Periodic Structural Stability Assessment

Chesterfield Power Station CCR Surface Impoundment: Upper Ash Pond

Submitted to:

Chesterfield Power Station

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Submitted by:

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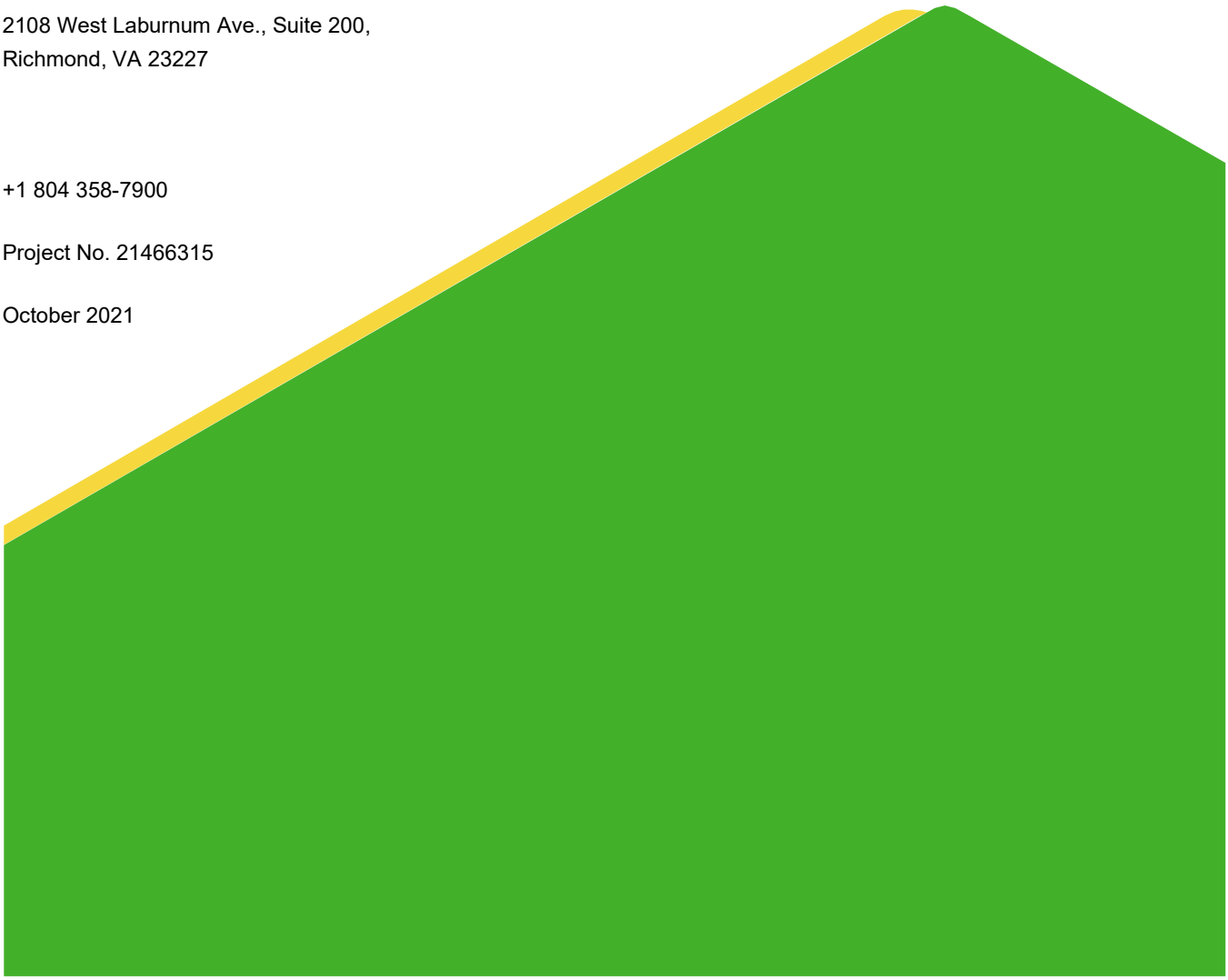
October 2021



