal CCR rule requires that CCR units such as the LVWSP at the Station 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 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 the groundwater elevations (including the seasonal high water table). For designing the base elevations for the retrofitted Pyrite Pond, the potential maximum water table was estimated using historical water level data from surrounding wells collected by the Station from November 1996 through July 2015 (TRC 2016). Additional data obtained by TRC from November 2015 through November 2016 during quarterly monitoring of the LVWSP monitoring wells were also available. Cross-sections showing the projected maximum potential groundwater elevations below the Pyrite Pond demonstrate that the base of the Pyrite Pond is more than five feet above the upper limit of the uppermost aquifer (Figure 3-15 and Drawing 66703-C7 in Appendix F).

The new reconstructed Ponds A and B were or will be constructed with a groundwater gradient control system to prevent intermittent, recurring, or sustained hydraulic connection between any portion of the base of the new LVWSP and the upper limit of the uppermost aquifer due to normal fluctuations in groundwater levels (including the seasonal high water table). The gradient control systems at each reconstructed LVWSP consist of a 2-foot thick drainage layer consisting of non-calcareous gravel sized aggregate with a geotextile filter on the top and bottom. Six-inch diameter high density polyethylene perforated piping placed in the aggregate at the perimeter of the base and diagonally across the base serves as a gradient control groundwater collection pipe system (Drawings 66703-C29, C38, and C46 in Appendix F). Above each gradient control system, a layer of general fill material is installed to provide the subbase grades for each new reconstructed LVWSP. Each new reconstructed LVWSP liner system is installed above the general fill. Groundwater collected in the gradient control system will be transported by gravity to a lift station. The groundwater gradient control system designed and constructed at each reconstructed LVWSP is to prevent intermittent, recurring, or sustained hydraulic connection between the base of the CCR unit and the upper limit of the uppermost aquifer.

Based on this demonstration, the base of the retrofitted Pyrite Pond is located greater than five feet above the upper limit of the uppermost aquifer; therefore, the retrofitted Pyrite Pond is in compliance with the requirements of §257.60. Reconstructed Ponds A and B are designed and are/will be constructed with a groundwater gradient control system to prevent intermittent, recurring, and sustained hydraulic connection between any portion of the bases of the reconstructed LVWSP and the upper limit of the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). Therefore, the reconstructed LVWSP are/will be in compliance with the requirements of §257.60.

2.2 §257.61 - Wetlands

The CCR location standards restrict existing and new CCR surface impoundments from being located in wetlands, as defined at 40 CFR 232.2 (40 CFR 257.61(a)). Wetlands are defined in 40 CFR 232.2 definition of *Waters of the United States* (3)(iv) as, "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." TRC reviewed historical aerial photographs, topographic maps and results of the 2015 geotechnical investigation to ascertain whether or not the LVWSP are located in wetlands.

As shown on the 1920 edition of the United States Geological Survey's Davis, West Virginia, 1:48,000 scale, quadrangle map (Appendix G), the LVWSP are located on what had been mapped in 1920 as a southeast facing hillslope. Based on the map's 50 feet contour interval, and the distance between contours in the vicinity of the LVWSP, TRC estimates that when this map was prepared the hillside had a 10 to 15 percent slope and a convex profile. TRC concludes from this map that prior to constructing the LVWSP the hillside was an upland area with sheet flow runoff.

TRC's 2015 geotechnical exploration of the LVWSP determined that the LVWSP were constructed on fill, overlying native sand and sandy clay. The fill underlying the LVWSP is mapped by the NRCS as Udrothents, smoothed, which is a non-hydric soil that has been disturbed by excavation or fill. The NRCS mapping agrees with TRC's geotechnical exploration. TRC concludes that the fill on which the LVWSP are situated is not a hydric soil.

As discussed in Section 2.1, above, Dominion and TRC have been monitoring groundwater elevations in the vicinity of the LVWSP since 1996. Water level monitoring has shown that groundwater in the vicinity of the LVWSP has ranged from 2 to more than 5 feet below ground surface. These observations suggest that soil saturation occurs deeper than the hydric soil saturation indicator of 12 inches or less, which is used to determine wetland hydrology.

Based on TRC's review of historical documentation and the geotechnical exploration, TRC is of the opinion that the LVWSP are not located in an area exhibiting wetland characteristics.

The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Mapper (Appendix H) (https://www.fws.gov/wetlands/Data/Mapper.html**)** was accessed to evaluate wetland conditions in the vicinity of the LVWSP. The NWI identifies areas exhibiting wetland characteristics and is based on biological attributes visible in aerial imagery. NWI identified wetlands are classified using the Cowardin classification system for wetlands and deep water habitats (Cowardin, *et al.*, 1979). As stated on NWI publications, NWI mapping is intended to delineate limits of jurisdictional wetland habitats.

Based on 2009 aerial imagery, the NWI maps the four LVWSP and much of the Pyrite Pond as Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (PUBHh) wetlands. Approximately 25 percent of the Pyrite Pond is mapped as a Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, Diked/Impounded (PUBFh) wetland.

Operation of and discharges from the LVWSP and Pyrite Pond are regulated under national pollution discharge elimination system (NPDES) permit WV0005525, issued by the WV DEP to Dominion. Since the LVWSP were designed and constructed to meet Clean Water Act requirements and were not constructed in wetlands, even if they exhibit wetland characteristics, they are not considered federally jurisdictional wetlands, as per federal rules published by the USACE and USEPA (33 CFR 328.3(b)(1), and 40 CFR 230.3 (2)(i), respectively).

A swale west of the LVWSP is mapped as a Palustrine, Aquatic Bed, Permanently Flooded, excavated (PABHx) wetland. This swale receives storm water runoff from the area surrounding the LVWSP and Pyrite Pond, and is a component of the Station's storm water management system. Storm water discharges associated with industrial activity are also regulated by the Station's NPDES permit. As the NWI mapped swale was designed and constructed to meet Clean Water Act requirements, even if it exhibits wetland characteristics, it is not considered federally jurisdictional wetlands, as per federal rules published by the USACE and USEPA (33 CFR 328.3(b)(1), and 40 CFR 230.3 (2)(i), respectively).

TRC concludes that the LVWSP are not located in wetlands and because of their use as NPDES treatment units are not wetlands, as defined in 40 CFR 232.2.

2.3 §257.62 - Fault areas

The federal CCR rule requires that CCR units not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time (11,700 years ago) 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. To determine recent fault activity in the area, the subsurface exploration and regional geologic information were reviewed.

As shown on the Geologic Map of West Virginia (Cardwell, *et al.* 1968), no faults have been mapped in the LVWSP area at the Station. Based on the bedrock geology of the Mount Storm Lake Quadrangle (Matchen, et. al 2008; Appendix B), no faults were identified in the vicinity of the LVWSP.

USGS information (2015) was reviewed to evaluate the geologic history of the Allegheny and Appalachian Mountains. A series of mountain building episodes caused uplift in this portion of West Virginia. These mountain building episodes include the Taconic, Appalachian, and Allegheny orogenies. The Allegheny orogeny is the most recent mountain building event and occurred between 320 million years ago to 250 million years ago in the late Paleozoic Era. Significant faulting in the region would likely be related to the most recent orogenic event (between 320 and 250 million years ago), which is significantly earlier than the Holocene.

Evidence of active faulting during the Holocene in the LVWSP area is not supported by this determination; therefore, the existing, retrofitted, and reconstructed LVWSP are in compliance with the requirements of §257.62.

2.4 §257.63 - Seismic Impact Zones

The federal CCR rule requires that CCR units 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. The federal CCR rule defines a seismic impact zone as "an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitation pull (g), will exceed 0.10 g in 50 years".

To determine whether the existing, retrofitted, or reconstructed LVWSP are located in a seismic impact zone, the USGS Earthquake Hazards Program was consulted to determine the earthquake hazard for the LVWSP. The 2015 National Earthquake Hazards Reduction Program U.S. seismic design maps website (USGS 2015; Appendix I) indicates a mapped peak ground acceleration of 0.05 g for the Station area. Using the default site adjustment factor results in a design peak ground acceleration of 0.08 g. This calculated design peak ground acceleration value is less than 0.10 g in 50 years.

Evidence of a seismic impact zone is not supported by this determination; therefore, the existing, retrofitted, and reconstructed LVWSP are not located in a seismic impact zone. The existing, retrofitted, and reconstructed LVWSP are in compliance with the requirements of §257.63.

2.5 §257.64 - Unstable Areas

The federal CCR rule requires that CCR units 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. Factors associated with soil conditions resulting in significant differential settlement, geologic or geomorphologic features, and human-made features or events must be evaluated to determine compliance.

This demonstration was performed by evaluating the results of a geotechnical exploration at the LVWSP (Civil Tech Engineering, Inc. 2015), reviewing local geology and topography, and evaluating human-made features or events at the LVWSP area.

The geotechnical exploration performed at the LVWSP area identified gravel and sand fill with bedrock fragments overlying medium dense native sand and very stiff native sandy clay (Appendix D). The soils occur above soft to hard shale and sandstone bedrock. These observations do not suggest unstable foundation conditions. Based on the subsurface conditions, unstable conditions due to foundation soils and bedrock are not present at the existing, retrofitted, and reconstructed LVWSP.

An engineering analysis was performed to evaluate the slope stability of the berms of the existing LVWSP. This global stability analysis resulted in satisfactory factors of safety for the existing LVWSP.

The reconstructed and retrofitted LVWSP were designed and constructed or will be constructed with engineered fill, which is placed and compacted in conformance to project specifications. This method of fill placement and compaction provides a stable base to support the liner system. In addition, the geomembrane liner system and gradient control system will prevent impounded water and groundwater from weakening the foundation soils. Design of the LVWSP retrofit and reconstruction included global stability analysis that resulted in satisfactory factors of safety. Based on these conditions, unstable berms are not present at the retrofitted and reconstructed LVWSP.

Geological and geomorphological information was reviewed to determine potential unstable areas at the existing, retrofitted, and reconstructed LVWSP. None of the geological or geomorphological information reviewed suggest the presence of unstable areas at the existing, retrofitted, and reconstructed LVWSP.

Human-made impacts have changed conditions since construction of the Station. Such features and events include Mount Storm Lake and its dam, grading and placement of fill as part of historical construction, and historical underground coal mining. No significant change in elevation is observed between the two topographic maps (dated 1983 and 2011) that would suggest uncontrolled fill placed in the area of the LVWSP. The surrounding elevations were compared to topographic maps that pre-date the Station without evidence of placement of uncontrolled fill. In addition, the geotechnical exploration did not document unstable soil conditions.

Due to the location of the existing, retrofitted, and reconstructed LVWSP adjacent to Mount Storm Lake, wave action on these LVWSP was considered. Evidence of wave erosion has not been observed on the outer berm of the former LVWSP (Pond D) adjacent to Mount Storm Lake. The alignment of the new reconstructed LVWSP will be shifted shoreward during construction as part of reconstruction; therefore, both new reconstructed LVWSP ponds will not be impacted by waves. The lake levels of Mount Storm Lake are controlled by a dam adjacent to the Station; therefore, potential flooding concerns are not supported.

The West Virginia Interactive Coal Mining Map (WVGES, 2015b) was reviewed to determine if previous mining had occurred in the vicinity of the LVWSP (Appendix J). The eastern boundary of the former Laurel Run Mining No. 1 Portal underground coal mine is located approximately 0.2 miles west of the existing, retrofitted, and reconstructed LVWSP. The attached documents (Appendix J) show the boundary of the former mine in relation to the LVWSP, indicating that underground mining has not occurred beneath or in close proximity to the LVWSP.

An evaluation was performed to determine if the existing, retrofitted, and reconstructed LVWSP were located in an area of potential mine subsidence. The evaluation was performed following methodology recommended by the Mine Safety and Health Administration Design Manual for Coal Refuse Facilities. The results of the evaluation determined that the former Laurel Run Mining No. 1 Portal underground coal mine was located within the zone of "normal extraction permitted" relative to the LVWSP (*i.e.*, the existing, retrofitted, and reconstructed LVWSP are located outside and to the east of the zone of potential mine subsidence that would be projected to be associated with the former underground coal mine). Therefore, impacts to the existing, retrofitted, and reconstructed LVWSP due to potential ground subsidence above the Laurel Run Mining No. 1 Portal is not anticipated to occur. The mine subsidence evaluation is provided in Appendix J).

Evidence of unstable areas due to soil conditions resulting in significant differential settling, geologic or geomorphologic features, or human-made features or events is not supported by this determination; therefore, the existing, retrofitted, and reconstructed LVWSP are not located in unstable areas. The existing, retrofitted, and reconstructed LVWSP are in compliance with the requirements of §257.64.

Section 3
Conclusions

Based on the evaluation provided in this demonstration, the existing, retrofitted, and reconstructed LVWSP at the Station are in compliance with the location restrictions provided in §257.60 through §257.64 of the CCR rule. No additional action, justification, or demonstration is required to document compliance with the location restrictions provided in the CCR rule after this demonstration has been placed into the operating record, posted to the publically accessible website, and government notifications provided.

Section 4
References

Cowardin, L.M., Carter, V., Golet, F.C., and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish & Wildlife Service Pub. FWS/OBS-79/31, Washington, DC.

Civil Tech Engineering, Inc. 2015. Geotechnical Investigation Report: Low Volume Ash Pond Project – Mt. Storm Station, Mt. Strom, West Virginia. Project No. 23060. May 6, 2015. 11 pp.

Martino, R.L. 2004. Sequence Stratigraphy of the Glenshaw Formation (Middle-Late Pennsylvanian) in the Central Appalachian Basin *in* J.C. Pashin and R.A. Gastaldo, eds., Sequence Stratigraphy, Paleoclimate, and Tectonics of Coal-Bearing Strata. America Association of Petroleum Geologist Studies in Geology 51, p. 1-28.

Matchen, D.L., N. Fedorko, III, B.M. Blake, Jr., P.J. Hunt, R.R. McDowell, S.J. Murphy. 2008. "Bedrock Geology of Canaan Valley, West Virginia." West Virginia Geological and Economic Survey. Morgantown, West Virginia. Publication OF-9902A. Maps. 2 p.

National Geodetic Survey (NGS). 2003. VERTCON. Software. Vers. 2.1. September 2003. National Oceanic and Atmospheric Association. Available online at http://www.ngs.noaa.gov/PC_PROD/VERTCON/. Accessed [4/13/2015].

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed [03/23/2015].

TRC. 2016. Hydrogeological Evaluation Report: Mount Storm Power Station. November 2016.

United States Fish and Wildlife Service. 2010. "Wetlands Mapper." National Wetlands Inventory. Available online at http://geohazards.usgs.gov/deaggint/2008/. Accessed [3/23/2015].

United States Geological Survey. 2015. "Geology of the National Parks: 3D and Photographic Tours, Valley and Ridge Province." Modified January 2015. Available online at http://3dparks.wr.usgs.gov/nyc/valleyandridge/valleyandridge.htm. Accessed [06/16/15].

United States Geological Survey (USGS). 2015. U.S. Seismic Design Maps: 2015 National Earthquake Hazards Reduction Program Provisions. Available Online at http://earthquake.usgs.gov/designmaps/beta/us/. Accessed [1/4/2017].

West Virginia Geological and Economic Survey. 2011. "Geologic Map of West Virginia." Publication Map 25A. 2p.

West Virginia Geological and Economic Survey. 2015a. "Physiographic Provinces of West Virginia." Available online at http://www.wvgs.wvnet.edu/www/geology/geologyphyp.htm. Accessed [1/18/2015].

West Virginia Geological and Economic Survey. 2015b. "Underground and Surface Coal Mines." Coal Bed Mapping Project. Available online at http://www.wvgs.wvnet.edu/GIS/CBMP/ all_mining.html. Accessed [6/10/2015].

Appendix A
Topographic Maps

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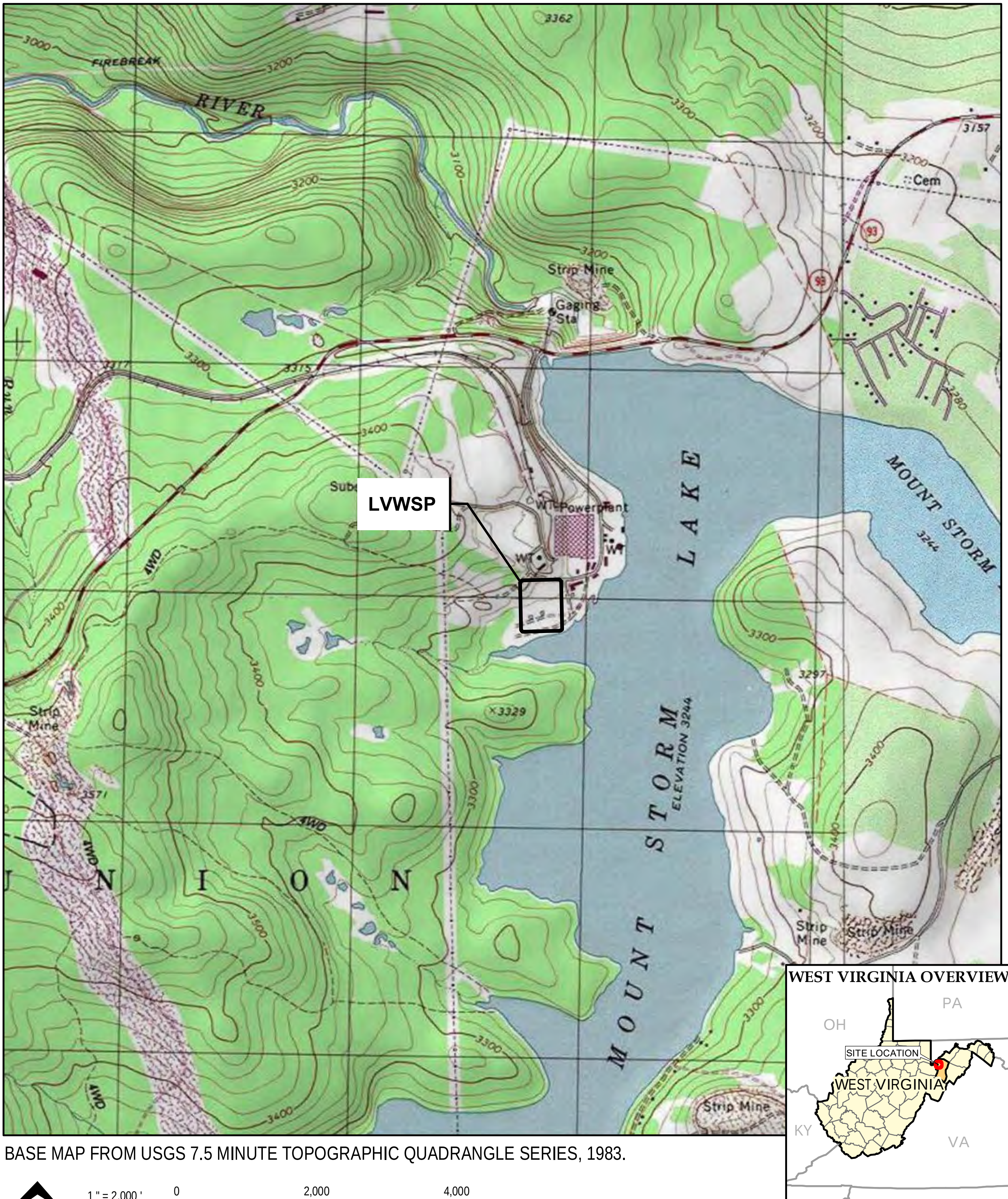
TRC - GIS



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES, 1983.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000 FEET

TRC

708 Heartland Trail
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Madison, WI 53717
Phone: 608.826.3600

DOMINION
MOUNT STORM POWER STATION
MOUNT STORM, GRANT COUNTY, WEST VIRGINIA

SITE LOCATION MAP

DRAWN BY:	
APPROVED BY:	
PROJECT NO:	230765
FILE NO.	230765-001slm.mxd
DATE:	APRIL 2015

FIGURE 1

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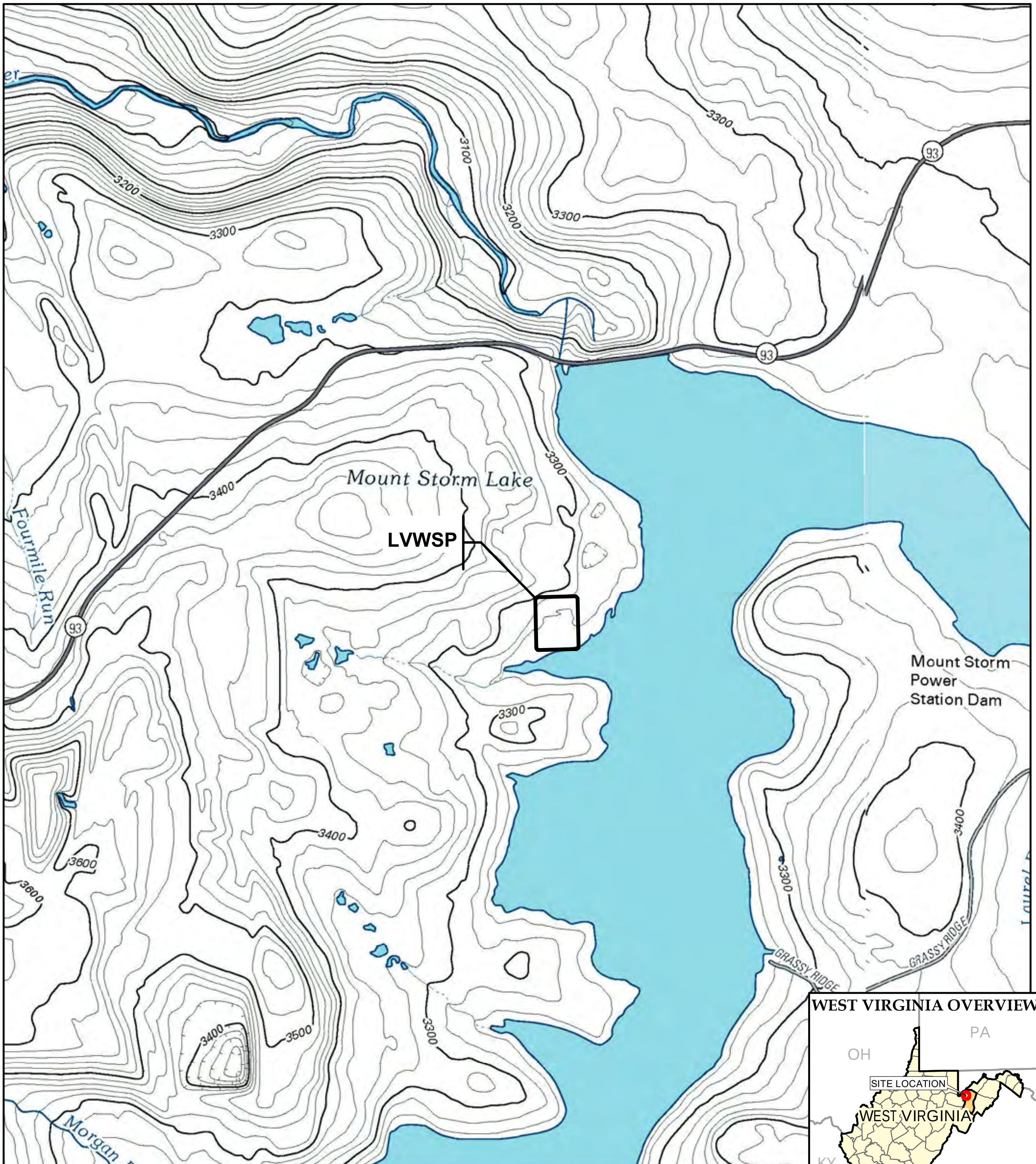

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES, 2011.

