HISTORY OF CONSTRUCTION

Bremo Power Station CCR Surface Impoundment: North Ash Pond

Submitted To: Bremo Power Station
1038 Bremo Bluff Road
Bremo Bluff, VA 23022

Submitted By: Golder Associates Inc.
2108 W. Laburnum Avenue, Suite 200
Richmond, VA 23227

October 2016

Project No. 15-20347
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1.0 CERTIFICATION

This History of Construction for the Bremo Power Station’s North Ash Pond was prepared by Golder Associates Inc. (Golder). The document and Certification/Statement of Professional Opinion are based on and limited to information that Golder has relied on from Dominion and others, but not independently verified, as well as work products produced by Golder.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that this document has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, at the same time, and in the same locale. It is my professional opinion that the document was prepared consistent with the requirements in §257.73(c) of the United States Environmental Protection Agency’s “Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments,” published in the Federal Register on April 17, 2015, with an effective date of October 19, 2015 [40 CFR §257.73(c)].

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

James R. DiFrancesco, P.E.
Print Name
Principal and Practice Leader
Title

Signature

10/13/2016
Date
2.0 INTRODUCTION
This History of Construction was prepared for the Bremo Power Station’s (Station) existing Coal Combustion Residuals (CCR) surface impoundment known as the North Ash Pond (NAP). This History of Construction was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.73(c).

The Station, owned and operated by Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion), is located in Fluvanna County at 1038 Bremo Road, east of Route 15 (James Madison Highway) and north of the James River. The Station includes an existing CCR surface impoundment, the NAP, as defined by the Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule (40 CFR §257; the CCR rule).

3.0 HISTORY OF CONSTRUCTION

3.1 CCR Unit
The NAP, previously referred to as the “Ash Disposal Pond” (1982) and the “Master Ash Pond” (1984), is located at the Station, as shown in the attached 2013 United States Geological Survey (USGS) 7½-minute topographic quadrangle map (Appendix A). The NAP is owned and operated by Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion). Dominion’s address, as well as contact information for the Station, are provided below.

Virginia Electric and Power Company
5000 Dominion Boulevard
Glen Allen, VA 23060

Mr. David A. Craymer
Vice President, Power Generation System Operations
Virginia Electric and Power Company
5000 Dominion Boulevard
Glen Allen, VA 23060

In 2014, the Station converted from a coal-fired power plant to a natural gas-fired power plant. The NAP is used as a water treatment pond to settle and manage low-volume wastewaters including CCR.

The NAP surface impoundment is regulated under the following permits:

- Virginia Department of Environmental Quality (DEQ) Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0004138
- DEQ VPDES Construction General Permit No. VAR10H875
- Virginia Department of Conservation and Recreation (DCR) Dam Permit, Inventory No. 06520
The long-term management of the NAP, which includes closure, post-closure care, and groundwater monitoring, will be governed by the Virginia DEQ Solid Waste Management Regulations (VSWMR) Permit No. 618, once issued. The embankments will continue to be regulated by DCR under the Impounding Structure Regulations (4VAC50-20 et seq.).

3.2 Watershed

The NAP is located within the Middle James – Buffalo Watershed (USGS Hydrologic Unit Code 02080203), which is approximately 1,273,600 acres. The NAP has a contributing drainage area of approximately 103 acres.

3.3 Foundation and Abutments

The NAP was constructed by damming a steep drainage feature in the rising natural hillside. The natural soils in the hillside area consist of a typical Piedmont residual, saprolitic soil profile, formed from in-place weathering of rock. Piedmont soils consist of fine sandy silts (ML) and silty sands (SM), with occasional coarser materials that include coarser sands and angular gravel pieces derived from seams of resistant materials (mainly quartz), as well as the lower saprolites and upper disintegrated rock. Material properties for the various strata were interpreted based on subsurface data and site reconnaissance taken from previous Golder investigations, analyses, and reports included in Golder’s March 2016 Virginia Department of Conservation and Recreation (DCR) Impounding Structure Geotechnical Design Report Supporting Documents (Golder 2016), and are presented in Table 1 below.