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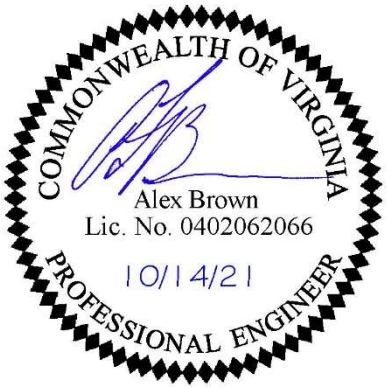
1.0 CERTIFICATION

This Structural Stability Assessment for the Chesterfield Power Station's Upper 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(d) 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(d)].

The use of the word "Certification" 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.

Alex Brown, PE	Senior Project Geotechnical Engineer
Print Name	Title
	10/14/2021
Signature	Date



2.0 INTRODUCTION

This periodic Structural Stability Assessment (Assessment) was prepared for the Chesterfield Power Station's (Station) existing Coal Combustion Residuals (CCR) surface impoundment known as the Upper Ash Pond (UAP). This Structural Stability Assessment was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.73(d).

The Station, owned and operated by Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion), is located in Chesterfield County, Virginia, at 500 Coxendale Road, east of I-95 (Richmond-Petersburg Turnpike) and south of the James River. The Station includes an existing CCR surface impoundment, the UAP, as defined by the Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule (40 CFR §257; the CCR rule). The UAP is also regulated as a dam by the Virginia Department of Conservation and Recreation (DCR) with Inventory Number 041045 (DCR Dam Permit).

3.0 PURPOSE

This periodic assessment is prepared pursuant to the requirements in the CCR Rule, § 257.73(d)(1) [40 CFR § 257.73(d)(1)]. The initial Structural Stability Assessment was completed on October 17, 2016, and is required to be updated every five (5) years pursuant to 40 CFR 257.73(f)(3).

4.0 STRUCTURAL STABILITY ASSESSMENT REQUIREMENTS

In accordance with § 257.73(d)(1), the owner or operator of a CCR surface impoundment must conduct periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR surface impoundment is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

- Stable foundations and abutments;
- Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;
- Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;
- Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;
- A single spillway or a combination of spillways that is designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the 1,000-year flood;
    - All spillways must be either of non-erodible construction and designed to carry sustained flows or Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected;
- Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and
- For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

5.0 STRUCTURAL STABILITY ASSESSMENT

5.1 Foundation and Abutments

The Station lies in a geologically stable area with no active (Holocene) faults, karst (limestone, dolomite, or marble) potential, or other geologic conditions of concern. The UAP is constructed on alluvial and terrace soils associated with the James River. These soils consist of Clayey Sand (SC), Silty Sand (SM), Poorly Graded Sand with Silt (SP-SM), Poorly Graded Sand (SP), and Silty Gravel (GM). Material properties within the UAP foundation and abutments were interpreted based on subsurface data and site reconnaissance taken from previous investigations, analyses, and reports included in GAI's Coal Combustion Residuals History of Construction and Dominion's 2016 Application for Virginia Department of Environmental Protection Solid Waste Permit Number 619 (GAI, 2016). The UAP is surrounded by its embankment, so there are no abutments. The embankment foundation is constructed of material excavated from within the UAP footprint.

Golder's assessment of embankment stability in the Periodic Safety Factor Assessment (Golder, 2021a) show that the UAP meets the minimum factor of safety requirements in the CCR Rule § 257.73(e)(1).

Additionally, the UAP has been routinely inspected and monitored by Station and Dominion personnel in accordance with the requirements in the DCR Dam Permit. Areas of concern are evaluated by professional engineers with corrective actions proposed and documented.