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DOMINION
MOUNT STORM POWER STATION
MOUNT STORM, GRANT COUNTY, WEST VIRGINIA

SITE LOCATION MAP

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PROJECT NO:	230765
FILE NO.	230765-002slm.mxd
DATE:	APRIL 2015

FIGURE 2

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TRC - GIS

BASE MAP IMAGERY FROM ESRI/BING, 2011.

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SITE LOCATION MAP

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FIGURE 3

Appendix B
Bedrock Geology Maps

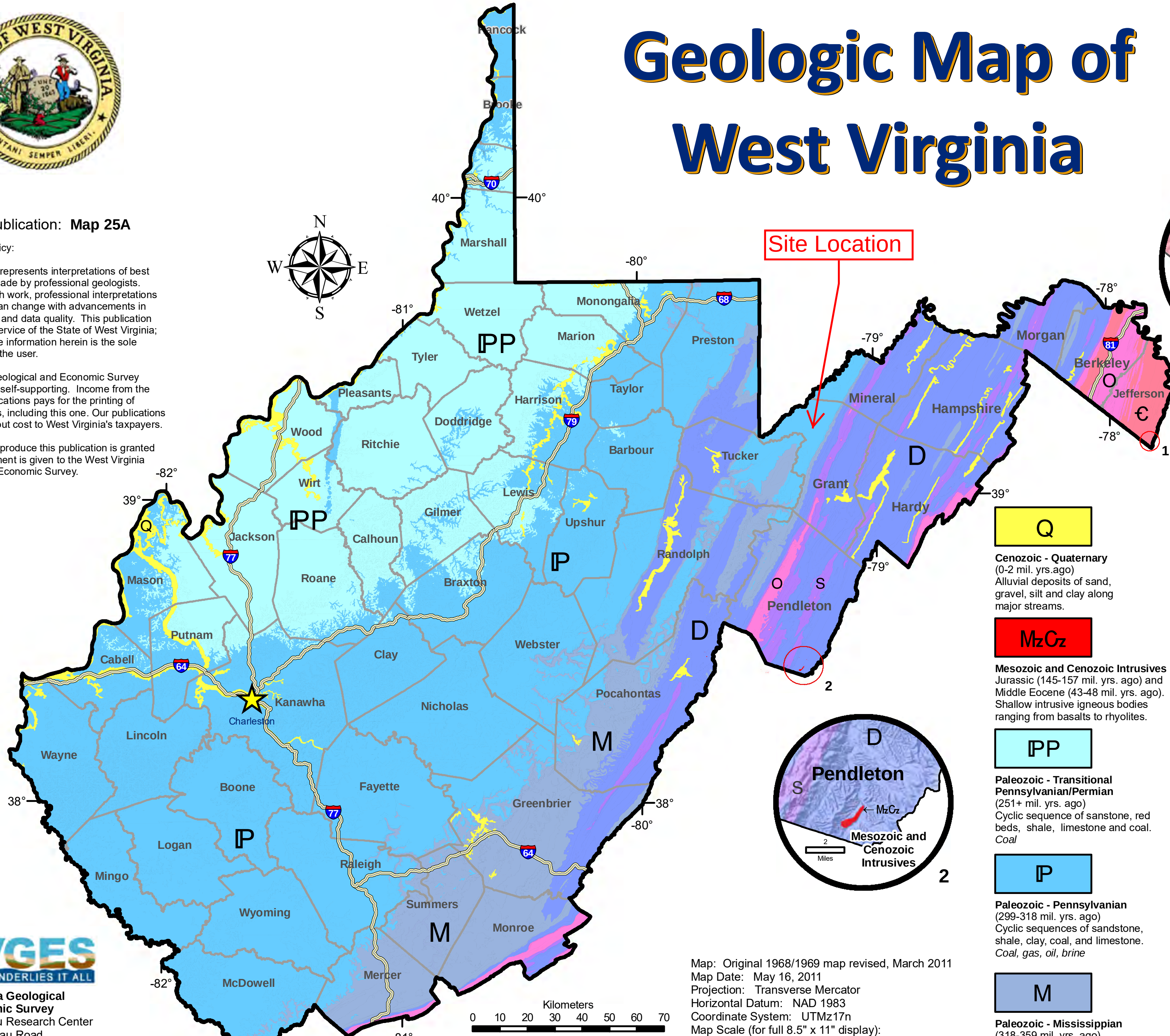
Geologic Map of West Virginia

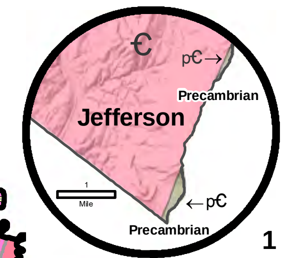
WVGES Publication: **Map 25A**

Publications Policy:

This publication represents interpretations of best available data made by professional geologists. As in all research work, professional interpretations may vary, and can change with advancements in both technology and data quality. This publication is offered as a service of the State of West Virginia; proper use of the information herein is the sole responsibility of the user.

West Virginia Geological and Economic Survey publications are self-supporting. Income from the sale of our publications pays for the printing of new publications, including this one. Our publications are printed without cost to West Virginia's taxpayers.





Map: Original 1968/1969 map revised, March 2011
Map Date: May 16, 2011
Projection: Transverse Mercator
Horizontal Datum: NAD 1983
Coordinate System: UTMz17n
Map Scale (for full 8.5" x 11" display):
For main map: 1:2,000,000
For inset maps: Jefferson Co. 1:200:000
Pendleton Co. 1:500,000

Legend:
Era-Period

USGS Geologic Coloring Scheme

Q
Cenozoic - Quaternary
(0-2 mil. yrs.ago)
Alluvial deposits of sand, gravel, silt and clay along major streams.

D
Paleozoic - Devonian
(359-416 mil. yrs. ago)
Redbeds, shale, sandstone, limestone, and chert.
Gas, silica sand, limestone

MzCz
Mesozoic and Cenozoic Intrusives
Jurassic (145-157 mil. yrs. ago) and Middle Eocene (43-48 mil. yrs. ago). Shallow intrusive igneous bodies ranging from basalts to rhyolites.

S
Paleozoic - Silurian
(416-444 mil. yrs ago)
Sandstone, shale, limestone, rock salt, and ferruginous beds.
Gas, limestone, artificial brine

PP
Paleozoic - Transitional Pennsylvanian/Permian
(251+ mil. yrs. ago)
Cyclic sequence of sanstone, red beds, shale, limestone and coal.
Coal

O
Paleozoic - Ordovician
(444-488 mil. yrs. ago)
Limestone, dolomite, sandstone. shale, and metabentonite.
Limestone (particularly low silica), building stone, clayshale

P
Paleozoic - Pennsylvanian
(299-318 mil. yrs. ago)
Cyclic sequences of sandstone, shale, clay, coal, and limestone.
Coal, gas, oil, brine

Є
Paleozoic - Cambrian
(488-542 mil. yrs. ago)
Limestone and dolomite, some sandstone and shale.

M
Paleozoic - Mississippian
(318-359 mil. yrs. ago)
Limestone, red beds, shale, and sandstone.
Limestone, gas, oil, brine

pЄ
Precambrian
(More than 542 mil. yrs. ago)
Greenstone. Present only in extreme eastern Jefferson Co.

WVGES
GEOLOGY UNDERLIES IT ALL

West Virginia Geological and Economic Survey
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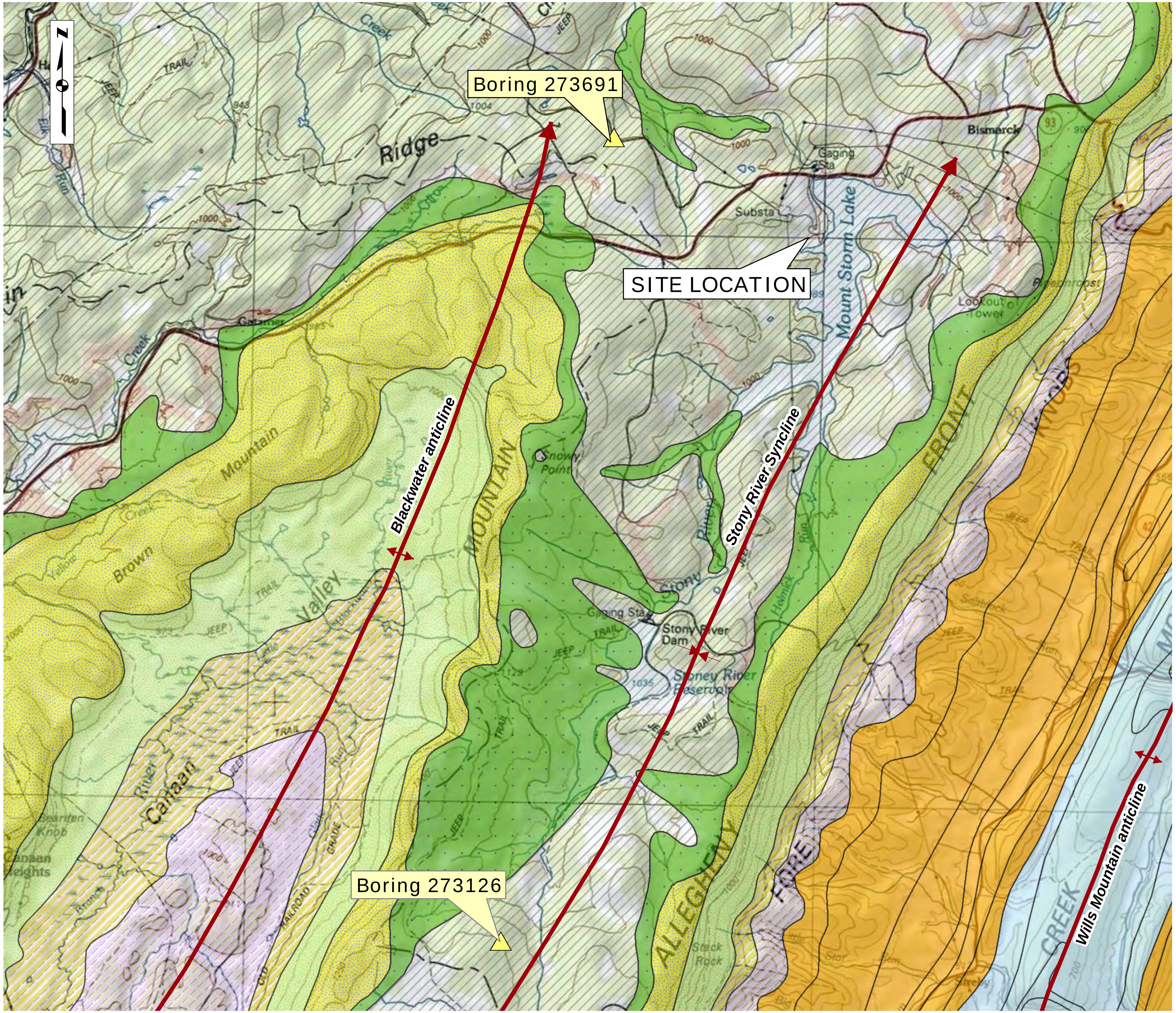
1 Mont Chateau Road
Morgantown, WV 26508-8079
Phone: (304) 594-2331
Web: **www.wvgs.wvnet.edu**



LEGEND

- BORING LOCATION (UNITED STATES GEOLOGICAL SURVEY - NATIONAL COAL RESOURCES DATA SYSTEM)
- GEOLOGIC CONTACT
- PLUNGING FOLD AXIS

GEOLOGIC UNITS
CARBONIFEROUS PERIOD
Pennsylvanian System
Conemaugh Group
Allegheny Formation
Pottsville Group
Mississippian System
Mauch Chunk Group
Greenbrier Group
Pocono Group
DEVONIAN PERIOD
Undifferentiated Groups
SILURIAN PERIOD
Undifferentiated Groups

SOURCES:

- West Virginia Geological and Economic Survey, Bedrock Geology of Canaan Valley, West Virginia, Publication OF–9902A, 2008.
- United States Geological Survey (USGS), Geologic Maps of the US, Online Spatial Data, (http://mrdata.usgs.gov/geology/state).
- USGS National Coal Resources Data System (http://ncrdspublic.er.usgs.gov/nflap).

0 1 2 3
Miles

PROJECT:
DOMINION RESOURCES SERVICES, INC.
MOUNT STORM POWER STATION, WEST VIRGINIA

SHEET TITLE:
REGIONAL GEOLOGY AND LOCATION OF USGS EXPLORATORY BORINGS

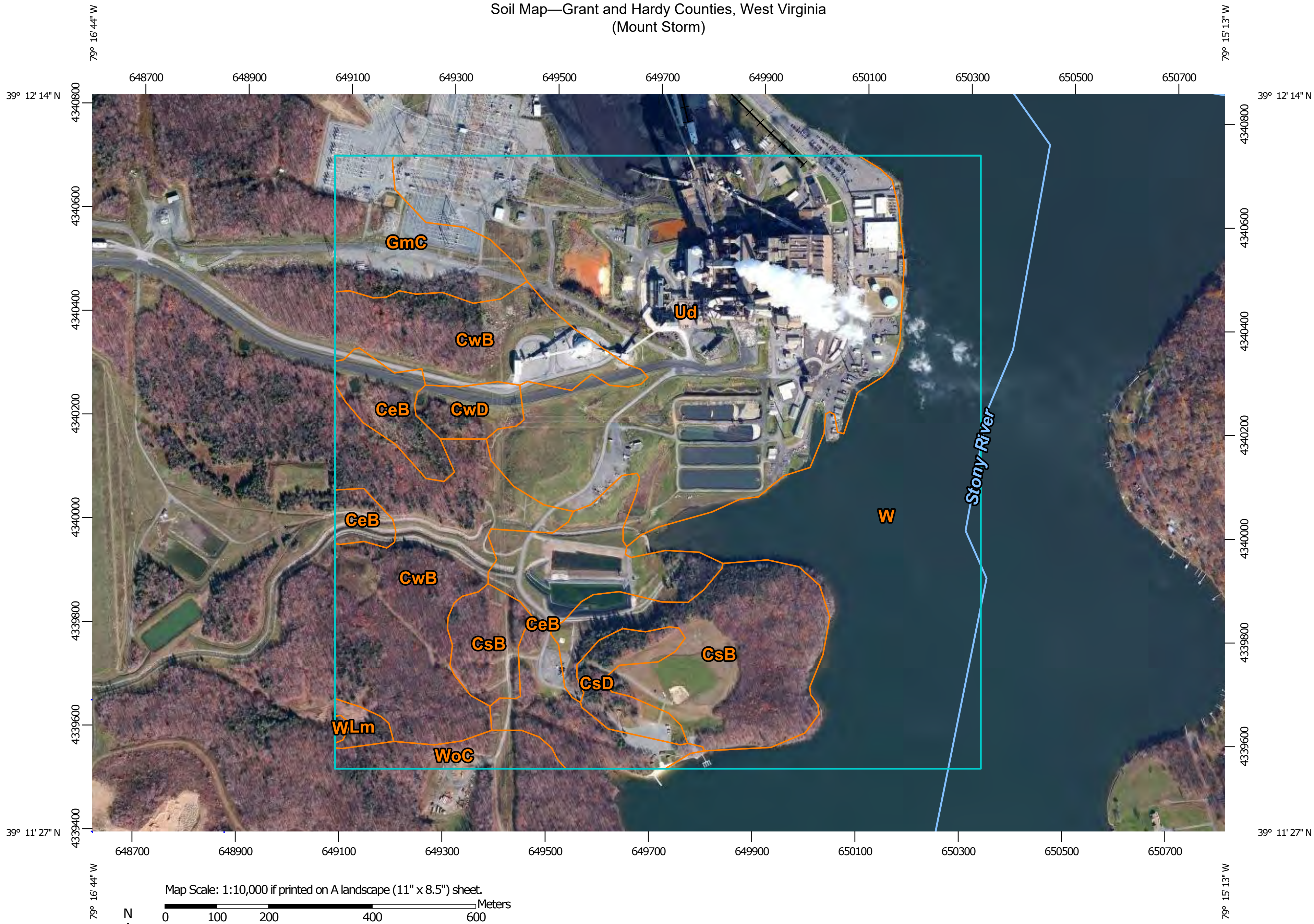
DRAWN BY: RSW	SCALE:	PROJ. NO. 230765.0.0	
CHECKED BY: LMC	1: 70,000	FILE NO. Fig2-3_RegionGeology.mxd	
APPROVED BY: GET	DATE PRINTED:	**FIGURE 2-3**	
DATE: NOVEMBER 2015			

TRC
30 Patewood Drive
Patewood Plaza One, Suite 300
Greenville, SC 29615
Phone: 864.281.0030
www.trcsolutions.com

TRC - GIS
Coordinate System: NAD 1983 2011 StatePlane West Virginia North FIPS 4701 FtUS (Foot US)
Map Rotation: 0
Saved By: AFEIGL on 4/8/2016, 12:58:49 PM
Path: P:_Vision\230765 - Dominion Mt Storm\ArcGIS10\Fig2-3_RegionGeology.mxd

Appendix C
Soil Survey Map by Natural Resources Conservation Service

Soil Map—Grant and Hardy Counties, West Virginia
(Mount Storm)



Map Scale: 1:10,000 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
Area of Interest (AOI)

Soils
Soil Map Unit Polygons
Soil Map Unit Lines
Soil Map Unit Points

Special Point Features
Blowout
Borrow Pit
Clay Spot
Closed Depression
Gravel Pit
Gravelly Spot
Landfill
Lava Flow
Marsh or swamp
Mine or Quarry
Miscellaneous Water
Perennial Water
Rock Outcrop
Saline Spot
Sandy Spot
Severely Eroded Spot
Sinkhole
Slide or Slip
Sodic Spot
Spoil Area
Stony Spot
Very Stony Spot
Wet Spot
Other
Special Line Features

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grant and Hardy Counties, West Virginia
Survey Area Data: Version 9, Sep 30, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 9, 2011—Oct 25, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Grant and Hardy Counties, West Virginia (WV628)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CeB	Cavode stony silt loam, 3 to 8 percent slopes	34.3	9.3%
CsB	Clymer stony loam, 3 to 15 percent slopes	36.7	10.0%
CsD	Clymer stony loam, 15 to 35 percent slopes	6.3	1.7%
CwB	Clymer and Wharton rubbly soils, 3 to 15 percent slopes	57.6	15.7%
CwD	Clymer and Wharton rubbly soils, 15 to 35 percent slopes	4.7	1.3%
GmC	Gilpin stony silt loam, 3 to 15 percent slopes	15.5	4.2%
Lm	Lickdale stony loam	1.6	0.4%
Ud	Udorthents, smoothed	117.2	31.9%
W	Water	87.2	23.8%
WoC	Wharton stony silt loam, 3 to 15 percent slopes	5.9	1.6%
Totals for Area of Interest		**366.9**	**100.0%**

