GOLDER

Groundwater Monitoring Plan
Bremo Power Station
East, North, and West Ponds
Solid Waste Permit No. 618

Prepared for:

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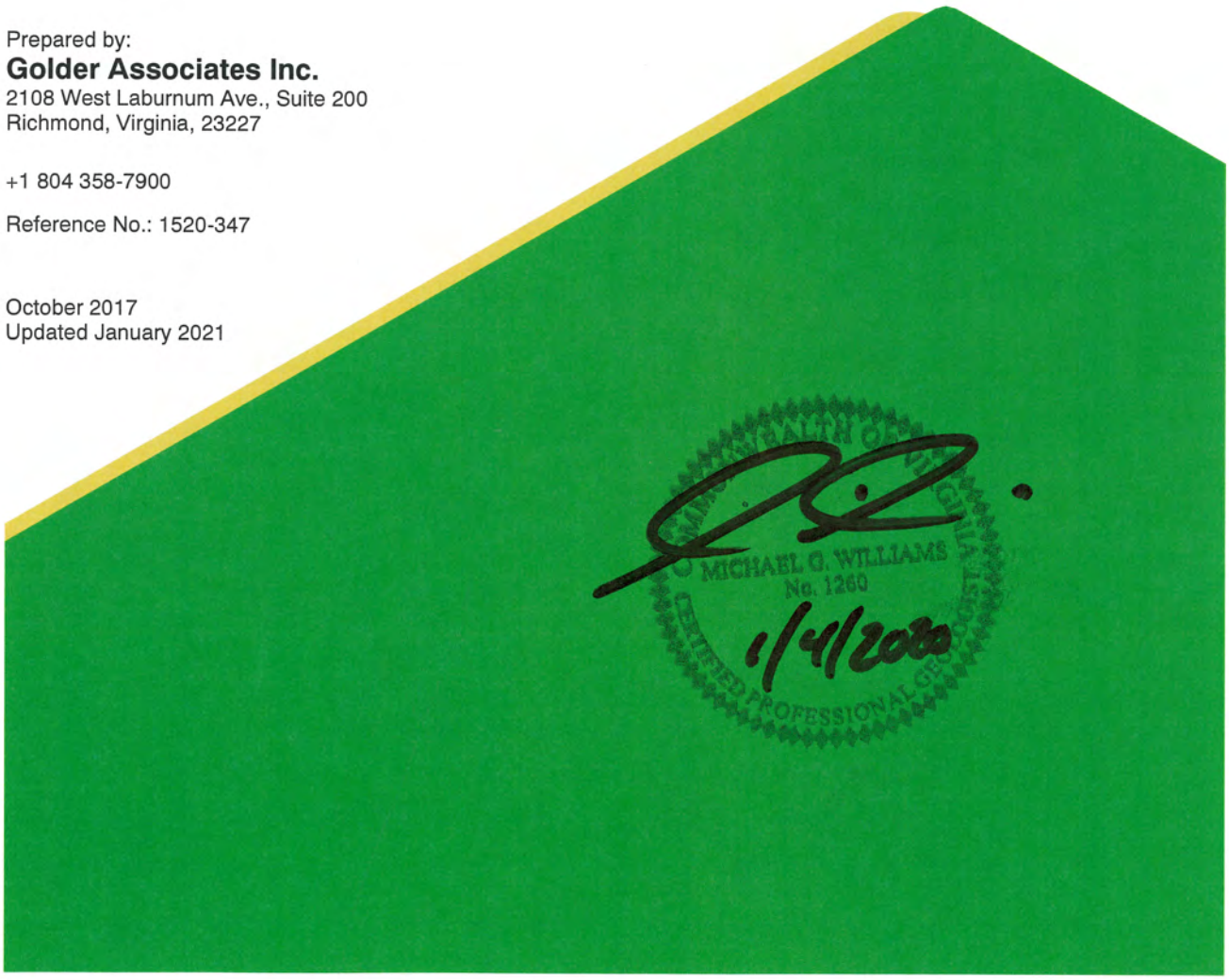

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1.0 INTRODUCTION

This Groundwater Monitoring Plan (GWMP) was prepared for the Bremo Power Station (Station) in Bremo Bluff, Virginia. The location of the Station is shown on Drawing 1. The Station is operated by Dominion Energy Virginia (Dominion Energy). As part of the Station operations, Dominion Energy historically operated three surface impoundments (East Pond, North Pond, and West Pond) that were used to store coal combustion residuals (CCR).

The West Pond was unlined and has been excavated, with the CCR materials transferred to the unlined North Pond. The East Pond is also unlined, and excavation began in 2017 and has been completed with the CCR materials being transferred to the North Pond. Based on current plans, subject to change, the North Pond is expected to be closed via removal in accordance with the CCR Rule, consistent with state and federal regulations. The former West and East Ponds are considered inactive CCR ponds and are scheduled for a closure-by-removal demonstration, which will include a groundwater demonstration in accordance with applicable federal and state regulations. The groundwater demonstration for the West and East Ponds will include the evaluation of groundwater quality data (modified Assessment Monitoring Program constituents as outlined herein) from the downgradient wells and one well to be constructed near the center of each former impoundment. Placement of this well will depend on the final grading plan of the ponds and future intended uses.

This GWMP was prepared for the three ponds at the Station and is designed to meet:

- Applicable provisions of the U.S. Environmental Protection Agency's (USEPA's) Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR Rule; Federal Register Vol. 80, No. 74, 21302 21501) as published on April 17, 2015 (40 CFR 257 *et seq*.);
- Applicable provisions of USEPA's CCR Rule amendment (Federal Register Vol. 81, No. 151, 51802-51808) as published on August 5, 2016;
- Applicable provisions of the CCR Rule as adopted in the Virginia Solid Waste Management Regulations (VSWMR, 2016) on January 27, 2016 (Title 9 Virginia Administrative Code Agency 20, Chapter 81, Section 800 *et seq*.; 9VAC20 81 800); and
- Applicable provisions of the Solid Waste Permit No. 618 issued June 5, 2019

Specifically, this GWMP outlines the procedures for collecting, analyzing, and managing groundwater samples and data from the uppermost aquifer underlying the three ponds. In the event that future amendments to the VSWMR and/or CCR Rule conflict with any provisions of this GWMP, the VSWMR and/or CCR Rule will supersede this GWMP, with the exception of Department of Environmental Quality (DEQ)-approved variances and Alternate Source Demonstrations (ASDs), and permit-specific conditions.

Revisions to this GWMP may be required in the future due to changes in the monitoring network, sampling action, revisions to USEPA or VSWMR regulations, or at the request of the unit owner. Any revisions made to the GWMP will be posted to the operating record and will be submitted to DEQ within 60 days of completion.

2.0 SITE LOCATION INFORMATION

The Bremo Power Station, owned and operated by Dominion Energy, is located in Fluvanna County at 1038 Bremo Road, east of Route 15 (James Madison Highway) and north of the James River. A site location map is presented as Drawing 1 and the layout of the Station, including monitoring well locations, is presented on Drawing 2.

2.1 Site Topography and Land Use

As shown on Drawing 1, a portion of the USGS 7½ minute topographic map of Arvonia, Virginia, the general area has moderately steep topography in the upland areas bordering the Station. The local topography is dissected by drainage swales that have developed a mix of dendritic and trellis drainage patterns reflecting an underlying structure control. Both intermittent and perennial streams characterize surface flow in the vicinity of the Station, with broad ridges and hilltops serving as topographical highs [maximum elevations of roughly 450 feet above mean sea level (AMSL) to the north of the Station]. The Station, along with the East and West Ponds, are located within the James River floodplain where topographic elevations range from 230 to 200 feet AMSL. The North Pond is located in the northern section of the Station in an upland area outside of the floodplain.

In general, the Station property consists of wooded, open, and developed land just north of the James River. The Station's northern, eastern, and western boundaries are bordered by primarily undeveloped parcels, and the Station property is bordered to the south by a CSX rail line and the James River. Land use surrounding the Station is classified as "A-1 Agricultural," and consists of undeveloped wooded and agricultural properties within a rural residential setting.

2.2 Climate

Based on available data from the Soil Survey of Fluvanna County, Virginia (USDA, 1958; USDA, 2015) and online National Oceanic and Atmospheric Administration (NOAA) data from Weatherspark (https://weatherspark.com/y/20218/Average-Weather-in-Palmyra-Virginia-United-States-Year-Round), the prevailing wind in the vicinity of the Station is from the west and north, and averages about 1.9 miles per hour (mph), with November through May being the months with the highest average wind speed of 2.2 mph. The average annual temperature is 56.3° Fahrenheit (F), the average daily maximum temperature is 66.6° F, and the average daily minimum is 47.3° F.

Based on statistics presented in the Soil Survey of Fluvanna County, Virginia (USDA, 1958), the average annual precipitation amount for the Station area is 41.24 inches. Precipitation is distributed throughout the year and averages 3.44 inches per month, with a low of 2.33 inches in November and a high of 4.53 inches in August. The average annual snowfall is 12.6 inches.

2.3 Site History

Power generation activities at the Station were initiated in the late 1930's. from the power generation activities has historically been stored in the three on-site CCR surface impoundments (East Pond, North Pond, and West Pond). In 2014, the Station converted from a coal-fired power plant to a natural gas-fired power plant. No newly generated CCR has been placed in these impoundments since the conversion to a gas-fired plant. The CCR materials in the West Pond were removed in the 2016 – 2017 timeframe and transferred to the North Pond. Removal of the CCR materials from the East Pond to the North Pond was completed in March 2019.

Historically, groundwater at the Station has been monitored on a 5-year cycle under Virginia Pollutant Discharge Elimination System (VPDES) Permit (Permit No. VA0004138). Beginning in 2013, following installation of an updated groundwater monitoring network under VPDES Permit No. VA0004138, quarterly background sampling activities were completed between March 2013 and October 2014. After completing the background sampling activities, a Groundwater Background and Water Quality Report was submitted to the DEQ on January 14, 2015. The report indicated that several parameters were present in groundwater at concentrations that exceeded background concentrations with arsenic concentrations present in MW-7 and MW-8 at concentrations that exceeded the United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL).

Based on the results from the 2015 report, a Corrective Action Plan (CAP) was submitted to the DEQ on April 14, 2015. The CAP included plans completing assessment activities for the East Pond and corrective measures for the East Pond, the West Pond, and the North Pond pursuant to the CCR Rule. The East Pond assessment activities included site characterization activities that involved the installation of three new wells (MW-16, MW-17, and MW-18) and the sampling of site wells and surface water. The results of the investigation, which included an assessment of risk, were submitted to the DEQ in an Assessment Report in July 2015. The risk assessment concluded that the observed groundwater impacts downgradient from the East Pond did not pose risks in excess of regulatory levels to human health or the environment.

In October 2016, following the installation of additional monitoring wells around the perimeter of the active North Pond, background sampling activities under the CCR Rule were initiated. The background sampling activities for the North Pond under the CCR Rule were completed in July 2017. The initial CCR Rule Detection Monitoring Program event for the North Pond was completed on September 6, 2017. Based on the results from the initial CCR Rule Detection Monitoring Program sampling event, a CCR Rule Assessment Monitoring Program was initiated (initial CCR Rule Appendix III and IV sampling event) for the North Pond on January 29, 2018, following placement of the statistically significant increase notification in the operating record on December 13, 2017, consistent with the CCR Rule. The initial semi-annual sampling event for the North Pond was completed on April 30, 2018.

Evaluation of analytical data collected during the first semi-annual compliance monitoring event in 2018 resulted in the identification of state and federal Groundwater Protection Standard (GWPS) exceedances for lithium in samples

collected from two groundwater monitoring wells (MW-35 and MW-27D) on September 6, 2018. Due to these exceedances, Dominion Energy initiated an Assessment of Corrective Measures (ACM) prior to December 5, 2018, consistent with the CCR Rule requirements.

An ACM field investigation was completed to delineate the vertical and horizontal extent of constituent of concern (COC) concentrations in groundwater that exceed the Coal Combustion Residuals (CCR) Rule GWPS in the vicinity of the North Pond. To fulfill the requirements of the ACM, two new boundary wells (MW-36S and MW-36D) downgradient of MW-27D were installed for hydraulic testing and groundwater sampling. In addition, geophysical logging was performed at two deep bedrock boreholes (MW-22D and MW-23D) to generate geological data. The locations of these wells are shown on Drawing 2. Geological and hydrogeological information collected during the investigation was generally consistent with previous site investigations and confirmed the existing site conceptual model.

The ACM Report, completed on May 3, 2019, summarized the results of the assessment of remedial alternatives for addressing the reported GPS exceedances based on the results of the field investigation, the updated site conceptual model, and Commonwealth of Virginia statutory requirements promulgated during the 2019 General Assembly for CCR source removal from unlined impoundments.

Background sampling activities for the CCR rule for the inactive East Pond and inactive West Pond were initiated in October 2017 following installation of additional monitoring wells for these units. The background sampling activities for these units were completed in February 2019.

On June 5, 2019, Solid Waste Facility Permit Number 618 was issued by the DEQ with groundwater monitoring provisions for all three of the Ponds at the Station. This GWMP has been updated to reflect current conditions are provisions in the Permit.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

The following sections present a summary of the geological and hydrogeological conditions for the Station and surrounding areas.

3.1 Site Soils

Based on the information obtained during hydrogeologic and geotechnical investigations (various investigations including URS, 2015; and Golder 2016 and 2017), the Station's soils are classified primarily as clays, silts, and sands. The soils, with the exception of alluvial and colluvial materials, are predominantly derived from the deposition of weathered local parent rock material (saprolite) and include predominantly more clayey soils (slate parent rock) to the west and sandy soils (granite and granodiorite parent rocks) to the east of the West Pond.

In general, saprolitic soil is present over the underlying bedrock in most areas of the Station with the exception of the floodplain area, where the saprolitic soils may be absent locally due to erosion. Additionally, the bedrock is locally exposed with no saprolite or alluvium cover in the escarpment demarcating the eastern section of the floodplain (area between the East Pond and the North Pond). In the upland area of the Station (surrounding the North Pond), the saprolite thickness can exceed 50 feet.

The floodplain sediments are a mix of alluvial materials, with a cobble and/or sand/gravel layer (interpreted high energy channel depositional environment similar to the current riverbed) identified immediately above the bedrock in selected borehole locations. Locally, the cobble/gravel bed appears to be absent. Where present, the cobble/gravel bed is overlain by a fine-grained clayey stratum (interpreted infilled channel meander). Where absent, the fine-grained clayey stratum directly overlies bedrock or a thin section of saprolite. The clayey stratum is in turn overlain by a sandy silt to sand that is rich in organic matter locally (interpreted overbank deposit).

The United States Department of Agriculture (USDA, 2015) has mapped a variety of soils at the Station (Drawing 3). The three major soil types within the immediate area, based on area of coverage from greatest to least, are the Louisburg sandy loam, Appling sandy loam, and Congaree silt loam (USDA, 2015). The Louisburg and Appling sandy loam soils are associated with upland areas, and the Congaree silt loam is characterized as a lowland soil sometimes overflowed by the adjacent streams. None of the soils beneath the CCR impoundments exhibit hydric characteristics.

3.2 Geology

As presented on Drawing 4, the Station is located in the central part of the Piedmont Physiographic Province on the Chopawamsic Terrane (Bailey and Owens, 2012; VDMR, 1993). The surrounding area is characterized by undulating terrain incised by a number of dendritically patterned, intermittent and perennial stream channels flowing in a generally southern direction towards the James River. The Piedmont Physiographic Province is characterized

by igneous and metamorphic rock formations of Pre Cambrian (Catoctin Formation) to Ordovician geologic age. The Province consists of a mosaic of accreted terrain and has been folded and faulted near the end of Ordovician time.

Regionally, the Station is located within the Central Virginia Volcanic - Plutonic Belt and southeast limb of the Blue Ridge anticlinorium. The Chopawamsic Terrane is variously described as being comprised of an arc complex series of metamorphosed volcanic, plutonic, and sedimentary rocks. Specifically, basin-origin proto-sedimentary deposits associated with the Arvonia/Quantico slate and the metamorphosed Buffard conglomerate formation unconformably overlie felsic and mafic metavolcanics that have been intruded by granitic rocks of the Columbia and Ellisville plutons (Bailey and Owens, 2012).

As shown on Drawing 4 and on the Virginia Division of Mineral Resources (VDMR) Geologic Map of the Dillwyn Quadrangle, the eastern half of the Station and portions of the western half of the Station are underlain by likely Pre Cambrian age medium- to coarse grained gneissic quartz diorite, granodiorite, and granite comprising the undifferentiated felsic metavolcanic rocks of the Chopawamsic Terrane (historically described as the Hatcher Complex; VDMR, 1969). Similarly, Drawing 4 indicates that the western portions of the Station are underlain by migmatitically interlayered hornblende gneiss of Pre-Cambrian age, and schist and slate units of Late Ordovician age of the Arvonia Formation. The Arvonia Formation rests unconformably with a basal conglomerate upon gneissic granodiorite and quartz diorite rocks (undifferentiated felsic metavolcanic rocks of the Chopawamsic Terrane, formerly the Hatcher Complex). These literature observations are confirmed by site observations from outcrops and soil borings advanced at the Station.

The sequence of units was folded into asymmetrical and overturned anticlines and synclines (Arvonia Syncline near the western limits of the Station) near the end of the Paleozoic period. The units were later subjected to the last major period of regional metamorphism near the end of the Mississippian Period. Metamorphic grade generally increases from west (greenschist) to east (amphibolite) across the Chopawamsic Terrane.

Attitudes of the Arvonia Syncline bedding indicate a steep southeasterly dip along the west limb of the fold, and a vertical or nearly vertical dip along the east limb of the fold, indicating that the Arvonia syncline is asymmetrical, with its axial plane dipping steeply to the southeast. Bedrock foliation within the vicinity of the Station is mapped as possessing a dominant northeasterly trend with varying attitudes of dip direction and angle. Northwesterly trending joints are also noted within bedrock underlying the Station (VDMR, 1969).

Site observations and regional mapping as illustrated on Drawing 4 indicate that portions of the Station near the James River are underlain by unconsolidated Quaternary-age alluvial sediments. Locally, a basal stratum is observed to overlie competent bedrock or saprolite and is generally characterized as a gravel or cobble deposit of variable thickness. The gravel is in turn overlain by fine-grained sediments that appear to be associated with fluvial infill sediments (fine-grained), which in turn are overlain by coarser grained overbank deposits.

To assist with illustration of the relationship between the site geology and hydrogeology, a series of cross sections have been prepared (A-A', B-B', C-C', and D-D') which are presented on Drawing 5. Cross section A-A' is parallel to the James River and illustrates the geology underlying the East and West Ponds. Sections B-B' and C-C' are perpendicular to the River and crosscut the West Pond, and the North and East Ponds. Section D-D' cuts the North Pond to illustrate the historical preconstruction conditions for that pond. As presented, the uppermost aquifer is comprised of bedrock overlain by saprolite with the saprolite in turn over lain by colluvial deposits and where the saprolite is absent, the bedrock is directly overlain by colluvium.

3.3 Hydrogeology

Based on information obtained from soil borings and wells installed at the Station, the Site Conceptual Model developed for the Station is comprised of an upland recharge area and a hydrogeologic boundary associated with the James River. Locally, it is expected that artificial recharge associated with the inactive CCR impoundments may create similar conditions to those expected in the upland recharge area. The uppermost aquifer potentiometric surface transcends geologic boundaries, with the aquifer matrix ranging from saprolite, fractured bedrock (various), to alluvium associated with the James River. These different geological units are expected to impart variability into the uppermost aquifer hydraulic properties as well as geochemical conditions. Details for the monitoring and observation wells installed at the Station are summarized in Table 1 and available soil boring and well construction logs are presented in Appendix A.

As presented on Drawing 6, the groundwater surface in the uppermost aquifer generally mimics site topography, with groundwater movement from topographically high areas to topographically low areas. The uppermost aquifer beneath the Station is unconfined and found in the surficially exposed overburden and bedrock. Locally, the groundwater flow direction in the uppermost aquifer is from the northeast to the southwest across the Station property towards the James River. As presented on Drawing 6, groundwater elevations range from 350 feet AMSL beneath the upland recharge areas to less than 220 feet AMSL along the boundary with the James River. Potentiometric surface level data for nested wells indicate that an upward gradient is present between the lower bedrock and the alluvium beneath the East and West Ponds. Similarly, potentiometric surface data indicate that variable vertical gradients are present between the lower bedrock and upper saprolite in the vicinity of the North Pond, with an upward gradient observed along the northern boundary and a downward gradient observed to the west and south of the North Pond.

Depth-to-water measurements have been obtained since 2012 from several observation and monitoring wells constructed at the Station. The trend and range of fluctuation in the water table surface beneath the study area, with some exceptions, are relatively consistent across the study area, and presumably a function of long-term variations in precipitation and seasonal trends. As expected, the magnitude of the fluctuation is greater in those wells located in the upland areas and wells located at the western portions of the Station, where fine-grained slate

bedrock is present, as opposed to those wells located near the East Pond and those closer to the James River hydrogeologic boundary.

Groundwater measurements collected in 2017 from wells screened in the uppermost aquifer beneath the study area indicate that the depth to groundwater in the vicinity of North Pond is between 50 and 100 feet depending on topographic elevation. The measured saturated thickness of the saprolite/bedrock uppermost aquifer beneath the North Pond exceeds 75 feet. The depth to groundwater in the vicinity of the East and West Ponds, both of which are located in the floodplain, ranges from 10 to 25 feet depending on topographic elevation. The measured saturated thickness of the alluvium/bedrock uppermost aquifer beneath the East and West Ponds exceeds 75 feet.

3.3.1 Uppermost Aquifer Hydraulic Conductivity

Analysis of slug testing data obtained from the observation and monitoring wells evaluated in 2012, 2016, 2017, 2019, and 2020 indicates that the average hydraulic conductivity of the uppermost unconfined aquifer is variable depending on the aquifer matrix. Table 2 summarizes the estimated hydraulic conductivities for the various aquifer matrices present at the Station based on analysis of the slug testing data using the Aqtesolv™ software and appropriate data evaluation procedures (see summary in Table 2). A summary of the geometric average hydraulic conductivity values for the aquifer matrices present at the Station is presented below.

Aquifer Matrix	Maximum Hydraulic Conductivity (ft/s)	Minimum Hydraulic Conductivity (ft/s)	Estimated Average Hydraulic Conductivity(ft/s)
Saprolite (North Pond)	5.98E-06	1.76E-06	3.24E-06
Gneiss Bedrock (East, West, and North Ponds)	5.09E-04	1.56E-08	1.53E-05
Slate/Phyllite Bedrock (East, West, and North Ponds)	2.66E-05	1.46E-06	6.35E-06
Alluvium (East and West Ponds)	6.59E-05	6.14E-07	1.11E-05

ft/s = foot per second

The effective porosity of the unconfined aquifer along the downgradient side of the Station (*i.e.*, area where the uppermost aquifer is present within alluvial sediments) is estimated at 20% (Saunders, 1998; Fetter, 1988). Similarly, the average effective porosity of the saprolite is estimated at approximately 20% based on expected primary and second porosity (chemical and physical weathering). Along the upgradient, northern area of the Station, the uppermost aquifer is believed to occur within a matrix comprised of partially weathered bedrock (saprolite) ranging to competent fractured bedrock. The effective porosity of this aquifer matrix is expected to range from a whole-rock porosity based primarily on secondary porosity (discontinuities) of approximately 1 to 5% or less on a megascopic to macroscopic scale, to greater than 50% on a microscopic scale along discrete preferential flow

pathways within the fractured rock (*i.e.*, open fractures). On average the effective porosity of the saprolite and bedrock is estimated at 2.5% (Fetter, 1988).

Understanding the interaction between the weathered/competent bedrock portion (*i.e.*, preferential pathways within this unit) of the uppermost aquifer and the overlying alluvial sediments comprising the uppermost aquifer in the southern portion of the site provides significant insight into the spatial and vertical distribution of the site's geochemical facies, as well as the overall movement of groundwater within the laterally and vertically continuous variable-matrix aquifer system. Current observations indicate that groundwater within the fractured bedrock/saprolite matrix beneath headlands on the northern side of the Station discharges to the alluvium in the floodplain area on the southern side of the Station. The basal gravel/cobble deposit in the southern floodplain portion of the Station, where present, is expected to provide the main conduit for the transmission of bedrock discharge based on a relatively high expected conductivity relative to the average conductivity of the alluvium. The observed confining conditions of the coarse-grained alluvium deposits indicate a robust connection with the underlying fractured bedrock, with an upward hydraulic gradient from the bedrock into the alluvium. Flow from the uppermost aquifer, including the alluvium and saprolite, is ultimately towards the James River.

3.3.2 Horizontal Component of Flow

Using the groundwater contours presented as an overlay on Drawing 6, the average hydraulic gradient for the uppermost aquifer in the study area was calculated as follows using the algorithm below.

Area	Starting Head (Elevation ft AMSL)	Ending Head (Elevation ft AMSL)	Distance (feet)	Calculated Gradient (unitless)
North Pond	350	200	3,856	0.039
East Pond	350	200	3,856	0.039
West Pond	225	200	1,138	0.022

Note:AMSL = Above Mean Sea Level

$$i_{gw} = \left({}^{h_L}/_{L}\right)$$

Where: i_{gw} = gradient

h_L = head loss (elevation difference)

L = length (horizontal distance)

Using the estimated average effective porosity value of 20% for the alluvium and saprolite and 2.5% for the bedrock, the estimated average hydraulic conductivity values for the different matrices, and the calculated gradients, the average rate of groundwater flow (Vgw) in the uppermost aquifer beneath the units was calculated as follows using the algorithm below.

Area	Gradient (unitless)	Effective Porosity	Maximum Hydraulic Conductivity (ft/s)	Maximum Groundwater Velocity (ft/year)	Minimum Hydraulic Conductivity (ft/s)	Minimum Groundwater Velocity (ft/year)	Average Hydraulic Conductivity (ft/s)	Average Groundwater Velocity (ft/year)
North Pond	0.039	0.20	5.98E-06	36.8	1.76E-06	10.8	3.24E-06	19.9
East Pond	0.039	0.20	6.59E-05	405	6.14E-07	3.78	1.11E-05	68.3
West Pond	0.022	0.20	6.59E-05	229	6.14E-07	2.13	1.11E-05	38.5
Gneiss Bedrock	0.039	0.025	5.09E-04	25,041	1.56E-08	0.77	1.53E-05	753
Slate-Phyllite Bedrock	0.039	0.025	2.66E-05	1,309	1.46E-06	71.8	6.35E-06	312

Notes:ft/s = foot per second
ft/year = feet per year

$$V_{gw} = K\, i \left(1/n_e\right)$$

Where: V_{gw} = Groundwater velocity

K = Hydraulic conductivity

i = Hydraulic gradient

n_e = Effective porosity

3.3.3 Vertical Component of Flow

Using groundwater elevation data from 2017 (2019 data for MW-22/MW-22D and MW36S/MW-36D), the vertical component of flow within the aquifer was evaluated using various well pairs as presented below. The vertical gradients for these well pairs were calculated as shown below.

$$i_{gw} = \left(h_L/L\right)$$

Where: h_L = head loss (elevation difference)

L = length (vertical distance – midpoint of the well screens)

Well Pair	Shallow Groundwater Elevation (ft AMSL)	Deep Groundwater Elevation (ft AMSL)	Distance (feet)	Gradient (unitless)	Effective Porosity	Hydraulic Conductivity (ft/s)	Groundwater Velocity (ft/year)
MW-22 / MW-22D	203.67	203.78	41	-2.68E-03	0.025	1.08E-05	-36.6
MW-29S / MW-29D	345.90	346.64	84.5	-8.8E-03	0.025	1.08E-05	-120
MW-26S / OW-26D	343.26	343.35	30	-3.0E-03	0.025	1.08E-05	-41.0
OW-32S / OW-32D	217.90	203.83	83.5	1.7E-01	0.20	3.24E-06	86.9
MW-27S / MW-27D	297.97	296.54	110.5	1.3E-02	0.20	3.24E-06	6.64
MW-25S / OW-25D	317.72	318.39	60	-1.1E-02	0.025	1.08E-05	-150

Well Pair	Shallow Groundwater Elevation (ft AMSL)	Deep Groundwater Elevation (ft AMSL)	Distance (feet)	Gradient (unitless)	Effective Porosity	Hydraulic Conductivity (ft/s)	Groundwater Velocity (ft/year)
MW-20S / MW-20D	202.65	203.56	43	-2.12E-02	0.025	1.08E-05	-289
MW-36S / MW-36D	234.18	239.37	39	-1.33E-01	0.025	3.24E-06	-544

Note: Negative velocity indicates upward flow.

The positive gradient for the OW-32S/OW-32D and MW-27S/MW-27D well pairs indicates that the hydraulic gradient is downward in these areas of the Station. The MW-27S/MW-27D well pair is located next to a hydrogeologic boundary (bedrock drainage) channel, and the observed gradient is expected. The OW-32S/OW-32D well pair is located near the interface between the upland recharge area and the floodplain discharge area, and the downward gradient likely reflects the hydraulic interaction that is occurring in this area.

The negative gradient observed at the remaining well pairs indicates that the groundwater flow direction in these areas is upward, reflecting the strong regional gradient in the underlying bedrock aquifer and the groundwater discharge features (receiving waters) associated with the North Pond and the James River.

3.4 Water Supply Wells

There are no known drinking water supply wells located downgradient from the North, West, or East Ponds (*i.e.*, between the units and the groundwater discharge divide associated with the James River). No drinking water wells are located on the Station property. A former low-capacity, non-potable water supply well was located next to the sewage treatment building. Current site information indicates that this former well was decommissioned and is no longer in use or accessible. The approximate location of the former pump house based on historical drawings from 1949 is shown on Drawing 2 and 6.

A second well is still in use at the Station. This well is pumped at a rate of approximately 2 gallons per minute and is used as part of the Station's sanitary wastewater treatment system. No information on well construction is currently available other than visual observations indicating that the well is cased with a 6 inch-diameter polyvinyl chloride (PVC) casing. Based on this observation, it is expected that the well is cased to bedrock with an open borehole in the bedrock. The approximate location of this well is shown on the site plan (Drawing 2). Based on available information, this well is not expected to significantly influence the flow of groundwater at the Station, as the measurable radius of influence is expected to be less than 50 feet.

4.0 DESIGN OF THE GROUNDWATER MONITORING SYSTEM

Three groundwater monitoring systems are proposed to monitor the groundwater quality in the vicinity of the North, West, and East Ponds. The monitoring wells proposed for the closure demonstration monitoring networks and compliance monitoring network are located and constructed with a sufficient number of wells to yield groundwater samples representative of the conditions in the uppermost aquifer beneath the units that:

- Accurately represent the quality of background groundwater that has not been affected by leakage from the waste management units (CCR units), and
- Accurately represent the quality of groundwater passing the waste boundary of the waste management units (CCR units). The downgradient monitoring systems installed at the waste boundary will ensure early detection of groundwater contamination in the uppermost aquifer. Dominion Energy will monitor potential contaminant pathways related to the waste management units (CCR units).

Certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of the CCR Rule (40 CFR 257.91(f)) is required. This certification was placed in the unit's operating record on October 17, 2017 in accordance with the recordkeeping requirements of 40 CFR 257.105. Pursuant to 40 CFR 257.106(h) and 40 CFR 257.107(h), the DEQ was notified on November 15, 2017 that the certification was placed in the operating record and on Dominion Energy's publicly available internet site. Any future modifications to the groundwater monitoring system will require DEQ approval and updates to the operating record and publicly available internet site in accordance with the CCR Rule.

Well placement, construction, development, and decommissioning procedures are discussed in the following sections. Monitoring well construction logs for existing wells are provided in Appendix A. Recommended monitoring well construction, development, and decommissioning procedures are included in Appendix B.

4.1 Special Conditions

Special conditions are site conditions that can affect the design of a groundwater monitoring system. These conditions may include:

- Waste management units, including CCR units, located above a mounded groundwater table;
- Waste management units, including CCR units, located above aquifers with seasonally variable groundwater flow directions;
- Waste management units, including CCR units, located in areas where nearby surface water features or tidally influenced surface water bodies may influence groundwater levels or expected flow directions;
- Waste management units, including CCR units, located near intermittently or continuously used groundwater production wells; and/or

- Waste management units, including CCR units, located in karst (carbonate bedrock) or faulted areas where subsurface geologic features may modify expected groundwater flow paths.

Based on the available hydrogeologic information for the Station, other than the considerations listed below, Dominion Energy is not aware of any special conditions, including those listed above, that would affect the design of a downgradient groundwater monitoring network that can effectively monitor the uppermost aquifer:

- Nearby residential properties may operate water supply wells that are screened in the lower fractured bedrock. The operation of these wells in sidegradient and upgradient locations is not expected to adversely impact Dominion Energy's ability to monitor groundwater beneath the CCR impoundments with a conventional groundwater monitoring network. This determination is based on the distance between the residential structures and the CCR ponds, the steep gradient that is present within the fractured bedrock, and the minimal expected groundwater extraction rate for residential wells (*i.e.*, limited cones of depression).

4.2 Monitoring Well Placement

The monitoring networks described herein are designed to meet the performance standards specified in the VSWMR and the CCR Rule and will be protective of human health and the environment. Accordingly, the monitoring networks are designed so that adequate monitoring coverage is provided to represent the quality of groundwater upgradient and downgradient of the existing and former CCR units. A summary of survey information for the monitoring wells is provided in Table 1, and available soil boring and well construction logs are presented in Appendix A. Drawing 6 shows the hydraulic locations of the compliance wells relative to the CCR units.

4.2.1 West Pond Compliance Network

As presented in the following sections, the compliance monitoring network for the West Pond includes four background wells and seven downgradient wells including one to be installed within the former impoundment (MW-38) that are screened within the uppermost aquifer beneath the West Pond.

4.2.1.1 West Pond Upgradient CCR Wells

The compliance monitoring network for the West Pond includes four background wells as follows:

MW-1	MW-11
MW-32S	MW-32D

As shown on Drawing 6, monitoring wells MW-1, MW-32S, and MW-32D are located upgradient from the West Pond and MW-11 is located upgradient from the Station. A summary of the well construction information is provided in Table 1 and soil boring-well construction logs are presented in Appendix A.

4.2.1.2 West Pond Downgradient CCR Wells

The compliance monitoring network for the West Pond includes seven downgradient wells, including one well installed within the former impoundment (MW-38) as follows:

MW-12	MW-13	MW-31
MW-37	MW-39D	MW-39S

As shown on Drawing 6, the downgradient compliance wells are or will be located hydraulically downgradient from the West Pond in close proximity to the downgradient waste unit boundary. MW-13 will continue to be monitored until MW-39S and MW-39D have been installed, at which time MW-13 will be removed from the compliance network. A summary of the well construction information for existing downgradient compliance wells is provided in Table 1.

4.2.1.3 Closure Demonstration Well

In addition to the CCR compliance wells, the West Pond will be monitored by a closure demonstration well to be installed inside the limits of the former pond. The proposed well will be installed as closure activities allow.

MW-38 (proposed)

4.2.2 East Pond Upgradient CCR Wells

The compliance monitoring network for the East Pond includes three upgradient wells as follows:

MW-11	MW-29S	MW-29D

As shown on Drawing 6, monitoring wells MW-29S and MW-29D are located hydraulically upgradient from the East and North Ponds, and MW-11 is located in a sidegradient location to the North Pond and is included as a background well since its groundwater quality assists with understanding the spatial variability of the natural water quality that is present in the water table portion of the uppermost aquifer beneath the East (and North) impoundments as such upper water is expected to discharge across the point of compliance downgradient from the upgradient area. A summary of the well construction information is provided in Table 1.

4.2.2.1 East Pond Downgradient CCR Wells

The compliance monitoring network for the East Pond includes seven downgradient wells, including one well installed within the former impoundment (MW-40) as follows:

MW-19	MW-20S	MW-20D
MW-21	MW-22	MW-23

As shown on Drawing 6, the downgradient compliance wells are located hydraulically downgradient from the East Pond in close proximity to the downgradient waste unit boundary. A summary of the well construction information for the downgradient compliance wells is provided in Table 1.

4.2.2.2 Closure Demonstration Well

In addition to the CCR compliance wells, the East Pond will be monitored by a closure demonstration well to be installed inside the limits of the former pond.

MW-40

4.2.3 North Pond Compliance Network

As presented in the following sections, the compliance monitoring network for the North Pond includes three background wells and five downgradient wells that are screened within the uppermost aquifer beneath the North Pond.

4.2.3.1 North Pond Upgradient CCR Wells

The compliance monitoring network for the North Pond includes three upgradient wells as follows:

MW-11	MW-29S	MW-29D

As shown on Drawing 6, monitoring wells MW-29S and MW-29D are located hydraulically upgradient from the North Pond, and MW-11 is located in a sidegradient location to the North Pond and is included as a background well since its groundwater quality assist with understanding the spatial variability of the natural groundwater quality that is present in the water table portion of the uppermost aquifer beneath the North (and East) impoundments as such upper water is expected to discharge across the point of compliance downgradient from the upgradient area. A summary of the well construction information is provided in Table 1.

4.2.3.2 North Pond Downgradient CCR Wells

The CCR compliance monitoring network for the North Pond includes five downgradient wells as follows:

MW-24	MW-27D	MW-33
MW-34	MW-35	

As shown on Drawing 6, the downgradient compliance wells are located hydraulically downgradient from the North Pond in close proximity to the downgradient waste unit boundary. A summary of the well construction information for downgradient compliance wells is provided in Table 1.

4.2.3.3 North Pond VSWMR Sentinel Wells

In addition to the CCR compliance wells, the North Pond will be monitored with six sentinel wells as follows:

MW-25S	MW-25D	MW-26S
MW-26D	MW-27S	MW-28

Details for construction of the VSWMR sentinel wells are presented in Table 1. Background sampling will not be required for the sentinel wells; rather, these wells will be sampled semi-annually with the compliance wells.

4.2.3.4 Closure Demonstration Well

In addition to the CCR compliance wells, the North Pond will be monitored by a closure demonstration well to be installed inside the limits of the former pond. The proposed well will be installed as closure activities allow.

MW-41 (proposed)

4.2.3.5 North Pond Observation Wells

In addition to the CCR and VSWMR compliance wells, Dominion Energy maintains several observation wells at the Station for periodic water level gauging. Construction details for these wells are presented in Table 1 and the well locations are shown on Drawing 6.

4.2.4 Horizontal Placement

The downgradient wells are placed as close to the CCR impoundment boundaries as is practical and, based on the groundwater contours, at a point where a release would be detected. The background wells are located so that groundwater samples will not be affected by a release from the CCR impoundments.

4.2.5 Vertical Placement

The monitoring wells have been drilled and completed to monitor the uppermost aquifer.

4.2.6 Screen Interval Placement

Monitoring well screen lengths are summarized in Table 1. As presented, the wells were designed and constructed with between 5 and 15 feet of screen to provide representative groundwater samples from the water-bearing portion of the uppermost aquifer underlying the CCR impoundments. In general, the wells are constructed so that the top of the screen is located beneath the seasonal low water table, and where practical, beneath the bottom of the adjoining CCR impoundment.

4.3 Monitoring Well Construction

Boring and well construction logs for the compliance monitoring network wells are presented in Appendix A. Consistent with USEPA guidance (Technical Enforcement Guidance; USEPA, 1986), the monitoring wells are constructed with 0.010-inch factory-slotted 2-inch inside diameter (ID) schedule 40 PVC well screen and 2-inch ID schedule 40 PVC riser casing. The well casing joints are threaded, and the bottom of the wells are equipped with PVC end caps. The surface completions for the monitoring wells are completed above grade, with wells that are located within the 100-year floodplain completed with a flood-resistant wellhead that is designed to seal the well in the event of rising floodwaters.

The monitoring wells were drilled using hollow-stem auger, air rotary equipment, and/or sonic drilling technology. It is anticipated that future wells will be constructed using sonic drilling technology or a similar industry-accepted method.

4.3.1 Drilling Methods

Drilling new monitoring wells and/or observation wells, if necessary, will be performed in general accordance with the specifications presented in Appendix B and are expected to use sonic drilling technology or a similar industry-accepted method. A qualified groundwater scientist will prepare a boring and well construction log for each new well. Dominion Energy will transmit the boring logs, well construction logs, and appropriate maps for any wells to be included in the permitted network to the DEQ within 14 days of certification (no more than 44 days from the completion of well construction activities, to include a survey by a licensed surveyor) by the qualified groundwater scientist in accordance with the VSWMR. Available boring logs and well construction diagrams for the existing on-site monitoring wells are provided in Appendix A.

4.3.2 Well Screens

Monitoring well screens should, in most circumstances, be 10 feet in length. The design of new monitoring wells should take into consideration the hydrogeologic conditions at the site, the fate and transport considerations of the potential contaminants being monitored, and the procedure(s) being used to sample the monitoring well(s). Ideally, to preserve the geochemical integrity of the water samples, well screens should be designed and placed (vertically) in a manner that prevents a change in the well screen exposure during sampling (relative to the exposure between sampling events) so that conditions during the sampling event do not change from the conditions that are present between sampling events. For CCR facilities, DEQ requires that all monitoring wells be screened solely within the saturated zone of the uppermost aquifer (no portion of the screen should be exposed above the zone of saturation). In addition, wells shall be screened in naturally occurring geologic formations, not in manmade deposits (*i.e.,* fill, mine spoil, etc.).

4.3.3 Wellhead Completions

Wells will be completed with a locking protective standpipe and a concrete apron for surface protection. Construction of new monitoring wells will be performed in general accordance with the specifications presented in Appendix B. Protective bollards for monitoring wells will be installed at the time of well construction as needed for wells located adjacent to high traffic areas or the 100-year floodplain, or later if it is determined that protective bollards are warranted. Bollards will generally be painted with high-visibility paint to assist with wellhead protection.

4.3.4 Well Development

Newly constructed wells will be developed to remove particulates that are present in the well casing, filter pack, and adjacent aquifer matrix due to construction activities. Development of new monitoring wells will be performed at least 24 hours after well construction. Wells may be developed with disposable PVC bailers, a well development pump, or other approved method. Well development procedures are presented in Appendix B.

Samples withdrawn from the monitoring wells should be clay- and silt-free; therefore, wells may require redevelopment from time to time based upon observed turbidity levels during sampling activities, and/or measurements of total depth over time that indicate sediment accumulation. If redevelopment of a monitoring well is required, it will be performed and documented in a manner similar to that used for a new well.

4.3.5 Pump Installations

Wells designated for use in the compliance monitoring networks have dedicated bladder pumps, or similar pumps, installed to facilitate micropurge sampling activities. The pumps and associated tubing are constructed of environment-inert materials suitable for use in compliance monitoring programs. Each pump should be placed within the middle portion of the well screen, and no closer than 2 feet from the bottom of the well.

4.3.6 Documentation

Documentation of future well construction activities will be in accordance with the VSWMR and CCR Rule. New wells will be surveyed by a licensed surveyor to within ±0.05 foot on the horizontal plane and ±0.01 foot vertically in reference to mean sea level. A boring log, well construction log, groundwater monitoring network map, and installation certification will be submitted to the DEQ within 14 days of certification by the qualified groundwater scientist in accordance with the VSWMR. Separately, a copy of the boring log, well construction log, groundwater monitoring network map, and installation certification will be incorporated into the Station's operating record as required under §257.105 of the CCR Rule as adopted in the VSWMR. The certification shall occur within 30 days of well construction (including the licensed well survey).

4.4 Monitoring Well Decommissioning Procedures

If a monitoring well becomes unusable during the life of the monitoring program, Dominion Energy will make reasonable attempts to decommission the monitoring well in accordance with procedures presented in Appendix B. Consistent with Permit condition X1.B.2.e, no wells onsite will be decommissioned without prior approval from DEQ.

4.4.1 Documentation

DEQ approval will be obtained prior to decommissioning any monitoring wells that are in the Station's compliance monitoring networks. A report describing the decommissioning procedures will be transmitted to DEQ following completion of the decommissioning activities. Separately, a copy of the report will be included in the Station's operating record in accordance with the recordkeeping requirements of §257.105 as adopted in the VSWMR.

4.5 Monitoring Well Replacement

Any monitoring well that fails to perform as designed shall be replaced prior to the next regularly scheduled groundwater sampling event, or as warranted. Non-performance of permitted groundwater monitoring wells should be reported to DEQ within 30 days of recognition.

If a monitoring well becomes unusable during the life of the monitoring program, Dominion Energy will make reasonable attempts to decommission the monitoring well in accordance with the procedures presented in Appendix B.

4.5.1 Documentation

DEQ approval will be obtained prior to decommissioning any monitoring wells that are in the compliance monitoring networks. A report describing the decommissioning procedures will be transmitted to DEQ following completion of the decommissioning activities. The report will be prepared in accordance with the provisions in Appendix B.

4.6 Well Operations and Maintenance

In accordance with the VSWMR and §257.91(e)(2), the compliance monitoring wells will be operated and maintained so they perform to their design specifications throughout the life of the monitoring program. Maintenance activities for the compliance wells are as follows:

Activity	Schedule
Lock Inspection	Each Monitoring Event
Protective Casing Inspection	Each Monitoring Event
Pump Inspection & Cleaning	Annually as needed
Depth to Well Bottom	Annually as needed

Activity	Schedule
Concrete Pad Inspection	Each Monitoring Event
Surface Water Infiltration Evaluation	Each Monitoring Event
Grass Mowing	As Needed

The results from the well inspections will be recorded on a Well Inspection Log during the routine semi-annual sampling events. A sample of a typical well inspection log is presented in Appendix B.

4.6.1 Floodplain Wells

Monitoring and observation wells that are located in the 100-year floodplain may at Dominion Energy's discretion be retrofitted with a flood-resistant well head as detailed in Figure 1 of Appendix B. This well head is designed to allow the well to breath under normal conditions (atmospheric pressure) and will close to prevent well flooding if the surrounding water level overtakes the vent housing. Additionally, the wells are protected from rafted debris with bollards on the four corners of the surface pad. If these well heads are used by Dominion, the wells will be inspected after every flooding event to ensure that there is no surficial damage from the flood that could impact the integrity of the well or future groundwater samples. If damage is observed, Dominion Energy will affect repairs before the next sampling event and will document the damage and completed repairs for the operating record.

