

Former Mad River Ash Pond Initial Safety Factor Assessment Report

Ohio Edison Company
Former Mad River Power Station
Clark County, Ohio

May 2026

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Certification/Statement of Professional Opinion

The Initial Safety Factor Assessment Report (Report) for the former Mad River Ash Pond (Ash Pond) was prepared by GAI Consultants, Inc. (GAI). The 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 Report was written. On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the State of Ohio that the Report 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 Report was prepared consistent with the requirements of § 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 and amended on May 8, 2024 with an effective date of November 8, 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.



Arica L. DiTullio, P.E.
Engineering Director



1.0 Purpose

Pursuant to the Federal Coal Combustion Residuals (CCR) Rule 40 CFR § 257.73(e)(1) and 40 CFR § 257.100(f)(2)(iv), each legacy CCR surface impoundment is required to conduct initial and periodic safety factor assessments 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 former Mad River Ash Pond (Ash Pond) is a legacy CCR surface impoundment located in Springfield, Clark County, Ohio (OH), approximately 0.15 miles southeast of the former Mad River Power Station (Station). The Station is an inactive electric utility also located in the City of Springfield, Clark County, OH. The former Ash Pond was used for the management, storage, and disposal of CCR when the former Station was operational. The former Station generated power through the combustion of coal from approximately 1926 to 1982 and was demolished around 2010. In or around 1985, the former Ash Pond was partially graded, and vegetation was established.

The former Ash Pond is bordered by Mad River to the west, along with a public roadway beyond the waterbody. A railroad right-of-way and railroad track crosses east-to-west through the site, bordering the former Ash Pond to the immediate north. The embankments and former Ash Pond area are covered with saplings and fully mature trees with some underbrush. No permanent pool presently exists in the former Ash Pond. Limited areas of standing water have been identified after storm events, primarily occupying puddles and tire ruts formed from all-terrain vehicle (ATV) trails throughout the former Ash Pond and on the embankments.

3.0 Background Information

As discussed in Section 2.0, the former Ash Pond is a legacy CCR surface impoundment. The former Station operated until approximately 1982 and was demolished around 2010. The former Ash Pond was partially graded around 1985 and vegetation was established. Historical records containing data from subsurface explorations were not available for this Initial Safety Factor Assessment. GAI performed a subsurface exploration in 2026 consisting of seven (7) borings and laboratory testing to characterize the subsurface conditions, and details of the investigation are provided in the Data Report, provided under a separate cover (Data Report, *Reference 1*).

3.1 Summary of Parameters

Soil parameters used in stability analyses were estimated from soil boring blow count correlations, laboratory test data, 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)
Compacted Embankment Fill	36	0	125
CCR Fill	28	0	105
Natural Soil (V. Loose-M. Dense / Soft-Stiff)	27	0	105

Material	Drained Friction Angle, ϕ' (degrees)	Drained Cohesion, c' (psf)	Unit Weight γ (pcf)
Natural Soil (Loose-V. Dense)	32	0	120

4.0 Factor of Safety Assessment

GAI reviewed the documents listed under the References (Section 6.0) in its assessment to determine if the former Ash Pond 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 performed using the Slide2 software package (Rocscience 2024, version 9.034). The analyses were conducted using the Morgenstern-Price Method. The material strength parameters used in the analyses were developed based on subsurface exploration, laboratory testing, historical document review, and engineering judgement. 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 sections used in the slope stability analyses are shown in plan on Figure A-1 in Appendix A. Phreatic surfaces were based on the peak water surface elevation following the 25-year flood and the 1,000-year flood event as described in the Inflow Design Flood Control System Plan (*Reference 3*). Perimeter and interior embankments were evaluated for the safety factor assessment. Sections indicating the critical calculated failure surfaces and the corresponding factors of safety are included as figures A-2 through A-7 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. As indicated in the Inflow Design Flood Control System Plan (*Reference 3*), there is no evidence of discharge structures within the former Ash Pond. Therefore, the long-term maximum storage pool loading condition will have a water surface elevation of 898.2 feet, which is the estimated peak water surface elevation in the former Ash Pond following the 25-year flood.

