DOMINION ENERGY

# PERIODIC SAFETY FACTOR ASSESSMENT

## POSSUM POINT POWER STATION INACTIVE CCR SURFACE IMPOUNDMENT: POND ABC

APRIL 2023

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## APPENDICES

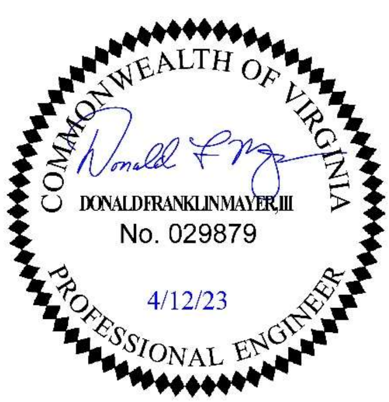
# 1 CERTIFICATION

This periodic Safety Factor Assessment for the Possum Point Power Station's Pond ABC was prepared by WSP USA Inc. (WSP; formerly d/b/a Golder Associates USA Inc.). The document and Certification/Statement of Professional Opinion are based on and limited to information that WSP has relied on from Dominion Energy and others, but not independently verified, as well as work products previously 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(e) 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(e)), as well as with the requirements in §257.100 resulting from the EPA's "Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Extension of Compliance Deadlines for Certain Inactive Surface Impoundments; Response to Partial Vacatur" published in the Federal Register on August 5, 2016, with an effective date of October 4, 2016 (40 CFR §257.100).

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.

| | |
|---|---|
| Donald Mayer, PE | Vice President |
| Print Name | Title |
|  | 4/12/2023 |
| Signature | Date |



# 2 INTRODUCTION

This periodic Safety Factor Assessment (Assessment) was prepared for Possum Point Power Station's (Station) inactive Coal Combustion Residuals (CCR) surface impoundment known as Pond ABC. This Safety Factor Assessment update was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.73(e).

The Station, owned and operated by Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion Energy), is in Prince William County, Virginia, at 19000 Possum Point Road, east of I-95 and bounded to the south and east by Quantico Creek and the Potomac River. The Station includes an existing, inactive CCR surface impoundment, Pond ABC, as defined by the Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule and Direct Final Rule (40 CFR §257; the CCR Rule). Pond ABC has historically also been regulated as an impounding structure by the Virginia Department of Conservation and Recreation (DCR), with Inventory Number 153001 (DCR Dam Permit).

Dominion Energy performed closure by removal activities in Pond ABC by removing the stored CCR and over-excavating soil pursuant to its solid waste permit closure plan (SWP 617). The Virginia Department of Environmental Quality (DEQ) verified removal activities in August 2019. The Pond remains subject to the CCR Rule requirements due to observed groundwater impacts that prevent full closure of the unit under the rule even though the Pond no longer impounds CCR materials. In addition, the Pond is no longer regulated by DCR as an impounding structure.

# 3 PURPOSE

This periodic Safety Factor Assessment is prepared pursuant to § 257.73(e)(1) of the CCR Rule [40 CFR § 257.73(e)(1)]. The initial Safety Factor Assessment was completed in April 2018 and is required to be updated every five (5) years pursuant to 40 CFR 257.73(f)(3). Pond ABC remains subject to the CCR Rule requirements, including this periodic safety factor assessment update, even though all CCR materials have been removed.

# 4 SAFETY FACTOR ASSESSMENT REQUIREMENTS

In accordance with § 257.73(e)(1), the owner or operator of a CCR surface impoundment must conduct periodic safety factor assessments and document whether the calculated factors of safety achieve the minimum safety factors specified for the critical cross section of the embankment. The safety factor assessments must be supported by appropriate engineering calculations. The minimum safety factors specified in § 257.73(e)(1)(i) through (iv) include:

— The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50;

— The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40;

— The calculated seismic factor of safety must equal or exceed 1.00; and

— For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

# 5 SAFETY FACTOR ASSESSMENT

Slope stability analyses of the Pond ABC embankment were conducted to determine whether the calculated factors of safety for the critical cross sections of the embankment meet or exceed the minimum safety factors specified in 40 CFR §257.73(e)(1).

## 5.1 METHODOLOGY

Stability safety factors were evaluated for each of the loading scenarios using the computer program SLIDE2 Version 9.011 (2020). As required by the EPA rule, a general limit equilibrium (GLE) method (Morgenstern and Price) was used to calculate factors of safety. The factor of safety is calculated by dividing the resisting forces by the driving forces along the critical slip surface.

Stability was evaluated along three cross-sections as shown in Figure 1 in Appendix D. Subsurface stratigraphy at each cross-section was developed from cone penetration tests (CPTs) completed during the subsurface exploration conducted in December 2017 by Golder Associates Inc. (Golder), and geotechnical data reported in Schnabel Engineering's 2014 report titled "Geotechnical Engineering Study, Possum Point Power Station Ash Ponds ABC, Dominion Resources Services, Inc., Prince William County, Virginia". Similarly, material properties were developed for the dike and foundation materials from these sources. The Material Properties Calculation Package (Appendix A) provides more details on Golder's geotechnical exploration and evaluation of geotechnical data.

## 5.2 NORMAL STORAGE POOL

The water level in Pond ABC is maintained at or lower than 8 feet mean sea level (ft-msl) through pumping efforts. Thus, the normal storage pool was set to elevation 8 ft-msl for stability analyses.

## 5.3 MAXIMUM SURCHARGE POOL

For the maximum surcharge pool, the peak water level within Pond ABC was the elevation of the top of the embankment at approximate elevation 16 ft-msl. For further details, refer to the outflow control presented in the Periodic Inflow Design Flood Control System Plan (WSP, 2023).

## 5.4 PSEUDO-STATIC STABILITY ANALYSIS

Factors of safety for stability under seismic loading conditions were calculated based on the earthquake hazard corresponding to a probability of exceedance of 2% in 50 years (2,475 return period). As part of the initial Safety Factor Assessment, Golder used the displacement-based seismic slope stability screening method as described in Bray and Travasarou (2009) to evaluate the seismic stability. For this method, a pseudo-static coefficient corresponding to an allowable displacement of six inches (15 centimeters) was used. The pseudo-static coefficient was calculated to be 0.01g. Details on the calculation of the pseudo-static coefficient are available in the Seismic

Hazard Calculation Package, included as Appendix B. As part of the current periodic assessment, a review of updates made by the United States Geological Survey (USGS) to the 2018 seismic hazard model was conducted, with an identical probability of exceedance identified to that used in the 2014 seismic hazard model used in the initial analysis. Consequently, the calculations conducted as part of the initial study remain appropriate for use in the current periodic assessment. Appendix B additionally contains a copy of the 2018 USGS Unified Hazard Tool results for the site.

For stability analysis, the shear strength of each soil under seismic conditions was modeled using the minimum of the drained and undrained strength of the soil. Details regarding the drained and undrained strengths are included in the Material Properties Package included as Appendix A.

## 5.5 POST-EARTHQUAKE LIQUEFACTION LOADING CONDITIONS

As part of the initial Safety Factor Assessment, Golder evaluated the liquefaction susceptibility of the site soils as presented in the Liquefaction Assessment Calculation Package included as Appendix C. The calculated factor of safety against liquefaction was found to be above 1.2 for the materials analyzed, including the dike soils and the foundation soils. Based on the findings of the initial analyses for the site soils, slope stability analyses evaluating the impacts of liquefaction were not necessary. Details of the liquefaction analysis are included as Appendix C.

# 6 SLOPE STABILITY ASSESSMENT RESULTS

The table below presents the results of the Safety Factor Assessments for the Pond ABC analysis cases required in 40 CFR §257.73(e)(1)(i) to (iv) of the CCR Rule. Stability analysis figures are included in Appendix D, and the summary of factors of safety are summarized in Table 1 below.

**Table 1 Slope Stability Assessment Results**

| Analysis Case | Normal Storage Pool | Maximum Surcharge Pool | Seismic | Post-Earthquake Liquefaction |
|---|---|---|---|---|
| Target Factor of Safety | 1.5 | 1.4 | 1.0 | 1.2 |
| Cross-Section | Calculated Factor of Safety | | | |
| A-A’ | 1.5 | 1.4 | 1.4 | Soils are calculated to not liquefy |
| B-B’ | 1.7 | 1.7 | 1.7 | |
| C-C’ | 1.3 | 1.3 | 1.3 | |

Localized erosion and/or sloughing on the back slope at Section C-C’ (approximately 150 feet laterally along the embankment, reference Figure 1 in Appendix D) resulted in the calculated factor of safety being below the required safety factors under the normal storage pool and maximum surcharge pool conditions, as noted in Section 4.0. In order to meet the required safety factors, WSP proposes to either: establish a 2H:1V slope grading with compacted structural fill covered by vegetation (Option 1); or to place rip-rap over a filter material on the back slope with a minimum thickness of 2 feet (Option 2). . The stability analyses performed for these two potential mitigation options are included as Appendix D.

The factors of safety for the two mitigation options are summarized in Table 2.

**Table 2 Slope Stability Assessment Results with Mitigation Options at Section C-C'**

| Analysis Case | Normal Storage Pool | Maximum Surcharge Pool | Seismic | Post-Earthquake Liquefaction |
|---|---|---|---|---|
| Target Factor of Safety | 1.5 | 1.4 | 1.0 | 1.2 |
| Mitigation Option | Calculated Factor of Safety | | | |
| 1 | 2.0 | 1.9 | 1.9 | Soils are calculated to not liquefy |
| 2 | 1.8 | 1.9 | 1.8 | |

# 7 CONCLUSION

The Pond ABC is subject to a periodic factor of safety assessment update (due every 5 years from the original assessment performed in April 2018). The pond remains subject to the CCR rule requirements, even though it no longer impounds CCR materials, due to observed groundwater impacts that prevent full closure of the unit under the rule. In addition, the pond is no longer regulated by DCR as an impounding structure.

Based on the known geotechnical site conditions, information referenced herein, as well as prior work performed by WSP, Golder, and others, Sections A-A' and B-B' at Pond ABC meet the minimum factors of safety as required by 40 CFR §257.7(e)(1) for each of the conditions analyzed. Two mitigation options are identified by WSP in Appendix D to enable Section C-C' to meet the minimum factors of safety as required by 40 CFR §257.7(e)(1) for the normal storage pool and maximum surcharge pool conditions.

# REFERENCES


- Bray, J.D., and Travasarou, T. 2009. Pseudostatic Coefficient for Use in Simplified Seismic Slope Stability Evaluation. Journal of Geotechnical and Geoenvironmental Engineering, Vol. 135, No. 9: pp. 1336-1340.
- Golder Associates. Safety Factor Assessment, Possum Point Power Station CCR Surface Impoundment: Pond ABC. April 2018.
- Rocscience (2020), SLIDE2 Version 9.011.
- Schnabel Engineering. "Geotechnical Engineering Study, Possum Point Power Station Ash Pond ABC, Dominion Resources Services, Inc., Prince William County, Virginia." December 9, 2014.
- Virginia DCR Dam Permit, Inventory No. 153001.
- WSP USA Inc. Periodic Inflow Design Flood Control Plan. Possum Point Power Station Inactive CCR Surface Impoundment: Pond ABC. April 2023.

# APPENDIX

## A Materials Properties Package

# CALCULATIONS

| | | | |
|---|---|---|---|
| **Date:** | February 15, 2018 | **Made by:** | G. Martin |
| **Project No.:** | 1662150 | **Checked by:** | L. Jin |
| **Site Name:** | Possum Point – Pond ABC | **Reviewed by:** | |
| **Subject** | **MATERIAL PROPERTIES PACKAGE** | | |

## 1.0 OBJECTIVE

The objective of this package is to characterize materials found at Pond ABC of Dominion Energy's Possum Point Power Station in Dumfries, VA. Specifically, Golder assessed the dike soils and foundation soils at Pond ABC to support stability and liquefaction analyses of the dikes.

## 2.0 METHODOLOGY

Site materials were grouped into five representative units for further analysis:

- Dike Fill
- Fine Grained Alluvium
- Coarse Grained Alluvium
- Terrace Deposits
- Cretaceous Sediments

For each unit, Golder developed material properties for use in stability and liquefaction analyses. Material properties were evaluated based on geotechnical data available from the following sources:

- Schnabel Engineering's 2014 report titled "Geotechnical Engineering Study, Possum Point Power Station Ash Pond ABC, Dominion Resources Services, Inc., Prince William County, Virginia"
- Golder's geotechnical exploration completed in December 2017.

## 2.1 Schnabel Engineering Report

Schnabel Engineering (Schnabel) completed a stability assessment of dikes surrounding Pond ABC in December 2014. Their report includes Standard Penetration Test (SPT) borehole data and qualitative hand auger logs in the dikes surrounding Pond ABC. Schnabel supplemented their field data with laboratory testing including two consolidated-undrained (CU) triaxial tests. One CU test was performed on the dike soils (noted as Fine-Grained Embankment Fill, Stratum A1 in the report), and the other CU test was conducted on a sample of the foundation soils (identified as Fine-Grained Alluvium, Stratum B1).



**Golder Associates Inc.**
3730 Chamblee Tucker Road
Atlanta, GA 30341 USA
Tel: (770) 496-1893 Fax: (770) 934-9476 www.golder.com

| Project No.: | 1662150 | Made by: | G. Martin |
|---|---|---|---|
| Site Name: | Possum Point – Pond ABC Inactive Pond Demonstration | Checked by: | L. Jin |
| Date: | 2/15/18 | Reviewed by: | |

Schnabel categorized the dike and foundation soils into six groups in their report, and for each group, Schnabel determined representative total and effective strengths and unit weights. Golder used the same groupings (listed above) for analyses, except Golder modeled the dike fill soils as a single stratum. Schnabel divided the dike fill soils into a fine-grained unit and a coarse-grained unit, but this distinction was not apparent in the CPT data Golder collected in December 2017. Golder found the dike soils to be more closely represented by Schnabel's fine-grained fill.

## 2.2 Golder Geotechnical Explorations

Golder completed six cone penetration tests (CPTs) to characterize the dike and foundation materials. These tests were conducted by ConeTec on December 19 and 20 of 2017 under the direction and supervision of Golder engineer Sarah Fick. Table 1 lists general information for the CPTs.

**Table 1: Golder CPT Locations and Testing Notes**

| Sounding ID | Date | Total Depth (ft) | Latitude[1] (deg) | Longitude[1] (deg) | Ground Surface Elevation[2] (ft-msl) | Testing Notes |
|---|---|---|---|---|---|---|
| **PP-ABC-SCPT-01** | 12/19/17 | 75.0 | 38.54265 | -77.28434 | 21.3 | Seismic CPT |
| **PP-ABC-CPT-02** | 12/19/17 | 35.9 | 38.54145 | -77.28338 | 21.6 | |
| **PP-ABC-CPT-03** | 12/20/17 | 33.1 | 38.54278 | -77.28463 | 14.8 | |
| **PP-ABC-CPT-04** | 12/20/17 | 55.8 | 38.54363 | -77.28575 | 19.0 | |
| **PP-ABC-CPT-05** | 12/20/17 | 62.3 | 38.54405 | -77.28567 | 21.2 | |
| **PP-ABC-CPT-06** | 12/20/17 | 32.7 | 38.54183 | -77.28421 | 21.7 | |

Notes:

1. Latitude/Longitude - WGS 84. Coordinates were recorded with a handheld GPS unit and should be considered approximate.

CPT logs presenting raw measurements (tip, sleeve, and pore pressure) and correlated shear strengths with depth are presented in the attachment following this text. The CPT correlation to undrained strength does not properly model the strength of the cretaceous layer; thus, Golder excluded the undrained shear strength correlation in this layer from the CPT logs.

## 3.0 SELECTED MATERIAL PROPERTIES

Golder selected strength parameters and unit weights for use in stability analyses based on data available in Schnabel's report and CPT data collected during Golder's geotechnical exploration. Golder found the values presented in Schnabel's report to be consistent with CPT data, so Golder used a modified version of Schnabel's properties. The following modifications were made to the values presented by Schnabel:

| Project No.: | 1662150 | Made by: | G. Martin |
|---|---|---|---|
| Site Name: | Possum Point – Pond ABC Inactive Pond Demonstration | Checked by: | L. Jin |
| Date: | 2/15/18 | Reviewed by: | |

- All dike fill was modeled as a single unit.
- Dike fill drained properties were modeled using a higher friction angle and lower cohesion than presented by Schnabel to better match conditions observed from CPT data. Dike fill undrained properties were based on Schnabel's fine-grained dike fill properties.
- The Coarse Grained Alluvium was modeled with drained strengths for all analyses. CPT data indicates this material will not behave in an undrained state during the scenarios considered in stability analyses.

The selected properties used for stability analyses are listed in Table 2. Also, the selected strengths are plotted on the attached CPT logs with the values correlated from CPT data.