For wells that are not retrofitted with the floodplain well housing, Dominion Energy will coordinate for removal and sealing of the wells with watertight compression caps as feasible. Such measures will prevent surface water from entering the well and impacting the uppermost aquifer. After the highwater has passed, each well will be accessed to determine if surficial damage that could impact the integrity of the well or future groundwater samples has occurred. Provided no damage is observed, the dedicated pumps will be reinstalled in the well after the assessment for use with the next compliance event. If damage is observed, Dominion Energy will affect repairs before the next sampling event and will document the damage and completed repairs for the operating record.

If Dominion Energy is not able to seal one or more wells prior to a flooding event, the well will be assessed after the flood event is over to determine the extent of impacts, if any. If available data indicates that the well head was submerged, the pump will be removed and decontaminated, and the well will be re-developed to remove silt and other materials that may have entered the well. The goal of the redevelopment activities will be silt removal and to flush the well and surrounding aquifer with aquifer water. Development activities will be conducted until such time as the pH and specific conductance of the water recovered from the well is measured to be to be similar (within the bound of) to the upper and lower confidence limits for the targeted parameters based on measurements collected during the previous four sampling events. If development activities are not able to restore the water quality, the DEQ will be contacted at that time to discuss alternative solutions.

As of the date of this revision, the following wells have or are scheduled to receive a flood resistant wellhead.

MW-1	MW-2	MW-3
MW-12	MW-13	MW-31
MW-32S	MW-32D	MW-37
MW-39S	MW-39D	MW-40

5.0 GROUNDWATER MONITORING PROGRAM

This GWMP is intended to provide a framework for consistent sampling and analysis procedures (as provided in Section 6.0) that are designed to ensure monitoring results provide an accurate representation of groundwater quality at the background and downgradient wells.

Groundwater monitoring activities for North Pond, East Pond, and West Pond have historically been performed in compliance with two regulatory programs:

1. Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0004138 – Groundwater monitoring and reporting activities are currently being conducted in accordance with the conditions in the Bremo Power Station VPDES Permit and the affiliated VPDES GWMP.

2. CCR Rule – Groundwater monitoring for the North Pond began in 2016 under the Detection Monitoring Program which included eight background sampling events and the initial Detection Monitoring Program event which was conducted in September 2017. Evaluation of Detection Monitoring Program data identified statistically significant increases (SSIs) over background for several CCR Rule Appendix III constituents. The SSI determination was completed in December 2017. Based on the SSI findings, Dominion Energy initiated the Assessment Monitoring Program with the initial Assessment Monitoring Program sampling event conducted in January 2018.

   CCR Rule - Groundwater monitoring for the East Pond and the West Pond, both of which are inactive CCR impoundments, began in October 2017 with the collection of the initial background samples under the Detection Monitoring Program. Background sampling activities and the initial Detection Monitoring Program compliance event were completed (analyses included) by April 17, 2019.

In order to comply with the requirements of the CCR Rule, as well as the Solid Waste Facility Permit Number 618, Dominion Energy has prepared this GWMP which presents a “modified” program modeled on the requirements of the CCR Rule and the Permit and as directed by DEQ. The modified Detection Monitoring Program is designed to meet the requirements of VSWMR’s First Determination Monitoring Program and CCR’s Detection Monitoring Program. The modified Assessment Monitoring Program is designed to meet the requirements of VSWMR’s Phase II Monitoring Program and CCR’s Assessment Monitoring Program. To the extent a conflict exists between the requirements of the CCR Rule and VSWMR, this GWMP utilizes the more stringent of requirements. Current monitoring programs for all three ponds have transitioned to the modified Assessment Monitoring Program.

Records of the background groundwater quality data and subsequent measurements, including concentration data, will be kept in the operating record, provided to DEQ, and placed on the publicly available website in accordance with the recordkeeping and notification requirements of §257.105, §257.106, and §257.107 as adopted in the

VSWMR. These records will be maintained throughout the active lives and post-closure care periods for the impoundments.

For each parameter, the laboratory certificates-of-analysis will identify the analytical Limit of Quantitation (LOQ), the analytical Limit of Detection (LOD), the reported concentration, and applicable laboratory quality assurance/quality control (QA/QC) data on surrogate and standards analyses. Statistical evaluations of the analytical data (if completed), GWPS comparisons, static water level determinations and evaluations, and use of other measurement, sampling, and analytical devices, will be retained throughout the active lives and post-closure care periods for the impoundments.

Details for the Modified Detection and Assessment Monitoring Programs are presented in the following sections.

5.1 Modified Detection Monitoring Program

Details regarding the modified Detection Monitoring Program are presented herein in the event that one or more impoundments meets the requirements for monitoring under the modified Detection Monitoring Program at a future time. Note that future implementation of the Modified Detection Monitoring Program would require the owner to complete a major permit modification.

The modified Detection Monitoring Program is designed to identify the presence and concentration of targeted potential CCR and solid waste constituents in the uppermost aquifer beneath the impoundments. Components of the modified Detection Monitoring Program, including analytical requirements, sampling frequency, and data evaluation, are discussed in the following sections.

5.1.1 Constituents

The modified Detection Monitoring Program will include sampling and analysis of the inorganic constituents (metals) listed in Table 3.1 Column A of the VSWMR and Appendix III of the CCR Rule. Samples will be analyzed using the appropriate analytical method from the latest edition of USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846* (USEPA, 2015), if available. Suggested analytical methods and Practical Quantitation Limits (PQL) are presented in Table 3.

5.1.2 Background Sampling

VSWMR and the CCR Rule differ in the minimum number of independent samples required to establish background; as a result, the more stringent of the regulatory requirements will be followed. Therefore, a minimum of eight independent background samples for monitored constituents and parameters will be collected from each background and downgradient well for the modified Detection Monitoring Program. The background sampling events will be performed on a temporal schedule (if feasible) that accounts for both seasonal and spatial variability

in groundwater quality for the constituents listed in Tables 3 and 4. The Detection Monitoring Program background sampling activities for the North, East, and West Ponds have been completed

5.1.3 Sampling Schedule

After establishing background concentrations for the impoundments, the modified Detection Monitoring Program sampling schedule will be based on a semi-annual schedule (once every 180 days plus or minus 30 days) with the sample analyses completed within the calendar year semi-annual period consistent with the CCR Rule.

5.1.4 Verification Sampling Events

If verification sampling events are undertaken to verify suspect analytical results, the verification sampling activities, including laboratory analyses, must be completed within the combined 30-day determination and 14-day reporting window for reporting statistical exceedances (total of 44 days from the date of receipt of the laboratory certificates of analysis for the sampling event).

5.1.5 Analytical Data Evaluation

VSWMR and the CCR Rule differ in the required evaluation period after the receipt of laboratory analytical results; as a result, the more stringent of the regulatory requirements will be followed. Therefore, within 30 days of receiving the laboratory analytical results, the groundwater data will be evaluated statistically as described in Section 7.0 of this GWMP. The results of the statistical analyses will then be evaluated as follows:

- Provided that there are no statistically significant detections over the impoundment background concentrations, the modified Detection Monitoring Program will continue on a semi-annual schedule with the results of the statistical analyses presented in the semi-annual and annual reports prepared for the impoundment.
- If one or more monitored constituents are detected at statistically significant concentrations over the impoundment background concentrations the Dominion Energy shall within 14 days of this finding notify the DEQ of its intention to:
  - Implement the modified Assessment Monitoring Program; or
  - Prepare and submit an ASD to the DEQ and obtain DEQ's approval of said ASD within 90 days unless a longer timeframe is granted by DEQ.

5.1.6 Reporting

Dominion Energy will comply with the requirements of the CCR Rule and VSWMR for data collection, storage, and reporting including:

- Recordkeeping requirements specified in 40 CFR 257.105(h);
- Recordkeeping requirements specified in 9VAC20-81-250.E.1;

- Reporting requirements specified in 9VAC20-81-250.E.2;
- Notification requirements specified in 40 CFR 257.106(h); and
- Publicly accessible Internet site requirements specified in 40 CFR 257.107(h).

Reports required under the modified Detection Monitoring Program include statistical exceedance notifications, if required; semi-annual reports; annual reports; and a Facility Background Determination Report. The minimum required information for each report and submittal timeframes for the reports are discussed in the following sections.

5.1.6.1 Statistical Exceedance Notification

In the event that one or more constituents are detected at a statistically significant concentration relative to the impoundment background concentrations, Dominion Energy is required to notify the DEQ within 14 days of this determination. The notification shall identify the impoundment, the constituent exceeding the background concentration, the well identification, and the owner's/operator's intent to either initiate a modified Assessment Monitoring Program for that impoundment or to submit and obtain DEQ approval of an ASD.

5.1.6.2 Semi-Annual Report

For each impoundment, no later than 120 days of completing the first semi-annual event of each year (*i.e.*, after receiving the laboratory analytical results), Dominion Energy will submit a semi-annual report to DEQ. Each semi-annual report will include the following:

- Signature page signed by a professional geologist or qualified groundwater scientist;
- Impoundment name and permit number;
- Statement noting whether or not all monitoring points within the permitted network for the impoundment installed to meet the requirements of the VSWMR were sampled as required during the event;
- Calculated rate of groundwater flow during the sampling period;
- The groundwater flow direction as determined during the sampling period presented as either plain text or graphically as a potentiometric surface map;
- Statement noting whether or not there were SSIs over background during the sampling period, the supporting statistical calculations, and reference to the date the director was notified of the increase pursuant to timeframes in the VSWMR, if applicable;
- Copy of the full Laboratory Analytical Report including dated signature page (laboratory manager or representative) to demonstrate compliance with the VSWMR timeframes. The DEQ will accept the lab report in CD-ROM format; and
- A brief discussion of the sampling and analysis activities.

5.1.6.3 Annual Report

For each impoundment Dominion Energy will prepare an annual report for submission to the DEQ no later than January 31st of each year pursuant to §257.90.e of the CCR Rule or 120 days from the date the second semi-annual sampling and analysis activities are complete pursuant to 9VAC20-81-250.E.2 of the VSWMR, whichever occurs first. The annual report will include the following:

- A signature page;
- A completed QA/QC DEQ Form ARSC-01.
- The impoundment's name, type, permit number, current owner or operator, and location keyed to a United States Geological Survey (USGS) topographic map;
- Summary of the design type, operational history, and size (acres) of the impoundment, including key dates such as beginning, and termination of waste disposal actions and dates different groundwater monitoring phases were entered;
- Description of the surrounding land use noting whether any adjoining landowners utilize private wells as a potable water source;
- A discussion of the topographic, geologic, and hydrologic setting of the impoundment including a discussion on the nature of the uppermost aquifer (*i.e.*, confined versus unconfined) and proximity to surface waters;
- A discussion of the monitoring wells network noting any modifications that were made to the network during the year or any nonperformance issues and a statement noting that the monitoring well network meets (or did not meet) the VSWMR performance requirements;
- A listing of the groundwater sampling events undertaken during the previous calendar year;
- A historical table listing the detected constituents, and their concentrations identified in each well during the sampling period; and
- Evaluations of and appropriate responses to the groundwater elevation data; groundwater flow rate as calculated using the prior year's elevation data; groundwater flow direction (as illustrated on a potentiometric surface map); and sampling and analytical data obtained during the past calendar year.

In addition to the above requirements, Dominion Energy must comply with the CCR Rule recordkeeping requirements specified in §257.105(h)(1), the notification requirements specified in §257.106(h)(1), and the internet requirements specified in §257.107(h)(1).

5.1.6.4 Alternate Source Demonstration

Dominion Energy may demonstrate that a source other than the impoundment caused the contamination, or that a statistically significant detection resulted from an error in sampling procedures, analysis, statistical procedures, or natural variation in groundwater quality. The ASD must be submitted to and approved by the DEQ within 90 days of confirming the statistical exceedance to avoid advancing into the modified Assessment Monitoring Program.

If the ASD is approved by the DEQ, the operator may continue with the modified Detection Monitoring Program. If the ASD is not approved by the DEQ, the operator will initiate the modified Assessment Monitoring Program within 90 days of the statistically significant detection.

5.1.6.5 Well Installation Report

Well installation reports as may be required shall be submitted to the DEQ within 44 days of well completion (including the licensed survey). The well installation reports shall include permit-required information and shall be certified by a qualified groundwater scientist. After installation is complete, eight background samples will be collected.

5.1.6.6 Well Decommissioning Report

Well decommissioning reports as may be required shall be submitted to the DEQ within 44 days of completing the physical well decommissioning activities. The well decommissioning reports shall include permit-required information and shall be certified by a qualified groundwater scientist.

5.1.6.7 Well Non-performance Notification

Well non-performance reports as may be required shall be submitted to the DEQ within 30 days of recognizing the non-performance issue.

5.2 Modified Assessment Monitoring Program

The modified Assessment Monitoring Program is designed to identify the presence and concentration of targeted potential CCR constituents in the uppermost aquifer beneath the CCR unit, and to determine if those constituents are derived from the CCR unit at concentrations that would require groundwater corrective action. Currently, North, East, and West Ponds are monitored under the modified Assessment Monitoring Program.

In accordance with the CCR Rule as adopted in the VSWMR, a notification must be prepared and placed in the Station's operating record and on the publicly available website stating that a modified Assessment Monitoring Program has been established. Pursuant to §257.106 as adopted in the VSWMR, the DEQ must be notified when the notice has been placed.

As requested by the DEQ, Dominion Energy will establish a background concentration for the constituents in the modified Assessment Monitoring Program. The background concentrations will be submitted to the DEQ as a Facility Background Report.

Components of the modified Assessment Monitoring Program, including analytical requirements, sampling frequency, and data evaluation, are discussed in the following sections.

5.2.1 Constituents

The modified Assessment Monitoring Program will consist of the following constituents:

- CCR Rule Appendix III constituents;
- CCR Rule Appendix IV constituents;
- VSWMR Table 3.1 Column B metals not included in the CCR Rule;
- Constituents and parameters that were sampled pursuant to VPDES Permit No. VA0004138 not included in the CCR Rule or VSWMR Table 3.1 metals; and
- Speciation of chromium (total and hexavalent).

Samples will be analyzed using the appropriate analytical method from the latest edition of USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* if available. The suggested analytical methods and PQL for the proposed modified Assessment Monitoring Program constituents are presented in Table 4. Final laboratory results will be reported in parts per billion for all metals constituents.

5.2.2 Sampling Schedule

Sampling under the modified Assessment Monitoring Program will occur semi-annually (180 days plus or minus 30 days) with the sample analyses completed within the calendar year semi-annual period consistent with the CCR Rule.

5.2.3 Verification Sampling Events

If verification sampling events are undertaken to verify suspect analytical results, the verification sampling activities, including laboratory analyses, must be completed within the combined 30-day determination and 14-day reporting window for GWPS exceedances (total of 44 days from the date of receipt of the laboratory certificates of analysis for the sampling event).

5.2.4 Establishing Groundwater Protection Standards

Impoundment-specific GWPS will be calculated using recent data for CCR Appendix IV constituents, VSWMR Table 3.1 Column B constituents, and boron. GWPS will be established in accordance with §257.95(h) as adopted in the VSWMR. The proposed GWPS will be developed based on the following requirements unless the requirements for establishing GWPS are revised by the USEPA with future revisions to the CCR Rule, in which case the CCR Rule provisions will supersede these provisions:

- For constituents for which a USEPA Maximum Contaminant Level (MCL) has been established, the MCL for that constituent will be used as GWPS;

- For constituents for which MCLs have not been established, the impoundment-specific background concentration established from the background wells will be used as GWPS; or
- For constituents for which the impoundment-specific background level is higher than the MCL, the background concentration established from the background wells will be used as GWPS, as approved by the DEQ.

The established GWPS will be included in the annual monitoring report required by §257.90(e) as adopted by the VSWMR and the corrective action report (if required). The MCL-based GWPS will be updated upon USEPA's promulgation of new or revised MCLs. Following approval, the background-based GWPS will be updated every 2 years such that the eight most recent background well sampling results will replace the oldest eight background well sampling results.

Following initiation of the modified Assessment Monitoring Program and the establishment of background concentrations for the Table 4 constituents to be presented to the DEQ in a Facility Background Report, proposed GWPS for the applicable constituents (CCR Rule Appendix IV constituents and VSWMR Table 3.1 Column B constituents) will be submitted to the DEQ consistent with the VSWMR and the CCR Rule. The GWPS based on MCLs will become effective immediately upon proposal. The GWPS based on background concentrations will become effective upon written DEQ approval.

The GWPS will be submitted to the operating record after completing the initial modified Assessment Monitoring Program event and no later than 30 days after establishing background concentrations for required monitoring constituents. Approved GWPS are presented in Appendix D.

5.2.5 Analytical Data Evaluation

Groundwater data will be evaluated statistically as described in Section 7.0 of this GWMP. The results of the statistical analyses will then be evaluated as follows:

- If the concentration of any monitored constituent is present in the groundwater at a concentration that is above the impoundment-specific background concentration, but below the current GWPS, Dominion Energy shall continue the modified Assessment Monitoring Program.
- If any monitored constituent is present at a concentration that exceeds the impoundment-specific background concentration and/or the most current established GWPS, Dominion Energy may:
  - Submit an ASD certified by a qualified professional engineer within 90 days of determining the exceedance of GWPS; or
  - Begin the initial steps toward groundwater Corrective Action. The Corrective Action Program will be consistent with both VSWMR 9VAC20-81-260 and §257.96, §257.97, and §257.98 of the CCR Rule.

5.2.6 Data Validation

In accordance with 9VAC20-81-250.A.4.j, voluntary third-party data validation of laboratory data may be completed during the 30-day statistical determination period.

5.2.7 Reporting

Reports required under the modified Assessment Monitoring Program include a GWPS exceedance notification (if required), a semi-annual report, and an annual report. Consistent with the CCR Rule reporting requirements, required reports will be provided to the DEQ Regional Office upon posting in the impoundment's operating record and publicly accessible web site.

The minimum required information for each report and submittal timeframes for the reports are discussed in the following sections.

5.2.7.1 Facility Background Report

A Facility Background Report will be prepared for the impoundment within 30 days of initially establishing background or re-establishing background. The Facility Background Report will present the impoundment's established background concentrations for the constituents listed in Table 4. The Facility Background Determination Report will be placed in the operating record within 30 days of completion.

5.2.7.2 Groundwater Protection Standard Exceedance Notifications

Consistent with §257.93(h)(2) of the CCR Rule and 9VAC20-81-250.C.3.e(3)(a) of the VSWMR, Dominion Energy will submit a GWPS exceedance notification for Table 4 constituents that have established GWPS to the DEQ within 14 days of identifying a statistical exceedance of a GWPS (44 days of issuance of the laboratory report).

The notification shall identify the constituent exceeding the GWPS, the impoundment, the well identification, and the owner's/operator's intent to either initiate a Corrective Action Program and proceed with a Nature and Extent Study and Assessment of Corrective Measures within 90 days of noting the GWPS exceedance, or to submit and obtain DEQ approval of an ASD.

5.2.7.3 Semi-Annual Report

No later than 120 days of completing the first semi-annual event of each year (*i.e.*, after receiving the laboratory analytical results), Dominion Energy will submit a semi-annual report for each impoundment to DEQ. Each semi-annual report will include the following:

- Signature page signed by a professional geologist or qualified groundwater scientist;
- Impoundment name and permit number;

- Statement noting whether or not all monitoring points within the permitted network installed to meet the requirements of the VSWMR were sampled as required during the event;
- Calculated rate of groundwater flow during the sampling period;
- The groundwater flow direction as determined during the sampling period presented as either plain text or graphically as a potentiometric surface map;
- Statement noting whether or not there were SSIs over background during the sampling period, the supporting statistical calculations, and reference to the date the director was notified of the increase pursuant to timeframes in the VSWMR, if applicable;
- Copy of the full Laboratory Analytical Report including dated signature page (laboratory manager or representative) to demonstrate compliance with the VSWMR timeframes. The DEQ will accept the lab report in CD-ROM format; and
- A brief discussion of the sampling and analysis activities.

5.2.7.4 Annual Report

Annual reports for each impoundment will be prepared and submitted to DEQ no later than 120 days after completing the second semi-annual event of each year (*i.e.*, after receiving the laboratory analytical results) or no later than January 31st of the following calendar year. The annual reports will include the following:

- A signature page;
- A completed QA/QC DEQ Form ARSC-01.
- The impoundment's name, type, permit number, current owner or operator, and location keyed to a United States Geological Survey (USGS) topographic map;
- Summary of the design type, operational history (*i.e.*, trench fill versus area fill), and size (acres) of the impoundment including key dates such as beginning, and termination of waste disposal actions and dates different groundwater monitoring phases were entered;
- Description of the surrounding land use noting whether any adjoining landowners utilize private wells as a potable water source;
- A discussion of the topographic, geologic, and hydrologic setting of the impoundment including a discussion on the nature of the uppermost aquifer (*i.e.*, confined versus unconfined) and proximity to surface waters;
- A discussion of the monitoring wells network noting any modifications that were made to the network during the year or any nonperformance issues and a statement noting that the monitoring well network meets (or did not meet) the VSWMR performance requirements;
- A listing of the groundwater sampling events undertaken during the previous calendar year;
- A historical table listing the detected constituents, and their concentrations identified in each well during the sampling period; and

- Evaluations of and appropriate responses to the groundwater elevation data; groundwater flow rate as calculated using the prior year's elevation data; groundwater flow direction (as illustrated on a potentiometric surface map); and sampling and analytical data obtained during the past calendar year.

In addition to the above requirements, Dominion Energy must comply with the CCR Rule recordkeeping requirements specified in §257.105(h)(1), the notification requirements specified in §257.106(h)(1), and the internet requirements specified in §257.107(h)(1).

5.2.7.5 Alternate Source Demonstration

Dominion Energy may demonstrate that a source other than the impoundment caused a statistically significant detection of one or more monitored constituents or statistical exceedances of a GWPS, or that the statistical increase resulted from an error in sampling procedures, analysis, statistical procedures, or natural variation in groundwater quality. The ASD must be submitted to the DEQ within 90 days of the sampling event from which the exceedance originated.

If an ASD associated with a GWPS exceedance is approved by the DEQ, Dominion Energy may continue with the modified Assessment Monitoring Program. If such an ASD is not approved by the DEQ, Dominion Energy must initiate an Assessment of Corrective Measures and a Corrective Action Program.

5.2.7.6 Well Installation Report

Well installation reports (for new wells) as may be required shall be submitted to the DEQ within 44 days of well completion (including the licensed survey). The well installation reports shall include permit-required information and shall be certified by a qualified groundwater scientist. After installation is complete, eight background samples will be collected.

5.2.7.7 Well Decommissioning Report

Well decommissioning reports as may be required shall be submitted to the DEQ within 44 days of completing the physical well decommissioning activities. The well decommissioning reports shall include permit-required information and shall be certified by a qualified groundwater scientist.

5.2.7.8 Well Non-performance Notification

Well non-performance reports as may be required shall be submitted to the DEQ within 30 days of recognizing the non-performance issue.

5.2.7.9 Modified Detection Monitoring Program Reversion Notification

Consistent with §257.95(e) as adopted in the VSWMR, if there are no SSIs over background concentrations for two consecutive monitoring events, Dominion Energy may revert the groundwater monitoring program to the modified

Detection Monitoring Program with DEQ's concurrence. This reversion shall be documented in a notification submitted to the DEQ before the next compliance monitoring event.

5.2.7.10 Groundwater Protection Standard Update Notifications

Notifications for GWPS updates due to changes in USEPA MCLs and/or impoundment-specific background concentrations shall be submitted to the DEQ within 30 days of the update.

5.2.7.11 Off-site Plume Notification

In the event that a groundwater plume (concentrations above GWPS) is determined to extend off site onto adjacent downgradient property, Dominion Energy will notify the DEQ and the affected landowner within 15 days of the determination consistent with Permit condition XI.K.3.

6.0 SAMPLE AND ANALYSIS PROGRAM

Proper sampling procedures are an important and fundamental aspect in an effective monitoring program. The following sections, which are consistent with USEPA guidance and the requirements of the CCR Rule, outline the proposed sample collection procedures.

6.1 Sampling Order

The existing compliance wells are equipped with dedicated purging and sampling equipment; therefore, the likelihood of cross-contamination during sampling is minimized. Accordingly, the anticipated sampling order will follow a sequence based on consideration of field conditions at the time of sampling.

6.2 Water Level Gauging

Prior to purging each monitoring well, the static water level will be gauged using an electronic water level indicator accurate to 0.01 foot. The measurement will be obtained from the surveyed measuring point on each well.

Prior to initial use and between wells, the portion of the water level indicator that comes in contact with the groundwater in the well will be decontaminated to avoid cross-contamination between monitoring wells. In addition to decontaminating the downhole equipment, sampling personnel will don new gloves between wells, and more frequently as needed, to avoid cross-contamination between monitoring wells.

6.3 Purging Procedure

The monitoring wells in the monitoring networks will be purged and sampled using a micropurge technique. Micropurge sampling can greatly reduce the volume of water that must be purged from a well before representative samples can be collected, and typically provides for the collection of more representative samples than do other purge methods, resulting in more consistency in analytical results. Micropurging is accomplished through the use of dedicated low-flow sampling devices. Bailers and portable pumps are not recommended because they cause mixing of the standing water column within the well (Robin and Gilham, 1987). This mixing action requires the removal of the traditional large purge volumes before sampling. Introducing any device into the well prior to sampling causes a surging effect that may increase turbidity and interfere with the normal flow of water through the well screen. This disturbance may remain in effect for as long as 24 to 48 hours (Kearl *et al.*, 1992).

For monitoring wells with dedicated bladder pumps equipped with check values that hold stagnant water in the discharge tubing between sampling events, the discharge tubing shall be purged prior to commencing micropurge activities to ensure that fresh formation water is sampled following the completion of micropurging. The discharge tube purge volume will be determined using the following equation:

Discharge Tube Volume (milliliters) = DTP * V_F

Where: DTP = Depth to the top of the pump to the nearest 0.1 foot

V_F = Volume Factor as follows:

10 = 1/4-inch diameter tubing

22 = 3/8-inch diameter tubing

39 = 1/2-inch diameter tubing

If discharge tube purging is required, the purge should be conducted at a rate equal to the well yield to avoid drawing stagnant well column water into the pump (*i.e.*, between 100 and 500 milliliters per minute). During the discharge tubing purge, the flow rate and the depth to groundwater should be monitored on regular intervals (every 3 to 5 minutes) to verify that the purge activities are not removing stagnant water from the water column in the monitoring well.

After completing the discharge tubing purge, if required, water quality parameters (pH, temperature, conductivity, and/or dissolved oxygen) along with the depth to water will be monitored during the micropurge consistent with USEPA guidance on micropurging. The stabilization of these parameters (generally +/- 10% for three consecutive readings) indicates when the discharge water is representative of formation water and samples can be collected for analysis. Measurements of turbidity may also be collected for the purpose of evaluating the purging technique. Water quality measurements will be collected on approximate 3- to 5-minute intervals and will be recorded on a Field Log or in the Field Book to document purge stabilization.

In addition to the water quality parameters, the flow rate may be monitored at regular intervals during the micropurge to verify that the micropurge activities are not removing stagnant water from the water column in the monitoring wells. In general, purge rates when using micropurge sampling procedures should not exceed 500 milliliters per minute, and the purge rate should be adjusted downward as needed to prevent the groundwater elevation from dropping more than 1 foot. Any measurements taken should be recorded on a Field Log or in the Field Book to document steady-state flow conditions during the purge. Sampling personnel will containerize and dispose of purge water generated during sampling activities in accordance with regulatory requirements.

On rare occasions, the yield of a monitoring well will be insufficient to keep up with the micropurge. In cases where the yield of the monitoring well is less than 50 milliliters per minute as documented by the recorded flow rate and continually decreasing head level as the well is purged, the required samples may be collected prior to stabilization of the water column provided the water quality parameters have stabilized within the required 10% range.

In the event that dedicated pumping equipment malfunctions during a sampling event, non-dedicated equipment may be used to micropurge the affected well(s) provided the pump can be decontaminated prior to use in each well.

The pump and associated discharge hoses must be decontaminated using a non-phosphate-based detergent and water mixture followed by a deionized water rinse to avoid cross-contamination between monitoring wells.

6.4 Sample Collection

Once the water quality data indicate that the micropurge activities have been completed, required samples should be collected directly from the discharge hose on the pump into laboratory-provided, pre-preserved sample containers selected for the required parameters or compatible parameters. Samples collected for the compliance program will not be filtered in the field or at the laboratory. Sample collection should be performed at the same rate (or lower) that was used during the micropurge. Following collection, samples will be placed in a cooler on ice under chain-of-custody control. Samples will be kept at no more than 6°C from collection to laboratory delivery.

Anticipated sample container, minimum volume, chemical preservative, and holding times for each analysis type are provided in Table 5. These standards may change depending on laboratory requirements. Sample preservation methods will be used to retard biological action, retard hydrolysis, and reduce sorption effects. These methods include chemical addition, refrigeration, and protection from light.

6.5 Sample Documentation

Chain-of-custody control is critical for documenting the integrity of the samples following collection, during transport to the laboratory, and at the laboratory. Consequently, the label for each sample container shall be completed to document the sample collection activities. An example sample container label is presented in Appendix C.

The chain-of-custody form should be signed by the sampling personnel and the receiving agent, with the date and time of transfer noted. In the event that the samples are being shipped to a laboratory, the signature of the receiving agent is not required; however, it is recommended that the tracking number for the shipping label be recorded on the chain-of-custody form. After completing the chain-of-custody form, it should be maintained with the samples. An example chain-of-custody form is presented in Appendix C.

6.6 Sample Seals

It is recommended that the shipping container be sealed to ensure that the samples have not been disturbed during transport to the laboratory. If sample seals are used, the tape should be labeled with instructions to notify the shipper if the seal is broken prior to receipt at the laboratory. An example chain-of-custody seal is presented in Appendix C.

6.7 Sample Event Documentation

The sampling event field notes should document the field activities such that they, along with the chain-of-custody form(s), are sufficient to allow for reconstruction of the sampling event by a third party.

6.8 Field Quality Assurance/Quality Control Procedures

Trip blanks, equipment blanks, field blanks, and field duplicates provide QA/QC measures for the monitoring program. The QA/QC measures are discussed in the following sections.

6.8.1 Trip Blanks

Trip blanks are a required part of the field sampling QA/QC program only when analytical parameters include volatile organic compounds (VOCs). Trip blanks are not required for this groundwater monitoring program.

6.8.2 Field Blanks

Field blanks may also be collected as part of the field sampling QA/QC program. The purpose of the field blank is to detect any contamination that might be introduced into the groundwater samples through the air or through sampling activities. At least one field blank is recommended to be collected and analyzed for the same parameters as those for which groundwater samples are analyzed.

Field blanks must be prepared in the field (at the sampling site) using laboratory-supplied bottles and deionized or laboratory reagent-quality water. Each field blank is prepared by pouring the deionized water into the sample bottles at the location of one of the wells in the sampling program. Preservatives are added to specific sample bottles as required. The well at which the field blank is prepared must be identified on the Field Log along with any observations that may help explain anomalous results (*e.g.*, prevailing wind direction, up-wind potential sources of contamination). Once a field blank is collected, it is handled and shipped in the same manner as the rest of the samples.

6.8.3 Equipment Blanks

For wells that must be sampled with non-dedicated equipment, decontamination procedures consist of rinsing the equipment once with deionized or laboratory reagent-quality water, brushing the equipment using laboratory-quality soap, and triple rinsing the equipment with deionized or laboratory reagent-quality water. One equipment blank may be collected during each sampling event and analyzed for the same parameters as those for which groundwater samples are analyzed. Equipment blanks are collected by pouring deionized or laboratory reagent-quality water into or over the sampling device (*e.g.*, the water level indicator), and then filling a set of sample bottles.

If the analytes for the equipment blank would normally be filtered, this water should be placed into a pre-filtration bottle and subsequently filtered. Whether or not it is filtered, this water is placed into the equipment blank bottles, and the proper preservative added (as required).

6.8.4 Field Duplicates

Duplicate samples are generally collected to demonstrate the reproducibility of the sampling technique. Duplicate samples may be collected on a 5% (1 in 20) frequency. This is a separate duplicate from the duplicates a laboratory must run and cannot be replaced by a laboratory-generated duplicate. Duplicates are representative of field sampling precision, whereas laboratory duplicates are a measure of analytical precision. Both pieces of information are essential to determining the quality of data generated for a project.

6.9 Laboratory Quality Control Procedures

The quality assurance program for the selected Virginia Environmental Laboratory Accreditation Program (VELAP)-accredited analytical laboratory will be documented in their Quality Assurance Program Plan (QAPP). This document describes mechanisms employed by the VELAP-accredited laboratory to ensure that reported data meet or exceed applicable USEPA and Virginia requirements. The QAPP describes the laboratory's experience, its organizational structure, and procedures in place to ensure quality of the analytical data. The QAPP outlines the sampling, analysis, and reporting procedures used by the laboratory. The laboratory is responsible for the implementation of and adherence to the QA/QC requirements outlined in the QAPP. A copy of the laboratory's QAPP will be available to the DEQ or Station personnel upon request.

Audits are an important component of the quality assurance program at the laboratory. Audits are conducted by the laboratory. Internal system and performance audits are conducted periodically to ensure adherence by all laboratory departments to the QAPP. External audits are conducted by accrediting agencies or states. These reports are transmitted to department managers for review and response. Corrective measures must be taken for any finding or deficiency found in an audit.

Data Quality Reviews (DQRs), or equivalent, are requests submitted to the laboratory to formally review results that differ from historical results, or that exceed certain permit requirements or quality control criteria. The laboratory prepares a formal written response to DQRs explaining discrepancies. The DQR is the first line of investigation following any anomalous result.

6.9.1 Laboratory Documentation

Upon receipt of the samples at the laboratory, the following activities are recommended:

- The date, time of sample collection, and analysis to be performed will be provided to the VELAP-accredited laboratory.
- The samples will be examined upon receipt to ensure collection in USEPA-approved containers for the requested analysis. The sample collection data and time will also be reviewed to ensure the USEPA-required sample holding time has not expired or will not expire before the analysis can be performed.

- The information concerning transportation mode and manner will be reported on the form. Samples must be transported on ice or under refrigeration, and the inside temperature of the cooler recorded upon opening.
- The pH of each sample as well as the sample appearance will be recorded if required by the analytical method. Also, preservative adjustments, filtration, and sample splitting must also occur as required prior to distribution. Sample adjustments will be fully documented.

During analysis of the samples, it is recommended that the laboratory agent maintain the integrity of the samples as follows:

- During the sample analysis period, the samples will remain refrigerated.
- If at any point during the analysis process, the results are considered technically inaccurate, the analysis must be performed again if holding times have not been exceeded.

Documentation activities should be completed with permanent ink in a legible manner with mistakes crossed out with a single line.

6.9.2 Laboratory Analyses

Analytical procedures for constituents listed in Table 3.1 of the VSWMR and Appendix IV of the CCR Rule will be performed in accordance with USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* as updated. Analytical methods for the remaining constituents and parameters required for the monitoring programs will be performed pursuant to procedures in USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* as updated or other USEPA-approved methods (*e.g.*, published drinking water methods, clean water act method, Standard Methods). The modified Detection Monitoring Program and modified Assessment Monitoring Program constituents, along with recommended test methods and PQLs, are listed in Tables 3 and 4. Laboratory analytical results for groundwater compliance samples will be reported on a total sample basis.

Alternate methods may be used if they have the same or lower PQL. Methods with higher PQLs will be considered if the concentration of the parameter is such that an alternate test method with a higher PQL will provide the same result.

6.9.3 Limits of Quantitation (LOQs)

Laboratory-specific LOQs will be used as the reporting limits for quantified detections of required monitoring constituents. Laboratory LOQs should be reported with the sample results.

6.9.4 Limits of Detection (LODs)

Laboratory-specific LODs will be used as the reporting limits for estimated detections of required monitoring constituents. Constituents detected at concentrations above the LOD but below the LOQ will be reported as

estimated with a qualifying "J" flag on the laboratory certificates of analysis. It is noted that estimated detections are not considered statistically significant and cannot trigger the Corrective Action Program. Laboratory LODs should be reported with the sample results.

6.9.5 Method Blanks

Laboratory method blanks are used during the analytical process to detect any laboratory-introduced contamination that may occur during analysis. A minimum of one method blank should be analyzed by the laboratory per sample batch.

6.9.6 Matrix Spike and Matrix Spike Duplicate Samples

A matrix spike/matrix spike duplicate sample will be run with every sample batch. The relative percent difference between the spike and the spike duplicate sample should be less than 20 percent. Higher values may indicate matrix interference.

6.10 Data Validation

The laboratory is responsible for verifying that the reported analytical results are correct. The QA/QC data provided by the laboratory will be reviewed to ensure that the analytical results meet the project's data quality objectives. The review process should be performed in general accordance with the procedures outlined in the following USEPA guidance documents:

- National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017 (USEPA, 2017); and
- Multi-Agency Radiological Laboratory Analytical Protocols Manual. (USEPA, 2004).

7.0 DATA EVALUATION

Statistical analysis of the data will be completed as discussed in the following subsections. These criteria represent a conservative approach to groundwater analysis and incorporate appropriate statistical and other evaluation methodologies.

7.1 Groundwater Data Evaluation

This section outlines the inter-well statistical evaluation methodologies that may be used to detect a release from the CCR units by comparing downgradient well results to unit-specific statistically calculated background concentrations.

During background sample collection, it will be necessary to examine the data for outliers, anomalies, and trends that might be an indication of a sampling or analytical error. Outliers and anomalies are inconsistently large or small values that can occur due to sampling, laboratory, transportation, or transcription errors, or even by chance alone. Significant trends indicate a source of systematic error, or an actual contamination occurrence, that must be evaluated and corrected before valid inter-well statistical evaluations can be implemented. The inclusion of such values in the historical database used for temporal water quality evaluations or in the unit's background database for inter-well statistical evaluations could cause misinterpretation of the data set, and result in high false positive (*i.e.*, an indication of a release when none exists) and/or false negative (*i.e.*, falsely concluding there is no release in the presence of an actual release) conclusions.

To prevent the inclusion of anomalous data in the inter-well database, background monitoring results will be evaluated during background development for any new wells constructed, once those well(s) have at least four measurements for a given constituent using time vs. concentration graphs. Parameter concentrations that appear anomalous (*e.g.*, that are 5 times or greater than the previous results) may be verified during the next sample collection event or after a reasonable period of time to ensure sample independence (*e.g.*, 3 months). If the anomalous result is not verified, the outlier may be removed from the database to maintain the accuracy of the evaluation method. Any detected systematic trends or verified outliers in the background database will be evaluated and reported to the DEQ in a timely manner.

7.1.1 Correcting for Linear Trends

If a data series exhibits a linear trend, the sample will exhibit temporal dependence when tested via the sample autocorrelation function (see Section 14.2.3 of the Unified Guidance; EPA, 2009), the rank von Neumann ratio (see Section 14.2.4 of the Unified Guidance; EPA, 2009), or similar procedure. These data can be de-trended, much like the data in the previous example were de-seasonalized. Typically, the easiest way to de-trend observations with a linear trend is to compute a linear regression on the data (see Section 17.3.1 of the Unified Guidance;

EPA, 2009) and then use the regression *residuals* instead of the original measurements in subsequent statistical analysis.

7.2 Statistical Methodology

In accordance with the CCR Rule §257.93(f)(6) as adopted in the VSWMR, Dominion Energy must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification will include a narrative description of the statistical method selected to evaluate the groundwater monitoring data. As adopted in the VSWMR, this certification is subject to the recordkeeping requirements specified in §257.105(h), the notification requirements specified in §257.106(h), and the internet requirements specified in §257.107(h).

The statistical test used to evaluate the groundwater monitoring data will be selected based on the size of the dataset, the data distribution, and statistical level of significance requirements as allowed by the VSWMR and the CCR Rule and associated state and Federal guidance documents. Dominion Energy will ensure that an adequate number of independent samples for the chosen statistical method are collected within the compliance period such that the level of significance for individual well comparison will be no less than 0.01 and no less than 0.05 for multiple comparisons for any statistical test. Possible statistical test methods are:

- A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method will include estimating and testing the contrasts between each compliance well's mean and the background mean levels for each constituent;
- An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify significant evidence of contamination. The method will include estimating and testing the contrasts between each compliance well's median and the background median levels for each constituent;
- A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit;
- A control chart approach that gives control limits for each constituent; or
- Another statistical test method that meets the performance standards specified by the DEQ. A justification for the alternate test method will be submitted for approval by the DEQ.

The statistical analysis chosen to evaluate the groundwater data will meet the following performance standards and will be consistent with the EPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009):

- The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of monitoring parameters or constituents. If the distribution is shown by Dominion Energy to be inappropriate for a normal theory test, then the data should be transformed, or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.

- If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a GWPS, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, predictions intervals, or control charts.
- If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration for each constituent of concern.
- If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentrations for each constituent of concern.
- The statistical method shall account for data below the LOD with one or more statistical procedures that shall be at least as effective as any other approach in this section for evaluating groundwater data. Any PQL that is used in the statistical method shall be the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the Station.
- If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

7.2.1 Reporting of Low and Zero Values

Chemical constituents that are not present above the detection limit of the analytical procedure are reported as NOT DETECTED (ND), or less than the LOD, rather than as zero or not present, and the laboratory's LOD is provided on the analytical report. There are a several methods for dealing with data that include values below detection, and the selected method should be consistent with the USEPA's Unified Guidance (USEPA, 2009).

7.2.2 Normality Testing

The original data must be tested for normality using an appropriate method consistent with USEPA's Unified Guidance (USEPA, 2009). The following generalized guidelines should be considered for decisions in normality testing:

- If the original data show that the data are not normally distributed, then the data must be natural log-transformed and tested for normality using the above methods.
- If the original or the natural log-transformed data confirm that the data are normally distributed, then a normal distribution test must be applied.
- If neither the original nor the natural log-transformed data fit a normal distribution, then a distribution-free test must be applied.

7.2.3 Missing Data Values

Missing data values may result in an incomplete measure of environmental variability and an increased likelihood of falsely detecting contamination. If data are missing, there is a danger that the full extent of contamination may not be characterized. Therefore, resampling will occur within 30 days to replace the missing data unless an alternative schedule is otherwise approved by DEQ.

7.2.4 Outliers

An outlier is a value that is much different from most other values in a data set for a given groundwater chemical constituent. The reasons for outliers may include:

- Sampling errors or field contamination;
- Analytical errors or laboratory contamination;
- Recording or transcription errors;
- Faulty sample preparation or preservation, or shelf-life exceedance; or
- Extreme, but accurately detected environmental conditions (*e.g.*, spills, migration from the unit).

Formal testing for outliers should be done only if an observation seems particularly high (by orders of magnitude) compared to the rest of the data set. If a sample value is suspect, the value should be evaluated using the appropriate outlier test described in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (USEPA, 2009). Background observations, which are considered to be outliers, will not be included in the statistical analysis to preserve the power of the test to detect a release from the impoundments.

7.3 Verification Procedure

Once groundwater analysis results have been collected, checked for QA/QC consistency, and determined to be above the appropriate statistical level, the results must be verified in accordance with the objectives of the VSWMR for groundwater monitoring. Verification re-sampling is an integral part of the statistical methodology described by USEPA's Unified Guidance (USEPA, 2009). Without verification re-sampling, much larger statistical limits would be required to achieve site-wide false positive rates of 5% or less. Furthermore, the resulting false negative rate would be greatly increased. Verification sampling should generally be performed for each constituent when it is initially determined to be present above its statistical limit. Consistent with the VSWMR, verification samples, if collected, must be obtained within the 30-day SSI determination period defined in 9VAC20-81-250.A.4.h.(2).

7.4 Comparison to Groundwater Protection Standards

Following the establishment of GWPS under the modified Assessment Monitoring Program, detected constituents will be statistically compared to the approved GWPS using one of the methods discussed below.

If the GWPS for a constituent is derived from the unit's background concentration, then the groundwater monitoring data must be compared directly to the GWPS using a value-to-value comparison. If the established GWPS is derived from a MCL (or other reference standard concentration), then the groundwater monitoring data may be compared to the GWPS statistically and/or using a value-to-value procedure. For constituents that derived GWPS from background and are not detected (100% non-detects) in upgradient monitoring wells, the double quantification rule will be used to determine downgradient exceedances. Whereas, if the constituent concentration in a compliance well exceeds the highest historical laboratory reporting limit for two consecutive events, an exceedance of GWPS will be confirmed.

Based on the above criteria, groundwater monitoring data will initially be compared to established GWPS via a value-to-value comparison. If a GWPS is exceeded during the value-to-value comparison for any parameter, a verification sample may be collected. The results from the verification sample will be compared to the GWPS via a value-to-value comparison. If the comparison indicates a GWPS exceedance, the source of the GWPS will be determined. If the GWPS is derived from an MCL, two additional groundwater samples for the suspect constituent(s) may be collected to facilitate a statistical comparison to the GWPS. It is noted that verification sampling and/or additional sampling required to perform a statistical evaluation must occur within the same compliance monitoring period during which the original samples were collected. The compliance monitoring period begins on the day of sampling and expires 6 months later, or the date of the next compliance sampling event, whichever occurs first.

To perform a statistical comparison, a minimum of four samples must be collected within the compliance monitoring period. Once data have been received for the four samples, then the lower confidence interval can be calculated and compared to the GWPS. The lower limit should be calculated initially by using a 95% confidence level. If the lower limit exceeds the GWPS, the DEQ may be contacted regarding the use of a confidence level greater than 95%.

8.0 HYDROGEOLOGIC ASSESSMENT

After each sampling event, groundwater surface elevations will be evaluated to determine whether the requirements for locating the monitoring wells continue to be satisfied and the rate and direction of groundwater flow will be determined. Groundwater elevations in monitoring wells must be measured within a period of time short enough (typically within 24 hours) to avoid temporal variations in groundwater flow that could preclude accurate determination of groundwater flow rate and direction.