5.2 Slope Protection

The UAP internal and external embankment was built at internal slopes of 2.5H:1V and external slopes of 3:0H:1V external. The external slopes are vegetated, except for the concrete-lined perimeter stormwater runoff drainage channels and riprap wave protection within the stormwater sediment pond situated at the eastern end of the UEP (GAI, 2016). In addition, the vegetation on the embankment is maintained to prevent brush, trees, clumping of weeds, etc. that would concentrate flow and lead to the development of erosion rills.

Dominion performs annual inspections in accordance with the requirements of the DCR Dam Permit. Dominion evaluates the vegetation on the slopes of the impoundment embankment as part of the annual inspections. The slope vegetation for the upstream slope and downstream slopes of the embankment were observed to be well maintained.

5.3 Compaction of Dikes

The previous Structural Stability Assessment from 2016 (GAI, 2016a) utilized standard penetration test data (SPT) collected by Schnabel (Schnabel, 2014) to determine relative density of the soil within the embankment. They found that the relative densities ranged from 70% to 100%. Slope stability analyses presented in the Periodic Safety Factor Assessment (Golder, 2021a) present the embankments to be stable.

5.4 Vegetated Slopes

As required by § 257.73(d)(1)(iv), vegetation on slopes and surrounding areas are not to exceed a height of six inches above the slope of the dike. Current operations at the UAP call for grass to be mowed 2-3 times per year to control vegetation height. The vegetated slopes are operated and maintained to be stable and to provide for visual observation of any instability.

5.5 Spillways

The UAP's principal spillway, located at the southeastern corner of the stormwater sediment pond, consists of a concrete riser structure with multiple orifices beginning at elevation 26.9 ft asml and a 24-inch reinforced concrete discharge pipe (10.73 ft asml) (Geosyntec, 2021). Non-contact stormwater collected in the UAP discharges through the principal spillway to an outfall regulated by the Station's Virginia Department of Environmental Quality (DEQ) Virginia Pollutant Discharge Elimination System Permit No. VA0004146 (VPDES Permit).

The UAP's emergency spillway is located adjacent to the principal spillway and consists of two 72-inch diameter steels pipes with slide gates (Geosyntec, 2021). The invert elevation of the emergency spillway system is 32.6 ft amsl (Geosyntec, 2021).

The size and capacity of the spillways are adequate to convey the runoff from the inflow design flood without overtopping the embankment or eroding the spillways. Analysis of the spillway capacity is described in the Periodic Inflow Design Flood Control System Plan (Golder, 2021b).

5.6 Hydraulic Structures

The principal spillway and emergency spillway pass through the dike of the UAP. The primary spillway is a 24-inch reinforced concrete diameter pipe connected to a 6-foot by 6-foot concrete riser structure that is anchored within the main dike segment. The UAP emergency spillway is adjacent to the principal spillway and consists of two 72-inch diameter steels pipes with slide gates that is also anchored within the main dike segment. There is no known record or knowledge of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris associated with the principal or emergency spillway.

5.7 Adjacent Water Bodies

The UAP sits within an artificial oxbow lake formed by the James River and a manmade channel. The embankment surrounding the UAP is subject to the 100-year flood event as defined by FEMA, with a flood elevation of 16 feet above mean sea level (ft-amsl). Golder states reliance on the accuracy of the rapid drawdown assessment performed by GAI for the 2016 Structural Stability Analysis. Golder performed an additional rapid drawdown assessment on the section outlined in the Safety Factor Assessment (Golder, 2021a). The target factor of safety for a rapid drawdown condition is 1.1 to 1.3 (USACE, 2003). The rapid drawdown factor of safety for cross section A, previously analyzed by GAI, through the stormwater sediment pond is 1.55 (GAI, 2016a), and the rapid drawdown factor of safety for cross section B, analyzed by Golder, through the maximum CCR height is 1.33. Both of these factors of safety exceed the requirement for a rapid drawdown condition. The locations of the cross sections analyzed for rapid drawdown are included in Figure 1, and calculations for the rapid drawdown assessment are included in Appendix A.