Engineering Properties

Grant and Hardy Counties, West Virginia

[Absence of an entry indicates that the data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
CeB:												
Cavode	0-5	Silt loam	ML	A-4	0	0-5	90-100	80-100	80-95	75-95	---	---
	5-60	Clay, channery silty clay loam, silty clay	CL-ML, ML	A-4, A-6, A-7	0	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	60-64	Bedrock	---	---	---	---	---	---	---	---	---	---
CwB:												
Clymer	0-6	Loam	GM, ML, SM	A-2, A-4	0-2	0-30	60-100	50-95	45-90	30-85	10-30	NP-9
	6-53	Channery loam, channery sandy clay loam, sandy loam	GC, GM, ML, SM	A-2, A-4	0	0-20	60-95	50-95	45-85	30-60	14-32	NP-9
	53-60	Channery loam, channery sandy clay loam, channery sandy loam	GC, GM, GP-GM, SM	A-1, A-2, A-3, A-4	0	10-30	30-75	25-70	20-60	5-40	14-32	NP-9
	60-64	Bedrock	---	---	---	---	---	---	---	---	---	---
Wharton	0-6	Silt loam	ML	A-4, A-6	0	0-10	70-90	60-85	55-80	50-75	---	---
	6-38	Channery silty clay loam, channery silt loam, silty clay loam	MH, ML	A-6, A-7	0	0-25	75-100	70-100	65-95	60-90	35-55	10-25
	38-58	Channery clay, channery silt loam, silt loam	GM, ML, SM	A-4, A-6, A-7	0	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	58-62	Bedrock	---	---	---	---	---	---	---	---	---	---

Component Text

Grant and Hardy Counties, West Virginia

[Only those components that have entries for the selected text kinds and categories are included in this report. This report shows only the major soils in each map unit]

Map unit: CeB - Cavode stony silt loam, 3 to 8 percent slopes

Componet: Cavode

Text kind/Category: Nontechnical description/GENSOIL

The Cavode component makes up 70 percent of the map unit. Slopes are 3 to 8 percent. This component is on ridges on mountains. The parent material consists of clayey residuum weathered from acid shale. Depth to a root restrictive layer, bedrock, lithic, is 60 to 64 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, May, October, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: CwB - Clymer and Wharton rubbly soils, 3 to 15 percent slopes

Componet: Clymer

Text kind/Category: Nontechnical description/GENSOIL

The Clymer component makes up 50 percent of the map unit. Slopes are 3 to 8 percent. This component is on ridges on mountains. The parent material consists of loamy residuum weathered from sandstone. Depth to a root restrictive layer, bedrock, lithic, is 60 to 64 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Componet: Wharton

Text kind/Category: Nontechnical description/GENSOIL

The Wharton component makes up 25 percent of the map unit. Slopes are 3 to 8 percent. This component is on ridges on mountains. The parent material consists of loamy residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 58 to 62 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: CwD - Clymer and Wharton rubbly soils, 15 to 35 percent slopes

Componet: Clymer

Text kind/Category: Nontechnical description/GENSOIL

The Clymer component makes up 50 percent of the map unit. Slopes are 15 to 35 percent. This component is on ridges on mountains. The parent material consists of loamy residuum weathered from sandstone. Depth to a root restrictive layer, bedrock, lithic, is 60 to 64 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component Text

Grant and Hardy Counties, West Virginia

Map unit: CwD - Clymer and Wharton rubbly soils, 15 to 35 percent slopes

Componet: Wharton

Text kind/Category: Nontechnical description/GENSOIL

The Wharton component makes up 25 percent of the map unit. Slopes are 15 to 35 percent. This component is on ridges on mountains. The parent material consists of loamy residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 58 to 62 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: GmC - Gilpin channery silt loam, moist, 3 to 15 percent slopes, very stony

Componet: Gilpin, moist

Text kind/Category: Nontechnical description/GENSOIL

The Gilpin component makes up 75 percent of the map unit. Slopes are 3 to 15 percent. This component is on hillslopes on dissected plateaus. The parent material consists of acid fine-loamy residuum weathered from shale and siltstone and/or fine-grained sandstone. Depth to a root restrictive layer, bedrock, lithic, is 25 to 40 inches (depth from the mineral surface is 25 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 72 percent. Below this thin organic horizon the organic matter content is about 11 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: Ud - Udorthents, smoothed

Componet: Udorthents

Text kind/Category: Nontechnical description/GENSOIL

The Udorthents component makes up 100 percent of the map unit. Slopes are 0 to 50 percent. This component is on cuts (road, railroad, etc.), fills. Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. This soil does not meet hydric criteria.

Map unit: W - Water

Componet: Water

Text kind/Category: Nontechnical description/GENSOIL

The Water component makes up 100 percent of the map unit. Slopes are Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. This soil does not meet hydric criteria.

Appendix D
Geotechnical Exploration Data

This appendix provides excerpts from the Civil Tech Engineering, Inc. 2015 Geotechnical Investigation.

COAL PILE SURVEY MONUMENTS

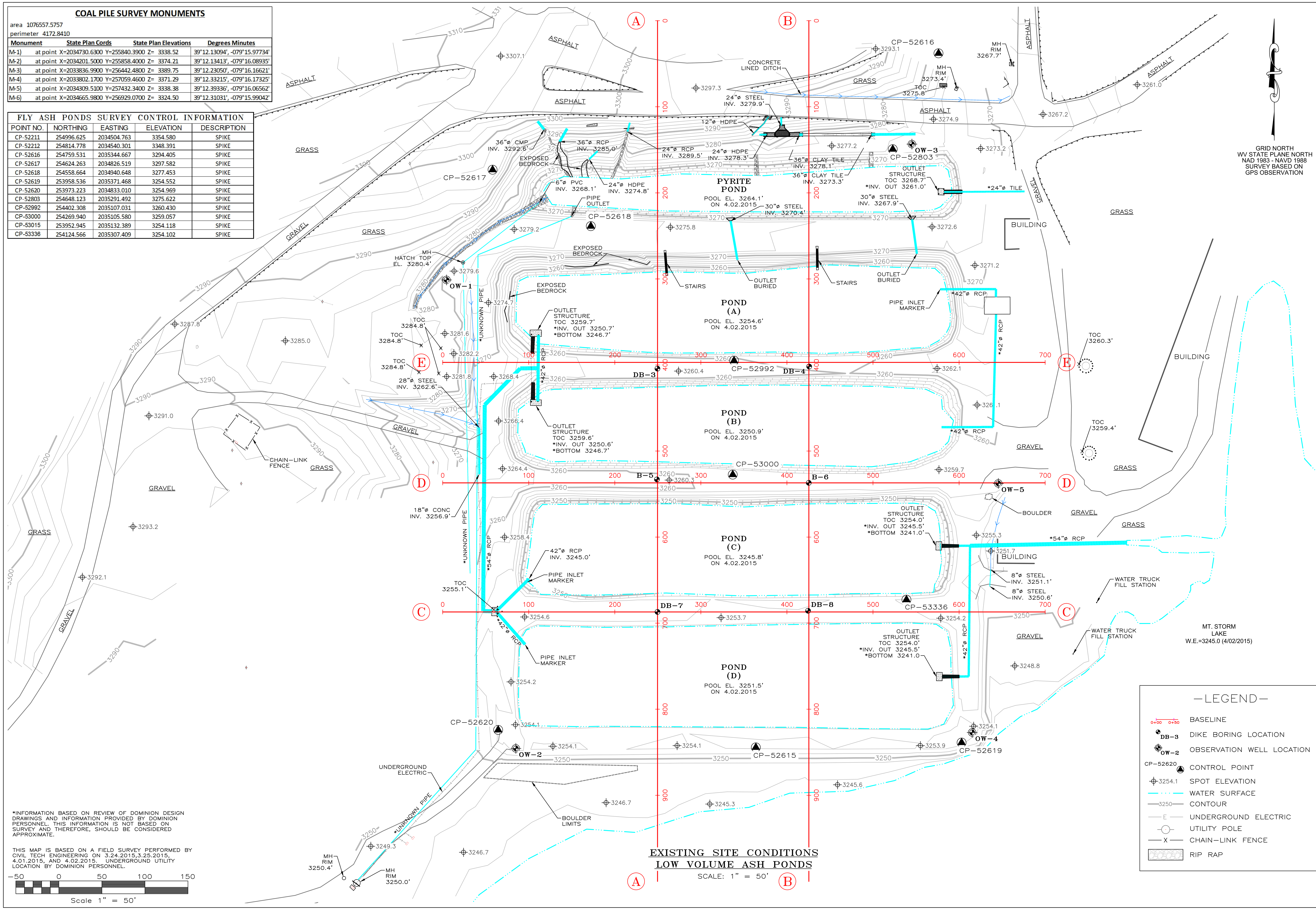
area 1076557.5757

perimeter 4172.8410

Monument	State Plan Cords		State Plan Elevations	Degrees Minutes
M-1)	at point X=2034730.6300	Y=255840.3900	Z= 3338.52	39°12.13094', -079°15.97734'
M-2)	at point X=2034201.5000	Y=255858.4000	Z= 3374.21	39°12.13413', -079°16.08935'
M-3)	at point X=2033836.9900	Y=256442.4800	Z= 3389.75	39°12.23050', -079°16.16621'
M-4)	at point X=2033802.1700	Y=257059.4600	Z= 3371.29	39°12.33215', -079°16.17325'
M-5)	at point X=2034309.5100	Y=257432.3400	Z= 3338.38	39°12.39336', -079°16.06562'
M-6)	at point X=2034665.9800	Y=256929.0700	Z= 3324.50	39°12.31031', -079°15.99042'

FLY ASH PONDS SURVEY CONTROL INFORMATION

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
CP-52211	254996.625	2034504.763	3354.580	SPIKE
CP-52212	254814.778	2034540.301	3348.391	SPIKE
CP-52616	254759.531	2035344.667	3294.405	SPIKE
CP-52617	254624.263	2034826.519	3297.582	SPIKE
CP-52618	254558.664	2034940.648	3277.453	SPIKE
CP-52619	253958.536	2035371.468	3254.552	SPIKE
CP-52620	253973.223	2034833.010	3254.969	SPIKE
CP-52803	254648.123	2035291.492	3275.622	SPIKE
CP-52992	254402.308	2035107.031	3260.430	SPIKE
CP-53000	254269.940	2035105.580	3259.057	SPIKE
CP-53015	253952.945	2035132.389	3254.118	SPIKE
CP-53336	254124.566	2035307.409	3254.102	SPIKE



EXISTING SITE CONDITIONS
LOW VOLUME ASH PONDS
SCALE: 1" = 50'

*INFORMATION BASED ON REVIEW OF DOMINION DESIGN DRAWINGS AND INFORMATION PROVIDED BY DOMINION PERSONNEL. THIS INFORMATION IS NOT BASED ON SURVEY AND THEREFORE, SHOULD BE CONSIDERED APPROXIMATE.

THIS MAP IS BASED ON A FIELD SURVEY PERFORMED BY CIVIL TECH ENGINEERING ON 3.24.2015,3.25.2015, 4.01.2015, AND 4.02.2015. UNDERGROUND UTILITY LOCATION BY DOMINION PERSONNEL.

−50 0 50 100 150

Scale 1" = 50'

REVISIONS		
DATE	BY	DESCRIPTION

SCALE: AS SHOWN

DRAWN BY: CDA
CHECKED BY: MEP

MOUNT STORM POWER STATION
MOUNT STORM, WEST VIRGINIA

EXISTING SITE CONDITIONS
LOW VOLUME ASH PONDS
MOUNT STORM POWER STATION

CIVIL TECH ENGINEERING, INC.
HURRICANE, WEST VIRGINIA

DATE 05/06/15

PROJECT NO. 15103

DRAWING NO. 1

LOG OF BORING OW-1

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	3" Topsoil at surface Dark Brown **Sandy Clay** with rock fragments, moist, very stiff **(FILL)**	6					
	SS		18	20				
5		5'						
	SS	Brown & Gray **Clay** with rock fragments, moist, stiff, **(NATURAL SOIL)** 7'	13	11				
		Auger resistance at 7 ft. Gray **Shale,** soft to medium hard						
	SS		37	10				
10								
	SS	Auger refusal at 11 ft. 11' Bottom of Test Boring @ 11 ft.	50/2"					
15								
20								
25								
30								
35								

Well Set in a 10" OD bore hole (6 1/4 inch ID Augers) at 10.9 ft below ground surface:

2" ID PVC Flush Joint Screen 10.9 to 5.9 ft. (5 ft.)
2" PVC Flush Joint Pipe 5.9 ft. to surface (5.9 ft.)
Concrete 0 - 2' (2 ft.)
Cement Grout - none used
Bentonite Seal 2 to 3.9' (1.9 ft.) - 5 gallons
Filter Sand 3.9' to 10.9' (7.0 ft.) - 8 -- 50# bags
Set lockable steel cover in concrete at the surface

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 11 ft.
ELEVATION: 3280.0 ft.(Ground) 3283.43 (Rim)
DATE STARTED/COMPLETED: 3-29-15 / 3-29-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Dry at completion
Water in the well 9.5 ft. at completion*
Water in the well 9.5 ft. at 24 hours*

*BGS - Below Ground Surface

FIGURE 1

LOG OF BORING OW-2

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	3" Topsoil at surface Brown **Sandy Clay** with rock fragments, boulders, and cobbles, moist, stiff **(FILL)** Broken rock fill encountered at 5 to 6 ft. 6'	7					
	SS		12	11				
5								
	SS	Brown & Gray **Sandy Clay** with rock fragments, moist, stiff to very stiff **(NATURAL SOIL)** 10.5'	10					
	SS		17	11				
10								
	SS	Gray **Sandstone,** hard 11' Auger refusal at 11 ft. Bottom of Test Boring @ 11 ft.	50/2"					
15								
20								
25								
30								
35								

Well Set in a 10" OD bore hole (6 1/4 inch ID Augers) at 10.7 ft below ground surface:

2" ID PVC Flush Joint Screen 10.7 to 5.7 ft. (5 ft.)
2" PVC Flush Joint Pipe 5.7 ft. to surface (5.7 ft.)
Concrete 0 - 2' (2 ft.)
Cement Grout - none used
Bentonite Seal 2 to 4' (2 ft.) - 5 gallons
Filter Sand 4' to 10.7' (6.7 ft.) - 8 -- 50# bags
Set lockable steel cover in concrete at the surface

BORING LOCATION:	SEE DRAWING NO. 1
COMPLETION DEPTH:	11 ft.
ELEVATION:	3254.6 ft.(Ground) 3257.85 (Rim)
DATE STARTED/COMPLETED:	3-29-15 / 3-29-15
ENGINEER/TECHNICIAN:	MEP
CIVIL TECH PROJECT NO.:	15103

NOTE:
Well dry during drilling.
Well dry at completion.

*BGS - Below Ground Surface

FIGURE 2

LOG OF BORING OW-3

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2" Topsoil at surface over Dark Brown **Sandy Clay** with rock fragments, boulders, & cobbles, moist, stiff **(FILL)** 2'	13	11				
	SS	Brown and Gray **Clay,** moist, very stiff to stiff **(NATURAL SOIL)**	20	19	50	26	3.0	
5	SS		17	17				
	SS	Red color at 7.5 ft.	20	10				
10	SS	Gray color at 11 ft. to rock at 18 ft.	14	13				
15	SS	18'	45	9				
	SS	Gray **Shale**, soft 18.5'	50/6"					
20		Bottom of Test Boring @ 18.5 ft.						
25								
30								
35								

Well Set in a 10" OD bore hole (6 1/4 inch ID Augers) at 16.1 ft below ground surface:

2" ID PVC Flush Joint Screen 16.1 to 5.9 ft. (10.2 ft.)
2" PVC Flush Joint Pipe 5.9 ft. to surface (5.9 ft.)
Concrete 0 - 2' (2 ft.)
Cement Grout 2 - 3' (1 ft.)
Bentonite Seal 3 to 4.1' (1.1 ft.) - 5 gallons
Filter Sand4.1.' to 16.1 ft. (12 ft.) - 12 -- 50# bags
Set lockable steel cover in concrete at the surface

BORING LOCATION:	SEE DRAWING NO. 1
COMPLETION DEPTH:	18.5 ft.
ELEVATION:	3275.6 ft.(Ground) 3278.43.(Rim)
DATE STARTED/COMPLETED:	3-29-15 / 3-31-15
ENGINEER/TECHNICIAN:	MEP
CIVIL TECH PROJECT NO.:	15103

NOTE:
Water first noted on tools at 17 ft*
Water in the well 9.5 ft. at 24 hours *
(well was incomplete on 3/30/15)
Water in the well 12.5 ft. on 3/31/15*
*BGS - Below Ground Surface

FIGURE 3

LOG OF BORING OW-4

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2" Topsoil at surface	11	9				
		Brown **Sandy Clay** with rock fragments,						
	SS	boulders, and cobbles , moist, stiff to medium stiff	13	8			3.0	
5		**(FILL)**						
	SS		11	11				
	SS		8					
10		10'						
	SS	Auger cuttings changed to dark brown 10 to 11.5 ft. No recovery obtained in split spoon 7.5 to 11.5'	10					
		Believed to be natural **Sandy Clay** below 10 ft. based on topography 12'						
15	SS		14					
		Brown **Sand,** coarse grained, wet, medium dense, changing to **Sandstone**, weathered, soft 17'						
		Auger refusal at 17 ft. Bottom of Test Boring @ 17 ft.						
20								
25								
30								
35								

Well Set in a 10" OD bore hole (6 1/4 inch ID Augers) at 16.6 ft below ground surface:

2" ID PVC Flush Joint Screen 16.6 to 6.4 ft. (10.2 ft.)
2" PVC Flush Joint Pipe 6.4 ft. to surface (6.4 ft.)
Concrete 0 - 2' (2 ft.)
Cement Grout 2 - 3' (1 ft.)
Bentonite Seal 3 to 5' (2 ft.) - 5 gallons
Filter Sand 5' to 16.6 ft. (11.6 ft.) - 12 -- 50# bags
Set lockable steel cover in concrete at the surface

BORING LOCATION:	SEE DRAWING NO. 1
COMPLETION DEPTH:	17 ft.
ELEVATION:	3255.0 ft.(Ground) 3258.73 (Rim)
DATE STARTED/COMPLETED:	3-29-15 / 3-29-15
ENGINEER/TECHNICIAN:	MEP
CIVIL TECH PROJECT NO.:	15103

NOTE:
Water first noted on tools at 16 ft*
Water in the well 6.9 ft. at completion*

*BGS - Below Ground Surface

FIGURE 4

LOG OF BORING OW-5

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2" ash at surface	11					
	SS	Brown **Sandy Clay** with rock fragments, moist, stiff	9	16				
5		**(FILL)**						
	SS		9	14				
		- with shale fragments, hard (7-8')						
	SS	8'	40	6				
10		Brown **Sand,** damp, dense						
	SS	**(POSSIBLE NATURAL SOIL)**	30	9				
		12.5'						
	SS	Dark Brown **Sandy Silty Clay** with organics, moist, stiff to soft	15	10				
15								
	SS	**(POSSIBLE NATURAL SOIL)**	7	21				
20		- tools and sample wet at 20 ft.						
	SS	- organics, sticks, and small roots from 20-21.5'	4	28				
		- with rock fragments from 23.5-25'						
25	**SS**	25'	4	17				

Bottom of Test Boring @ 25 ft.

Well Set in a 10" OD bore hole (6 1/4 inch ID Augers) at 24.0 ft below ground surface:

2" ID PVC Flush Joint Screen 24' to 13.8 ft. (10.2 ft.)
2" PVC Flush Joint Pipe 13.8 ft. to surface (13.8 ft.)
Concrete 0 - 4' (4 ft.) - 6 bags
Cement Grout 4' - 6 ' (2 ft.) - 2 bags
Bentonite Seal to 6' to 10' (4 ft.) - 10 gallons
Filter Sand 10' to 24 ft. (14 ft.) - 17 -- 50# bags
Set lockable steel cover in concrete at the surface

30

35

BORING LOCATION:	SEE DRAWING NO. 1
COMPLETION DEPTH:	25 ft.
ELEVATION:	3259.0 ft.(Ground) 3262.80 (Rim)
DATE STARTED/COMPLETED:	3-29-15 / 3-31-15
ENGINEER/TECHNICIAN:	MEP
CIVIL TECH PROJECT NO.:	15103

NOTE:
Water first noted on tools at 20 ft.*
Water in the well 11 ft. at completion*

*BGS - Below Ground Surface

FIGURE 5

LOG OF BORING DB-3

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

CIVIL TECH ENGINEERING

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2 inches ash over Brown **Sandstone** and **Shale,** broken with sand and silt, dry, dense **(FILL)** 2.5'	28					
	SS	Brown **Sandy Clay** with rock fragments, and cobbles, moist, very stiff to stiff	19	17	41	18	4.5	
5								
	SS	**(FILL)** 7.5'	14					
	SS	Brown & Gray **Sandy Clay** with rock fragments and occassional cobbles, moist, stiff	13	17			3.5	
10								
	SS	**(FILL)** 15'	12					
15								
	SS	Brown **Sandstone** to Gray/Black **Shale** @ 15.5', hard to medium hard	50/2"					
20		**Coal** @ 20 ft. 20.8 ft.						
	SS	Bottom of Test Boring @ 20.8 ft.	50/4"					
25								
30								
35								

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 20.8 ft.
ELEVATION: 3260.3 ft.
DATE STARTED/COMPLETED: 3-27-15 / 3-27-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Boring dry during drilling.
Depth to cave-in 15 ft. when tools are pulled from the borehole.
Depth to water 10 ft. at completion.