The rate and direction of groundwater flow will be determined each time groundwater is sampled by comparing the groundwater surface elevations among the monitoring wells, and at least annually, constructing a groundwater surface contour map. The groundwater flow rate shall be determined using the following equation:

$$V_{gw} = K\, i\, (1/n_e)$$

Where:

V_{gw} = Groundwater velocity

K = Hydraulic conductivity

i = Hydraulic gradient

n_e = Effective porosity

If the evaluation shows that the groundwater monitoring system does not satisfy the requirements of the VSWMR, the monitoring system will be modified to comply with those regulations after obtaining approval from the DEQ. Dominion Energy will request the appropriate permit amendment action related to any revisions of the monitoring well network(s) deemed necessary due to a change in groundwater flow pattern or functionality of any monitoring well. Proposed revisions will be submitted to the DEQ within 30 days of determining that the system does not satisfy the requirements of the VSWMR; the modifications may include a change in the number, location, or depth of the monitoring wells.

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TABLES

Table 1
Summary of Construction Information for Exisiting Wells
Bremo Power Station

Well Number	Northing	Easting	Top of Casing Elevation (feet AMSL)	Ground Surface Elevation (feet AMSL)	Well Construction	Well Depth (feet below top of casing)	Boring Depth (feet below ground surface)	Screened Interval (feet below ground surface)	Management Unit	Well Hydraulic Position	Date Constructed
MW-1	3,783,032.88	11,542,749.05	221.76	219.0	2" PVC with 10-foot screen interval	24.4	21.5	11 to 21	West Ash Pond	Upgradient	12/4/2012
MW-11	3,783,128.03	11,546,850.62	330.52	327.7	2" PVC with 15-foot screen interval	51.78	49.0	34 to 49	Stormwater Management Basin, East Ash Pond, North Ash Pond	Upgradient	11/28/2012
MW-12	3,782,305.04	11,542,587.17	219.13	216.5	2" PVC with 8-foot screen interval	35.41	33.0	25 to 33	West Ash Pond (deep well)***	Downgradient	12/4/2012
MW-13	3,782,386.53	11,542,133.80	218.84	216.6	2" PVC with 10-foot screen interval	22.5	22.5	11 to 21	Metals Pond	Downgradient	11/29/2012
MW-19	3,781,076.28	11,545,271.66	235.21	232.2	2" PVC with 10-foot screen interval	55.60	52.0	42 to 52	East Ash Pond	Downgradient	9/19/2017
MW-20S	3,780,720.23	11,545,625.00	228.07	225.0	2" PVC with 10-foot screen interval	47.53	45.0	34 to 44	East Ash Pond	Downgradient	9/21/2017
MW-20D	3,780,725.18	11,545,617.00	228.28	225.4	2" PVC with 10-foot screen interval	88.80	90.0	77 to 87	East Ash Pond	Downgradient	9/20/2017
MW-21	3,780,558.08	11,546,020.58	233.61	236.1	2" PVC with 10-foot screen interval	58.30	55.0	44 to 54	East Ash Pond	Downgradient	9/23/2017
MW-22	3,780,358.10	11,546,471.50	238.79	235.7	2" PVC with 10-foot screen interval	57.98	55.0	44 to 54	East Ash Pond	Downgradient	9/22/2017
MW-22D	3,780,403.12	11,546,481.78	215.53	212.4	2" PVC with 10-foot screen interval	120.53	105.0	85 to 95	East Ash Pond	Downgradient	12/6/2018
MW-23	3,780,114.49	11,546,871.64	236.87	233.8	2" PVC with 10-foot screen interval	56.23	55.0	42 to 52	East Ash Pond	Downgradient	9/21/2017
MW-23D	3,780,088.23	11,546,900.38	236.61	233.5	2" PVC with 10-foot screen interval	136.61	140.0	90 to 100	East Ash Pond	Downgradient	12/6/2018
MW-24	3,780,807.34	11,547,158.73	346.04	343.5	2" PVC with 20-foot screen interval	155.6	154.0	133 to 153	North Ash Pond	Downgradient	9/7/2016
MW-25S	3,781,289.45	11,547,937.10	361.36	358.1	2" PVC with 10-foot screen interval	97.3	95.3	84 to 94	North Ash Pond	Downgradient	10/13/2016
MW-25D	3,781,287.15	11,547,933.61	361.41	358.1	2" PVC with 10-foot screen interval	157.31	158.0	144 to 154	North Ash Pond	Downgradient	11/2/2016
MW-26S	3,781,781.03	11,548,679.74	394.82	392.5	2" PVC with 10-foot screen interval	110.3	108.0	98 to 108	North Ash Pond	Downgradient	9/24/2016
MW-26D	3,781,789.70	11,548,685.31	394.28	391.5	2" PVC with 10-foot screen interval	140.8	138.0	128 to 138	North Ash Pond	Downgradient	9/23/2016
MW-27S	3,782,267.83	11,546,752.84	330.88	328.3	2" PVC with 10-foot screen interval	90.6	88.0	78 to 88	North Ash Pond	Downgradient	9/15/2013
MW-27D	3,782,253.20	11,546,755.36	329.22	326.7	2" PVC with 10-foot screen interval	200.6	198.0	188.5 to 198.5	North Ash Pond	Downgradient	9/13/2016
MW-28	3,782,659.57	11,546,966.51	329.87	326.6	2" PVC with 10-foot screen interval	70.3	67.0	57 to 67	North Ash Pond	Downgradient	9/22/2016
MW-29S	3,782,998.91	11,548,622.35	387.32	390.5	2" PVC with 10-foot screen interval	74.7	71.5	61.5 to 71.5	North Ash Pond	Upgradient	10/6/2016
MW-29D	3,783,005.27	11,548,618.92	390.43	387.3	2" PVC with 10-foot screen interval	161.2	158.0	146 to 156	North Ash Pond	Upgradient	10/4/2016
MW-30	3,782,541.31	11,541,665.13	222.22	219.8	2" PVC with 5-foot screen interval	29.40	27.0	22.0 to 27.0	East Ash Pond	Upgradient	2/13/2020
MW-31	3,782,152.90	11,543,414.47	218.94	216.9	2" PVC with 10-foot screen interval	35.90	33.5	23 to 33	West Ash Pond	Downgradient	9/23/2017

Table 1
Summary of Construction Information for Exisiting Wells
Bremo Power Station

Well Number	Northing	Easting	Top of Casing Elevation (feet AMSL)	Ground Surface Elevation (feet AMSL)	Well Construction	Well Depth (feet below top of casing)	Boring Depth (feet below ground surface)	Screened Interval (feet below ground surface)	Management Unit	Well Hydraulic Position	Date Constructed
MW-32S	3,782,886.43	11,542,303.29	221.94	219.5	2" PVC with 5-foot screen interval	22.13	19.0	14 to 19	West Ash Pond	Upgradient	11/9/2016
MW-32D	3,782,886.87	11,542,307.88	221.61	219.3	2" PVC with 10-foot screen interval	108.23	113.0	95 to 105	West Ash Pond	Upgradient	11/11/2016
MW-33	3,781,521.96	11,546,369.11	336.50	334.0	2" PVC with 10-foot screen interval	133.53	131.0	121.5 to 131.5	North Ash Pond	Downgradient	10/21/2016
MW-34	3,781,273.59	11,546,547.29	338.18	335.2	2" PVC with 10-foot screen interval	154.02	151.0	141 to 151	North Ash Pond	Downgradient	10/20/2016
MW-35	3,780,897.63	11,546,792.20	335.65	332.7	2" PVC with 10-foot screen interval	136.47	133.5	123 to 133	North Ash Pond	Downgradient	9/8/2016
MW-36S	3,782,150.18	11,546,033.52	249.32	246.7	2" PVC with 10-foot screen interval	216.67	30.0	20 to 30	ACM - North Ash Pond	Downgradient	11/13/2018
MW-36D	3,782,143.23	11,546,026.85	249.03	246.3	2" PVC with 10-foot screen interval	177.34	70.0	59 to 69	ACM - North Ash Pond	Downgradient	11/13/2018
MW-37	3,782,111.49	11,543,069.04	222.15	219.5	2" PVC with 10-foot screen interval	34.20	31.5	21.5 to 31.5	West Ash Pond	Downgradient	2/13/2020
MW-38	--	--	--	217+/-	2" PVC with 10-foot screen interval	~40	~40	~30-40	West Ash Pond	Downgradient	To Be Determined
MW-39S	3,782,339.24	11,542,319.17	218.22	215.9	2" PVC with 5-foot screen interval	24.30	22.0	17.0 to 22.0	West Ash Pond	Downgradient	2/13/2020
MW-39D	3,782,335.61	11,542,331.02	218.10	216.0	2" PVC with 10-foot screen interval	71.64	69.5	59.5 to 69.5	West Ash Pond	Downgradient	2/13/2020
MW-40	3,780,905.49	11,545,796.81	216.79	214.9	2" PVC with 10-foot screen interval	33.90	32.0	22 to 32	East Ash Pond	Downgradient	2/13/2020
MW-41	--	--	--	225+/-	2" PVC with 10-foot screen interval	~40	~40	~30-40	North Ash Pond	Downgradient	To Be Determined

Notes:
AMSL = Above Mean Sea Level
-- = Not Applicable.

Table 2
Summary of Hydraulic Conductivity Testing Results
Bremo Power Station

Well Identification	Formation	Lithology	Evaluation Method	Evaluation Method	Confined Hydraulic Conductivity for Saturated Thickness (ft/sec)	Evaluation Method	Transmissivity (ft^2/sec)	10-foot Screen Weighted Hydraulic Conductivity (ft/sec)	Evaluation Method	Transmissivity (ft^2/sec)	10-foot Screen Weighted Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity Geometric Mean (ft/sec)	Sum of Fracture Width (Average) (inch)	Fracture Hydraulic Conductivity (ft/sec)	Secondary Whole Rock Hydraulic Conductivity (ft/sec)
MW-19	Bedrock	Schist	Slug, Rising Head	KGS Skin Model	8.24E-05	Cooper-Bredehoeft-Papadopulos	7.01E-04	7.01E-05	Barker-Black Double Porosity Fractures	7.05E-04	7.05E-05	7.41E-05	1.00	8.46E-03	1.00E-07
			Slug, Falling Head		6.02E-05		8.00E-04	8.00E-05		7.88E-04	7.88E-05	7.24E-05	1.00	9.46E-03	1.00E-07
MW-20S	Bedrock	Schist	Slug, Rising Head	KGS Skin Model	3.00E-05	Cooper-Bredehoeft-Papadopulos	5.44E-04	5.44E-05	Barker-Black Double Porosity Fractures	3.44E-04	3.44E-05	3.83E-05	1.00	4.13E-03	1.00E-07
			Slug, Falling Head		5.66E-05		4.83E-04	4.83E-05		6.67E-04	6.67E-05	5.67E-05	1.00	8.01E-03	1.00E-07
MW-20D	Bedrock	Gneiss	Slug, Rising Head	KGS Model	2.20E-07	Cooper-Bredehoeft-Papadopulos	4.52E-06	4.52E-07	Barker-Black Double Porosity Fractures	4.60E-06	4.60E-07	3.57E-07	1.00	5.52E-05	1.00E-07
			Slug, Falling Head		5.81E-07		2.69E-05	2.69E-06		4.82E-06	4.82E-07	9.10E-07	1.00	5.78E-05	1.00E-07
MW-21	Bedrock	Gneiss	Slug, Rising Head	KGS Skin Model	4.62E-06	Cooper-Bredehoeft-Papadopulos	3.44E-05	3.44E-06	Barker-Black Double Porosity Fractures	3.01E-05	3.01E-06	3.63E-06	1.00	3.61E-04	1.00E-07
			Slug, Falling Head		6.24E-06		5.29E-05	5.29E-06		5.29E-05	5.29E-06	5.59E-06	1.00	6.35E-04	1.00E-07
MW-22	Bedrock	Gneiss	Slug, Rising Head	KGS Skin Model	1.10E-05	Cooper-Bredehoeft-Papadopulos	No Fit	No Fit	Barker-Black Double Porosity Fractures	No Fit	No Fit	1.10E-05	1.00	No Fit	1.00E-07
			Slug, Falling Head		6.20E-06		No Fit	No Fit		No Fit	No Fit	6.20E-06	1.00	No Fit	1.00E-07
MW-22D	Bedrock	Gneiss	Slug, Rising Head	KGS Skin Model	1.74E-05	Cooper-Bredehoeft-Papadopulos	3.98E-04	3.98E-05	Barker-Black Double Porosity Fractures	1.99E-04	1.99E-05	2.40E-05	1.00	2.39E-03	1.00E-07
			Slug, Falling Head		4.47E-05		3.67E-04	3.67E-05		1.93E-04	1.93E-05	3.16E-05	1.00	2.32E-03	1.00E-07
MW-23	Bedrock	Gneiss	Slug, Rising Head	KGS Model	8.66E-07	Cooper-Bredehoeft-Papadopulos	7.05E-06	7.05E-07	Barker-Black Double Porosity Fractures	5.68E-06	5.68E-07	7.02E-07	1.00	6.81E-05	1.00E-07
			Slug, Falling Head		1.46E-06		1.10E-05	1.10E-06		8.06E-06	8.06E-07	1.09E-06	1.00	9.67E-05	1.00E-07
MW-24	Bedrock	Schist	Slug, Rising Head	KGS Model	3.12E-07	Cooper-Bredehoeft-Papadopulos	8.35E-06	8.35E-07	Barker-Black Double Porosity Fractures	5.65E-06	5.65E-07	5.28E-07	1.00	6.78E-05	1.00E-07
			Slug, Falling Head		6.99E-07		3.54E-05	3.54E-06		1.46E-05	1.46E-06	1.53E-06	1.00	1.75E-04	1.00E-07
MW-25D	Bedrock	Schist	Slug, Rising Head	KGS Model	1.86E-04	Cooper-Bredehoeft-Papadopulos	3.13E-03	3.13E-04	Barker-Black Double Porosity Fractures	1.45E-03	1.45E-04	2.04E-04	1.00	1.74E-02	1.00E-07
			Slug, Falling Head		1.66E-04		2.22E-03	2.22E-04		1.21E-03	1.21E-04	1.65E-04	1.00	1.45E-02	1.00E-07
MW-25S	Bedrock	Schist	Slug, Rising Head	KGS Skin Model	No Data	Cooper-Bredehoeft-Papadopulos	No Data	No Data	Barker-Black Double Porosity Fractures	No Data	No Data	No Data	No Data	No Data	No Data
			Slug, Falling Head		1.72E-04		3.69E-03	3.69E-04		1.60E-03	1.60E-04	2.16E-04	1.00	1.92E-02	1.00E-07
MW-26D	Bedrock	Schist	Slug, Rising Head	KGS Model	1.01E-05	Cooper-Bredehoeft-Papadopulos	2.16E-04	2.16E-05	Barker-Black Double Porosity Fractures	1.41E-04	1.41E-05	1.46E-05	1.00	1.70E-03	1.00E-07
			Slug, Falling Head		1.01E-05		No Data	No Data		No Data	No Data	1.01E-05	No Data	No Data	No Data
MW-29S	Bedrock	Schist	Slug, Rising Head	KGS Skin Model	3.07E-05	Cooper-Bredehoeft-Papadopulos	2.11E-04	2.11E-05	Barker-Black Double Porosity Fractures	1.96E-04	1.96E-05	2.33E-05	1.00	2.35E-03	1.00E-07
			Slug, Falling Head		3.01E-05		2.11E-04	2.11E-05		1.52E-04	1.52E-05	2.13E-05	1.00	1.83E-03	1.00E-07
MW-29D	Bedrock	Gneiss	Slug, Rising Head	KGS Model	No Data	Cooper-Bredehoeft-Papadopulos	No Data	No Data	Barker-Black Double Porosity Fractures	No Data	No Data	No Data	No Data	No Data	No Data
			Slug, Falling Head		9.12E-09		2.27E-07	2.27E-08		1.84E-07	1.84E-08	1.56E-08	1.00	2.20E-06	1.00E-07
MW-31	Bedrock	Gneiss	Slug, Rising Head	KGS Skin Model	7.25E-06	Cooper-Bredehoeft-Papadopulos	7.97E-05	7.97E-06	Barker-Black Double Porosity Fractures	5.14E-05	5.14E-06	6.67E-06	1.00	6.17E-04	1.00E-07
			Slug, Falling Head		5.51E-06		5.07E-05	5.07E-06		4.02E-05	4.02E-06	4.82E-06	1.00	4.82E-04	1.00E-07
MW-36S	Bedrock	Gneiss	Slug, Rising Head	KGS Skin Model	5.27E-05	Cooper-Bredehoeft-Papadopulos	6.73E-04	6.73E-05	Barker-Black Double Porosity Fractures	6.39E-04	6.39E-05	6.09E-05	1.00	7.66E-03	1.00E-07
			Slug, Falling Head		1.89E-04		5.65E-04	5.65E-05		5.51E-04	5.51E-05	8.38E-05	1.00	6.62E-03	1.00E-07
MW-36D	Bedrock	Gneiss	Slug, Rising Head	KGS Model	2.57E-04	Cooper-Bredehoeft-Papadopulos	5.43E-03	5.43E-04	Barker-Black Double Porosity Fractures	5.12E-03	5.12E-04	4.15E-04	1.00	6.15E-02	1.00E-07
			Slug, Falling Head		1.89E-04		8.61E-03	8.61E-04		8.12E-03	8.12E-04	5.09E-04	1.00	9.75E-02	1.00E-07
MW-37	Bedrock	Gneiss	Slug, Rising Head	KGS Model	No Data	Cooper-Bredehoeft-Papadopulos	No Data	No Data	Barker-Black Double Porosity Fractures	No Data	No Data	No Data	No Data	No Data	No Data
			Slug, Falling Head		3.11E-05		8.30E-04	8.30E-05		3.96E-04	3.96E-05	4.68E-05	1.00	4.75E-03	1.00E-07
MW-39D	Bedrock	Schist	Slug, Rising Head	KGS Model	1.96E-05	Cooper-Bredehoeft-Papadopulos	6.61E-04	6.61E-05	Barker-Black Double Porosity Fractures	5.26E-04	5.26E-05	4.09E-05	1.00	6.31E-03	1.00E-07
			Slug, Falling Head		No Data		No Data	No Data		No Data	No Data	No Data	No Data	No Data	No Data
MW-40	Bedrock	Gneiss	Slug, Rising Head	KGS Model	3.47E-05	Cooper-Bredehoeft-Papadopulos	5.31E-04	5.31E-05	Barker-Black Double Porosity Fractures	5.31E-04	5.31E-05	4.61E-05	1.00	6.37E-03	1.00E-07
			Slug, Falling Head		6.42E-05		1.21E-03	1.21E-04		1.08E-03	1.08E-04	9.42E-05	1.00	1.29E-02	1.00E-07
Gneiss Bedrock Aquifer Geometric Mean:					**1.29E-05**			**1.98E-05**			**1.42E-05**	**1.53E-05**			

Table 2
Summary of Hydraulic Conductivity Testing Results
Bremo Power Station

Well Identification	Formation	Lithology	Evaluation Method	Evaluation Method	Confined Hydraulic Conductivity for Saturated Thickness (ft/sec)	Evaluation Method	Transmissivity (ft^2/sec)	10-foot Screen Weighted Hydraulic Conductivity (ft/sec)	Evaluation Method	Transmissivity (ft^2/sec)	10-foot Screen Weighted Hydraulic Conductivity (ft/sec)	Hydraulic Conductivity Geometric Mean (ft/sec)	Sum of Fracture Width (Average) (inch)	Fracture Hydraulic Conductivity (ft/sec)	Secondary Whole Rock Hydraulic Conductivity (ft/sec)
MW-32D	Bedrock	Slate	Slug, Rising Head	KGS Model	1.24E-06	Cooper-Bredehoeft-Papadopulos	1.57E-05	1.57E-06	Barker-Black Double Porosity Fractures	1.59E-05	1.59E-06	1.46E-06	1.00	1.91E-04	1.00E-07
			Slug, Falling Head		1.31E-06		4.03E-05	4.03E-06		1.43E-05	1.43E-06	1.96E-06	1.00	1.72E-04	1.00E-07
MW-33	Bedrock	Slate	Slug, Rising Head	KGS Model	No Data	Cooper-Bredehoeft-Papadopulos	No Data	No Data	Barker-Black Double Porosity Fractures	No Data	No Data	No Data	No Data	No Data	No Data
			Slug, Falling Head		No Data		No Data	No Data		No Data	No Data	No Data	No Data	No Data	No Data
MW-34	Bedrock	Slate	Slug, Rising Head	KGS Model Skin	2.62E-05	Cooper-Bredehoeft-Papadopulos	6.46E-04	6.46E-05	Barker-Black Double Porosity Fractures	5.76E-05	5.76E-06	2.14E-05	1.00	6.92E-04	1.00E-07
			Slug, Falling Head		2.86E-05		7.75E-04	7.75E-05		8.46E-05	8.46E-06	2.66E-05	1.00	1.02E-03	1.00E-07
Slate/Phyllite Bedrock Aquifer Geometric Mean:					**5.90E-06**			**1.33E-05**			**3.25E-06**	**6.35E-06**			
MW-11	Saprolite	Saprolite	Slug, Rising Head	Bower-Rice	5.98E-06										
			Slug, Falling Head		1.76E-06										
Saprolite Aquifer Geometric Mean:					**3.24E-06**										
MW-3	Overburden	Alluvium/Clay	Slug, Rising Head	Bower-Rice	6.14E-07										
			Slug, Falling Head		6.85E-07										
MW-5	Overburden	Alluvium/Clay	Slug, Rising Head	Bower-Rice	1.40E-05										
			Slug, Falling Head		1.26E-05										
MW-7	Overburden	Fill	Slug, Rising Head	Bower-Rice	6.90E-06										
			Slug, Falling Head		8.32E-06										
MW-30	Overburden	Alluvium/Gravel	Slug, Rising Head	Bower-Rice	1.82E-05										
			Slug, Falling Head		6.59E-05										
MW-32S	Overburden	Alluvium/Gravel	Slug, Rising Head	KGS Model	5.83E-05										
			Slug, Falling Head		1.46E-05										
MW-39S	Overburden	Alluvium/Gravel	Slug, Rising Head	KGS Model	2.36E-05										
			Slug, Falling Head		3.53E-05										
Alluvium Aquifer Geometric Mean:					**1.11E-05**										

Notes: cm/sec = centimeter per second
ft/sec = foot per second
ft/day = foot (feet) per day
KGS = Hyder et al. (1994)

Gneiss Bedrock Aquifer Geometric Mean: **1.53E-05 feet per second**
Slate/Phyllite Bedrock Aquifer Geometric Mean: **6.35E-06 feet per second**
Saprolite Aquifer Geometric Mean: **3.24E-06 feet per second**
Alluvium Aquifer Geometric Mean: **1.11E-05 feet per second**

TABLE 3

Summary of Modified Detection Monitoring Program Constituents and Parameters

Bremo Power Station

PARAMETER	CLASS	CAS RN	TYPICAL METHOD	TYPICAL LOQ/PQL (ug/L)
CCR Appendix III to Part 257				
Boron	metal	7440-42-8	6010C/6020B	50
Calcium	metal	7440-70-2	6010C/6020B	5,000
Chloride	anion	16887-00-6	9056A	1,000
Fluoride	anion	16984-48-8	9056A	100
pH	field parameter	NA	9040C	NA
Sulfate	anion	18785-72-3	9056A	1,000
Total Dissolved Solids (TDS)	dissolved cations and anions	Total	SM2540C	50,000
Virginia Solid Waste Management Regulation Table 3.1 Column A Constituents				
Antimony	metal	Total	6010C/6020B	5
Arsenic	metal	Total	6010C/6020B	1
Barium	metal	Total	6010C/6020B	5
Beryllium	metal	Total	6010C/6020B	1
Cadmium	metal	Total	6010C/6020B	1
Chromium	metal	Total	6010C/6020B	5
Cobalt	metal	Total	6010C/6020B	1
Copper	metal	Total	6010C/6020B	5
Lead	metal	Total	6010C/6020B	1
Nickel	metal	Total	6010C/6020B	5
Selenium	metal	Total	6010C/6020B	5
Silver	metal	Total	6010C/6020B	5
Thallium	metal	Total	6010C/6020B	1
Vanadium	metal	Total	6010C/6020B	5
Zinc	metal	Total	6010C/6020B	20

Notes:

- Class: General type of compound
- CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
- Method: Analytical Method from EPA SW-846 Methods for Evaluating Solid Waste will be used for applicable constituents. Samples will be analyzed using the version of each method that is current at the time of sampling.
- LOQ: Limit of Quantitation.
- PQL: Practical Quantitation Limit.
- µg/L: micrograms per liter
- NA: Not Available
- Acceptable alternatives to the analytical methods listed above include current SW-846 Methods and other EPA-approved laboratory methods.

TABLE 4

Summary of Modified Assessment Monitoring Program Constituents and Parameters

Bremo Power Station

PARAMETER	CLASS	CAS RN	TYPICAL METHOD	TYPICAL LOQ/PQL (µg/L)
CCR Appendix III to Part 257				
Boron	metal	7440-42-8	6010C/6020B	50
Calcium	metal	7440-70-2	6010C/6020B	5,000
Chloride	anion	16887-00-6	9056A	1,000
Fluoride	anion	16984-48-8	9056A	100
pH	field parameter	NA	9040C	NA
Sulfate	anion	18785-72-3	9056A	1,000
Total Dissolved Solids (TDS)	dissolved cations and anions	Total	SM2540C	50,000
CCR Appendix IV to Part 257				
Antimony	metal	Total	6010C/6020B	5
Arsenic	metal	Total	6010C/6020B	1
Barium	metal	Total	6010C/6020B	5
Beryllium	metal	Total	6010C/6020B	1
Cadmium	metal	Total	6010C/6020B	1
Chromium	metal	Total	6010C/6020B	5
Cobalt	metal	Total	6010C/6020B	1
Fluoride	metal	Total	9056A	300
Lead	metal	Total	6010C/6020B	1
Lithium	metal	Total	6010C/6020B	40
Mercury	metal	Total	7470	2
Molybdenum	metal	Total	6010C/6020B	10
Selenium	metal	Total	6010C/6020B	10
Thallium	metal	Total	6010C/6020B	1
Radium 226 and 228 combined	radionuclide	(226) - 13982-63-3 (228) - 15262-20-1	9315/9320 or other EPA-approved methods	1.00 pCi/L

TABLE 4

Summary of Modified Assessment Monitoring Program Constituents and Parameters

Bremo Power Station

PARAMETER	CLASS	CAS RN	TYPICAL METHOD	TYPICAL LOQ/PQL (µg/L)
Pertinent Virginia Solid Waste Management Regulation Table 3.1 Column B Constituents				
Copper	metal	Total	6010C/6020B	5
Nickel	metal	Total	6010C/6020B	10
Silver	metal	Total	6010C/6020B	5
Tin	metal	Total	6010C/6020B	10
Vanadium	metal	Total	6010C/6020B	5
Zinc	metal	Total	6010C/6020B	20
VPDES Permit No. VA0004138 Constituents				
Ammonia	hydride	7664-41-7	350.1	100
Hardness	anion	NA	SM2340B	662
Iron	metal	Total	6010C/6020B	50
Manganese	metal	Total	6010C/6020B	0.50
Nitrate	anion	14797-55-8	9056A	100
Other Analytes				
Hexavalent Chromium	metal	18540-29-9	7196A/7199	5

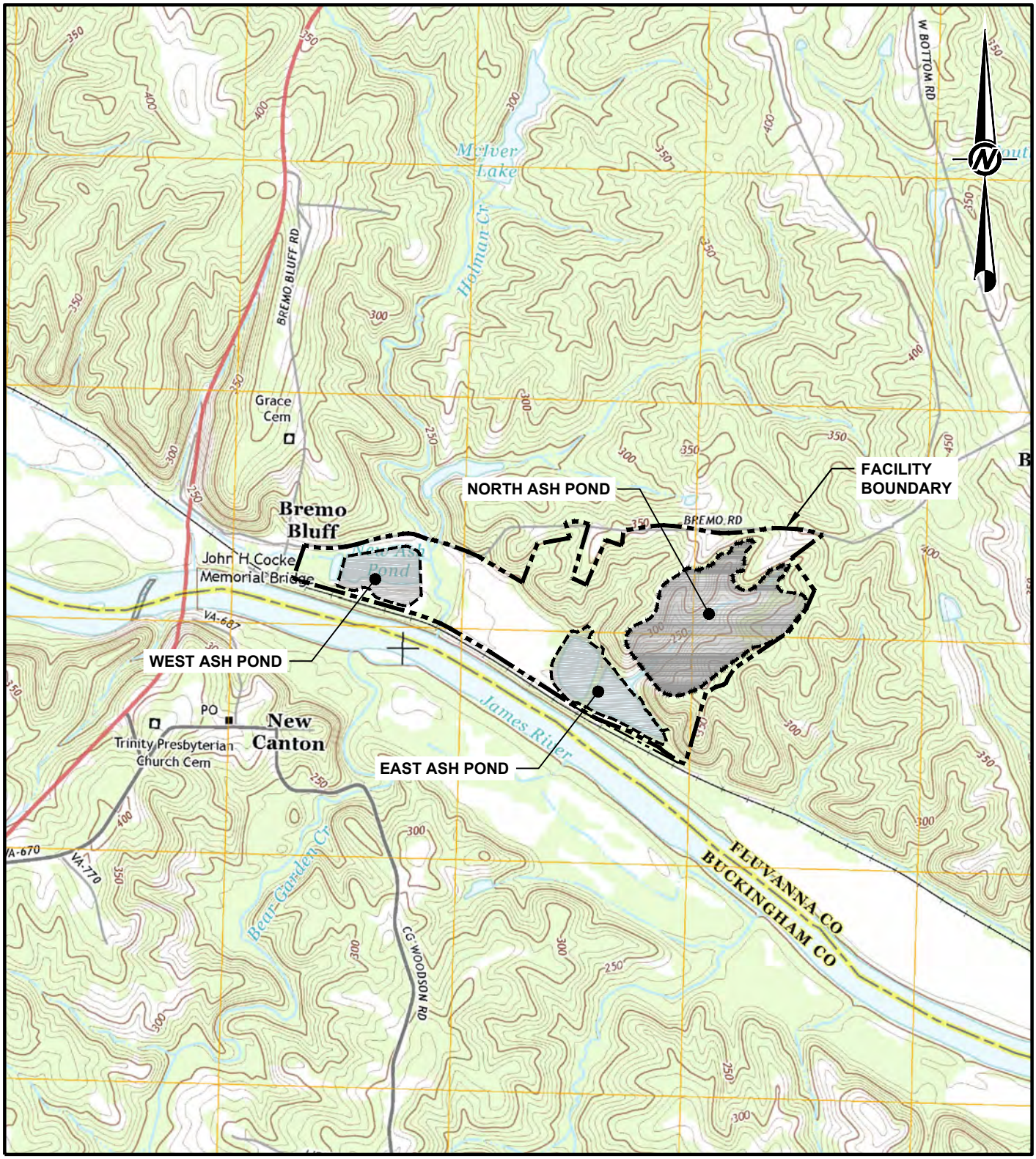
Notes:

- Class: General type of compound
- CAS RN: Chemical Abstracts Service Registry Number. Where 'Total' is entered, all species that contain the element are included.
- Method: Analytical Method from EPA SW-846 Methods for Evaluating Solid Waste will be used for applicable constituents. Samples will be analyzed using the version of each method that is current at the time of sampling.
- LOQ: Limit of Quantitation
- PQL: Practical Quantitation Limit
- µg/L: micrograms per liter
- NA: Not Available
- pCi/L: picocuries per liter
- Acceptable alternatives to the analytical methods listed above include current SW-846 Methods and other EPA-approved laboratory methods.

TABLE 5
Summary of Sample Container Information and Hold Times
Bremo Power Station

Parameter	Container & Volume	Preservative	Maximum Holding Time
pH	Flow-through cell or plastic, 500 milliliter (mL)	None	15 minutes (field analysis)
Specific Conductance	Flow-through cell or plastic, 500 mL	None	15 minutes (field analysis)
Temperature	Flow-through cell or plastic, 500 mL	None	15 minutes (field analysis)
Mercury (total)	Plastic; 250 mL	Nitric Acid to pH<2	28 days
Metals (total) except mercury	Plastic, 250 mL	Nitric Acid to pH<2	6 months
Total Dissolved Solids (TDS)	Plastic, 200 mL	None	7 days
Fluoride, Chloride, Sulfate	Plastic, 250 mL	None	28 days
Hexavalent Chromium	Plastic, 500 mL	None	24 hours
Ammonia	Plastic, 250 mL	Sulfuric Acid to ph<2	28 days
Hardness	Plastic; 250 mL	Nitric Acid to pH<2	6 months
Nitrate	Plastic, 250 mL	None	48 hours
Radium 226/228	Plastic, 1/2 gallon (2 Liter)	Nitric Acid to pH<2	6 months

DRAWINGS



REFERENCE

BASE MAP CONSISTS OF 7.5-MINUTE USGS TOPOGRAPHIC QUADRANGLE NAMED ARVONIA, VIRGINIA, DATED 2013.

2000 0 2000
SCALE FEET

CLIENT
DOMINION ENERGY

PROJECT
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

CONSULTANT
GOLDER

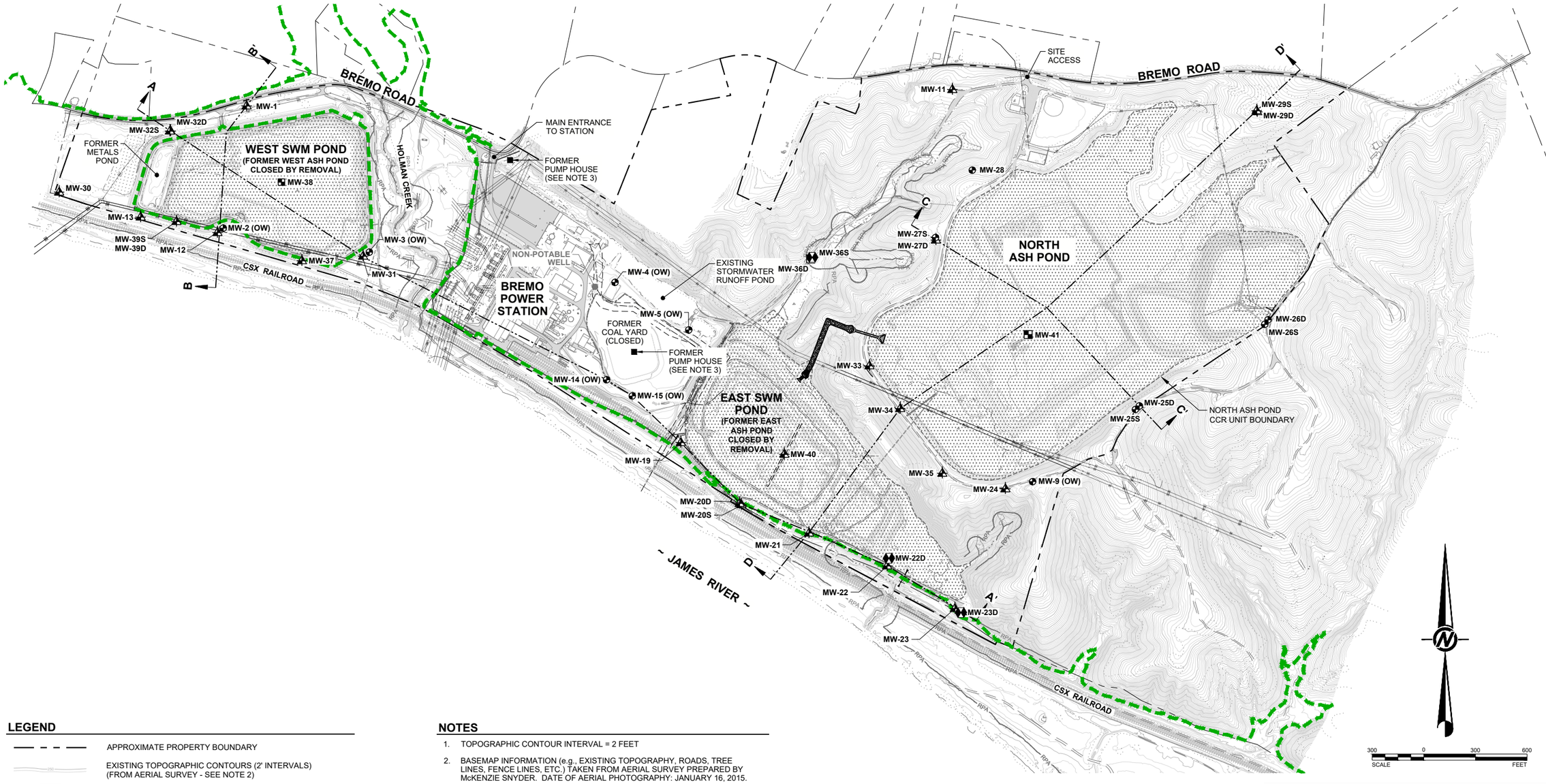
YYYY-MM-DD	2018-05-09
DESIGNED	DPM
PREPARED	BPG
REVIEWED	ATN
APPROVED	JRD

TITLE
SITE LOCATION MAP

PROJECT NO. 15-20347 | REV. 0 | DRAWING 1

Path: G:\Plan Production Data Files\Drawing Data Files\15-20347\E - Bremo GW Monitoring Plan\Active Drawings\1520347E01.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS) (FROM AERIAL SURVEY - SEE NOTE 2)
- WETLANDS
- SURFACE WATER BOUNDARY
- APPROXIMATE LIMITS OF EXISTING ASH PONDS
- LIMITS OF 100-YR FLOOD PLAIN
- MW-29D — FEDERAL CCR RULE COMPLIANCE WELL LOCATION AND IDENTIFICATION
- MW-26S — STATE GROUNDWATER COMPLIANCE WELL LOCATION AND IDENTIFICATION
- MW-5 (OW) — GROUNDWATER OBSERVATION WELL LOCATION AND IDENTIFICATION
- MW-36S — ACM GROUNDWATER WELL LOCATION AND IDENTIFICATION
- MW-38 — PROPOSED WELL LOCATION AND IDENTIFICATION
- A A' — GEOLOGIC CROSS-SECTION LOCATION

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET
2. BASEMAP INFORMATION (e.g., EXISTING TOPOGRAPHY, ROADS, TREE LINES, FENCE LINES, ETC.) TAKEN FROM AERIAL SURVEY PREPARED BY McKENZIE SNYDER. DATE OF AERIAL PHOTOGRAPHY: JANUARY 16, 2015.
3. FORMER PUMP HOUSE APPROXIMATE LOCATIONS FROM STONE & WEBSTER ENGINEERING CORPORATION 1949 DRAWINGS.
4. SEE DRAWING 5 FOR GEOLOGIC CROSS SECTIONS.

7	07/29/19	RESPONSE TO DEQ COMMENTS	RIP	SIB	RIP	MGW
6	09/14/18	RESPONSE TO DEQ COMMENTS	MGW	ATN	ATN	MGW
5	10/10/17	FINAL UPDATE FOR NEW WELLS	MGW	SIB	ATN	MGW
4	01/13/17	RESPONSE TO COMMENTS	MGW	BPG	ATN	MGW
3	02/15/16	RESPONSE TO COMMENTS	MGW	BPG	MGW	MGW
NO.	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

CLIENT
DOMINION ENERGY
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

PROJECT
CCR SURFACE IMPOUNDMENT
CLOSURE PLAN

TITLE
GROUNDWATER MONITORING PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2019-07-29
DESIGNED	JRD
PREPARED	BPG
REVIEWED	MGW
APPROVED	JRD

PROJECT NO. 15-20347 | REV. 5 | DRAWING 2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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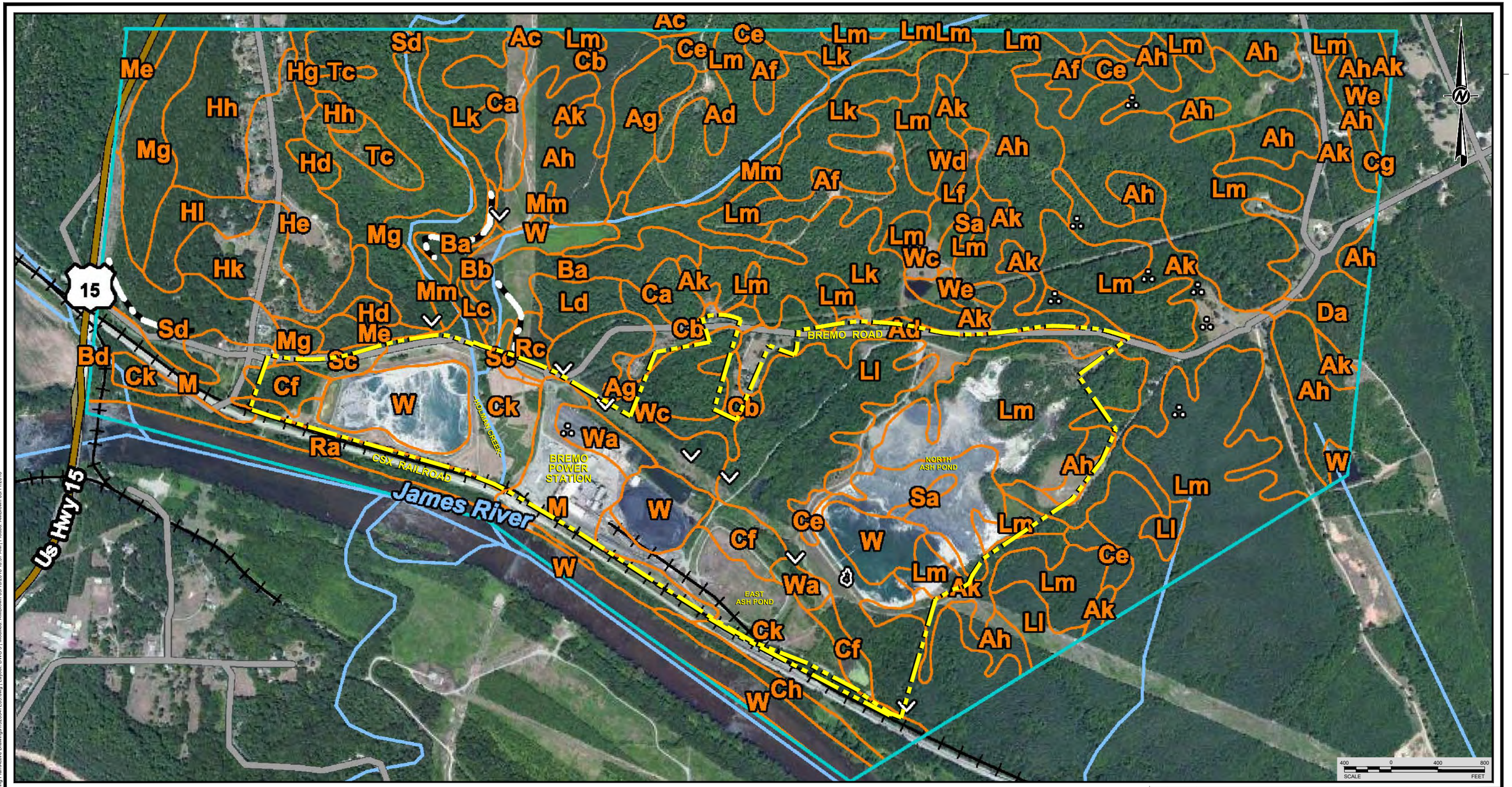

REFERENCE

1. MAP SOURCE: NATURAL RESOURCES CONSERVATION SERVICE
2. SOILS MAP IS GENERATED FROM THE USDA-NRCS CERTIFIED DATA AS OF THE VERSION DATES LISTED BELOW:
   SOIL SURVEY AREA: BUCKINGHAM CO., VA, VERSION 2, DEC. 11, 2013
   SOIL SURVEY AREA: FLUVANNA CO., VA, VERSION 11, DEC. 11, 2013
3. AERIAL IMAGERY SHOWN WAS PHOTOGRAPHED MAY 10, 2010 - JULY 4, 2010.

