

INITIAL SAFETY FACTOR ASSESSMENT

40 CFR 257.73 (e)

Bottom Ash Pond Complex

Glen Lyn Plant Site

Glen Lyn, Virginia

May, 2026

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215



Glen Lyn Plant Site
Bottom Ash Pond Complex
Initial Safety Factor Assessment

PREPARED BY _____ DATE _____
Dan Murphy, P.E.

REVIEWED BY _____ DATE _____
Blake Arthur, P.E.

APPROVED BY David Anthony Miller DATE 05.04.2026
David Anthony Miller, P.E.
Director- Ash Management Services



I certify to the best of my knowledge, information, and belief that the information contained in this safety factor assessment meets the requirements of 40 CFR § 257.73(e)

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Attachment A: Initial Safety Factor Assessment Report

1.0 OBJECTIVE

The “Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments”, 89 Fed. Reg. 38950 (May 8, 2024) (amending 40 C.F.R. §257) requires owners and operators of facilities with a legacy coal combustion residual (CCR) surface impoundment to prepare an initial safety factor assessment document for each legacy CCR surface impoundment at the facility.

The Bottom Ash Pond Complex at the Glen Lyn Plant Site is subjected to this rule.

2.0 DESCRIPTION OF THE CCR UNIT

The Glen Lyn Plant Site is located adjacent to the New River in Giles County, Virginia, approximately 10 miles east of Princeton, West Virginia. The latitude/longitude of the facility is: 37° 22' 12" N/ 80° 51' 48" W. The facility address is 100 APCO Road, Glen Lyn, VA, 24093. The Bottom Ash Pond Complex is located approximately 500 feet northeast from the Plant site.

The Glen Lyn Plant operated from 1919 to 2015. The Bottom Ash Pond Complex is formed by a perimeter ring dike nearly 2,500 feet long. The Bottom Ash Pond Complex is roughly 7 acres in size. The Bottom Ash Complex contains internal splitter dikes that create 3 internal ponds known as the North Bottom Ash Pond, South Bottom Ash Pond, and the Clearwater Pond.

3.0 SAFETY FACTOR ASSESSMENT 257.73(e)

The Initial Safety Factor Assessment was prepared by GAI Consultants, Inc. and is included as Attachment A.

The most critical failure surfaces of the perimeter dike of the Glen Lyn Bottom Ash Pond Complex meet the required factor of safety values. Therefore, it is concluded that the Glen Lyn Bottom Ash Pond Complex is stable and meets the stability factors of safety required by 40 CFR §257.73(e).

ATTACHMENT A

Initial Safety Factor Assessment Report



Glen Lyn Bottom Ash Pond Initial Safety Factor Assessment Report

American Electric Power
Glen Lyn Plant
Giles County, Virginia

GAI Project Number: C121043.12, Task 003

May 2026



BOUNDLESS ENERGYSM

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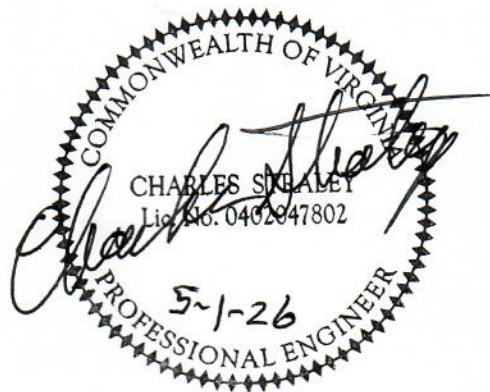
Certification/Statement of Professional Opinion

The Initial Safety Factor Assessment (Assessment) Report for the Glen Lyn Bottom Ash Pond was prepared by GAI Consultants, Inc. (GAI). The Assessment Report was based on certain information that, other than for information GAI originally prepared, GAI has relied on, but not independently verified. Therefore, this Certification/Statement of Professional Opinion is limited to the information available to GAI at the time the Assessment Report was written. On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia (VA), that the Assessment 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, and at the time and in the same locale. It is my professional opinion that this Initial Safety Factor Assessment was prepared consistent with the requirements of the United States Environmental Protection Agency's Federal Coal Combustion Residuals (CCR) Rule 40 CFR § 257.73(e), published in the Federal Register on May 8, 2024 with an effective date of November 4, 2024.

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



Charles F. Straley, P.E.
Engineering Director



1.0 Purpose

Pursuant to the Federal Coal Combustion Residuals (CCR) Rule 40 CFR § 257.73(e)(1)(i-iv), each CCR impoundment is required to conduct an initial and periodic safety factor assessment to determine whether the CCR unit achieves the minimum safety factors at the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations including loading conditions.

2.0 Introduction

The Glen Lyn Bottom Ash Pond is associated with the Glen Lyn Plant located in Giles County, Virginia (VA). The Bottom Ash Pond is located approximately 500 feet northeast of the Plant site. The Station operated from 1919 to 2015. Ash generated after 2008 was disposed of off-site. The Bottom Ash Pond is not closed and has previously been used for the management, storage, and disposal of CCR. Available historic records indicate that the primary waste managed by the Bottom Ash Pond was bottom ash or cinders.

The Station began operating in 1919 and was acquired by Appalachian Power Company in 1925. In 1919, the first coal-fired generating unit had a capacity of 15 megawatts of electricity. The first coal-fired unit was retired in 1954. In 1920, the second unit was put into service. The third unit was put into service in 1924. In 1927, the fourth unit was put into service. Units 2, 3, and 4 had the capacity to generate 65 megawatts of electricity and were retired in 1971. The fifth unit was put into service in 1944 and had the capacity to generate 95 megawatts of electricity. The sixth unit was put into service in 1957 and had the capacity to generate 240 megawatts of electricity. The fifth and sixth units were retired in 2015 when the plant ceased production.

The Bottom Ash Pond is no longer receiving CCR material. The Bottom Ash Pond received CCR material from the Station between 1963 and 2015. The Bottom Ash Pond has not been closed but is normally dry. It is the intent of AEP to close the Bottom Ash Pond by removal of all CCR material in future efforts, and GAI understands that the Closure Plan for Bottom Ash Pond has already been approved. The CCR material generated from the closure of Bottom Ash Pond will be placed in a proposed CCR Landfill.