<table>
<thead>
<tr>
<th>Material</th>
<th>Total Unit Weight (pound per cubic foot, pcf)</th>
<th>Strength Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Peak $\phi'$ (°)</td>
</tr>
<tr>
<td><strong>Dike Fill Soils- NAP</strong></td>
<td>125</td>
<td>0 - 40 ft: 31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 40 ft: 28</td>
</tr>
<tr>
<td><strong>Residuum</strong></td>
<td>125</td>
<td>28</td>
</tr>
<tr>
<td><strong>Disintegrated Rock</strong></td>
<td>140</td>
<td>31</td>
</tr>
</tbody>
</table>

3.4 Construction Details

The NAP was constructed in 1982 and 1983, in two phases. Phase I involved the construction of the embankment and spillway foundation, and Phase II involved the remainder of the embankment and spillway construction. Borrow soil was obtained from within the planned NAP ponded footprint, excavating into the natural ground. The natural soils in the hillside area are described above.
The dike extends primarily across the mouth of the steep drainage feature (about 1,000 feet long). The main segment of the dike is over 100 feet high with slopes of 2.5H:1V, benches on the upstream and downstream side, and 6-inch toe drains at the toe of the embankment. The main dike segment abuts steep natural slopes on either side of the valley outlet to the floodplain. Additional dike segments wrap around the west side and fill in some minor declivities in the ridgeline, but are generally 20 feet or less in height. The dike was designed as a zoned embankment with a core of theoretically less permeable material, and upstream and downstream shells consisting of theoretically more permeable materials. However, as borrow materials from the residual Piedmont soils were used for both the core and shell, and in spite of an attempt to segregate soils based on fines content, the difference in permeability achieved was relatively small based on the water surface in the dam, which is nearly consistent with that expected for a homogeneous embankment.

During Phase II, the remainder of the primary spillway was constructed, as well as the emergency spillway. The primary and emergency spillway systems are further discussed in Section 2.8. Historical record drawings for the phased construction of the NAP were completed in December of 1983 and are provided in Appendix B.

The NAP is currently in the process of being closed in accordance with §257.102(d) by leaving CCR in place, removing and treating free liquids, and installing an engineered final cover system. Closure details are included in the Closure Plan.

### 3.5 Engineering Drawings

Current detailed dimensional drawings of the NAP’s existing conditions, extracted from Golder’s March 2016 DCR Impounding Structure Geotechnical Design Report Supporting Documents (Golder 2016), are provided in Appendix C.

### 3.6 Instrumentation

A network of pumps and dewatering wells has been installed within the NAP. The surface water and pore water collected in the NAP are conveyed to the on-site Centralized Source Water Treatment System (CSWTS) for treatment and compliance with permitted effluent limits prior to discharge through a permitted outfall.

Additionally, groundwater monitoring wells are being installed. The downgradient monitoring network is comprised of five downgradient CCR rule compliance groundwater wells, four perimeter VSWMR sentinel monitoring wells, and two upgradient wells. These wells will be supplemented during the site characterization activities by two deep observation wells that will also be installed.
In addition, there are three existing piezometers in the NAP embankment that were historically used to observe static water levels within the embankment.

3.7 Area-Capacity Curves

Using the August 2016 aerial topographic survey, the available stage-storage capacities were computed from the top of the previously impounded CCR [elevation 317 feet above mean sea level (ft amsl)] to the top of the embankment (elevation 333 ft amsl). The NAP stage-storage capacity data are provided in Table 2 and Figure 1, below.

**Table 2: Stage-Storage Capacity**

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Area (square feet, sf)</th>
<th>Area (acres, ac)</th>
<th>Volume (cubic feet, cf)</th>
<th>Volume (cubic yard, cy)</th>
<th>Cumulative Volume (cy)</th>
<th>Cumulative Volume (acre-foot, ac-ft)</th>
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<tr>
<td>333</td>
<td>2,477,161</td>
<td>56.868</td>
<td>2,464,954.5</td>
<td>91,294.6</td>
<td>555,052.2</td>
<td>344.04</td>
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<td>-</td>
<td>-</td>
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</table>
3.8 Diversion and Spillway Details

The NAP was constructed by damming a steep drainage feature in the rising natural hillside. The main dike segment abuts steep natural slopes on either side of the valley outlet to the floodplain. Additional dike segments wrap around the west side and fill in some minor declivities in the ridgeline, but are generally 20 feet or less in height. Outside of the dike segments, no additional diversions are in place.