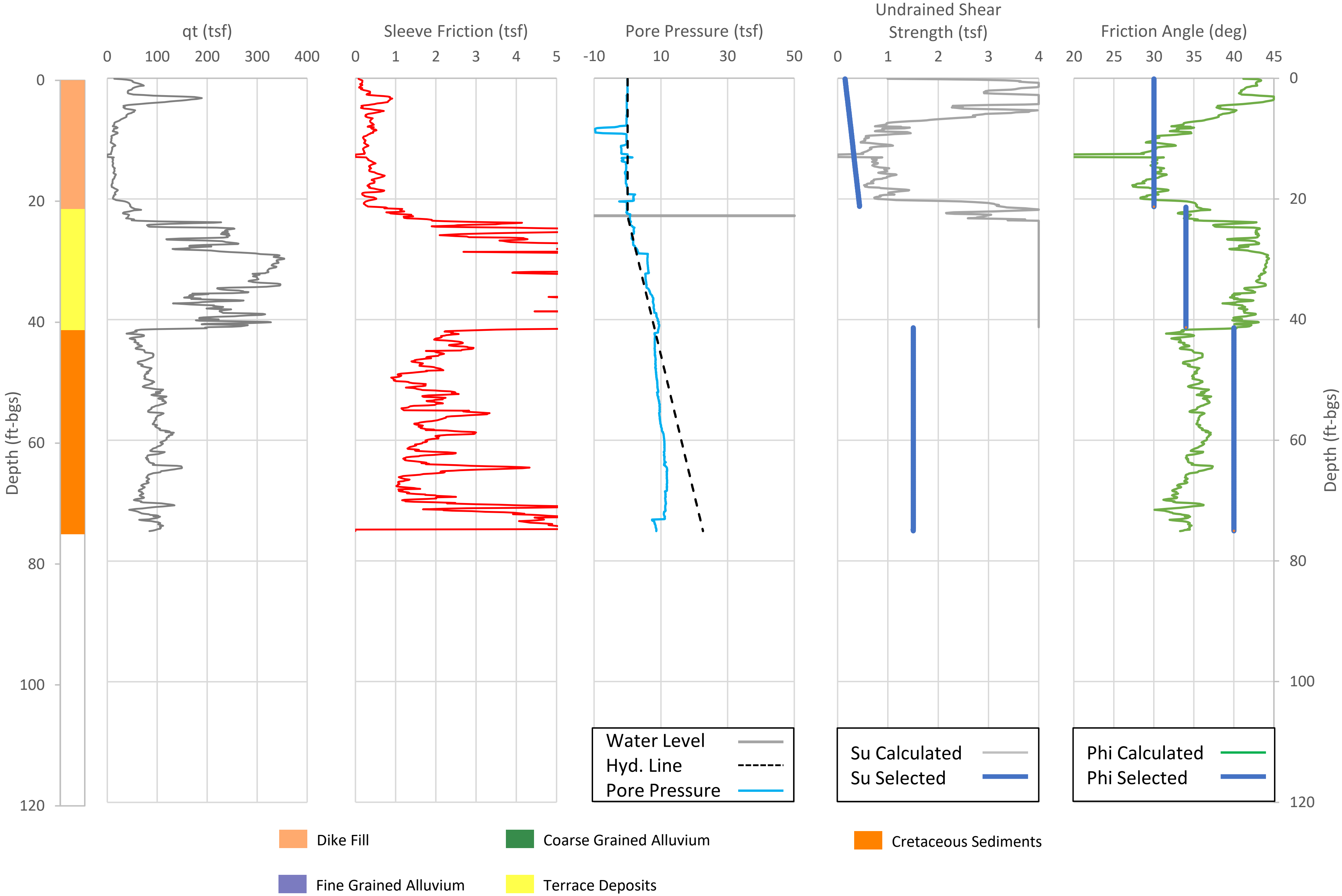
**Table 2: Selected Material Properties for Use in Slope Stability Analysis**

| Material | Drained Strength | | Undrained Strength | | Unit Weight (pcf) |
|---|---|---|---|---|---|
| | ϕ' (degrees) | c' (psf) | ϕ (degrees) | c (psf) | |
| Dike Fill | 30 | 100 | 14 | 290 | 125 |
| Fine Grained Alluvium | 28 | 100 | 14 | 290 | 120 |
| Coarse Grained Alluvium | 32 | 200 | N/A | N/A | 120 |
| Terrace Deposits | 34 | 0 | N/A | N/A | 130 |
| Cretaceous Sediments | 40 | 0 | 0 | 3,000 | 125 |

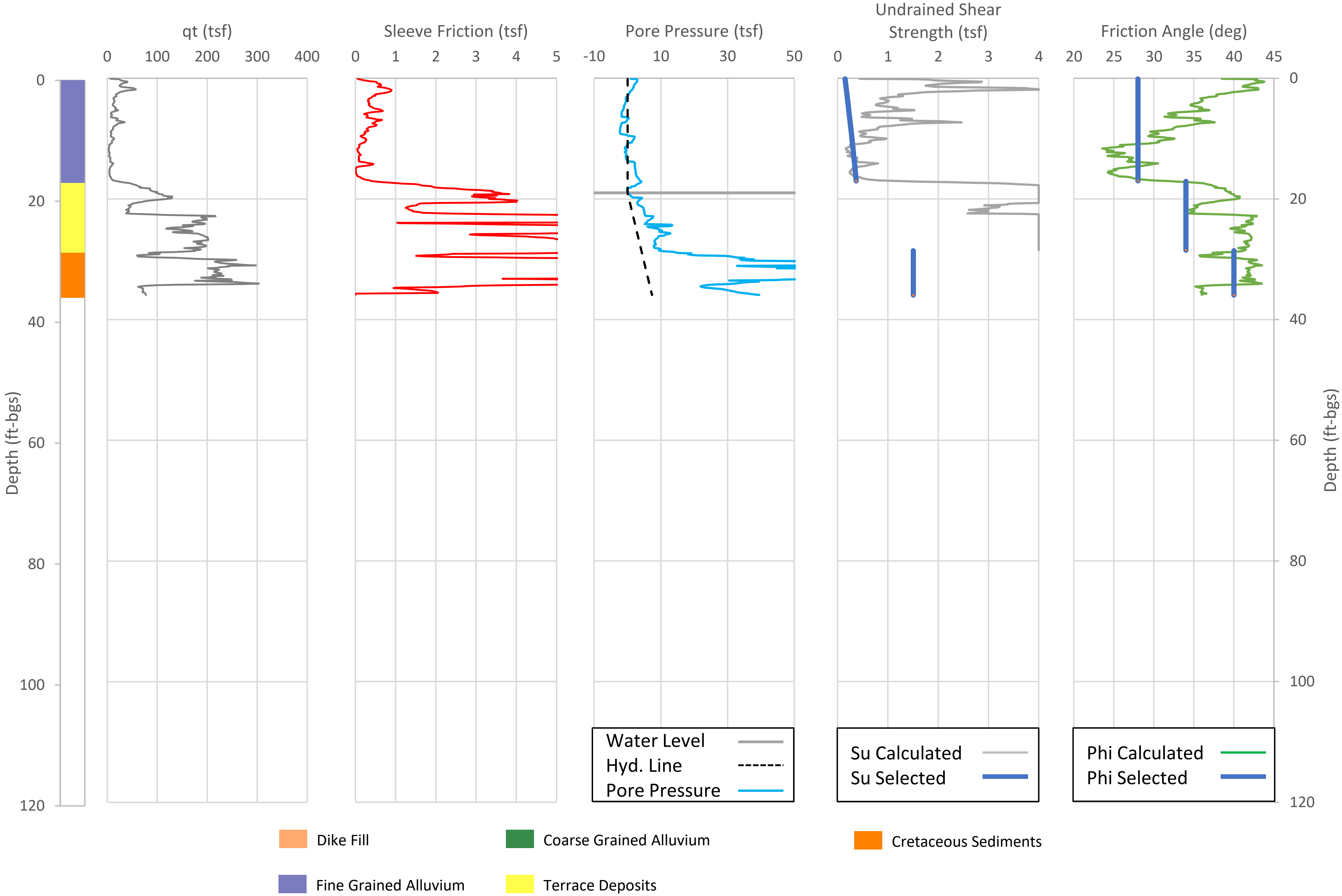
## 4.0 REFERENCES

Schnabel Engineering (2014). "Geotechnical Engineering Study, Possum Point Power Station Ash Pond ABC, Dominion Resources Services, Inc., Prince William County, Virginia." December 9, 2014.

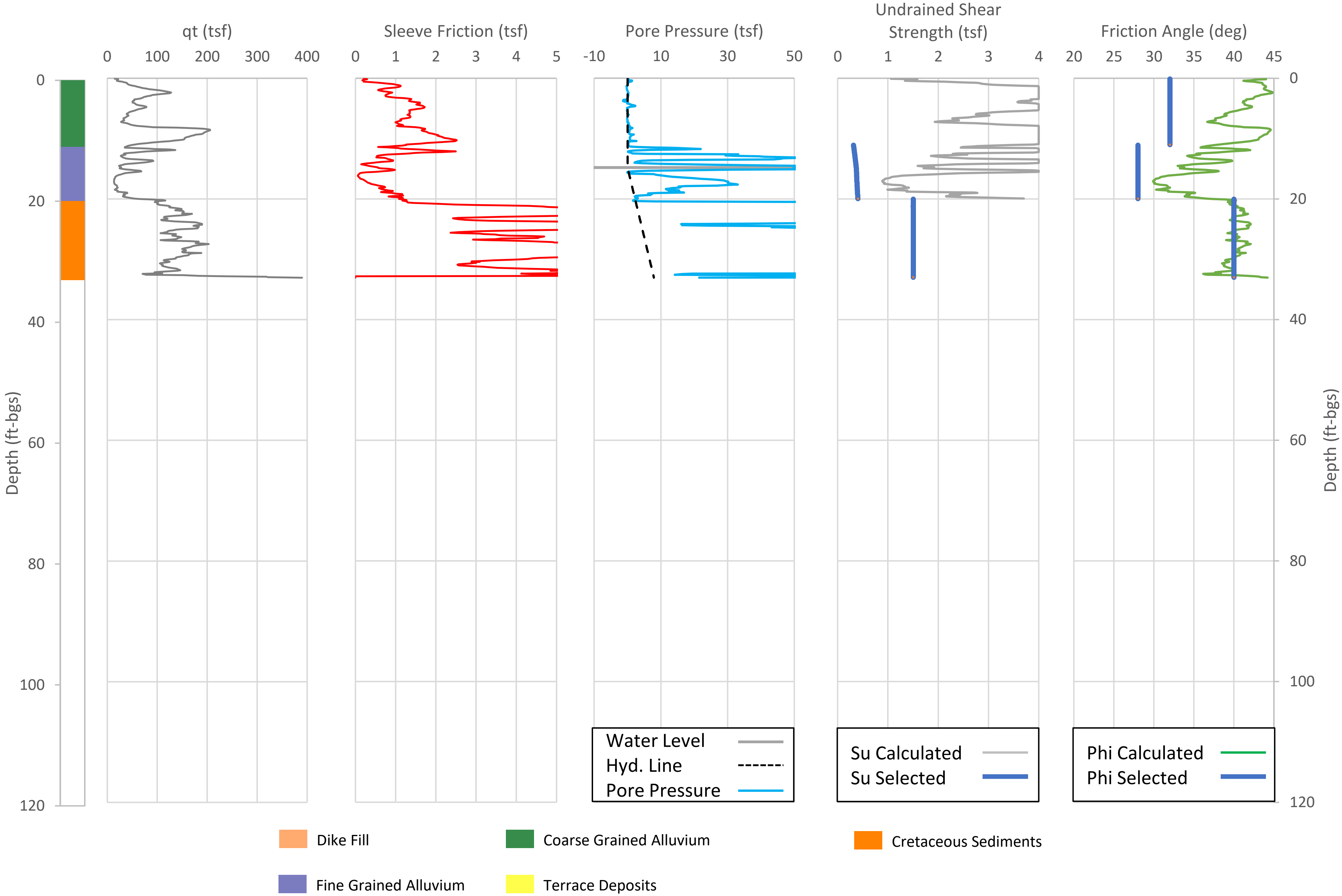
| | | | | | |
|---|---|---|---|---|---|
| **Test ID:** | **CPT-ABC-01** | **CPT Rig Type:** | **Track** | **Project #:** | **1662150** |
| **GS Elev. (ft-msl):** | **21.3** | **Location:** | **Possum Point** | **Project Name:** | **Inactive Pond Demonstrations** |
| **Test Depth (ft):** | **75.0** | **Groundwater Depth (ft-bgs):** | **22.8** | **Client:** | **Dominion Energy** |



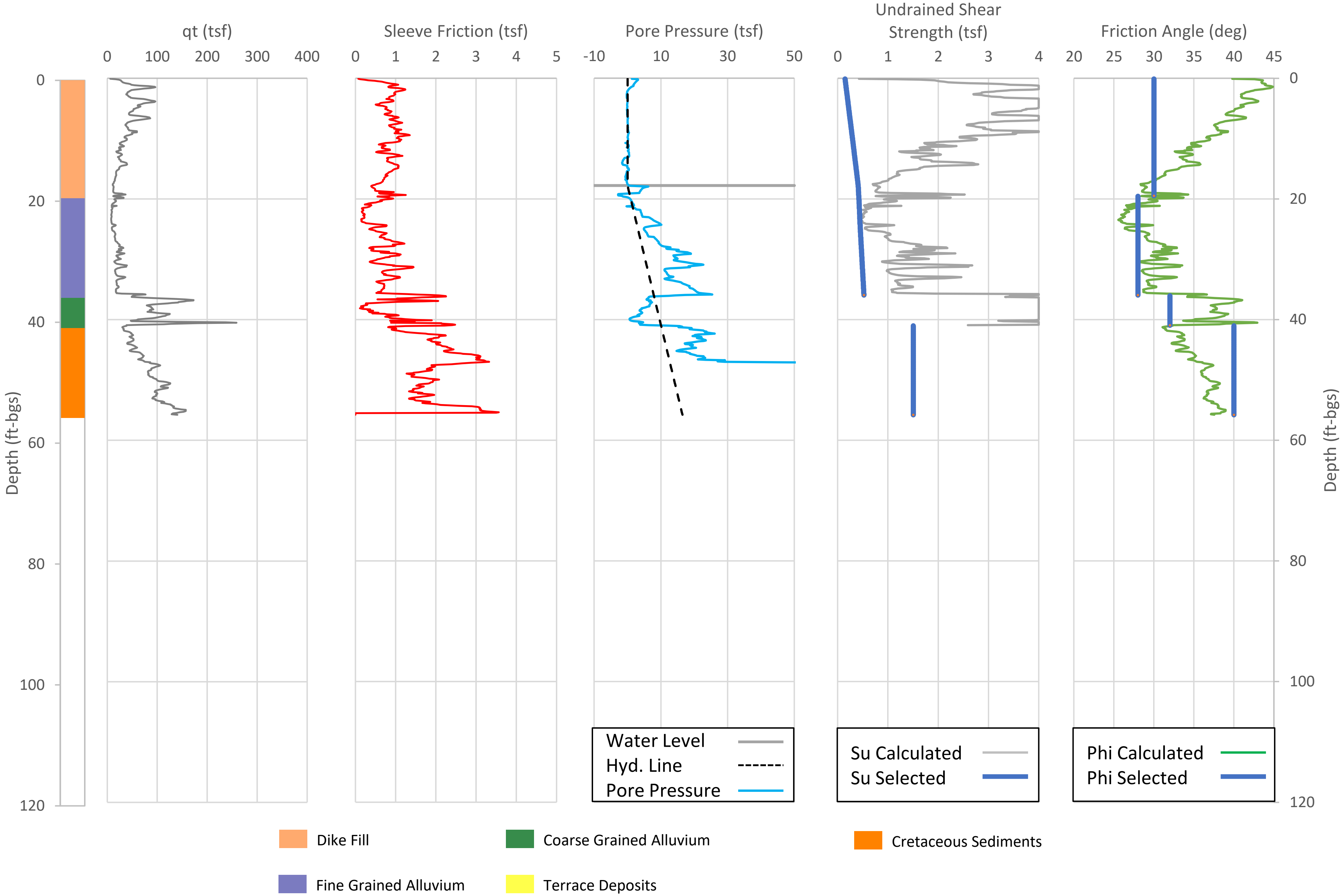
**Test ID:** CPT-ABC-02
**GS Elev. (ft-msl):** 21.6
**Test Depth (ft):** 35.9
**CPT Rig Type:** Truck
**Location:** Possum Point
**Groundwater Depth (ft-bgs):** 19.0
**Project #:** 1662150
**Project Name:** Inactive Pond Demonstrations
**Client:** Dominion Energy



| | | | | | | |
|---|---|---|---|---|---|---|
| **Test ID:** | **CPT-ABC-03** | **CPT Rig Type:** | **Track** | | **Project #:** | **1662150** |
| **GS Elev. (ft-msl):** | **14.8** | **Location:** | **Possum Point** | | **Project Name:** | **Inactive Pond Demonstrations** |
| **Test Depth (ft):** | **33.1** | **Groundwater Depth (ft-bgs):** | | **14.8** | **Client:** | **Dominion Energy** |



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test ID:** | **CPT-ABC-04** | **CPT Rig Type:** | **Track** | | **Project #:** | **1662150** |
| **GS Elev. (ft-msl):** | **19.0** | **Location:** | **Possum Point** | | **Project Name:** | **Inactive Pond Demonstrations** |
| **Test Depth (ft):** | **55.8** | **Groundwater Depth (ft-bgs):** | | **17.8** | **Client:** | **Dominion Energy** |