3.0 Background Information

As discussed in Section 2.0, the Bottom Ash Pond no longer receives CCR material. GAI Consultants, Inc. (GAI) submitted a Closure Plan in October 2023 and later submitted revisions in January 2024, September 2024, and December 2024. Prior to the development of the Closure Plan, GAI submitted Delineation Data Reports in June 2017 and June 2018. The objective of the delineation reports was to identify the limits of the closure area for the Bottom Ash Pond. Subsurface explorations were performed for the above-mentioned reports, but no additional subsurface explorations were performed for this Bottom Ash Pond Initial Safety Factor Assessment. Additional reports listed in Section 3.1, submitted by GAI and others for the CCR facilities were used to supplement data for the Bottom Ash Pond Initial Safety Factor Assessment.

3.1 Historical Data

GAI reviewed historical records for the CCR facilities to obtain pertinent information to use in this Assessment Report. The historical records for the proposed closures, and previous subsurface explorations and analyses are included in the following documents:

- Closure Plan – AEP Auxiliary Fly Ash Pond, GAI Consultants, Inc., 2013
- Bottom Ash Pond Complex Delineation Data Report – Glen Lyn Power Station, GAI Consultants, Inc., 2017

- Bottom Ash Pond Complex Delineation Data Report Addendum – Glen Lyn Power Station, GAI Consultants, Inc., 2018
- Analysis Report – Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant, GEI Consultants, Inc., 2018
- Data Report – Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant, GEI Consultants, Inc., 2018
- Closure Plan - AEP Former Glen Lyn Power Plan Bottom Ash Pond, GAI Consultants, Inc., Revised 2024
- History of Construction - Bottom Ash Pond Complex – Glen Lyn Plant Site, American Electric Power Service Corporation, 2026

3.2 Summary of Parameters

Soil parameters used in stability analyses were estimated from the historical data referenced in Section 3.1, literature review, and engineering judgment.

The soil parameters used in stability analyses are summarized in Table 1.

Table 1 – Summary of Parameters

Material	Drained Friction Angle, ϕ' (degrees)	Drained Cohesion, c' (psf)	Unit Weight γ (pcf)
Lean Clay	28	200	120
Dike Fill	32	0	105
Lean Sandy Clay	28	0	110
Sand and Gravel	32	0	120
Rip Rap	42	0	115
Clay Shale	Infinite Strength		150

4.0 Factor of Safety Assessment

GAI reviewed all the documents listed under the References (Section 5.0) in its assessment to determine if the impoundment meets the following safety factors:

- i. The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- ii. The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
- iii. The calculated seismic factor of safety must equal or exceed 1.00.
- iv. For dikes constructed of soils that are susceptible to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

The stability assessments were evaluated using the Slide2 software package (Rocscience 2024, version 9.034). All analyses were conducted using the Morgenstern-Price Method. The material strength parameters used in the analyses were developed based on previous subsurface explorations including laboratory testing, literature review, and engineering judgment. The CCR rule discusses

development of “critical cross section(s)” that represent the most severe cases. These critical sections should produce the lowest factors of safety for a given loading condition. The cross section used in the slope stability analysis is shown in plan view on Figure A-1 in Appendix A. The phreatic surface used in the analyses was based on water level readings obtained from the network of monitoring wells surrounding the Bottom Ash Pond. Sections indicating the critical calculated failure surfaces and the corresponding factors of safety are included as Figures A-2 through A-5 in Appendix A.

4.1 Long-Term, Maximum Storage Pool Loading Condition

The long-term maximum storage pool condition considers slope stability with steady-state seepage under the maximum sustained operating pool. The long-term, maximum storage pool is defined as the maximum water level that can be regularly maintained and results in the full development of a steady state seepage condition. Drained (effective) strength parameters are most applicable for such analyses. Both upstream (US) and downstream (DS) embankments were evaluated for the safety factor assessment. The Bottom Ash Pond is inactive, and there is no normal pool since free water has been removed. The phreatic surface in the stability analysis was modeled at elevation (El.) 1494.7 feet, which is based on the most recent available monitoring well data from May 2022 to September 2025.

The results of the analysis of the long-term, maximum storage pool loading condition are summarized in Table 2.

Table 2 – Calculated Minimum Factors of Safety – Long-Term, Maximum Pool Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS		Acceptable (Yes/No)
		DS Slope	US Slope	
BAP BA-1	1.5	1.7	1.5	Yes

4.2 Maximum Surcharge Pool Loading Condition

The maximum surcharge pool loading condition considers slope stability under the maximum surcharge pool level. The maximum surcharge pool represents a temporary rise in pool elevation above the maximum storage pool in the event of an inflow design flood and spillway discharge condition. This condition allows the evaluation of the effects of a raised level, which is similar to the effects of a flood surcharge. Both upstream (US) and downstream (DS) embankments were evaluated for the safety factor assessment. The Bottom Ash Pond is inactive, and there is no surcharge pool since free water has been removed. The phreatic surface in the stability analysis was modeled at elevation (El.) 1494.7 feet, which is based on the most recent available monitoring well data from May 2022 to September 2025.

The results of the analysis of the maximum surcharge loading condition are summarized in Table 3.

Table 3 – Calculated Minimum Factors of Safety – Maximum Surcharge Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS		Acceptable (Yes/No)
		DS Slope	US Slope	
BAP BA-1	1.4	1.7	1.5	Yes

4.3 Seismic Loading Condition

The seismic loading condition considers slope stability as a result of the Maximum Design Earthquake (MDE) event. The MDE is defined by the CCR rule as a seismic event with a 2 percent probability of

exceedance in 50 years (i.e. earthquake of approximate 2,500-year return period). Pseudostatic analysis was used to evaluate slope stability under the seismic loading condition. The ground motion used in the analyses was a peak ground acceleration (PGA) of approximately 0.25 times the acceleration of gravity (g), or 0.25 g, obtained from the United States Geological Survey (USGS) seismic hazard tool using the latest 2023 National Seismic Hazard Model (NSHM).

Both US and DS slopes were analyzed under the seismic loading conditions. The Bottom Ash Pond is inactive, and there is no normal pool since free water has been removed. The phreatic surface in the stability analysis was modeled at elevation (El.) 1494.7 feet, which is based on the most recent available monitoring well data from May 2022 to September 2025.