FIGURE 6

LOG OF BORING DB-4

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2 inches ash over Brown **Sandstone** and **Shale,** broken with some sand and silt, dry, medium dense	17					
	SS	**(FILL)**	16					
5		5'						
	SS	Brown & Gray **Sandy Clay** with rock fragments and cobbles, moist, very stiff to stiff	23	17				
	SS		18	17			3.0	
10		**(FILL)**						
	SS		15	20			3.5	
15		15'						
	SS	Brown **Sand,** damp, medium dense	23					
20		20.0'						
	SS	Gray **Shale**, weathered, soft 20.4'	50/5"					
		Bottom of Test Boring @ 20.4 ft.						
25								
30								
35								

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 20.4 ft.
ELEVATION: 3259.9 ft.
DATE STARTED/COMPLETED: 3-27-15 / 3-27-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Boring dry during drilling.
Depth to cave-in 15 ft. when tools are pulled from the borehole.
Depth to water 10 ft. at completion.

FIGURE 7

LOG OF BORING DB-5

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2 inches ash over Brown **Sandstone,** broken**,** dry, medium dense **(FILL)** 1.5'	24					
		Brown **Sandy Clay** with rock fragments and occassional cobbles and boulders, moist, stiff to medium stiff **(FILL)**						
	SS		12	13			4	
5		Sandstone cobbles at 5 ft.						
	SS		7	15				
	SS	Sandstone boulder at 8 ft.	50/4'	14			2.5	
10								
	SS	11'	13					
		Gray broken **Shale,** loose, dry **(FILL)** 15'						
15								
	SS	No spoon recovery at 15 ft. - drove rock. Possible natural **Sandy Clay** below 15 ft. based on visual examination of the auger cuttings 20'	9					
20								
	SS	Brown and Gray **Sand**, silty, fine to medium grained, damp, loose **(NATURAL SOIL)** 25'	9	19				
25								
	SS	Gray **Sandy Silty Clay** with small shale fragments, very moist, very stiff 26.5'	28	17				
		Bottom of Test Boring @ 26.5 ft.						
30	SS							
35	SS							

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 26.5 ft.
ELEVATION: 3260.0 ft.
DATE STARTED/COMPLETED: 3-26-15 / 3-26-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Water first noted on tools at 15 ft.
Depth to cave-in 11 ft. when tools are pulled from the borehole.
Boring dry to 11 ft. at completion.

FIGURE 8

LOG OF BORING DB-6

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2 inches ash over Brown broken **Sandstone** and **Shale,** dry, medium dense **(FILL)** 1.5'	24					
	SS	Brown **Sandy Clay** with rock fragments and occassional cobbles and boulders, moist, stiff	15	13			3.5	
5								
	SS	**(FILL)** 7.5'	11	12			3.0	
	SS	Brown and Gray broken **Sandstone & Shale,** with some silt, damp, dense	25	7				
10		**(FILL)** 10'						
	SS	Brown & Gray **Sandy Clay** with rock fragments and occassional cobbles, moist, very stiff	26	9			4.0	
15		**(FILL)** 15'						
	SS	Dark brown **Sandy Silt to Coarse Sand**, wet to damp, stiff to medium dense **(NATURAL SOIL)**	11	15				
20		20'						
	SS	Brown and Gray **Sandy Clay**, very moist, medium stiff with small roots (organics)	5	32			0.5	
25		25'						
	SS	Gray **Sandy Silty Clay** with small shale fragments, very moist, medium stiff	6	28	33	10	1.0	
		29'						
30		**Sandstone Conglomerate,** hard 30.2'						
	SS	Bottom of Test Boring @ 30.2 ft.	50/2"					
35								

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 30.2 ft.
ELEVATION: 3258.6 ft.
DATE STARTED/COMPLETED: 3-26-15 / 3-26-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Water first noted on tools at 10 ft.
Depth to cave-in 3 ft. when tools are pulled from the borehole.
Boring dry to 3 ft. at completion.

FIGURE 9

LOG OF BORING DB-7

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2" crushed stone and ash at surface Brown **Sandy Clay** with rock fragments and random layers of Gray Broken **Shale**, moist, stiff **(FILL)** 4.5'	7					
	SS		9	17			2.5	
5	SS	Gray and Black **Sandy Silt, Crushed Sandstone,** and **Broken Shale,** damp, medium dense **(FILL)** 7.5'	22	8			2.75	
	TUBE		Sample attempted & could not be obtained					
	SS	Brown **Sandy Clay** with rock fragments and random layers of Gray Broken **Shale**, moist, medium stiff **(FILL)** 15'	8					
10								
	SS		5	11				
15								
	SS	Brown and Gray **Sandy Clay** with shale fragments very moist, soft to medium stiff **(NATURAL SOIL)** 28'	4	12				
20								
	SS		5	21	34	14		
25								
	SS		4	22				
30		Dark Brown and Gray **Sandy Silty Clay** with rock fragments, moist, stiff 36.5'						
	SS		15	13				
35								
	SS		14	16				
		Bottom of Test Boring @ 36.5 ft.						

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 36.5 ft.
ELEVATION: 3254.3 ft.
DATE STARTED/COMPLETED: 3-26-15 / 3-26-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Water first noted on tools at 12.5 ft.
Water on tools at 15 ft.
Depth to water 17.5 ft. at completion.
Depth to cave-in 17.5 ft. when tools are pulled from the borehole.

FIGURE 10

LOG OF BORING DB-8

CIVIL TECH ENGINEERING

ASH POND CLOSURE AND LINING PROJECT
MT. STORM STATION, MT. STORM, WV

DEPTH (FEET)	SAMPLE TYPE	SOIL/ROCK DESCRIPTION	SPT BLOWS	% MOIST	LIQUID LIMIT	PLASTIC INDEX	q_u TSF	
	SS	2" crushed stone and ash at surface Brown **Sandy Clay** with rock fragments and random layers of Gray Broken **Shale**, moist, stiff to very stiff **(FILL)**	17					
	SS		10	17				
5	SS		27	11				
	SS		10	14			3.5	
10	SS	Auger cuttings moist at 9.5 ft.	11	14				
15		15'						
	SS	Brown and Gray **Sandy Clay** with shale fragments moist, medium stiff **(NATURAL SOIL)** 16.5'	8	22			0.5	
		Brown **Sand,** with some silt and pebbles, medium to coarse grained, wet, very loose to medium dense						
20	SS		5	13				
25	SS		20	11				
30		30'						
	SS	Dark Brown **Sandy Silty Clay** with rock fragments, moist, medium stiff **Split spoon refusal at 35.25 ft. on hard Sandstone**	6	14				
35	SS	35.25'	50/3"					
		Bottom of Test Boring @ 35.25 ft.						

BORING LOCATION: SEE DRAWING NO. 1
COMPLETION DEPTH: 35.25 ft.
ELEVATION: 3253.8 ft.
DATE STARTED/COMPLETED: 3-26-15 / 3-26-15
ENGINEER/TECHNICIAN: MEP
CIVIL TECH PROJECT NO.: 15103

NOTE:
Water first noted on tools at 19 ft.
Depth to water 8 ft. at completion.
Depth to cave-in 19 ft. when tools are pulled from the borehole.

FIGURE 11

Appendix E
Excerpts from Low Volume Wastewater Pond Retrofit and Reconstruction Drawings

STAGE VS STORAGE MATRIX		
ELEVATION	PYRITE POND CAPACITY (GAL)	PYRITE POND CAPACITY (AC FT)
3,265	2,300	0.0
3,266	29,200	0.1
3,267	89,200	0.3
3,268	195,100	0.6
3,269	360,200	1.1
3,270	577,200	1.8

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POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

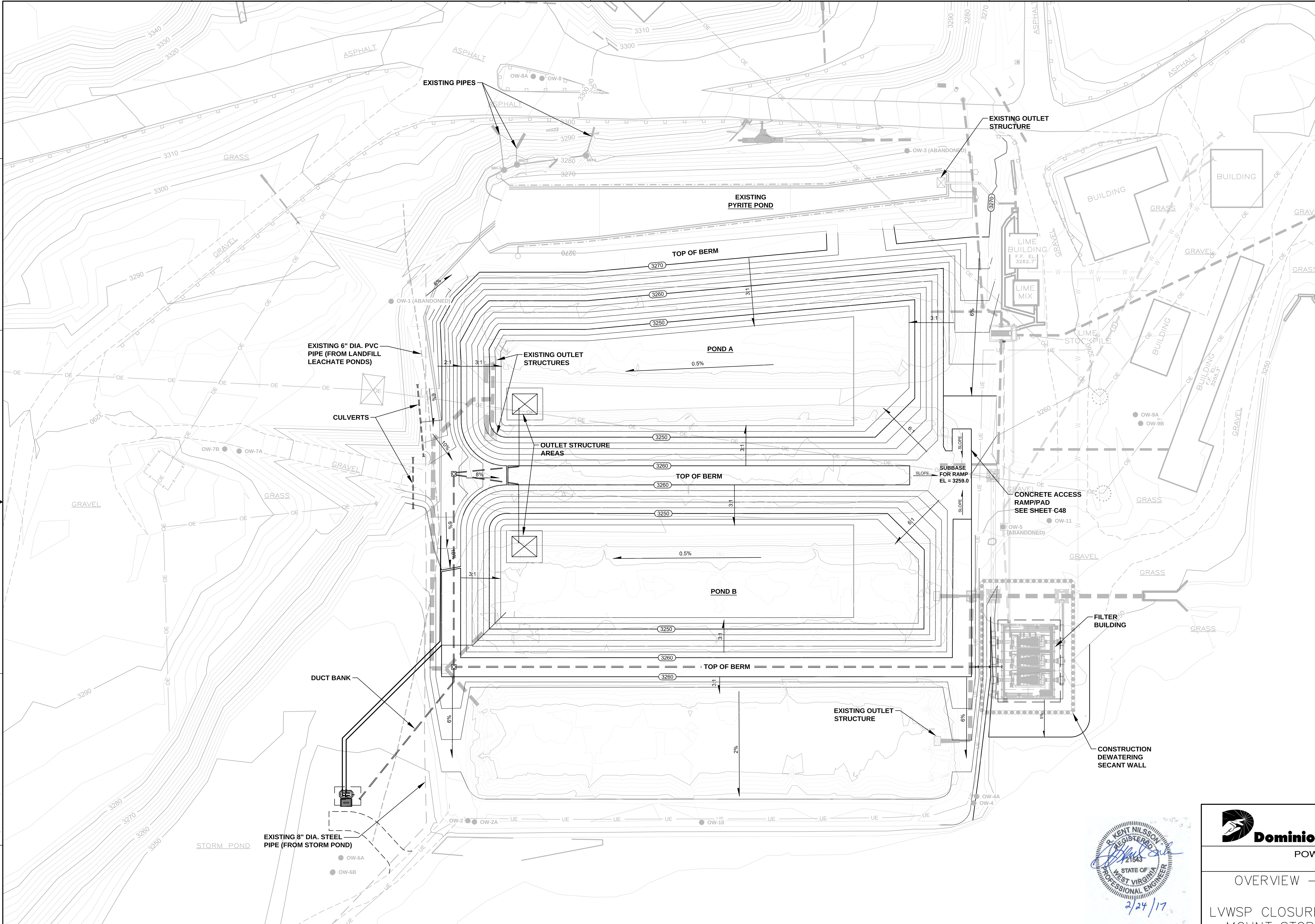
PYRITE POND BASE AND PIPING PLAN

LVWSP CLOSURE & RECONSTRUCTION – PHASE 1
MOUNT STORM POWER STATION, WEST VIRGINIA

REV	DESCRIPTION	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR
1	RE-ISSUED FOR BID	6 16 2016	DM	LLS	JNH		NA	RKN	CBS	SM			
0	ISSUED FOR BID	4 29 2016	DM	LLS	JNH	NA		RKN	CBS	CB			

DSGN D.MARSHALL | DSGN SUPV
DRWN L. STORMER | ENGR SUPV
CHKD JHN | PROJ ENGR
DISPL ENGR RKN | SCALE: AS NOTED UNLESS OTHERWISE NOTED

DATE JUNE 2016
DGNSPEC FOR FILE VERIFICATION
DRAWING NO. 66703–C6
REV. 1
SH C6 OF 23



NOTES

1. REFER TO PLAN SHEET 66703-7 AND C24 OF THIS PLAN SET FOR GENERAL NOTES AND CIVIL STANDARD LEGEND.
2. REFER TO PLAN SHEET 66703-C39 FOR PROPOSED YARD PIPING PLAN.

STAGE VS STORAGE MATRIX

ELEVATION	Pond A Capacity (CY)	North Pond Capacity (CF)	POND A CAPACITY (GAL)	POND A CAPACITY (AC FT)
3,247	1,183	31,935	238,900	0.7
3,248	1,966	53,069	397,000	1.2
3,249	3,471	93,706	700,900	2.2
3,250	5,162	139,367	1,042,500	3.2
3,251	6,979	188,439	1,409,500	4.3
3,252	8,925	240,988	1,802,600	5.5
3,253	11,003	297,078	2,222,100	6.8
3,254	13,214	356,773	2,668,700	8.2
3,255	15,560	420,119	3,142,500	9.6
3,256	18,043	487,160	3,644,000	11.2
3,257	20,666	557,982	4,173,700	12.8
3,258	23,432	632,654	4,732,200	14.5
3,259	26,343	711,251	5,320,200	16.3
3,260	29,401	793,830	5,937,800	18.2

STAGE VS STORAGE MATRIX

ELEVATION	POND B Capacity (CY)	Pond B Capacity (CF)	POND B CAPACITY (GAL)	POND B CAPACITY (AC FT)
3,247	1,183	31,942	238,900	0.7
3,248	1,995	53,852	402,800	1.2
3,249	3,477	93,880	702,200	2.2
3,250	5,147	138,962	1,039,400	3.2
3,251	6,943	187,462	1,402,200	4.3
3,252	8,868	239,442	1,791,000	5.5
3,253	10,925	294,970	2,206,400	6.8
3,254	13,115	354,113	2,648,800	8.1
3,255	15,442	416,935	3,118,700	9.6
3,256	17,908	483,503	3,616,600	11.1
3,257	20,514	553,882	4,143,000	12.7
3,258	23,264	628,140	4,698,500	14.4
3,259	26,160	706,332	5,283,400	16.2
3,260	29,205	788,547	5,898,300	18.1

R. KENT NILSSON REGISTERED 21543 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

2/24/17

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POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

OVERVIEW – PYRITE POND, PONDS A AND B SUBGRADE PLAN

LVWSP CLOSURE AND RECONSTRUCTION – PHASE II
MOUNT STORM POWER STATION, WEST VIRGINIA

REV	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR	
0	02 24 2017	DM	LLS	JNH	NA		RKN	CBS	SM	BCA			ISSUED FOR BID

DSGN D.MARSHALL	DSGN SUPV	DATE FEBRUARY 2017 DGNSPEC FOR FILE VERIFICATION	
DRWN L. STORMER	ENGR SUPV	DRAWING NO. 66703–C30	REV. 0
CHKD JNH	PROJ ENGR		
DISPL ENGR RKN	SCALE: AS NOTED	UNLESS OTHERWISE NOTED	SH C30 OF 31

Appendix F
Groundwater Elevation Data

LEGEND

MONITORING WELL

POTENTIAL MAXIMUM WATER TABLE CONFIGURATION CONTOURS

NOTES:

1) WELLS WERE SURVEYED BY CIVIL TECH ENGINEERING, INC.

2) AERIAL PHOTOGRAPH SOURCE: ESRI WORLD IMAGERY.

3) ASSUME NO INTERACTION BETWEEN PONDS AND GROUNDWATER.

4) ASSUME MAXIMUM LAKE ELEVATION OF 3248.3.

5) SAFETY FACTOR OF 3 FEET ADDED TO JULY 8, 2015 WATER ELEVATIONS IN OBSERVATION WELLS.

N

0 150 300 Feet

PROJECT: DOMINION RESOURCES SERVICES, INC. MOUNT STORM POWER STATION, WEST VIRGINIA

SHEET TITLE: POTENTIAL MAXIMUM WATER TABLE CONFIGURATION

DRAWN BY: AMF	SCALE: 1: 2,400	PROJ. NO. 230765.0.0
CHECKED BY: LMC		FILE NO. Fig3-15_PotMaxWTConfig.mxd
APPROVED BY: GET	DATE PRINTED:	FIGURE 3-15
DATE: SEPTEMBER 2015		

TRC

30 Patewood Drive
Patewood Plaza One, Suite 300
Greenville, SC 29615
Phone: 864.281.0030
www.trcsolutions.com

TRC - GIS

Coordinate System: NAD 1983 2011 StatePlane West Virginia North FIPS 4701 FUS (Foot US)
Map Rotation:

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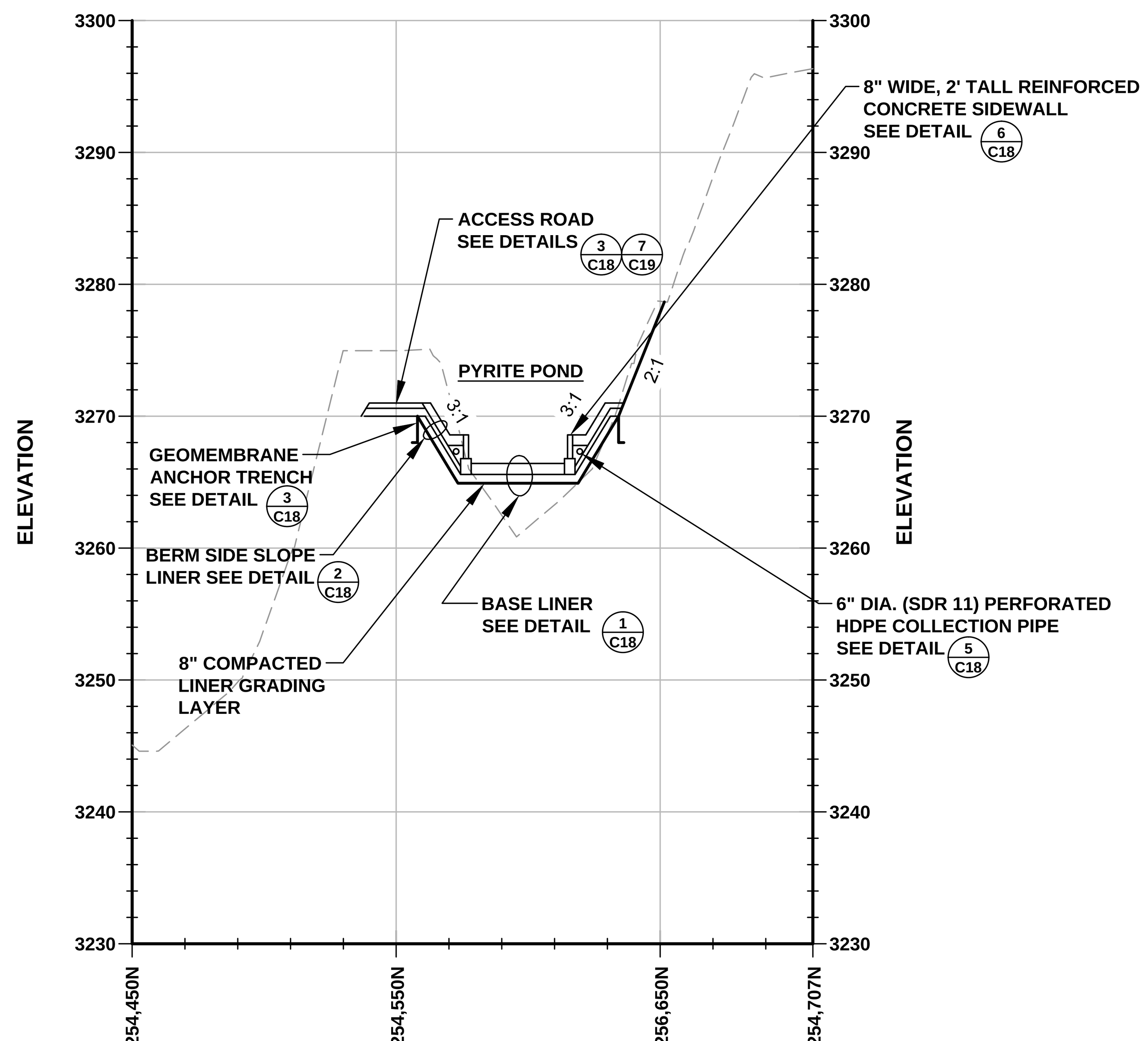
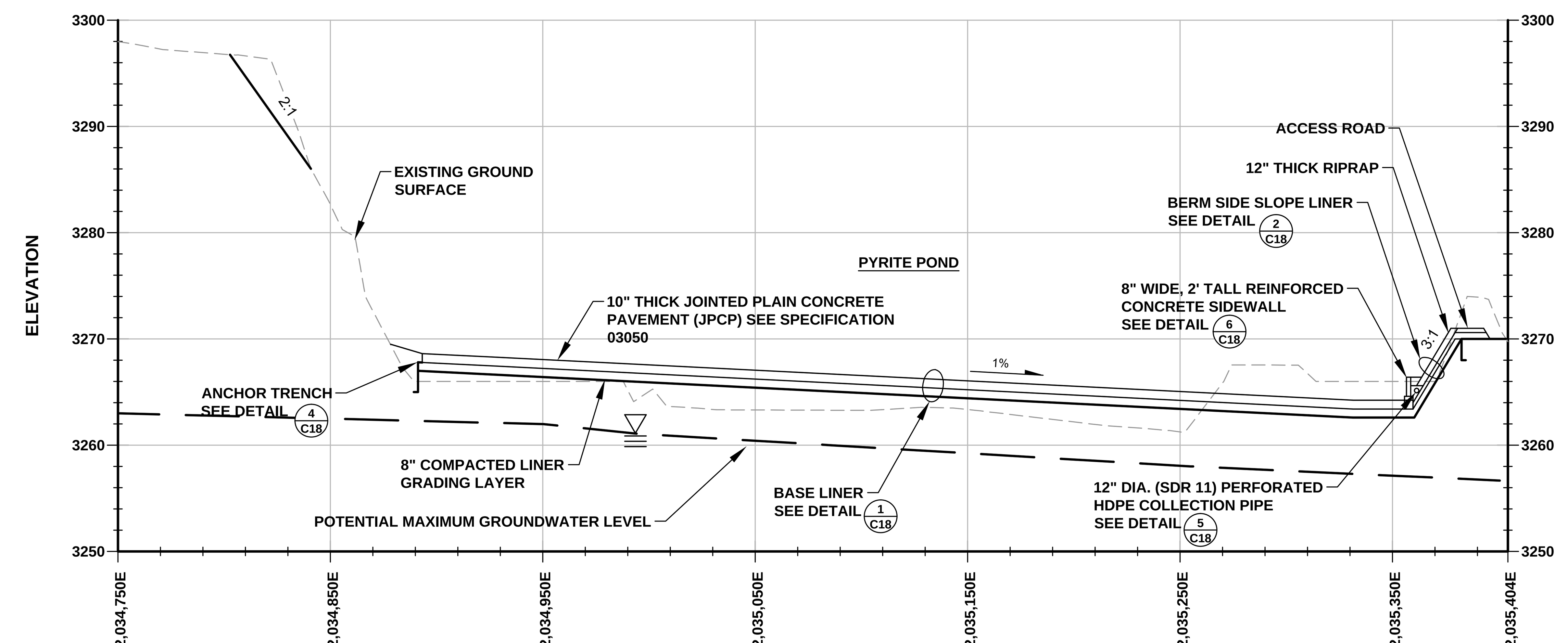