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)
Section 1-1	1.5	1.1	No
Section 2-2	1.5	1.1	No

4.2 Maximum Surge Pool Loading Condition

The maximum surge pool loading condition considers slope stability under the maximum surge pool level. The maximum surge 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 surge. The Inflow Design Flood Control System Plan (*Reference 3*) indicates that the pool in the former Ash Pond following a 1,000-year flood would attain an estimated water surface elevation of 900.12 feet. Therefore, the maximum surge pool loading condition will have a water elevation of 900.12 feet.

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

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

Section Analyzed	Minimum Required FOS	Calculated Minimum FOS	Acceptable (Yes/No)
Section 1-1	1.4	1.1	No
Section 2-2	1.4	1.1	No

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 0.13 times the acceleration of gravity (*g*), or 0.13 *g*, obtained from the United States Geological Survey (USGS) seismic hazard tool using the latest 2023 National Seismic Hazard Model (NSHM). The seismic loading condition was evaluated using the long-term maximum storage pool loading condition.

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)
Section 1-1	1.0	0.8	No
Section 2-2	1.0	0.8	No

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 former Ash Pond (Idriss and Boulanger, 2008; *Reference 5*). 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 the foundation soils within the former Ash Pond are susceptible to liquefaction under the CCR Rule criteria, as calculated liquefaction factors of safety were less than 1.2. Accordingly, a separate post-earthquake stability analysis is typically required, however, a post-earthquake stability analysis was not performed due to the former Ash Pond not meeting minimum required safety factors for the long-term maximum storage pool loading, maximum surcharge pool loading, and seismic loading conditions as well.

5.0 Conclusion

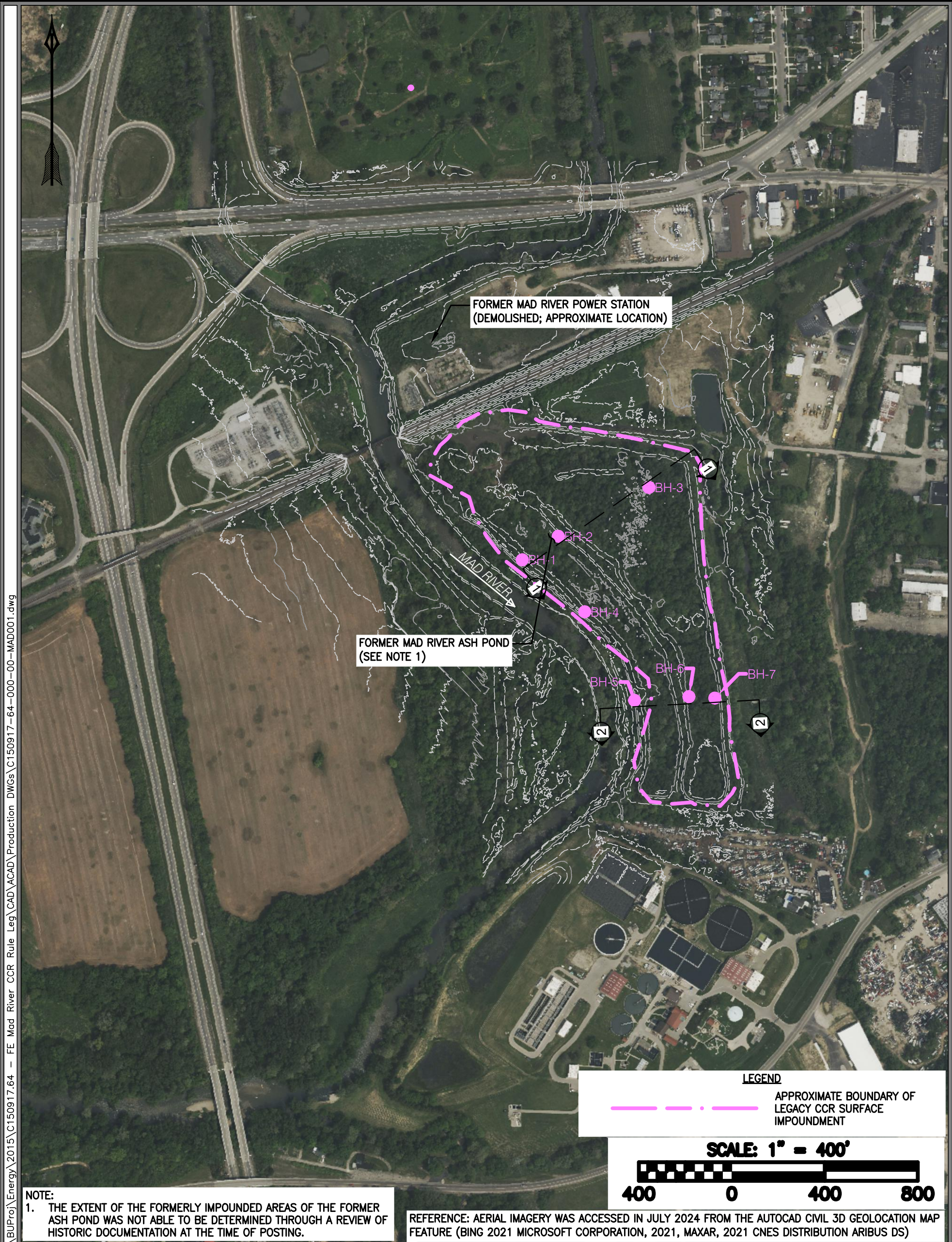
Based on the analyses conducted for the conditions outlined in the CCR Rule, the former Ash Pond does not meet the required factors of safety.