The results of the analysis of the seismic loading condition are summarized in Table 4.

Table 4 – Calculated Minimum Factors of Safety – Seismic Loading Condition

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS		Acceptable (Yes/No)
		DS Slope	US Slope	
BAP BA-1	1.0	1.0	1.0	Yes

4.4 Liquefaction Factor of Safety

The liquefaction loading condition addresses the potential for loose, saturated, or partially saturated soils to undergo a loss of strength during seismic events. This reduction in strength can result in slope instability, settlement, subsidence, or other forms of embankment distress. The assessment of liquefaction potential generally involves evaluating the susceptibility of each material zone within the embankment and its foundation to liquefaction triggering. For materials identified as susceptible, the potential impacts on embankment stability are then evaluated by incorporating reduced shear strength parameters representative of post-liquefaction conditions.

Liquefaction analysis was performed using the “Simplified Procedure” for each SPT interval in every boring drilled within the Bottom Ash Pond (Idriss and Boulanger, 2008). The ground motions used in the liquefaction analysis were based on the PGA described in Section 4.3. Results of the liquefaction evaluation indicate that no soils within the Bottom Ash Pond embankment or its foundation are susceptible to liquefaction under the CCR Rule criteria, as calculated liquefaction factors of safety were equal to or greater than 1.2. Accordingly, a separate post-earthquake stability analysis was not required.

5.0 Conclusion

GAI reviewed previous stability analyses for this Initial Safety Factor Assessment and conducted new analyses to meet the requirements of the CCR Rule. Based on the analyses conducted for the conditions outlined in the CCR Rule, the Bottom Ash Pond meets or exceeds the required factors of safety.

6.0 References

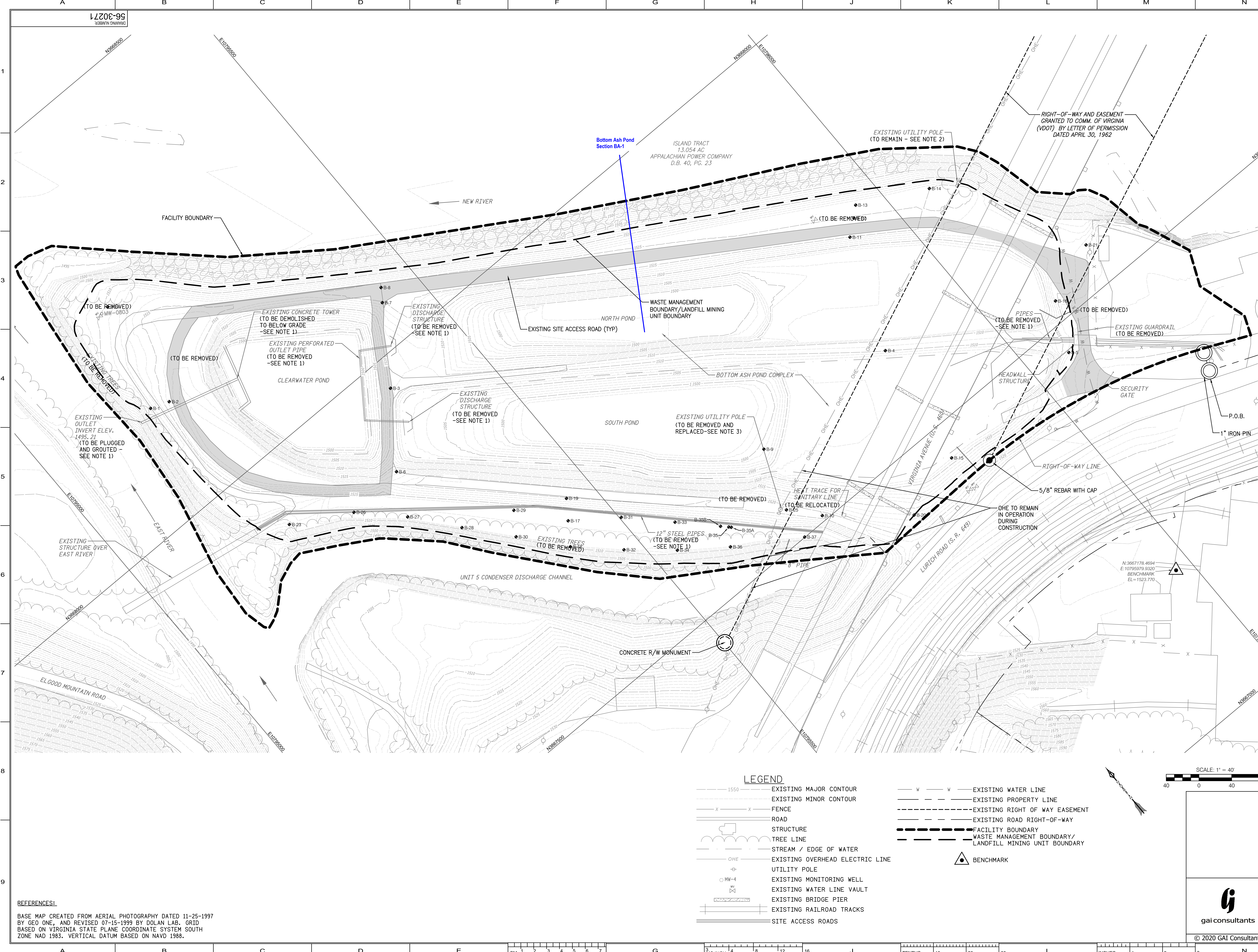
1. American Electric Power Service Corporation. History of Construction – Bottom Ash Pond Complex – Glen Lyn Plant Site. February 2026.
2. GAI Consultants. *Bottom Ash Pond Complex Delineation Data Report*. June 2017.
3. GAI Consultants. *Bottom Ash Pond Complex Delineation Data Report Addendum*. June 2018.
4. GAI Consultants. *Closure Plan – AEP Auxiliary Fly Ash Pond*. February 2013.
5. GAI Consultants. *Closure Plan – AEP Former Glen Lyn Power Plant Bottom Ash Pond*. Revised December 2024.
6. GEI Consultants. *Analysis Report – Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant*. August 2018.
7. GEI Consultants. *Data Report – Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant*. August 2018.
8. *Soil Liquefaction during Earthquakes*, Idriss and Boulanger, EERI Monograph MNO-12, 2008.
9. *Coal Ash: Characteristics, Management and Environmental Issues*, Technical Update - Coal Combustion Products - Environmental Issues, Electric Power Research Institute, September 2009.