Prior to May 2016, the primary spillway, an intake tower and 24-inch diameter pipe, regulated the NAP pool elevation. The intake tower, standing within the impoundment area at approximately 110 feet in height, is constructed of steel-reinforced concrete and has three openings that are regulated by a floating skimmer and concrete stop planks. Water formerly exited the NAP through a 24-inch diameter pipe that is connected to the outlet tower structure near the highest section of the main dike segment. This pipe extends to a concrete-armored basin within the East Ash Pond (EAP), and the water was ultimately released through a permitted outfall. As of May 2016, the 24-inch diameter pipe of the primary spillway has been plugged to satisfy discharge permit requirements. Surface water and pore water within the NAP are pumped to the on-site CSWTS for treatment and discharge.
The emergency spillway is located on the west side of the NAP and would allow flow into the valley to the west, through a small stormwater pond, and then into the ditch along the north side of the EAP, and either to the west into the main plant stormwater pond or east toward the open water portion of the EAP. The existing emergency spillway is an approximately trapezoidal-shaped, broad-crested spillway that is built into the road surface along the top of the impoundment natural ridgeline. Its original design crest width of 200 feet has been reduced to a width of approximately 153 feet due to operations and road maintenance over the years. The spillway has an effective depth of 2.6 feet, and is surfaced with well-compacted gravel. Considering the NAP’s current configuration, the size and capacity of the emergency spillway are adequate to convey the runoff from the probable maximum flood (PMF) event without overtopping the embankment or eroding the spillway. The analysis of the spillway capacity is included in Appendix B of the Inflow Design Flood Control System Plan.

### 3.9 Surveillance, Maintenance, and Repair

Inspections and maintenance are currently conducted in accordance with 40 CFR §257.83. General construction specifications and provisions for future surveillance, maintenance, and repair of the NAP are included in the Closure and Post-Closure Plans. Annual inspections by a Professional Engineer are conducted to satisfy the requirements of the DCR Dam Safety Regulations.

### 3.10 Structural Instability

There is no record or knowledge of structural instability of the NAP. The NAP dikes are in good condition, without evidence of significant issues.
Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.
Appendix A

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

SITE LOCATION MAP

SITE AREA
WEST ASH POND
BREMNO POWER STATION
EAST ASH POND
NORTH ASH POND

SCALE
0 4000 4000 0

DOMINION, BREMNO POWER STATION

FIGURE 1
Appendix B
North Ash Pond Phase I & II Historical Record Drawings
PHASE I - CONSTRUCTION
CONSISTS OF DAM CONSTRUCTION TO ELEV. 120.0 & APPURTEANCES

SCALE: 1" = 200'
SOIL PROFILE AT DAM CENTRILINE

STRATUM DESCRIPTIONS

STRATUM A: Compacted Fill, Base Grade to

STRATUM B: Gray Fly Ash

STRATUM C: Colored Fly Ash

GENERAL NOTES

1. STRATUM A: Compacted Fill, Base Grade to

2. STRATUM B: Gray Fly Ash

3. STRATUM C: Colored Fly Ash

As Built 12-21-83

VEFCO PN 73884104
MOUNTING STATION - PLAN VIEW DETAIL

MOUNTING STATION - DETAIL SECTION A - A

NOTE: TOPO ON THIS SHEET IS ORIGINAL GROUND PRIOR TO START OF CONSTRUCTION. FOR AS-BUILT TOPO REFER TO SHEETS 1TC, 1TD, 1TE & 1TF.

NEW DESIGN CONDITIONS

VEPCO P/N 7386404

PHASE II

ASH DISPOSAL POND
Appendix C

North Ash Pond Existing Conditions Drawings
1. REFER TO FIGURE G-1 FOR GENERAL NOTES AND REFERENCES.
2. REFER TO FIGURE G-6 FOR LEGEND INFORMATION.
3. PROPOSED CONTOURS ARE THE SAME AS EXISTING GRADES.
SECTION NP F - F'

SECTION NP G - G'

LINE WORK LEGEND
- EXISTING GRADES
- PROPOSED GRADES
- BATHYMETRY CONTOURS
- HISTORICAL BOTTOM GRADES
- 1967 USGS TOPOGRAPHY

NOTES
1. REFER TO FIGURE G-1 FOR GENERAL NOTES AND REFERENCES.
2. REFER TO FIGURE G-4 FOR LEGEND INFORMATION.

GEOLOGICAL EXPLORATION
SECTIONS
(NORTH POND 6 OF 7)

REVISION DESCRIPTION
DES
CADD
CHECK
RVW

REV
DATE
CHECK
REV
DES
CADD

PROJECT No.
15-20347
FILE No.
1520347AG06-18

1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 100 0 100

SECTION NP F - F'

SECTION NP G - G'

EXISTING GRADES
PROPOSED GRADES
BATHYMETRY CONTOURS
HISTORICAL BOTTOM GRADES
1967 USGS TOPOGRAPHY
PRE-POND CONSTRUCTION

NOTES
1. REFER TO FIGURE G-1 FOR GENERAL NOTES AND REFERENCES.
2. REFER TO FIGURE G-4 FOR LEGEND INFORMATION.