LEGEND

Ac	Appling fine sandy loam, rolling phase	He	Hiwassee clay loam, eroded undulating phase	Sc	Starr loam
Ad	Appling fine sandy loam, undulating phase	Hg	Hiwassee fine sandy loam, rolling light-colored phase	Sd	Stony land
Af	Appling gritty fine sandy loam, undulating phase	Hh	Hiwassee fine sandy loam, undulating light-colored phase	Tc	Tatum silt loam, undulating phase
Ag	Appling sandy loam, eroded rolling phase	Hk	Hiwassee silt loam, rolling phase	W	Water
Ah	Appling sandy loam, rolling phase	Hl	Hiwassee silt loam, undulating phase	Wa	Wehadkee silt loam
Ak	Appling sandy loam, undulating phase	Lc	Lloyd silt loam, rolling phase	Wc	Wilkes sandy loam, hilly and steep phases
Ba	Bremo silt loam, hilly phase	Ld	Lloyd silt loam, undulating phase	Wd	Wilkes sandy loam, rolling phase
Bb	Bremo silt loam, rolling phase	Lf	Lloyd silty clay loam, eroded undulating phase	We	Worsham sandy loam
Bd	Buncombe loamy fine sandy	Lk	Louisburg sandy loam, eroded rolling and hilly phases		
Ca	Cecil clay loam, eroded rolling phase	Ll	Louisburg sandy loam, eroded steep phase		PROPERTY LINE
Cb	Cecil clay loam, eroded undulating phase	Lm	Louisburg sandy loam, rolling and hilly phases		SOIL SURVEY BOUNDARY
Ce	Cecil sandy loam, undulating phase	M	Made land		
Cf	Chewacla silt loam	Me	Manteo silt loam, hilly phase		
Cg	Colfax sandy loam	Mg	Manteo silt loam, steep phase		
Ch	Congaree fine sandy loam	Mm	Mixed alluvial land, well drained		
Ck	Congaree silt loam	Ra	Riverwash		
Da	Durham fine sandy loam, undulating phase	Rc	Rough gullied land		
Hd	Hiwassee clay loam, eroded rolling phase	Sa	Seneca fine sandy loam		

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
2	06/08/16	PARCEL ADDITION	MGW	BPG	MGW	MGW
1	04/15/16	UPDATE NOTATION	-	BPG	ATN	JRD

PROJECT

DOMINION
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

TITLE

SOILS MAP

GOLDER

PROJECT No.		15-20347	FILE No.		1520347E05
DESIGN	CJL	06/25/15	SCALE		AS SHOWN
CADD	BPG	08/18/15	DRAWING 3		
CHECK	CJL	12/03/15			
REVIEW	JRD	12/03/15			

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LEGEND

Qal	ALLUVIUM
Oap	PORPHYROBLASTIC BIOTITE AND BIOTITE-GARNET SCHIST AND SLATE
g	GARNET-AMPHIBOLE-QUARTZ ROCK
Pzh	GNEISSIC QUARTZ DIORITE, GRANODIORITE, AND SOME GRANITE
Pzhg	HORNBLENDE GNEISS
	APPROXIMATE PROPERTY BOUNDARY
	EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS) (FROM AERIAL SURVEY - SEE NOTE 2)
	WETLANDS
	SURFACE WATER BOUNDARY
	APPROXIMATE LIMITS OF EXISTING ASH PONDS
	LIMITS OF 100-YR FLOOD PLAIN
MW-29D	FEDERAL CCR RULE COMPLIANCE WELL LOCATION AND IDENTIFICATION
MW-26S	STATE GROUNDWATER COMPLIANCE WELL LOCATION AND IDENTIFICATION
MW-5 (OW)	GROUNDWATER OBSERVATION WELL LOCATION AND IDENTIFICATION
MW-36S	ACM GROUNDWATER WELL LOCATION AND IDENTIFICATION
MW-37	PROPOSED WELL LOCATION AND IDENTIFICATION
A A'	GEOLOGIC CROSS-SECTION LOCATION

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
4	07/29/19	RESPONSE TO DEQ COMMENTS	RIP	SIB	RIP	MGW
3	09/14/18	RESPONSE TO DEQ COMMENTS	MGW	BPG	ATN	MGW
2	01/13/17	RESPONSE TO COMMENTS	MGW	BPG	ATN	MGW
1	02/15/16	RESPONSE TO COMMENTS	MGW	BPG	MGW	MGW

PROJECT

DOMINION
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

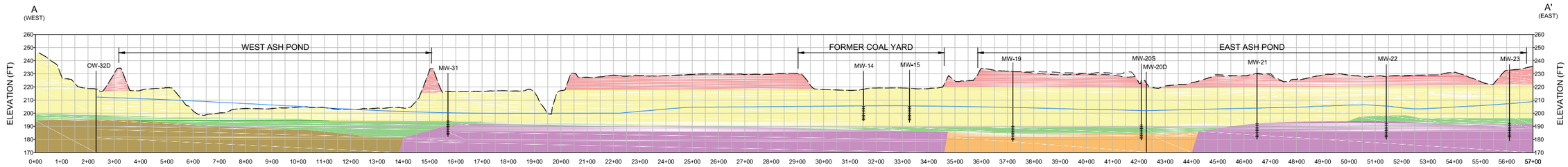
TITLE

GEOLOGIC MAP

GOLDER

PROJECT No.		15-20347	FILE No.	1520347E04
DESIGN	CJL	12/03/15	SCALE	AS SHOWN
CADD	BPG	01/06/16		
CHECK	MGW	01/06/16		
REVIEW	JRD	01/06/16		

DRAWING 4



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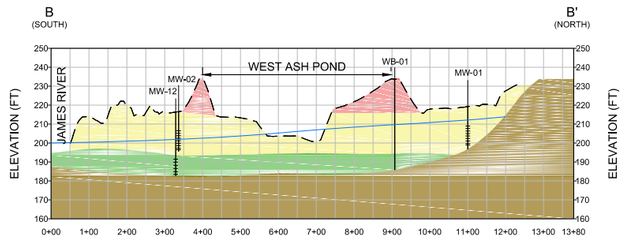

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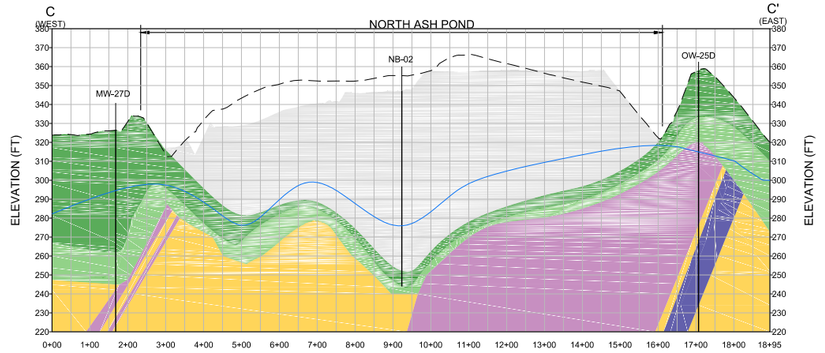

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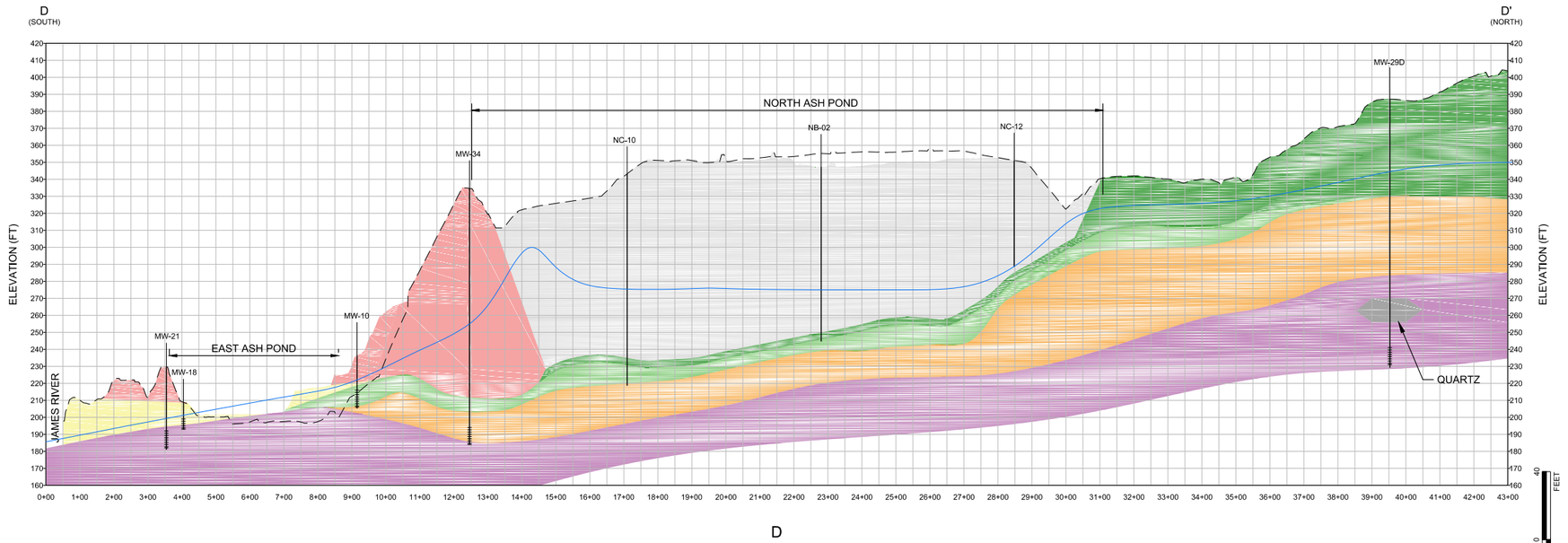


D

NOTES

1. WATER TABLE SURFACE BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATUM, TOPOGRAPHIC CONTOURS AND KNOWN FIELD CONDITIONS. THEREFORE, WATER TABLE SURFACE MAY NOT REFLECT ACTUAL GROUND WATER CONDITIONS.
2. THE WATER TABLE SURFACE IN THE VICINITY OF NORTH ASH POND WAS DEVELOPED USING GROUNDWATER ELEVATION DATA COLLECTED UNDER PUMPING CONDITIONS.

LEGEND

- EXISTING GROUND
- GROUND WATER
- ALLUVIUM
- COAL COMBUSTION RESIDUALS (CCR)
- PARTIALLY WEATHERED BEDROCK
- BERM MATERIAL
- SAPROLITE

BEDROCK

- PORPHYROBLASTIC BIOTITE AND BIOTITE-GARNET SCHIST
- GNEISSIC QUARTZ DIORITE, GRANODIORITE, AND SOME GRANITE
- SLATE
- AMPHIBOLITE

CLIENT
DOMINION ENERGY

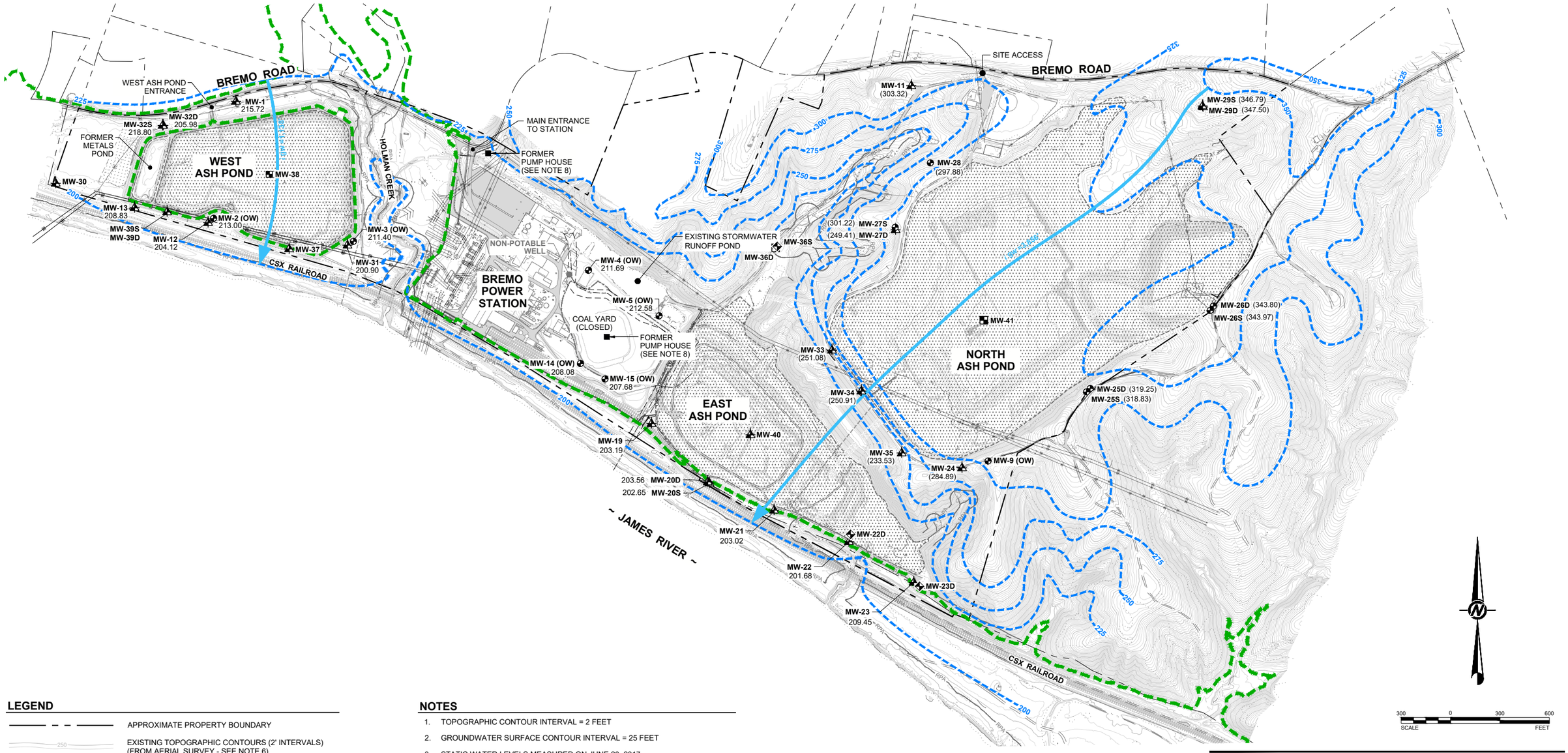
PROJECT
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

TITLE
GEOLOGIC CROSS SECTIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-14
DESIGNED	MGW
PREPARED	SIB
REVIEWED	ATN
APPROVED	JRD

PROJECT NO. 15-20347 | REV. 0 | DRAWING 5



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS) (FROM AERIAL SURVEY - SEE NOTE 6)
- GROUNDWATER CONTOURS
- WETLANDS
- SURFACE WATER BOUNDARY
- APPROXIMATE LIMITS OF EXISTING ASH PONDS
- LIMITS OF 100-YR FLOOD PLAIN
- MW-29D — FEDERAL CCR RULE COMPLIANCE WELL LOCATION AND IDENTIFICATION
- MW-26S — STATE GROUNDWATER COMPLIANCE WELL LOCATION AND IDENTIFICATION
- MW-5 (OW) — GROUNDWATER OBSERVATION WELL LOCATION AND IDENTIFICATION
- MW-36S — ACM GROUNDWATER WELL LOCATION AND IDENTIFICATION
- MW-38 — PROPOSED WELL LOCATION AND IDENTIFICATION
- A A' — GEOLOGIC CROSS-SECTION LOCATION

NOTES

1. TOPOGRAPHIC CONTOUR INTERVAL = 2 FEET
2. GROUNDWATER SURFACE CONTOUR INTERVAL = 25 FEET
3. STATIC WATER LEVELS MEASURED ON JUNE 20, 2017.
4. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATUM, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS. THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL GROUNDWATER CONDITIONS.
5. GROUNDWATER CONTOUR LINES SHOW THE WATER TABLE SHAPE AND ELEVATION. THESE CONTOURS ARE INFERRED LINES FOLLOWING THE GROUNDWATER SURFACE AT A CONSTANT ELEVATION ABOVE SEA LEVEL. THE GROUNDWATER FLOW DIRECTION IS GENERALLY PERPENDICULAR TO THE GROUNDWATER SURFACE CONTOURS, SIMILAR TO THE RELATIONSHIP BETWEEN SURFACE WATER FLOW AND TOPOGRAPHIC CONTOURS.
6. BASEMAP INFORMATION (e.g., EXISTING TOPOGRAPHY, ROADS, TREE LINES, FENCE LINES, ETC.) TAKEN FROM AERIAL SURVEY PREPARED BY McKENZIE SNYDER. DATE OF AERIAL PHOTOGRAPHY: FEBRUARY 18, 2017.
7. NON-POTABLE WELL LOCATION IS TO BE CONSIDERED APPROXIMATE.
8. FORMER PUMP HOUSE APPROXIMATE LOCATIONS FROM STONE & WEBSTER ENGINEERING CORPORATION 1949 DRAWINGS.

2	07/29/19	RESPONSE TO DEQ COMMENTS	RIP	SIB	RIP	MGW
1	09/14/18	RESPONSE TO COMMENTS	MGW	ATN	ATN	MGW
Δ	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

CLIENT
DOMINION ENERGY
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

PROJECT
CCR SURFACE IMPOUNDMENT
CLOSURE PLAN

TITLE
POTENTIOMETRIC SURFACE MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2020-03-16
DESIGNED	MGW
PREPARED	ATN
REVIEWED	MEO
APPROVED	MGW

PROJECT NO. 15-20347 | REV. 2 | DRAWING 6

APPENDIX A

BORING AND MONITORING WELL CONSTRUCTION LOGS

Well Construction Log

Well ID: MW-1

PROJECT INFORMATION

PROJECT:	**1201828**
SITE LOCATION:	**Bremo Bluff, VA**
JOB NAME:	**Dominion - Bremo Bluff Pwr Stn**
LOGGED BY:	**Seth Christman**
PROJECT MANAGER:	**Tim Davis**
DATES DRILLED:	**12/4/12 - 1130**
WELL ID:	**MW-1**
NORTHING:	**3783032.88**
EASTING:	**11542749.05**

DRILLING INFORMATION

DRILLER:	**Brian Thomas**
BORING DEPTH:	**21.59 feet below grade**
DRILLING CO.:	**Geologic Exploration**
RIG TYPE:	**D-120**
DRILLING METHOD:	**HSA**
SAMPLING METHODS:	**2ft Spit-Spoon Macrocores**
HAMMER:	**140 LBS**
TOC ELEVATION:	**221.76 ft AMSL**
TOG ELEVATION:	**218.95 ft AMSL**

▼ Observed Water Level N/A = Not Applicable TOG - Top of Ground TOC - Top of Casing AMSL - Above Mean Sea Level

DEPTH	SOIL SYMBOLS	SOIL DESCRIPTION	PID (ppm)	NOTES (bls)	WELL CONSTRUCTION	WELL MATERIAL NOTES
0 to -6		Silty CLAY, brown, med plastic, moist. CL				Boring diameter 6"
-6 to -10		Lean CLAY with trace silt, wet pockets of moisture, moist. CL		2-1-2-3		PVC Casing: 0' - 11' below grade Grout: 0'-7' below grade Bentonite Seal: 7'-9' below grade
-10 to -16		Clayey SILT with rounded to sub-angular peopples, wet. ML		2-3-4-4		Flush Joint, ATSM F480-88 2 thread Sand Pack DSI #2: 9'-21' below grade
-16 to -20		Clayey SAND, fine to medium grained, sub angular to rounded, poorly sorted. SC		2-4-4-5		PVC Screen 10- slot screen: 11'-21' below grade
-20		Alluvium deposit of sand and cobbles. GP Auger refusal @ 21.5'		5-16-6-7		

Well Construction Log

Well ID: MW-11

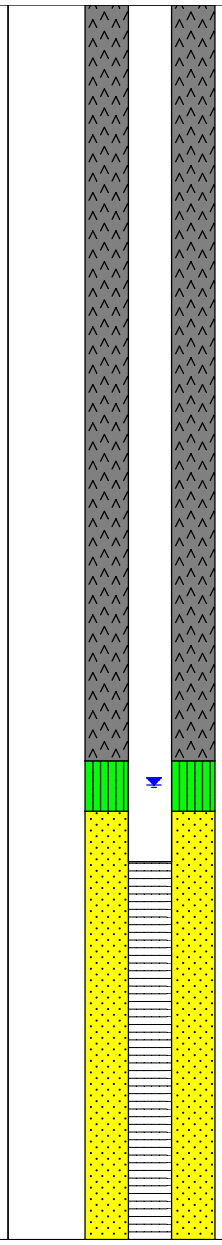
PROJECT INFORMATION

PROJECT:	**1201828**
SITE LOCATION:	**Bremo Bluff, VA**
JOB NAME:	**Dominion - Bremo Bluff Pwr Stn**
LOGGED BY:	**Seth Christman**
PROJECT MANAGER:	**Tim Davis**
DATES DRILLED:	**11/28/12 -1350**
WELL ID:	**MW-11**
NORTHING:	**3783128.03**
EASTING:	**11546850.62**

DRILLING INFORMATION

DRILLER:	**Brian Thomas**
BORING DEPTH:	**49.27 feet below grade**
DRILLING CO.:	**Geologic Exploration**
RIG TYPE:	**D-120**
DRILLING METHOD:	**HSA**
SAMPLING METHODS:	**2ft Spit-Spoon Macrocores**
HAMMER:	**140 LBS**
TOC ELEVATION:	**330.52 ft AMSL**
TOG ELEVATION:	**327.74 ft AMSL**

▼ Observed Water Level N/A = Not Applicable TOG - Top of Ground TOC - Top of Casing AMSL - Above Mean Sea Level

DEPTH	SOIL SYMBOLS	SOIL DESCRIPTION	PID (ppm)	NOTES (bls)	WELL CONSTRUCTION	WELL MATERIAL NOTES
0 to -48		Clayey SILT, slightly plastic. ML High relic structure of parent rock, foliated layers, non-plastic, dense. Granodiorite rock frags, angular. Clayey SILT, red to tan, non-plastic, dry, phylitic texture, hard. ML SILT with fine grains of quartz, feldspar, and mica, non-plastic, moist. ML SAND, fine to medium grained, sub-angular to rounded, poorly sorted, quartz, hornblende, muscovite, and feldspar minerals present. SP *Gravel Layer @ 20.8' SILT with mica and trace rock frags, red/tan to dark grey, banded foliation. ML SILT with trace sand and rock frags, non-plastic, dry, foliated. ML Dence material, saturated. No recovery.		7-27-36-43 5-20-16-17 9-16-17-23 10-13-11-7 9-12-16-15 16-50/4 16-50/4 16-50/4		Boring diameter 6" PVC Casing: 0' - 34' below grade Grout: 0'-30' below grade Bentonite Seal: 30'-32' below grade Flush Joint, ATSM F480-88 2 thread PVC Screen 10- slot screen: 34'-49' below grade Sand Pack DSI #2: 32'-49' below grade

Well Construction Log

Well ID: MW-12

PROJECT INFORMATION

PROJECT:	**1201828**
SITE LOCATION:	**Bremo Bluff, VA**
JOB NAME:	**Dominion - Bremo Bluff Pwr Stn**
LOGGED BY:	**Seth Christman**
PROJECT MANAGER:	**Tim Davis**
DATES DRILLED:	**12/4/12 -900**
WELL ID:	**MW-12**
NORTHING:	**3782305.43**
EASTING:	**11542586.74**

DRILLING INFORMATION

DRILLER:	**Brian Thomas**
BORING DEPTH:	**33.23 feet below grade**
DRILLING CO.:	**Geologic Exploration**
RIG TYPE:	**D-120**
DRILLING METHOD:	**HSA**
SAMPLING METHODS:	**2ft Spit-Spoon Macrocores**
HAMMER:	**140 LBS**
TOC ELEVATION:	~~**218.93 ft**~~ **AMSL** **TOC - 219.13 AMSL Wellhead modified for floodplain wellhead protection on 9/26/17.**
TOG ELEVATION:	**216.52 ft AMSL**

▼ Observed Water Level N/A = Not Applicable TOG - Top of Ground TOC - Top of Casing AMSL - Above Mean Sea Level

DEPTH	SOIL SYMBOLS	SOIL DESCRIPTION	PID (ppm)	NOTES (bls)	WELL CONSTRUCTION	WELL MATERIAL NOTES
0 to -32		CLAY, tan to grey moltled, non-plastic, dry. CL SAA, slightly plastic, moist.CL Silty CLAY, tan, slightly plastic, wet. CL Clayey SAND, fine to medium grained, sub angular to rounded, poorly sorted. SC Alluvium deposit of sub rounded gravel 1cm to 1" in diameter. GP Weathered SLATE with small garnet crystals, "Arrovian Slate", dry.		2-3-5-5 3-4-5-7 3-3-2-2 1-2-19-20 9-50/2 50/6		Boring diameter 6" Grout: 0'-21' below grade PVC Casing: 0' - 25' below grade Bentonite Seal: 21'-23' below grade Flush Joint, ATSM F480-88 2 thread Sand Pack DSI #2: 23'-33' below grade

Well Construction Log

Well ID: MW-13

PROJECT INFORMATION

PROJECT:	**1201828**
SITE LOCATION:	**Bremo Bluff, VA**
JOB NAME:	**Dominion - Bremo Bluff Pwr Stn**
LOGGED BY:	**Seth Christman**
PROJECT MANAGER:	**Tim Davis**
DATES DRILLED:	**11/29/12 -925**
WELL ID:	**MW-13**
NORTHING:	**3782386.86**
EASTING:	**11542133.65**

DRILLING INFORMATION

DRILLER:	**Brian Thomas**
BORING DEPTH:	**22.41 feet below grade**
DRILLING CO.:	**Geologic Exploration**
RIG TYPE:	**D-120**
DRILLING METHOD:	**HSA**
SAMPLING METHODS:	**2ft Spit-Spoon Macrocores**
HAMMER:	**140 LBS**
TOC ELEVATION:	~~**219.07 ft**~~ **AMSL** **TOC - 218.84 AMSL Wellhead modified for floodplain wellhead protection on 9/26/17.**
TOG ELEVATION:	**216.57 ft AMSL**

▼ Observed Water Level N/A = Not Applicable TOG - Top of Ground TOC - Top of Casing AMSL - Above Mean Sea Level

DEPTH	SOIL SYMBOLS	SOIL DESCRIPTION	PID (ppm)	NOTES (bls)	WELL CONSTRUCTION	WELL MATERIAL NOTES
0 to -6		CLAY, tan to grey moltled, non-plastic, dry. CL		4-6-6-9	Boring diameter 6" PVC Casing: 0' - 11' below grade Grout: 0'-7' below grade	
-6 to -12		CLAY, slightly plastic, moist.CL		3-3-4-5	Bentonite Seal: 7'-9' below grade Flush Joint, ATSM F480-88 2 thread	
-12 to -20		CLAY, wet, plastic. CH		3-3-3-3	Sand Pack DSI #2: 9'-21' below grade PVC Screen 10- slot screen: 11'-21' below grade	
-20 to -22		Alluvium, gravel composed of rounded to angular quartz sand, poorly sorted. GP		2-2-10-43		
-22		Partially weathered slate, foliated with garnet porhyroblast. "Arovian Slate"				

RECORD OF BOREHOLE MW-19

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 52.00 ft
DRILL METHOD: Sonic

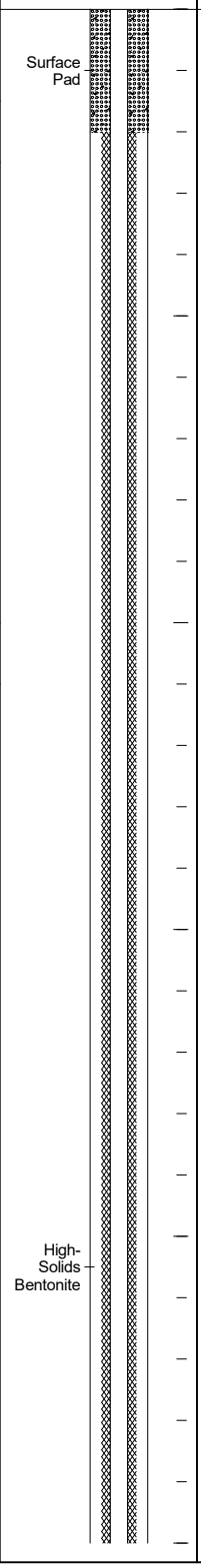
DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/18/17
DATE COMPLETED: 9/19/17

NORTHING: 3,781,076.28
EASTING: 11,545,271.66
GS ELEVATION: 232.23 ft
TOC ELEVATION: 235.14

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0		0.00 - 1.50 FILL - (CL-GC) silty CLAY and GRAVEL; 3/4" gravel; light brown; w<PL; loose.	CL		230.73
		1.50 - 2.50 FILL - (CL) silty CLAY and GRAVEL; 1/2" gravel; orange to tan; some dark orange oxidation; w<PL; stiff.	CL		1.50 229.73
	230	2.50 - 10.00 FILL - (CL) SILTY CLAY; trace fine sand; dark brown; w<PL; very stiff.			2.50
5			CL		
	225				
10					222.23
		10.00 - 11.00 (CL) SILTY CLAY; trace fine and medium sand; light brown; w<PL; soft.	CL		10.00 221.23
		11.00 - 30.00 (CL) SILTY CLAY; trace medium sand; some decomposed wood; gray/brown; w~PL; stiff.			11.00
	220				
15					
	215		CL		
20					
	210				
25					

Log continued on next page

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-42.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x3'
Protective Casing: 4-inch round stickup - aluminum

ANNULUS SEAL
Interval: 2.0-39.0 feet BGS
Type: High-Solids Bentonite

FILTER PACK SEAL
Interval: 39.0-41.0 feet BGS
Type: Bentonite

FILTER PACK
Interval: 41.0-52.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 42.0-52.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 52.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-19

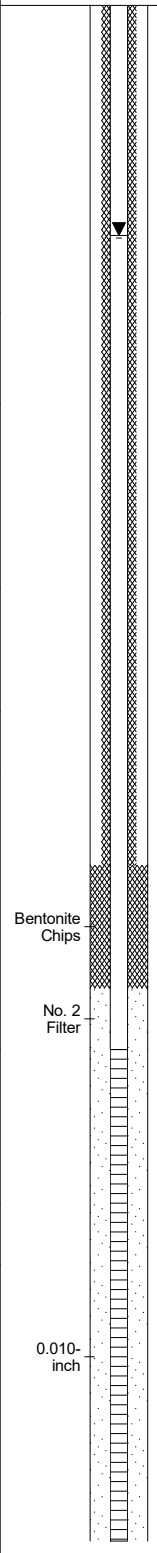
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 52.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/18/17
DATE COMPLETED: 9/19/17

NORTHING: 3,781,076.28
EASTING: 11,545,271.66
GS ELEVATION: 232.23 ft
TOC ELEVATION: 235.14

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
25		11.00 - 30.00 (CL) SILTY CLAY; trace medium sand; some decomposed wood; gray/brown; w~PL; stiff. *(Continued)*	CL		202.23
30	205	30.00 - 31.50 (CL) SILTY CLAY; trace medium sand; dark brown; w<PL; very stiff.	CL		30.00 200.73
	200	31.50 - 34.50 (CL) SILTY CLAY; light brown with "shiny luster"; some grey in matrix; w<PL; very stiff.	CL		31.50 197.73
35		34.50 - 36.50 (SC) clayey SAND; fine to medium sand; light brown; wet; loose.	SC		34.50 195.73
	195	36.50 - 37.50 (SC) clayey SAND; fine to medium sand; some sub-rounded to sub-angular cobbles up to 3" diameter; light brown; wet; loose.	SC		36.50 194.73
40		37.50 - 42.00 (ML) clayey SILT; some fine sand; trace sub-angular gravel (weathered in place) up to 1/4" diameter; light gray to light brown; relict structure; w<PL; very stiff.	CL		37.50 190.23
	190	42.00 - 44.50 (SM) clayey SILTY SAND and GRAVEL; fine to medium sand; some cobbles up to 3" diameter; gray; wet; compact.	SM		42.00 187.73
45		44.50 - 45.50 quartzofeldspathic biotite SCHIST; light gray; moderately weathered.			44.50 186.73
	185	45.50 - 52.00 quartzofeldspathic biotite SCHIST; light gray; some fractures filled with fine to medium sand.			45.50
50		Log continued on next page			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-42.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x3'
Protective Casing: 4-inch round stickup - aluminum

ANNULUS SEAL
Interval: 2.0-39.0 feet BGS
Type: High-Solids Bentonite

FILTER PACK SEAL
Interval: 39.0-41.0 feet BGS
Type: Bentonite

FILTER PACK
Interval: 41.0-52.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 42.0-52.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 52.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-19

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 52.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/18/17
DATE COMPLETED: 9/19/17

NORTHING: 3,781,076.28
EASTING: 11,545,271.66
GS ELEVATION: 232.23 ft
TOC ELEVATION: 235.14

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		45.50 - 52.00 quartzofeldspathic biotite SCHIST; light gray; some fractures filled with fine to medium sand. *(Continued)*			180.23		**WELL CASING** Interval: 0.0-42.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 3'x3' Protective Casing: 4-inch round stickup - aluminum **ANNULUS SEAL** Interval: 2.0-39.0 feet BGS Type: High-Solids Bentonite **FILTER PACK SEAL** Interval: 39.0-41.0 feet BGS Type: Bentonite **FILTER PACK** Interval: 41.0-52.0 feet BGS Type: No. 2 **WELL SCREEN** Interval: 42.0-52.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 52.0 feet BGS
	180	Boring completed at 52.00 ft					
55							
	175						
60							
	170						
65							
	165						
70							
	160						
75							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 10/10/17

RECORD OF BOREHOLE MW-20S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 45.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/20/17
DATE COMPLETED: 9/21/17

NORTHING: 3,780,720.23
EASTING: 11,545,625.00
GS ELEVATION: 224.98 ft
TOC ELEVATION: 228.00

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0		0.00 - 1.00 FILL - (CL) clayey sandy SILT and GRAVEL; fine sand; some slate gravel; dark brown; moist; loose.	CL		223.98 1.00
		1.00 - 2.00 FILL - (ML) possible ASH; sandy SILT; fine sand; dark gray; wet; loose.	ML		222.98 2.00
		2.00 - 10.00 FILL - (CL) silty CLAY; trace fine to medium sand; light brown with some light gray in matrix; w>PL; stiff.	CL		
5	220				
10	215	10.00 - 20.00 (CL) silty CLAY; trace sand; light brown with some gray in matrix; w~PL; very stiff.	CL		214.98 10.00
15	210				
20	205	20.00 - 25.00 (CL) silty sandy CLAY; fine sand; light brown; w>PL; soft.	CL		204.98 20.00
25	200				199.98

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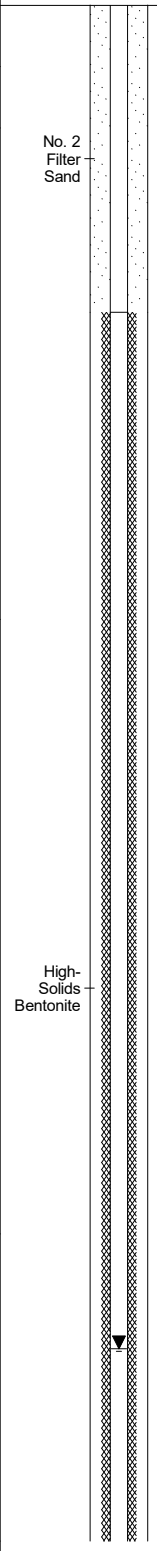
MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-34.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch round stickup

ANNULUS SEAL
Interval: 0.0-27.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 27.0-30.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 30.0-45.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 34.0-44.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 44.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-20S

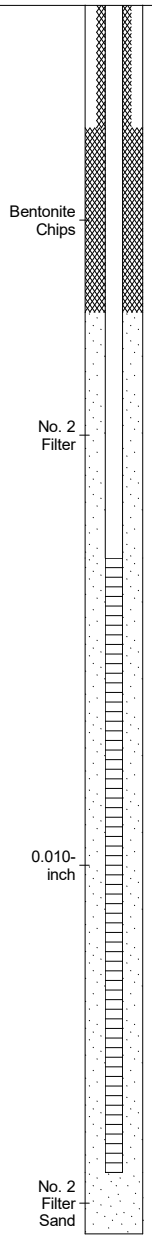
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 45.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/20/17
DATE COMPLETED: 9/21/17

NORTHING: 3,780,720.23
EASTING: 11,545,625.00
GS ELEVATION: 224.98 ft
TOC ELEVATION: 228.00

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
25		25.00 - 30.00 (SP) silty SAND and GRAVEL; sub-rounded gravel (quartzite) up to 1.5" diameter; some clay; light orange, wet, loose.	SP		25.00
					194.98
30	195	30.00 - 32.00 (SP) silty clayey SAND and GRAVEL; fine sand; some sub-rounded cobbles up to 3" diameter; brown; wet; loose.	SP		30.00
					192.98
		32.00 - 33.00 (GP) COBBLES, disintegrated/weathered gneissic rock; silt texture; white; dry, loose.			32.00
					191.98
		33.00 - 34.00 (SP) SAND; fine; well-sorted; brown; dry; compact.	SP		33.00
					190.98
		34.00 - 35.00 (GP) COBBLES, disintegrated/weathered schist; silt texture; white; dry, compact.			34.00
35	190				189.98
		35.00 - 36.00 quartzofeldpathic biotite SCHIST (possible boulder); weathered; gray.			35.00
					188.98
		36.00 - 38.00 (GP) COBBLES, slate and quartzite; sub-angular to sub-rounded.			36.00
					186.98
		38.00 - 45.00 quartzofeldpathic biotite SCHIST; weathered with high angle fractures; sodium plagioclase banding; some secondary mineralization (calcite); highly fractured zone 39-41 feet below grade.			38.00
40	185				
45	180	Boring completed at 45.00 ft			179.98
50	175				

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-34.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch round stickup

ANNULUS SEAL
Interval: 0.0-27.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 27.0-30.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 30.0-45.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 34.0-44.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 44.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-20D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 90.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/19/17
DATE COMPLETED: 9/20/17

NORTHING: 3,780,725.18
EASTING: 11,545,617.00
GS ELEVATION: 225.42 ft
TOC ELEVATION: 228.21

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	225	0.00 - 1.00 FILL - (CL) clayey sandy SILT and GRAVEL; fine sand; some slate gravel; dark brown; moist; loose.	CL		224.42		
		1.00 - 3.00 FILL - (ML) sandy SILT (possible ASH); fine sand; dark grey; wet; loose.	ML		1.00 222.42	No. 2 Filter Sand	
		3.00 - 10.00 FILL - (CL) silty CLAY; trace fine to medium sand; light brown with some light gray in matrix; w>PL; stiff.	CL		3.00 215.42		
10	215	10.00 - 20.00 (CL) silty CLAY; trace sand; light brown with some gray in matrix; w~PL; very stiff.	CL		10.00 205.42		
20	205	20.00 - 25.00 (CL) silty sandy CLAY; fine sand; light brown; w>PL; soft.	CL		20.00 200.42		
25		Log continued on next page					

WELL CASING
Interval: 0.0-77.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch round stickup

ANNULUS SEAL
Interval: 5.0-71.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 71.0-74.0 feet BGS
Type: Bentonite

FILTER PACK
Interval: 74.0-90.0 feet bgs
Type: No. 2

WELL SCREEN
Interval: 77.0-87.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 87.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-20D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 90.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/19/17
DATE COMPLETED: 9/20/17

NORTHING: 3,780,725.18
EASTING: 11,545,617.00
GS ELEVATION: 225.42 ft
TOC ELEVATION: 228.21

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25	200	25.00 - 30.00 (SP) silty SAND and GRAVEL; sub-rounded gravel (quartzite) up to 1.5" diameter; some clay; light orange, wet, loose.	SP		25.00 195.42		**WELL CASING** Interval: 0.0-77.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4-inch round stickup **ANNULUS SEAL** Interval: 5.0-71.0 feet BGS Type: Bentonite **FILTER PACK SEAL** Interval: 71.0-74.0 feet BGS Type: Bentonite **FILTER PACK** Interval: 74.0-90.0 feet bgs Type: No. 2 **WELL SCREEN** Interval: 77.0-87.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 87.0 feet BGS
30	195	30.00 - 32.00 (ML) clayey sandy SILT; fine sand; light brown to tan; w<PL: loose.	CL		30.00 193.42		
		32.00 - 34.00 (SP) clayey silty SAND and GRAVEL; fine to medium sand; sub-rounded gravel between 1-2"; some cobble; light brown to light gray; wet; loose.	SP		32.00 191.42		
35	190	34.00 - 43.00 quartzofelspathic biotite SCHIST; heavily weathered and fractured; fractures filled with clayey silt and sandy silt (gray).			34.00	High-Solids Bentonite	
40	185						
45	180	43.00 - 67.00 quartzofeldspathic biotite SCHIST; some fractures throughout; secondary mineralization (chlorite and calcite); some solution voids present.			182.42 43.00		
50		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-20D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 90.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/19/17
DATE COMPLETED: 9/20/17

NORTHING: 3,780,725.18
EASTING: 11,545,617.00
GS ELEVATION: 225.42 ft
TOC ELEVATION: 228.21

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50	175	43.00 - 67.00 quartzofeldspathic biotite SCHIST; some fractures throughout; secondary mineralization (chlorite and calcite); some solution voids present. *(Continued)*					
55	170						
60	165						
65	160				158.42		
		67.00 - 68.00 VOID/FRACTURE			67.00 157.42		
		68.00 - 72.50 quartzofeldspathic biotite SCHIST; weathered; fractures and iron stained; sodium plagioclase; secondary mineralization (calcite).			68.00		
70	155						
		72.50 - 77.00 quartzofeldspathic GNEISS; competent bedrock; sodium plagioclase banding.			152.92 72.50	Bentonite Chips	
75		Log continued on next page					

WELL CASING
Interval: 0.0-77.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch round stickup

ANNULUS SEAL
Interval: 5.0-71.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 71.0-74.0 feet BGS
Type: Bentonite

FILTER PACK
Interval: 74.0-90.0 feet bgs
Type: No. 2

WELL SCREEN
Interval: 77.0-87.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 87.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-20D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 90.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/19/17
DATE COMPLETED: 9/20/17

NORTHING: 3,780,725.18
EASTING: 11,545,617.00
GS ELEVATION: 225.42 ft
TOC ELEVATION: 228.21

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75	150	72.50 - 77.00 quartzofeldspathic GNEISS; competent bedrock; sodium plagioclase banding. *(Continued)*			148.42	No. 2 Filter	**WELL CASING** Interval: 0.0-77.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
		77.00 - 80.00 quartzofeldspathic biotite SCHIST; highly fractured; some weathering and solution voids.			77.00 145.42		**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4-inch round stickup **ANNULUS SEAL** Interval: 5.0-71.0 feet BGS Type: Bentonite
80	145	80.00 - 84.00 quartzofeldspathic GNEISS; competent bedrock; sodium plagioclase banding.			80.00 141.42	0.010-inch	**FILTER PACK SEAL** Interval: 71.0-74.0 feet BGS Type: Bentonite **FILTER PACK** Interval: 74.0-90.0 feet bgs Type: No. 2
85	140	84.00 - 87.00 quartzofeldspathic GNEISS; heavily weathered and fractured; some secondary mineralization (chlorite).			84.00 138.42		**WELL SCREEN** Interval: 77.0-87.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 87.0 feet BGS
		87.00 - 90.00 quartzofeldspathic GNEISS; competent bedrock; sodium plagioclase banding.			87.00 135.42	No. 2 Filter Sand	
90	135	Boring completed at 90.00 ft					
95	130						
100							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 10/10/17

RECORD OF BOREHOLE MW-21

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/23/17
DATE COMPLETED: 9/23/17

NORTHING: 3,780,558.08
EASTING: 11,546,020.58
GS ELEVATION: 236.15 ft
TOC ELEVATION: 239.16

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	235	0.00 - 1.00 FILL - (CL) silty sandy CLAY and GRAVEL; fine to medium sand; some roots; light brown; w~PL; soft.	CL		235.15 1.00		**WELL CASING** Interval: 0.0-44.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
		1.00 - 3.00 FILL - (CL) silty CLAY; micaceous; some possible ash; light orange; w~PL; stiff.	CL		233.15 3.00		**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4-inch square stickup - aluminum
5	230	3.00 - 11.50 FILL - (CL) silty sandy CLAY and GRAVEL; micaceous; fine to coarse sand; gravel with up to 1" diameter; brown; W~PL; firm.	CL				**ANNULUS SEAL** Interval: 20.0-37.0 feet BGS Type: Bentonite/Sand **FILTER PACK SEAL** Interval: 37.0-39.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 39.0-55.0 feet BGS Type: No. 2
10	225				224.65 11.50	No. 2 Filter Sand	**WELL SCREEN** Interval: 44.0-54.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 54.0 feet BGS
15	220	11.50 - 30.00 FILL - (CL) silty CLAY; micaceous; some fine sand; some possible ash from 20-21' BGS; light brown; w<PL; stiff.	CL				
20	215						
25							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-21

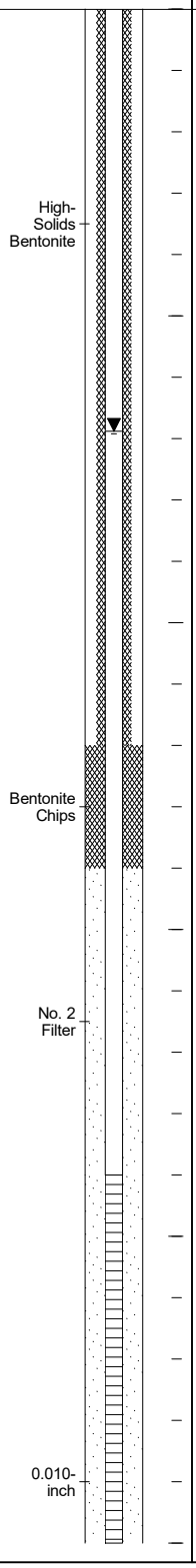
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/23/17
DATE COMPLETED: 9/23/17

NORTHING: 3,780,558.08
EASTING: 11,546,020.58
GS ELEVATION: 236.15 ft
TOC ELEVATION: 239.16

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
25	210	11.50 - 30.00 FILL - (CL) silty CLAY; micaceous; some fine sand; some possible ash from 20-21' BGS; light brown; w<PL; stiff. *(Continued)*	CL		206.15 / 30.00
30	205	30.00 - 33.00 (CL) silty CLAY; micaceous; trace fine sand; light brown with some light grey root-filled in matrix; very stiff; w~PL.	CL		203.15 / 33.00
35	200	33.00 - 43.00 (CL) silty CLAY; trace fine sand; micaceous; light brown with some light grey root-filled matrix; micaceous; w>PL; soft.	CL		193.15 / 43.00
40	195				
45	190	43.00 - 55.00 quartzofeldspathic GNEISS; some quartz and sodium plagioclase; secondary mineralization (chlorite); some shale and sub-rounded quartzite and slate cobbles in fractures.			
50		Log continued on next page			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-44.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 20.0-37.0 feet BGS
Type: Bentonite/Sand

FILTER PACK SEAL
Interval: 37.0-39.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 39.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 44.0-54.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 54.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-21

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/23/17
DATE COMPLETED: 9/23/17

NORTHING: 3,780,558.08
EASTING: 11,546,020.58
GS ELEVATION: 236.15 ft
TOC ELEVATION: 239.16

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		43.00 - 55.00 quartzofeldspathic GNEISS; some quartz and sodium plagioclase; secondary mineralization (chlorite); some shale and sub-rounded quartzite and slate cobbles in fractures. *(Continued)*					
	185						
55		Boring completed at 55.00 ft			181.15	No. 2 Filter Sand	
	180						
60							
	175						
65							
	170						
70							
	165						
75							