APPENDIX A

Calculations

Figure A-1

- NOTES:**
1. REMOVE FEATURES IN ACCORDANCE WITH THE CONSTRUCTION SEQUENCE (SEE DRAWING SHEET 10 OF 12, DRAWING 56-30277) AND THE CONTRACTOR'S APPROVED WORK PLAN, UNLESS SPECIFICALLY APPROVED OTHERWISE BY THE OWNER.
 2. DURING CONSTRUCTION PROTECT UTILITY POLE TO REMAIN WITH BARRIERS.
 3. AEP TO COORDINATE WORK TO REMOVE AND REPLACE THE EXISTING UTILITY POLE.



REFERENCES:
 BASE MAP CREATED FROM AERIAL PHOTOGRAPHY DATED 11-25-1997 BY GEO ONE, AND REVISED 07-15-1999 BY DOLAN LAB. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1983. VERTICAL DATUM BASED ON NAVD 1988.

LEGEND

--- 1550	EXISTING MAJOR CONTOUR	---	EXISTING WATER LINE
--- 1500	EXISTING MINOR CONTOUR	---	EXISTING PROPERTY LINE
-x-x-	FENCE	---	EXISTING RIGHT OF WAY EASEMENT
---	ROAD	---	EXISTING ROAD RIGHT-OF-WAY
---	STRUCTURE	---	FACILITY BOUNDARY
---	TREE LINE	---	WASTE MANAGEMENT BOUNDARY/ LANDFILL MINING UNIT BOUNDARY
---	STREAM / EDGE OF WATER	▲	BENCHMARK
—O—	EXISTING OVERHEAD ELECTRIC LINE		
—○—	UTILITY POLE		
—○—	EXISTING MONITORING WELL		
—v—	EXISTING WATER LINE VAULT		
—v—	EXISTING BRIDGE PIER		
—v—	EXISTING RAILROAD TRACKS		
---	SITE ACCESS ROADS		

DATE	NO.	DESCRIPTION	APPR.
12/20/24	C	REVISED PER DEO COMMENTS	KMB
09/27/24	B	REVISED PER DEO COMMENTS	KMB
01/22/23	A	ISSUED FOR PERMIT	ALD

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APPALACHIAN POWER CO.
GLEN LYN PLANT
 GLEN LYN, VIRGINIA
 BOTTOM ASH POND COMPLEX CLOSURE
EXISTING SITE CONDITIONS AND DEMOLITION PLAN

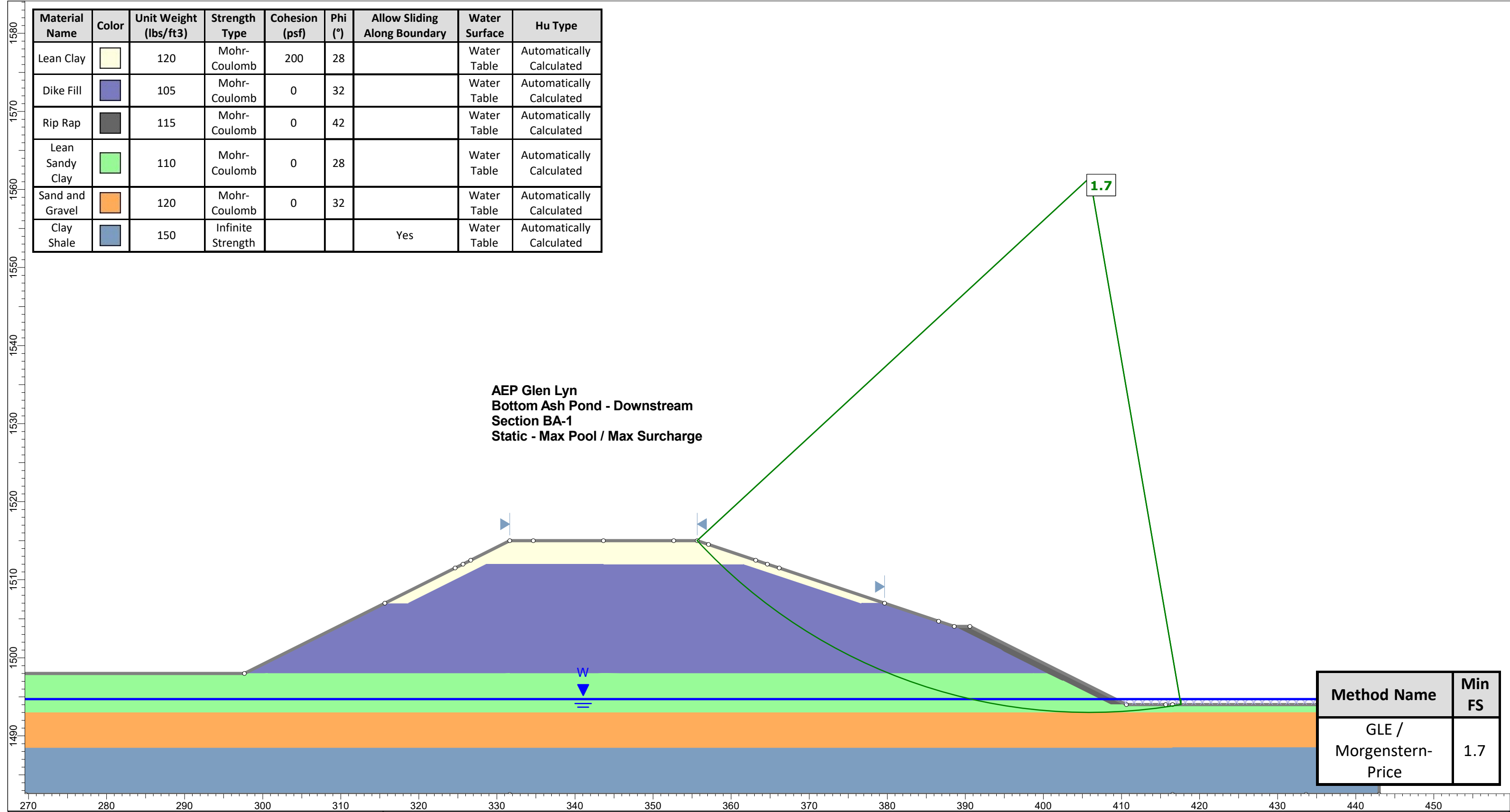
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	56-30271(SH02 OF 12)	B
SCALE:	APPROVED BY:	
DR. DOYLE	[Signature]	
CH. MULLEN	[Signature]	
SUP.	[Signature]	
ENG. DITULLIO	[Signature]	
DATE: 01/22/2020	[Signature]	

gai consultants
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 COLUMBUS, OH 43215