CROSS SECTION 2035100E

(SECTION LOCATIONS SHOWN ON SHEETS C5 AND C6)

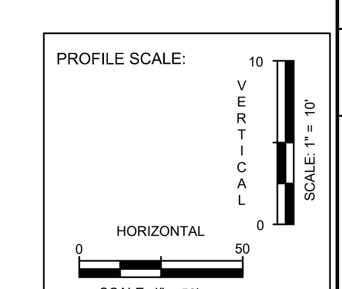


CROSS SECTION 254610N

(SECTION LOCATIONS SHOWN ON SHEETS C5 AND C6)

NOTES

1. REFER TO PLAN SHEET 66703-2 AND C1 OF THIS PLAN SET FOR GENERAL NOTES AND CIVIL STANDARD LEGEND.



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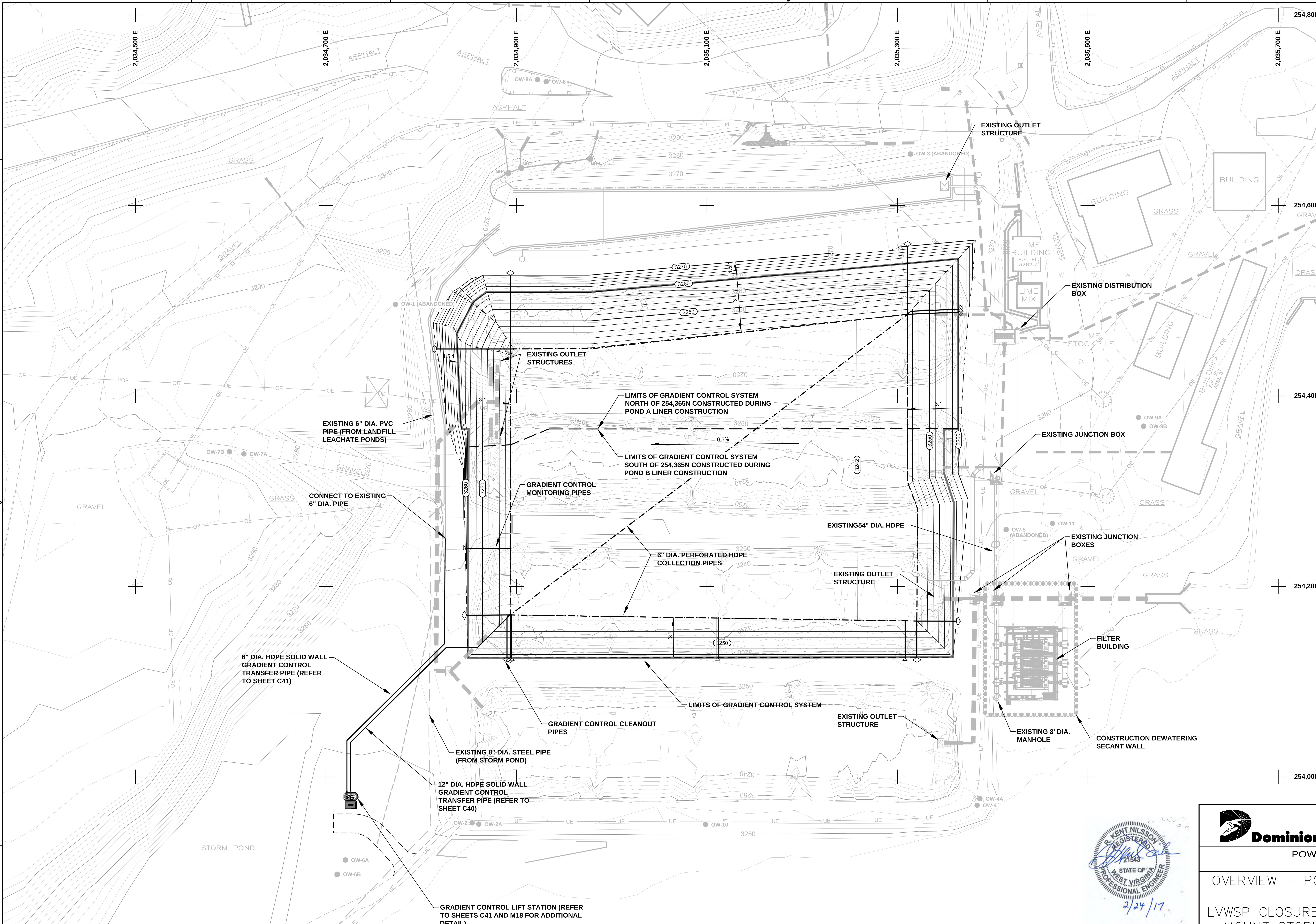
POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

CROSS SECTIONS PYRITE POND

LVWSP CLOSURE & RECONSTRUCTION – PHASE 1
MOUNT STORM POWER STATION, WEST VIRGINIA

REV	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR	DESCRIPTION
1	6 16 2016	DM	LLS	JNH		NA	RKN	CBS	SM				RE-ISSUED FOR BID
0	4 29 2016	DM	LLS	JNH	NA		RKN	CBS	CB				ISSUED FOR BID

DSGN D.MARSHALL	DSGN SUPV	DATE JUNE 2016 DGNSPEC FOR FILE VERIFICATION	
DRWN L. STORMER	ENGR SUPV	DRAWING NO. 66703–C7	REV. 1
CHKD JHN	PROJ ENGR		
DISPL ENGR RKN	SCALE: AS NOTED	UNLESS OTHERWISE NOTED	SH C7 OF 23



NOTES

1. REFER TO PLAN SHEET 66703-7 AND C24 OF THIS PLAN SET FOR GENERAL NOTES AND CIVIL STANDARD LEGEND.
2. AREAS OF UNSUITABLE OR DISTURBED SUBGRADE SHALL BE OVER EXCAVATED AND BACKFILLED WITH COMPACTED FILL OR STABILIZED. STABILIZE AREAS OF WET DISTURBED SAND WITH GEOGRID AND AGGREGATE BASE AS DIRECTED IN SPECIFICATION 02316.

R. KENT NILSSON REGISTERED No. 21543 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
2/24/17

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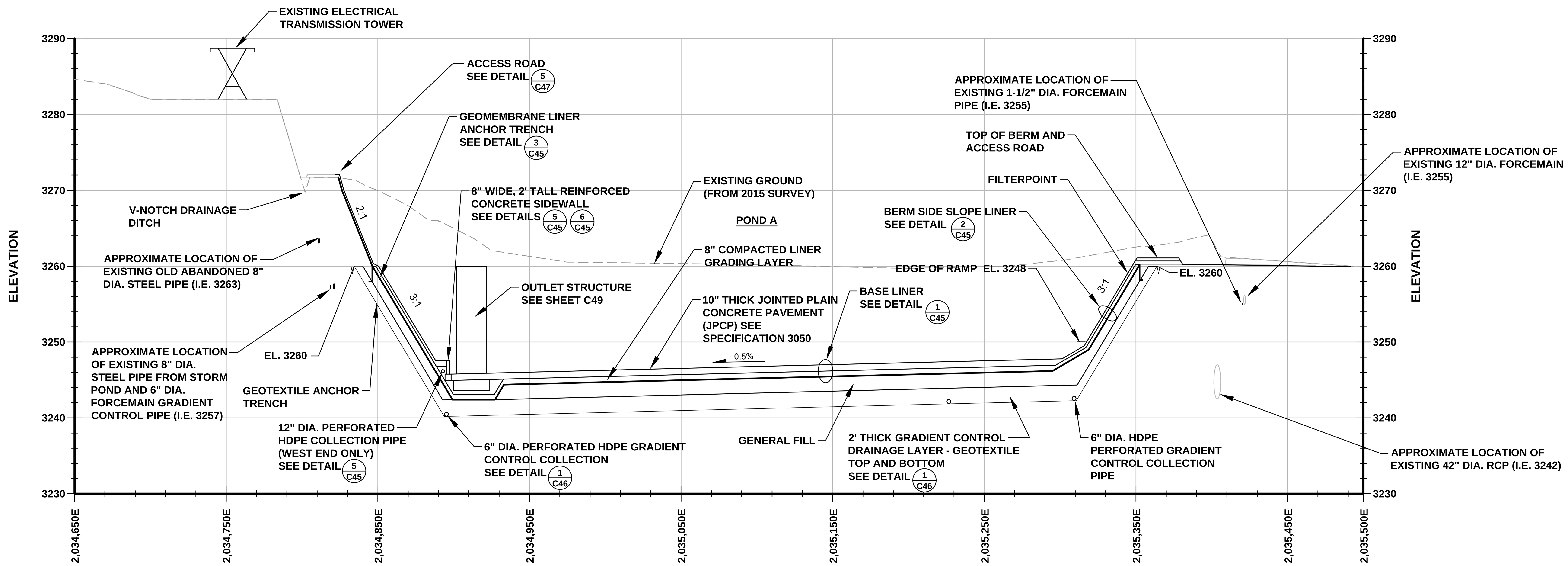
POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

OVERVIEW – PONDS A AND B GRADIENT SUBBASE AND PIPING

LVWSP CLOSURE AND RECONSTRUCTION – PHASE II
MOUNT STORM POWER STATION, WEST VIRGINIA

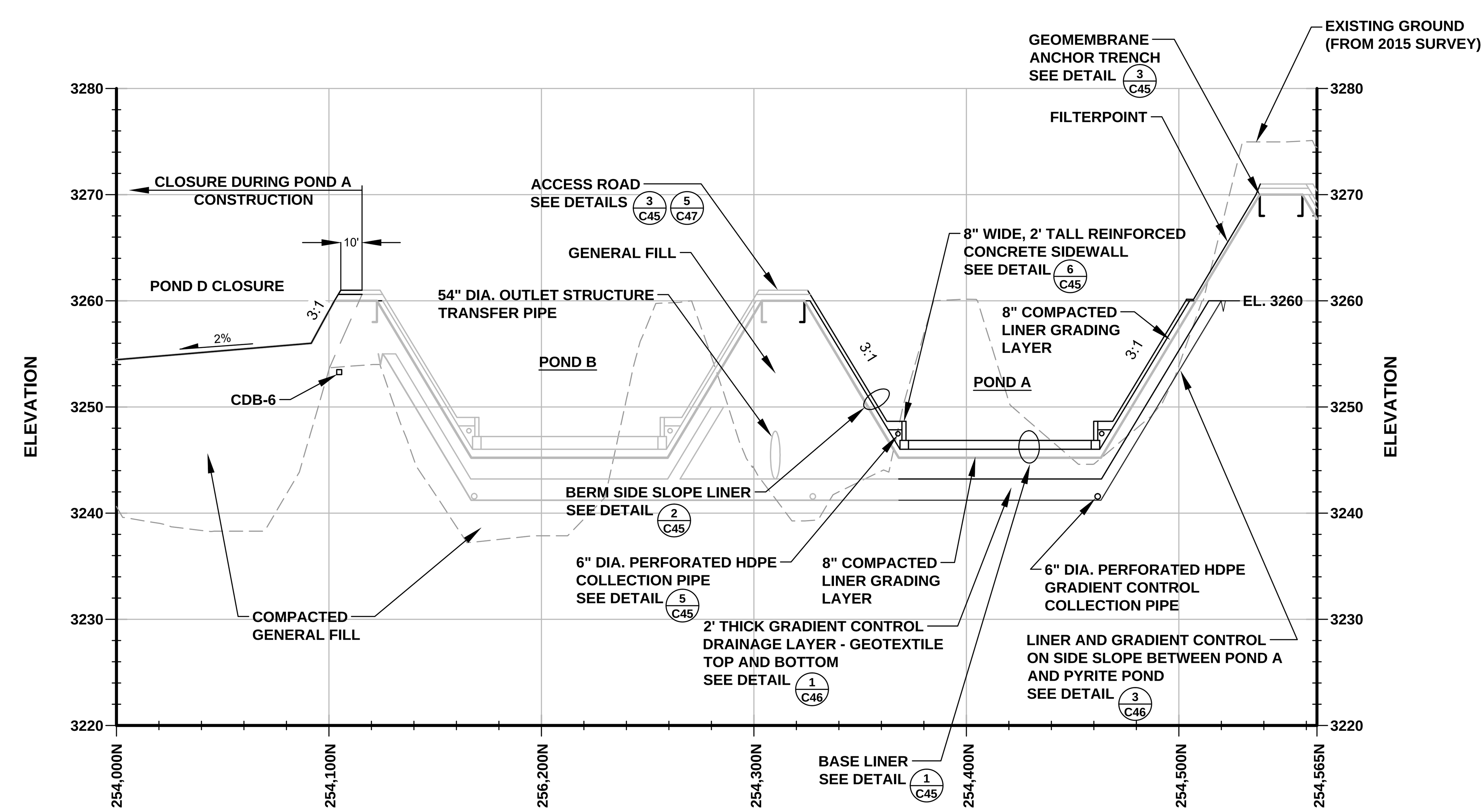
DSGN D.MARSHALL	DSGN SUPV	DATE FEBRUARY 2017 DGNSPEC FOR FILE VERIFICATION	
DRWN L. STORMER	ENGR SUPV	DRAWING NO. 66703–C29	REV. 0
CHKD JNH	PROJ ENGR		
DISPL ENGR RKN	SCALE: AS NOTED	UNLESS OTHERWISE NOTED	SH C29 OF 31

REV	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR
0 ISSUED FOR BID	02 24 2017	DM	LLS	JNH	NA		RKN	CBS	SM	BCA		



CROSS SECTION 254400N

(SECTION LOCATIONS SHOWN ON C35,C36, AND C37)



CROSS SECTION 2035100E

(SECTION LOCATIONS SHOWN ON C35, C36, AND C37)

NOTES

1. REFER TO PLAN SHEET C24 OF THIS PLAN SET FOR CIVIL STANDARD LEGEND.
2. LOCATION OF EXISTING PIPES WAS ESTIMATED BY REFERRING TO THE PHASE 1-2016 CONSTRUCTION DRAWINGS DATED JUNE 2016 (PYRITE POND): DRAWING NUMBERS. 66703-C11, 66703-C12, 66703-C13; AND DRAWINGS PROVIDED BY DOMINION: MS04241E-DC-12-[-S001], MS04214E-DC-9-1-[S009], MS-NPDES-77-R-1158-C-7 [S001]. CONTRACTOR SHALL VERIFY LOCATION OF PIPES PRIOR TO BEGINNING EXCAVATION ACTIVITIES.

PROFILE SCALE: VERTICAL SCALE: 1" = 10' HORIZONTAL SCALE: 1" = 50'

R. KENT NILSSON REGISTERED 21543 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

2/24/17

Dominion

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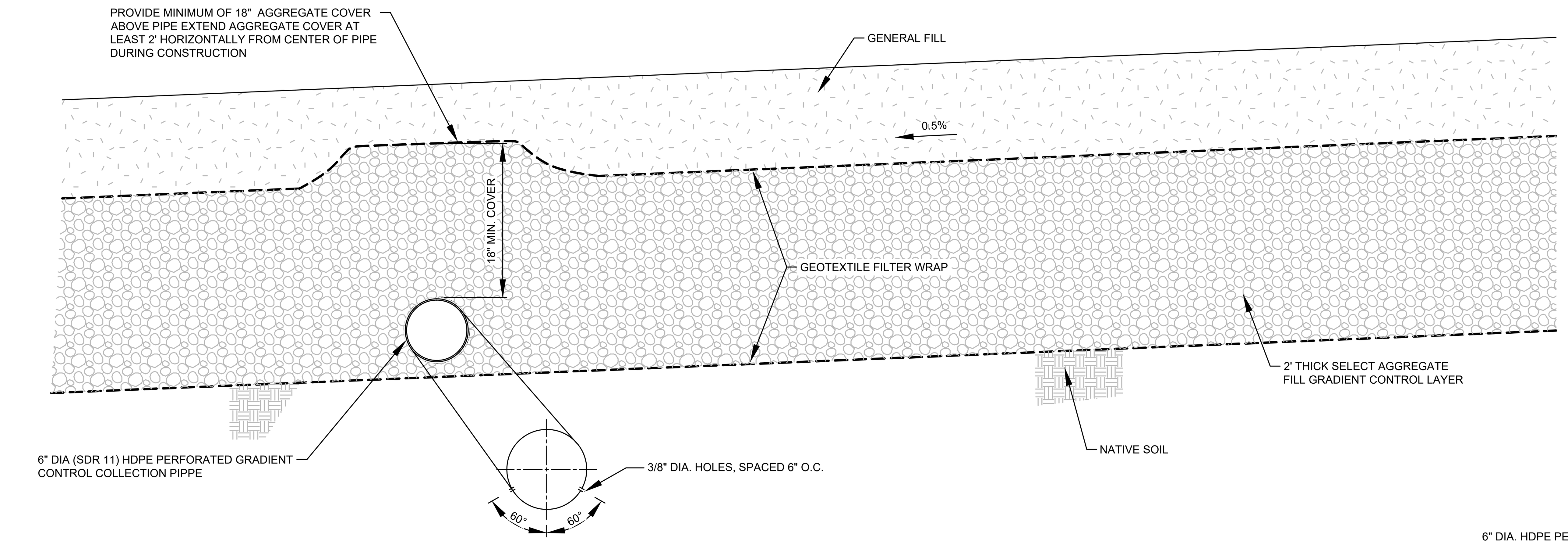
POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

CROSS SECTIONS – POND A AND POND D CLOSURE
LVWSP CLOSURE AND RECONSTRUCTION – PHASE II
MOUNT STORM POWER STATION, WEST VIRGINIA

REV	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR
0	02 24 2017	DM	LLS	JNH	NA		RKN	CBS	SM	BCA		