WELL CASING
Interval: 0.0-44.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 20.0-37.0 feet BGS
Type: Bentonite/Sand

FILTER PACK SEAL
Interval: 37.0-39.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 39.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 44.0-54.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 54.0 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-22

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/22/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,358.10
EASTING: 11,546,471.50
GS ELEVATION: 235.68 ft
TOC ELEVATION: 238.72

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	235	0.00 - 10.00 FILL - (CL) SILTY CLAY; some gravel (road base); dark orange; w<PL; very stiff.	CL				**WELL CASING** Interval: 0.0-44.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4-inch square stickup - aluminum **ANNULUS SEAL** Interval: 20.0-37.0 feet BGS Type: Bentonite/Sand **FILTER PACK SEAL** Interval: 37.0-39.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 39.0-55.0 feet BGS Type: No. 2 **WELL SCREEN** Interval: 44.0-54.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 54.0 feet BGS
5	230					No. 2 Filter Sand	
10	225	10.00 - 22.00 FILL - (CL) SILTY CLAY; some medium sand; slate gravel (road base) 11-11.4 feet below grade; light brown, some grey in matrix; w<PLdark orange; w<PL; stiff.	CL		225.68 10.00		
15	220						
20	215				213.68		
		22.00 - 23.00 FILL - (CL) SILTY CLAY & GRAVEL; slate gravel (road base); grey; dry; loose.	CL		22.00 212.68		
		23.00 - 30.00 FILL - (CL) SILTY CLAY; trace fine sand; light brown, w<PL, stiff.	CL		23.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-22

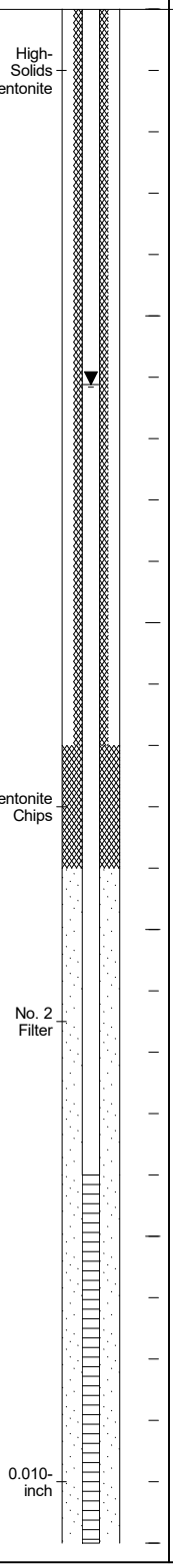
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/22/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,358.10
EASTING: 11,546,471.50
GS ELEVATION: 235.68 ft
TOC ELEVATION: 238.72

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
25	210	23.00 - 30.00 FILL - (CL) SILTY CLAY; trace fine sand; light brown, w<PL, stiff. *(Continued)*	CL		205.68 / 30.00
30	205	30.00 - 33.00 FILL - (CL) CLAY & GRAVEL; slate gravel (road base); some medium sand; light brown with some grey in matrix; w~PL, stiff.	CL		202.68 / 33.00
		33.00 - 34.00 (CH) CLAY; brown; w>PL; soft	CH		201.68 / 34.00
35	200	34.00 - 40.00 (CL) SILTY CLAY; some roots; light brown with some orange and grey (root-filed) matrix; w~PL stiff.	CL		195.68 / 40.00
40	195	40.00 - 42.00 quartzofeldspathic GNEISS; heavily weathered.			193.68 / 42.00
45	190	42.00 - 55.00 quartzofeldspathic GNEISS; heavily weathered and fractured; sodium plagioclase banding; iron staining; secondary mineralization (calcite, pyrite, chlorite); some quartz (amorphous); posible drag folding and microfaulting.			
50		Log continued on next page			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-44.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 20.0-37.0 feet BGS
Type: Bentonite/Sand

FILTER PACK SEAL
Interval: 37.0-39.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 39.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 44.0-54.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 54.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-22

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/22/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,358.10
EASTING: 11,546,471.50
GS ELEVATION: 235.68 ft
TOC ELEVATION: 238.72

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50	185	42.00 - 55.00 quartzofeldspathic GNEISS; heavily weathered and fractured; sodium plagioclase banding; iron staining; secondary mineralization (calcite, pyrite, chlorite); some quartz (amorphous); posible drag folding and microfaulting. *(Continued)*					**WELL CASING** Interval: 0.0-44.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4-inch square stickup - aluminum **ANNULUS SEAL** Interval: 20.0-37.0 feet BGS Type: Bentonite/Sand **FILTER PACK SEAL** Interval: 37.0-39.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 39.0-55.0 feet BGS Type: No. 2 **WELL SCREEN** Interval: 44.0-54.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 54.0 feet BGS
55	180	Boring completed at 55.00 ft			180.68	No. 2 Filter Sand	
60	175						
65	170						
70	165						
75							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-22D

SHEET 1 of 1

PROJECT: ACM Investigation
PROJECT NUMBER: 1520-347
DRILLED DEPTH: 105.00 ft
DRILL METHOD: Rotosonic

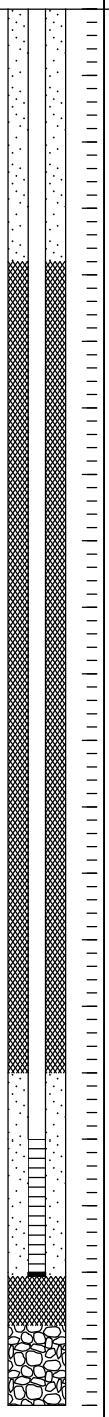
DRILL RIG: Spider 08
DATE STARTED: 11/14/18
DATE COMPLETED: 12/6/18

NORTHING: 3,780,403.12
EASTING: 11,546,481.78
GS ELEVATION: 212.41 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0	210	0.00 - 10.00 Grey-brown SILTY CLAY, trace gravel in upper 2 feet. Moist. Fill.	CL	202.41
10	200	10.00 - 19.50 Grey-brown SILTY CLAY with black nodules. Moist. Fill.	CL	10.00 192.91
20	190	19.50 - 20.00 Broken cobble/pulverized rock.		190.41
		20.00 - 22.00 Hard to very hard, fresh, dark grey to black biotite GNEISS.		22.00
25	185	22.00 - 30.00 Hard to very hard, fresh, grey, medium-grained granitic GNEISS. Slightly fractured to sound. Moderately high-angle fractures from 22 to 26 feet bgs.		182.41
30	180	30.00 - 40.00 Hard to very hard, grey, medium grained granitic GNEISS. Moderately to extremely fractured/broken core, especially from approximately 30 to 35 ft. Orange staining observed in fracture zone from 30 to 31 feet bgs.		30.00 172.41
40	170	40.00 - 50.00 Hard to very hard, grey, medium grained granitic GNEISS. Moderately to extremely fractured/broken core. No staining observed.		40.00 162.41
50	160	50.00 - 60.00 GNEISS. Fractured zone from 50 to 51.5 feet bgs.		50.00 152.41
60	150	60.00 - 70.00 Dark grey, massive, phaneritic GNEISS. Steeply dipping mineral foliation. Biotite lens at 66 feet bgs. Steeply dipping black-filled fracture at 68.5 feet bgs.		60.00 142.41
70	140	70.00 - 80.00 Massive, phaneritic quartz-biotite banded GNEISS with aphanitic quartz-muscovite. Low to moderately dipping foliation. Biotite lens at 74.5 feet bgs. Massive aphanitic quartz band from approximately 74.5 to 79.5 feet bgs. Steeply dipping muscovite foliation at 79.5 feet bgs. Near-vertical quartz vein at aproximately 80 feet bgs.		70.00 132.41
80	130	80.00 - 90.00 Biotite-quartz GNEISS with moderately dipping to near-vertical foliation. Moderately dipping fractures observed at approximtaely 80.5 and 87.5 feet bgs.		80.00 122.41
90	120	90.00 - 91.00 Massive quartz vein with closed fractures.		91.00
		91.00 - 95.00 Biotite-quartz GNEISS with quartz veins. Massive matrix.		117.41
95	115	95.00 - 105.00 Quartz-biotite GNEISS with moderately dipping foliation. Biotite-rich zone from approximately 100 to 101 feet bgs. Near-vertical fractures observed from 101 to 105 feet bgs. Chalcopyrite or pyrite present in biotite partings.		95.00
100	110			
105	105	Boring completed at 105.00 ft		107.41
110	100			
115				

ATT / REC

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS / COMMENTS

WELL CASING
Interval: -2.5 to 85 ft bgs
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 3x3x0.5-foot Concrete Pad
Protective Casing: 4-inch diameter Steel

ANNULUS SEAL
Interval: 19 to 80 ft bgs
Type: Bentonite Chips

FILTER PACK SEAL
Interval: 19 to 80 ft bgs
Type: Bentonite Chips

FILTER PACK
Interval: 80 to 95 ft bgs
Type: #2 Driller Services Sand

WELL SCREEN
Interval: 85 to 95 ft bgs
Material: PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: Flush-bottom

DRILLING METHODS
Type: Rotosonic

LOG SCALE: 1 in = 14.44 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Rick Tustin

PREPARED: H. Elkinton
REVIEWED: M. Williams
DATE: 3/20/2019

GOLDER

BOREHOLE RECORD BREMO_ACM_GINT_LOGS.GPJ ENV_BORING.GDT 01/30/19

RECORD OF BOREHOLE MW-23

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/21/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,114.49
EASTING: 11,546,871.64
GS ELEVATION: 233.78 ft
TOC ELEVATION: 236.80

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 1.00 FILL - (CL) SILTY CLAY & GRAVEL; some roots; some brick fragments; orange-red; w<PL; firm.	CL		232.78		
		1.00 - 2.00 FILL - (CL) silty, sandy, CLAY & GRAVEL; some coal fragments; slate gravel up to 2-inch diameter; moist, loose.	CL		1.00 231.78		
		2.00 - 10.00 FILL - (ML) CLAYEY SILT; some fine to coarse sand; some gravel (slate and quartzite); brown with some light grey color in matrix; w<PL, very stiff.	ML		2.00		
	230						
5							
	225						
10					223.78		
		10.00 - 12.00 FILL - (CL) SILTY CLAY; some organics (wood fibers); some gravel (slate); some coal fragments; trace coarse sand; potential ash mixed in with matrix; w<PL; soft.	CL		10.00 221.78		
		12.00 - 21.00 FILL - (CL) CLAY; some silt (possibly ash); trace fine sand; trace roots; light brown-orange with light grey in matrix and dark grey intervals (possible ash) 1 to 2 cm thick; w<PL, firm.	CL		12.00	High-Solids Bentonite	
	220						
15							
	215						
20					212.78		
		21.00 - 22.50 FILL - (ML) SILT (Possible Ash); dark grey; moist; loose. Interval of fine sand; light brown, with some light grey; 1-inch thick at base of interval.	ML		21.00 211.28		
		22.50 - 30.00 FILL - (CL) SILTY CLAY; trace medium sand; trace roots; light brown with light grey material in matrix; w~PL; stiff.	CL		22.50		
	210						
25							

Log continued on next page

WELL CASING
Interval: 0.0-42.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x3'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 0.0-35.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 35.0-38.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 38.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 42.0-52.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 52.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-23

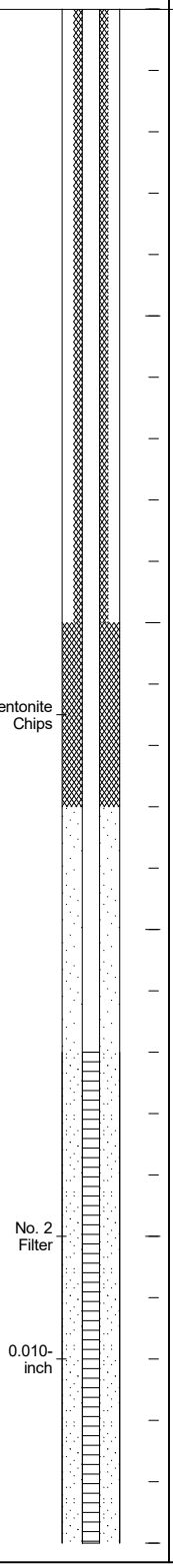
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/21/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,114.49
EASTING: 11,546,871.64
GS ELEVATION: 233.78 ft
TOC ELEVATION: 236.80

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
25		22.50 - 30.00 FILL - (CL) SILTY CLAY; trace medium sand; trace roots; light brown with light grey material in matrix; w~PL; stiff. *(Continued)*	CL		
	205				
30					203.78
		30.00 - 31.00 FILL - (CL) sandy SILTY CLAY & GRAVEL; some sub-rounded quartzite cobbles up to 4-inch diameter; posible ash material in matrix; brown to grey; wet; very loose.	CL		30.00 202.78
		31.00 - 40.00 (CL) SILTY CLAY; light orange-brown; w~PL; stiff.	CL		31.00
	200				
35					
	195				
40					193.78
		40.00 - 43.00 quartzofeldspathic GNEISS; heavily weathered and fractured, quartz-filled fractures; sodium plagioclase fledspar banding; secondary mineralization (calcite and chlorite); some evidence of drag folds and microfaulds.			40.00 190.78
		43.00 - 49.00 quartzofeldspathic GNEISS; competent; few high angle fractures; some secondary mineralization (chlorite) and solution voids.			43.00
	190				
45					
	185				184.78
		49.00 - 51.00 quartzofeldspathic GNEISS; heavily weathered and fractured; sodium plagioclase feldspar banding; some quartz in fractures.			49.00
50		Log continued on next page			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-42.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x3'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 0.0-35.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 35.0-38.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 38.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 42.0-52.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 52.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-23

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 55.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/21/17
DATE COMPLETED: 9/22/17

NORTHING: 3,780,114.49
EASTING: 11,546,871.64
GS ELEVATION: 233.78 ft
TOC ELEVATION: 236.80

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		49.00 - 51.00 quartzofeldspathic GNEISS; heavily weathered and fractured; sodium plagioclase feldspar banding; some quartz in fractures. *(Continued)*			182.78 51.00		
	180					No. 2 Filter Sand	
55		Boring completed at 55.00 ft					
	175						
60							
	170						
65							
	165						
70							
	160						
75							

WELL CASING
Interval: 0.0-42.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x3'
Protective Casing: 4-inch square stickup - aluminum

ANNULUS SEAL
Interval: 0.0-35.0 feet BGS
Type: Bentonite

FILTER PACK SEAL
Interval: 35.0-38.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 38.0-55.0 feet BGS
Type: No. 2

WELL SCREEN
Interval: 42.0-52.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 52.0 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-23D

SHEET 1 of 1

PROJECT: ACM Investigation
PROJECT NUMBER: 1520-347
DRILLED DEPTH: 140.00 ft
DRILL METHOD: Rotosonic

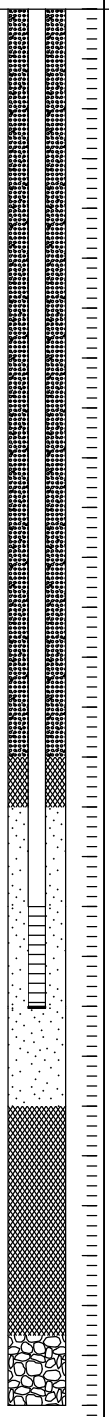
DRILL RIG: Spider 08
DATE STARTED: 11/28/18
DATE COMPLETED: 12/6/18

NORTHING: 3,780,088.23
EASTING: 11,546,900.38
GS ELEVATION: 233.52 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0	230	0.00 - 2.00 Organic brown soil with vegetation. Fill.		231.52
5		2.00 - 8.00 Brown-grey moist clayey fine SILT and SAND. Fill.	SM	2.00 225.52
10	225	8.00 - 8.25 Black organic layer. No odor.	SP	223.52
15	220	8.25 - 10.00 Grey SAND with rock fragments. Fragment of steel guard-rail observed in returns. Fill	CH	10.00 218.52
20	215	10.00 - 15.00 Brown-grey sandy CLAY with rock fragments and black mottling. No odor. Moist. Fill.	CL CH	216.52 17.00 212.52
25	210	15.00 - 17.00 Brown SILTY CLAY with rounded and angular rock fragments, organic matter (vegetation), and black mottling. Wet. Fill.	SP ML	21.00 208.52 25.00 203.52
30	205	17.00 - 21.00 Loose, wet, black organic CLAY with rock fragments and organic matter (vegetation). Earthy odor. Fill.	CH	30.00
35	200	21.00 - 25.00 Brown-grey SAND and rock fragments. Dry. Fill.		
40	195	25.00 - 30.00 Brown organic CLAYEY SILT and fine sand with rock fragments, roots, and coal fragments. Black mottling. Saturatation at approximtaely 27 feet bgs. Fill.		193.52 40.00
45	190	30.00 - 40.00 Brown to red-orange CLAY with trace fine sand and grey mottling. Moist. Earthy odor.		
50	185	40.00 - 50.00 Micaceous banded GNEISS with epidote-filled fractures at approximately 49 feet bgs. Near-vertical fractures below 48 feet bgs. Moderately dipping foliation.		183.52 50.00
55	180	50.00 - 60.00 Biotite GNEISS with increasingly steeply dipping foliation with depth. Quartz-muscovite pegmatite with epidote veins at approximately 52 feet bgs.		
60	175	60.00 - 67.00 Biotite GNEISS with steeply dipping micaceous foliation and filled fractures. Quartz vein steeply cross-cutting core recovery at approximately 66 feet bgs.		173.52 60.00 166.52
65	170	67.00 - 74.00 Biotite-quartz GNEISS with epidote-filled fractures. Pyrite and balck mineral observed on fracture at approximately 70.5 feet bgs.		67.00
70	165			159.52
75	160	74.00 - 80.00 Fine-grained to coarse-grained biotite-quartz GNEISS with strong foliation and steeply dipping epidote-filled fractures. Gneissic banding from 78 to 80 feet bgs.		74.00 153.52
80	155	80.00 - 90.00 Very hard, fresh, grey medium to fine grained biotite-quartz GNEISS. Closed high-angle fractures observed.		80.00
85	150			
90	145	90.00 - 100.00 Very hard, fresh, medium to coarse grained biotite-quartz GNEISS. Breaks along high-angle fractures, possible fracture zone at approximately 95', no staining observed.		143.52 90.00
95	140			
100	135	100.00 - 110.00 Very hard, fresh, medium to coarse grained biotite-quartz GNEISS.		133.52 100.00
105	130			
110	125	110.00 - 120.00 Biotite-quartz GNEISS with steeply dipping mineral (biotite) orientation. Steeply dipping epidote-filled fractures at 115 feet bgs.		123.52 110.00
115	120			
120	115	120.00 - 130.00 Quartz-biotite GNEISS with steeply dipping biotite structure. No fractures observed.		113.52 120.00
125	110			
130	105	130.00 - 140.00 Biotite-quartz GNEISS. Fractures at approximately 132 and 135 feet bgs. Biotite-rich zone from 135 to 136 feet bgs.		103.52 130.00
135	100			
140	95	Boring completed at 140.00 ft		93.52
145	90			
150	85			
	80			

ATT / REC

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS / COMMENTS

WELL CASING
Interval: -2.5 to 90 ft bgs
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 3x3x0.5-foot Concrete Pad
Protective Casing: 4-inch diameter Steel

ANNULUS SEAL
Interval: 0 to 75 ft bgs
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 75 to 80 ft bgs
Type: Bentonite Chips

FILTER PACK
Interval: 80 to 110 ft bgs
Type: #2 Driller Services Sand

WELL SCREEN
Interval: 90 to 100 ft bgs
Material: PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: Flush-bottom

DRILLING METHODS
Type: Rotosonic

LOG SCALE: 1 in = 19.25 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Rick Tustin
PREPARED: H. Elkinton
REVIEWED:
DATE:

GOLDER

BOREHOLE RECORD BREMO_ACM_GINT_LOGS.GPJ ENV_BORING.GDT 01/30/19

RECORD OF BOREHOLE MW-31

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 33.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/24/17
DATE COMPLETED: 9/24/17

NORTHING: 3,782,152.90
EASTING: 11,543,414.47
GS ELEVATION: 216.89 ft
TOC ELEVATION: 218.87

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 1.00 TOPSOIL - (CL) SILTY CLAY; some roots; brown; w<PL; firm.	CL		215.89 1.00		**WELL CASING** Interval: 0.0-23.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
	215	1.00 - 20.00 FILL - (CL) SILTY CLAY; some roots; brown; micaceous; w<PL; firm.					**WELL COMPLETION** Pad: 3'x4' Protective Casing: Floodplain wellhead and cover
5							**ANNULUS SEAL** Interval: 0.0-18.0 feet BGS Type: Bentonite
	210					High-Solids Bentonite	**FILTER PACK SEAL** Interval: 15.0-18.0 feet BGS Type: Bentonite Chips
10			CL				**FILTER PACK** Interval: 18.0-33.5 feet BGS Type: No. 2
	205						**WELL SCREEN** Interval: 23.0-33.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 33.0 feet BGS
15							
	200					Bentonite Chips	
20		20.00 - 20.50 (GP) COBBLES; quartzite; up to 4-inch diameter and sub-rounded.	GW		196.89 20.00 196.39		
		20.50 - 21.00 Horneblende GNEISS; weathered and fractured; dark grey to black; sodium plagioclase banding; microcrystalline; iron staining; some pyrite.			20.50 195.89 21.00		
	195	21.00 - 33.50 Horneblende GNEISS; weathered and fractured; dark grey to black; sodium plagioclase banding; some biotite/amphibole schist banding, microcrystalline; some garnet (pink) porphyroblasts; iron staining; some pyrite.					
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege
PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

RECORD OF BOREHOLE MW-31

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 33.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8150LS
DATE STARTED: 9/24/17
DATE COMPLETED: 9/24/17

NORTHING: 3,782,152.90
EASTING: 11,543,414.47
GS ELEVATION: 216.89 ft
TOC ELEVATION: 218.87

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		21.00 - 33.50 Horneblende GNEISS; weathered and fractured; dark grey to black; sodium plagioclase banding; some biotite/amphibole schist banding, microcrystalline; some garnet (pink) porphyroblasts; iron staining; some pyrite. *(Continued)*				No. 2 Filter	**WELL CASING** Interval: 0.0-23.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
	190						**WELL COMPLETION** Pad: 3'x4' Protective Casing: Floodplain wellhead and cover
						0.010-inch	
30							**ANNULUS SEAL** Interval: 0.0-18.0 feet BGS Type: Bentonite
	185						**FILTER PACK SEAL** Interval: 15.0-18.0 feet BGS Type: Bentonite Chips
							FILTER PACK Interval: 18.0-33.5 feet BGS Type: No. 2
					183.39	No. 2 Filter	**WELL SCREEN** Interval: 23.0-33.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 33.0 feet BGS
		Boring completed at 33.00 ft			33.50		
35							
	180						
40							
	175						
45							
	170						
50							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: GEOlogic Exploration
DRILLER: A. Gloege

PREPARED: Craig LaCosse
REVIEWED:
DATE:

Golder Associates

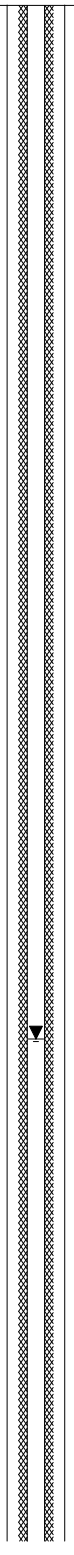
RECORD OF BOREHOLE MW-32D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 113.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 11/9/16
DATE COMPLETED: 11/11/16

NORTHING: 3,782,887.06
EASTING: 11,542,307.79
GS ELEVATION: 219.70 ft
TOC ELEVATION: 222.89

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
0		0.00 - 1.00 Topsoil; (CL) SILTY CLAY; some fine sand; dark brown; w~PL; soft.	CL		218.70					
		1.00 - 3.50 (CL) SILTY CLAY; trace fine sand; orange-red; w~PL; soft; micaceous.	CL		1.00 216.20	1	DRILL	N/A		4.00 / 4.00
		3.50 - 6.00 (CL) SILTY CLAY; trace fine sand; orange-red; w>PL; soft; micaceous.	CL		3.50 213.70	2	SS	WOH/24	WOH/24	0.30 / 2.00
5	215	6.00 - 10.00 (CL) SILTY CLAY; gray with some light brown/orange mottling in matrix; w>PL; soft.	CL		6.00 209.70	3	SS	1 -2 -2 -3	4	2.00 / 2.00
						4	SS	2 -2 -3 -3	5	0.80 / 2.00
10	210	10.00 - 12.00 (CL) SILTY CLAY; dark brown; w>PL; soft; top 12" saturated.	CL		10.00 207.70	5	SS	2 -4 -4 -5	8	1.80 / 2.00
		12.00 - 14.00 (CL) CLAY; brownish gray - dark gray; trace mica; massive; stiff; wet.	CL		12.00 205.70	6	SS	3 -5 -5 -8	10	1.75 / 2.00
	205	14.00 - 15.00 (CL) CLAY; brown; wet; w>PL.	CL		14.00 204.70	7	SS	2 -2 -12 -46	14	2.00 / 2.00
15		15.00 - 15.50 (ML) clayey SILT; some fine sand; trace small gravel; brown; wet; w<PL.	ML		15.00 204.20					
		15.50 - 17.00 (CL) CLAY; brown; gray brown; dense; w>PL; wet.	CL		15.50 202.70	8	SS	6 -10 -9 -50/4	19	0.80 / 2.00
		17.00 - 18.00 Cobbles; brown clay to yellowish-brown sand matrix; broken rounded rock up to 1-inch in diameter; wet.			17.00 201.70					
	200	18.00 - 20.00 Cobbles with clayey sand matrix; coarse sand; brown to yellowish brown; rounded edges; wet.			18.00 199.70	9	SS	4 -50/3	50/3	0.50 / 2.00
20		20.00 - 22.00 (SM) silty SAND; some rounded gravel/ quartz pebbles up to 1-inch in diameter light brown; compact.	SM		20.00 197.70	10	SS	40 -16 -16 -50/4	32	1.20 / 2.00
		22.00 - 24.00 Weathered SCHIST with slate; dark gray; highly weathered; dry; micaceous.			22.00 195.70	11	SS	50/0	50/0	0.00 / 0.00
	195	24.00 - 26.00 Weathered Arvonia SLATE/PHYLLITE; light gray; dry; micaceous.			24.00					
25		Log continued on next page								



WELL CASING
Interval: 0.0-95.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x4'
Protective Casing: Floodplain wellhead and cover

ANNULUS SEAL
Interval: 0.0-88.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 88.0-90.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 90.0-113.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 95.0-105.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 113.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-32D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 113.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 11/9/16
DATE COMPLETED: 11/11/16

NORTHING: 3,782,887.06
EASTING: 11,542,307.79
GS ELEVATION: 219.70 ft
TOC ELEVATION: 222.89

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		24.00 - 26.00 Weathered Arvonia SLATE/PHYLLITE; light gray; dry; micaceous. *(Continued)*			193.70							
		26.00 - 113.00 Arvonia SLATE/PHYLLITE; gray to dark gray; dry; micaceous.			26.00							
30	190											
35	185											
40	180											
45	175										Bentonite Grout	
50	170											

Log continued on next page

WELL CASING
Interval: 0.0-95.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x4'
Protective Casing: Floodplain wellhead and cover

ANNULUS SEAL
Interval: 0.0-88.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 88.0-90.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 90.0-113.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 95.0-105.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 113.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-32D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 113.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 11/9/16
DATE COMPLETED: 11/11/16

NORTHING: 3,782,887.06
EASTING: 11,542,307.79
GS ELEVATION: 219.70 ft
TOC ELEVATION: 222.89

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		26.00 - 113.00 Arvonia SLATE/PHYLLITE; gray to dark gray; dry; micaceous. *(Continued)*										
55	165											
60	160											
65	155											
70	150											
75	145											

Log continued on next page

WELL CASING
Interval: 0.0-95.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x4'
Protective Casing: Floodplain wellhead and cover

ANNULUS SEAL
Interval: 0.0-88.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 88.0-90.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 90.0-113.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 95.0-105.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 113.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-32D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 113.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 11/9/16
DATE COMPLETED: 11/11/16

NORTHING: 3,782,887.06
EASTING: 11,542,307.79
GS ELEVATION: 219.70 ft
TOC ELEVATION: 222.89

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		26.00 - 113.00 Arvonia SLATE/PHYLLITE; gray to dark gray; dry; micaceous. *(Continued)*										
80	140											
85	135											
90	130										Bentonite Chips	
95	125											
100	120										No. 2 Filter Sand 0.010-	

Log continued on next page

WELL CASING
Interval: 0.0-95.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x4'
Protective Casing: Floodplain wellhead and cover

ANNULUS SEAL
Interval: 0.0-88.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 88.0-90.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 90.0-113.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 95.0-105.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 113.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-32D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 113.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 11/9/16
DATE COMPLETED: 11/11/16

NORTHING: 3,782,887.06
EASTING: 11,542,307.79
GS ELEVATION: 219.70 ft
TOC ELEVATION: 222.89

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100	115	26.00 - 113.00 Arvonia SLATE/PHYLLITE; gray to dark gray; dry; micaceous. *(Continued)*									inch	**WELL CASING** Interval: 0.0-95.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 3'x4' Protective Casing: Floodplain wellhead and cover **ANNULUS SEAL** Interval: 0.0-88.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 88.0-90.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 90.0-113.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 95.0-105.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 113.0 feet BGS
105	110										No. 2 Filter Sand	
110	105				106.70							
		Boring completed at 113.00 ft										
115	100											
120	95											
125												

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-32S

SHEET 1 of 1

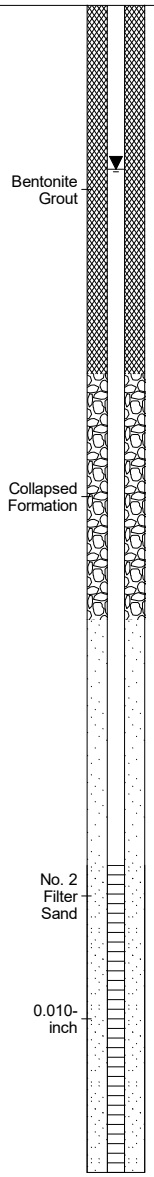
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 19.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 11/8/16
DATE COMPLETED: 11/9/16

NORTHING: 3,782,886.56
EASTING: 11,542,303.24
GS ELEVATION: 218.90 ft
TOC ELEVATION: 222.04

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
0		0.00 - 1.00 Topsoil; (CL) SILTY CLAY; some fine sand; dark brown; w~PL; soft.	CL		217.90					
		1.00 - 3.50 (CL) SILTY CLAY; trace fine sand; orange-red; w~PL; soft; micaceous.	CL		1.00 215.40	1	DRILL	N/A		4.00 / 4.00
	215	3.50 - 6.00 (CL) SILTY CLAY; trace fine sand; orange-red; w>PL; soft; micaceous.	CL		3.50 212.90	2	SS	WOH/24	WOH/24	0.30 / 2.00
5		6.00 - 10.00 (CL) SILTY CLAY; gray with some light brown/orange mottling in matrix; w>PL; soft.	CL		6.00 208.90	3	SS	1 -2 -2 -3	4	2.00 / 2.00
	210					4	SS	2 -2 -3 -3	5	0.80 / 2.00
10		10.00 - 12.00 (CL) SILTY CLAY; dark brown; w>PL; soft; top 12" saturated.	CL		10.00 206.90	5	SS	2 -4 -4 -5	8	1.80 / 2.00
		12.00 - 14.00 (CL) CLAY; brownish gray - dark gray; trace mica; massive; stiff; wet.	CL		12.00 204.90	6	SS	3 -5 -5 -8	10	1.75 / 2.00
	205	14.00 - 15.00 (CL) CLAY; brown; wet; w>PL.	CL		14.00 203.90					
15		15.00 - 15.50 (ML) clayey SILT; some fine sand; trace small gravel; brown; wet; w<PL.	ML		15.00 203.40	7	SS	2 -2 -12 -46	14	2.00 / 2.00
		15.50 - 17.00 (CL) CLAY; brown - gray brown; dense; w>PL; wet.	CL		15.50 201.90	8	SS	6 -10 -9 -50/4	19	0.80 / 2.00
		17.00 - 18.00 Cobbles; brown clay to yellowish-brown sand matrix; broken rounded rock up to 1-inch; wet.			17.00 200.90					
	200	18.00 - 19.00 Cobbles with clayey sand matrix; coarse sand; brown to yellowish brown; rounded edges; wet.			18.00 199.90					
20		Boring completed at 19.00 ft								
	195									
25										

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-14.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 3'x4'
Protective Casing: Floodplain wellhead and cover

ANNULUS SEAL
Interval: 0.0-6.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 0.0-6.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 10.0-19.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 14.0-19.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 19.0 feet feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 10/10/17

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 1.00 (CL) silty CLAY; dark brown; highly organic; moderate plasticilty; wet, soft.	CL		342.50		**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		1.00 - 5.00 (ML) SILT. bright reddish orange; highly micaceous; non-cohesive; moist, soft.	ML		1.00 338.50		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
5	340	5.00 - 7.00 (CL-ML) clayey SILT; dark brown - dull reddish orange; numerous depleted organics; moist, soft.	CL-ML		5.00 336.50		**ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout
		7.00 - 8.00 (ML) clayey SILT. dark reddish brown; some organics; low - no plasticity; dry, soft.	ML		7.00 335.50		**FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips
	335	8.00 - 13.00 (ML) clayey SILT; bright reddish orange; dry, soft.	ML		8.00 330.50		**FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand
10							**WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
	330	13.00 - 25.00 (ML) clayey SILT. tan; low-no plasticity; dry, soft.	ML		13.00		
15							
	325						
20							
	320						
25					318.50		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		25.00 - 27.00 (ML) SILT; very thinly bedded (0.80") dull white and bright tan; biotite flakes; dry, soft.	ML		25.00 316.50		**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		27.00 - 37.00 (ML) silt, trace sand; fine, quartz; dull tan; dry - moist, soft.			27.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	315						**ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout
30							**FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips
			ML				**FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand
	310						**WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
35					306.50		
		37.00 - 44.00 (ML) SILT and severely weathered phyllite; dull - bright tan; dry, soft.			37.00		
	305						
40			ML				
	300				299.50		
		44.00 - 46.00 GNEISS; severely weathered. silt matrix; dark gray - bright orange bedding.			44.00 297.50		
45		46.00 - 51.00 quartzofeldspathic - biotite GNEISS; highly weathered; soft.			46.00		
	295						
50		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		46.00 - 51.00 quartzofeldspathic - biotite GNEISS; highly weathered; soft. *(Continued)*			292.50		**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		51.00 - 55.00 (ML) SILT, some gravel; coarse, quartz; dark brown; moist.	ML		51.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	290						**ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout
55					288.50		**FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips
		55.00 - 67.00 quartzofeldspathic - biotite GNEISS; severely weathered; soft.			55.00		**FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand
	285						**WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
60						Bentonite Grout	
	280						
65					276.50		
		67.00 - 71.00 quartzofeldspathic - biotite GNEISS; moderately weathered; hard.			67.00		
	275						
70					272.50		
		71.00 - 74.00 No recovery			71.00		
	270				269.50		
		74.00 - 76.25 quartzofeldspathic - biotite GNEISS; moderately weathered; hard.			74.00		
75		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		74.00 - 76.25 quartzofeldspathic - biotite GNEISS; moderately weathered; hard. *(Continued)*			267.25		**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		76.25 - 77.00 quartzofeldspathic - biotite GNEISS; moderately weathered, orange stained fractures; hard.			76.25 266.50		
		77.00 - 81.00 quartzofeldspathic - biotite GNEISS; moderately weathered, orange staining penetrates rock mass; hard.			77.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	265						**ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout
80					262.50		**FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips
		81.00 - 83.00 No recovery			81.00 260.50		**FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand
	260	83.00 - 87.00 quartzofeldspathic - biotite GNEISS; moderately weathered, orange staining penetrates rock mass, closed joints; hard.			83.00		**WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
85					256.50		
		87.00 - 88.90 quartzofeldspathic - biotite GNEISS; moderately weathered, orange staining penetrates rock mass; hard - very hard.			87.00 254.60		
	255	88.90 - 89.00 quartzofeldspathic - biotite GNEISS; moderately weathered, orange staining penetrates rock mass, quartz filled vugs; hard - very hard.			89.00		
90		89.00 - 91.00 No recovery			252.50		
		91.00 - 97.00 quartzofeldspathic - biotite GNEISS; moderately weathered, orange staining penetrates rock mass; hard - very hard.			91.00		
	250						
95					246.50		
		97.00 - 97.50 QUARTZ; milky white.			97.00 246.00		
		97.50 - 113.00 quartzofeldspathic - biotite GNEISS; unweathered; very hard.			97.50		
	245						
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		97.50 - 113.00 quartzofeldspathic - biotite GNEISS; unweathered; very hard. *(Continued)*					**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
105	240						
110	235						
115	230	113.00 - 113.50 quartzofeldspathic - biotite SCHIST; unweathered; very hard. 113.50 - 124.50 quartzofeldspathic - biotite SCHIST; unweathered; very hard.			230.50 113.00 230.00 113.50		
120	225						
125	220	Log continued on next page			219.00 124.50		

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 2/22/17

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		124.50 - 129.00 quartzofeldspathic - biotite GNEISS; trace garnet, trace pyrite; slightly weathered, numerous tight - very tight joints; hard. *(Continued)*				Bentonite Chips	**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
	215				214.50		
		129.00 - 144.00 quartzofeldspathic - biotite GNEISS; unweathered; very hard.			129.00		
130							
	210						
135							
	205						
140						No. 2 Filter Sand	
						0.010-inch Slot Screen	
	200				199.50		
		144.00 - 154.00 quartzofeldspathic - biotite SCHIST; slightly weathered, some orange staining, core pulverized to gravel; hard- moderately hard.			144.00		
145							
	195						
150		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-24

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/17/16
DATE COMPLETED: 10/19/16

NORTHING: 3,780,807.34
EASTING: 11,547,158.73
GS ELEVATION: 343.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
150		144.00 - 154.00 quartzofeldspathic - biotite SCHIST; slightly weathered, some orange staining, core pulverized to gravel; hard- moderately hard. *(Continued)*					**WELL CASING** Interval: 0.0-133.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	190				189.50	No. 2 Filter Sand	**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
		Boring completed at 154.00 ft					**ANNULUS SEAL** Interval: 0.0-124.0 feet BGS Type: Bentonite Grout
155							**FILTER PACK SEAL** Interval: 124.0-127.3 feet BGS Type: Bentonite Chips
							FILTER PACK Interval: 127.3-154.0 feet BGS Type: No. 2 Filter Sand
	185						**WELL SCREEN** Interval: 133.0-153.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 153.0 feet BGS
160							
	180						
165							
	175						
170							
	170						
175							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-28

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 67.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 9/20/16
DATE COMPLETED: 9/22/16

NORTHING: 3,782,659.57
EASTING: 11,546,966.51
GS ELEVATION: 326.60 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.50 TOPSOIL; silty CLAYEY SAND; fine; brown; leaf litter; dry; loose.	SC-SM		326.10 0.50		**WELL CASING** Interval: 0.0-57.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
	325	0.50 - 6.50 (CL) silty SANDY CLAY; fine; light red-orange; some vertical relict structures; w <PL; soft.	CL				**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4"
5							**ANNULUS SEAL** Interval: 0.0-50.0 feet BGS Type: Bentonite Grout
	320				320.10		**FILTER PACK SEAL** Interval: 50.0-52.0 feet BGS Type: Bentonite Chips
		6.50 - 13.00 (SM) SILTY SAND; fine; some clay; some vertical relict structures; tan to light orange; dry; loose.	SM		6.50		**FILTER PACK** Interval: 52.0-67.0 feet BGS Type: No. 2 Filter Sand
10							**WELL SCREEN** Interval: 57.0-67.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 67.0 feet BGS
	315				313.60		
		13.00 - 17.50 (SM) SILTY SAND; fine; some clay; trace dark brown to black laminations in matrix; some relict structure of weathered material with ~45 degree layering that is light gray in color; tan to light orange; dry; loose.	SM		13.00		
15							
	310				309.10		
		17.50 - 28.50 (SC) silty clayey SAND; fine; tan to light orange; some black laminations; relict structure; dry; loose.	SC		17.50		
20							
	305						
25		Log continued on next page				Bentonite	

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-28

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 67.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 9/20/16
DATE COMPLETED: 9/22/16

NORTHING: 3,782,659.57
EASTING: 11,546,966.51
GS ELEVATION: 326.60 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES
25		17.50 - 28.50 (SC) silty clayey SAND; fine; tan to light orange; some black laminations; relict structure; dry; loose. *(Continued)*	SC		298.10	Grout
	300					
		28.50 - 32.00 (SC) silty CLAYEY SAND; fine; tan/white to light orange; some black laminations/relict structures; moist; soft.	SC		28.50 294.60	
30	295					
		32.00 - 35.00 (SC) silty CLAYEY SAND; fine; white to light gray/tan; some black laminations/relict structure; moist; compact.	SC		32.00 291.60	
35		35.00 - 36.50 (SP) SAND; fine; some clay; some silt; brown; wet; compact; micaceous.	SP		35.00 290.10	
	290	36.50 - 39.00 (SC) CLAYEY SAND; fine; some silt; tan to light brown; wet; compact.	SC		36.50 287.60	
		39.00 - 45.00 (CL) sandy SILTY CLAY; fine; tan to light brown; w~PL; firm.	CL		39.00 281.60	
40	285					
45		45.00 - 50.00 (CL) SILTY CLAY; some fine sand; light brown to white to light gray; micaceous; relict structure (weathered in-place gneissic rock); w~PL; stiff.	CL		45.00 276.60	
	280					
50		Log continued on next page				

WELL CASING
Interval: 0.0-57.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-50.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 50.0-52.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 52.0-67.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 57.0-67.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 67.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-28

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 67.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 9/20/16
DATE COMPLETED: 9/22/16

NORTHING: 3,782,659.57
EASTING: 11,546,966.51
GS ELEVATION: 326.60 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		50.00 - 55.00 (CL) sandy SILTY CLAY; fine; light brown to tan to white/gray; micaceous; relict structure (weathered in-place gneissic rock); w~PL; very stiff.	CL		50.00	Bentonite Chips	**WELL CASING** Interval: 0.0-57.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-50.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 50.0-52.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 52.0-67.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 57.0-67.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 67.0 feet BGS
55	275				271.60		
		55.00 - 67.00 (CL) SILTY CLAY; some fine sand; light brown to tan to gray; micaceous; relict structure (weathered in-place gneissic rock), w~PL; stiff.			55.00		
60	270					No. 2 Filter Sand	
			CL				
65	265					0.010-inch	
	260				259.60		
		Boring completed at 67.00 ft					
70	255						
75							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 2/22/17

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.50 (CL) silty CLAY; dark brown; numerous roots; moist - wet, soft.	CL		333.50		**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 111.0-116.5 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
		0.50 - 1.50 (CL) silty CLAY; bright orange; moist, soft.	CL		0.50 332.50		
		1.50 - 3.75 (CL) silty CLAY; bright orange; dry, soft.	CL		1.50 330.25		
	330	3.75 - 4.00 (CL) silty CLAY; reddish orange; moist, soft.	CL		4.00		
		4.00 - 5.00 (CL-ML) silty CLAY; dull light brown; dry - moist, soft.	CL-ML		329.00		
5		5.00 - 6.00 (CL-ML) silty CLAY; dull light brown; moist, soft.	CL-ML		5.00 328.00		
		6.00 - 9.00 (CL) silty CLAY; brown; moist, soft.	CL		6.00 325.00		
	325	9.00 - 15.00 (CL-ML) silty CLAY; brown; moist - dry, soft.	CL-ML		9.00 319.00		
10							
	320						
15		15.00 - 15.75 (CH) CLAY; dark reddish brown; moist, firm.	CH		15.00 318.25		
		15.75 - 24.00 (ML) SILT; brown; moist, soft.	ML		15.75		
	315						
20							
	310				310.00		
		24.00 - 26.00 (ML) SILT; bright reddish orange; highly micaceous; dry, soft.	ML		24.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		24.00 - 26.00 (ML) SILT; bright reddish orange; highly micaceous; dry, soft. *(Continued)*	ML		308.00		**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		26.00 - 29.00 (ML) clayey SILT; dark tan; moist - dry, soft.	ML		26.00 305.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	305	29.00 - 29.50 (ML) clayey SILT; dark tan; large cobbles of diabase, heavily weathered, massive; moist - dry, soft.	ML		29.00 304.50		**ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout
30		29.50 - 35.00 (ML) clayey SILT; dark tan; moist - dry, soft.	ML		29.50		**FILTER PACK SEAL** Interval: 111.0-116.5 feet BGS Type: Bentonite Chips
	300				299.00		**FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand
35		35.00 - 37.00 (ML) SILT and severly weathered schist; dark brown - light tan; dry, soft.	ML		35.00 297.00		**WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
	295	37.00 - 57.00 PHYLLITE; severly weathered, orange staining; silt matrix; tan - brown; dry.			37.00	6-inch Carbon Steel Casing	
40							
	290						
45							
	285						
50		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		37.00 - 57.00 PHYLLITE; severly weathered, orange staining; silt matrix; tan - brown; dry. *(Continued)*					**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	280						**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
55						Bentonite Grout	**ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout
							FILTER PACK SEAL Interval: 111.0-116.5 feet BGS Type: Bentonite Chips
					277.00		**FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand
		57.00 - 67.00 hornfelsic PHYLLITE, quartz banding; weakly foliated; heavily weathered; orange staining; soft.			57.00		**WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
	275						
60							
	270						
65					267.00		
		67.00 - 69.00 quartzofeldspathic - biotite SCHIST; heavily weathered, orange staining along fracture planes; soft; vertical foliation.			67.00		
	265				265.00		
		69.00 - 72.00 quartzofeldspathic - biotite SCHIST; garnet; heavily weathered, orange staining along fracture planes; soft; vertical foliation.			69.00		
70							
					262.00		
		72.00 - 75.00 garnetiferous biotite SCHIST; highly weathered; green - black; garnet phenocrysts 0.5 - 2.0 mm; soft.			72.00		
	260						
75					259.00		
		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		75.00 - 90.00 garnetiferous biotite SCHIST; unweathered; green - black; garnet phenocrysts 0.5 - 2.0 mm; soft.			75.00		**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 111.0-116.5 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
80	255						
85	250						
90	245				244.00 90.00		
95	240	90.00 - 107.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard.					
100	235						