6.0 CORRECTIVE MEASURES

No structural stability deficiencies were identified, so no corrective measures are required.

7.0 CONCLUSIONS

Based on known site conditions, review of available information and the current analyses performed for the UAP, the UAP surface impoundment design, construction, operations, and maintenance procedures are consistent with good engineering practices for the volume of CCR and CCR wastewater that is impounded and meets the requirements of 40 CFR 257.73(d).

8.0 REFERENCES

GAI Consultants, Inc. Coal Combustion Residuals Unit Structural Stability Assessment. October 2016a.

GAI Consultants, Inc. Coal Combustion Residuals Unit History of Construction. October 2016b.

Geosyntec Consultants. Dam Breach Inundation Analysis Lower Ash Pond and Upper Ash Pond Embankments. April 2021.

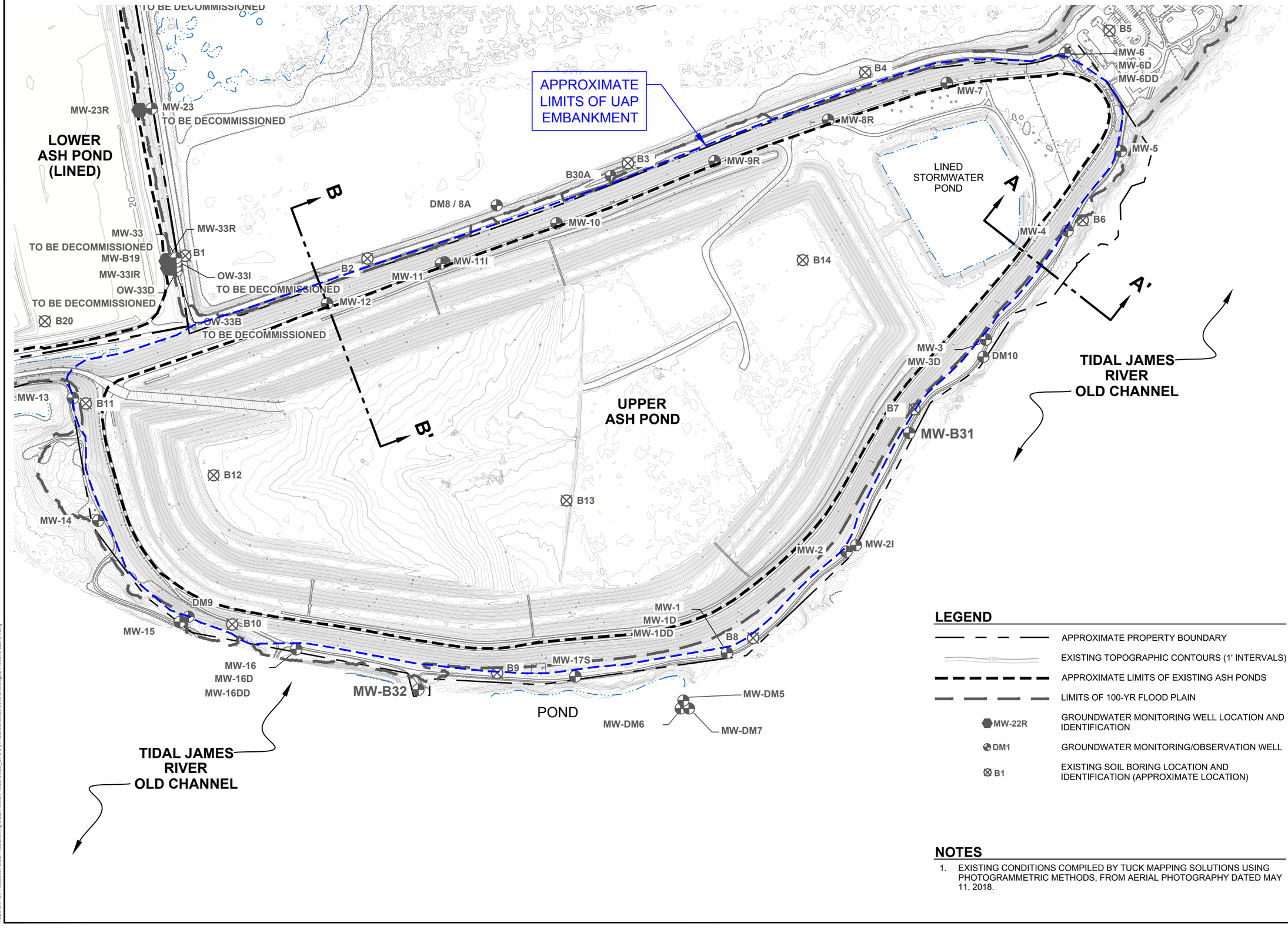
Golder Associates. Periodic Safety Factor Assessment, Chesterfield Power Station CCR Surface Impoundment: Upper Ash Pond. October 2021a.