ISSUED FOR BID

DSGN SMOBLEY	DSGN SUPV	DATE FEBRUARY 2017 DGNSPEC FOR FILE VERIFICATION	
DRWN L. STORMER	ENGR SUPV	DRAWING NO. 66703–C38	REV. 0
CHKD JNH	PROJ ENGR		
DISPL ENGR RKN	SCALE: AS NOTED	UNLESS OTHERWISE NOTED	SH C38 OF 31

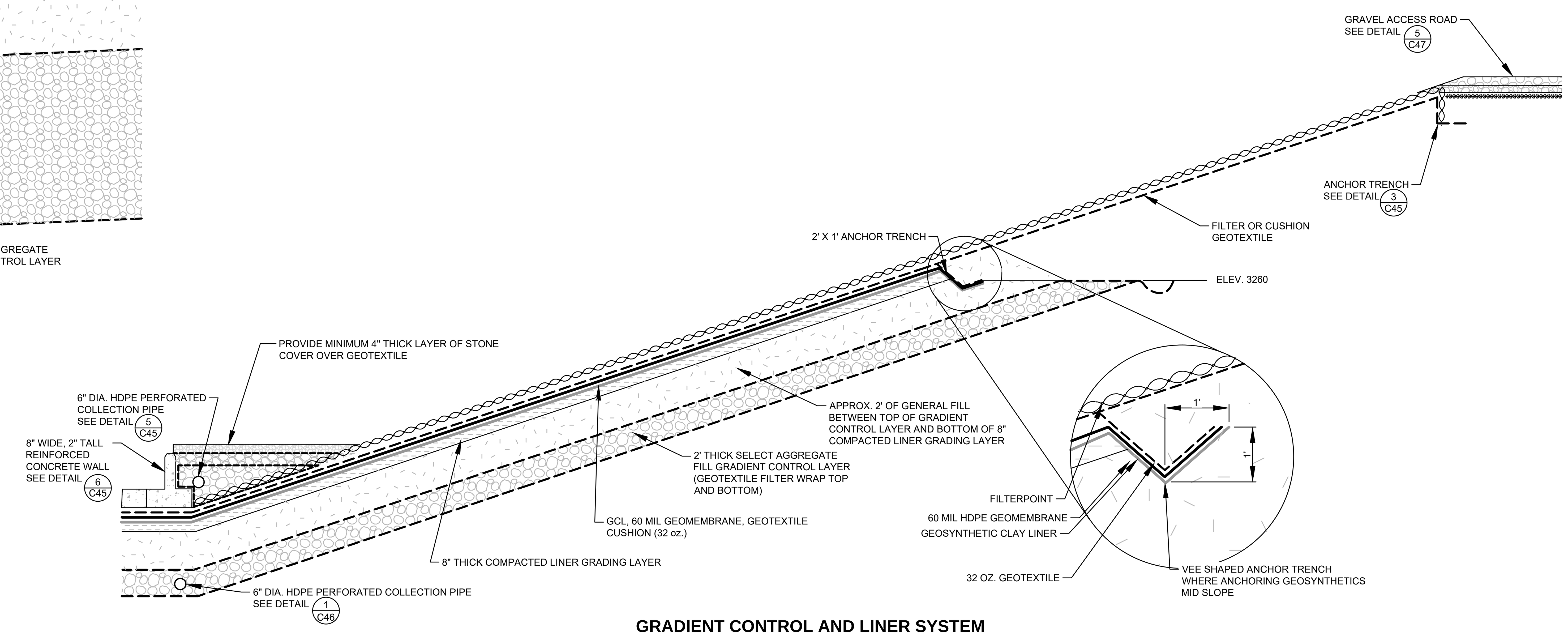


1
C46

GRADIENT CONTROL PIPE TRENCH (TYPICAL)

(NOT TO SCALE)

REFERENCED ON SHEETS C31, C34, C35, AND C38

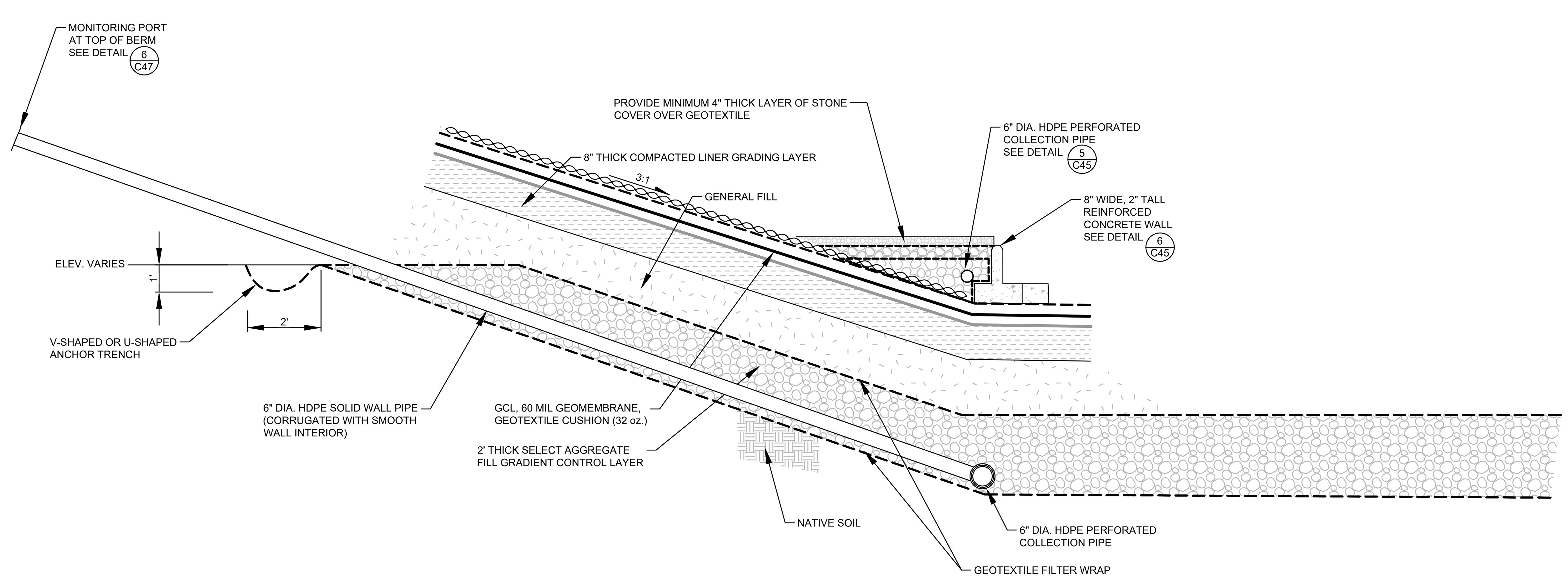


3
C46

GRADIENT CONTROL AND LINER SYSTEM (DIVIDING BERM BETWEEN POND A AND PYRITE POND AND WEST SIDE OF GRADIENT CONTROL SYSTEM)

(NOT TO SCALE)

REFERENCED ON SHEETS C37, AND C38

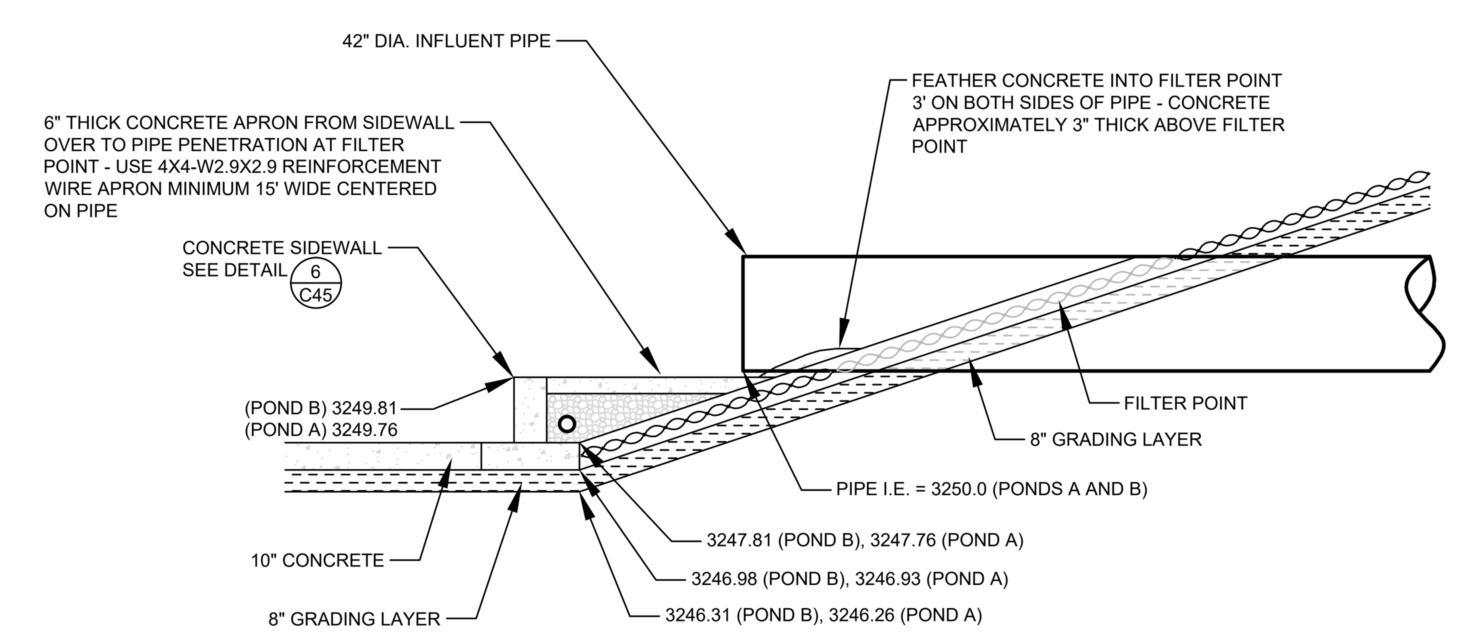


2
C46

GRADIENT CONTROL MONITORING PIPE (TYPICAL)

(NOT TO SCALE)

REFERENCED ON SHEETS C31, C34, AND C35



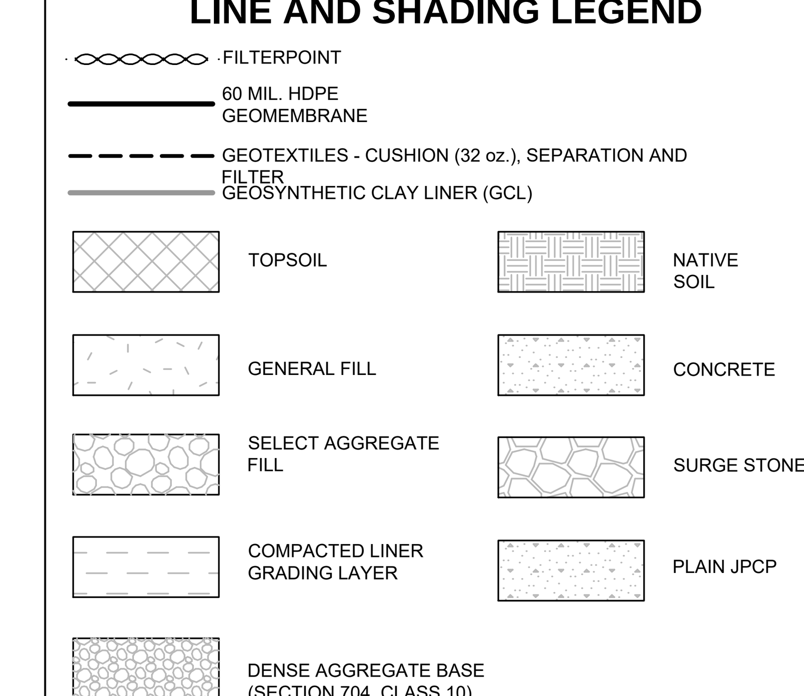
4
C46

CONCRETE PIPE APRON

(NOT TO SCALE)

REFERENCED ON SHEETS C33, AND C37

LINE AND SHADING LEGEND



Dominion

TRC

POWER GENERATION ENGINEERING
RICHMOND, VIRGINIA

CIVIL DETAILS

LVWSP CLOSURE AND RECONSTRUCTION – PHASE II
MOUNT STORM POWER STATION, WEST VIRGINIA

0	ISSUED FOR BID												
	02 24 2017	DM	LLS	JNH	NA		RKN	CBS	SM	BCA			
REV	DATE	DSGN	DRWN	CHKD	DSGN SUPV	PROJ ENGR	CIVIL ENGR	ELEC ENGR	MECH ENGR	ARCH	E.M. ENGR	I&C ENGR	

DSGN D.MARSHALL	DSGN SUPV	DATE FEBRUARY 2017 DGNSPEC FOR FILE VERIFICATION	
DRWN L. STORMER	ENGR SUPV	DRAWING NO. 66703–C46	REV. 0
CHKD JNH	PROJ ENGR		
DISPL ENGR RKN	SCALE: AS NOTED	UNLESS OTHERWISE NOTED	SH C46 OF 31

Appendix G
1920 United States Geological Survey

U. S. GEOLOGICAL SURVEY
TOPOGRAPHIC FILES

RETAINED COPY
This sheet must not be taken from the files without an order from the Chief Geographer.

816-S-IV-W/2

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, SECRETARY
U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

TOPOGRAPHY

STATE OF WEST VIRGINIA
I. C. WHITE
STATE GEOLOGIST

Advance sheet.
Subject to correction.

WEST VIRGINIA–MARYLAND
DAVIS QUADRANGLE

(Franklin $\frac{1}{125000}$)
(Beverly $\frac{1}{125000}$)
(Franklin $\frac{1}{125000}$)

Edition of 1920

R. B. Marshall, Chief Geographer.
Frank Sutton, Geographer in charge.
Topography by E. I. Ireland J. I. Gayetty, W. C. Hall,
W. K. McKinley, J. J. Murphy, W. F. Chenault and A. T. Munson
Control by S. S. Gannett, J. B. Metcalfe, Jr., K. F. Maxcy,
E. E. Harris and Walter McCrea.
Surveyed in 1899 1916, and 1919.

SURVEYED IN COOPERATION WITH THE STATE OF WEST VIRGINIA

Scale $\frac{1}{48000}$

1 ½ 0 1 2 3 4 Miles

4000 2000 0 4000 8000 12000 16000 Feet

1 ½ 0 1 2 3 4 5 Kilometers

Contour interval 50 feet.

Datum is mean sea level.

	815	
	I N II	
800	III 816 IV	828
	I S II	
	III IV	
	817	

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION 1916

FILE COPY
RETURN TO CENTRAL FILE

DAVIS

Appendix H
Wetlands

U.S. Fish and Wildlife Service

National Wetlands Inventory

Mount Storm

Mar 23, 2015

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Enter Classification code: (Example: L1UB1Hx)

For geographically specific information* (optional), please enter a State code: (Example: TX for Texas)

DECODE

Description for code PUBHh :

P System PALUSTRINE: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 ppt. Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics: 1. are less than 8 hectares (20 acres); 2. do not have an active wave-formed or bedrock shoreline feature; 3. have at low water a depth less than 2 meters (6.6 feet) in the deepest part of the basin; 4. have a salinity due to ocean-derived salts of less than 0.5 ppt.

Subsystem :

UB Class **UNCONSOLIDATED BOTTOM**: Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.

Subclass :

Modifier(s):

H WATER REGIME **Permanently Flooded**: Water covers the land surface throughout the year in all years.

h SPECIAL MODIFIER Diked/Impounded : These wetlands have been created or modified by a man-made barrier or dam which obstructs the inflow or outflow of water. The descriptors ‘diked’ and ‘impounded’ have been combined into a single modifier since the observed effect on wetlands is similar. They have been combined here due to image interpretation limitations. For clarification of the extent of impoundment see discussion of Lacustrine System limits.

WV Plant Specie(s):

Scientific Name	Common Name	Indicator	Reference Info.

WV Soil(s):

Series	Subgroup	Soils Fields Ind.	Drainage Class	Flood Frequency	Flood Duration	Flood Latest	HWT Depth	HWT Latest	LRR	Soil-5 Code

Hydric Soils (WV)

Grant and Hardy Counties, West Virginia

[The information in this report provides a rating for all components of a map unit whether they meet the hydric criteria or not]

Map symbol and map unit name	Component	Percent of map unit	Landform	Hydric rating	Hydric criteria
CeB:					
Cavode stony silt loam, 3 to 8 percent slopes	Cavode	70	Ridges	No	---
	Armagh	3	Ridges	Yes	2
CsB:					
Clymer stony loam, 3 to 15 percent slopes	Clymer	70	Ridges	No	---
CsD:					
Clymer stony loam, 15 to 35 percent slopes	Clymer	75	Ridges	No	---
CwB:					
Clymer and Wharton rubbly soils, 3 to 15 percent slopes	Clymer	50	Ridges	No	---
	Wharton	25	Ridges	No	---
	Armagh	2	Ridges	Yes	2
CwD:					
Clymer and Wharton rubbly soils, 15 to 35 percent slopes	Clymer	50	Ridges	No	---
	Wharton	25	Ridges	No	---
	Armagh	2	Ridges	Yes	2
GmC:					
Gilpin stony silt loam, 3 to 15 percent slopes	Gilpin	70	Ridges	No	---
Lm:					
Lickdale stony loam	Lickdale	75	Flats	Yes	2, 3
Ud:					
Udorthents, smoothed	Udorthents	100	---	No	---
W:					
Water	Water	100	---	No	---
WoC:					
Wharton stony silt loam, 3 to 15 percent slopes	Wharton	75	Ridges	No	---
	Armagh	2	Ridges	Yes	2

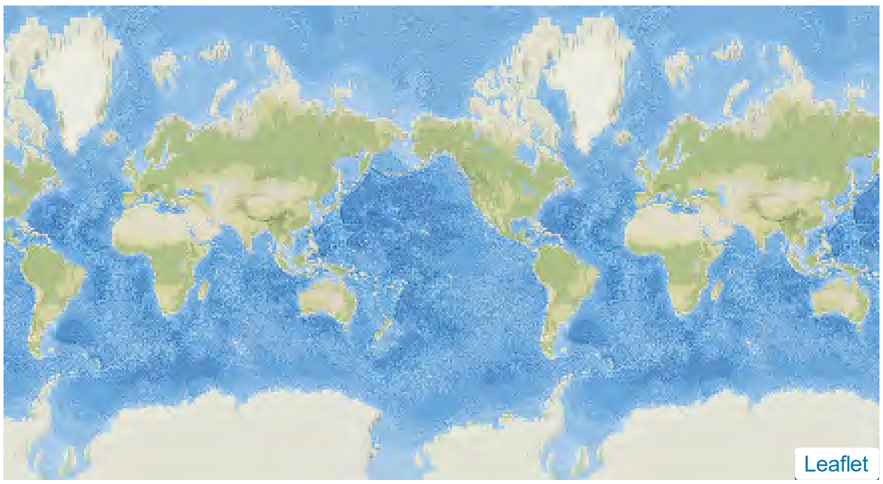
Appendix I
U.S. Seismic Design Maps

U.S. Geological Survey - Earthquake Hazards Program

Mount Storm - Location Standards

Latitude = 39.198°N, Longitude = 79.264°W

Location



Reference Document

2015 NEHRP Provisions

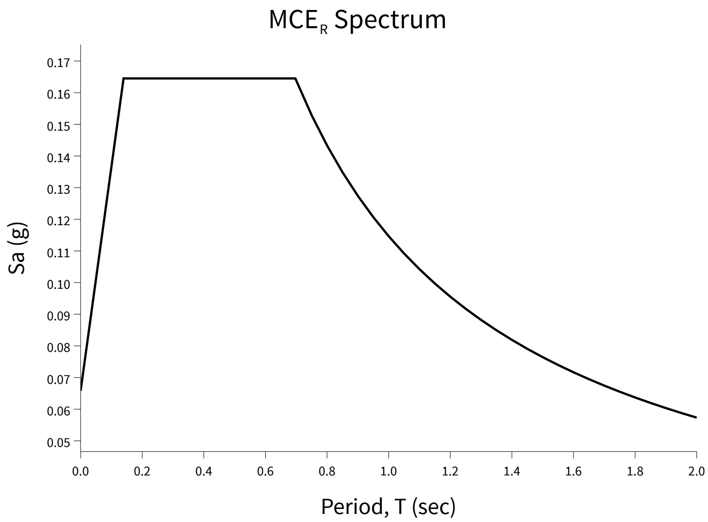
Site Class

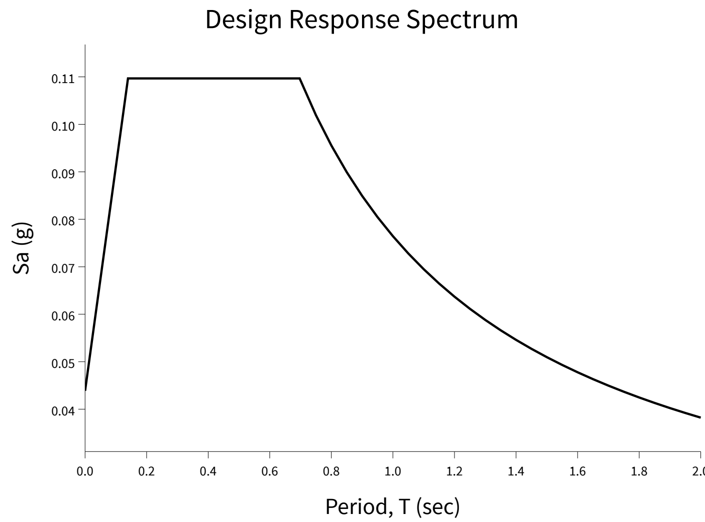
D (determined): Stiff Soil

Risk Category

I or II or III

S_S =	0.103 g	S_{MS} =	0.165 g	S_{DS} =	0.110 g
S_1 =	0.048 g	S_{M1} =	0.115 g	S_{D1} =	0.076 g


MCE$_R$ Spectrum
Sa (g)
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Period, T (sec)


Design Response Spectrum
Sa (g)
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Period, T (sec)

Mapped Acceleration Parameters, Long-Period Transition Periods, and Risk Coefficients

Note: The S_S and S_1 ground motion maps provided below are for the direction of maximmum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) 1.3 (to obtain S_1).