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		90.00 - 107.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard. *(Continued)*					**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	230						**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
105							**ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout
							FILTER PACK SEAL Interval: 111.0-116.5 feet BGS Type: Bentonite Chips
					227.00		**FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand
		107.00 - 108.00 Fracture; water bearing.			107.00 226.00		**WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
		108.00 - 116.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard.			108.00		
	225						
110							
						Bentonite Chips	
	220						
115							
					218.00		
		116.00 - 131.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard; extensive water producing fractures.			116.00		
	215						
120							
	210					No. 2 Filter Sand	
125		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-33

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 131.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/21/16
DATE COMPLETED: 10/21/16

NORTHING: 3,781,521.96
EASTING: 11,546,369.11
GS ELEVATION: 334.00 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		116.00 - 131.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard; extensive water producing fractures. *(Continued)*				0.010-inch Slot	**WELL CASING** Interval: 0-121.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.00-111.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 111.0-116.5 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.5-131.5 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 121.5-131.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 131.5 feet BGS
130	205				203.00		
		Boring completed at 131.50 ft			131.00		
135	200						
140	195						
145	190						
150	185						

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	335	0.00 - 0.50 (CL) silty CLAY, trace sand; dark brown; highly organic, numerous roots; moist - wet, firm.	CL		334.70		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
		0.50 - 0.75 (CL) gravelly CLAY; fine, well sorted, angular; dark gray; road material; wet, compact.	CL		0.75		
		0.75 - 4.00 (CL) silty CLAY, trace sand; reddish tan - orange; berm material; moist, soft.	CL		331.20		
		4.00 - 5.00 (CL) silty CLAY; bright orange; berm material; highly micaceous; moist - dry, soft.	CL		4.00 330.20		
5	330	5.00 - 6.00 QUARTZ; gravel, coarse, angular; white; berm material.			5.00 329.20		
		6.00 - 7.00 (CL) silty CLAY; bright orange; berm material; highly micaceous; moist - dry, soft.	CL		6.00 328.20		
		7.00 - 7.50 (ML) clayey SILT; dull tan; berm material; moist - dry, soft.	ML		7.00 327.70		
		7.50 - 8.00 (CL) silty sandy CLAY; fine, well sorted; dull bluish gray; berm material; cohesive; moist, firm.	CL		7.50 327.20		
		8.00 - 10.00 (CL) silt CLAY; bright tan; berm material; moist, soft.	CL		8.00 325.20		
10	325	10.00 - 17.00 (CL) sand silty CLAY; fine, well sorted; orange - bright tan; berm material; highly micaceous; moist, soft.	CL		10.00 318.20		
15	320	17.00 - 19.50 (CL) silty CLAY; brown; highly micaceous; berm material; moist, soft.	CL		17.00 315.70		
20	315	19.50 - 24.00 (CL) sandy silty CLAY; fine, well sorted; brown; highly micaceous; moist, soft.	CL		19.50 311.20		
		24.00 - 26.00 (CL) sandy silty CLAY; fine, well sorted; some quartz cobbles; brown; berm material; moist, soft.	CL		24.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25	310	24.00 - 26.00 (CL) sandy silty CLAY; fine, well sorted; some quartz cobbles; brown; berm material; moist, soft. *(Continued)*	CL		309.20		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		26.00 - 27.50 (CL) sandy silty CLAY; fine, well sorted; dark gray; berm material; highly micaceous; wet - moist, soft.	CL		26.00 307.70		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
		27.50 - 28.00 (CL) sandy silty CLAY; fine, well sorted; dark gray; berm material; highly micaceous; wet - moist, soft.	CL		27.50 307.20		
		28.00 - 29.00 (CL) sandy silty CLAY; fine, well sorted; bright orange; berm material; moist, soft.	CL		28.00 306.20		**ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout
30	305	29.00 - 34.00 (CL) sandy silty CLAY; fine, well sorted; dark gray; moist, soft.	CL		29.00 301.20		**FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
35	300	34.00 - 38.00 (CL) sandy silty CLAY; fine, well sorted; dark gray; berm material; highly micaceous; wet - moist, soft.	CL		34.00 297.20		
		38.00 - 40.00 (CL) sandy silty CLAY; fine, well sorted; tan; berm material; moist, soft.	CL		38.00 295.20		
40	295	40.00 - 45.00 (CL) sandy silty CLAY; fine, well sorted; dark gray, occassional thin reddish brown beds; berm material; moist, soft.	CL		40.00 290.20		
45	290	45.00 - 53.00 (CH-CL) sithy CLAY; bright reddish brown; berm material; moist, soft - firm.	CH-CL		45.00		
50		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50	285	45.00 - 53.00 (CH-CL) sithy CLAY; bright reddish brown; berm material; moist, soft - firm. *(Continued)*	CH-CL		282.20		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		53.00 - 54.00 (CH) CLAY; dark reddish brown; berm material; some organics; slight rotten organinc odor; moist, firm - stiff.	CH		53.00 281.20		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
		54.00 - 75.00 (CH-CL) sithy CLAY; tan - orange; berm material; highly micaceous; moist, soft - firm.			54.00		**ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout
55	280						**FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips
							FILTER PACK Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand
60	275						**WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
			CH-CL			6-inch Carbon Steel Casing Bentonite Grout	
65	270						
70	265						
75		Log continued on next page			260.20		

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75	260	75.00 - 90.00 (CL) silty CLAY, some sand; fine, well sorted; reddish orange; berm material; moist, soft.	CL		75.00		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
80	255						
85	250						
90	245				245.20		
		90.00 - 94.00 (CH) CLAY; dark reddish brown, gray mottles; berm material; micaceous; moist, stiff - very stiff.	CH		90.00		
					241.20		
		94.00 - 97.00 (CH) CLAY, some gravel; coarse; dark reddish brown; berm material; numerous organics; moist, hard - very stiff.	CH		94.00		
95	240				238.20		
		97.00 - 125.00 (CH-CL) sandy silty CLAY; fine, well sorted; reddish brown, gray mottles; mottles bear sand; numerous roots; moist, stiff - very stiff.	CH-CL		97.00		
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100	235	97.00 - 125.00 (CH-CL) sandy silty CLAY; fine, well sorted; reddish brown, gray mottles; mottles bear sand; numerous roots; moist, stiff - very stiff. *(Continued)*	CH-CL				**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
105	230						
110	225						
115	220						
120	215						
125					210.20		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125	210	125.00 - 132.00 PHYLLITE; heavily weathered, orange staining penetrates rock mass; some quartz veins.			125.00		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 131.4-136.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
130	205				203.20		
		132.00 - 141.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard.			132.00	Bentonite Chips	
135	200						
140	195				194.20		
		141.00 - 142.00 Fracture; water bearing.			141.00 193.20		
		142.00 - 151.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard; some water producing fractures.			142.00	No. 2 Fitler Sand 0.010-inch Slot	
145	190						
150							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-34

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 150.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 10/2/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,273.59
EASTING: 11,546,547.29
GS ELEVATION: 335.20 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
150	185	142.00 - 151.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard; some water producing fractures. *(Continued)*			184.20		**WELL CASING** Interval: 0-141 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		Boring completed at 150.00 ft			151.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
155	180						**ANNULUS SEAL** Interval: 0-131.4 feet BGS Type: Bentonite Grout
							FILTER PACK SEAL Interval: 131.4-136.1 feet BGS Type: Bentonite Chips
							FILTER PACK Interval: 136.1-151 feet BGS Type: No. 2 Filter Sand
160	175						**WELL SCREEN** Interval: 141-151 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 151.0 feet BGS
165	170						
170	165						
175							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0		0.00 - 1.00 (CL) silty CLAY; dull brown - orange; some organics; dry, soft.	CL	331.70
		1.00 - 1.50 (SC) silty clayey SAND; fine, well sorted; orange - tan; non-cohesive; dry, loose - very loose.	SC	1.00 331.20
	330	1.50 - 4.00 (SP) silty SAND; fine, well sorted; bright tan; dry, loose.	SP	1.50 328.70
5		4.00 - 7.00 (ML) SILT; bright tan; dry, loose.	ML	4.00 325.70
	325	7.00 - 10.00 (ML) SILT; bright tan; dry, loose.	ML	7.00 322.70
10		10.00 - 14.00 (ML) SILT; bright tan; some bedrock fragments; dry, loose.	ML	10.00 318.70
	320	14.00 - 16.00 (ML) SILT; bright tan - dull white; some fragmented bedrock; dry, loose.	ML	14.00 316.70
15		16.00 - 24.50 (ML) SILT; dull orange - dull tan; bedrock cobbles; dry, loose.	ML	16.00
	315			
20				
	310			308.20
25				24.50

Log continued on next page

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES

WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0 - 123.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2' concrete
Protective Casing: 4"x4" aluminum

ANNULUS SEAL
Interval: 0-112.90 feet BGS
Type: 3:1 Portland Cement / Bentonite Grout

FILTER PACK SEAL
Interval: 112.90-116.10 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 116.10-133.50 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 123.5-133.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 133.50 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		24.50 - 29.00 PHYLLITE; severely weathered; silt matrix; dark brown - dull orange; dry - moist, loose. *(Continued)*			303.70		**WELL CASING** Interval: 0 - 123.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	305						
		29.00 - 29.50 (ML) SILT; dark gray; high biotite content; relict schistose features; dry, soft.	ML		29.00 303.20		**WELL COMPLETION** Pad: 2'x2' concrete Protective Casing: 4"x4" aluminum
		29.50 - 35.00 (ML) SILT; light tan; some bedrock fragments; dry, loose.			29.50		**ANNULUS SEAL** Interval: 0-112.90 feet BGS Type: 3:1 Portland Cement / Bentonite Grout
30							**FILTER PACK SEAL** Interval: 112.90-116.10 feet BGS Type: Bentonite Chips
	300		ML				**FILTER PACK** Interval: 116.10-133.50 feet BGS Type: No. 2 Filter Sand
							WELL SCREEN Interval: 123.5-133.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 133.50 feet BGS
35					297.70		
		35.00 - 36.00 (ML) SILT; orange - dull gray; relict shistose features; moist, firm.	ML		35.00 296.70		
		36.00 - 44.00 (ML) SILT; thinly bedded dark grayish blue, brown, and dark tan (~6" beds); some severely weathered bedrock cobbles; moist, firm.			36.00		
	295					6-inch Sch. 80 PVC	
40			ML				
	290						
					288.70		
		44.00 - 56.00 quartzofeldspathic - biotite PHYLLITE; severely weathered, orange staining penetrates rock mass; soft.			44.00		
45							
	285						
50							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		44.00 - 56.00 quartzofeldspathic - biotite PHYLLITE; severely weathered, orange staining penetrates rock mass; soft. *(Continued)*					**WELL CASING** Interval: 0 - 123.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	280						**WELL COMPLETION** Pad: 2'x2' concrete Protective Casing: 4"x4" aluminum
55							**ANNULUS SEAL** Interval: 0-112.90 feet BGS Type: 3:1 Portland Cement / Bentonite Grout
					276.70 / 56.00	3:1 Portland/ Bentonite Grout	**FILTER PACK SEAL** Interval: 112.90-116.10 feet BGS Type: Bentonite Chips
	275	56.00 - 66.00 quartzofeldspathic - biotite PHYLLITE; heavily weathered, orange staining penetrates rock mass; soft.					**FILTER PACK** Interval: 116.10-133.50 feet BGS Type: No. 2 Filter Sand
60							**WELL SCREEN** Interval: 123.5-133.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 133.50 feet BGS
	270						
65					266.70 / 66.00		
	265	66.00 - 76.00 quartzofeldspathic - biotite SCHIST; slightly weathered, orange staining along fracture planes; hard. vertical foliation.					
70							
	260						
75		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		66.00 - 76.00 quartzofeldspathic - biotite SCHIST; slightly weathered, orange staining along fracture planes; hard. vertical foliation. *(Continued)*			256.70 / 76.00		**WELL CASING** Interval: 0 - 123.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' concrete Protective Casing: 4"x4" aluminum **ANNULUS SEAL** Interval: 0-112.90 feet BGS Type: 3:1 Portland Cement / Bentonite Grout **FILTER PACK SEAL** Interval: 112.90-116.10 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.10-133.50 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 123.5-133.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 133.50 feet BGS
		76.00 - 106.00 quartzofeldspathic - biotite SCHIST; unweathered; hard. vertical foliation.					
80	255						
85	250						
90	245						
95	240						
100	235						

Log continued on next page

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		76.00 - 106.00 quartzofeldspathic - biotite SCHIST; unweathered; hard. vertical foliation. *(Continued)*					**WELL CASING** Interval: 0 - 123.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' concrete Protective Casing: 4"x4" aluminum **ANNULUS SEAL** Interval: 0-112.90 feet BGS Type: 3:1 Portland Cement / Bentonite Grout **FILTER PACK SEAL** Interval: 112.90-116.10 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.10-133.50 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 123.5-133.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 133.50 feet BGS
105	230				226.70		
		106.00 - 113.50 hornblende GNEISS; slightly weathered; quartz filled vertical joint; dark gray, some white. hard.			106.00		
110	225						
	220				219.20		
		113.50 - 115.50 quartzofeldspathic - biotite SCHIST; epidote rich; unweathered; hard; vertical foliation.			113.50	Bentonite Chip	
115					217.20		
		115.50 - 121.00 quartzofeldspathic - biotite SCHIST; unweathered; hard. vertical foliation.			115.50		
	215						
120					211.70		
		121.00 - 121.50 hornblende GNEISS; slightly weathered; quartz filled vertical joint; dark gray, some white. hard.			121.00 211.20		
		121.50 - 125.00 quartzofeldspathic - biotite SCHIST; unweathered; hard. vertical foliation.			121.50		
	210						
125		Log continued on next page			207.70	No. 2 Filter	

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 2/22/17

RECORD OF BOREHOLE MW-35

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 133.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 8/29/16
DATE COMPLETED: 9/8/16

NORTHING: 3,780,897.63
EASTING: 11,546,792.20
GS ELEVATION: 332.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		125.00 - 126.00 VOID			125.00 206.70	Sand	**WELL CASING** Interval: 0 - 123.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		126.00 - 127.00 quartzofeldspathic - biotite SCHIST; moderately weathered; hard. vertical foliation.			126.00 205.70		
	205	127.00 - 130.00 quartzofeldspathic - biotite SCHIST; unweathered; hard. vertical foliation.			127.00	0.010-inch Slot Screen	**WELL COMPLETION** Pad: 2'x2' concrete Protective Casing: 4"x4" aluminum **ANNULUS SEAL** Interval: 0-112.90 feet BGS Type: 3:1 Portland Cement / Bentonite Grout
130					202.70		
		130.00 - 133.50 quartzofeldspathic - biotite SCHIST; calcite rich, trace garnet, trace pyrite; moderately weathered, gravel sized recovery; moderately hard. vertical foliation.			130.00		**FILTER PACK SEAL** Interval: 112.90-116.10 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 116.10-133.50 feet BGS Type: No. 2 Filter Sand
	200				199.20		**WELL SCREEN** Interval: 123.5-133.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 133.50 feet BGS
		Boring completed at 133.50 ft					
135							
	195						
140							
	190						
145							
	185						
150							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-36S

SHEET 1 of 1

PROJECT: ACM Investigation
PROJECT NUMBER: 1520-347
DRILLED DEPTH: 30.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Spider 08
DATE STARTED: 11/7/18
DATE COMPLETED: 11/13/18

NORTHING: 3,782,150.18
EASTING: 11,546,033.52
GS ELEVATION: 246.67 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)
0		0.00 - 1.00 Gravel. Fill.	GW	245.67
	245	1.00 - 3.00 Red-brown CLAYEY SILT, little fine sand, few roots. Moist.	ML	1.00 243.67
5		3.00 - 6.50 Brown to dark brown SILT and fine sand, little clay. Residual rock fabric visible. Moist. Saprolite.	ML	3.00 240.17
	240	6.50 - 10.00 Tan-brown to orange-brown SILT and fine sand, some clay, trace medium to coarse sand. Red and black inclusions (weathered minerals). Moist. Saprolite	ML	6.50 236.67
10		10.00 - 10.50 Brown to dark brown SAND and silt with gravel-sized rock fragments. Weathered/pulverized bedrock.		236.17 10.50
	235	10.50 - 13.20 Grey-green SAND and silt with gravel-sized fragments of dark grey rock. Weathered/pulverized bedrock.		233.47
15		13.20 - 16.00 Pale grey-green to tan SAND and silt with gravel-sized fragments of rock. Weathered/pulverized bedrock.		13.20 230.67
	230	16.00 - 30.00 Moderately hard, moderately to slightly weathered, dark grey, fine-grained GNEISS. Moderately to extremely fractured rock cores. Orange weathering and pyrite observed along open fracture surfaces throughout.		16.00
20				
	225			
25				
	220			
30		Boring completed at 30.00 ft		216.67
	215			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES

WELL CONSTRUCTION DETAILS / COMMENTS

WELL CASING
Interval: - 2.5 to 20 ft bgs
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 3x3x0.5-foot Concrete Pad
Protective Casing: 4-inch diameter Steel

ANNULUS SEAL
Interval: 0 to 15 ft bgs
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 15 to 18 ft bgs
Type: Bentonite Chips

FILTER PACK
Interval: 18 to 30 ft bgs
Type: #2 Driller Services Sand

WELL SCREEN
Interval: 20 to 30 ft bgs
Material: PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: Flush-bottom

DRILLING METHODS
Type: Rotosonic

LOG SCALE: 1 in = 4.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Rick Tustin

PREPARED: H. Elkinton
REVIEWED: M. Williams
DATE: 3/20/2019

GOLDER

BOREHOLE RECORD BREMO_ACM_GINT_LOGS.GPJ ENV_BORING.GDT 01/30/19

RECORD OF BOREHOLE MW-36D

SHEET 1 of 1

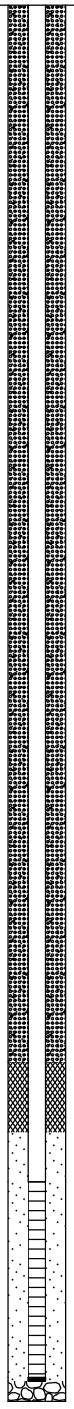
PROJECT: ACM Investigation
PROJECT NUMBER: 1520-347
DRILLED DEPTH: 70.00 ft
DRILL METHOD: Rotosonic

DRILL RIG: Spider 08
DATE STARTED: 11/8/18
DATE COMPLETED: 11/13/18

NORTHING: 3,782,143.23
EASTING: 11,546,026.85
GS ELEVATION: 246.35 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	ATT / REC
0	245	0.00 - 0.70 Gravel. Fill.	GW ML		244.55	
		0.70 - 1.80 Red-brown CLAYEY-SILT, some fine to coarse sand, few roots. Moist. Topsoil/fill.	SP		243.35	
5	240	1.80 - 3.00 Tan-brown fine SAND and silt, some medium to coarse sand and gravel. Moist. 3.00 - 10.00 Red-brown to black to tan-brown SILT and fine sand. Red and black inclusions observed (weathered minerals). Residual rock fabric observed. Moist. Saprolite.	ML		3.00 236.35	
10	235	10.00 - 15.00 Pale grey-green SAND and gravel-sized rock fragments. Weathered/pulverized rock.			10.00 231.35	
15	230	15.00 - 20.00 Hard, grey, slightly weathered, fine-grained foliated GNEISS. Moderately fractured/broken rock core. Abundant orange-brown staining, possible pyrite on open fracture surfaces.			15.00 226.35	
20	225	20.00 - 30.00 Hard, grey, slightly weathered, fine-grained foliated GNEISS. Moderately to extremely fractured core, with several high-angle fractures observed throughout, possible pyrite observed on open fracture surfaces. Orange-brown staining throughout.			20.00 216.35	
30	215	30.00 - 40.00 Hard, very slightly weathered, dark grey, fine to medium grained, foliated GNEISS. Very limited staining. Several high-angle fractures.			30.00 206.35	
40	205	40.00 - 50.00 Hard, very slightly weathered, dark grey to green-grey, fine to medium grained, foliated GNEISS. Moderately to extremely fractured/broken core. Limited pyrite and garnet observed. Epidote-filled fractures observed.			40.00 196.35	
50	195	50.00 - 60.00 Hard, fresh, dark grey fine to medium grained GNEISS. Moderately to extremely fractured core. Bright red mineral and epidote-filled fractures.			50.00 186.35	
60	185	60.00 - 70.00 Hard, fresh, dark grey to light grey/white, fine to medium grained GNEISS. Extremely fractured/broken core. Epidote-filled fractures. Drilling water returns lost at approximately 62'.			60.00 176.35	
70	175	Boring completed at 70.00 ft				
75	170					

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS / COMMENTS

WELL CASING
Interval: -2.5 to 59 ft bgs
Material: PVC
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 3x3x0.5-foot Concrete Pad
Protective Casing: 4-inch diameter Steel

ANNULUS SEAL
Interval: 0 to 53 ft bgs
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 53 to 56.5 ft bgs
Type: Bentonite Chips

FILTER PACK
Interval: 56.5 to 69 ft bgs
Type: #2 Drillers Services Sand

WELL SCREEN
Interval: 59 to 69 ft bgs
Material: PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: Flush Bottom

DRILLING METHODS
Type: Rotosonic

LOG SCALE: 1 in = 9.63 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Rick Tustin

PREPARED: H. Elkinton
REVIEWED: M. Williams
DATE: 3/20/2019

GOLDER

BOREHOLE RECORD BREMO_ACM_GINT_LOGS.GPJ ENV_BORING.GDT 01/30/19

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.50 (CL) sandy clay and gravel; fine to medium; light brown; moist; loose/soft; some roots.	CL		357.60		**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
		0.50 - 2.00 (SM) clayey SILTY SAND; fine; tan; moist; loose.	SM		0.50 356.10		
		2.00 - 3.00 (SC) silty CLAYEY SAND; fine; light red - orange; dry; loose.	SC		2.00 355.10		**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4"
	355	3.00 - 4.00 (SM) SILTY SAND; fine; some clay; light orange; dry; compact; relict structure is vertical foliation; micaceous.	SM		3.00 354.10		**ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout
		4.00 - 9.50 (SM) SILTY SAND; fine; some clay; micaceous; relict structure; dry; loose; some clayey sand lenses.	SM		4.00 348.60		**FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips
5							**FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand
	350						**WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
		9.50 - 10.00 (SP) SAND; fine; some silt; white; dry; loose.	SP		9.50 348.10		
10		10.00 - 23.00 (SM) SILTY SAND; fine; light brown - light orange - white; trace clay lamination; dry; compact; laminations brown to drak brown; relict structures; micaceous; trace 0.25 inch sub-rounded gravel; Increase foliation (relict) in fabric at 21 ft BGS.	SM		10.00		
	345						
15							
	340						
20							
	335				335.10		
		23.00 - 26.00 PHYLLITE; white with light tan matrix; relict structure/foliation; micaceous; silt, fine sand, and some clay in matrix.			23.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		23.00 - 26.00 PHYLLITE; white with light tan matrix; relict structure/foliation; micaceous; silt, fine sand, and some clay in matrix. *(Continued)*			332.10		
		26.00 - 33.00 (GP) GRAVEL (weathered rock); angular and up to 0.75 inch in diameter (primarily quartz).	GP		26.00		
	330						
30							
					325.10		
	325	33.00 - 37.00 quartzofeldspathic - biotite GNEISS; highly weathered; soft.			33.00		
35							
					321.10		
		37.00 - 55.00 quartzofeldspathic - biotite GNEISS; moderately weathered; light gray to white; hard.			37.00		
	320						
40							
	315						
45							
	310						
50		Log continued on next page					

WELL CASING
Interval: 0.0-144.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-130.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 130.0-137.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 137.0-154.4 feet BGS
Type: No. 2 Fitler Sand

WELL SCREEN
Interval: 144.0-154.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 154.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		37.00 - 55.00 quartzofeldspathic - biotite GNEISS; moderately weathered; light gray to white; hard. *(Continued)*					**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
	305						**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4"
55		55.00 - 76.00 quartzofeldspathic - biotite GNEISS; highly weathered, soft.			303.10 55.00		**ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout
	300						**FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips
60							**FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand
	295						**WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
65						Bentonite Grout	
	290						
70							
	285						
75		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		55.00 - 76.00 quartzofeldspathic - biotite GNEISS; highly weathered, soft. *(Continued)*			282.10 76.00		**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
	280	76.00 - 81.00 quartzofeldspathic - biotite GNEISS; some mafic minerals (chlorite/epidote, hornblende); moderately weathered; soft.			277.10 81.00		
80							
	275	81.00 - 96.00 quartzofeldspathic - biotite SCHIST; grey - white; moderately weathered; soft.					
85							
	270						
90							
	265						
95					262.10 96.00		
	260	96.00 - 106.00 amphibolite; aphantic; mafic; trace quartz, clear - slightly cloudy.					
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		96.00 - 106.00 amphibolite; aphantic; mafic; trace quartz, clear - slightly cloudy. *(Continued)*					**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
	255						
105					252.10		
		106.00 - 110.00 amphibolite; some calcite and quartz; transitioning to biotite/hornblende - quartz schist; white - black.			106.00		
	250						
110					248.10		
		110.00 - 120.00 amphiobolite; some epidote and green calcite; very fine grained; small octahedral cuttings.			110.00		
	245						
115							
	240						
120					238.10		
		120.00 - 140.00 quartzofeldspathic - biotite SCHIST; some muscovite in cuttings; hard.			120.00		
	235						
125		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		120.00 - 140.00 quartzofeldspathic - biotite SCHIST; some muscovite in cuttings; hard. *(Continued)*					**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
	230						
130							
	225					Bentonite Chips	
135							
	220						
140					218.10		
		140.00 - 144.00 quartzofeldspathic - biotite SCHIST; some green calcite; hard.			140.00		
	215						
					214.10		
		144.00 - 150.00 schist; orange staining; some biotite; soft.			144.00		
145						No. 2 Filter Sand	
	210						
						0.010-inch	
150					208.10		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 154.40 ft
DRILL METHOD: Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/24/16
DATE COMPLETED: 11/2/16

NORTHING: 3,781,287.15
EASTING: 11,547,933.61
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
150		150.00 - 158.00 quartzofeldspathic - biotite SCHIST; white - black; slightly weathered; moderately hard.			150.00		**WELL CASING** Interval: 0.0-144.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-130.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 130.0-137.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 137.0-154.4 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 144.0-154.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 154.0 feet BGS
	205					No. 2 Filter Sand Bentonite Chips Slough	
155							
	200	Boring completed at 154.40 ft			200.10 158.00		
160							
	195						
165							
	190						
170							
	185						
175							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Payner

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 95.30 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/13/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,289.45
EASTING: 11,547,937.10
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
0		0.00 - 0.50 (CL) sandy clay and gravel; fine to medium; light brown; moist; loose/soft; some roots.	CL		357.60					
		0.50 - 2.00 (SM) clayey SILTY SAND; fine; tan; moist; loose.	SM		0.50 356.10	1	SS	4 -5 -4 -6	9	1.30 2.00
		2.00 - 3.00 (SC) silty CLAYEY SAND; fine; light red - orange; dry; loose.	SC		2.00 355.10	2	SS	5 -5 -13 -12	18	2.00 2.00
	355	3.00 - 4.00 (SM) SILTY SAND; fine; some clay; light orange; dry; compact; relict structure is vertical foliation; micaceous.	SM		3.00 354.10					
		4.00 - 9.50 (SM) SILTY SAND; fine; some clay; micaceous; relict structure; dry; loose; some clayey sand lenses.	SM		4.00	3	SS	2 -5 -5 -4	10	1.60 2.00
5						4	SS	1 -4 -4 -4	8	1.50 2.00
	350					5	SS	4 -5 -6 -8	11	2.00 2.00
		9.50 - 10.00 (SP) SAND; fine; some silt; white; dry; loose.	SP		348.60 9.50 348.10					
10		10.00 - 23.00 (SM) SILTY SAND; fine; light brown - light orange - white; trace clay lamination; dry; compact; laminations brown to drak brown; relict structures; micaceous; trace 0.25 inch sub-rounded gravel; Increase foliation (relict) in fabric at 21 ft BGS.	SM		10.00	6	SS	7 -8 -7 -6	15	0.90 2.00
	345					7	SS	3 -5 -7 -8	12	2.00 2.00
15						8	SS	4 -8 -13 -11	21	1.30 2.00
						9	SS	3 -9 -12 -15	21	2.00 2.00
	340					10	SS	5 -2 -11 -16	13	2.00 2.00
20						11	SS	17 -29 -40 -50/2	>50	1.70 1.70
	335	23.00 - 26.00 PHYLLITE; white with light tan matrix; relict structure/foliation; micaceous; silt, fine sand, and some clay in matrix.			335.10 23.00	12	SS	7 -10 -9 -10	19	0.70 2.00
						13	SS	9 -10 -15 -30	25	1.40 2.00
25		Log continued on next page								

WELL CASING
Interval: 0.0 - 84.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-77.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 77.0-79.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 79.0-95.3 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 84.0-94.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 94.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 95.30 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/13/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,289.45
EASTING: 11,547,937.10
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25					332.10	13	SS	9 -10 -15 -30	25	1.40 / 2.00		**WELL CASING** Interval: 0.0 - 84.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Threaded **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-77.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 77.0-79.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 79.0-95.3 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 84.0-94.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 94.0 feet BGS
		26.00 - 33.00 (GP) GRAVEL (weathered rock); angular and up to 0.75 inch in diameter (primarily quartz).	GP		26.00							
30	330				325.10							
35	325	33.00 - 37.00 quartzofeldspathic - biotite GNEISS; highly weathered; soft.			33.00							
		37.00 - 55.00 quartzofeldspathic - biotite GNEISS; moderately weathered; light gray to white; hard.			321.10 37.00						Bentonite Grout	
40	320											
45	315											
50	310											

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 95.30 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/13/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,289.45
EASTING: 11,547,937.10
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		37.00 - 55.00 quartzofeldspathic - biotite GNEISS; moderately weathered; light gray to white; hard. *(Continued)*										
	305											
55					303.10 55.00							
		55.00 - 76.00 quartzofeldspathic - biotite GNEISS; highly weathered, soft.										
	300											
60												
	295											
65												
	290											
70												
	285											
75		Log continued on next page										

WELL CASING
Interval: 0.0 - 84.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-77.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 77.0-79.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 79.0-95.3 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 84.0-94.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 94.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-25S

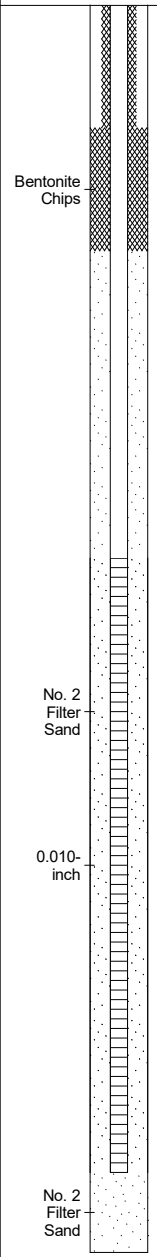
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 95.30 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 10/13/16
DATE COMPLETED: 10/20/16

NORTHING: 3,781,289.45
EASTING: 11,547,937.10
GS ELEVATION: 358.10 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
75		55.00 - 76.00 quartzofeldspathic - biotite GNEISS; highly weathered, soft. *(Continued)*			282.10					
		76.00 - 81.00 quartzofeldspathic - biotite GNEISS; some mafic minerals (chlorite/epidote, hornblende); moderately weathered; soft.			76.00 277.10					
80	280									
		81.00 - 95.30 quartzofeldspathic - biotite SCHIST; grey - white; moderately weathered; soft.			81.00					
85	275									
90	270									
95	265				262.80					
		Boring completed at 95.30 ft								
100	260									

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0 - 84.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Threaded

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-77.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 77.0-79.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 79.0-95.3 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 84.0-94.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 94.0 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	390	0.00 - 8.00 (CL) silty CLAY bright reddish orange; highly micaceous; dry, soft - firm.	CL				**WELL CASING** Interval: 0.0-128.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-118.7 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 118.7-122.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 122.0-138.0 feet BGS Type: No. 2 filter Sand **WELL SCREEN** Interval: 128.0-138.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 138 feet BGS
5	385				383.50		
10	380	8.00 - 17.00 (CL) silty CLAY; reddish orange, bright tan mottles; highly micaceous; moist, soft.	CL		8.00		
15	375				374.50		
		17.00 - 18.00 (CL) silty CLAY; dull tan; highly micaceous; moist, soft.	CL		17.00 373.50		
20	370	18.00 - 23.00 (CL) silty CLAY trace sand; dull golden brown, red mottles; highly micaceous; moist, very soft.	CL		18.00 368.50		
25		23.00 - 26.75 (CL) silty CLAY, trace sand; fine; reddish orange, dull golden brown mottles; highly micaceous; moist, very soft.	CL		23.00		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		23.00 - 26.75 (CL) silty CLAY, trace sand; fine; reddish orange, dull golden brown mottles; highly micaceous; moist, very soft. *(Continued)*	CL				**WELL CASING** Interval: 0.0-128.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	365				364.75		
		26.75 - 27.00 (CL) silty CLAY; black - dark brown; moist, soft.	CL		27.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
		27.00 - 42.00 (CL-ML) silty CLAY; dull golden brown; highly micaceous; low plasticity; dry - moist, soft.					**ANNULUS SEAL** Interval: 0.0-118.7 feet BGS Type: Bentonite Grout
30							**FILTER PACK SEAL** Interval: 118.7-122.0 feet BGS Type: Bentonite Chips
	360						**FILTER PACK** Interval: 122.0-138.0 feet BGS Type: No. 2 filter Sand
							WELL SCREEN Interval: 128.0-138.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 138 feet BGS
35			CL-ML				
	355						
40							
	350				349.50		
		42.00 - 47.00 (CL-ML) silty CLAY trace sand; dull golden brown; highly micaceous; low plasticity; dry - moist, soft.			42.00		
45			CL-ML				
	345				344.50		
		47.00 - 50.00 PHYLLITE; severely weathered; sandy silt matrix; fine, well sorted; tan; moist - dry, soft			47.00		
50					341.50		
		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		50.00 - 56.00 (CL-ML) silty CLAY trace sand; dull brown, occasional white mottles; highly micaceous; moist, soft.	CL-ML		50.00		**WELL CASING** Interval: 0.0-128.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	340						**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
55					335.50		**ANNULUS SEAL** Interval: 0.0-118.7 feet BGS Type: Bentonite Grout
	335	56.00 - 60.00 (CL-ML) silty CLAY; dull brown; highly micaceous; moist, soft.	CL-ML		56.00		**FILTER PACK SEAL** Interval: 118.7-122.0 feet BGS Type: Bentonite Chips
						Bentonite Grout	**FILTER PACK** Interval: 122.0-138.0 feet BGS Type: No. 2 filter Sand
60					331.50		**WELL SCREEN** Interval: 128.0-138.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 138 feet BGS
	330	60.00 - 65.00 (CL-ML) silty CLAY; dull brown; highly micaceous; wet - moist, soft.	CL-ML		60.00		
65					326.50		
	325	65.00 - 73.00 (CL-ML) silty CLAY; dull brown; highly micaceous; moist, soft.	CL-ML		65.00		
70							
	320				318.50		
		73.00 - 79.00 PHYLLITE and QUARTZ; severely weathered; silt matrix; dull brown; dry.			73.00		
75		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		73.00 - 79.00 PHYLLITE and QUARTZ; severely weathered; silt matrix; dull brown; dry. *(Continued)*			312.50		**WELL CASING** Interval: 0.0-128.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	315						
		79.00 - 82.00 PHYLLITE; severely weathered; silt matrix; dull brown; dry.			79.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-118.7 feet BGS Type: Bentonite Grout
80							
	310				309.50		**FILTER PACK SEAL** Interval: 118.7-122.0 feet BGS Type: Bentonite Chips
		82.00 - 88.00 PHYLLITE; severely - heavily weathered, orange staining penetrates rock mass; tan; soft.			82.00		**FILTER PACK** Interval: 122.0-138.0 feet BGS Type: No. 2 filter Sand **WELL SCREEN** Interval: 128.0-138.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 138 feet BGS
85							
	305						
					303.50		
		88.00 - 95.00 No recovery			88.00		
90							
	300						
					296.50		
95		95.00 - 104.00 quartzofeldspathic - biotite SCHIST; highly weathered, orange staining penetrates rock mass; white and black; apparent fracture dip angle ~45-degrees; moderately hard. vertical foliations.			95.00		
	295						
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		95.00 - 104.00 quartzofeldspathic - biotite SCHIST; highly weathered, orange staining penetrates rock mass; white and black; apparent fracture dip angle ~45-degrees; moderately hard. vertical foliations. *(Continued)*			287.50		**WELL CASING** Interval: 0.0-128.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	290						
		104.00 - 106.50 QUARTZ; cloudy white; some iron oxidation inclusions.			104.00 285.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-118.7 feet BGS Type: Bentonite Grout
105							
	285	106.50 - 111.00 quartzofeldpathic - biotite SCHIST; heavily weathered, orange staining at fractures; white - black; vertical foliations; moderately hard.			106.50		**FILTER PACK SEAL** Interval: 118.7-122.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 122.0-138.0 feet BGS Type: No. 2 filter Sand
110					280.50		**WELL SCREEN** Interval: 128.0-138.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 138 feet BGS
	280	111.00 - 113.00 quartzofeldpathic - biotite SCHIST; heavily weathered, orange staining at fractures; white - black; vertical foliations; soft.			111.00 278.50		
		113.00 - 124.00 quartzofeldpathic - biotite SCHIST; heavily weathered, orange staining around mafic porphory; white - black; vertical foliations; soft.			113.00		
115							
	275						
120						Bentonite Chips	
	270						
		124.00 - 127.00 quartzofeldpathic - biotite - chlorite SCHIST; slightly weathered, some orange staining; white - black; vertical foliations; hard - moderately hard.			267.50 124.00		
125		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 138.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/22/16
DATE COMPLETED: 9/23/16

NORTHING: 3,781,789.70
EASTING: 11,548,685.31
GS ELEVATION: 391.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		124.00 - 127.00 quartzofeldpathic - biotite - chlorite SCHIST; slightly weathered, some orange staining; white - black; vertical foliations; hard - moderately hard. *(Continued)*					
	265				264.50		
		127.00 - 130.00 quartzofeldpathic - biotite SCHIST; moderately weathered, orange staining penetrates rock mass; white - black; vertical foliations; soft - moderately hard.			127.00		
130					261.50	No. 2 Filter Sand	
		130.00 - 136.00 quartzofeldpathic - biotite SCHIST; heavily weathered, orange staining at fractures; white - black; vertical foliations; moderately hard.			130.00		
	260						
						0.010-inch Slot	
135					255.50		
		136.00 - 138.00 quartzofeldpathic - biotite SCHIST; moderately weathered, some orange staining; white - black; vertical foliations; hard.			136.00		
	255						
					253.50		
		Boring completed at 138.00 ft					
140							
	250						
145							
	245						
150							

WELL CASING
Interval: 0.0-128.0 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2' Concrete
Protective Casing: 4"x4" Aluminum

ANNULUS SEAL
Interval: 0.0-118.7 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 118.7-122.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 122.0-138.0 feet BGS
Type: No. 2 filter Sand

WELL SCREEN
Interval: 128.0-138.0 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 138 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 108.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/24/26
DATE COMPLETED: 9/24/16

NORTHING: 3,781,781.03
EASTING: 11,548,679.74
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.30 (CL) silty CLAY; udark brown; numerous roots; wet, soft.	CL		326.40 0.30		**WELL CASING** Interval: 0.0-98.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4' Aluminum **ANNULUS SEAL** Interval: 0.0-89.6 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 89.6-93.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 93.1-108.0 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 98.0-108.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 108.0 feet BGS
		0.30 - 1.00 (CH - CL) silty CLAY trace sand; fine; bright reddish orange; wet, soft.	CH-CL		325.70 1.00		
	325	1.00 - 2.50 (CH - CL) silty CLAY trace sand; fine; bright reddish orange; moist - dry, soft.	CH-CL		324.20		
		2.50 - 4.00 (CL) silty CLAY trace sand; fine; bright reddish orange; micaceous; moist - dry, soft.	CL		2.50 322.70		
5		4.00 - 9.00 (CL) silty CLAY trace sand; fine; bright reddish orange; micaceous; dry, soft.	CL		4.00 317.70		
	320						
		9.00 - 12.00 (CL) silty CLAY; reddish brown, dull tan mottles; highly micaceous; moist, soft - firm.	CL		9.00 314.70		
10	315	12.00 - 13.50 (CL) silty CLAY trace sand; reddish orange, reddish brown mottles; moist - dry, soft.	CL		12.00 313.20		
		13.50 - 18.00 (CL) silty CLAY; tan, occasional reddish brown mottles; moist - dry, soft.	CL		13.50 308.70		
15	310	18.00 - 19.00 (CL) silty CLAY trace sand; tan, red mottles; moist, soft - very soft.	CL		18.00 307.70		
		19.00 - 19.25 (CL) silty CLAY trace sand; thin black lamination (~ 0.25"); moist, soft - very soft.	CL		19.25		
		19.25 - 20.00 (CL) silty CLAY trace sand; tan, red mottles; moist, soft - very soft.	CL		306.70 20.00		
20		20.00 - 20.50 (CL) silty CLAY trace sand; thin black lamination (~ 0.50"); moist, soft - very soft.	CL		306.20		
		20.50 - 20.75 (CL) silty CLAY trace sand; tan, red mottles; moist, soft - very soft.	CL		21.00		
	305	20.75 - 21.00 (CL) silty CLAY trace sand; thin black lamination (~ 0.25"); moist, soft - very soft.	CL				
		21.00 - 23.00 (CL) silty CLAY trace sand; tan, red mottles; moist, soft - very soft.	CL		303.70		
		23.00 - 27.00 (CL) silty CLAY; reddish brown, tan mottles; highly micaceous; dry - moist, soft.	CL		23.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 108.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/24/26
DATE COMPLETED: 9/24/16

NORTHING: 3,781,781.03
EASTING: 11,548,679.74
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		23.00 - 27.00 (CL) silty CLAY; reddish brown, tan mottles; highly micaceous; dry - moist, soft. *(Continued)*	CL				**WELL CASING** Interval: 0.0-98.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	300				299.70		
		27.00 - 28.50 (CL - ML) silty CLAY; dark tan; moist - dry, soft.	CL-ML		27.00 298.20		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4' Aluminum
		28.50 - 30.00 (CL - ML) silty CLAY; bright reddish orange; highly micaceous; moist, soft.	CL-ML		28.50 296.70		**ANNULUS SEAL** Interval: 0.0-89.6 feet BGS Type: Bentonite Grout
30		30.00 - 35.00 (ML) SILT some clay, some sand; reddish brown, tan mottles; moist, soft.	ML		30.00		**FILTER PACK SEAL** Interval: 89.6-93.1 feet BGS Type: Bentonite Chips
	295						**FILTER PACK** Interval: 93.1-108.0 feet BGS Type: No. 2 Fitler Sand
					291.70		**WELL SCREEN** Interval: 98.0-108.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 108.0 feet BGS
35		35.00 - 37.75 (ML) SILT some clay, some sand; tan, reddish brown mottles; moist, soft.	ML		35.00		
	290				288.95		
		37.75 - 38.00 (ML) sandy SILT, trace clay; fine, well sorted; white - tan; moist, non-cohesive, loose.	ML		38.00		
		38.00 - 43.00 (CL) silty CLAY, some sand; fine, well sorted; dark tan, occassional black laminations; highly micaceous; wet, soft - very soft.	CL				
40							
	285				283.70		
		43.00 - 58.00 (CL) silty CLAY, trace sand; fine, well sorted; dark tan; highly micaceous; moist.	CL		43.00		
45						Bentonite Grout	
	280						
50							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 108.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/24/26
DATE COMPLETED: 9/24/16

NORTHING: 3,781,781.03
EASTING: 11,548,679.74
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		43.00 - 58.00 (CL) silty CLAY, trace sand; fine, well sorted; dark tan; highly micaceous; moist. *(Continued)*	CL				**WELL CASING** Interval: 0.0-98.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4' Aluminum **ANNULUS SEAL** Interval: 0.0-89.6 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 89.6-93.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 93.1-108.0 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 98.0-108.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 108.0 feet BGS
	275						
55							
	270				268.70		
		58.00 - 64.00 (CL) silty CLAY; fine, well sorted; dark tan; highly micaceous; moist.	CL		58.00		
60							
	265				262.70		
		64.00 - 68.00 (ML) SILT some clay; dull tannish gray; relict foliation features; moist, soft.	ML		64.00		
65							
	260				258.70		
		68.00 - 75.00 (ML) clayey SILT; brown, some tan and white; relict foliation features; moist, soft.	ML		68.00		
70							
	255						
75					251.70		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 108.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/24/26
DATE COMPLETED: 9/24/16

NORTHING: 3,781,781.03
EASTING: 11,548,679.74
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		75.00 - 82.00 (ML) clayey SILT some sand; fine; brown, some tan and white; relict foliation features; moist, soft.	ML		75.00		**WELL CASING** Interval: 0.0-98.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4' Aluminum **ANNULUS SEAL** Interval: 0.0-89.6 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 89.6-93.1 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 93.1-108.0 feet BGS Type: No. 2 Fitler Sand **WELL SCREEN** Interval: 98.0-108.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 108.0 feet BGS
	250						
80							
	245				244.70		
		82.00 - 85.00 PHYLLITE; severely weathered; dull gray; silt matrix; moist - wet.			82.00		
85					241.70		
		85.00 - 85.50 QUARTZ; light gray; severely weathered; dry.			85.00 241.20		
		85.50 - 86.00 PHYLLITE; severely weathered; greenish tan; silt matrix; moist - wet.			85.50 240.70		
		86.00 - 87.00 PHYLLITE; severely weathered; greenish tan; silt matrix; dry.			86.00 239.70		
	240	87.00 - 98.00 quartzofeldspathic - biotite SCHIST; white and black; heavily weathered, orange staining;			87.00		
90						Bentonite Chips	
	235						
95						No. 2 Filter Sand	
	230						
					228.70		
		98.00 - 106.00 quartzofeldspathic - biotite SCHIST; white and black; moderately weathered;			98.00		
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-26S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 108.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/24/26
DATE COMPLETED: 9/24/16