Golder Associates. Periodic Inflow Design Flood Control System Plan, Chesterfield Power Station CCR Surface Impoundment: Upper Ash Pond. October 2021b.

Schnabel Engineering. Geotechnical Engineering Report: Upper Pond Stability Evaluation. August 15, 2014.

U.S. Army Corps of Engineers (USACE). Engineering and Design, Engineer Manual, Slope Stability. October 31, 2003.

Virginia DCR Dam Permit, Inventory No. 041045.



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING TOPOGRAPHIC CONTOURS (1' INTERVALS)
- APPROXIMATE LIMITS OF EXISTING ASH PONDS
- LIMITS OF 100-YR FLOOD PLAIN
- MW-22R — GROUNDWATER MONITORING WELL LOCATION AND IDENTIFICATION
- DM1 — GROUNDWATER MONITORING/OBSERVATION WELL
- B1 — EXISTING SOIL BORING LOCATION AND IDENTIFICATION (APPROXIMATE LOCATION)

NOTES

1. EXISTING CONDITIONS COMPILED BY TUCK MAPPING SOLUTIONS USING PHOTOGRAMMETRIC METHODS, FROM AERIAL PHOTOGRAPHY DATED MAY 11, 2018.

CLIENT
DOMINION ENERGY
CHESTERFIELD POWER STATION
CHESTERFIELD COUNTY, VIRGINIA

CONSULTANT
GOLDER
MEMBER OF WSP

	YYYY-MM-DD	2021-08-18
DESIGNED		ATN
PREPARED		SIB
REVIEWED		ATN
APPROVED		JRD

PROJECT