- FIGURE 22-1 S_S Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 0.2 s Spectral Response Acceleration (5% of Critical Damping), Site Class B
- FIGURE 22-2 S_1 Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 1.0 s Spectral Response Acceleration (5% of Critical Damping), Site Class B
- FIGURE 22-9 Maximum Considered Earthquake Geometric Mean (MCE_G) PGA, %g, Site Class B for the Conterminous United States
- FIGURE 22-14 Mapped Long-Period Transition Period, T_L (s), for the Conterminous United States
- FIGURE 22-18 Mapped Risk Coefficient at 0.2 s Spectral Response Period, C_{RS}
- FIGURE 22-19 Mapped Risk Coefficient at 1.0 s Spectral Response Period, C_{R1}

Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site class as Site Class , based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

<table>
<tr><th>Site Class</th><th>$\bar{v}_s$</th><th>$\bar{N}$ or $\bar{N}_{ch}$</th><th>$\bar{s}_u$</th></tr>
<tr><td>A. Hard Rock</td><td>>5,000 ft/s</td><td>N/A</td><td>N/A</td></tr>
<tr><td>B. Rock</td><td>2,500 to 5,000 ft/s</td><td>N/A</td><td>N/A</td></tr>
<tr><td>C. Very dense soil and soft rock</td><td>1,200 to 2,500 ft/s</td><td>>50</td><td>>2,000 psf</td></tr>
<tr><td>D. Stiff Soil</td><td>600 to 1,200 ft/s</td><td>15 to 50</td><td>1,000 to 2,000 psf</td></tr>
<tr><td>E. Soft clay soil</td><td><600 ft/s</td><td><15</td><td><1,000 psf</td></tr>
<tr><td></td><td colspan="3">Any profile with more than 10 ft of soil having the characteristics:
• Plasticity index PI > 20
• Moisture content w ≥ 40%, and
• Undrained shear strength $\bar{s}_u$ < 500 psf</td></tr>
<tr><td>F. Soils requiring site response analysis in accordance with Section 21.1</td><td colspan="3">See Section 20.3.1</td></tr>
<tr><td colspan="4">For SI: 1ft/s = 0.3048 m/s 1lb/ft ^{2} = 0.0479 kN/m ^{2}</td></tr>
</table>

Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Risk-targeted Ground Motion (0.2 s)

$C_{RS}S_{SUH} = 0.936 \times 0.110 = 0.103$ g

Deterministic Ground Motion (0.2 s)

$S_{SD} = 1.500$ g

$S_S \equiv$ "Lesser of $C_{RS}S_{SUH}$ and S_{SD}" = 0.103 g

Risk-targeted Ground Motion (1.0 s)

$C_{R1}S_{1UH} = 0.921 \times 0.052 = 0.048$ g

Deterministic Ground Motion (1.0 s)

$S_{1D} = 0.600$ g

$S_1 \equiv$ "Lesser of $C_{R1}S_{1UH}$ and S_{1D}" = 0.048 g

Table 11.4-1: Site Coefficient F_a

Site Class	Spectral Reponse Acceleration Parameter at Short Period					
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S = 1.25$	$S_S \geq 1.50$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.3	1.2	1.2	1.2	1.2
D (determined)	1.6	1.4	1.2	1.1	1.0	1.0
D (default)	1.6	1.4	1.2	1.2	1.2	1.2
E	2.4	1.7	1.3	1.2 *	1.2 *	1.2 *
F	See Section 11.4.7					

* For Site Class E and $S_S \geq 1.0$ g, see the requirements for site-specific ground motions in Section 11.4.7 of the 2015 NEHRP Provisions. Here the exception to those requirements allowing F_a to be taken as equal to that of Site Class C has been invoked.

Note: Use straight-line interpolation for intermediate values of S_S.

Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of F_a shall be taken as 1.0 per Section 11.4.2.

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of F_a shall not be less than 1.2 per Section 11.4.3.

For Site Class = D (determined) and S_S = 0.103 g, F_a = 1.600

Table 11.4-2: Site Coefficient F_v

Site Class	Spectral Response Acceleration Parameter at 1-Second Period					
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 = 0.50$	$S_1 \geq 0.60$
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.8	0.8	0.8	0.8	0.8	0.8
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.5	1.5	1.5	1.5	1.5	1.4
D (determined)	2.4	2.2 [1]	2.0 [1]	1.9 [1]	1.8 [1]	1.7 [1]
D (default)	2.4	2.2 [1]	2.0 [1]	1.9 [1]	1.8 [1]	1.7 [1]
E	4.2	3.3 [1]	2.8 [1]	2.4 [1]	2.2 [1]	2.0 [1]
F	See Section 11.4.7					

[1] For Site Class D or E and $S_1 \geq 0.2$ g, site-specific ground motions might be required. See Section 11.4.7 of the 2015 NEHRP Provisions.

Note: Use straight-line interpolation for intermediate values of S_1.

Note: Where Site Class B is selected, but site-specific velocity measurements are not made, the value of F_v shall be taken as 1.0 per Section 11.4.2.

For Site Class = D (determined) and S_1 = 0.048 g, F_v = 2.400

Site-adjusted MCE_R (0.2 s)

$$S_{MS} = F_a S_S = 1.600 \times 0.103 = 0.165 \text{ g}$$

Site-adjusted MCE_R (1.0 s)

$$S_{M1} = F_v S_1 = 2.400 \times 0.048 = 0.115 \text{ g}$$

Design Spectral Acceleration Parameters

Design Ground Motion (0.2 s)

$S_{DS} = ⅔ S_{MS} = ⅔ \times 0.165 = 0.110$ g

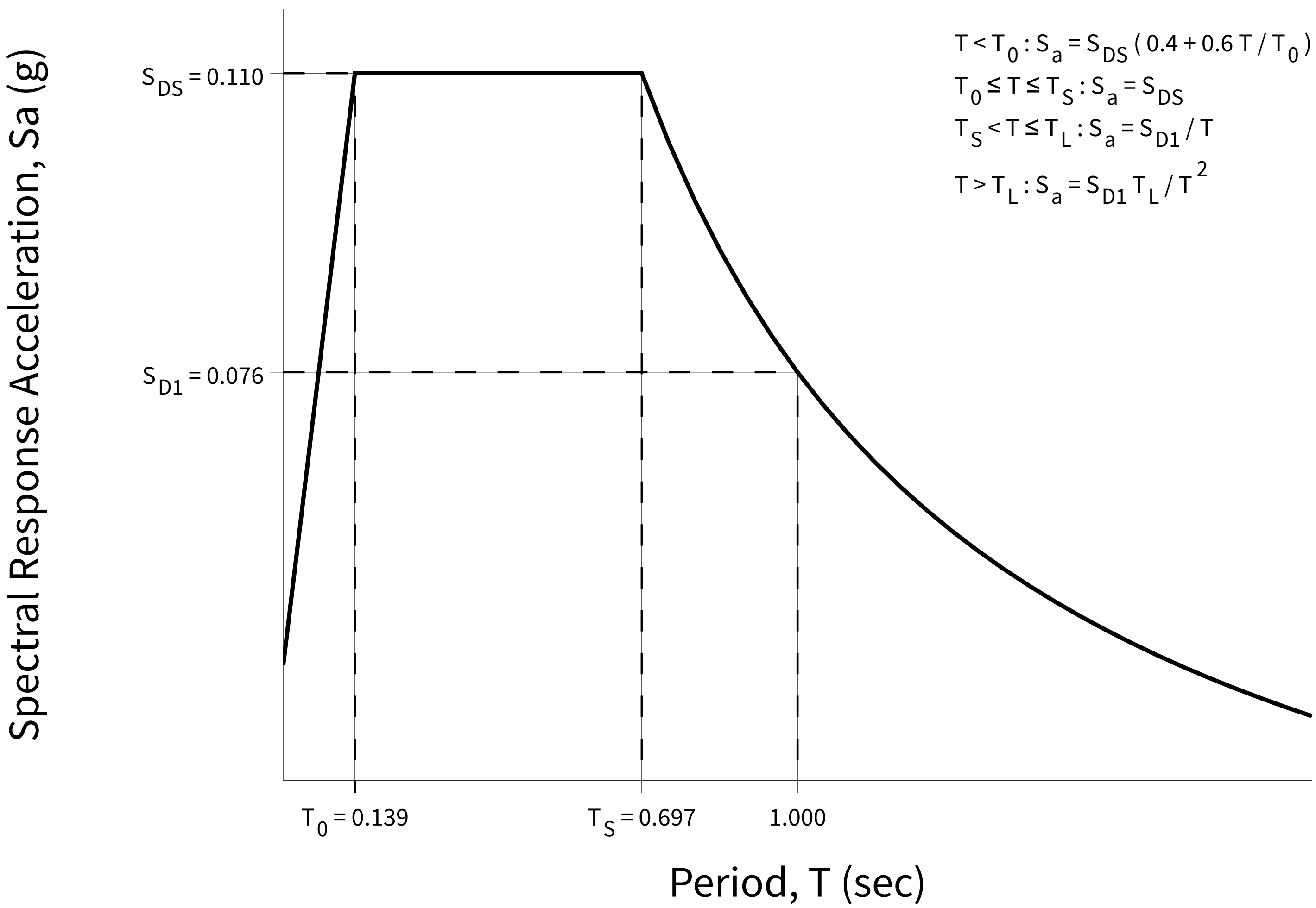
Design Ground Motion (1.0 s)

$S_{D1} = ⅔ S_{M1} = ⅔ \times 0.115 = 0.076$ g

Design Response Spectrum

Long-Period Transition Period = T_L = 12 s

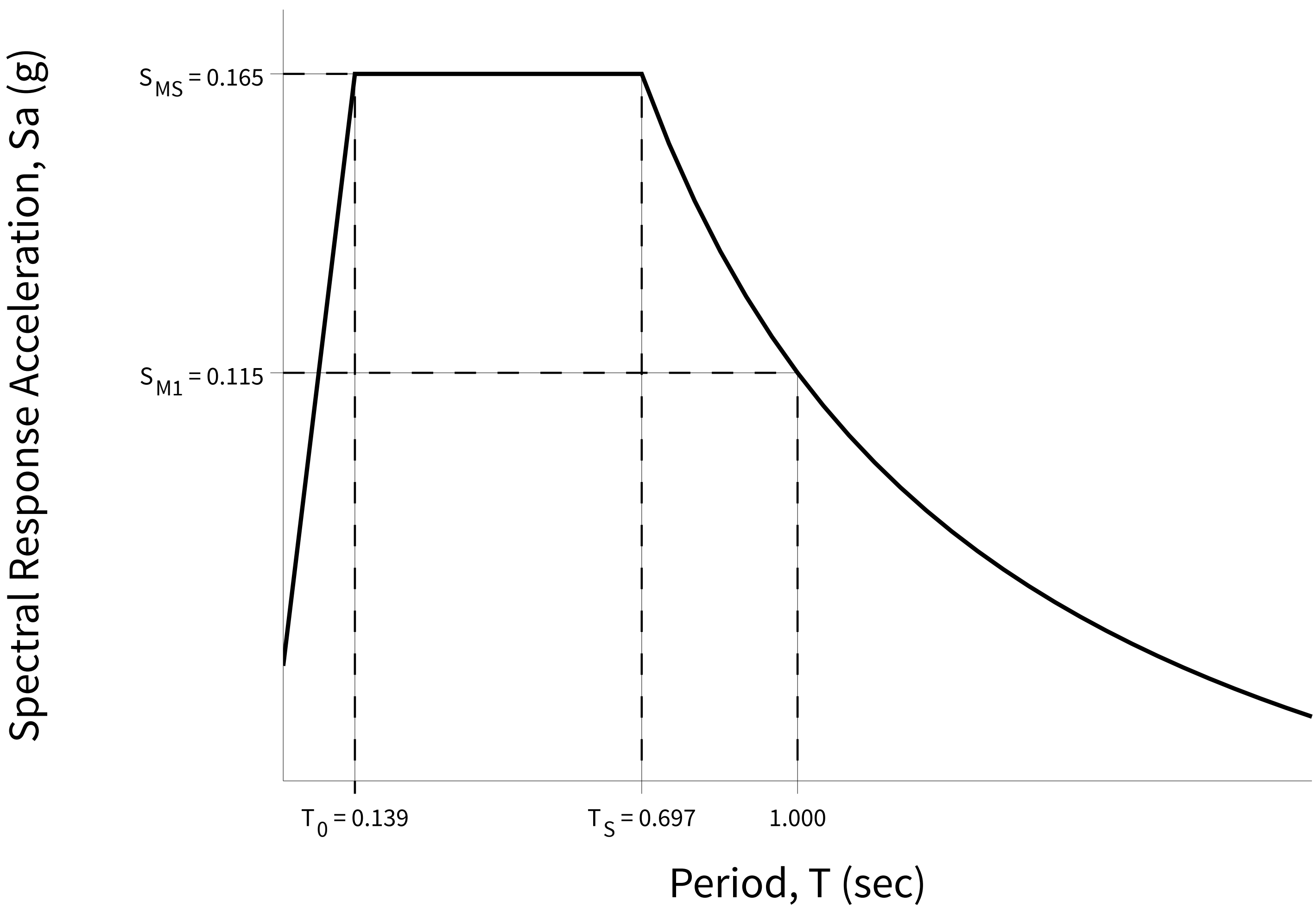
Figure 11.4-1: Design Response Spectrum



$T < T_0 : S_a = S_{DS} (0.4 + 0.6 T / T_0)$
$T_0 \leq T \leq T_S : S_a = S_{DS}$
$T_S < T \leq T_L : S_a = S_{D1} / T$
$T > T_L : S_a = S_{D1} T_L / T^2$
$S_{DS} = 0.110$
$S_{D1} = 0.076$
Spectral Response Acceleration, Sa (g)
$T_0 = 0.139$
$T_S = 0.697$
1.000
Period, T (sec)

MCE_R Response Spectrum

The MCE_R response spectrum is determined by multiplying the design response spectrum above by 1.5.



Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

Table 11.8-1: Site Coefficient for F_{PGA}

Site Class	Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration					
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA = 0.50	PGA ≥ 0.60
A	0.8	0.8	0.8	0.8	0.8	0.8
B (measured)	0.9	0.9	0.9	0.9	0.9	0.9
B (unmeasured)	1.0	1.0	1.0	1.0	1.0	1.0
C	1.3	1.2	1.2	1.2	1.2	1.2
D (determined)	$\boxed{1.6}$	1.4	1.3	1.2	1.1	1.1
D (default)	1.6	1.4	1.3	1.2	1.2	1.2
E	2.4	1.9	1.6	1.4	1.2	1.1
F	See Section 11.4.7					

Note: Use straight-line interpolation for intermediate values of PGA

Note: Where Site Class D is selected as the default site class per Section 11.4.2, the value of F_{pga} shall not be less than 1.2.

For Site Class = D (determined) and PGA = 0.050 g, F_{PGA} = 1.600

Mapped MCE_G

PGA = 0.050 g

Site-adjusted MCE_G

$PGA_M = F_{PGA}PGA = 1.600 \times 0.050 = 0.079$ g

Appendix J
Coal Mine Information

708 Heartland Trail, Suite 3000 (53717) Madison, WI (608) 826-3600 FAX: (608) 826-3941

PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
Mount Storm Plant	By: J. Hotstream	Date: 3/25/2015	By:	Date:	230765.0000

Interactive Coal Mining Map

Mine Information

Mine: **LAUREL RUN MINING NO 1 PORTAL**

Company: **LAUREL RUN MINING**

Edit Delete

Document ID:	377404
Polygon ID:	A
State Permit:	
Federal Permit:	
WVGES Comments:	
Mine Type:	Underground
UTM North:	4340989
UTM East:	647695
Latitude:	
Longitude:	
Commodity:	
Location:	
Notes:	
Coordinate Selection:	
Reported Bed:	U FREEPORT
Supplemental:	
Counties:	Grant
Quads:	Mount Storm Lake
Beds:	U FREEPORT
Modified Date:	01-JAN-96
Modified User:	

OPERATORS STATEMENTS

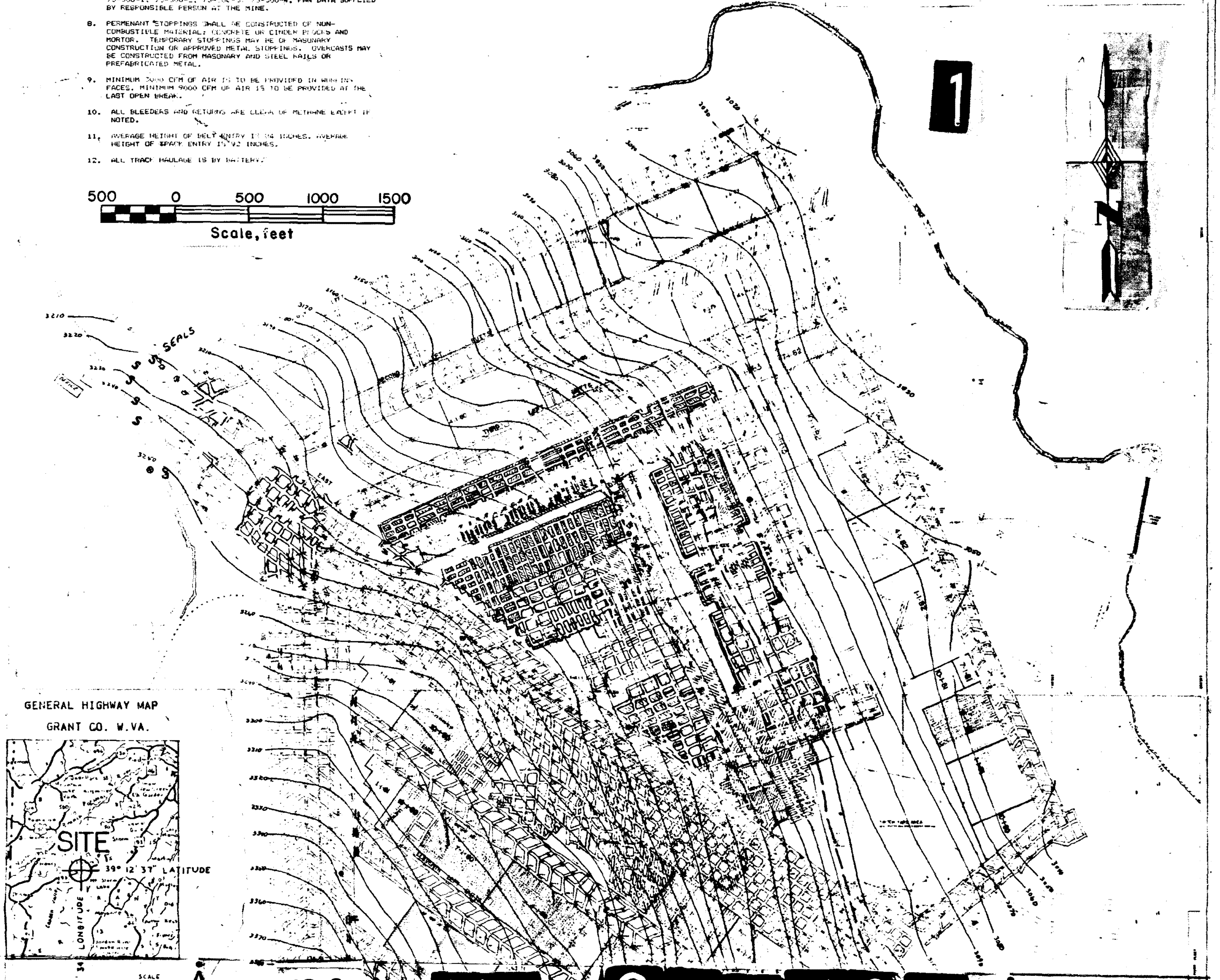
1. ESCAPEWAYS, BLEEDER EVALUATION POINTS, AND REGULATORS ARE TO BE EXAMINED AND TESTED ON A WEEKLY BASIS BY A CERTIFIED FIREBOSS USING APPROVED METHANE DETECTOR, FLAME SAFETY LAMP, ANEMOMETER, HAMMER AND TAPE.
2. AIR QUANTITY AND QUALITY VALUES INDICATED ON THIS MAP WERE MEASURED BY A CERTIFIED FIREBOSS AND WERE SUPPLIED BY THE OPERATOR.
3. ESCAPEWAYS ARE TO BE MAINTAINED ALONG THE ROUTE SHOWN EXCEPT THAT FALLS OR OTHER CONDITIONS MAY REQUIRE MINOR CHANGES IN ROUTING.
4. CONTROLS ARE AS SHOWN EXCEPT WHERE CONDITIONS MAY REQUIRE UNANTICIPATED CHANGES.
5. ANTICIPATED PROJECTIONS ARE AS SHOWN, EXCEPT THAT WANTS, FAULTS, SLIPS, OR OTHER ADVERSE CONDITIONS MAY REQUIRE CHANGES.
6. MAN DOORS ARE TO BE LOCATED EVERY 300 FEET OR 500 FEET APART WHEN SEAM IS OVER 48 INCHES.
7. FAN IS INSTALLED AND MAINTAINED ACCORDING TO CFR 75-300, 75-300-1, 75-300-2, 75-300-3, 75-300-4. FAN DATA SUPPLIED BY RESPONSIBLE PERSON AT THE MINE.
8. PERMENANT STOPPINGS SHALL BE CONSTRUCTED OF NON-COMBUSTIBLE MATERIAL; CONCRETE OR CINDER BLOCKS AND MORTOR. TEMPORARY STOPPINGS MAY BE OF MASONARY CONSTRUCTION OR APPROVED METAL STOPPINGS. OVERCASTS MAY BE CONSTRUCTED FROM MASONARY AND STEEL RAILS OR PREFABRICATED METAL.
9. MINIMUM 3000 CFM OF AIR IS TO BE PROVIDED IN WORKING FACES. MINIMUM 9000 CFM OF AIR IS TO BE PROVIDED AT THE LAST OPEN BREAK.
10. ALL BLEEDERS AND RETURNS ARE CLEAR OF METHANE EXCEPT IF NOTED.
11. AVERAGE HEIGHT OF BELT ENTRY IS 94 INCHES. AVERAGE HEIGHT OF TRACK ENTRY IS 92 INCHES.
12. ALL TRACK HAULAGE IS BY BATTERY.