NORTHING: 3,781,781.03
EASTING: 11,548,679.74
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		98.00 - 106.00 quartzofeldspathic - biotite SCHIST; white and black; moderately weathered; *(Continued)*					**WELL CASING** Interval: 0.0-98.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	225						
						0.010-inch Slot	**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4' Aluminum
105							**ANNULUS SEAL** Interval: 0.0-89.6 feet BGS Type: Bentonite Grout
							FILTER PACK SEAL Interval: 89.6-93.1 feet BGS Type: Bentonite Chips
					220.70		
		106.00 - 108.00 quartzofeldspathic - biotite SCHIST; white and black; heavily weathered, orange staining;			106.00		**FILTER PACK** Interval: 93.1-108.0 feet BGS Type: No. 2 Fitler Sand
	220						
					218.70		**WELL SCREEN** Interval: 98.0-108.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 108.0 feet BGS
		Boring completed at 108.00 ft					
110							
	215						
115							
	210						
120							
	205						
125							

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.75 (CL) silty CLAY; dark brown; dry, soft.	CL		325.95		**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	325	0.75 - 5.00 (CL) silty CLAY; bright reddish orange; highly micaceous; moist - dry, soft.	CL		0.75 321.70		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
5		5.00 - 11.00 (CL) silty CLAY; dull reddish brown; highly micaceous; low plasticity; soft.	CL		5.00 315.70	3:1 Portland/ Bentonite Grout	**ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout
	320						**FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips
10		11.00 - 13.50 (ML) SILT, some clay; dull brown; fragments of schist; highly micaceous; non-cohesive, dry, soft.	ML		11.00 313.20		**FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand
	315	13.50 - 19.00 (ML-GP) gravelly SILT; fine, angular, poorly sorted; dull gray; heavy biotite content; non-cohesive, dry, soft.	ML-GP		13.50 307.70		**WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
15							
	310	19.00 - 23.00 (ML) SILT some gravel; fine, angular, platy, poorly sorted; thinly bedded bright orang - bright tan; high biotite content; dry, soft.	ML		19.00 303.70		
20							
	305	23.00 - 34.00 (ML-GP) SILT and GRAVEL; coarse, angular, platy, poorly sorted;thinly bedded orange, tan, and bright tan (~6" bedding); dry, soft.	ML-GP		23.00		
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		23.00 - 34.00 (ML-GP) SILT and GRAVEL; coarse, angular, platy, poorly sorted;thinly bedded orange, tan, and bright tan (~6" bedding); dry, soft. *(Continued)*	ML-GP				**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout **FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
	300						
30							
	295						
					292.70		
		34.00 - 37.00 (GP) silty GRAVEL; coarse, angular, poorly sorted; platy; light tan; dry, loose.	GP		34.00		
35							
	290				289.70		
		37.00 - 45.50 (ML) SILT; bright orange; relict schistose fabric in clay nodules; moist - dry, stiff.	ML		37.00		
40							
	285						
45					281.20		
		45.50 - 46.50 (CL-ML) silty CLAY; dark burnt orange; moist, firm.	CL-ML		45.50 280.20		
	280	46.50 - 48.00 (ML-GP) gravelly SILT; coarse - fine, angular, poorly sorted; light tan; dry, soft.	ML-GP		46.50 278.70		
		48.00 - 52.50 (ML) SILT some gravel; fine, angular, poorly sorted; dull brown; dry. soft.	ML		48.00		
50		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		48.00 - 52.50 (ML) SILT some gravel; fine, angular, poorly sorted; dull brown; dry. soft. *(Continued)*	ML				**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	275				274.20		
		52.50 - 55.00 (CL) silty CLAY, trace gravel; dull brown; high plasticity; dry, soft.	CL		52.50 271.70		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
55		55.00 - 56.50 (GP) silty GRAVEL; coarse - fine, angular, poorly sorted; light tan; dry, loose.	GP		55.00 270.20		**ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout
	270	56.50 - 58.00 (GP) silty GRAVEL; coarse - fine, angular, poorly sorted; medium bedded light tan and dull orange; dry, loose.	GP		56.50 268.70		**FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips
		58.00 - 67.00 (ML) SILT, trace gravel; dark brown; low plasticity; dry - moist, soft.	ML		58.00		**FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand
60							**WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
	265						
65							
	260				259.70		
		67.00 - 75.00 PHYLLITE; severely weathered; silt matrix; dull orange; dry.			67.00		
70							
	255						
75					251.70		
		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		75.00 - 77.50 (ML-CL) silty CLAY; dark gray - gray; moist, soft.	CL-ML		75.00		**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	250				249.20		
		77.50 - 78.00 (ML-CL) silty CLAY; dark gray - gray; wet, soft.	CL-ML		77.50 248.70		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
		78.00 - 79.00 hornblende GNEISS; heavily weathered; dark gray - black, some white; soft - moderately hard.			78.00 247.70		**ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout
		79.00 - 80.00 quartzofeldspathic - biotite SCHIST; slightly weathered; moderately hard; vertical foliation.			79.00 246.70		
80		80.00 - 83.00 Void			80.00		**FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips
	245				243.70		**FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand
		83.00 - 84.00 hornblende GNEISS; moderately weathered; quartz veins; dark gray - black, some white; soft - moderately hard.			83.00 242.70		**WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
		84.00 - 86.00 quartzofeldspathic - biotite SCHIST; slightly weathered; moderately hard; vertical foliation.			84.00 240.70		
85		86.00 - 88.00 hornblende GNEISS; slightly weathered; dark gray - black, some white; hard.			86.00		
	240				238.70		
		88.00 - 88.50 quartzofeldspathic - biotite SCHIST; slightly weathered; moderately hard; vertical foliation.			88.00 238.20		
		88.50 - 89.75 hornblende GNEISS; slightly weathered; dark gray - black, some white; very hard.			88.50 236.95		
90		89.75 - 90.75 quartzofeldspathic - biotite SCHIST; slightly weathered; moderately hard; vertical foliation.			89.75 235.95		
		90.75 - 96.00 hornblende GNEISS; unweathered; dark gray - black, some white; very hard.			90.75		
	235						
95					230.70		
		96.00 - 99.00 quartzofeldspathic - biotite SCHIST; unweathered; hard; vertical foliation.			96.00		
	230				227.70	Bentonite Grout	
		99.00 - 100.00 hornblende GNEISS; garnet; unweathered; dark gray - black, some white; very hard.			99.00 226.70		
100		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		100.00 - 101.00 hornblende GNEISS gravel; garnet; moderately weathered; dark gray - black, some white; moderately hard.			100.00 225.70		**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		101.00 - 108.00 quartzofeldspathic - biotite SCHIST; slightly weathered; moderately hard; vertical foliation.			101.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	225						**ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout
105							**FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips
	220						**FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand
		108.00 - 127.00 quartzofeldspathic - biotite SCHIST; slightly weathered; hard; vertical foliation.			218.70 108.00		**WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
110							
	215						
115							
	210						
120							
	205						
125		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

AA BOREHOLE RECORD (NO PID) 2016 NAP MONITORING WELL INSTALL.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 2/22/17

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		108.00 - 127.00 quartzofeldspathic - biotite SCHIST; slightly weathered; hard; vertical foliation. *(Continued)*					
	200				199.70		
		127.00 - 128.00 quartzofeldspathic - biotite SCHIST; moderately weathered; moderately hard; vertical foliation.			127.00 198.70		
		128.00 - 130.50 quartzofeldspathic - biotite SCHIST; unweathered; hard; vertical foliation.			128.00		
130					196.20		
		130.50 - 131.50 hornblende GNEISS; trace pyrite; slightly weathered; dark gray - black, some white; very hard - hard.			130.50 195.20		
	195	131.50 - 132.50 quartzofeldspathic - biotite SCHIST; slightly weathered; epidote filled joints; hard; vertical foliation.			131.50 194.20		
		132.50 - 135.00 hornblende GNEISS; trace pyrite; slightly weathered; epidote filled joints; dark gray - black, some white; hard.			132.50		
135					191.70		
		135.00 - 138.00 hornblende GNEISS; trace pyrite; slightly weathered; epidote crystals, radial flat prismatic habit, in calcite; dark gray - black, some white; hard.			135.00		
	190				188.70		
		138.00 - 139.00 quartzofeldspathic - biotite SCHIST; unweathered; epidote filled joints; hard; vertical foliation.			138.00 187.70		
		139.00 - 140.50 hornblende GNEISS; unweathered; dark gray - black, some white; very hard.			139.00		
140					186.20		
		140.50 - 144.00 quartzofeldspathic - biotite SCHIST; unweathered; hard; vertical foliation.			140.50		
	185				182.70		
		144.00 - 145.00 hornblende GNEISS; unweathered; dark gray - black, some white; very hard.			144.00 181.70		
145		145.00 - 148.00 quartzofeldspathic - biotite SCHIST; pyrite and garnet; unweathered; hard; vertical foliation.			145.00		
	180				178.70		
		148.00 - 152.00 hornblende GNEISS; unweathered; dark gray - black, some white; very hard.			148.00		
150		Log continued on next page					

WELL CASING
Interval: 0.0-188.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2' Concrete
Protective Casing: 4"x4" Aluminum

ANNULUS SEAL
Interval: 0-177.9 feet BGS
Type: 3:1 Portland/ Bentonite Grout

FILTER PACK SEAL
Interval: 177.9-180.6 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 180.6-198.5 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 188.5-198.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 198.5 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
150		148.00 - 152.00 hornblende GNEISS; unweathered; dark gray - black, some white; very hard. *(Continued)*					**WELL CASING** Interval: 0.0-188.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
	175				174.70		
		152.00 - 155.00 quartzofeldspathic - biotite SCHIST; pyrite and garnet; unweathered; hard; vertical foliation.			152.00		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
155					171.70		**ANNULUS SEAL** Interval: 0-177.9 feet BGS Type: 3:1 Portland/ Bentonite Grout
		155.00 - 155.50 hornblende GNEISS; unweathered; dark gray - black, some white; very hard.			155.00 171.20		**FILTER PACK SEAL** Interval: 177.9-180.6 feet BGS Type: Bentonite Chips
		155.50 - 169.00 quartzofeldspathic - biotite SCHIST; unweathered; hard; vertical foliation.			155.50		**FILTER PACK** Interval: 180.6-198.5 feet BGS Type: No. 2 Filter Sand
	170						**WELL SCREEN** Interval: 188.5-198.5 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch End Cap: 198.5 feet BGS
160							
	165						
165							
	160						
					157.70		
		169.00 - 176.00 hornblende GNEISS; unweathered; dark gray - black, some white; hard.			169.00		
170							
	155						
175							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27D

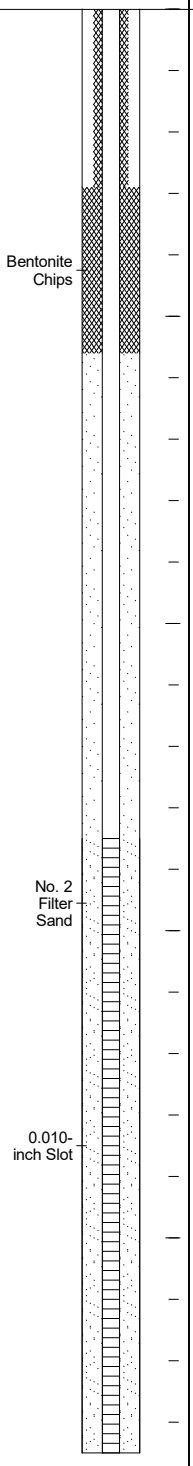
PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 198.50 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/9/16
DATE COMPLETED: 9/13/16

NORTHING: 3,782,253.20
EASTING: 11,546,755.36
GS ELEVATION: 326.70 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
175		169.00 - 176.00 hornblende GNEISS; unweathered; dark gray - black, some white; hard. *(Continued)*			150.70
		176.00 - 181.00 quartzofeldspathic - biotite SCHIST; slightly weathered; epidote filled joint; hard; vertical foliation.			176.00
	150				
180					145.70
		181.00 - 183.00 hornblende GNEISS; unweathered; dark gray - black, some white; hard.			181.00
	145				143.70
		183.00 - 183.30 QUARTZ; opaque white; trace chlorite at upper and lower contacts.			143.40 183.30
		183.30 - 185.00 hornblende GNEISS; unweathered; dark gray - black, some white; hard.			141.70
185		185.00 - 186.50 quartzofeldspathic - biotite SCHIST; unweathered; very hard; vertical foliation.			185.00
					140.20
	140	186.50 - 188.00 hornblende GNEISS; unweathered; dark gray - black, some white; hard.			186.50
					138.70
		188.00 - 191.50 quartzofeldspathic - biotite SCHIST; unweathered; very hard; vertical foliation.			188.00
190					135.20
	135	191.50 - 195.00 hornblende GNEISS; slightly weathered; dark gray - black, some white; hard.			191.50
					131.70
195		195.00 - 197.00 quartzofeldspathic - biotite SCHIST; slightly weathered; hard; vertical foliation.			195.00
	130				129.70
		197.00 - 198.00 quartzofeldspathic - biotite SCHIST; slightly weathered; epidote filled joints; hard; vertical foliation.			197.00
					128.70
		Boring completed at 198.50 ft			198.00
200					

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-188.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2' Concrete
Protective Casing: 4"x4" Aluminum

ANNULUS SEAL
Interval: 0-177.9 feet BGS
Type: 3:1 Portland/ Bentonite Grout

FILTER PACK SEAL
Interval: 177.9-180.6 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 180.6-198.5 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 188.5-198.5 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 198.5 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 88.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/14/16
DATE COMPLETED: 9/15/16

NORTHING: 3,782,267.83
EASTING: 11,546,752.84
GS ELEVATION: 328.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 1.75 (CL) silty CLAY; dark brown; numerous organics; dry, soft.	CL		326.55		**WELL CASING** Interval: 0.0-78.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread
		1.75 - 7.00 (CL-ML) silty CLAY, trace sand; fine; bright orange; low plasticity, dry, soft.			1.75		**WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum
	325		CL-ML				**ANNULUS SEAL** Interval: 0.0-66.0 feet BGS Type: 3:1 Portland/ Bentonite Grout
5		5.00 - 28.00 (ML) SILT; tan - dull tannish brown; moist - dry, soft.					**FILTER PACK SEAL** Interval: 66.0-69.6 feet BGS Type: Bentonite Chips
					321.30		**FILTER PACK** Interval: 69.6-88.0 feet BGS Type: No. 2 Filter Sand
		7.00 - 8.00 (CL) silty CLAY; dull grayish brown; nodules of severly weathered rock fragments; dry, soft.	CL		7.00		
	320	8.00 - 20.00 (ML) SILT; bright tannish white; some severely weathered rock fragments; dry, soft.			320.30 8.00		**WELL SCREEN** Interval: 78.0-88.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch Slot End Cap: 88.0 feet BGS
10						3:1 Portland/ Bentonite Grout	
	315		ML				
15			ML				
	310						
20					308.30		
		20.00 - 21.00 (CL-ML) silty CLAY; burnt orange; nodules of severely weathered rock fragments; moist, soft - firm.	CL-ML		20.00		
		21.00 - 22.75 (ML) SILT, trace sand; fine; tannish white - bright tan; dry - moist, soft.	ML		307.30 21.00		
		22.75 - 23.00 (ML) SILT; dark orange - bright white; dry - moist, soft - firm.	ML		305.55		
	305						
25		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 88.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/14/16
DATE COMPLETED: 9/15/16

NORTHING: 3,782,267.83
EASTING: 11,546,752.84
GS ELEVATION: 328.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		5.00 - 28.00 (ML) SILT; tan - dull tannish brown; moist - dry, soft. *(Continued)*	ML		300.30		**WELL CASING** Interval: 0.0-78.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-66.0 feet BGS Type: 3:1 Portland/ Bentonite Grout **FILTER PACK SEAL** Interval: 66.0-69.6 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 69.6-88.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 78.0-88.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch Slot End Cap: 88.0 feet BGS
	300	28.00 - 38.00 (ML) SILT; thickly bedded dull tan, dull brown, and dull gray (~3" repeating beds); moist - dry, soft.			28.00		
30							
	295		ML				
35							
					290.30		
	290	38.00 - 39.50 (SW) SAND, some silt; fine, well sorted; dull tan; high biotite content; wet, loose - compact.	SW		38.00 288.80		
		39.50 - 40.00 (CL-ML) silty CLAY - SILT; dull gray, orange mottles; wet - moist, soft.	CL-ML		39.50 288.30		
40		40.00 - 41.50 (ML) SILT; dull orange; low plasticity; moist, firm.	ML		40.00 286.80		
		41.50 - 42.00 (ML) SILT; dull gray; low plasticity; moist, soft - firm.	ML		41.50 286.30		
		42.00 - 44.00 (ML) SILT; dark orange - bright white; relict foliation features; moist - dry, firm.	ML		42.00 284.30		
	285						
		44.00 - 58.00 (ML) SILT; thickly bedded tan and dull gray (~3" - 6" beds); dry soft.	ML		44.00	Bentonite Chips	
45							
	280						
50							

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus
PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 88.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/14/16
DATE COMPLETED: 9/15/16

NORTHING: 3,782,267.83
EASTING: 11,546,752.84
GS ELEVATION: 328.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		44.00 - 58.00 (ML) SILT; thickly bedded tan and dull gray (~3" - 6" beds); dry soft. *(Continued)*	ML				**WELL CASING** Interval: 0.0-78.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Concrete Protective Casing: 4"x4" Aluminum **ANNULUS SEAL** Interval: 0.0-66.0 feet BGS Type: 3:1 Portland/ Bentonite Grout **FILTER PACK SEAL** Interval: 66.0-69.6 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 69.6-88.0 feet BGS Type: No. 2 Filter Sand **WELL SCREEN** Interval: 78.0-88.0 feet BGS Material: Sch. 40 PVC Diameter: 2-inch Slot Size: 0.010-inch Slot End Cap: 88.0 feet BGS
	275						
55							
					270.30		
	270	58.00 - 71.50 PHYLLITE; severely weathered; silt matrix; thickly bedded tan and gray; dry, soft.			58.00		
60							
	265						
65							
	260						
70					256.80		
		71.50 - 73.00 (SW) silty clayey SAND; fine, well sorted; dark gray; high biotite content; wet, loose - compact.	SW		71.50		
					255.30		
	255	73.00 - 78.00 PHYLLITE; severely weathered; silt matrix; thickly bedded tan and gray; dry, soft.			73.00		
75		Log continued on next page					

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-27S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 88.00 ft
DRILL METHOD: Sonic

DRILL RIG: Bort T-300
DATE STARTED: 9/14/16
DATE COMPLETED: 9/15/16

NORTHING: 3,782,267.83
EASTING: 11,546,752.84
GS ELEVATION: 328.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		73.00 - 78.00 PHYLLITE; severely weathered; silt matrix; thickly bedded tan and gray; dry, soft. *(Continued)*			250.30		
	250	78.00 - 79.00 hornblende GNEISS; heavily weathered, orange staining penetrates rock mass; soft			78.00 249.30	No. 2 Filter Sand	
		79.00 - 84.00 quartzofeldspathic - biotite SCHIST; moderately weathered; vertical foliation;			79.00		
80							
	245					0.010-inch Slot	
					244.30		
		84.00 - 86.00 No recovery			84.00		
85					242.30		
		86.00 - 87.00 hornblende GNEISS; heavily weathered, some pitting and orange staining; black, some white; moderately hard.			86.00 241.30		
		87.00 - 87.50 quartzofeldspathic - biotite SCHIST; heavily weathered - moderately weathered; moderately hard - hard.			87.00 240.80 87.50		
	240	87.50 - 88.00 hornblende GNEISS; heavily weathered, some orange staining; black, some white; soft.			240.30		
		Boring completed at 88.00 ft					
90							
	235						
95							
	230						
100							

WELL CASING
Interval: 0.0-78.0 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2' Concrete
Protective Casing: 4"x4" Aluminum

ANNULUS SEAL
Interval: 0.0-66.0 feet BGS
Type: 3:1 Portland/ Bentonite Grout

FILTER PACK SEAL
Interval: 66.0-69.6 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 69.6-88.0 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 78.0-88.0 feet BGS
Material: Sch. 40 PVC
Diameter: 2-inch
Slot Size: 0.010-inch Slot
End Cap: 88.0 feet BGS

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Cascade Drilling, L.P.
DRILLER: Fred Kraus

PREPARED: J. Kasperski
REVIEWED: Craig LaCosse, C.P.G.
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT
0		0.00 - 0.50 (GP) SILTY CLAYEY GRAVEL; Fill material; shale gravel; blue-gray - brown; moist; loose.	GP		386.80 0.50					
		0.50 - 1.50 (CL) SILTY CLAY; Fill material; light orange; micaceous; w>PL; firm.	CL		385.80 1.50	1	SS	3 -3 -3 -6	6	2.00 2.00
	385	1.50 - 2.50 (CL) SILTY CLAY; trace sand; light orange - red-orange; micaceous; w>PL; firm.	CL		384.80 2.50	2	SS	9 -11 -13 -16	24	1.00 2.00
5		2.50 - 8.00 (CL) SILTY CLAY; trace fine sand; red-orange; micaceous; w<PL; firm.	CL			3	SS	3 -4 -6 -7	10	2.00 2.00
	380					4	SS	2 -3 -5 -5	8	2.00 2.00
					379.30					
		8.00 - 14.00 (CL) silty SANDY CLAY; fine sand; trace quartz gravel up to 0.5 inches in diameter; light orange - light brown; micaceous; w<PL; soft; vertical relict structures.			8.00	5	SS	1 -4 -5 -5	9	2.00 2.00
10			CL			6	SS	4 -6 -6 -9	12	2.00 2.00
	375					7	SS	1 -2 -3 -5	5	2.00 2.00
					373.30					
		14.00 - 22.00 (CL) silty sandy CLAY; fine to medium sand particles; trace quartzite gravel; tan - light orange; micaceous; horizontal relict structures; w<PL; soft.			14.00	8	SS	3 -4 -7 -6	11	2.00 2.00
15						9	SS	2 -5 -8 -11	13	0.80 2.00
	370		CL			10	SS	4 -5 -7 -7	12	2.00 2.00
20						11	SS	4 -7 -7 -15	14	0.90 2.00
					365.30					
	365	22.00 - 27.00 (SM) clayey SILTY SAND; fine; some clay lenses; tan to white; dry; loose; relict structures present; micaceous; vertical foliation.	SM		22.00	12	SS	7 -10 -12 -15	22	2.00 2.00
						13	SS	10 -17 -20 -37	37	1.00 2.00
25		Log continued on next page								

WELL CASING
Interval: 0.0-146.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-139.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 139.0-141.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 141.0-158.0
No. 2 Filter Sand
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 146.0-156.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 156.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES
25		22.00 - 27.00 (SM) clayey SILTY SAND; fine; some clay lenses; tan to white; dry; loose; relict structures present; micaceous; vertical foliation. *(Continued)*	SM			13	SS	10 -17 -20 -37	37	1.00 / 2.00	
					360.30	14	SS	10 -17 -22 -26	39	1.40 / 2.00	
	360	27.00 - 34.00 (SM) clayey SILTY SAND; fine; some clay as depth increases; trace quartzite gravel up to 1.25 inches in diameter; tan to white; dry; loose; relict structures present; micaceous; vertical foliation.			27.00						
						15	SS	7 -10 -12 -20	22	2.00 / 2.00	
30			SM			16	SS	7 -10 -12 -17	22	2.00 / 2.00	
	355					17	SS	9 -11 -20 -25	31	0.70 / 2.00	
					353.30						
		34.00 - 38.00 SAPROLITE; (CL) sandy SILTY CLAY; fine to coarse; tan - brown; micaceous; vertical relict structures; weathered rock gravel up to 1.5 inches in diameter; w<PL, firm; foliation is predominantly horizontal.	CL		34.00	18	SS	10 -11 -14 -18	25	2.00 / 2.00	
35											
						19	SS	12 -25 -29 -40	>50	1.30 / 2.00	
	350										
					349.30						
		38.00 - 45.00 SAPROLITE; (CL) sandy SILTY CLAY; fine to coarse sand particles; white - light gray; micaceous; gneissic relic structures; w<PL; firm.			38.00	20	SS	5 -15 -24 -30	39	2.00 / 2.00	
40						21	SS	15 -49 -50/4	>50	1.30 / 1.30	
			CL								
	345										
					342.30						
45		45.00 - 50.00 (SM) clayey silty SAND; fine; some coarse sand; some gravel (weathered rock); tan to white/light gray; micaceous; relict structures present; dry; compact.			45.00	22	SS	23 -50/5	50/5	0.90 / 0.90	
	340		SM								
					337.30						
50		Log continued on next page									

WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0-146.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-139.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 139.0-141.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 141.0-158.0
No. 2 Filter Sand
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 146.0-156.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 156.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		50.00 - 56.00 (SM) clayey SILTY SAND; fine sand particles; tan to white/light gray; micaceous; relict structures present; wet; dense.	SM		50.00	23	SS	38 -50/4	50/4	0.80 / 0.80		**WELL CASING** Interval: 0.0-146.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread
	335											**WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4"
55						24	SS	24 -42 -50/5	>50	1.10 / 1.40		**ANNULUS SEAL** Interval: 0.0-139.0 feet BGS Type: Bentonite Grout
		56.00 - 74.00 quartzofeldspathic - biotite SCHIST; mostly competent.			331.30 56.00							**FILTER PACK SEAL** Interval: 139.0-141.0 feet BGS Type: Bentonite Chips
	330											**FILTER PACK** Interval: 141.0-158.0 No. 2 Filter Sand Type: No. 2 Filter Sand
60						25	SS	8 -26 -50/5	36	1.40 / 1.40		**WELL SCREEN** Interval: 146.0-156.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 156.0 feet BGS
	325											
65						26	SS	50/5	50/5	0.40 / 0.40		
	320										Bentonite Grout	
70						27	SS	29 -50/2	50/2	0.70 / 0.70		
	315											
		74.00 - 78.00 quartzofeldspathic - biotite SCHIST; competent.			313.30 74.00							
75		Log continued on next page										

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
75		74.00 - 78.00 quartzofeldspathic - biotite SCHIST; competent. *(Continued)*										
	310				309.30							
		78.00 - 97.00 quartzofeldspathic - biotite SCHIST; yellow-orange - orange, some white; schistose.			78.00							
80												
	305											
85												
	300											
90												
	295											
95												
	290				290.30							
		97.00 - 102.00 quartzofeldspathic - biotite SCHIST; white - red-orange; schistose.			97.00							
100		Log continued on next page										

WELL CASING
Interval: 0.0-146.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-139.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 139.0-141.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 141.0-158.0
No. 2 Filter Sand
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 146.0-156.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 156.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
100		97.00 - 102.00 quartzofeldspathic - biotite SCHIST; white - red-orange; schistose. *(Continued)*			285.30							
	285	102.00 - 111.00 quartzofeldspathic - biotite GNEISS; white with dark gray banding, some red-orange; gneissic.			102.00							
105												
	280											
110					276.30							
		111.00 - 117.00 quartzofeldspathic - biotite GNEISS; some hornblende; black and white/gray.			111.00							
	275											
115					270.30							
	270	117.00 - 132.00 QUARTZ; milky white.			117.00							
120												
	265											
125		Log continued on next page										

WELL CASING
Interval: 0.0-146.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-139.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 139.0-141.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 141.0-158.0
No. 2 Filter Sand
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 146.0-156.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 156.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
125		117.00 - 132.00 QUARTZ; milky white. *(Continued)*										
	260											
130												
					255.30							
	255	132.00 - 158.00 hornblende gneiss; dark gray to gray, some light gray; increase mica content with depth.			132.00							
135												
	250											
140											Bentonite Chips	
	245											
145												
	240											
150		Log continued on next page									No. 2 Filter Sand	

WELL CASING
Interval: 0.0-146.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-139.0 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 139.0-141.0 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 141.0-158.0
No. 2 Filter Sand
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 146.0-156.0 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 156.0 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29D

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 158.00 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers/Air Hammer

DRILL RIG: CME 850
DATE STARTED: 9/28/16
DATE COMPLETED: 10/4/16

NORTHING: 3,783,005.27
EASTING: 11,548,618.92
GS ELEVATION: 387.30 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
150		132.00 - 158.00 hornblende gneiss; dark gray to gray, some light gray; increase mica content with depth. *(Continued)*									0.010-inch No. 2 Filter Sand	**WELL CASING** Interval: 0.0-146.0 feet BGS Material: Sch. 40 Diameter: 2-inch Joint Type: Thread **WELL COMPLETION** Pad: 2'x2' Protective Casing: 4"x4" **ANNULUS SEAL** Interval: 0.0-139.0 feet BGS Type: Bentonite Grout **FILTER PACK SEAL** Interval: 139.0-141.0 feet BGS Type: Bentonite Chips **FILTER PACK** Interval: 141.0-158.0 No. 2 Filter Sand Type: No. 2 Filter Sand **WELL SCREEN** Interval: 146.0-156.0 feet BGS Material: Sch. 40 Diameter: 2-inch Slot Size: 0.010-inch End Cap: 156.0 feet BGS
155	235											
160	230				229.30							
165	225	Boring completed at 158.00 ft										
170	220											
175	215											

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 71.50 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 10/5/16
DATE COMPLETED: 10/6/16

NORTHING: 3,782,998.91
EASTING: 11,548,622.35
GS ELEVATION: 390.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0	390	0.00 - 0.50 (GP) SILTY CLAYEY GRAVEL; Fill material; shale gravel; blue-gray - brown; moist; loose.	GP		390.00		
		0.50 - 1.50 (CL) SILTY CLAY; Fill material; light orange; micaceous; w>PL; firm.	CL		0.50 389.00		
		1.50 - 2.50 (CL) SILTY CLAY; trace sand; light orange - red-orange; micaceous; w>PL; firm.	CL		1.50 388.00		
5	385	2.50 - 8.00 (CL) SILTY CLAY; trace fine sand; red-orange; micaceous; w<PL; firm.	CL		2.50 382.50		
10	380	8.00 - 14.00 (CL) silty SANDY CLAY; fine sand; trace quartz gravel up to 0.5 inches in diameter; light orange - light brown; micaceous; w<PL; soft; vertical relict structures.	CL		8.00 376.50		
15	375	14.00 - 22.00 (CL) silty sandy CLAY; fine to medium sand particles; trace quartzite gravel; tan - light orange; micaceous; horizontal relict structures; w<PL; soft.	CL		14.00 368.50		
20	370	22.00 - 27.00 (SM) clayey SILTY SAND; fine; some clay lenses; tan to white; dry; loose; relict structures present; micaceous; vertical foliation.	SM		22.00		
25		Log continued on next page					

WELL CASING
Interval: 0.0-61.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-54.5 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 54.5-56.5 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 56.5-71.5 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 61.5-71.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 71.5 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 71.50 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 10/5/16
DATE COMPLETED: 10/6/16

NORTHING: 3,782,998.91
EASTING: 11,548,622.35
GS ELEVATION: 390.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25	365	22.00 - 27.00 (SM) clayey SILTY SAND; fine; some clay lenses; tan to white; dry; loose; relict structures present; micaceous; vertical foliation. *(Continued)*	SM		363.50		
		27.00 - 34.00 (SM) clayey SILTY SAND; fine; some clay as depth increases; trace quartzite gravel up to 1.25 inches in diameter; tan to white; dry; loose; relict structures present; micaceous; vertical foliation.			27.00	Bentonite Grout	
30	360		SM		356.50		
		34.00 - 38.00 SAPROLITE; (CL) sandy SILTY CLAY; fine to coarse; tan - brown; micaceous; vertical relict structures; weathered rock gravel up to 1.5 inches in diameter; w<PL, firm; foliation is predominantly horizontal.			34.00		
35	355		CL		352.50		
		38.00 - 45.00 SAPROLITE; (CL) sandy SILTY CLAY; fine to coarse sand particles; white - light gray; micaceous; gneissic relic structures; w<PL; firm.			38.00		
40	350		CL		345.50		
45	345	45.00 - 50.00 (SM) clayey silty SAND; fine; some coarse sand; some gravel (weathered rock); tan to white/light gray; micaceous; relict structures present; dry; compact.	SM		45.00		
50					340.50		

Log continued on next page

WELL CASING
Interval: 0.0-61.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-54.5 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 54.5-56.5 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 56.5-71.5 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 61.5-71.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 71.5 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-29S

PROJECT: Dominion - Bremo Power Station
PROJECT NUMBER: 15-20347.230.001
DRILLED DEPTH: 71.50 ft
DRILL METHOD: 6.25-inch ID Hollow-Stem Augers

DRILL RIG: CME 850
DATE STARTED: 10/5/16
DATE COMPLETED: 10/6/16

NORTHING: 3,782,998.91
EASTING: 11,548,622.35
GS ELEVATION: 390.50 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50	340	50.00 - 56.00 (SM) clayey SILTY SAND; fine sand particles; tan to white/light gray; micaceous; relict structures present; wet; dense.	SM		50.00		
55	335				334.50	Bentonite Chips	
		56.00 - 71.50 quartzofeldpathic - biotite SCHIST; mostly competent.			56.00		
60	330						
65	325					No. 2 Filter Sand	
70	320					0.010-inch	
					319.00		
75		Boring completed at 71.50 ft					

WELL CASING
Interval: 0.0-61.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Joint Type: Thread

WELL COMPLETION
Pad: 2'x2'
Protective Casing: 4"x4"

ANNULUS SEAL
Interval: 0.0-54.5 feet BGS
Type: Bentonite Grout

FILTER PACK SEAL
Interval: 54.5-56.5 feet BGS
Type: Bentonite Chips

FILTER PACK
Interval: 56.5-71.5 feet BGS
Type: No. 2 Filter Sand

WELL SCREEN
Interval: 61.5-71.5 feet BGS
Material: Sch. 40
Diameter: 2-inch
Slot Size: 0.010-inch
End Cap: 71.5 feet BGS

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: Parratt-Wolff Inc.
DRILLER: Paul Poyner

PREPARED: Craig LaCosse
REVIEWED: J. Church
DATE: 2/15/17

Golder Associates

RECORD OF BOREHOLE MW-30

SHEET 1 of 1

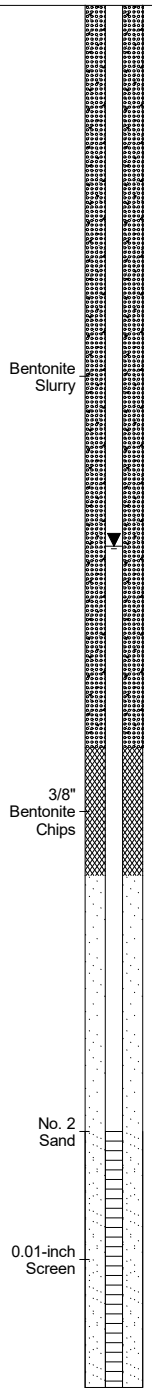
PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 27.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/23/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,541.31
EASTING: 11,541,665.13
GS ELEVATION: 219.81 ft
TOC ELEVATION: 222.22 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0		0.00 - 0.50 FILL - pad gravel			219.31 0.50
		0.50 - 8.00 (CL) SILTY CLAY, some sand, light brown, micaceous, W (water content) > PL (plastic limit), soft.	CL		
5	215				211.81
		8.00 - 10.00 (CL) SILTY CLAY, some sand, dark brown, micaceous, W~PL, very stiff.	CL		8.00 209.81
10	210	10.00 - 19.00 (CL) SILTY CLAY, some sand, light brown, micaceous, wet.	CL		10.00
15	205				200.81
		19.00 - 25.00 (SM) SILTY SAND, fine to medium sand, micaceous, dark gray, wet, loose.	SM		19.00
20	200				
25	195				194.81
		25.00 - 26.00 (GM) SILTY GRAVEL, subrounded fine to medium gravel, mostly quartzite, dark gray, wet, loose.	GM		25.00 193.81
		26.00 - 27.00 SLATE; dark gray, highly weathered, soft rock.			26.00 192.81
		Boring completed at 27.00 ft			
30	190				

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-27'
Material: SCH 40 PVC
Diameter: 2-inch
Joint Type: threaded

WELL COMPLETION
Pad: 4'x3'
Protective Casing: Floodplain Wellhead

ANNULUS SEAL
Interval: 0'-14.5'
Type: Bentonite Slurry

FILTER PACK SEAL
Interval: 14.5'-17'
Type: 3/8" Bentonite Chips

FILTER PACK
Interval: 17'-27'
Type: No. 2 Sand

WELL SCREEN
Interval: 22'-27'
Material: SCH 40 PVC
Diameter: 2-inch
Slot Size: 0.01-inch
End Cap: 2-inch PVC

LOG SCALE: 1 in = 3.75 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

AA BOREHOLE RECORD (NO PID) 2020-01 BREMO EAP WAP WELLS.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 3/11/20

RECORD OF BOREHOLE MW-37

SHEET 1 of 1

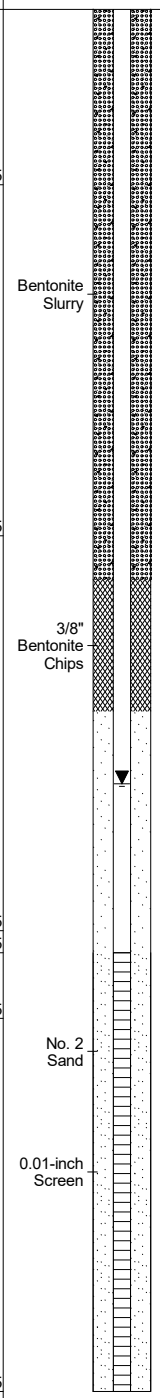
PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 31.50 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/28/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,111.49
EASTING: 11,543,069.04
GS ELEVATION: 219.45 ft
TOC ELEVATION: 222.15 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0	220	0.00 - 4.00 (CL) SILTY CLAY, trace fine sand, brown, micaceous, W>PL, stiff.	CL		218.15
5	215	4.00 - 12.00 (CL) SILTY CLAY, some fine sand, poorly sorted, dark brown, micaceous, very stiff, W~PL.	CL		4.00 210.15
10	210	12.00 - 21.00 (CL) sandy SILTY CLAY, fine to medium sand, well sorted, light brown, micaceous, soft, wet.	CL		12.00 201.15
15	205				
20	200	21.00 - 21.50 (GM) SILTY GRAVEL, subrounded, fine gravel, mostly quartzite, light brown, wet, loose.	GM		200.65 21.50
25	195	21.50 - 23.00 hornblende GNEISS; light gray, highly weathered, soft rock.			199.15
30	190	23.00 - 31.50 hornblende GNEISS interbedded with biotitie SCHIST; light gray to dark gray, moderately weathered and fractured, iron staining in fractures.			23.00 190.65
35		Boring completed at 31.50 ft			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-31.5'
Material: SCH 40 PVC
Diameter: 2-inch
Joint Type: threaded

WELL COMPLETION
Pad: 4'x3'
Protective Casing: Floodplain Wellhead

ANNULUS SEAL
Interval: 0'-13'
Type: Bentonite Slurry

FILTER PACK SEAL
Interval: 13'-16'
Type: 3/8" Bentonite Chips

FILTER PACK
Interval: 16'-31.5'
Type: No. 2 Sand

WELL SCREEN
Interval: 21.5'-31.5'
Material: SCH 40 PVC
Diameter: 2-inch
Slot Size: 0.01-inch
End Cap: 2-inch PVC

LOG SCALE: 1 in = 4.38 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

AA BOREHOLE RECORD (NO PID) 2020-01 BREMO EAP WAP WELLS.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 3/11/20

RECORD OF BOREHOLE MW-39S

SHEET 1 of 1

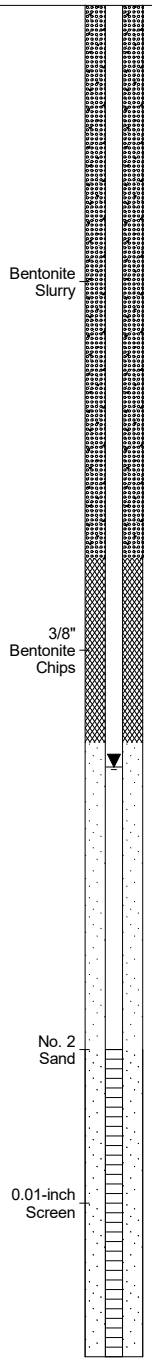
PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 22.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/28/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,339.24
EASTING: 11,542,319.17
GS ELEVATION: 215.92 ft
TOC ELEVATION: 218.22 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0	215	0.00 - 4.00 (CL) SILTY CLAY, trace fine sand, light brown, micaceous, W>PL, firm.	CL		214.22 / 4.00
5	210	4.00 - 11.00 (CL) SILTY CLAY, dark brown, micaceous, W~PL, stiff.	CL		207.22 / 11.00
10	205	11.00 - 15.50 (CL) SILTY CLAY, trace fine sand, light brown, micaceous, soft, wet.	CL		202.72 / 15.50
15	200	15.50 - 19.50 (SC) CLAYEY SAND, fine grained, poorly sorted, dark gray to brown, micaceous, soft, wet.	SC		198.72 / 19.50
20	195	19.50 - 20.00 (GP) sandy GRAVEL, poorly sorted, subrounded to rounded fine gravel, mostly quartzite, wet, loose.	GP		198.22 / 20.00
25		20.00 - 22.00 SCHIST; highly weathered, soft rock, dark to light gray, dry.			196.22
		Boring completed at 22.00 ft			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-22'
Material: SCH 40 PVC
Diameter: 2-inch
Joint Type: threaded

WELL COMPLETION
Pad: 4'x3'
Protective Casing: Floodplain Wellhead

ANNULUS SEAL
Interval: 0'-9'
Type: Bentonite Slurry

FILTER PACK SEAL
Interval: 9'-12'
Type: 3/8" Bentonite Chips

FILTER PACK
Interval: 12'-22'
Type: No. 2 Sand

WELL SCREEN
Interval: 17'-22'
Material: SCH 40 PVC
Diameter: 2-inch
Slot Size: 0.01-inch
End Cap: 2-inch PVC

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

AA BOREHOLE RECORD (NO PID) 2020-01 BREMO EAP WAP WELLS.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 3/11/20

RECORD OF BOREHOLE MW-39D

PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 69.50 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/23/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,335.61
EASTING: 11,542,331.02
GS ELEVATION: 215.96 ft
TOC ELEVATION: 218.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0	215	0.00 - 4.00 (CL) SILTY CLAY, trace fine sand, light brown, micaceous, W>PL, firm.	CL		214.10 / 4.00
5	210	4.00 - 11.00 (CL) SILTY CLAY, dark brown, micaceous, W~PL, stiff.	CL		207.10 / 11.00
10	205	11.00 - 15.50 (CL) SILTY CLAY, trace fine sand, light brown, micaceous, soft, wet.	CL		202.60 / 15.50
15	200	15.50 - 19.50 (SC) CLAYEY SAND, fine grained, poorly sorted, dark gray to brown, micaceous, soft, wet.	SC		198.60 / 19.50
20	195	19.50 - 20.00 (GP) sandy GRAVEL, poorly sorted, subrounded to rounded fine gravel, mostly quartzite, wet, loose.	GP		198.10 / 20.00
		20.00 - 21.00 SCHIST; highly weathered, soft rock, dark to light gray, dry.			197.10 / 21.00
25		21.00 - 30.00 porphyroblastic SCHIST; light gray, abundant garnets, moderately weathered and fractured.			