PERIODIC SAFETY FACTOR ASSESSMENT
STABILITY ANALYSIS
UPPER ASH POND

TITLE
STABILITY
CROSS SECTION LOCATION

PROJECT NO.
21-466315

REV.
0

FIGURE
1

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

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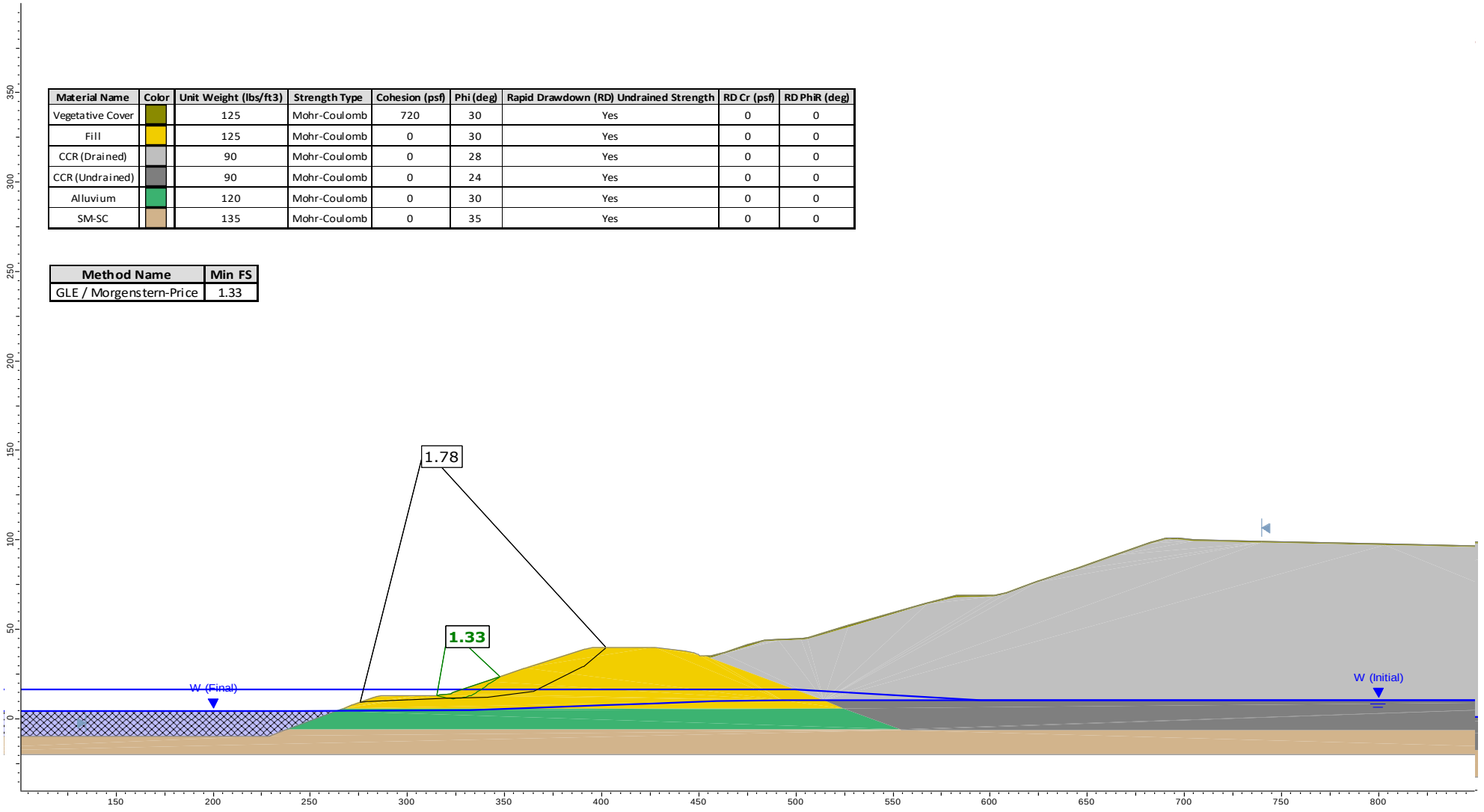
APPENDIX A

Rapid Drawdown Stability Assessment, Chesterfield Power Station, Upper Ash Pond

Cross Section B

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Vegetative Cover		125	Mohr-Coulomb	720	30	Yes	0	0
Fill		125	Mohr-Coulomb	0	30	Yes	0	0
CCR (Drained)		90	Mohr-Coulomb	0	28	Yes	0	0
CCR (Undrained)		90	Mohr-Coulomb	0	24	Yes	0	0
Alluvium		120	Mohr-Coulomb	0	30	Yes	0	0
SM-SC		135	Mohr-Coulomb	0	35	Yes	0	0

Method Name	Min FS
GLE / Morgenstern-Price	1.33



Note: GLE/Morgenstern Price method results displayed.

GOLDER
MEMBER OF WSP

SCALE	AS SHOWN
DATE	Aug 2021
MADE BY	SDRM
CAD	-
CHECK	ALB
REVIEW	ATN

PROJECT: **Chesterfield Power Station**

TITLE: **Upper Ash Pond Rapid Drawdown**

CLIENT: **Dominion Energy**

FIGURE: 4

FILE: SAFETY FACTOR ASSESSMENT

PROJECT No. 21466315 REV. 0

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