GAI FILE PATH: Z:\ENERGY\AEP\GLEN LYN\GLEN LYN CAD\TASKS\GLEN LYN\PRODUCTION DRAWINGS\56-30271.DWG PLOTTED: 12/18/2024 BY: KEVIN R. APEL
 CROSS REFS:

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Allow Sliding Along Boundary	Water Surface	Hu Type
Lean Clay		120	Mohr-Coulomb	200	28		Water Table	Automatically Calculated
Dike Fill		105	Mohr-Coulomb	0	32		Water Table	Automatically Calculated
Rip Rap		115	Mohr-Coulomb	0	42		Water Table	Automatically Calculated
Lean Sandy Clay		110	Mohr-Coulomb	0	28		Water Table	Automatically Calculated
Sand and Gravel		120	Mohr-Coulomb	0	32		Water Table	Automatically Calculated
Clay Shale		150	Infinite Strength			Yes	Water Table	Automatically Calculated



Method Name	Min FS
GLE / Morgenstern-Price	1.7



<i>Project</i>		Slide2 - An Interactive Slope Stability Program	
<i>Group</i>	Max Pool / Max Surcharge	<i>Scenario</i>	Master Scenario
<i>Drawn By</i>		<i>Company</i>	
<i>Date</i>	3/27/2026, 9:18:53 AM	<i>File Name</i>	Section BA-2 (Downstream).slmd