Log continued on next page

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES

WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-69.5'
Material: SCH 40 PVC
Diameter: 2-inch
Joint Type: threaded

WELL COMPLETION
Pad: 4'x3'
Protective Casing: Floodplain Wellhead

ANNULUS SEAL
Interval: 0'-51.5'
Type: Bentonite Slurry

FILTER PACK SEAL
Interval: 51.5'-54.5'
Type: 3/8" Bentonite Chips

FILTER PACK
Interval: 54.5'-69.5'
Type: No. 2 Sand

WELL SCREEN
Interval: 59.5'-69.5'
Material: SCH 40 PVC
Diameter: 2-inch
Slot Size: 0.01-inch
End Cap: 2-inch PVC

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

RECORD OF BOREHOLE MW-39D

PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 69.50 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/23/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,335.61
EASTING: 11,542,331.02
GS ELEVATION: 215.96 ft
TOC ELEVATION: 218.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
25		21.00 - 30.00 porphyroblastic SCHIST; light gray, abundant garnets, moderately weathered and fractured. *(Continued)*				Bentonite Slurry	**WELL CASING** Interval: 0'-69.5' Material: SCH 40 PVC Diameter: 2-inch Joint Type: threaded **WELL COMPLETION** Pad: 4'x3' Protective Casing: Floodplain Wellhead **ANNULUS SEAL** Interval: 0'-51.5' Type: Bentonite Slurry **FILTER PACK SEAL** Interval: 51.5'-54.5' Type: 3/8" Bentonite Chips **FILTER PACK** Interval: 54.5'-69.5' Type: No. 2 Sand **WELL SCREEN** Interval: 59.5'-69.5' Material: SCH 40 PVC Diameter: 2-inch Slot Size: 0.01-inch End Cap: 2-inch PVC
	190						
30					188.10 30.00		
		30.00 - 50.00 porphyroblastic SCHIST; dark to light gray, abundant garnets, slightly fractured.					
	185						
35							
	180						
40							
	175						
45							
	170						
50					168.10		

Log continued on next page

LOG SCALE: 1 in = 3.13 ft
DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

RECORD OF BOREHOLE MW-39D

PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 69.50 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/23/20
DATE COMPLETED: 2/13/20

NORTHING: 3,782,335.61
EASTING: 11,542,331.02
GS ELEVATION: 215.96 ft
TOC ELEVATION: 218.10 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
50		50.00 - 69.50 pophyroblastic SCHIST; some phyllite interbeds, abundant garnets, dark to light gray, moderately weathered, intensely fractured, smooth high angle planar fractures partially coated by quartz, calcite, and solution voids.			50.00		**WELL CASING** Interval: 0'-69.5' Material: SCH 40 PVC Diameter: 2-inch Joint Type: threaded **WELL COMPLETION** Pad: 4'x3' Protective Casing: Floodplain Wellhead **ANNULUS SEAL** Interval: 0'-51.5' Type: Bentonite Slurry **FILTER PACK SEAL** Interval: 51.5'-54.5' Type: 3/8" Bentonite Chips **FILTER PACK** Interval: 54.5'-69.5' Type: No. 2 Sand **WELL SCREEN** Interval: 59.5'-69.5' Material: SCH 40 PVC Diameter: 2-inch Slot Size: 0.01-inch End Cap: 2-inch PVC
55	165					3/8" Bentonite Chips	
60	160						
65	155					No. 2 Sand 0.01-inch Screen	
70	150				148.60		
75	145	Boring completed at 69.50 ft					

LOG SCALE: 1 in = 3.13 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

RECORD OF BOREHOLE MW-40

SHEET 1 of 1

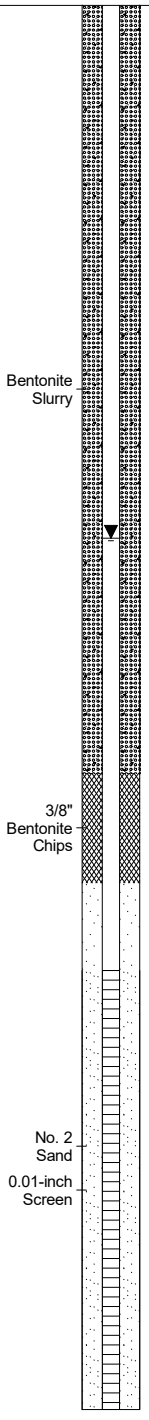
PROJECT: Bremo Power Station
PROJECT NUMBER: 1520-347.230C
DRILLED DEPTH: 32.00 ft
DRILL METHOD: Sonic

DRILL RIG: Geoprobe 8140LS
DATE STARTED: 1/17/20
DATE COMPLETED: 2/13/20

NORTHING: 3,780,905.49
EASTING: 11,545,796.81
GS ELEVATION: 214.92 ft
TOC ELEVATION: 216.79 ft

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)
0	215	0.00 - 11.00 (CL) SILTY CLAY, trace fine sand, brown-orange, micaceous, W>PL, very stiff.	CL		205.79
5	210				
10	205	11.00 - 19.00 (CL) sandy SILTY CLAY, medium sand, brown and gray with orange mottling, micaceous, W>PL, stiff.	CL		11.00 197.79
15	200	19.00 - 20.50 (SM/GM) SILTY SAND and GRAVEL, fine to coarse sand, subrounded, fine gravel, dark gray, wet, loose.	SM		19.00 196.29
20	195	20.50 - 21.50 (SM/GM) SILTY SAND and GRAVEL, medium to coarse sand, medium to coarse subrounded to rounded gravel, mostly quartzite, dark gray, wet, loose.	GM		20.50 195.29
		21.50 - 22.00 GNEISS; white, disintegrated, soft rock.			194.79 22.00
25	190	22.00 - 27.00 quartz-biotite GNEISS; light gray, steeply dipping biotite foliation, slightly weathered.			189.79
30	185	27.00 - 32.00 quartz-biotite GNEISS interbedded with SCHIST; light gray to black, steeply dipping biotite foliation, moderately weathered, slightly fractured.			27.00 184.79
35		Boring completed at 32.00 ft			

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-32'
Material: SCH 40 PVC
Diameter: 2-inch
Joint Type: threaded

WELL COMPLETION
Pad: 4'x3'
Protective Casing: Floodplain Wellhead.

ANNULUS SEAL
Interval: 0'-17.5'
Type: Bentonite Slurry

FILTER PACK SEAL
Interval: 17.5'-20'
Type: 3/8" Bentonite Chips

FILTER PACK
Interval: 20'-32'
Type: No. 2 Sand

WELL SCREEN
Interval: 22'-32'
Material: SCH 40 PVC
Diameter: 2-inch
Slot Size: 0.01-inch
End Cap: 2-inch PVC

LOG SCALE: 1 in = 4.38 ft

DRILLING COMPANY: M&W Drilling
DRILLER: Chad White

PREPARED: C. Joyner
REVIEWED: Craig LaCosse
DATE: 3/11/20

GOLDER

AA BOREHOLE RECORD (NO PID) 2020-01 BREMO EAP WAP WELLS.GPJ ENVIRONMENTAL DATA TEMPLATE.GDT 3/11/20

APPENDIX B

GROUNDWATER MONITORING WELL CONSTRUCTION SPECIFICATIONS, WELL DEVELOPMENT GUIDANCE, WELL DECOMMISSIONING GUIDANCE, AND FIGURE 1 – MONITORING WELL DETAILS

GROUNDWATER MONITORING WELL CONSTRUCTION SPECIFICATIONS

1.0 DRILLING

1.1 Nominal Boring Diameter

In all cases where the diameter of the well pipe will be 2 inches, the minimum nominal borehole diameter of borings advanced through soil materials will be 6 inches in order to help ensure that the minimum width of the annulus around the well pipe will be 2 inches.

1.2 Drilling Methods

Boring should be advanced with drilling technology appropriate for the subsurface conditions at the site.

1.3 Cuttings

Drilling will be performed in a manner that minimizes the spreading of soil cuttings. Disposition of cuttings upon project completion will be the responsibility of Owner/Operator or the Owner/Operator's designated representative. Cuttings will be disposed of in accordance with the DEQ's Investigative Derived Waste Disposal Policy.

2.0 SOIL SAMPLING

2.1 Cuttings

During borehole drilling, the driller will attempt to sample the soil cuttings by providing samples of the cuttings at intervals specified by the Owner/Operator or the Owner/Operator's representative. The driller will keep cuttings clear of the borehole.

2.3 Sample Disposition

Disposition of sample material upon completion of the project will be the responsibility of the Owner/Operator or the Owner/Operator's designated representative.

3.0 WELL CONSTRUCTION

3.1 Well Pipe and Screen

Each monitoring well will be constructed of pre-cleaned Schedule 40 PVC pipe having an inner diameter of 2 inches.

The base of each well will terminate with a screen 10 feet in length unless otherwise requested by the client or regulatory agency or dictated by geologic conditions. Screens will be factory-slotted. Slots will be 0.01 inch in width.

The driller will wear clean surgical-type gloves whenever handling PVC well pipe, and the pipe will be maintained in a clean manner.

In order to provide a clean cut, a PVC pipe cutter will be used whenever it is necessary to shorten sections of the PVC well pipe; a hacksaw will not be used.

3.3 Sand Pack

Filter sand will be a clean sand of proper size in relation to the screen slots to prevent its passage into the well, with no fraction coarser than 0.25-inch nominal diameter.

Filter sand will be placed in the annulus around the well riser and to a point approximately 2 feet above the top of the screen. A tremie pipe will be used as feasible.

3.4 Bentonite Seal

The annulus around the well pipe will be sealed with a layer of bentonite pellets, to be placed directly above the sand filter pack. The minimum thickness of the bentonite layer will be approximately two feet. The bentonite pellets should ideally be allowed 24 hours for hydration prior to continuing with well construction. A tremie pipe will be used as feasible

3.5 Grout

Following hydration of the bentonite seal, each boring will be sealed with a Portland Type I bentonite/cement slurry, using the tremie pipe method or a bentonite slurry grout if required by the project.

Bentonite content in the cement slurry will be 2 to 5 percent by weight to help reduce shrinkage.

3.6 Surface Completion

The driller will be prepared for either manhole or stickup surface completions.

In the case of manhole installations, suitable surface completion will consist of capped PVC riser and steel manhole.

The PVC riser will be provided with a lockable, watertight, expansion cap. The driller will provide a lock for each cap. All locks will be keyed identically and all keys relinquished to the owner.

The manhole will be placed in a manner that permits surface water to runoff and drain away from the manhole cover.

In the case of stickup installations, suitable surface completion will consist of a concrete apron, capped PVC well riser, and outer protective casing. The apron will be constructed in such a manner that surface water will not return to it.

The concrete apron will have the following minimum dimensions: 3 feet x 3 feet x 3.5 inches, and will be centered with respects to the riser. A form will be used in constructing the apron. The form will be centered with respect to the PVC riser. The upper surface of the apron will be graded to provide drainage away from the PVC riser. A spike will be set into the pad for surveying purposes.

The inner PVC riser (well pipe) will extend to an approximate height of 1.75 feet above the top of the concrete pad. A vent hole having a diameter of 0.25 inches will be drilled through the PVC riser at a point 2 inches below its top. Shavings generated by drilling the PVC riser will be prevented from falling into the well. The PVC riser will be provided with a slip on PVC cap.

The outer protective casing will be constructed of steel pipe having a diameter, or diagonal, of not less than 8 inches. The top of the outer protective casing, when uncovered, will be placed at a point between 0.5-inch above the top of the PVC well pipe and 0.5-inch below the top of the PVC pipe. A drain hole having a diameter of 0.5-inch will be drilled through the outer protective casing near the top of the concrete apron. Shavings generated by drilling the steel casing will be prevented from falling into the well. The casing will be marked for surveying purposes.

The outer protective casing will be lockable. The driller will provide a lock for each protective casing cap. All locks will be keyed identically.

4.0 SURVEYING

A licensed surveyor will survey well elevation. Survey point(s) will include:

- concrete pad (marked with a spike);
- outer protective steel casing, when open (engraved mark);
- inner PVC well pipe (engraved mark);
- ground surface (not marked);
- well location to within $\pm$ 0.5 foot in horizontal plane;
- ground surface elevation to within $\pm$ 0.01 foot;

- surveyor's pin elevation on concrete apron within ± 0.01 foot;
- top of monitoring well casing elevation to within ± 0.01 foot; and,
- top of protective steel casing elevation to within ± 0.01 foot.

5.0 WELL DEVELOPMENT AND INSPECTION

The driller will develop each well until sediment free water with stabilized field constituents (i.e., temperature, pH and specific conductance) is obtained.

Development will be conducted using a surge block followed by pumping or bailing. The surge block may be used as a means of assessing the integrity of the well screen and riser.

In the event a pump is employed, the design of the pump will be such that any groundwater that has come into contact with air is not allowed to drain back into the well. Air surging will not be used.

All well development equipment (bailers, pumps, surge blocks) and any additional equipment that contacts subsurface formations will be decontaminated prior to on site use, between consecutive on site uses, and/or between consecutive well installations, as directed by Owner/Operator or Owner/Operator's designated representative.

6.0 ANCILLARY REQUIREMENTS

6.1 Extraneous Material

The driller will take all reasonable care to ensure that each boring is free from all materials other than those required for well construction. Materials required for well construction is here defined to include polyvinyl chloride (PVC), sand, bentonite, Portland cement and natural soil materials. All other materials accidentally or purposely placed in the hole will be removed by driller prior to well completion.

6.2 Decontamination

All drilling equipment (drill steel, bits, casing materials) and any additional equipment, that contacts subsurface formations will be decontaminated prior to on site use, between consecutive on site uses, and/or between consecutive well installations, as directed by Owner/Operator or Owner/Operator's designated representative.

Appropriate decontamination procedure will consist of steam cleaning with potable water and biodegradable detergent (e.g., Liquinox) approved by Owner/Operator

or Owner/Operator's designated representative. Steam cleaning will be conducted in a manner that minimizes over-spray and runoff.

6.3 Disposition of Waste Water

If drilling fluids are used or monitoring wells constructed in an area of suspected contamination, well development wastewater will be placed in 55-gallon drums at the well site and subsequently transported to a publicly operated treatment works (POTW) or the sites leachate collection system for disposal.

6.4 Site Safety Plan

The driller is responsible for maintaining the personal safety of his employees while on site. The driller will keep a fire extinguisher (in good working condition) and first aid kit at the site at all times during which his employees occupy the site.

The driller will be responsible for providing any personal protective equipment that might be required by state and federal occupational safety and health agencies, including, but not necessarily limited to, hard hats, hearing protection and steel-toed boots, for all personnel employed by the driller.

6.5 Cleanup

The driller will be responsible for removing all refuse from each well site. Such refuse typically includes, but is not limited to, PVC pipe wrappers, sand bags, bentonite bags, cement bags, beverage containers, food wrappers and other forms of litter. Smoking on site will not be permitted.

The driller will be responsible for providing the following information to the Owner/Operator's designated representative after well installation has been performed:

- date and time of construction;
- drilling method and fluid used (if applicable);
- boring diameter;
- well pipe (inner casing) specifications;
- well depth (+/-0.01 ft.);
- drilling/lithologic logs;
- specifications for other casing materials (if applicable);
- screen specifications;
- well pipe/screen joint type;
- filter pack specifications (material, size);
- filter pack volume and calculations;
- filter pack placement methods;

- bentonite seal specifications;
- bentonite seal volume;
- bentonite seal placement method;
- grout specifications;
- grout volume;
- grout placement method;
- surface completion specifications; and
- well development procedure

7.0 WELL CONSTRUCTION AND SOIL BORING LOGS

In accordance with 9VAC-20-81-250-A.3.g of the Virginia Solid Waste Management Regulations or other applicable regulations, certified copies of well construction and soil boring logs will be forwarded to the DEQ following completion of well construction activities.

g:\projects\dominion\chesterfield power stn\1532-864 uap and lap groundwater\uap groundwater monitoring plan\2016-04 submittal - rtc deq ltr 2016-02-26\appendices\appendix iia monitoring well construction specifications - golder vswmr amendment 7 update.docx

WELL DEVELOPMENT PROCEDURES

- Record the static water level in the well.
- If a pump is present in the well, remove the pump from the well and measure the total depth of the well.
- Calculate saturated volume of the well and filter pack.
- Using a disposable bailer, collect a water sample from the top of the water column and record field measurements of water quality parameters (Water Quality Parameters (WQP): turbidity, pH, temperature, and specific conductance).
- Surge the well with the teflon surge block or large diameter weighted bailer for three to five minutes.
- Remove the surging device and purge the well with a pneumatic well development pump at a rate that is greater than the natural recharge rate of the well.
- Containerize all purge water for disposal at the location designated by the site.
- Record measurements of WQP on development logs following the removal of each consecutive well and filter pack volume.
- Continue purging until the turbidity level stabilizes or is reduced to less than 5 NTU, then repeat surging with surge block. Surging and purging are to be continued for a minimum of 4 hours, or until turbidity levels following a surging event are less than 10 NTU.
- If the well purges dry, record the rate of recharge and continue purging and surging activities after the well has recovered. Reduce the purge rate to slightly less than the natural recharge rate of the well.
- All non-disposable equipment that will be placed inside of the well during the development process will be decontaminated prior to each day's use using a phosphate-free detergent followed by a deionized water rinse.
- Purge water should be disposed of in a manner that is consistent with the Virginia Department of Environmental Quality's Investigative Derived Waste Disposal Policy.

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1.0 STANDARD OVERVIEW

This Standard represents recommended procedures for decommissioning monitoring wells at solid waste facilities. All wells (monitor wells, water supply wells, etc.) and piezometers not actively being used for their intended purpose and with no future plan for utilization should be decommissioned. Wells and piezometers represent potential conduits for cross-contamination through annulus transfer, improper construction, corrosion, accidents and vandalism. Proper decommissioning eliminates the potential for cross-contamination. In addition to the threat of cross-contamination, improperly decommissioned wells can pose a threat to the integrity of future baseliners. In expansion areas over unconsolidated material, unless the well casing is removed and replaced with a flexible grout, the casing can damage the baseliner in the event of differential settlement or subsidence. The weight of the overlying waste mass often causes a limited amount of subsidence, especially in fine-grained deposits. Since future expansions can occur in areas not currently foreseen, all unused wells within the vicinity of a solid waste disposal facility should be abandoned in accordance with this Standard.

The following well decommissioning procedures are designed to ensure that well materials (including cement grout) will not cause damage to liner materials in the event of subsidence and to minimize the potential for contaminant migration through annular materials. Where regulatory requirements conflict with the procedures described herein, approval should be sought to adhere to this Standard. The procedures described in this Standard generally meet or exceed most regulatory requirements. Possible reasons for variation to this Standard include, but are not limited to, unusual site hydrogeologic conditions, deep wells (>100 feet), multiple cased monitor wells or larger diameter wells (>4”), driven casing wells and State-specific well decommissioning requirements that differ from this Standard.

The goal of well decommissioning is to remove all borehole components including the existing grout and gravel pack and replace the borehole contents with a suitable grout mixture. Removal of all borehole components is best accomplished by overdrilling the well using an auger of a diameter 1.25 times that of the original borehole coupled with a centering device.

This standard was developed in consideration of the following reference materials:

- ASTM D 5299-99, 2005. Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. ASTM 1993 Annual Book of Standards, vol. 04.08, pp. 1318-1333.
- AWWA/ANSI A100-06, 2006. AWWA Standard for Water Wells, American Water Works Association, Denver Colorado. Appendix G.
- Lutenegger, A.J. and DeGroot, D.J. 1993, Hydrologic properties of contaminant transport barriers as borehole sealants. Hydraulic conductivity and Waste Contaminant Transport in Soils, ASTM STP 1142, D.E. Daniel and S.J. Trautwein, eds., ASTM Philadelphia, Pennsylvania.
- NWWA, 1975 (National Water Well Association Committee on Water Well Standards, 1975) Manual of Water Well Construction Practices, EPA –570/9-75-001. Office of Water Supply, Washington D.C.
- Smith, S.A., 1994, Well & Borehole Sealing, S.A. Smith Consulting Services, Ada, Ohio with Wisconsin Water Well Association for Groundwater publishing Co., Dublin, Ohio, 69p.

2.0 SURVEY CONTROL

Unless detailed survey information exists, each well shall be surveyed for both horizontal and vertical control, prior to decommissioning. The location of the well shall be surveyed to the nearest 0.5 feet. The ground surface elevation and top of well casing shall also be surveyed to the nearest 0.1 feet and 0.1 feet, respectively, relative to mean sea level. A State-licensed surveyor shall perform surveying.

3.0 GROUT SPECIFICATIONS

The following are specifications for three grout mixtures commonly used in well decommissioning and referenced throughout this Standard:

1. Neat cement grout - a mixture in the proportion of 94 pounds of Portland cement and not more than six gallons of water. Used to decommission wells completed in competent bedrock formations.
2. Neat Bentonite grout - a mixture in the proportion of 94 pounds of Portland cement and not more than six gallons of water, with bentonite up to five percent by weight of cement (between 3 and 4.7 pounds of bentonite per 94 pounds of Portland cement). Used to decommission wells completed in competent bedrock formations.
3. High solids bentonite grout - a mixture of water and a minimum of 30 percent by weight of bentonite (see discussion below), with no additives (minimum of 2.5 pounds of bentonite per gallon of water). Used to decommission wells completed in unconsolidated materials and competent rock, where appropriate.

Typically, a high solids grout can be prepared using granular bentonite and pumped at a relatively low-viscosity state if done quickly (within 15 minutes). This is due to the slower hydration of the granular bentonite as compared to powdered bentonite. However, if these timeframes cannot be achieved or if it is desirable to have a slower "set," an alternative is to use what has been termed the "Ohio mix". The "Ohio mix" involves preparing a low-solids bentonite grout slurry (30 to 50lbs/100 gallons of water) using API 200-mesh bentonite (e.g., Natural Gel, Gold Seal), into which 125 lb. of granular bentonite (8 to 20-mesh) is added and mixed (stirred). The hydrated bentonite in the slurry delays hydration of the granular bentonite without the addition of polymers or other agents. The result is a high solids bentonite grout at a viscosity that is feasible to pump with reasonable working time (Eidil et al. 1992 from Smith, 1994).

3.1 Cement

The cement shall be Portland Cement® Type 1 in accordance with ASTM C150, Type 1 or API-10A, Class A.

3.2 Water

Water shall be obtained from an approved source. Water used for down-hole purposes shall have a Total Dissolved Solids (TDS) concentration of less than 500 mg/L (Smith, 1994) and be certified free from contaminants, or sampled for volatile organic compounds by EPA method 8260.

3.3 Bentonite

Bentonite shall be an additive free granular sodium bentonite (Benseal, Enviroplug, PDS Granular, Volclay Crumbles or equivalent) generally 8 to 20 mesh particle size. Use of granular bentonite *in lieu* of powdered bentonite allows the placement of a high-solids grout with relatively low viscosity, if mixing and pumping are done quickly. If following the "Ohio mix" discussed above, additive free API 200-mesh bentonite is used for the initial slurry (e.g., Natural Gel, Gold Seal) into which granular bentonite (8 to 20 mesh) is added and mixed.

3.4 Grouting Equipment

Grout mixers shall be paddle or blade type capable of thoroughly mixing grout. All grouting lines (i.e., hoses, pipes, drill rods, etc.) shall have an inside diameter of at least 0.50 inches to prevent clogging. Grout pumps shall be of a positive displacement or progressive cavity type (Moyno) capable of delivering a minimum pressure of 20 psi. Venturi mixing and centrifugal pumps are less desirable alternatives due to clay particle shearing and clogging problems, respectively.

4.0 DECOMMISSIONING PROCEDURES

Decommissioning procedures must be tailored to each well type and geologic environment. The broad range of suitable decommissioning methods for different situations is covered in detail in ASTM D5299-99 and the above referenced standards and literature. The purpose of this standard is to establish minimum requirements for the most common well construction types at our facilities. For landfill facilities, the most common type of well installation consists of single cased wells installed in unconsolidated material at relatively shallow depths (i.e., < 100 feet). The procedures described herein can be used to decommission two-inch or four-inch diameter single cased PVC or steel wells installed at depths generally less than 100 feet. Other less common well types requiring specialized procedures and materials include large diameter wells, multiple cased wells and driven casing wells.

The goal of decommissioning is to completely remove all well materials either through overdrilling or pulling of the well or casing. Once all well materials have been removed, the resulting borehole can be properly sealed with a suitable grout mixture.

In general, a high solids bentonite grout mixture (30% by weight) is preferred for most well decommissioning projects. State regulations often stipulate that for wells installed in bedrock, non-flexible grout mixtures must be used, such as neat cement grout or neat bentonite grout. Non-flexible grout mixtures more closely match the physical characteristics of competent bedrock. For all wells or portions of wells completed in unconsolidated material a high solids bentonite grout as defined above is the requisite grouting material. For wells of portions of wells completed in competent bedrock grouting materials can be either of the three grout types specified above with preference given to high solids bentonite grout.

The following are specific decommissioning procedures. These steps shall generally be completed in the order listed below.

1. Ensure that adequate survey control exists for each well and obtain a copy of the original well construction log.
2. Well decommissioning drilling equipment, augers, water level marker, and other tools must be decontaminated before being brought to the site.
3. The depth of the well shall be measured and compared to the anticipated well depth to determine if any obstructions are in the well. If the well is obstructed, the obstruction will be removed prior to sealing the well, if possible.
4. Expected grout volume calculations shall be completed using the depth information derived from Steps 1 and 3. The expected volume shall be recorded for reconciliation with the final grout volumes used.
5. Remove the protective casing. Position the drill rig directly over the well and attach a chain to the outer protective casing. Pull directly upward on the protective casing. Often for shallow wells this procedure will also pull up the inner-casing and annular materials. If this occurs, continue to pull all well materials out, as practicable.

6. Remove the well casing and associated annular materials. Typically, removal is accomplished through overdrilling using a Hollow Stem Auger (HSA) drill rig equipped with an auger bit that exceeds the diameter of the original bit (1.25 times the original auger diameter) used to construct the well. The key to successful overdrilling is insuring the auger bit remains centered on the well for the duration of overdrilling. For wells constructed of PVC, either employ a pilot bit to insure centering is maintained or place A-rod (steel rod) throughout the length of the well to act as a guide during overdrilling. A pilot bit consists of an elongate pointed pin with a maximum diameter slightly less than that of the inner well casing. For wells constructed of steel materials, the steel casing itself can be used to maintain centering during overdrilling. Essentially, an auger is selected with an inner diameter slightly larger than the diameter of the steel casing. During overdrilling the auger follows the steel casing to the target depth. Centering must be assured through use of one of the above-described centering methods. The overdrilling shall progress slowly to insure that the drilling operation remains centered over the well/boring. Once the base of the well is reached the auger or drilling equipment shall be left in place, to prevent cave in of materials, while proceeding to Step 6.

   For unconsolidated wells installed using driven casing or equivalent methods (i.e., no annular materials), it may be possible to pull the outer casing or well *in lieu* of overdrilling. If this procedure is used, grouting must be completed concurrently with the pulling of casing with grout level maintained within 5 feet of ground surface while the casing is pulled. The grout shall be introduced into the well from the base using a tremie line through the innermost casing (with the base of the well removed). The grout mixtures and procedures shall be as described in Step 6.

   Driven casing wells completed entirely in competent bedrock may be decommissioned without removing the casing by tremie grouting according to the procedures described in Step 6.

7. Upon removal of the casing, well screen and annular materials, the resulting boring shall be tremie grouted. The grout shall be a high solids bentonite grout as defined above. Essentially, the grout mixture shall contain as high a bentonite content as can be reasonably pumped (30% bentonite by weight). For wells installed in competent bedrock state regulations often mandate use of a neat cement grout mixture. It is preferable in cases where the borehole intersects both competent bedrock and unconsolidated materials that the unconsolidated interval shall be abandoned using a high solids bentonite grout. Grout shall be mixed to a uniform consistency. The grout shall be pumped into the boring through a tremie pipe placed at the bottom of the boring. The auger flights shall be left in place until the tremie line is situated at the bottom of the boring. Grouting shall proceed in a continuous and expeditious manner by concurrently pulling the auger flights and pumping grout until the grout level is within two feet of the ground surface. Both the bottom of the tremie pipe and the base of the auger flights must remain submerged in grout while the well is grouted.

   After the grout has settled for 24 hours, the borehole must be checked for grout settlement, and if necessary, topped off with the appropriate grout mixture. The final level of the grout shall be within two feet of the ground surface. The top two feet of the borehole shall be abandoned by adding and compacting native soils.

8. Equipment used for well decommissioning shall be cleaned and decontaminated between decommissioning locations.

9. Upon completion of decommissioning activities, well decommissioning materials and equipment will be removed from the site and the site will be restored. Over-drilled well materials and cuttings shall be properly disposed.

10. After the well has been decommissioned, a record must be prepared. The record must contain the following information, at a minimum:
    - Name and address of property owner;
    - Name, license or registration number of the contractor doing the work, name of the driller performing the work, and the signature of the representative;
    - Date work was completed;
    - Survey information including the county, township, range, section, and three quartiles, and the street address or fire number of the well or boring (for unincorporated areas);
    - A description of the geological material penetrated by the well (i.e., copy of the original boring log);
    - The original well or boring depth, and current well or boring depth;
    - The approximate date of construction;
    - The grout or sealing materials, type, quantities, and intervals;
    - The casing type, diameter, and depth, if present;
    - The screen or open hole depth interval, if present;
    - A description of any obstruction, if present;
    - A description of any deviations from the above procedures, or other unusual conditions encountered or actions taken; and
    - A statement as to whether or not all well materials were removed and if not a detailed explanation of the type of materials left in place and their approximate elevation, type, condition, etc.
11. Copies of the decommissioning record are to be forwarded to the site and the State agency if required.

4.1 Failure to remove all well materials

If for any reason the above decommissioning procedures fail to remove all well casing and screen materials, the well shall be permanently marked with a steel post and attached name plate containing the well identification. The name plate and/or site records shall contain, at a minimum, the following:

- Well Identification;
- Date of installation;
- Date of decommissioning;
- Survey coordinates; and
- Approximate elevation interval of in place well materials.

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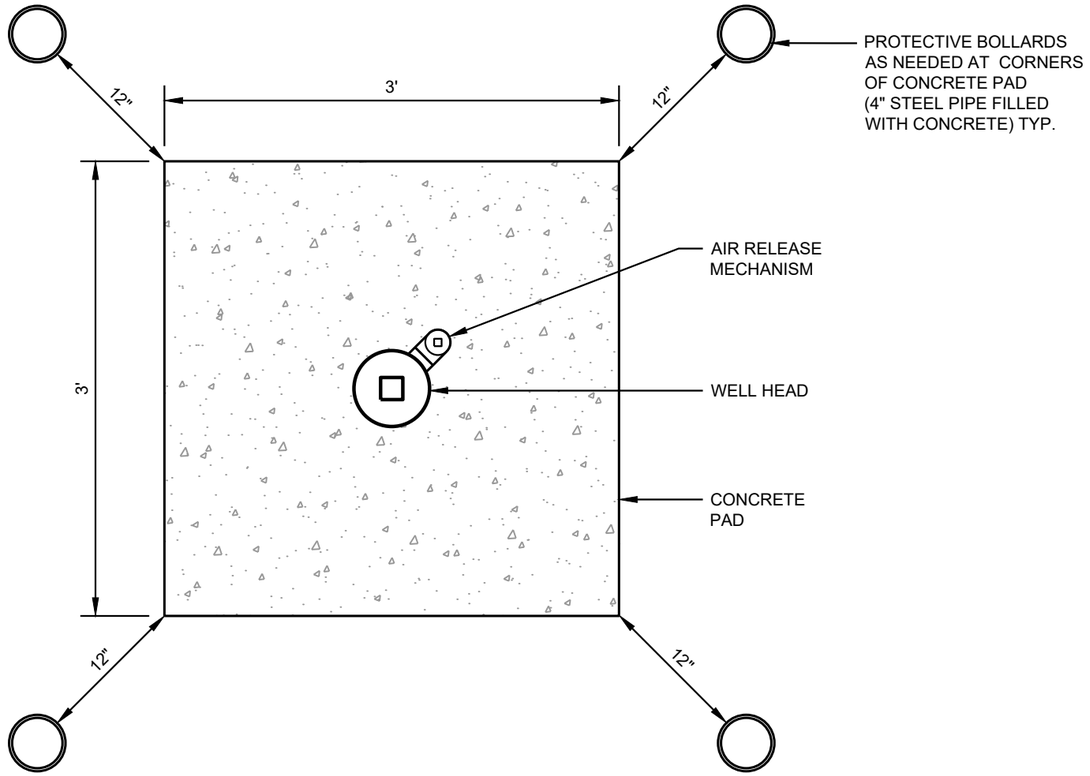
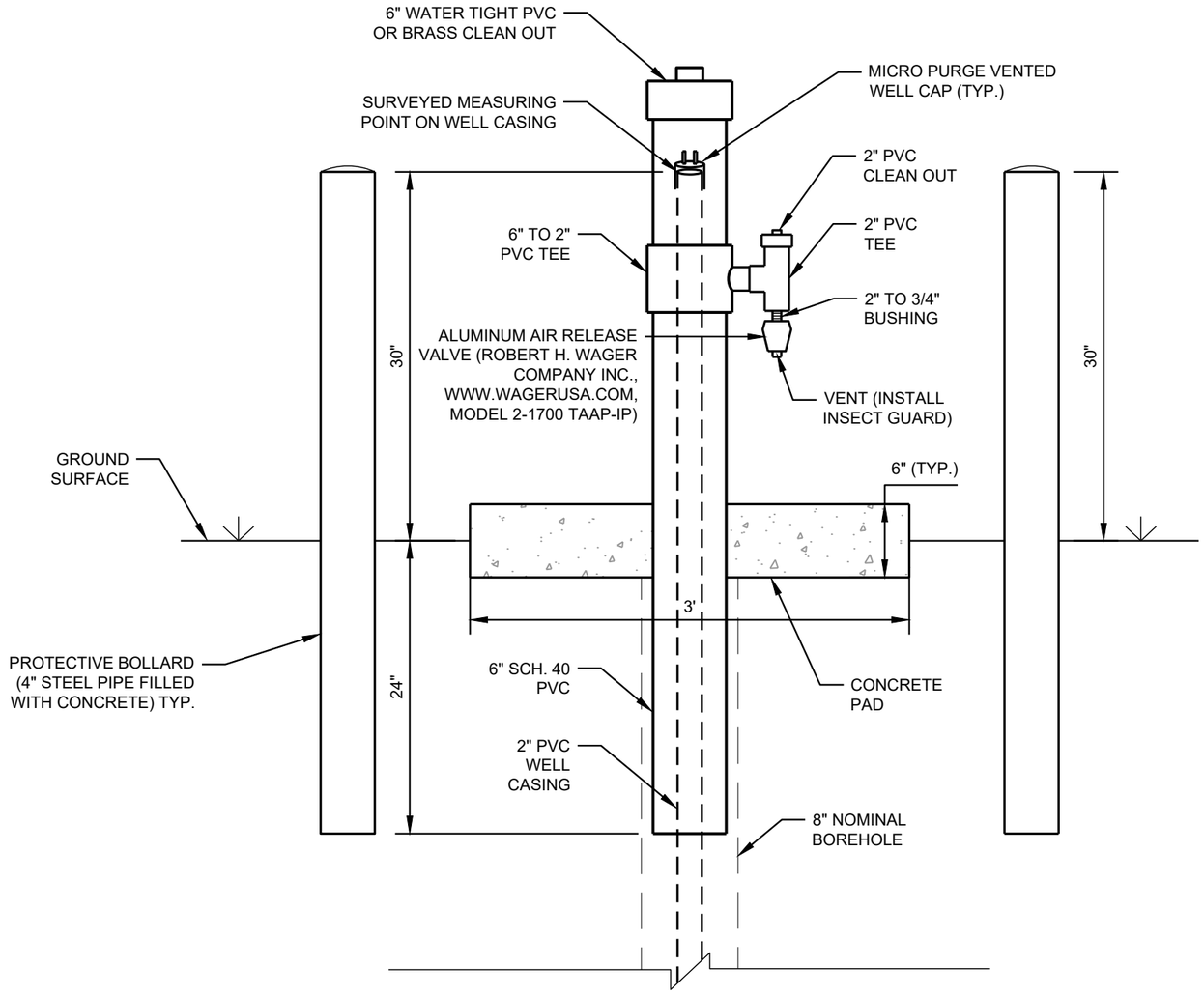


PLAN VIEW

SCALE: 1" = 1'

NOTE: PROTECTIVE BOLLARDS TO BE INSTALLED AS NEEDED BASED ON SITE CONDITIONS TO PROTECT WELLHEAD INTEGRITY (AS DETERMINED BY DOMINION).



CROSS-SECTION VIEW

SCALE: 1" = 1'

CLIENT
DOMINION ENERGY

CONSULTANT
GOLDER

YYYY-MM-DD	2016-06-29
DESIGNED	MGW
PREPARED	BPG
REVIEWED	
APPROVED	

PROJECT
BREMO POWER STATION
FLUVANNA COUNTY, VIRGINIA

TITLE
MONITORING WELL DETAILS

PROJECT NO.
15-20347

REV.
0

FIGURE
1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in
0

Path: G:\Plan Production Data Files\Drawing Data Files\15-20347E - Bremo GW Monitoring Plan\Active Drawings\15203347E28.dwg

WELL INSPECTION REPORT

FACILITY INFORMATION

Facility: _____ **Location:** _____

INSPECTION

Inspection Date: _____ **Inspector Name:** _____

Time: _____ **Weather Conditions:** _____

MONITORING WELL CONDITIONS

Well ID: _____

Lock Condition: _____

Protective Casing Condition: _____

Bollard Condition:_____

If no bollards, is the well in a high traffic area?:_____

Pad Condition: _____

Pump Length: _____

Pump Condition (include tubing size): _____

Tubing Condition: _____

Sediment Accumulation in Well (describe): _____

Depth to Water (feet): _____

Depth to top of Pump (feet):
_____

Depth to Bottom (feet): _____

Comments: _____

_____

Signature: _____ **Date:** _____

https://golderassociates.sharepoint.com/sites/123492/project files/5 technical work/field binder information/dominion well inspection form.doc

APPENDIX C

EXAMPLE CHAIN-OF-CUSTODY FORM, SAMPLE LABEL, AND CHAIN-OF-CUSTODY SEAL

ENVIRONMENTAL SAMPLING SUPPLY

LOT#

SAMPLE ID

SAMPLED BY	DATE
	TIME
LOCATION	PRESERVATIVE
ANALYSIS	CLIENT

Oakland, CA • Houston, TX • Chicago, IL • Richmond, VA
(510) 562-4988 www.essvial.com (800) 233-8425

ENVIRONMENTAL SAMPLING SUPPLY

LOT#

SAMPLE ID

SAMPLED BY	DATE
	TIME
LOCATION	PRESERVATIVE
ANALYSIS	CLIENT

Oakland, CA • Houston, TX • Chicago, IL • Richmond, VA
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ENVIRONMENTAL SAMPLING SUPPLY

LOT#

SAMPLE ID

SAMPLED BY	DATE
	TIME
LOCATION	PRESERVATIVE
ANALYSIS	CLIENT

Oakland, CA • Houston, TX • Chicago, IL • Richmond, VA
(510) 562-4988 www.essvial.com (800) 233-8425

ENCO

CUSTODY SEAL

Date: ______________________________

Signature: __________________________

ENCO

ENVIRONMENTAL CONSERVATION LABORATORIES, INC.
4810 Executive Park Ct., Ste 211 • Jacksonville, FL 32216-6069 • (904) 296-3007
10775 Central Port Drive • Orlando, FL 32824 • (407) 826-5314
102-A Woodwinds Industrial Court • Cary, NC 27511 • (919) 467-3090

ENVIRONMENTAL SAMPLING SUPPLY

LOT#

SAMPLE ID

SAMPLED BY	DATE
	TIME
LOCATION	PRESERVATIVE
ANALYSIS	CLIENT

Oakland, CA • Houston, TX • Chicago, IL • Richmond, VA
(510) 562-4988 www.essvial.com (800) 233-8425

ENVIRONMENTAL SAMPLING SUPPLY

LOT#

SAMPLE ID

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ENVIRONMENTAL SAMPLING SUPPLY

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	TIME
LOCATION	PRESERVATIVE
ANALYSIS	CLIENT

Oakland, CA • Houston, TX • Chicago, IL • Richmond, VA
(510) 562-4988 www.essvial.com (800) 233-8425

ENCO

CUSTODY SEAL

Date: ______________________________

Signature: __________________________

ENCO

ENVIRONMENTAL CONSERVATION LABORATORIES, INC.
4810 Executive Park Ct., Ste 211 • Jacksonville, FL 32216-6069 • (904) 296-3007
10775 Central Port Drive • Orlando, FL 32824 • (407) 826-5314
102-A Woodwinds Industrial Court • Cary, NC 27511 • (919) 467-3090

CHAIN OF CUSTODY

CLIENT NAME:	PROJECT NAME:
CLIENT CONTACT:	SITE NAME:
CLIENT ADDRESS:	PROJECT NUMBER:
CLIENT PHONE NUMBER:	P.O. NUMBER:
CLIENT FAX NUMBER:	REGULATORY AUTHORITY:

Is sample for compliance reporting? YES NO	Is sample from a chlorinated supply? YES NO	PWS#
SAMPLER NAME (PRINT):	SAMPLER SIGNATURE:	**Turn Around Time:** **Day(s)**

CLIENT SAMPLE I.D.	Date Sampled	Time Sampled	Number of Containers	Grab	Composite	Field Filtered	MATRIX: Groundwater	Wastewater	Drinking Water	Soil	Solids	Other	ANALYSIS							COMMENTS
																				PLEASE NOTE PRESERVATIVE(S)
1)																				
2)																				
3)																				
4)																				
5)																				
6)																				
7)																				
8)																				
9)																				
10)																				

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME	**LAB USE ONLY** **COOLER TEMP ℃** _____
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME	
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME	

APPENDIX D

GROUNDWATER PROTECTION STANDARDS

Groundwater Protection Standards (GPS) 2019
East Ash Pond
Dominion Energy Bremo Bluff SWP 618

Parameter Group	Constituent	CAS No.	Units	GPS µg/L	Source
METAL	Antimony	7440-36-0	µg/L	6	MCL
METAL	Arsenic	7440-38-2	µg/L	10	MCL
METAL	Barium	7440-39-3	µg/L	2000	MCL
METAL	Beryllium	7440-41-7	µg/L	4	MCL
METAL	Boron	7440-42-8	µg/L	250	BKG
METAL	Cadmium	7440-43-9	µg/L	5	MCL
METAL	Chromium	7440-47-3	µg/L	100	MCL
METAL	Chromium (VI), Hexavalent	18540-29-9		TBD	
METAL	Cobalt	7440-48-4	µg/L	7.83	BKG
METAL	Copper	7440-50-8	µg/L	1300	MCL
METAL	Fluoride	16984-48-8	µg/L	4000	MCL
METAL	Lead	7439-92-1	µg/L	5	BKG
METAL	Lithium	7439-93-2	µg/L	25	BKG
METAL	Mercury	7439-97-6	µg/L	2	MCL
METAL	Molybdenum	7439-98-7	µg/L	16.4	BKG
METAL	Nickel	7440-02-0	µg/L	7.9	BKG
METAL	Selenium	7782-49-2	µg/L	50	MCL
METAL	Silver	7440-22-4	µg/L	5	BKG
METAL	Thallium	7440-28-0	µg/L	2	MCL
METAL	Tin	7440-31-5	µg/L	5	BKG
METAL	Vanadium	7440-62-2	µg/L	22.5	BKG
METAL	Zinc	7440-66-6	µg/L	50	BKG
RADIONUCLIDE	Radium 226 & 228 Combined	13982-63-3/ 15262-20-1	pCi/L	5	MCL

Notes:
CAS No. - Chemical Abstracts Service Registry Number
MCL - Maximum Contaminant Level
BKG - Site-specific Background Value
µg/L - Microgram per liter
pCi/L - picoCurie per liter
TBD – To Be Determined

Groundwater Protection Standards (GPS) 2019
North Ash Pond
Dominion Energy Bremo Bluff SWP 618

Parameter Group	Constituent	CAS No.	Units	GPS µg/L	Source
METAL	Antimony	7440-36-0	µg/L	6	MCL
METAL	Arsenic	7440-38-2	µg/L	10	MCL
METAL	Barium	7440-39-3	µg/L	2000	MCL
METAL	Beryllium	7440-41-7	µg/L	4	MCL
METAL	Boron	7440-42-8	µg/L	250	BKG
METAL	Cadmium	7440-43-9	µg/L	5	MCL
METAL	Chromium	7440-47-3	µg/L	100	MCL
METAL	Chromium (VI), Hexavalent	18540-29-9		TBD	
METAL	Cobalt	7440-48-4	µg/L	7.83	BKG
METAL	Copper	7440-50-8	µg/L	1300	MCL
METAL	Fluoride	16984-48-8	µg/L	4000	MCL
METAL	Lead	7439-92-1	µg/L	5	BKG
METAL	Lithium	7439-93-2	µg/L	25	BKG
METAL	Mercury	7439-97-6	µg/L	2	MCL
METAL	Molybdenum	7439-98-7	µg/L	16.4	BKG
METAL	Nickel	7440-02-0	µg/L	7.9	BKG
METAL	Selenium	7782-49-2	µg/L	50	MCL
METAL	Silver	7440-22-4	µg/L	5	BKG
METAL	Thallium	7440-28-0	µg/L	2	MCL
METAL	Tin	7440-31-5	µg/L	5	BKG
METAL	Vanadium	7440-62-2	µg/L	22.5	BKG
METAL	Zinc	7440-66-6	µg/L	50	BKG
RADIONUCLIDE	Radium 226 & 228 Combined	13982-63-3/ 15262-20-1	pCi/L	5	MCL

Notes:
CAS No. - Chemical Abstracts Service Registry Number
MCL - Maximum Contaminant Level
BKG - Site-specific Background Value
µg/L - Microgram per liter
pCi/L - picoCurie per liter
TBD – To Be Determined

Groundwater Protection Standards (GPS) 2019
West Ash Pond
Dominion Energy Bremo Bluff SWP 618

Parameter Group	Constituent	CAS No.	Units	GPS µg/L	Source
METAL	Antimony	7440-36-0	µg/L	6	MCL
METAL	Arsenic	7440-38-2	µg/L	10	MCL
METAL	Barium	7440-39-3	µg/L	2000	MCL
METAL	Beryllium	7440-41-7	µg/L	4	MCL
METAL	Boron	7440-42-8	µg/L	250	BKG
METAL	Cadmium	7440-43-9	µg/L	5	MCL
METAL	Chromium	7440-47-3	µg/L	100	MCL
METAL	Chromium (VI), Hexavalent	18540-29-9		TBD	
METAL	Cobalt	7440-48-4	µg/L	5	BKG
METAL	Copper	7440-50-8	µg/L	1300	MCL
METAL	Fluoride	16984-48-8	µg/L	4000	MCL
METAL	Lead	7439-92-1	µg/L	5	BKG
METAL	Lithium	7439-93-2	µg/L	25	BKG
METAL	Mercury	7439-97-6	µg/L	2	MCL
METAL	Molybdenum	7439-98-7	µg/L	5	BKG
METAL	Nickel	7440-02-0	µg/L	9.3	BKG
METAL	Selenium	7782-49-2	µg/L	50	MCL
METAL	Silver	7440-22-4	µg/L	5	BKG
METAL	Thallium	7440-28-0	µg/L	2	MCL
METAL	Tin	7440-31-5	µg/L	5	BKG
METAL	Vanadium	7440-62-2	µg/L	22.5	BKG
METAL	Zinc	7440-66-6	µg/L	50	BKG
RADIONUCLIDE	Radium 226 & 228 Combined	13982-63-3/ 15262-20-1	pCi/L	5	MCL

Notes:
CAS No. - Chemical Abstracts Service Registry Number
MCL - Maximum Contaminant Level
BKG - Site-specific Background Value
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TBD – To Be Determined

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