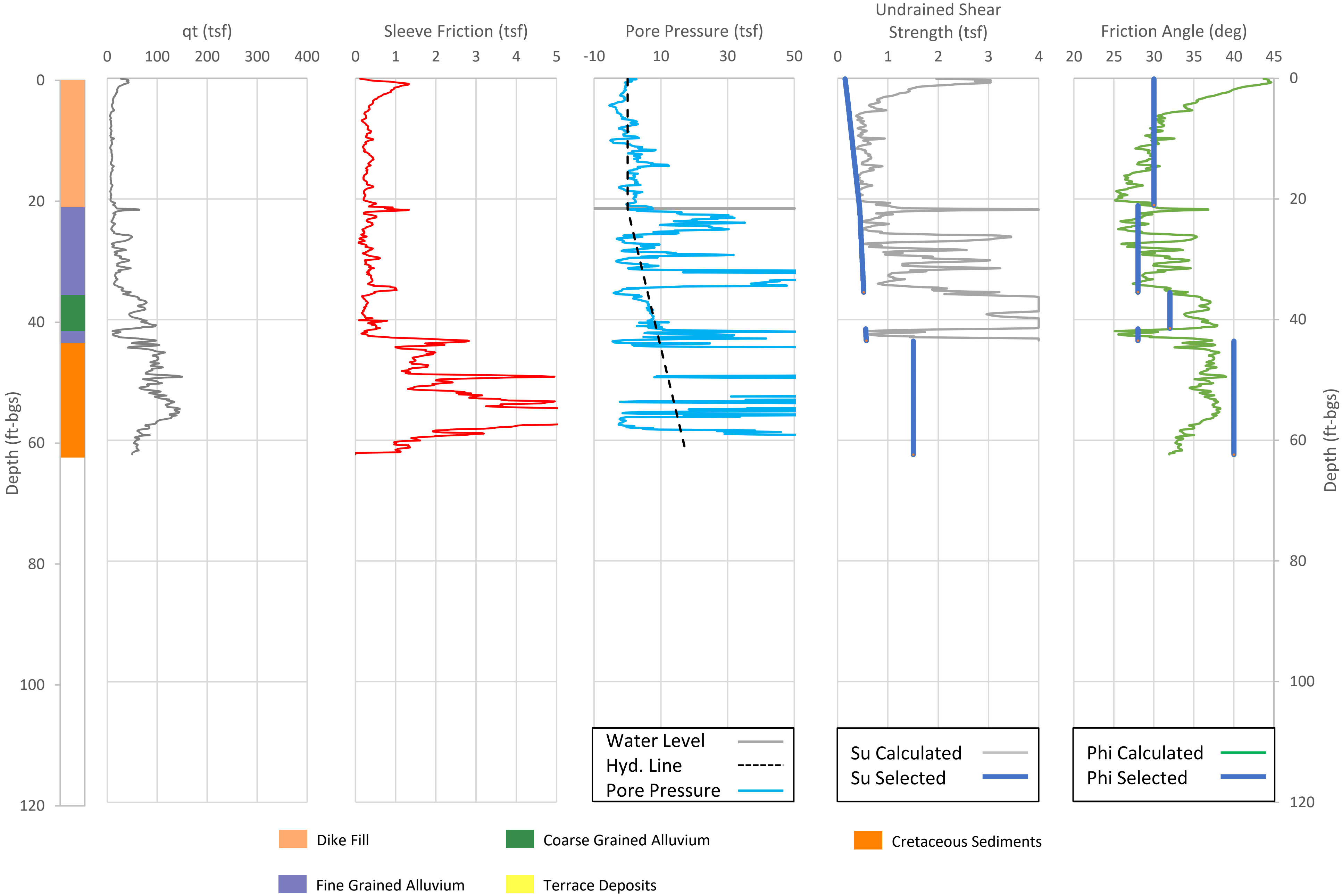


**Test ID:** CPT-ABC-05
**GS Elev. (ft-msl):** 21.2
**Test Depth (ft):** 62.3

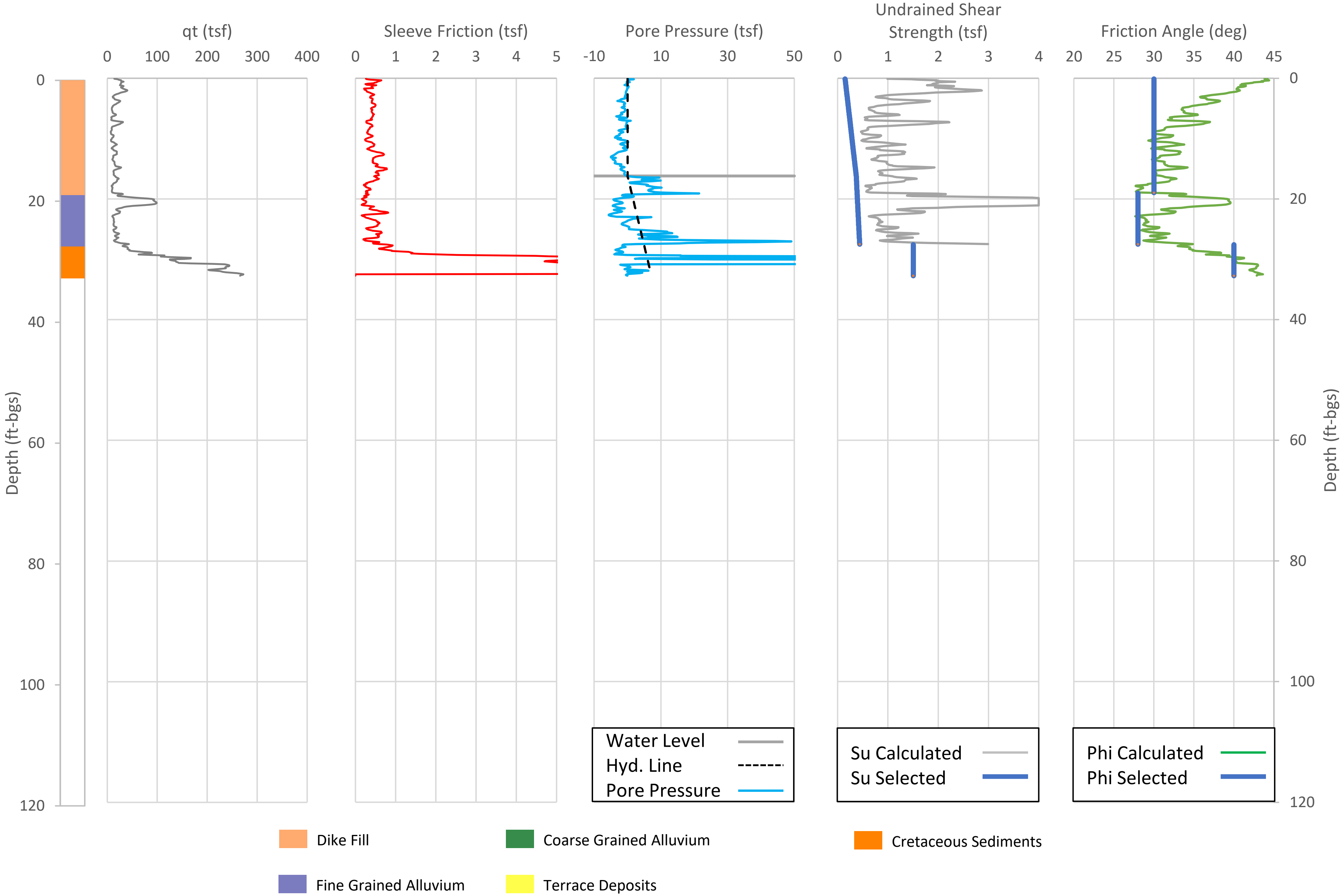
**CPT Rig Type:** Track
**Location:** Possum Point
**Groundwater Depth (ft-bgs):** 21.6

**Project #:** 1662150
**Project Name:** Inactive Pond Demonstrations
**Client:** Dominion Energy

Golder Associates



| | | | | | |
|---|---|---|---|---|---|
| **Test ID:** | **CPT-ABC-06** | **CPT Rig Type:** | **Track** | **Project #:** | **1662150** |
| **GS Elev. (ft-msl):** | **21.7** | **Location:** | **Possum Point** | **Project Name:** | **Inactive Pond Demonstrations** |
| **Test Depth (ft):** | **32.7** | **Groundwater Depth (ft-bgs):** | **16.2** | **Client:** | **Dominion Energy** |



# APPENDIX

# B Seismic Hazard Calculation Package

| | | | |
|---|---|---|---|
| **Date:** | January 9, 2018 | **Made by:** | L. Jin |
| **Project No.:** | 1662150 | **Checked by:** | G. Martin |
| **Subject:** | Seismic Hazard Assessment | **Reviewed by:** | |
| **Project:** | **POSSUM POINT POND ABC – INACTIVE POND DEMONSTRATION** | | |

## 1.0 OBJECTIVE

This calculation package identifies and summarizes the seismic hazard at the project site located at 77.286˚W and 38.547˚N. The seismic hazard assessment is necessary for geotechnical design evaluations of stability under earthquake loading and liquefaction susceptibility.

## 2.0 SEISMIC HAZARD SUMMARY

For ash pond closures, the United State Environmental Protection Agency's (USEPA) CCR Rule has specified seismic analyses be completed for a seismic event with a 2% probability of exceedance in 50 years (2% / 50yr), equivalent to a return period of approximately 2,500 years. The United States Geological Survey (USGS) has provided online tools associated with this hazard for its 2014 seismic hazard model. The sections below detail the use of these tools to obtain seismic hazard data for use in analyses.

## 3.0 PEAK GROUND AND SPECTRAL ACCELERATION

The peak ground acceleration (PGA) and spectral ground accelerations ($S_a$) corresponding to a range of spectral periods are necessary for many engineering analyses including slope stability analysis and liquefaction analysis. For a 2% probability of exceedance (PE) in 50 years, The USGS provides a reference PGA and spectral accelerations corresponding to a reference site on the border between the National Earthquake Reductions Hazard Program (NEHRP) site classes B and C with an average shear wave velocity in the upper 30 m ($V_{s30}$) of 760 m/s. These reference accelerations are often referenced with a BC subscript (e.g. $PGA_{BC}$) and are scaled as appropriate to match site conditions and analysis input requirements. Figure 1 below shows the project site on the 2014 seismic hazard map for $PGA_{BC}$, and Figure 2 displays the uniform hazard response spectrum curve, which plots the reference spectral acceleration, or ground motion, for various spectral periods. The uniform hazard response spectrum curve is presented in tabular form in Table 1.



**Golder Associates Inc.**
3730 Chamblee Tucker Road
Atlanta, GA 30341 USA
Tel: (770) 496-1893 Fax: (770) 934-9476 www.golder.com

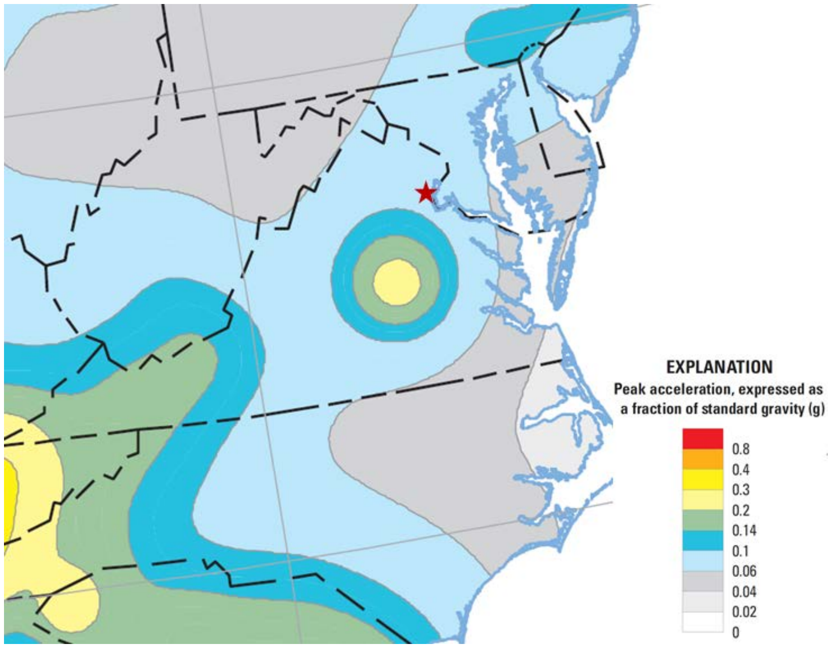



**Figure 1: $PGA_{BC}$ for the 2% PE in 50 years at the project site (red star). (USGS 2014).**

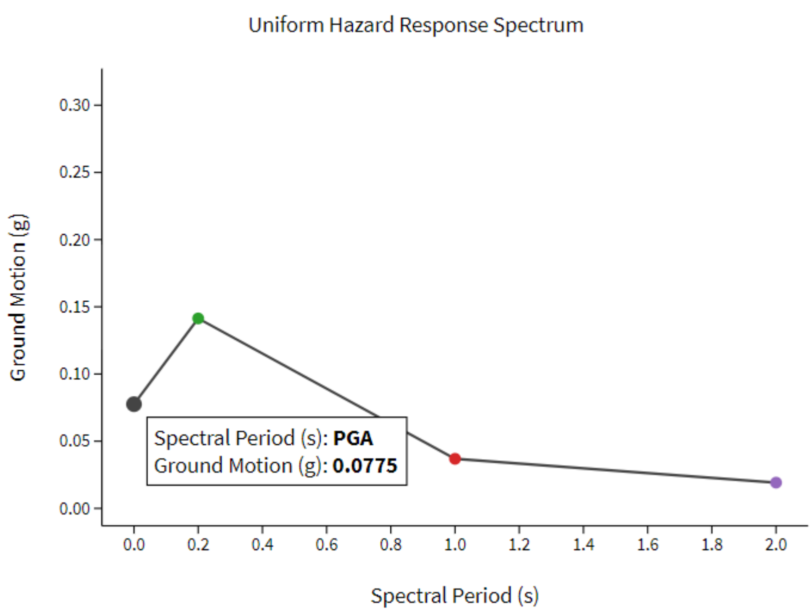


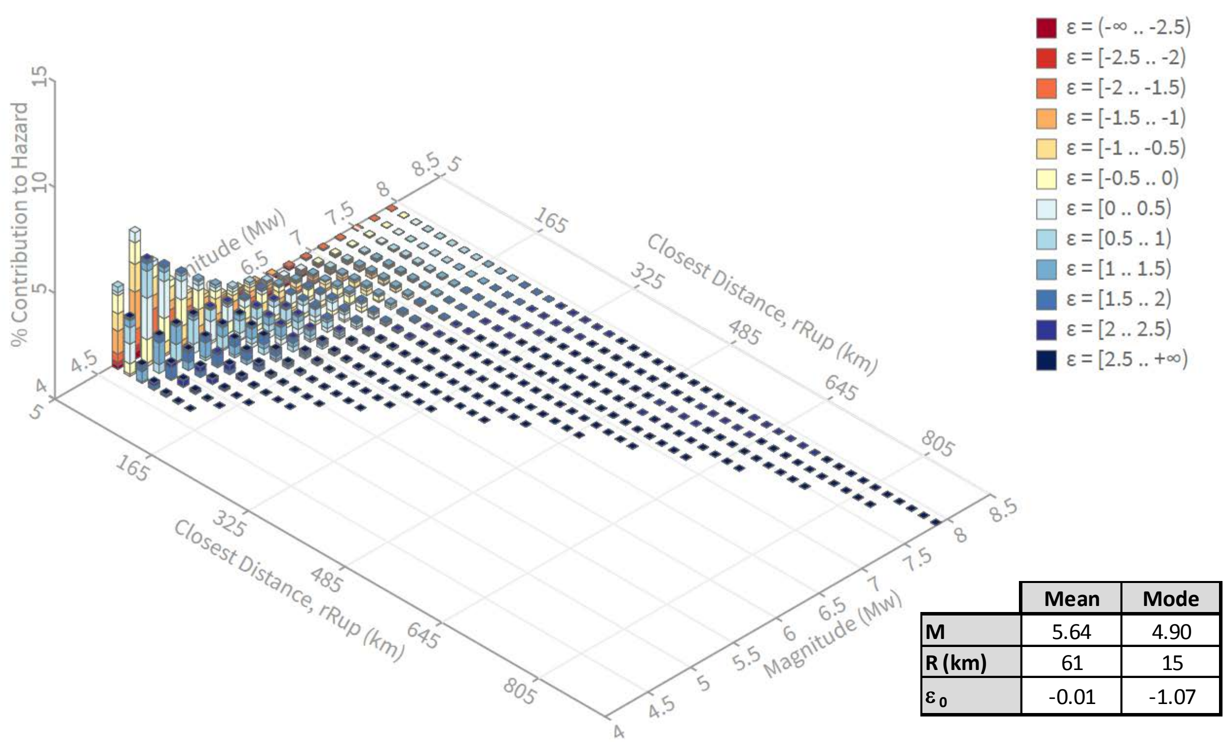

**Figure 2: Uniform Hazard Response Spectrum for the 2% PE in 50 years Seismic Hazard at the Project Site (USGS 2014).**

**Table 1: Reference site (BC) PGA and Spectral Acceleration for the 2% PE in 50 year Seismic Hazard at the Project Site (USGS 2014).**

| Spectral Period (s) | Acceleration, BC (g) |
|---|---|
| 0 (PGA) | 0.0775 |
| 0.2 | 0.1414 |
| 1.0 | 0.0369 |
| 2.0 | 0.0192 |

## 3.1 Seismic Hazard Deaggregation

The seismic hazard is compiled from multiple predictive models which consider many seismic sources of varying combinations of earthquake magnitude and distance from the project site. For each magnitude and distance pair, models predict the resulting accelerations and activity rates for the project site. The results of these predictive models are aggregated to produce the seismic hazard model for specified return periods. The seismic hazard model can be deaggregated to obtain the contribution to hazard percentage of each magnitude and distance combination. This information is necessary for analyzes requiring earthquake magnitude (e.g. liquefaction susceptibility) or distance. Figure 3 below displays a deaggregation plot of the $PGA_{BC}$ at the project site for a 2% PE in 50 years with descriptive statistics available through the USGS online tools.




| | Mean | Mode |
|---|---|---|
| M | 5.64 | 4.90 |
| R (km) | 61 | 15 |
| $\varepsilon_0$ | -0.01 | -1.07 |

**Figure 3: Deaggregation Plot of the $PGA_{BC}$ at the Project Site for a 2% PE in 50 Years**

## 3.2 Design Earthquake Magnitude

Some seismic analysis methods require a design earthquake magnitude as an input. One such analysis is the liquefaction screening method. Based on its application in the liquefaction screening, a design earthquake magnitude of 5.50 was selected. Additional details on the design earthquake magnitude are available in the Liquefaction Assessment Calculation Package. This design earthquake magnitude was used in all analyses for consistency.

# 4.0 DETERMINATION OF SITE-SPECIFIC PEAK GROUND ACCELERATION

For liquefaction analysis, the site-specific peak ground acceleration at the surface, $a_{max}$, was calculated from the site reference peak ground acceleration ($PGA_{BC}$). The $PGA_{BC}$ was multiplied by an amplification factor calculated from the average shear wave velocity in the upper 30 meters (Vs30) to obtain a representative $a_{max}$. The shear wave velocity was directly measured every meter in one CPT (CPT-ABC-01), and a representative shear wave velocity was derived from these measurements. Figure 4 shows the measured shear wave velocities and the representative shear wave velocity profile. The Vs30 (listed in Table 2) was calculated from the representative profile to be 1164 ft/s.

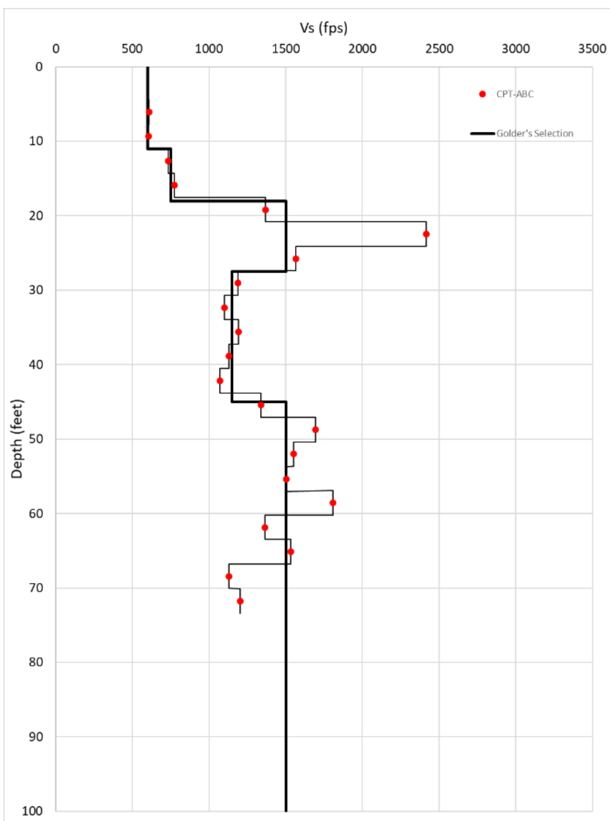



**Figure 4. Shear wave velocity profile for Pond ABC**

**Table 2: Representative Shear Wave Velocity in the Upper 30 m (Vs30)**

| Pond ID | Vs30 (ft/s) | Vs30 (m/s) |
|---|---|---|
| ABC | 1164 | 355 |

## 4.1 Determination of site coefficient $F_a$

An amplification factor was evaluated from two sources:

- Atkinson and Boore's 2006 publication on earthquake ground-motion prediction equations for Eastern North America
- the International Building Code (IBC, 2012)

Atkinson and Boore's publication provides a site response term which is used to amplify the $PGA_{BC}$, and the IBC provides a site coefficient $F_a$ (amplification factor) as well. Amplification factors from these two sources were averaged to obtain a representative amplification factor.