SLIDEINTERPRET 9.034

Figure A-3

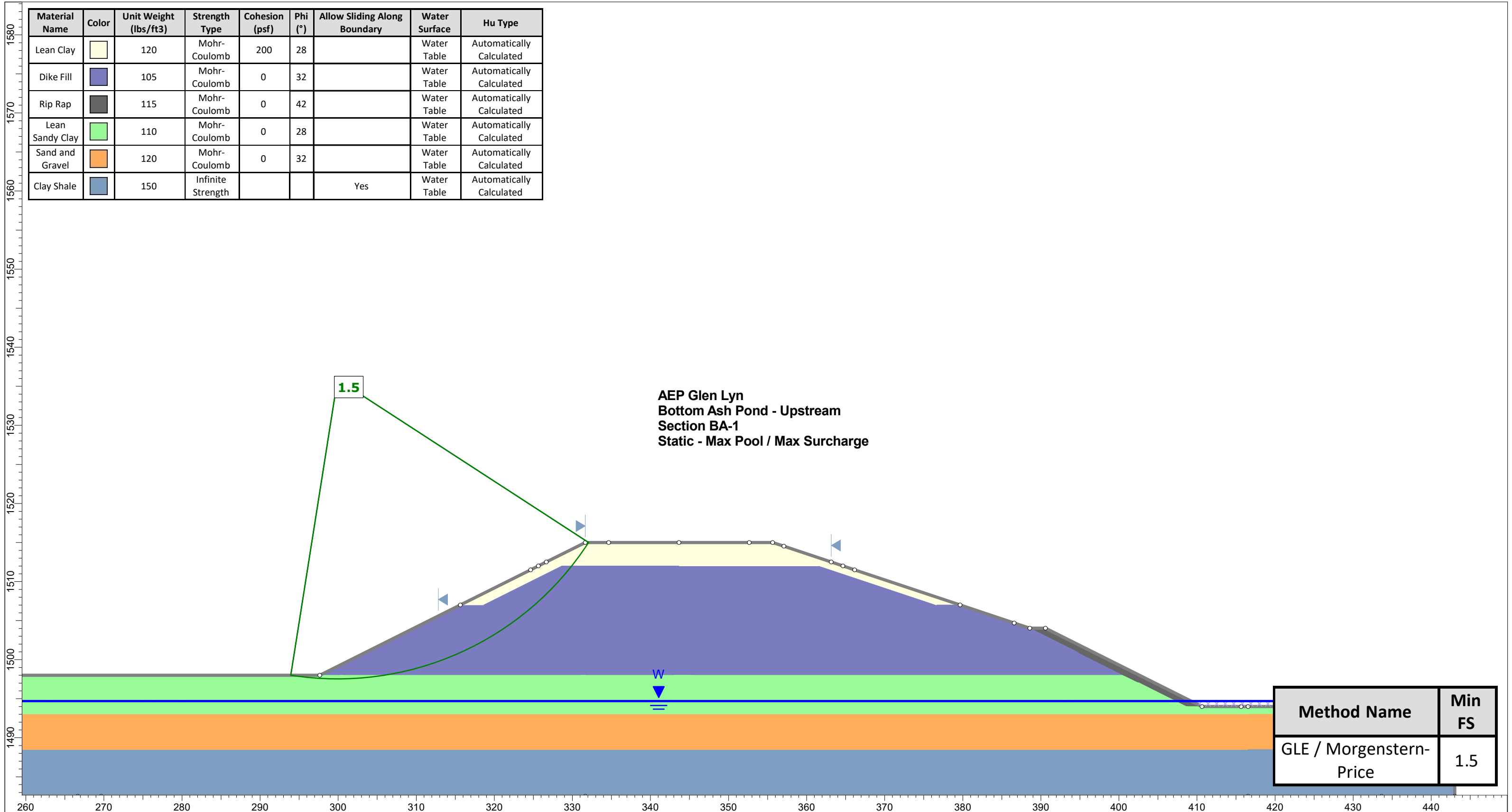


Figure A-4

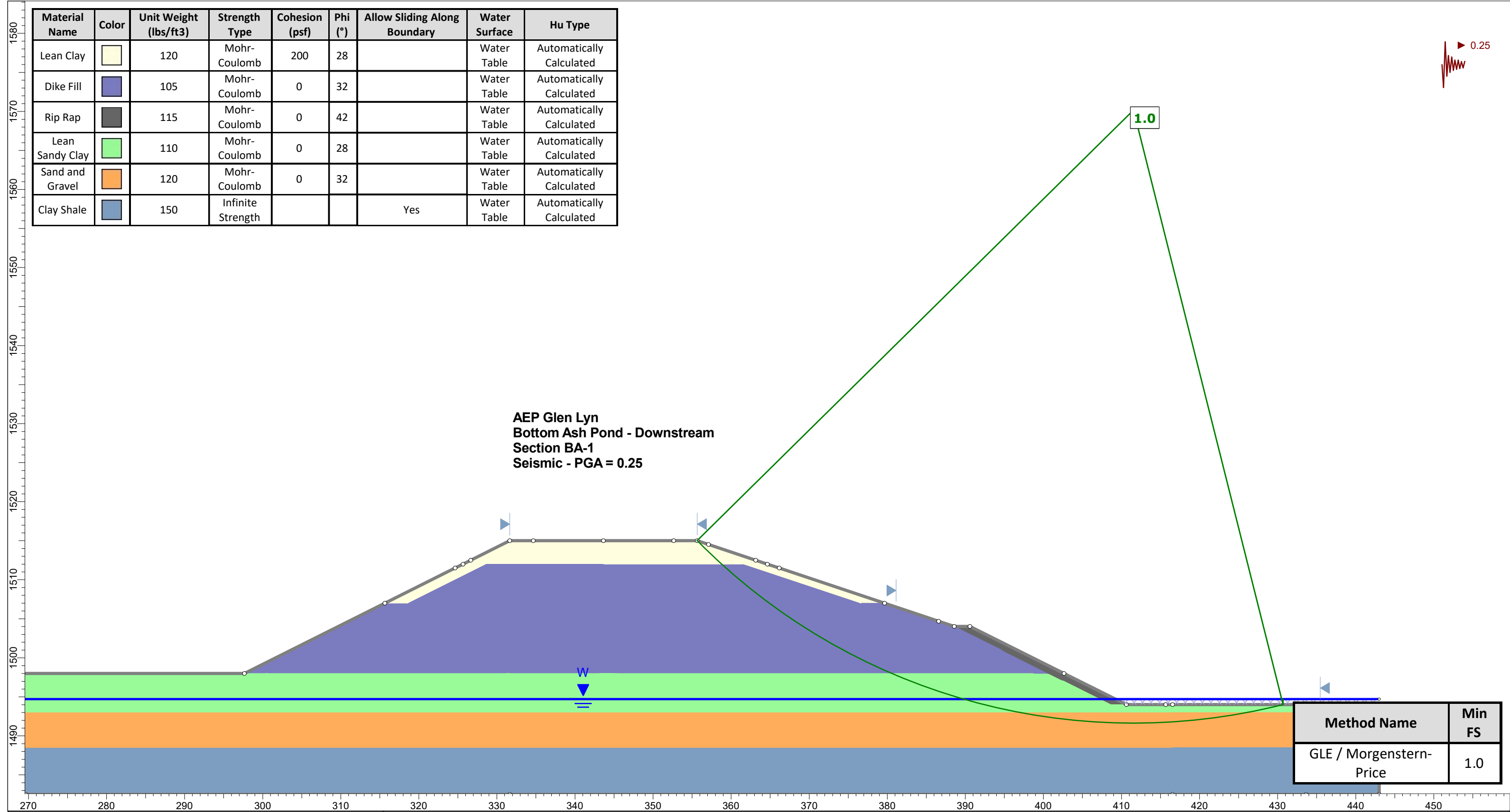
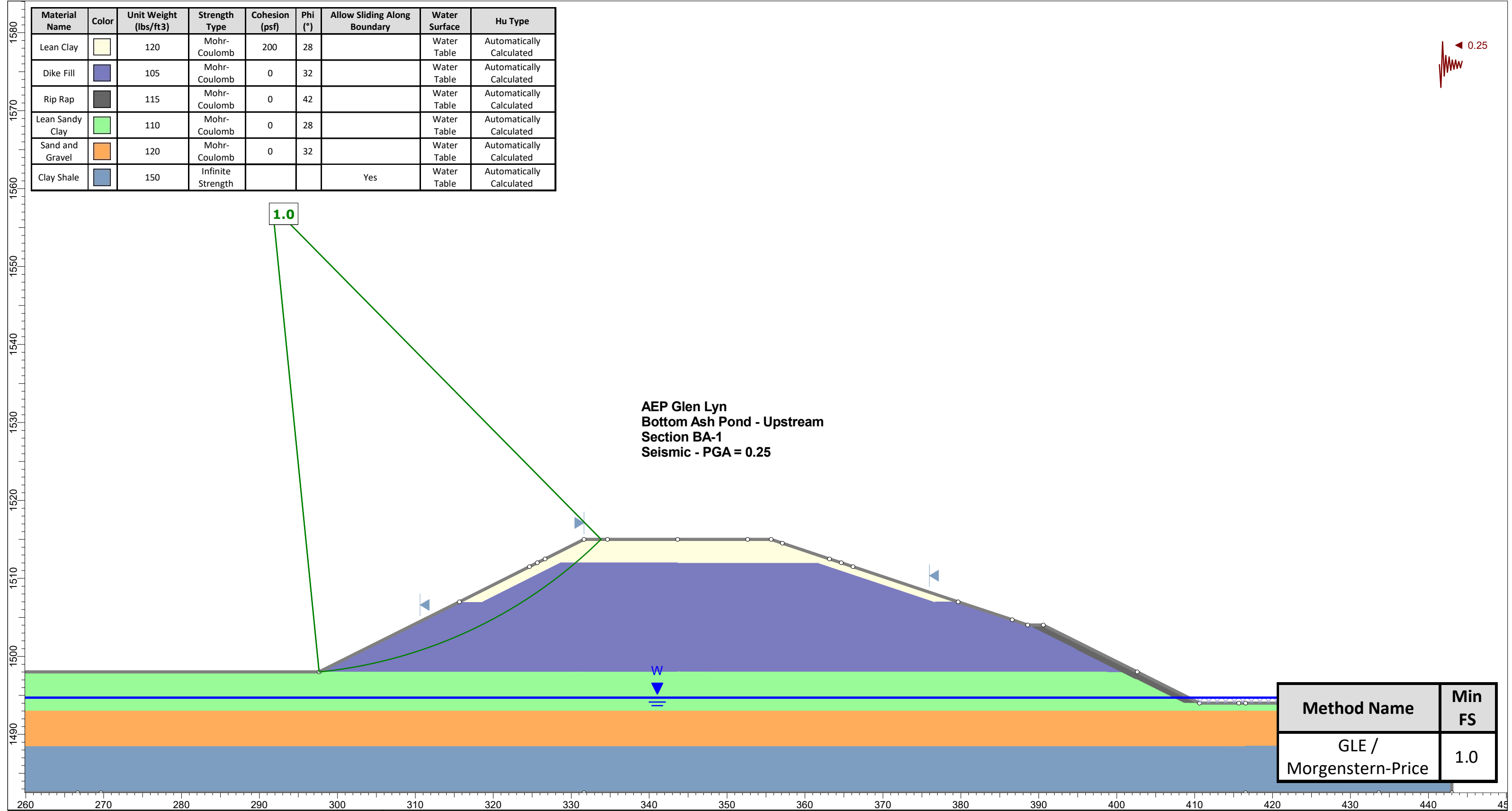