FAN (IDLE)
JEFFREY MODEL 8-HU-96
TYPE: VANE-AXIAL
SIZE: 8 FEET
880 RPM
WATER GAUGE
VOLUME: CFM
BLADE SETTING 6875
MOTOR
WESTHOUSE
TYPE: LAC INDUCTION MOTOR
500 H.P.
VOLTAGE
AMPS

LEGEND

FAN
INTAKE AIR
RETURN AIR
ESCAPEWAY
ALTERNATE ESCAPEWAY
TEMPORARY STOPPING
PERMANENT STOPPING
PROPOSED STOPPING
SEAL
PROPOSED SEAL
DOOR
REGULATOR
BOX CHECK
CHECK CURTAIN
LINE BRATTICE
BLEEDER EVALUATION
OVERCAST
TRACK
FALL
WATER POOL
PILLARED AREA
BELT & DRIVE
LOADING POINT
CRIBBED AREA
PROPERTY LINE
BARRIER LINE
GAS LINE
WATER LINE
ELECTRIC LINE
TELEPHONE LINE
CONTROL POINT, UNDERGROUND
CONTROL POINT, SURFACE
BENCH MARK, SURFACE
BENCH MARK, UNDERGROUND
LATITUDE & LONGITUDE
CORE HOLE
SURFACE STATION
UNDERGROUND STATION
POWER CENTER
BATTERY CENTER
SUB-STATION
PUMPING STATION
OIL WELL
PLUGGED OIL WELL
GAS WELL
PLUGGED GAS WELL
CHANNEL SAMPLE
BORE HOLE (AIR/WATER/POWER)

500 0 500 1000 1500
Scale, feet



HS 3 16X 377404

TRC 708 Heartland Trail, Suite 3000, Madison, WI 53717 • www.TRCsolutions.com

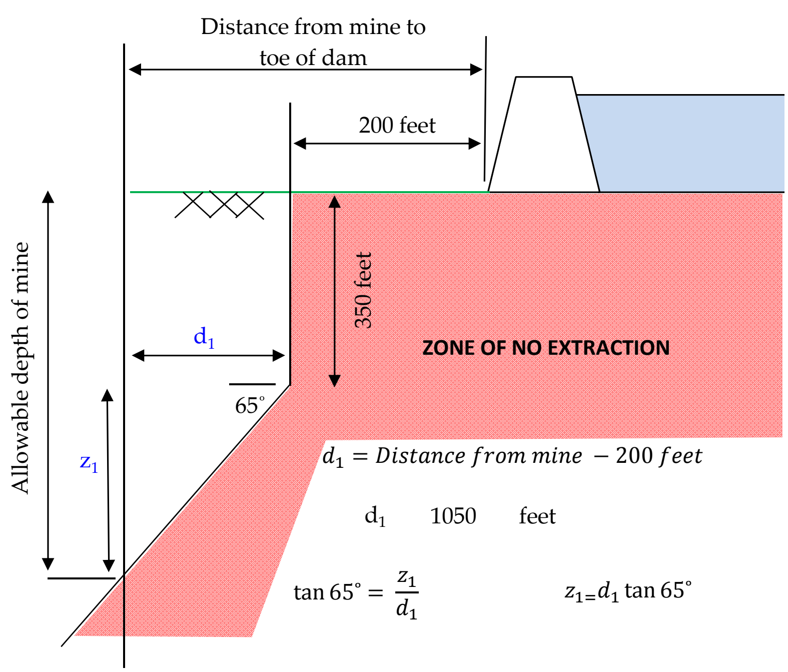
PROJECT / LOCATION: Mount Storm Location Criteria		PROJECT / PROPOSAL NO.
SUBJECT: Mining Land Subsidence Impact Evaluation		230765.00
PREPARED BY: J. Hotstream	DATE: 4/6/2015	FINAL □
CHECKED BY: D. Engstrom	DATE: 4/9/2015	REVISION □

Purpose: Evaluate the potential of land subsidence of the Laurel Run Mine on the proposed surface impoundments using rule of thumb method.

Method: Use the method presented by Babcock and Hooker (1976) as recommended in the Engineering and Design Manual for Coal Refuse Disposal Facilities (Second Edition August 2010) by the Mine Safety and Health Administration. The Safety distance is based on the method for mining beneath dams and impounded body of surface water, refer to references.

Approximate Distance of Mine from toe of dam: 1250 feet

Approximate bottom elevation of impoundment/berm toe: 3240 feet



$d_1 = Distance\ from\ mine\ - 200\ feet$

d_1 1050 feet

$\tan 65^\circ = \frac{z_1}{d_1}$ $z_1 = d_1 \tan 65^\circ$

z_1 2252 feet

Allowable Depth of Mine = 350 feet + z_1

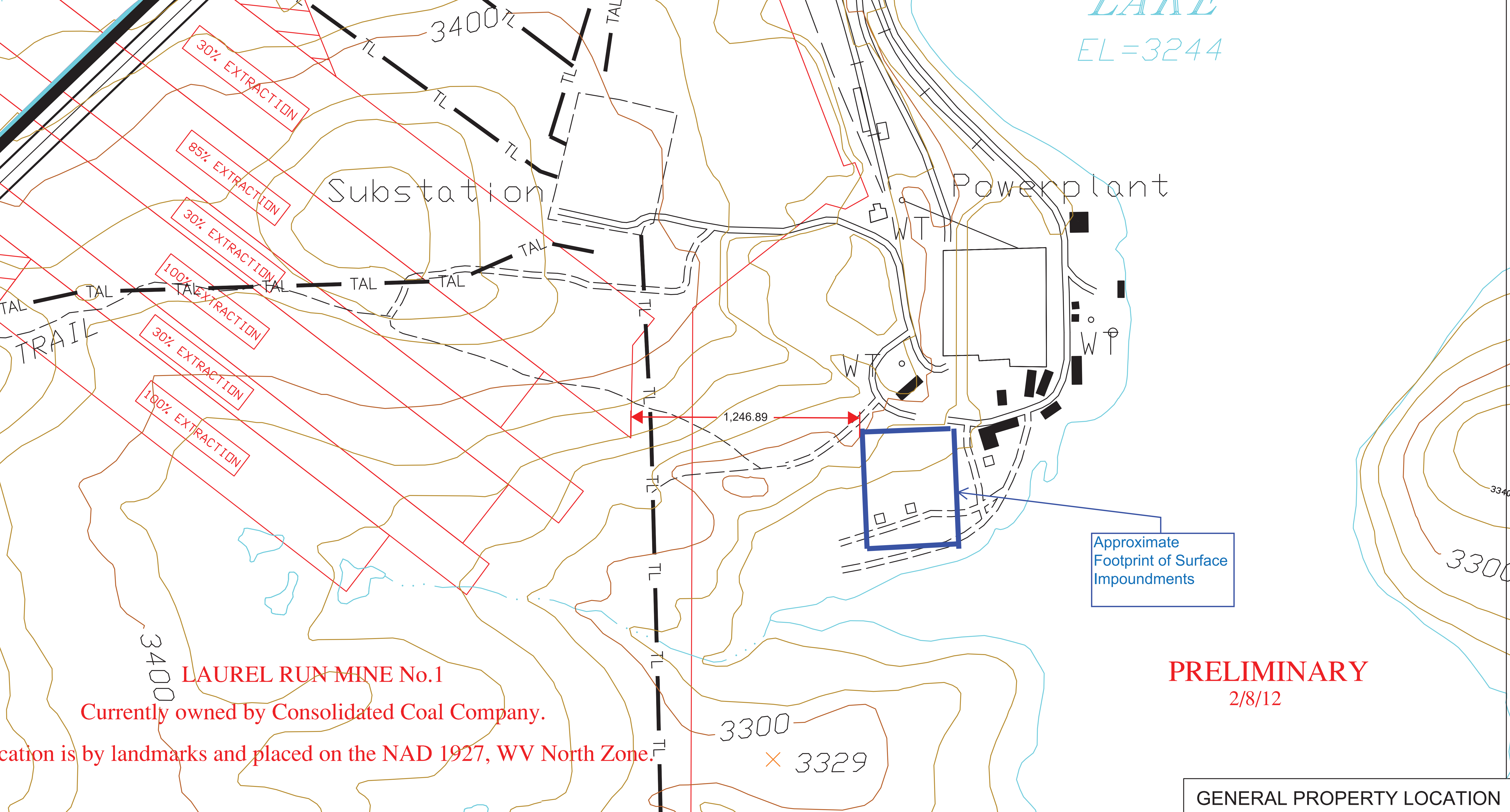
Allowable Depth of Mine: 2602 feet

Allowable Mine Elevation: 638 feet

Discussion: According to the Babcock and Hooker method if the mine is within a depth of 2602 feet or base is above elevation of 638 feet, the Laurel Run mine should not impact the impoundments due to surface subsidence.

Based on the approximate depth of the mine and distance from the toe of berm, it is TRC's conclusion that the Laurel Mine No. 1 is located within the "Normal Extraction Permitted" zone and the Laruel Mine No. 1 should not impact the current or proposed locations of the surface impoundments.

References



GENERAL PROPERTY LOCATION

BASE MAPPING - PARTIAL USGS QUAD
MT. STORM LAKE (N39-07-30, W 79-22-30/7.5)

REVISIONS

No.	DATE	COMMENTS
1	2/8/12	Initial Compiled Drawing
2		
3		
4		
5		
6		
7		

MT. TOP INDUSTRIAL PARK
Grant County Development Authority

Mt. Storm, West Virginia

ENGINEER: Geary Associates

Engineering -- Construction Management -- Surveying

Mark C. Geary PE, PS
106 North Main Street
BUS: 304-257-2022
FAX: 304-257-2023

SCALE:
1"=500'

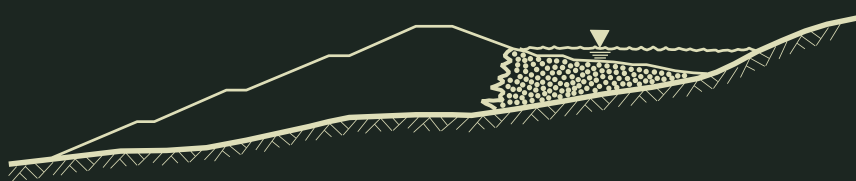
DRAWING No.
LOC

SHEET No.
1

U.S. Department of Labor
Mine Safety and Health Administration

ENGINEERING AND DESIGN MANUAL

COAL REFUSE DISPOSAL FACILITIES



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NOTE: Instructions for using this DVD version of the Manual are provided on the page ii.

MSHA
Mine Safety and Health Administration

Prepared by:

D'APPOLONIA ENGINEERING

- Improving the in-situ materials by grouting.
- Constructing an engineered barrier.
- Isolating the structure from the area of influence of the mining or altering the mining sequence or plan.
- Constructing secondary defense measures such as bulkheads to contain a breakthrough within the mine.
- Other engineered measures or impoundment operating procedures to control seepage and reduce pressures in the areas of potential breakthrough.

Subsidence mitigation measures are dependent on the structure that must be protected. Mine workings beneath a dam must be stabilized such that support for the impounding embankment and abutments is achieved. Overburden or outcrop barriers beneath an impoundment must be sufficient to prevent breakthrough. Mitigation measures for breakthroughs are discussed in MSHA (2003) and NRC (2002) and are summarized in the following sections, which describe potential mitigation alternatives and methods for the design of bulkheads to seal mine entries.

8.5.1 Mine Subsidence and Breakthrough Mitigation

8.5.1.1 Use of Safety Zones

For new impoundments, the most effective method for preventing damage to the dam or a breakthrough is to leave an unmined safety zone between the mine workings and the impoundment so that any mining-induced ground disturbance cannot cause a breakthrough or other significant adverse effects. At new facilities, siting of the impoundment at locations that are not or will not be undermined is preferred. If mine workings cannot be avoided, other mitigation measures may be feasible provided that support for the impounding embankment and appurtenant structures is achieved.

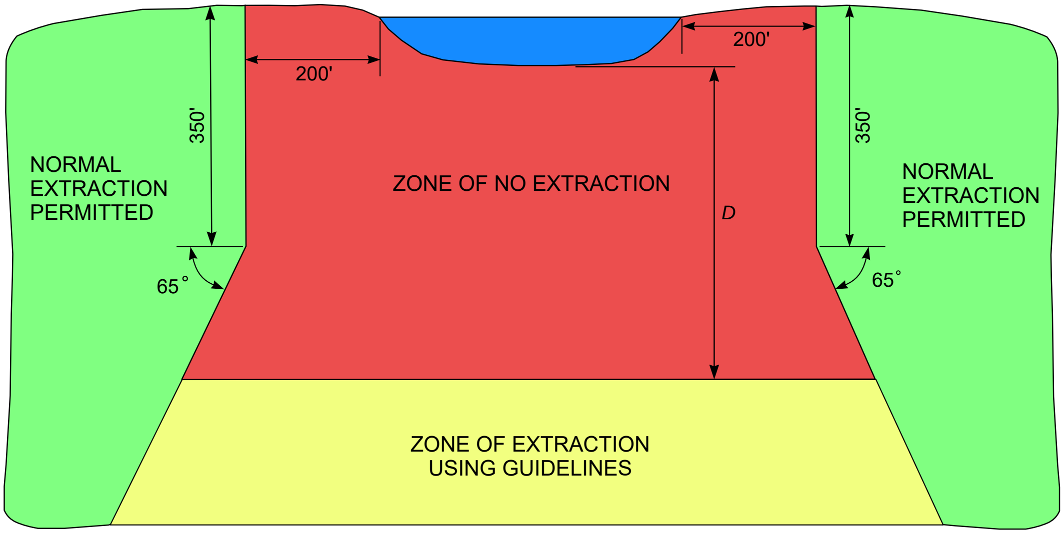
For existing impoundments where the mine workings are already close enough to potentially cause a problem, a safety zone can be created (if necessary) by backfilling the mine workings. Guidelines for sizing safety zones around impoundments are provided in Babcock and Hooker (1977). Figure 8.6 provides an illustration of these guidelines. Kendorski et al. (1979) provide criteria for determining when a surface water body represents a hazard to mining. Peng and Luo (1993) provide guidance for establishing safety zones for sensitive structures.

8.5.1.2 Mine Backfilling

If the thickness and natural characteristics of the overburden barrier cannot be relied on to prevent a sinkhole, subsidence cracks, or other subsidence-related failure mechanisms, filling previously-mined areas with grout or other material (commonly referred to as “stowing”) may be a necessary remedy. The lateral extent of backfilling must include critical areas within the angle of draw based on the results of subsidence analyses described in Section 8.4.2.

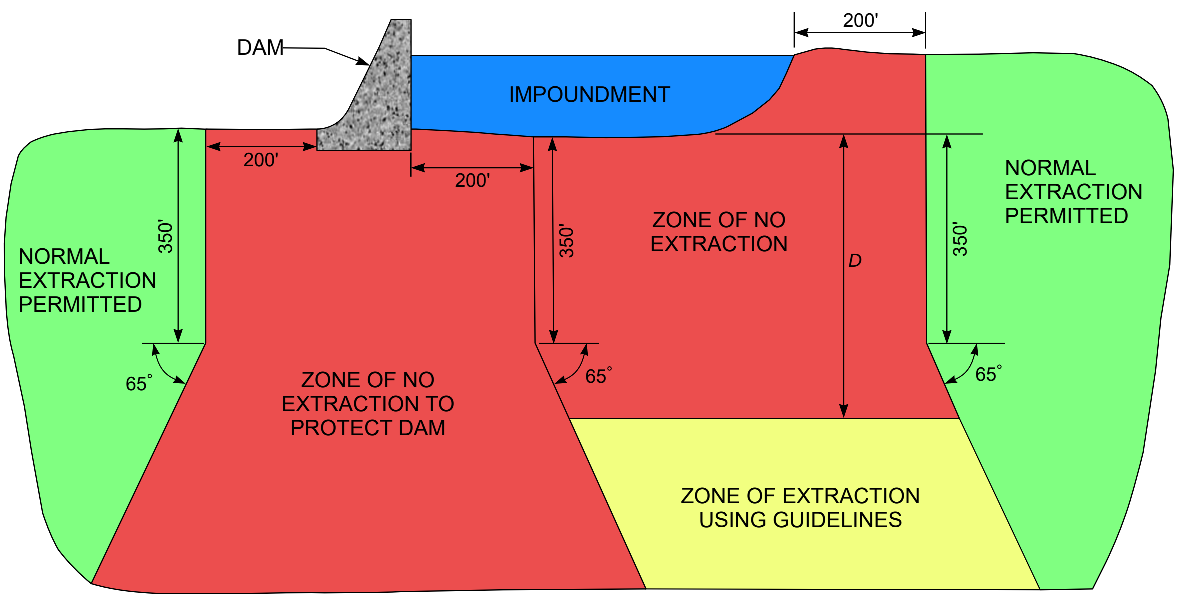
The mine backfill material can have minimal strength, and even a partial backfill will offer confinement to mine pillars, thereby reducing spalling and dramatically increasing pillar strength. However, it is good practice to backfill to the roof of the mine, using material with sufficient strength (typically above 100 psi) to reduce consolidation and prevent erosion. This can be difficult to accomplish, as full contact with the mine roof is often not possible because of roof irregularity and the rolling nature of coal seams. However, partial roof contact will reduce roof falls and will dramatically limit roof fall propagation into the overburden.

Pozzolan slurry makes a good backfill, because it readily flows into irregular spaces. Because of the high sulfate environment in a coal mine, any fill containing cement should employ sulfate-resistant



ROOM AND PILLAR	*D* = 5*s* or 10*t*, whichever is larger	*s* = maximum entry width (ft)
PANEL	*D* = 3*p* or 270 feet, whichever is larger	*p* = panel width (ft)
TOTAL EXTRACTION	*D* = 60*t*	*t* = extraction height (ft)

8.6a SAFETY ZONE BENEATH BODY OF SURFACE WATER



ROOM AND PILLAR	*D* = 5*s* or 10*t*, whichever is larger	*s* = maximum entry width (ft)
PANEL	*D* = 3*p* or 270 feet, whichever is larger	*p* = panel width (ft)
TOTAL EXTRACTION	*D* = 60*t*	*t* = extraction height (ft)

8.6b SAFETY ZONE BENEATH DAM AND IMPOUNDED BODY OF SURFACE WATER

NOTE: THE ZONE OF NO EXTRACTION TO DEPTH "*D*" IS PRESUMED TO COMPRISE SOLID ROCK STRATA (IF MATERIAL OTHER THAN SOLID ROCK COVER IS INCLUDED, IT IS NECESSARY TO DEMONSTRATE THE NATURE AND PERMEABILITY OF SUCH MATERIAL). THE ZONE OF NO EXTRACTION MAY BE INCREASED OR DECREASED, IF JUSTIFIED BY LOCAL OBSERVATION AND/OR EXPERIENCE.

FIGURE 8.6 SAFETY ZONE GUIDELINES FOR MINING IN THE VICINITY OF DAMS AND IMPOUNDMENTS