**Table 3: Site coefficient $F_a$**

| Pond ID | Atkinson and Boore (2006) | IBC (2012) | Selected for Analysis |
|---|---|---|---|
| ABC | 1.36 | 1.41 | 1.39 |

## 4.2 Site-specific peak ground acceleration $a_{max}$

$$a_{max} = PGA_{BC} * F_a = 0.0775g * 1.39 = 0.11\ g \qquad (1)$$

With an amplification factor $F_a$ of 1.39, Golder calculated the site-specific peak ground acceleration $a_{max}$ to be 0.11 g for the considered seismic hazard.

**Table 4: $a_{max}$ at Pond E, Possum Point**

| Pond ID | $a_{max}$ |
|---|---|
| ABC | 0.11 g |

# 5.0 PSEUDOSTATIC COEFFICIENT

For slope stability analyses, Golder used the Bray and Travasarou (2009) screening method which models the seismic loading using a pseudostatic coefficient ($k$). This section details the calculation of the pseudostatic coefficient for the project site. Details on the slope stability analysis are available in a separate calculation package.

Stability under seismic conditions is calculated using the pseudo-static method to model horizontal seismic forces as the product of a seismic coefficient ($k$) and the weight of the sliding mass. Bray and Travasarou (2009) proposed screening methodology to determine the seismic coefficient k based on the degraded period of the sliding mass and an allowable seismic displacement threshold. The screening method includes an equation to calculate the pseudostatic coefficient for periods of 0.2 and 0.5 seconds, which encompasses the range of typical slope periods. A period of 0.2 s is more conservative, so for this analysis, Golder used the equation associated with a period of 0.2 s and an allowable seismic displacement of 15 cm:

$$k_{15\,cm} = (0.036M_w - 0.004)S_a - 0.030 > 0.0,\ for\ S_a = S_a(T = 0.2\ s) < 2.0\ \text{g} \qquad (2)$$

Where, $k_{15cm}$ = pseudostatic coefficient

$M_w$ = Design Earthquake Magnitude

$S_a$ = Spectral acceleration at the base of the sliding mass

As noted in Section 3.0, the BC spectral acceleration at a period of 0.2 s is 0.1414 g. This value is multiplied by an amplification factor to obtain the acceleration at the base of the sliding mass. Golder used an amplification factor of 1.6 as prescribed by the international building code (IBC 2012) for a site class D. The project site was classified as D according to the representative shear wave velocity in the upper 30 meters or 100 feet (Vs30). Thus, the spectral acceleration $S_a$ used in the equation is 0.226 g (0.1414g x 1.6). The pseudostatic coefficient was calculated to be 0.01g as shown in the table below.

**Table 5: $k_{15\,cm}$ at Pond E, Possum Point**

| Pond ID | $k_{15\,cm}$ |
|---|---|
| ABC | 0.01 g |

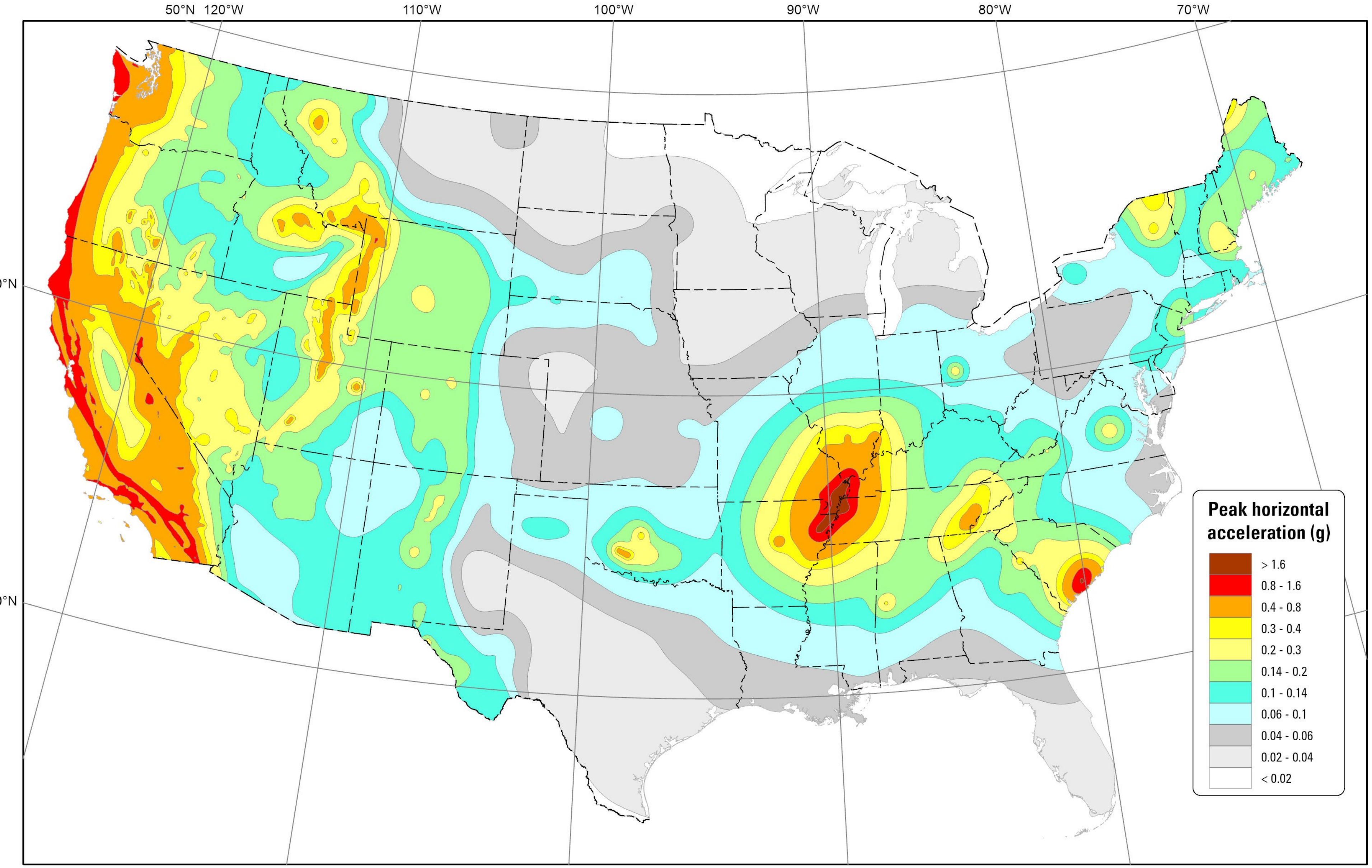
## 6.0 REFERENCE

Atkinson, G.M. and D.M. Boore (2006) "Earthquake Ground-Motion Prediction Equations for Eastern North America," Bulletin of the Seismological Society of America, Vol. 96, No. 6, pp. 2181-2205.

Bray, J.D., and Travasarou, T. (2009). Pseudostatic Coefficient for Use in Simplified Seismic Slope Stability Evaluation. Journal of Geotechnical and Geoenvironmental Engineering, Vol. 135, No. 9: pp. 1336-1340.

United States Geologic Survey (2018), Unified Hazard Tool. Accessed January 9, 2018. https://earthquake.usgs.gov/hazards/interactive/.

International Code Council, Inc. (2012), "2012 Insertional Building Code", Section 1613.3




# 2018 National Seismic Hazard Model for the conterminous United States

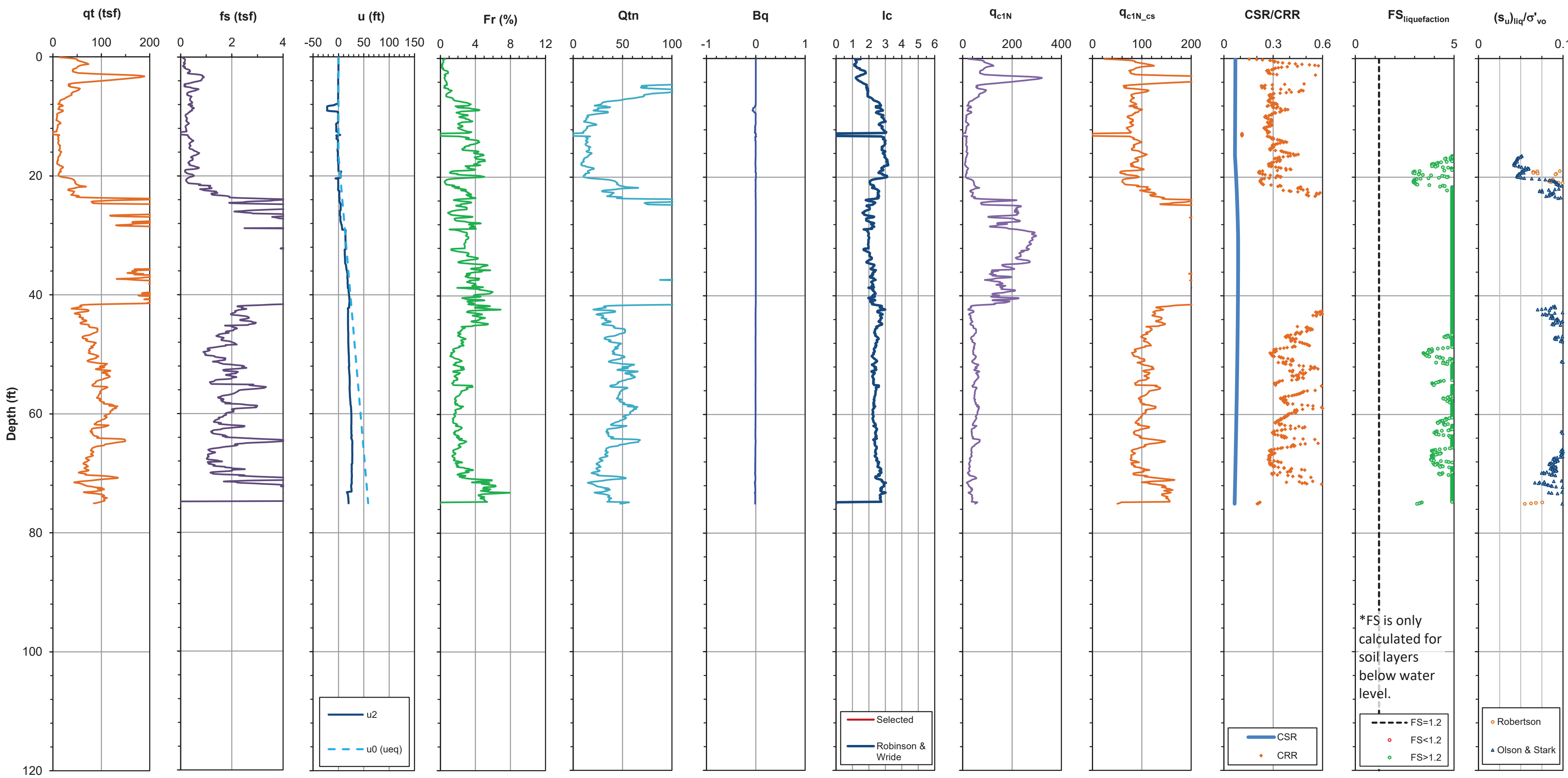
**Peak horizontal acceleration**
**with a 2% probability of exceedance in 50 years**
**NEHRP site class B/C ($V_{s30}$ = 760 m/s)**

# APPENDIX

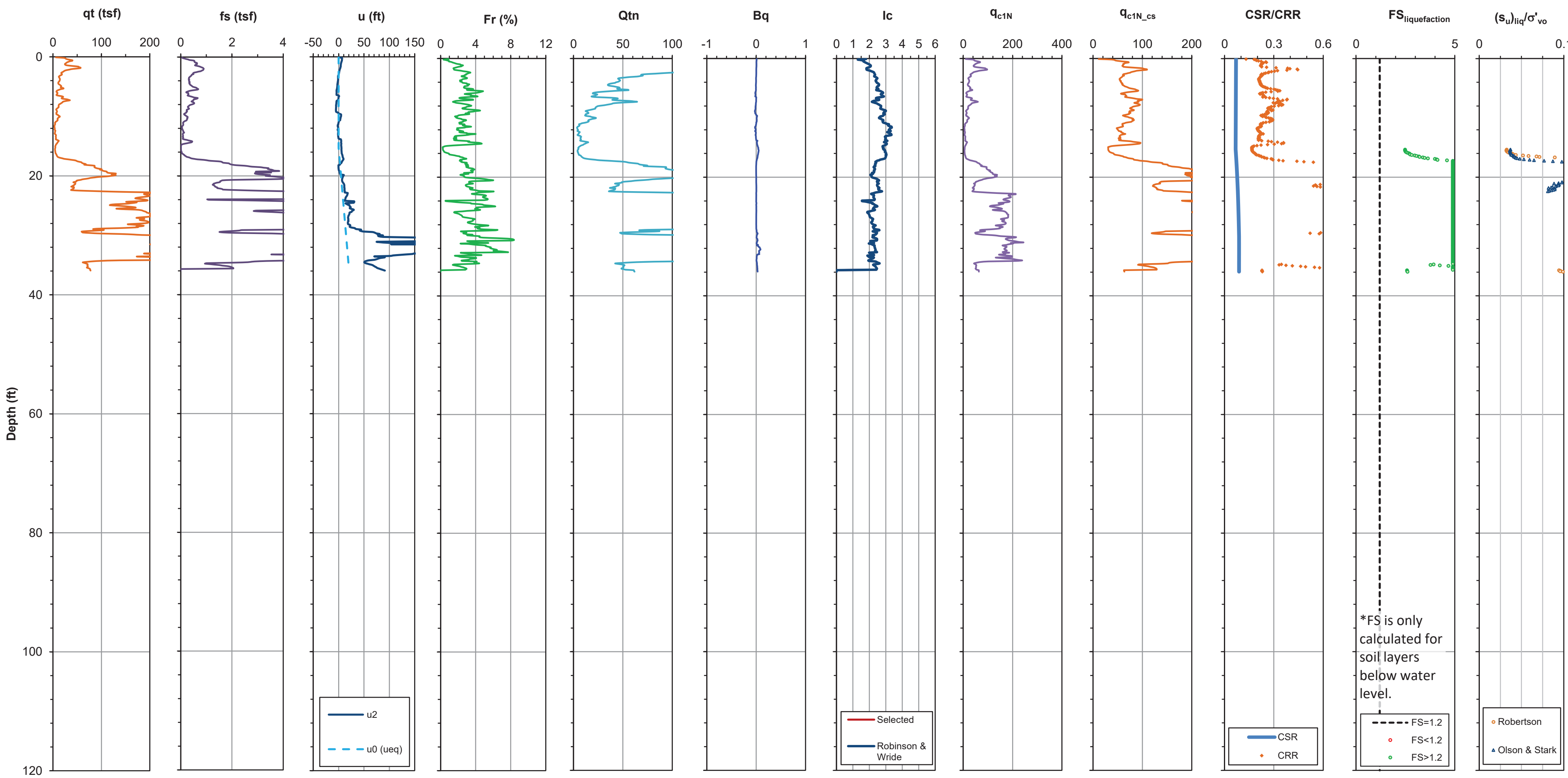
# C

## Liquefaction Assessment Calculation Package

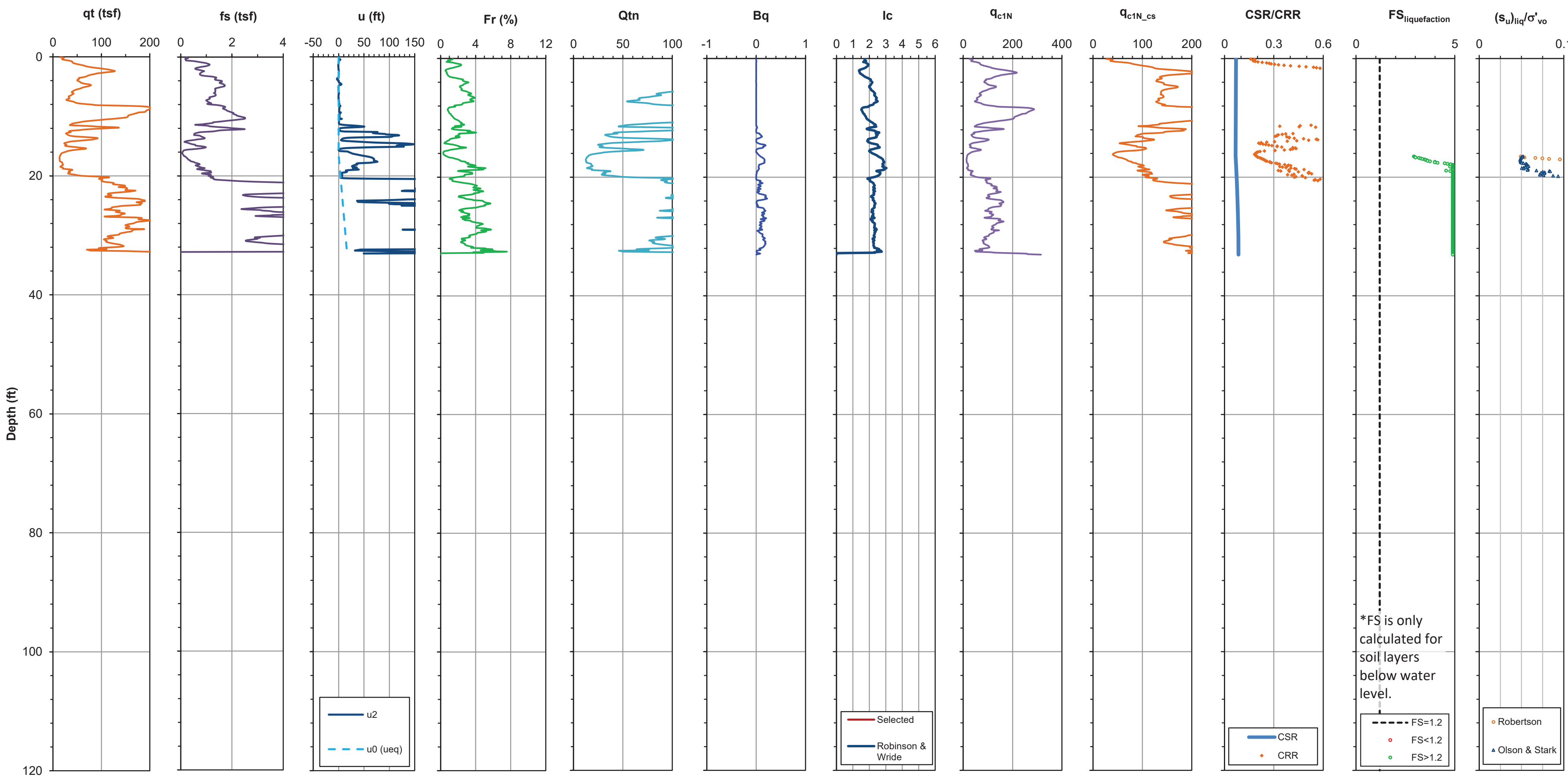
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/19/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 16.4 ft | **2% PE in 50 years Seismic Hazard** | | |
| **Test ID:** | CPT-ABC-01 | **Location:** | Dumfries, VA | **Device:** | 10 $cm^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** | 5.5 | |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | **$a_{max}$:** | 0.11 g | |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | | | |
| **Elevation:** | 21.3 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | | | |



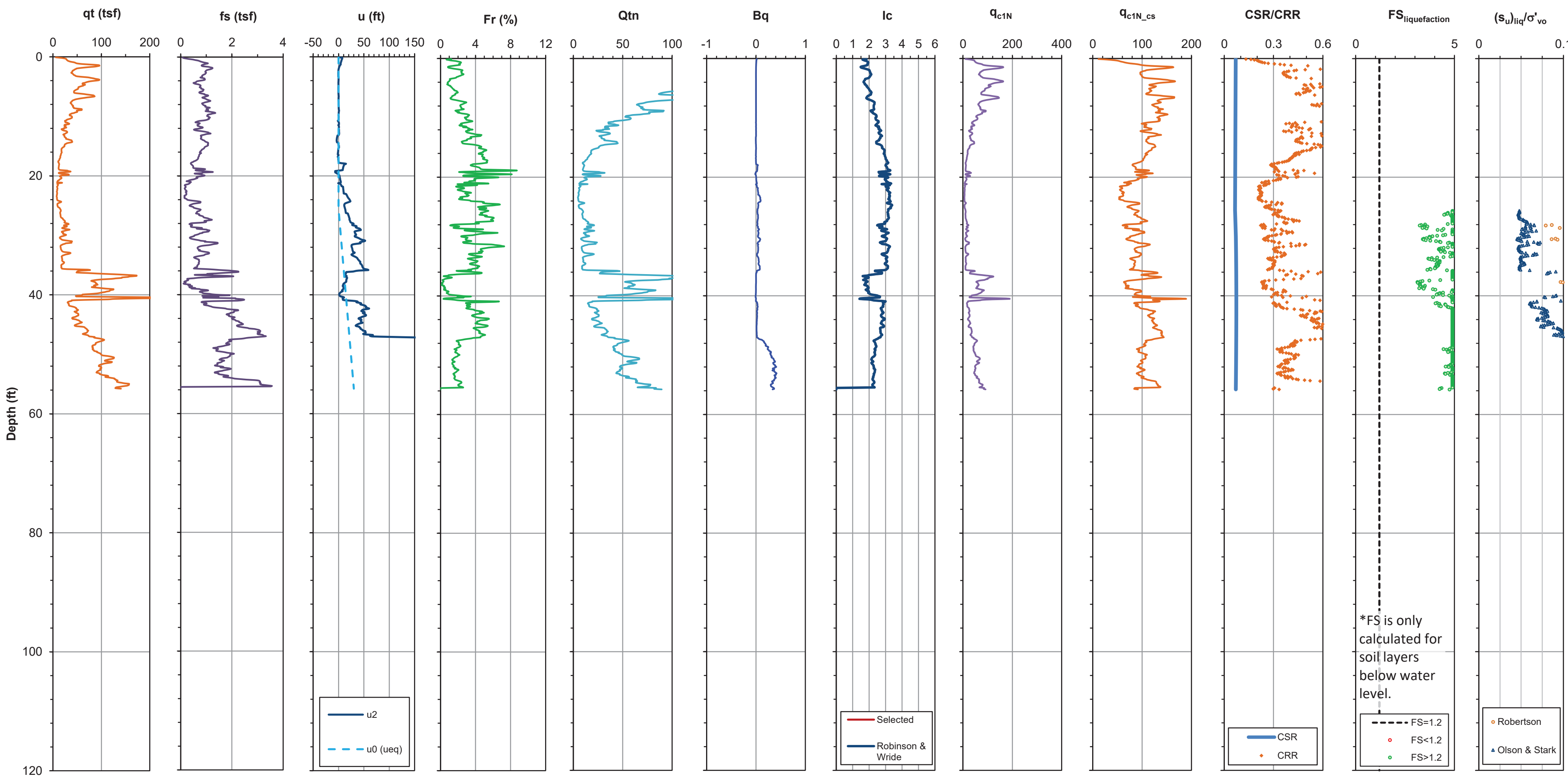
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/19/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 15.3 ft | **2% PE in 50 years Seismic Hazard** | |
| **Test ID:** | CPT-ABC-02 | **Location:** | Dumfries, VA | **Device:** | 10 $cm^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** | 5.5 |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | $a_{max}$**:** | 0.11 g |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | | |
| **Elevation:** | 21.6 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | | |



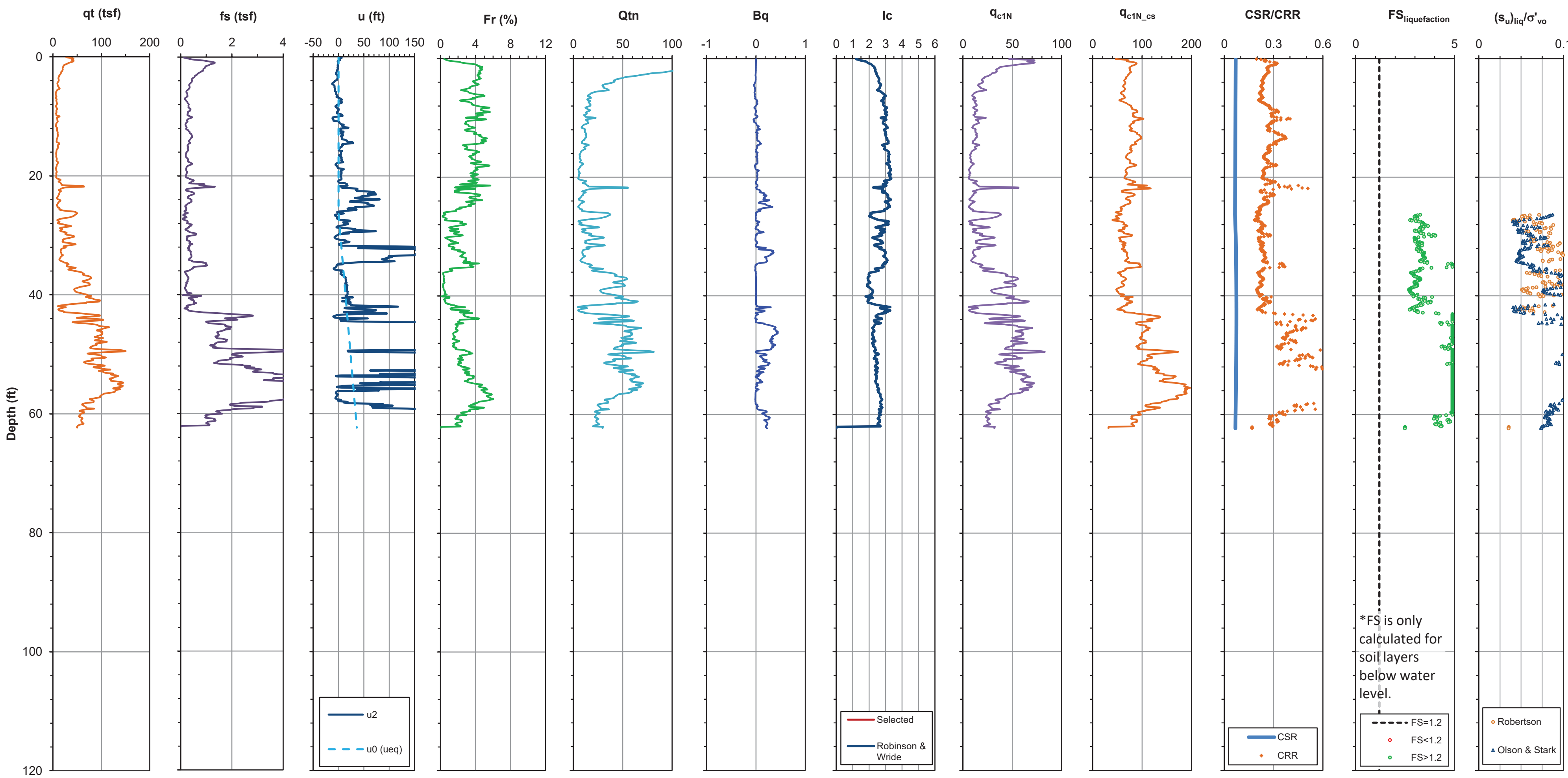
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/20/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 16.4 ft | **2% PE in 50 years Seismic Hazard** | |
| **Test ID:** | CPT-ABC-03 | **Location:** | Dumfries, VA | **Device:** | 10 $cm^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** | 5.5 |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | **$a_{max}$:** | 0.11 g |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | | |
| **Elevation:** | 14.8 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | | |



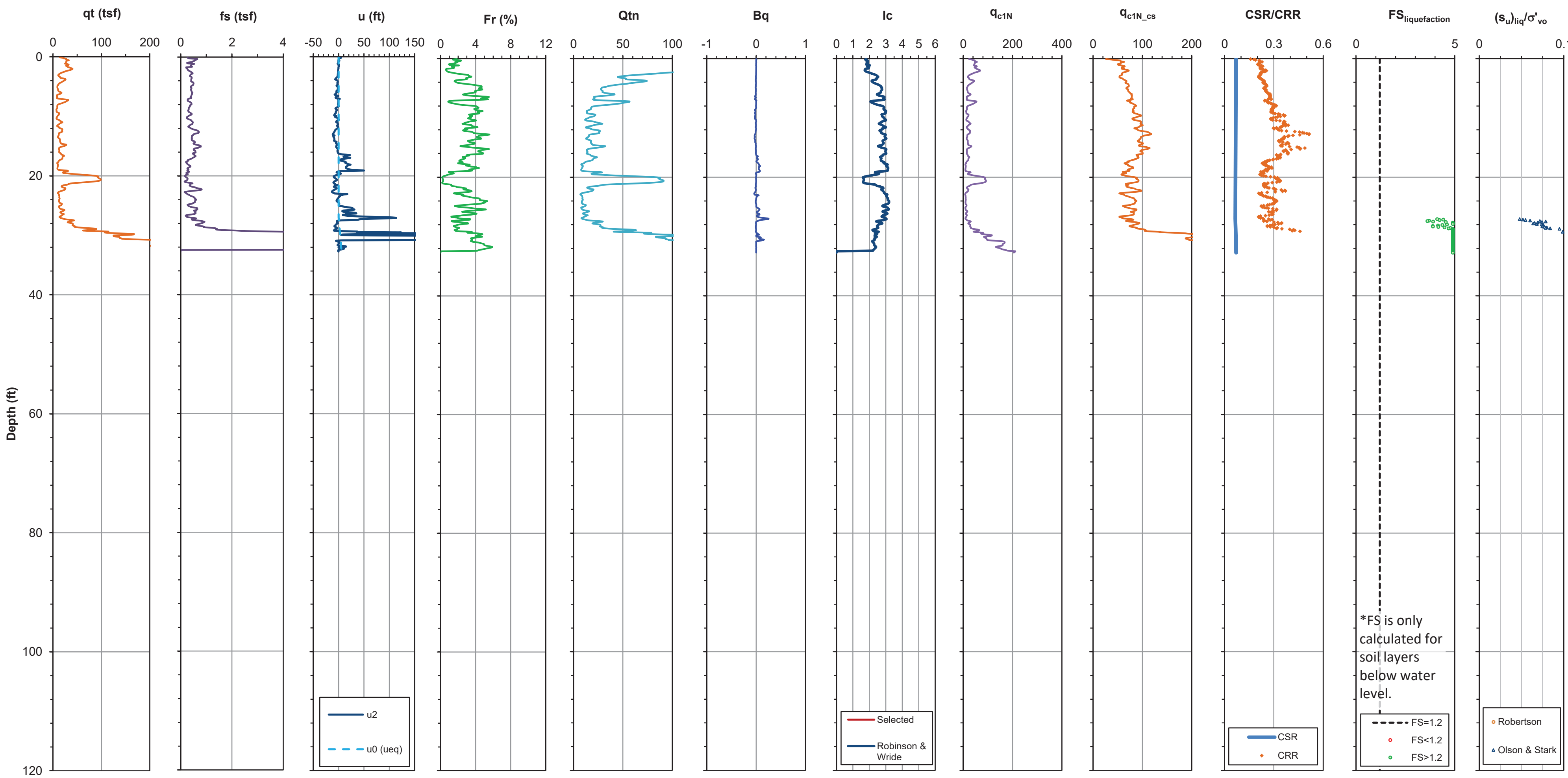
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/20/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 25.6 ft | **2% PE in 50 years Seismic Hazard** | |
| **Test ID:** | CPT-ABC-04 | **Location:** | Dumfries, VA | **Device:** | 10 cm$^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** | 5.5 |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | **$a_{max}$:** | 0.11 g |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | | |
| **Elevation:** | 19.0 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | | |



| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/20/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 26.3 ft | **2% PE in 50 years Seismic Hazard** |
| **Test ID:** | CPT-ABC-05 | **Location:** | Dumfries, VA | **Device:** | 10 $cm^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** 5.5 |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | **$a_{max}$:** 0.11 g |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | |
| **Elevation:** | 21.2 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | |



| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Test Date:** | 12/20/2017 | **Project:** | Possum Point Pond ABC | **Test Type:** | CPTU | **Water Table:** | 27.0 ft | **2% PE in 50 years Seismic Hazard** | |
| **Test ID:** | CPT-ABC-06 | **Location:** | Dumfries, VA | **Device:** | 10 $cm^2$, Type 2 filter | **Golder Eng:** | LJ | **Magnitude:** | 5.5 |
| **Latitude** | 38.5 | **Client:** | Dominion Energy | **Standard:** | ASTM D5778 | **Check** | JGM | **$a_{max}$:** | 0.11 g |
| **Longitude** | -77.3 | **Proj No.:** | 1662150 | **Push Co.:** | ConeTec | **Review:** | | | |
| **Elevation:** | 21.7 ft | **Termination:** | 60.2 ft-bgs | **Operator:** | 0 | | | | |



# APPENDIX

# D Geotechnical Stability Figures


**LEGEND**

EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS)

GOLDER CONE PENETRATION TEST (CPT)

A — SLOPE STABILITY SECTIONS

**REFERENCE(S)**

1. TOPOGRAPHY PER SURVEY TAKEN IN 2019, FILE 21 1223 - 2102019 - ... AERIAL SURVEY REV 1 AND 12016 - POSSUMPOINT -- LANDXML-0001.