Figure A-5



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Allow Sliding Along Boundary	Water Surface	Hu Type
Lean Clay		120	Mohr-Coulomb	200	28		Water Table	Automatically Calculated
Dike Fill		105	Mohr-Coulomb	0	32		Water Table	Automatically Calculated
Rip Rap		115	Mohr-Coulomb	0	42		Water Table	Automatically Calculated
Lean Sandy Clay		110	Mohr-Coulomb	0	28		Water Table	Automatically Calculated
Sand and Gravel		120	Mohr-Coulomb	0	32		Water Table	Automatically Calculated
Clay Shale		150	Infinite Strength			Yes	Water Table	Automatically Calculated

Method Name	Min FS
GLE / Morgenstern-Price	1.0

SLIDEINTERPRET 9.034

G.S. Elev. = 1525.8
γ_{overburden} = 105.0 (pcf)

W.T. Elev. = 1494.7
a_{max} = 0.25
Est. EQ Mag = 5.77

Bottom Elev. = 1525.8
Top Elev. = 1525.8

Boring 9503

Idriss and Boulanger (2008)

Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C _E	C _B	C _S	C _R	N ₆₀	Existing σ _{vo} (tsf)	Existing σ' _{vo} (tsf)	C _N	Design σ _{vo} (tsf)	Design σ' _{vo} (tsf)	(N ₁) ₆₀	ΔN for fines content	(N ₁) _{60cs}	r _d	CSR	MSF	K _σ	CRR for M=7.5 and σ _{vc} '=1atm	CRR	Factor of Safety
0.5	1.5	1524.3	110.0	105.0	2.0	29	0.8	1.0	1.0	0.75	17	0.0788	0.0788	1.70	0.08	0.08	30	0	30	1.0018	0.1628	1.6	1.10	0.459898	0.796	-
0.9	3.0	1522.8	110.0	105.0	2.0	8	0.8	1.0	1.0	0.75	5	0.1575	0.1575	1.70	0.16	0.16	8	0	8	0.9946	0.1616	1.6	1.10	0.105635	0.183	-
1.4	4.5	1521.3	110.0	105.0	2.0	7	0.8	1.0	1.0	0.75	4	0.2363	0.2363	1.70	0.24	0.24	7	0	7	0.9869	0.1604	1.6	1.10	0.099077	0.171	-
1.8	6.0	1519.8	110.0	105.0	2.0	6	0.8	1.0	1.0	0.75	4	0.3150	0.3150	1.70	0.32	0.32	6	0	6	0.9788	0.1590	1.6	1.09	0.092767	0.160	-
2.3	7.5	1518.3	110.0	105.0	2.0	5	0.8	1.0	1.0	0.75	3	0.3938	0.3938	1.63	0.39	0.39	5	0	5	0.9702	0.1577	1.6	1.07	0.085477	0.144	-
2.7	9.0	1516.8	110.0	105.0	2.0	4	0.8	1.0	1.0	0.75	2	0.4725	0.4725	1.49	0.47	0.47	4	0	4	0.9612	0.1562	1.6	1.06	0.078143	0.130	-
3.2	10.5	1515.3	110.0	105.0	2.0	2	0.8	1.0	1.0	0.80	1	0.5513	0.5513	1.38	0.55	0.55	2	0	2	0.9519	0.1547	1.6	1.04	0.068890	0.113	-
3.7	12.0	1513.8	110.0	105.0	2.0	3	0.8	1.0	1.0	0.80	2	0.6300	0.6300	1.29	0.63	0.63	2	0	2	0.9422	0.1531	1.6	1.03	0.072414	0.118	-
4.3	14.1	1511.7	110.0	105.0	2.0	26	0.8	1.0	1.0	0.85	18	0.7402	0.7402	1.19	0.74	0.74	21	0	21	0.9281	0.1508	1.6	1.05	0.218659	0.360	-
5.7	18.6	1507.2	110.0	105.0	2.0	100	0.8	1.0	1.0	0.85	68	0.9765	0.9765	1.03	0.98	0.98	70	0	70	0.8961	0.1456	1.6	1.02	2.000000	3.204	-
6.9	22.7	1503.1	110.0	105.0	2.0	100	0.8	1.0	1.0	0.95	76	1.1918	1.1918	0.94	1.19	1.19	71	0	71	0.8652	0.1406	1.6	0.96	2.000000	3.019	-

Notes:

- σ'_{vo} Vertical Effective Stress (tons/ft²)
- (N₁)₆₀ Standardized and Normalized SPT blow counts (blows/foot)
- r_d Stress Reduction Factor (dimensionless)
- a_{max} Peak horizontal ground surface acceleration (in g)
- CSR Cyclic stress ratio based on design earthquake (dimensionless)
- CRR_{7.5} Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
- MSF Magnitude scaling factor (dimensionless)
- K_σ High overburden stress correction factor (dimensionless)
- K_α Ground slope correction factor (dimensionless) [advised not to be used by reference]
- CRR Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR_{7.5} * K_σ * K_α
- FS_L Factor of safety against liquefaction (dimensionless)

FS_{min} N/A

References:

- (1) Idriss, I. M., and Boulanger, R. W. (2008). Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

G.S. Elev. = 1524.0
γ_{overburden} = 105.0 (pcf)

W.T. Elev. = 1494.7
a_{max} = 0.25
Est. EQ Mag = 5.77

Bottom Elev. = 1524.0
Top Elev. = 1524.0

Boring 9524

Idriss and Boulanger (2008)

Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C _E	C _B	C _S	C _R	N ₆₀	Existing σ _{vo} (tsf)	Existing σ' _{vo} (tsf)	C _N	Design σ _{vo} (tsf)	Design σ' _{vo} (tsf)	(N ₁) ₆₀	ΔN for fines content	(N ₁) _{60cs}	r _d	CSR	MSF	K _σ	CRR for M=7.5 and σ _{vc} '=1atm	CRR	Factor of Safety
2.8	9.1	1514.9	110.0	105.0	9.4	6	0.8	1.0	1.0	0.75	4	0.4777	0.4777	1.48	0.48	0.48	5	1	6	0.9606	0.1561	1.6	1.06	0.093294	0.156	-
4.3	14.1	1509.9	110.0	105.0	9.4	4	0.8	1.0	1.0	0.85	3	0.7402	0.7402	1.19	0.74	0.74	3	1	4	0.9281	0.1508	1.6	1.02	0.081130	0.131	-
5.8	19.1	1504.9	110.0	105.0	9.4	24	0.8	1.0	1.0	0.85	16	1.0028	1.0028	1.02	1.00	1.00	17	1	18	0.8924	0.1450	1.6	1.00	0.179092	0.283	-
7.3	24.1	1499.9	110.0	105.0	9.4	16	0.8	1.0	1.0	0.95	12	1.2653	1.2653	0.91	1.27	1.27	11	1	12	0.8543	0.1388	1.6	0.98	0.131947	0.203	-
8.9	29.1	1494.9	110.0	105.0	50.0	6	0.8	1.0	1.0	0.95	5	1.5278	1.5278	0.83	1.53	1.53	4	6	9	0.8149	0.1324	1.6	0.97	0.113823	0.173	-
10.4	34.1	1489.9	110.0	105.0	5.0	41	0.8	1.0	1.0	1.00	33	1.8023	1.6525	0.79	1.80	1.65	26	0	26	0.7750	0.1374	1.6	0.92	0.317926	0.461	3.35
11.2	36.9	1487.1	110.0	105.0	5.0	100	0.8	1.0	1.0	1.00	80	1.9563	1.7191	0.78	1.96	1.72	62	0	62	0.7528	0.1392	1.6	0.85	2.000000	2.679	19.25

Notes:

- σ'_{vo} Vertical Effective Stress (tons/ft²)
- (N₁)₆₀ Standardized and Normalized SPT blow counts (blows/foot)
- r_d Stress Reduction Factor (dimensionless)
- a_{max} Peak horizontal ground surface acceleration (in g)
- CSR Cyclic stress ratio based on design earthquake (dimensionless)
- CRR_{7.5} Cyclic resistance ratio based on an earthquake of magnitude 7.5 (dimensionless)
- MSF Magnitude scaling factor (dimensionless)
- K_σ High overburden stress correction factor (dimensionless)
- K_α Ground slope correction factor (dimensionless) [advised not to be used by reference]
- CRR Corrected cyclic resistance ratio based on overburden pressure and ground surface slope (dimensionless) = CRR_{7.5} * K_σ * K_α
- FS_L Factor of safety against liquefaction (dimensionless)

FS_{min} 3.35

References:

(1) Idriss, I. M., and Boulanger, R. W. (2008). Soil liquefaction during earthquakes. Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

G.S. Elev. = 1508.9
γ_{overburden} = 105.0 (pcf)

W.T. Elev. = 1494.7
a_{max} = 0.25
Est. EQ Mag = 5.77

Bottom Elev. = 1508.9
Top Elev. = 1508.9

Boring 9526

Idriss and Boulanger (2008)

Test Depth (m)	Test Depth (ft)	Test Elevation (ft)	Saturated Unit Weight (pcf)	Moist Unit Weight (pcf)	Fines Content (%)	N	C _E	C _B	C _S	C _R	N ₆₀	Existing σ _{vo} (tsf)	Existing σ' _{vo} (tsf)	C _N	Design σ _{vo} (tsf)	Design σ' _{vo} (tsf)	(N ₁) ₆₀	ΔN for fines content	(N ₁) _{60cs}	r _d	CSR	MSF	K _σ	CRR for M=7.5 and σ _{vc} '=1atm	CRR	Factor of Safety		
1.2	4.0	1504.9	110.0	105.0	9.4	24	0.8	1.0	1.0	0.75	14	0.2100	0.2100	1.70	0.21	0.21	24	1	25	0.9895	0.1608	1.6	1.10	0.298898	0.517	-		
2.7	9.0	1499.9	110.0	105.0	9.4	48	0.8	1.0	1.0	0.75	29	0.4725	0.4725	1.49	0.47	0.47	43	1	44	0.9612	0.1562	1.6	1.10	2.000000	3.460	-		
4.3	14.0	1494.9	110.0	105.0	50.0	18	0.8	1.0	1.0	0.85	12	0.7350	0.7350	1.19	0.74	0.74	15	6	20	0.9288	0.1509	1.6	1.05	0.208363	0.343	-		
5.8	19.0	1489.9	110.0	105.0	5.0	34	0.8	1.0	1.0	0.85	23	1.0095	0.8597	1.10	1.01	0.86	25	0	25	0.8931	0.1704	1.6	1.03	0.301900	0.490	2.87		