0 100 200
1" = 100' FEET

wsp

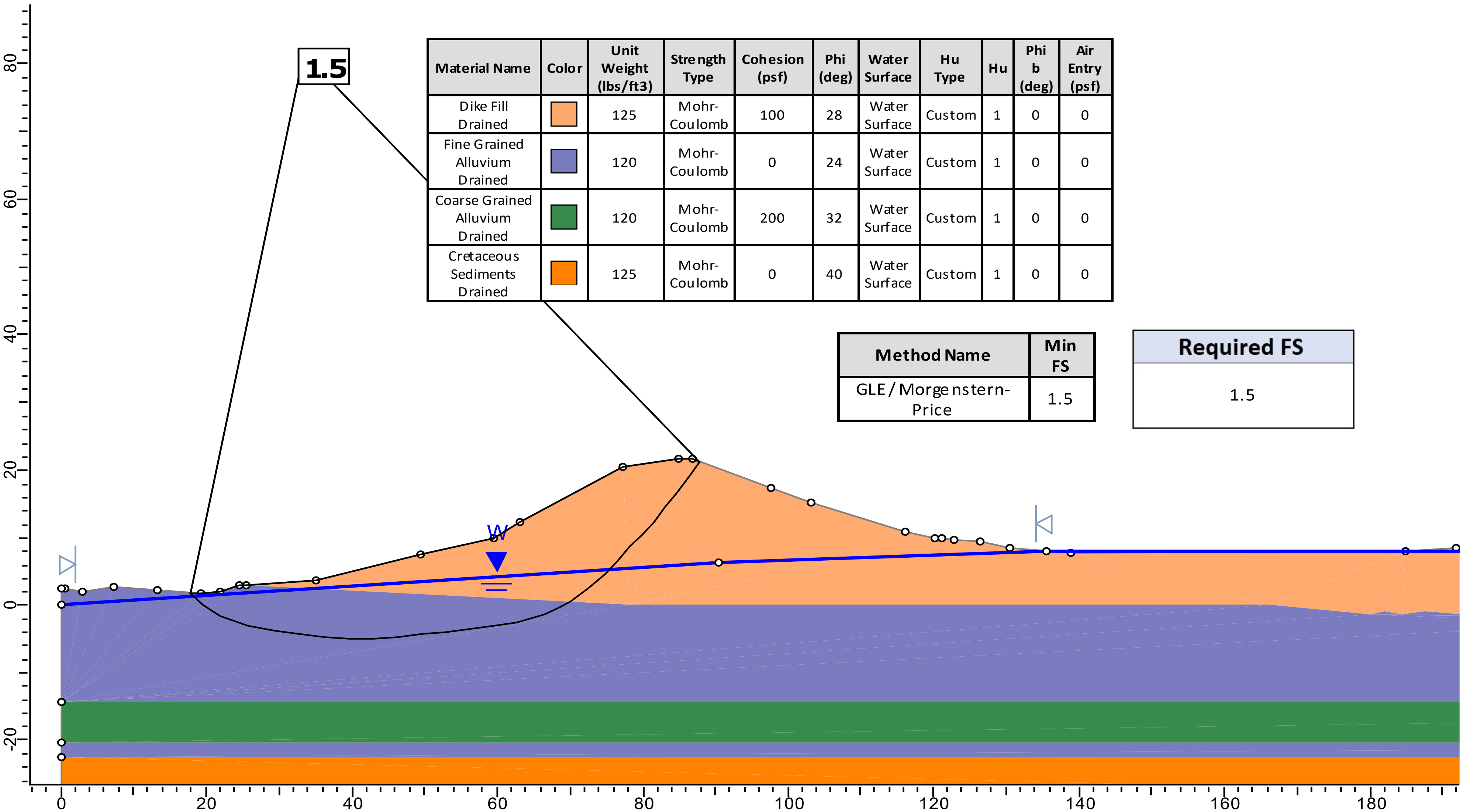
**DOMINION ENERGY - POSSUM POINT**

INACTIVE POND DEMONSTRATION

SAFETY FACTOR ASSESSMENT - POND ABC PLAN VIEW

FIGURE 1

# Appendix D-2
# 2023 Safety Factor Assessment
# Geotechnical Stability Figures

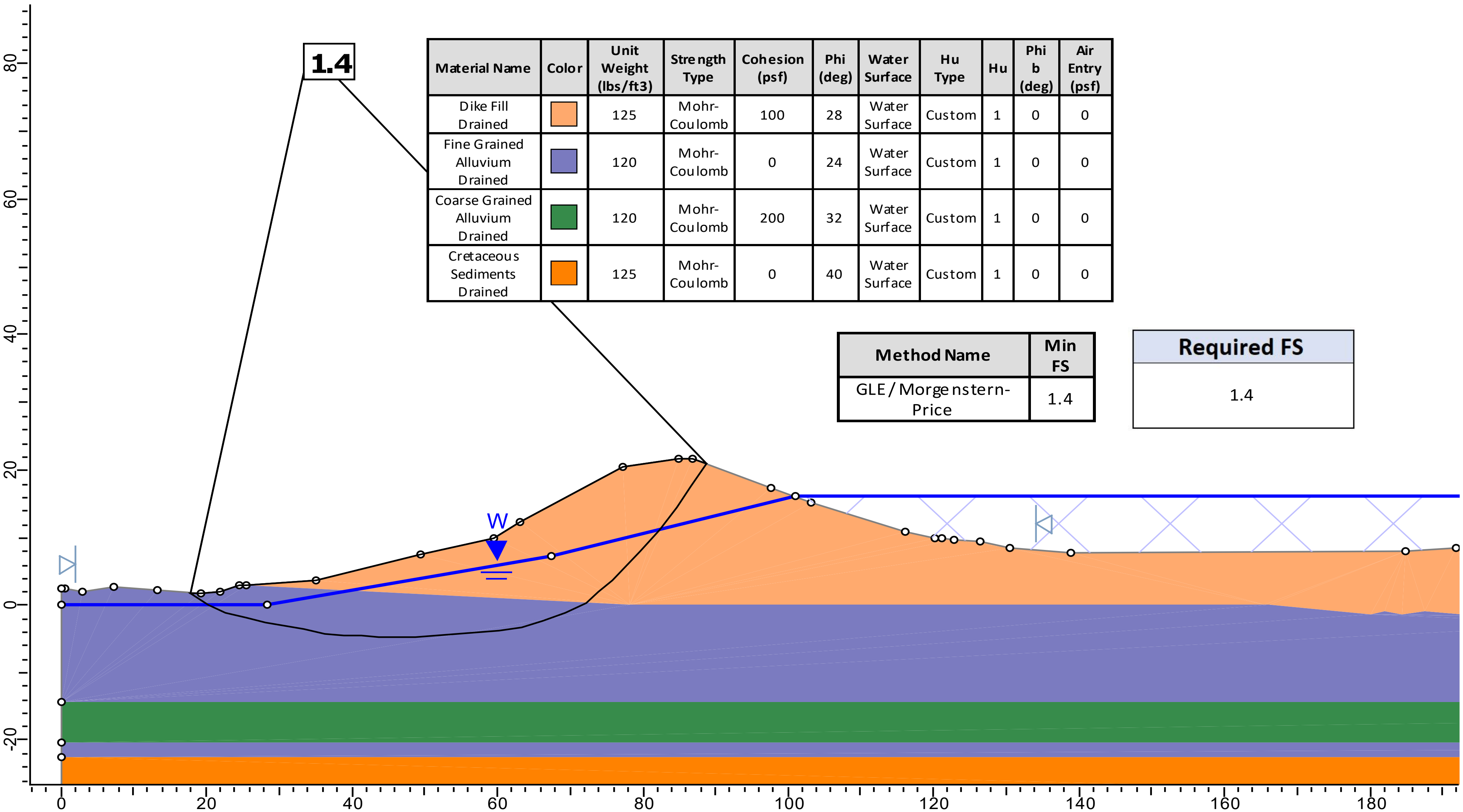



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 0 | 24 | Water Surface | Custom | 1 | 0 | 0 |
| Coarse Grained Alluvium Drained | | 120 | Mohr-Coulomb | 200 | 32 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.5 |

| Required FS |
|---|
| 1.5 |

| | | | |
|---|---|---|---|
| wsp | SCALE: AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| | DATE: April 2023 | TITLE | Section A-A<br>Long Term, Normal Storage Pool |
| | MADE BY: WJF | | |
| | CAD: - | | |
| FILE: STABILITY | CHECK: HJ | CLIENT: Dominion Energy | FIGURE: 2(a) |
| PROJECT No. GL24166315 / REV. 0 | REVIEW: GLH | | |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 0 | 24 | Water Surface | Custom | 1 | 0 | 0 |
| Coarse Grained Alluvium Drained | | 120 | Mohr-Coulomb | 200 | 32 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

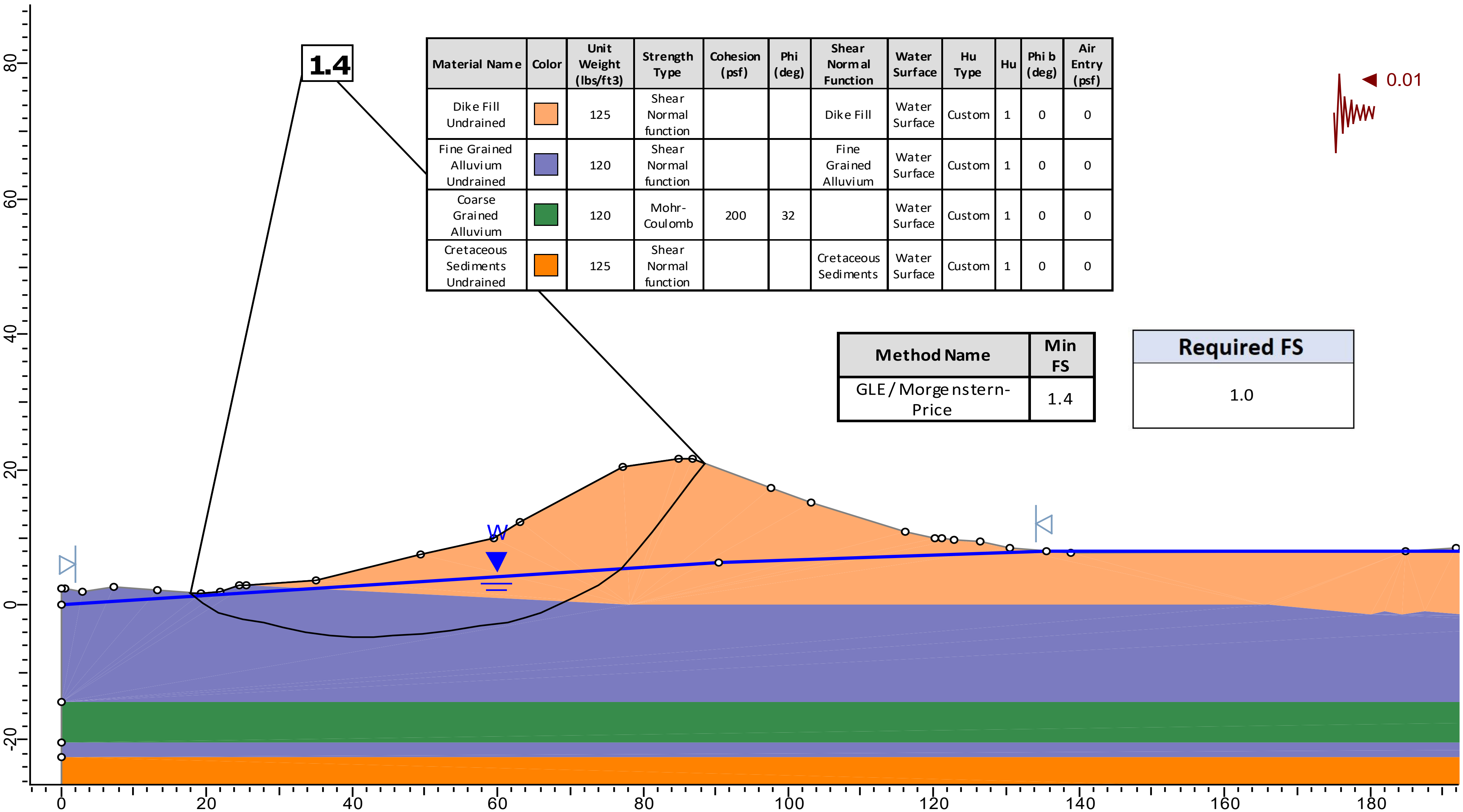
| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.4 |

| Required FS |
|---|
| 1.4 |

| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | **Possum Point Pond ABC - 2023 Safety Factor Assessment** |
| DATE | April 2023 | TITLE | **Section A-A**<br>**Maximum Surchage Pool** |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | **Dominion Energy** |
| REVIEW | GLH | FIGURE | **2(b)** |

FILE STABILITY

PROJECT No. GL24166315 REV. 0




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Shear Normal Function | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Undrained | | 125 | Shear Normal function | | | Dike Fill | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Undrained | | 120 | Shear Normal function | | | Fine Grained Alluvium | Water Surface | Custom | 1 | 0 | 0 |
| Coarse Grained Alluvium | | 120 | Mohr-Coulomb | 200 | 32 | | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Undrained | | 125 | Shear Normal function | | | Cretaceous Sediments | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.4 |

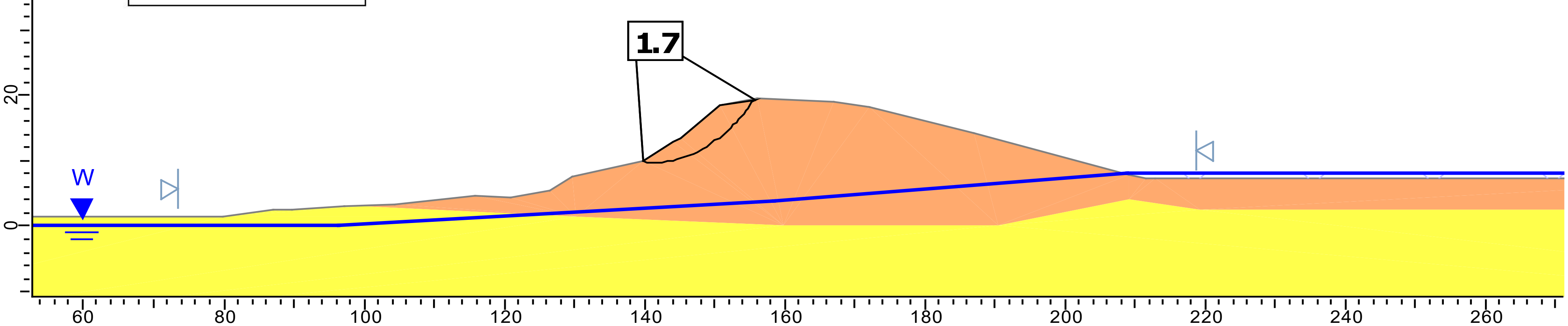
| Required FS |
|---|
| 1.0 |

| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | **Possum Point Pond ABC - 2023 Safety Factor Assessment** |
| DATE | April 2023 | TITLE | **Section A-A Seismic Screening** |
| MADE BY | WJF | | |
| CAD | - | | |
| FILE: STABILITY | CHECK: HJ | CLIENT | **Dominion Energy** |
| PROJECT No. GL24166315 REV. 0 | REVIEW: GLH | FIGURE | **2(c)** |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Terrace Deposits Drained | | 130 | Mohr-Coulomb | 0 | 34 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.7 |

| Required FS |
|---|
| 1.5 |




| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section B-B<br>Long Term, Normal Storage Pool |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 3(a) |

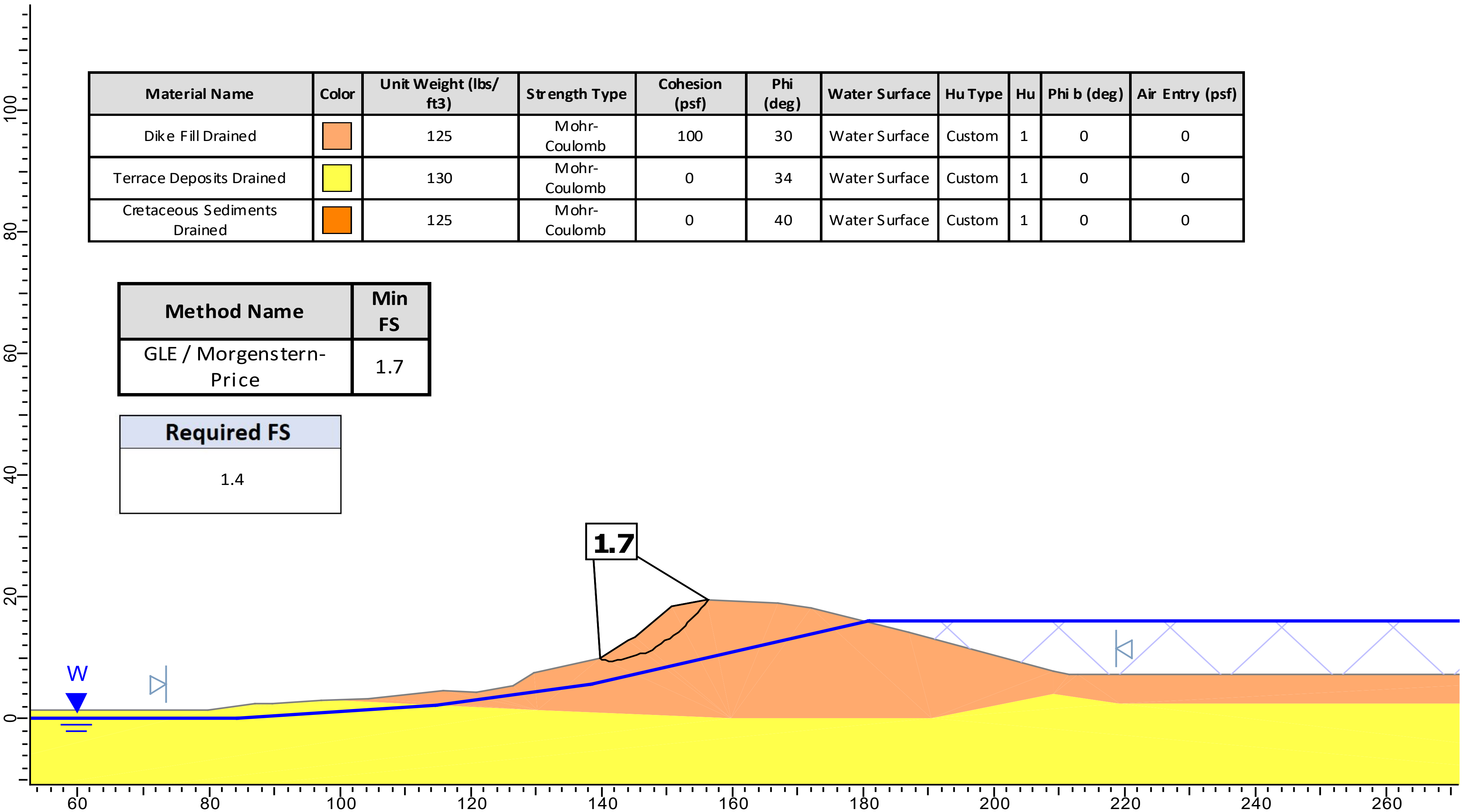
FILE: STABILITY

PROJECT No. GL24166315 REV. 0

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Terrace Deposits Drained | | 130 | Mohr-Coulomb | 0 | 34 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.7 |

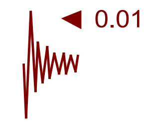
| Required FS |
|---|
| 1.4 |




| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section B-B<br>Maximum Surchage Pool |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 3(b) |

FILE STABILITY

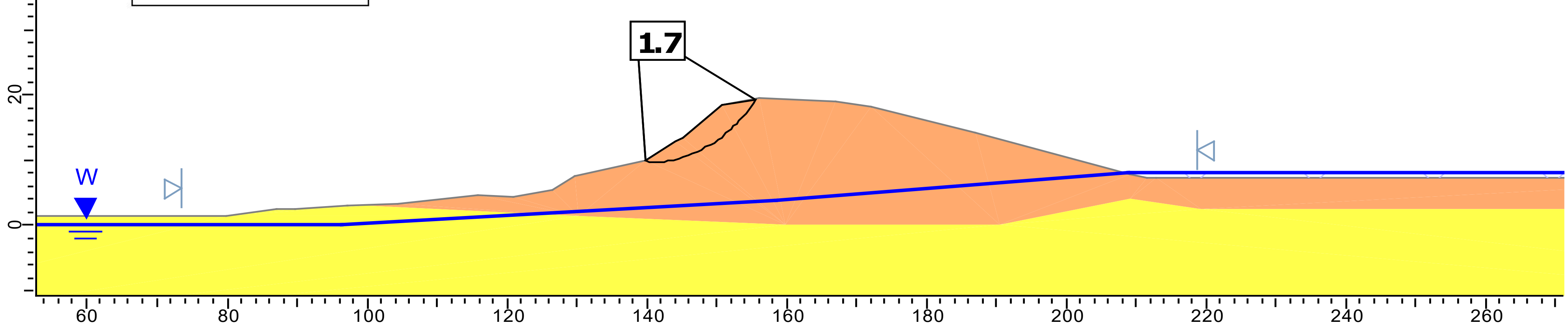
PROJECT No. GL24166315 REV. 0




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Shear Normal Function | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrace Deposits Drained | | 130 | Mohr-Coulomb | 0 | 34 | | Water Surface | Custom | 1 | 0 | 0 |
| Dike Fill Undrained | | 125 | Shear Normal function | | | Dike Fill | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Undrained | | 125 | Shear Normal function | | | Cretaceous Sediments | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.7 |

| Required FS |
|---|
| 1.0 |

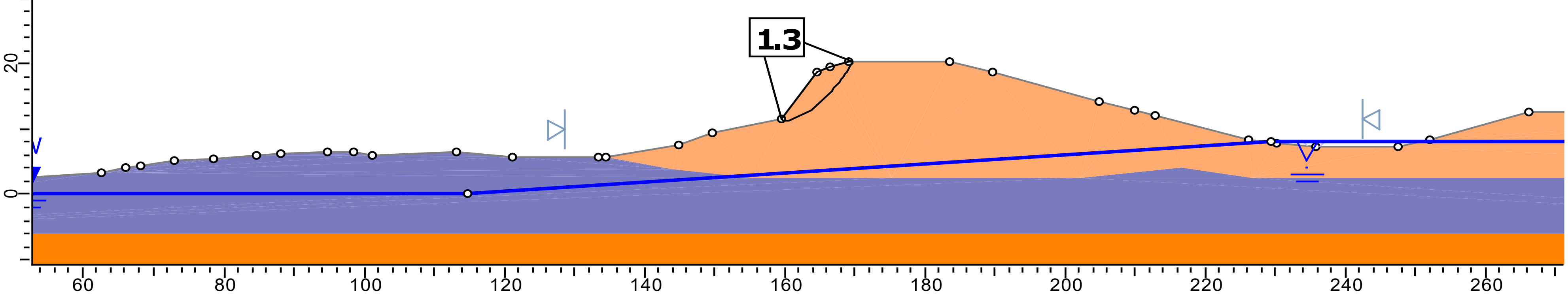



| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section B-B<br>Seismic Screening |
| MADE BY | WJF | | |
| CAD | - | | |
| FILE: STABILITY | CHECK: HJ | CLIENT | Dominion Energy |
| PROJECT No.: GL24166315 REV.: 0 | REVIEW: GLH | FIGURE | 3(c) |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.3 |

| Required FS |
|---|
| 1.5 |

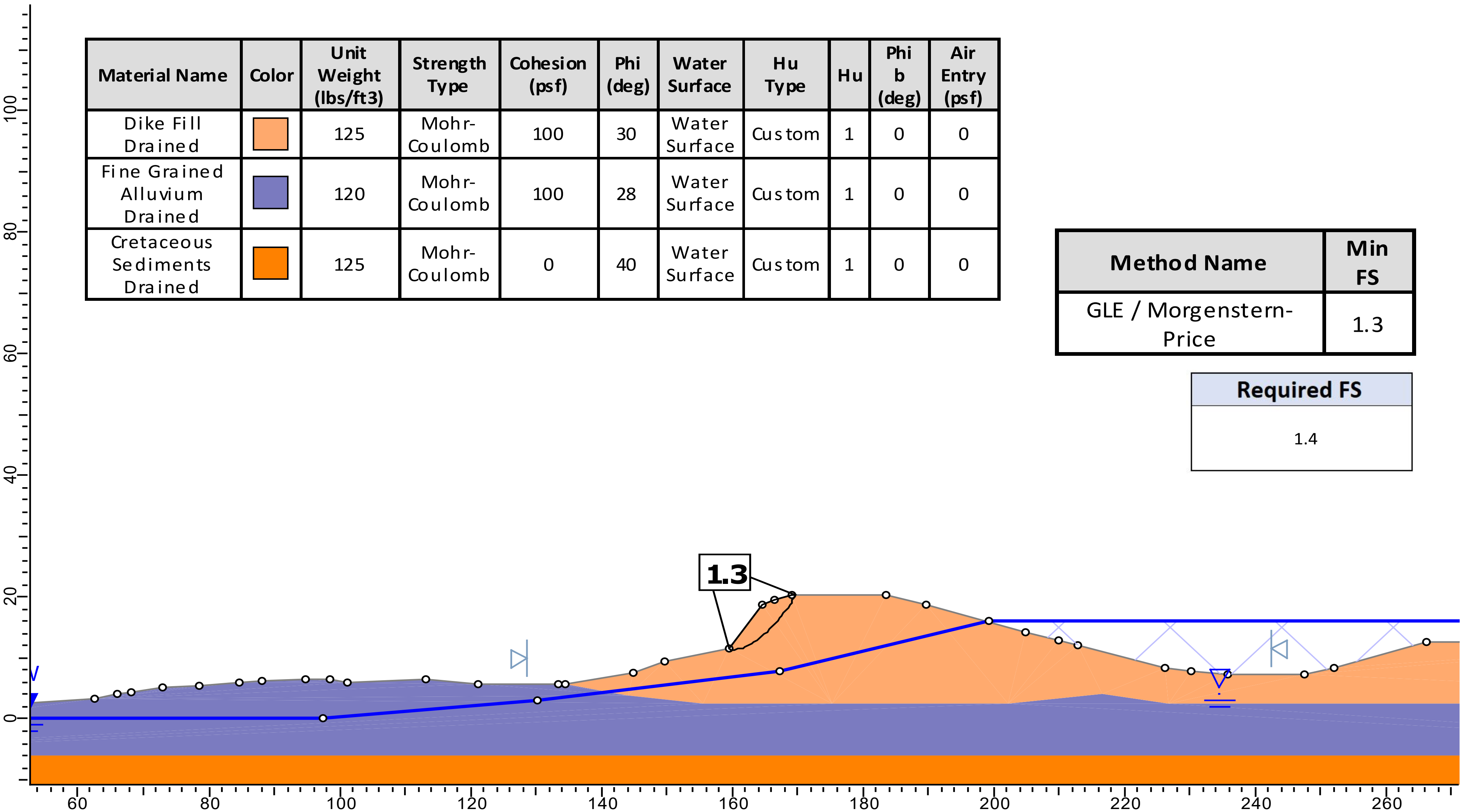



| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C<br>Long Term, Normal Storage Pool |
| MADE BY | WJF | | |
| CAD | - | | |
| FILE | STABILITY | CHECK | HJ |
| PROJECT No. | GL24166315 | REV. | 0 |
| REVIEW | GLH | CLIENT | Dominion Energy |
| FIGURE | 4(a) | | |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.3 |

| Required FS |
|---|
| 1.4 |




| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C<br>Maximum Surchage Pool |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 4(b) |

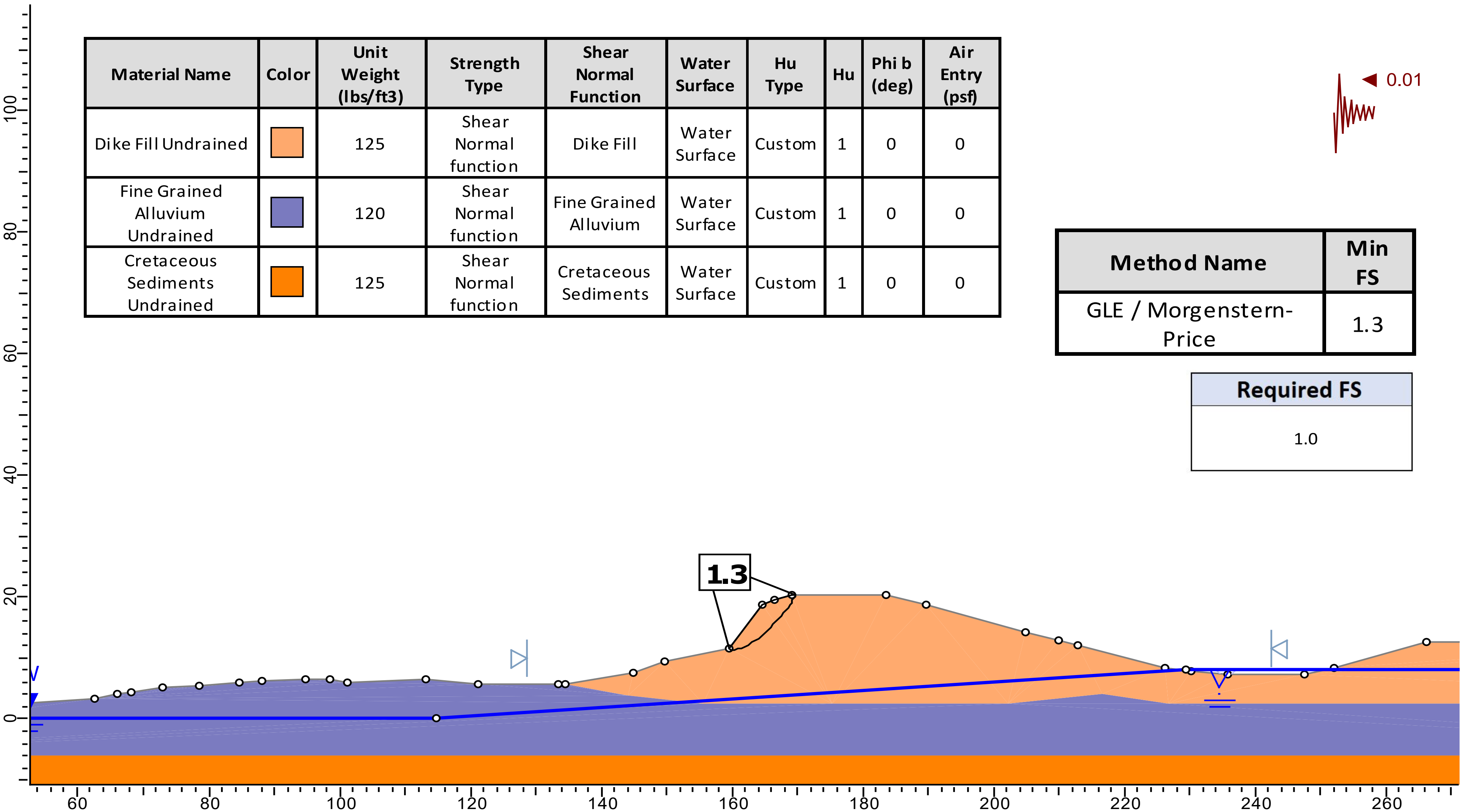
FILE STABILITY

PROJECT No. GL24166315 REV. 0

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Shear Normal Function | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Undrained | | 125 | Shear Normal function | Dike Fill | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Undrained | | 120 | Shear Normal function | Fine Grained Alluvium | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Undrained | | 125 | Shear Normal function | Cretaceous Sediments | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.3 |

| Required FS |
|---|
| 1.0 |

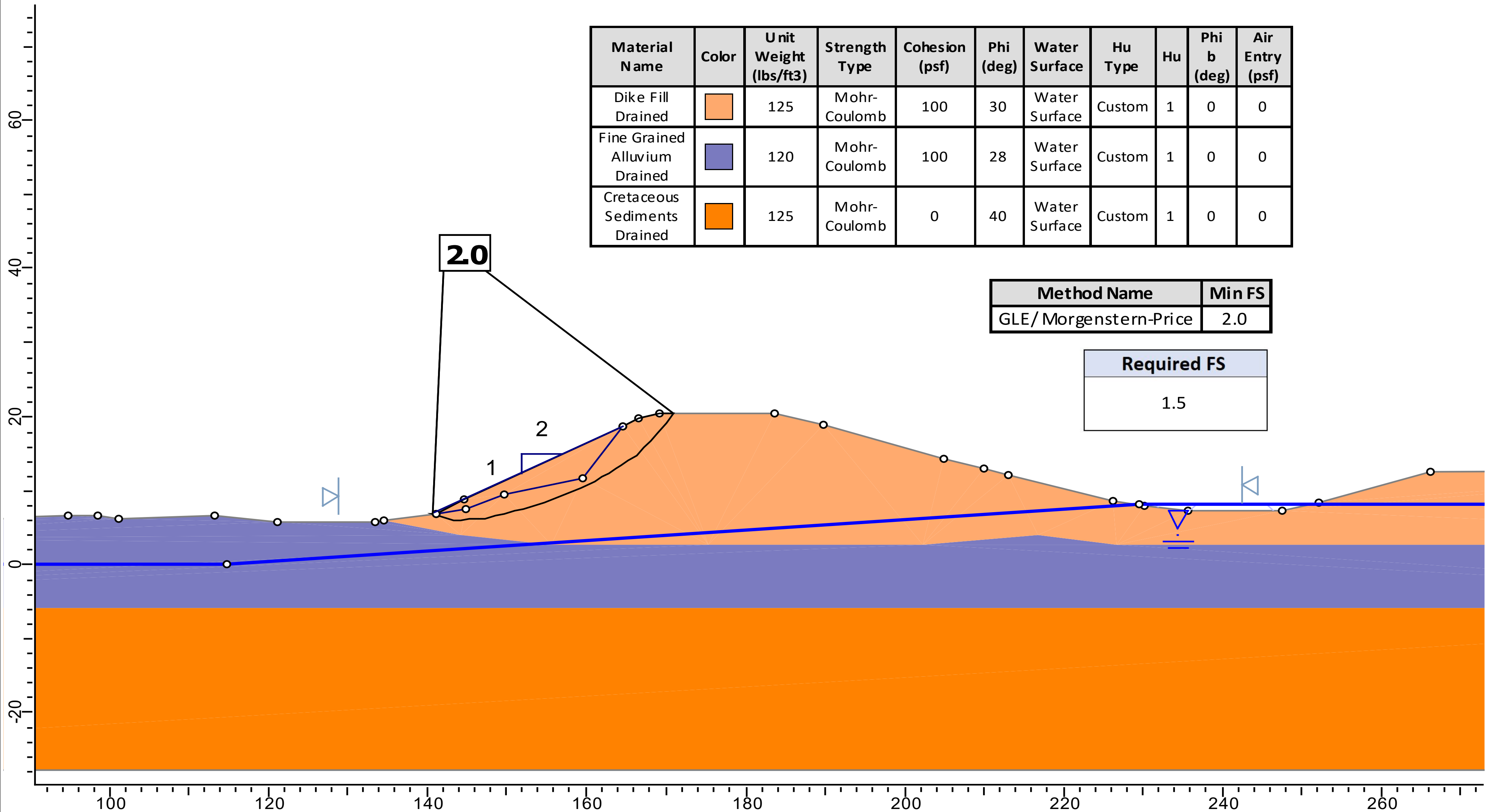



| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C<br>Seismic Screening |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 4(c) |

FILE: STABILITY

PROJECT No. GL24166315 REV. 0

# Appendix D-3
# 2023 Safety Factor Assessment
# Geotechnical Stability Figures
# Section C-C' Mitigation Options




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

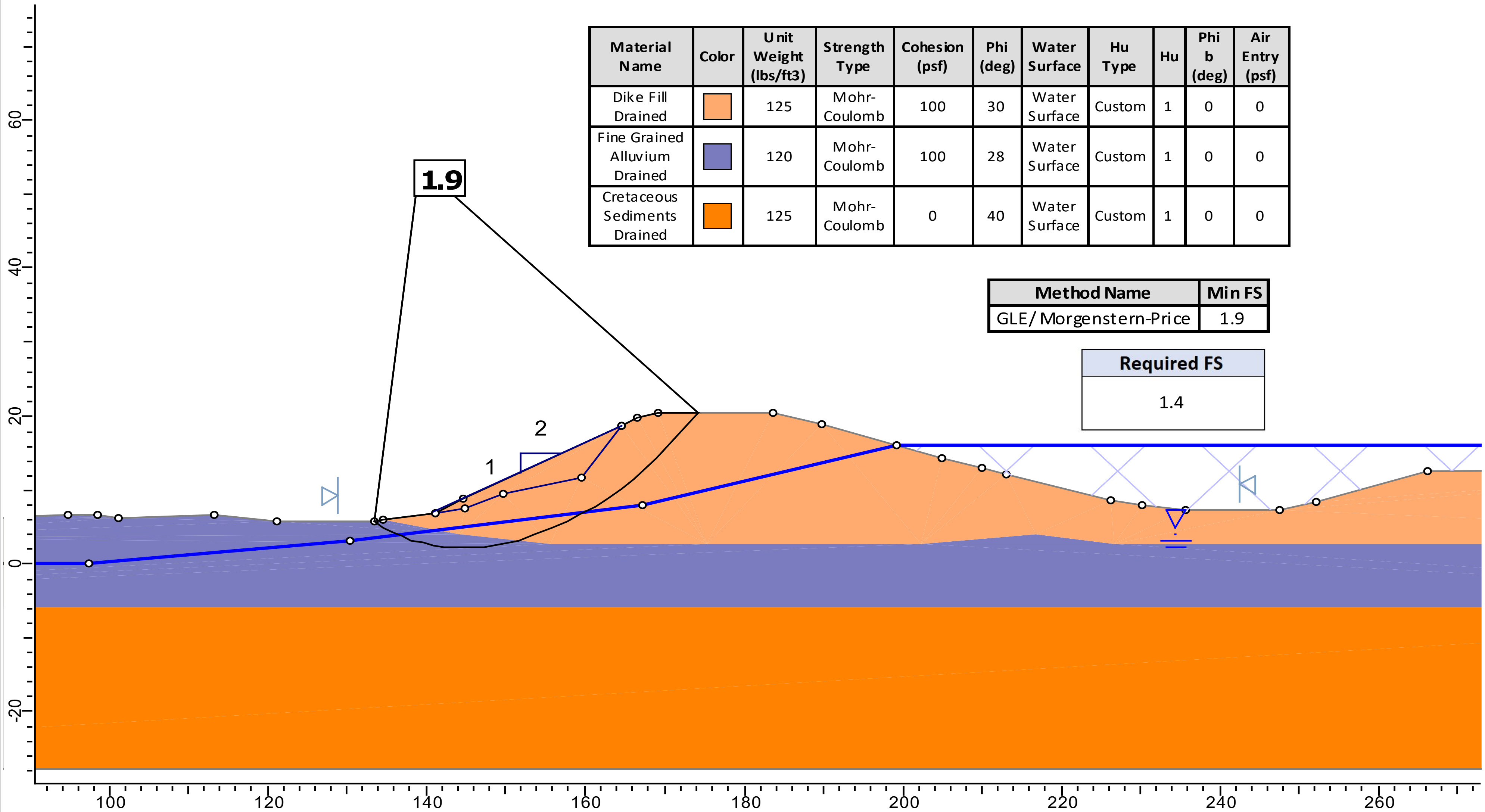
| Method Name | Min FS |
|---|---|
| GLE/Morgenstern-Price | 2.0 |

| Required FS |
|---|
| 1.5 |

| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C<br>Long Term, Normal Storage Pool<br>Mitigation Option 1 |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 5(a) |

FILE STABILITY

PROJECT No. GL24166315 REV. 0




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE/Morgenstern-Price | 1.9 |

| Required FS |
|---|
| 1.4 |

wsp

| | |
|---|---|
| SCALE | AS SHOWN |
| DATE | April 2023 |
| MADE BY | WJF |
| CAD | - |
| CHECK | HJ |
| REVIEW | GLH |

FILE STABILITY

PROJECT No. GL24166315 REV. 0

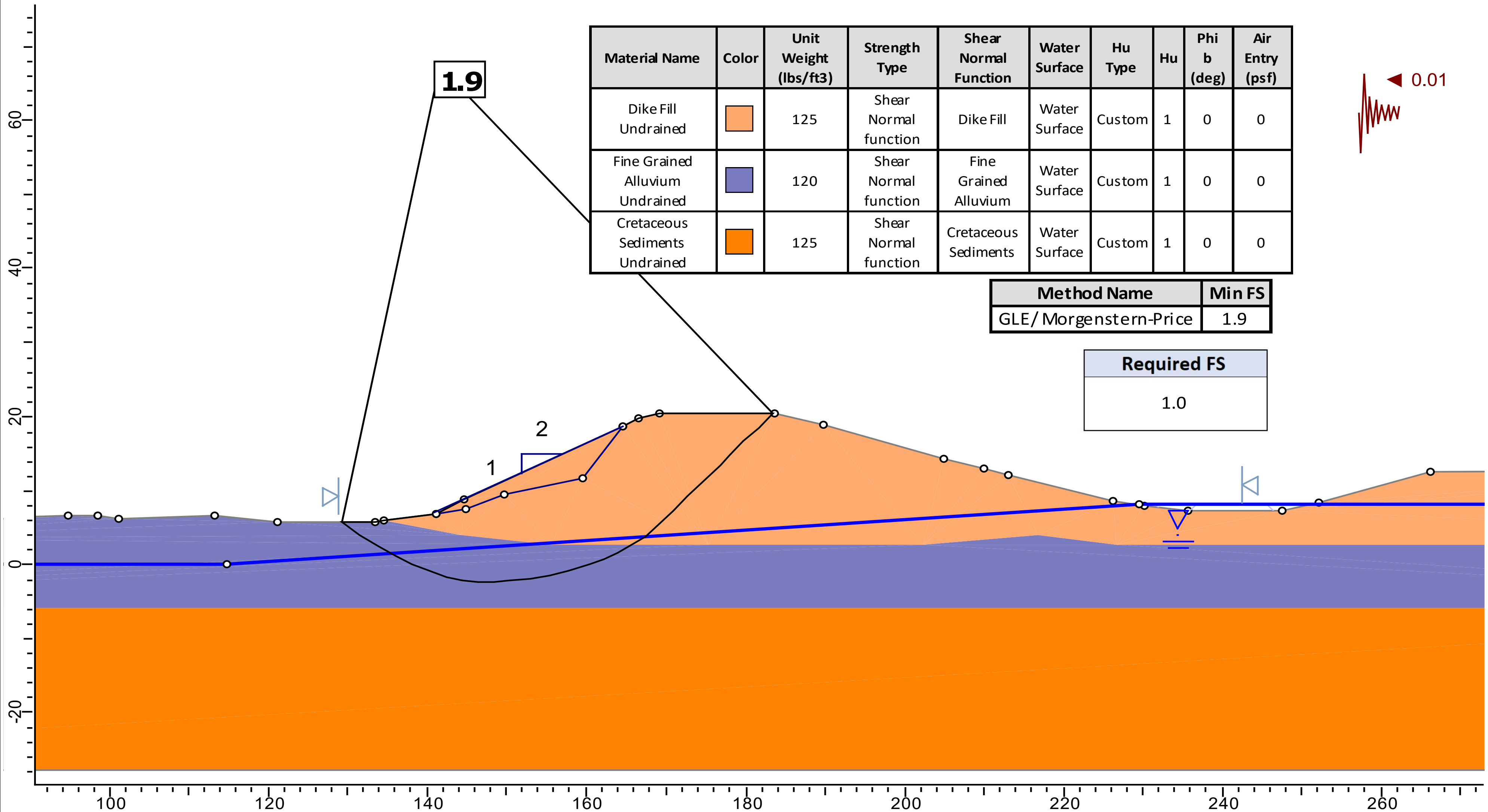
PROJECT **Possum Point Pond ABC - 2023 Safety Factor Assessment**

TITLE

**Section C-C**
**Maximum Surcharge Pool**
**Mitigation Option 1**

CLIENT **Dominion Energy**

FIGURE **5(b)**




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Shear Normal Function | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Undrained | | 125 | Shear Normal function | Dike Fill | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Undrained | | 120 | Shear Normal function | Fine Grained Alluvium | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Undrained | | 125 | Shear Normal function | Cretaceous Sediments | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE/Morgenstern-Price | 1.9 |

| Required FS |
|---|
| 1.0 |

| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C Seismic Screening Mitigation Option 1 |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | Dominion Energy |
| REVIEW | GLH | FIGURE | 5(c) |

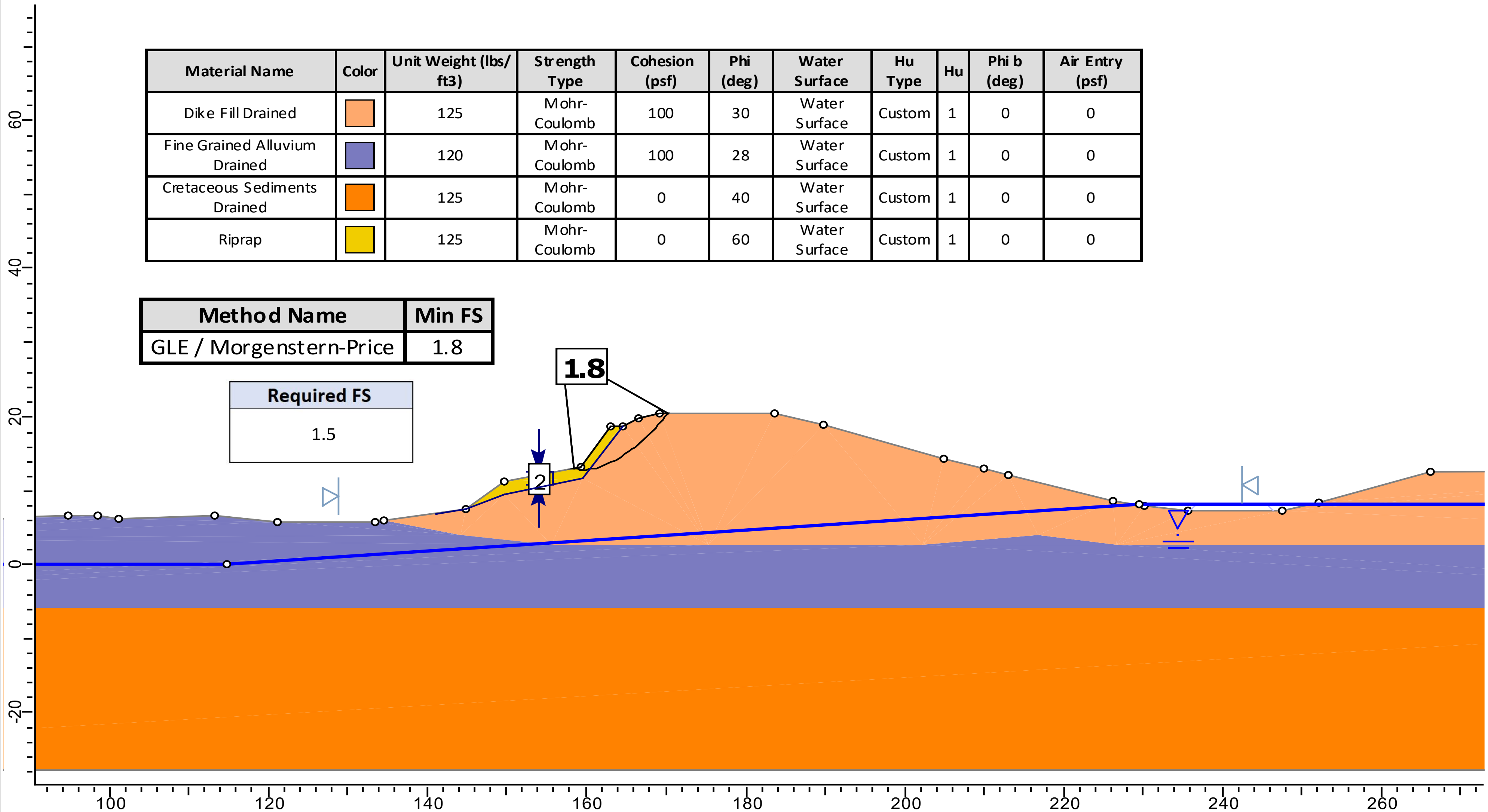
FILE: STABILITY

PROJECT No. GL24166315 REV. 0

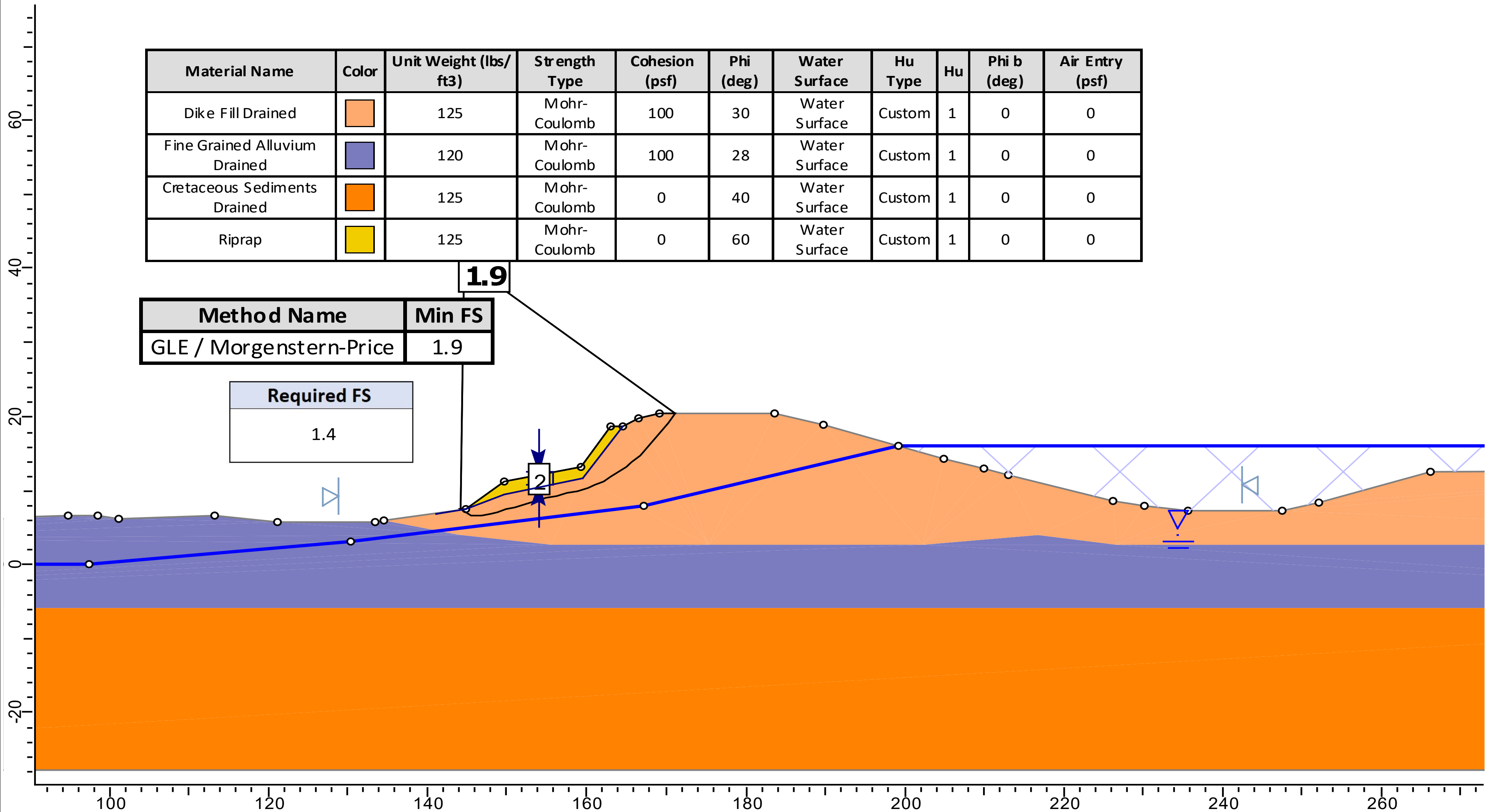
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |
| Riprap | | 125 | Mohr-Coulomb | 0 | 60 | Water Surface | Custom | 1 | 0 | 0 |

| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.8 |

| Required FS |
|---|
| 1.5 |




| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | Possum Point Pond ABC - 2023 Safety Factor Assessment |
| DATE | April 2023 | TITLE | Section C-C<br>Long Term, Normal Storage Pool<br>Mitigation Option 2 |
| MADE BY | WJF | | |
| CAD | - | | |
| FILE: STABILITY | CHECK: HJ | CLIENT | Dominion Energy |
| PROJECT No. GL24166315, REV. 0 | REVIEW: GLH | FIGURE | 6(a) |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Drained | | 125 | Mohr-Coulomb | 100 | 30 | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Drained | | 120 | Mohr-Coulomb | 100 | 28 | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Drained | | 125 | Mohr-Coulomb | 0 | 40 | Water Surface | Custom | 1 | 0 | 0 |
| Riprap | | 125 | Mohr-Coulomb | 0 | 60 | Water Surface | Custom | 1 | 0 | 0 |

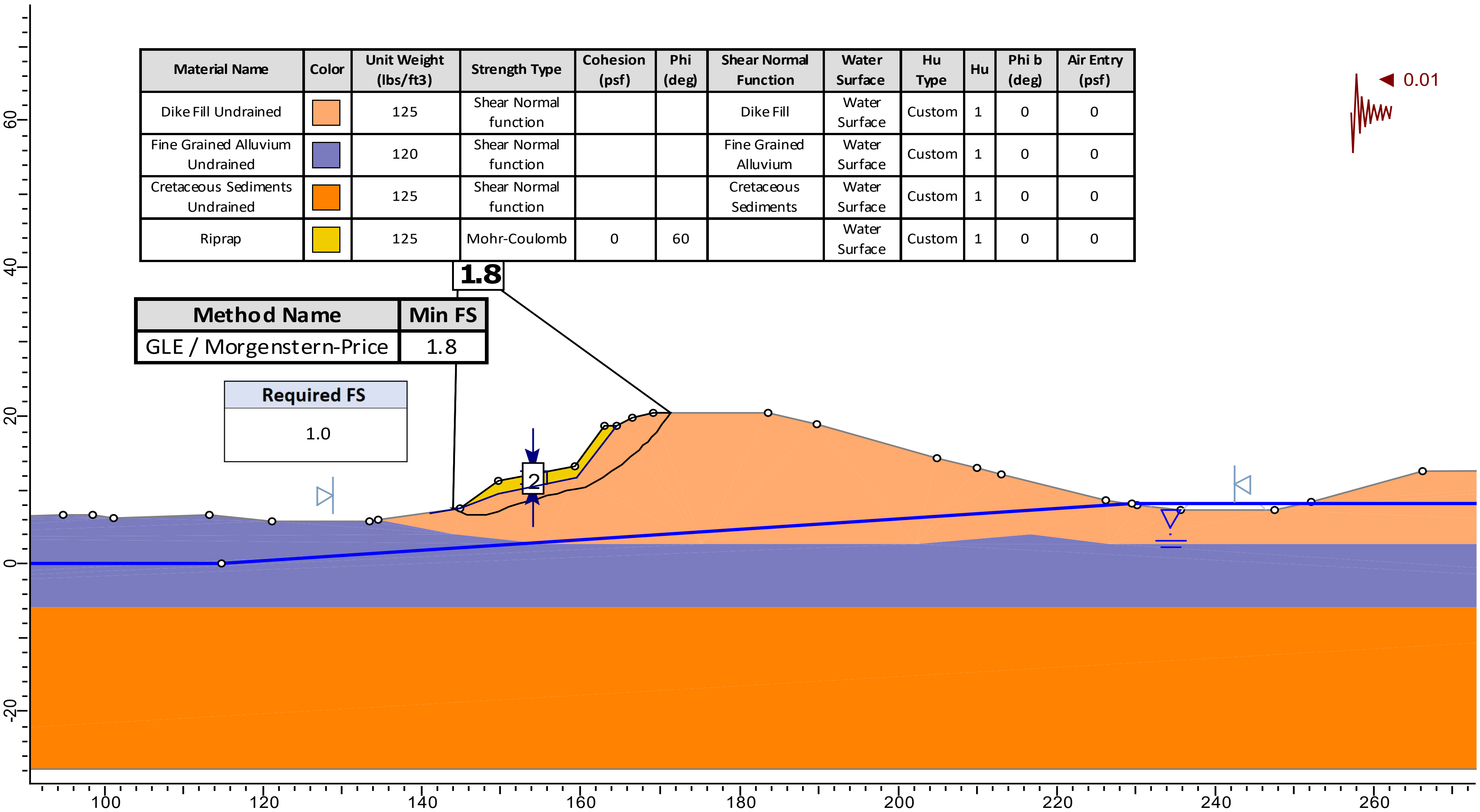
| Method Name | Min FS |
|---|---|
| GLE / Morgenstern-Price | 1.9 |

| Required FS |
|---|
| 1.4 |

| | | | |
|---|---|---|---|
| SCALE | AS SHOWN | PROJECT | **Possum Point Pond ABC - 2023 Safety Factor Assessment** |
| DATE | April 2023 | TITLE | **Section C-C**<br>**Maximum Surcharge Pool**<br>**Mitigation Option 2** |
| MADE BY | WJF | | |
| CAD | - | | |
| CHECK | HJ | CLIENT | **Dominion Energy** |
| REVIEW | GLH | FIGURE | **6(b)** |

FILE STABILITY

PROJECT No. GL24166315 REV. 0




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Shear Normal Function | Water Surface | Hu Type | Hu | Phi b (deg) | Air Entry (psf) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dike Fill Undrained | | 125 | Shear Normal function | | | Dike Fill | Water Surface | Custom | 1 | 0 | 0 |
| Fine Grained Alluvium Undrained | | 120 | Shear Normal function | | | Fine Grained Alluvium | Water Surface | Custom | 1 | 0 | 0 |
| Cretaceous Sediments Undrained | | 125 | Shear Normal function | | | Cretaceous Sediments | Water Surface | Custom | 1 | 0 | 0 |
| Riprap | | 125 | Mohr-Coulomb | 0 | 60 | | Water Surface | Custom | 1 | 0 | 0 |

| | |
|---|---|
| SCALE | AS SHOWN |
| DATE | April 2023 |
| MADE BY | WJF |
| CAD | - |
| CHECK | HJ |
| REVIEW | GLH |
| FILE | STABILITY |
| PROJECT No. | GL24166315 |
| REV. | 0 |

PROJECT **Possum Point Pond ABC - 2023 Safety Factor Assessment**

TITLE

**Section C-C**
**Seismic Screening**
**Mitigation Option 2**

CLIENT **Dominion Energy**

FIGURE **6(c)**