6.0 References

1. GAI Consultants. *Data Report – Former Mad River Ash Pond*. May 2026.
2. GAI Consultants. *History of Construction Report – Former Mad River Ash Pond*. February 2026.
3. GAI Consultants. *Initial Inflow Design Flood Control System Report – Former Mad River Ash Pond*. May 2026.
4. GAI Consultants. *Initial Structural Stability Assessment Report – Former Mad River Ash Pond*. May 2026.
5. *Soil Liquefaction during Earthquakes*, Idriss and Boulanger, EERI Monograph MNO-12, 2008.

APPENDIX A


Calculations

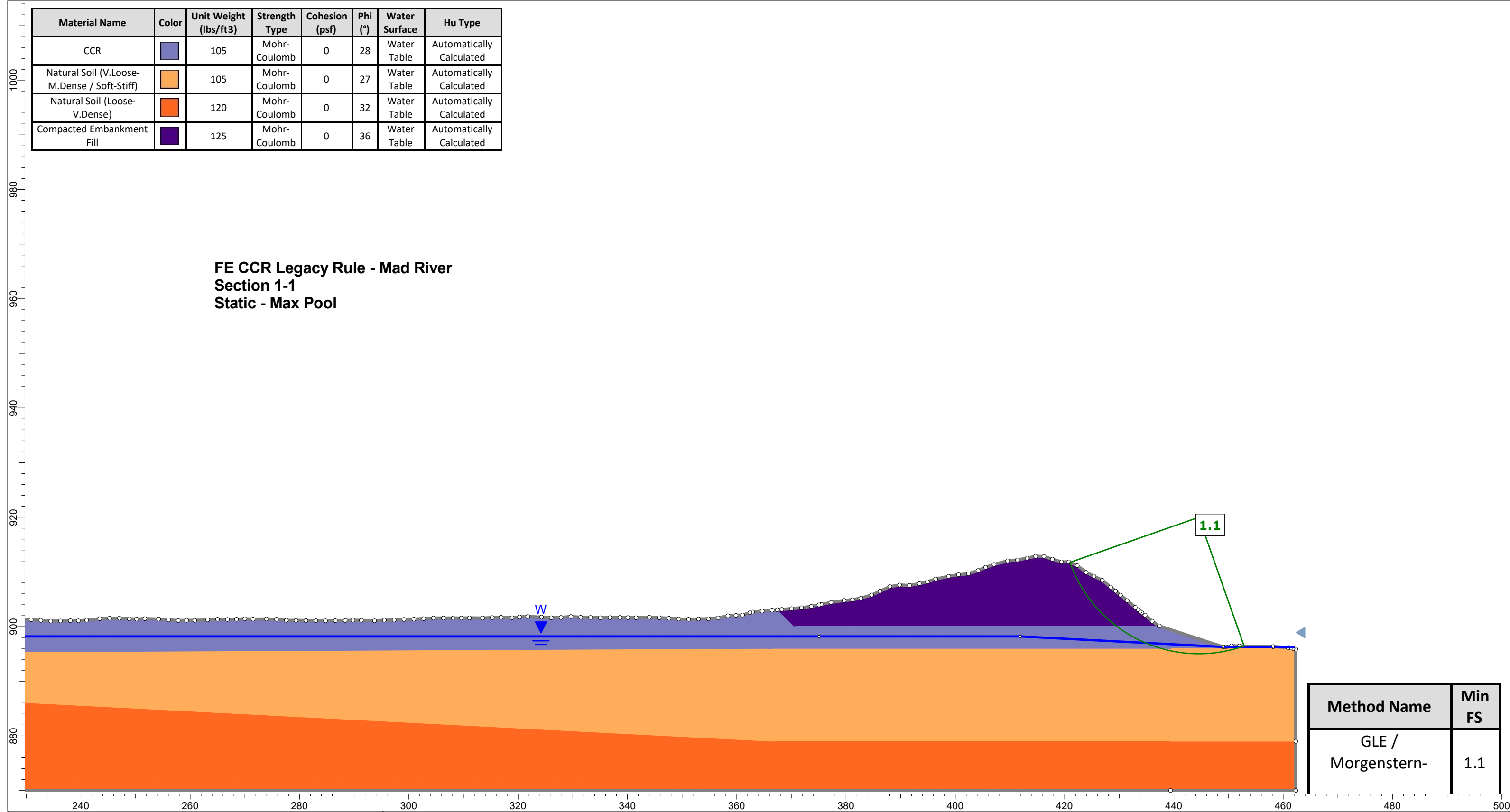


NOTE:
 1. THE EXTENT OF THE FORMERLY IMPOUNDED AREAS OF THE FORMER ASH POND WAS NOT ABLE TO BE DETERMINED THROUGH A REVIEW OF HISTORIC DOCUMENTATION AT THE TIME OF POSTING.

REFERENCE: AERIAL IMAGERY WAS ACCESSED IN JULY 2024 FROM THE AUTOCAD CIVIL 3D GEOLOCATION MAP FEATURE (BING 2021 MICROSOFT CORPORATION, 2021, MAXAR, 2021 CNES DISTRIBUTION ARIBUS DS)

GAI CAD FILE PATH: \\gaisconsultants.local\BUPro\Energy\2015\C150917.64 - FE Mad River CCR Rule Leg\CAD\ACAD\Production DWGs\C150917-64-000-00-MAD001.dwg

DRAWING TITLE		DRAWN BY:		ISSUE DATE:	
FORMER MAD RIVER POWER STATION		WOLFESM		10/11/2024	
PROJECT	 gai consultants	CLIENT		CHECKED BY:	
APPLICABILITY REPORT LEGACY CCR SURFACE IMPOUNDMENT FORMER MAD RIVER STATION CLARK COUNTY, OH		OHIO EDISON COMPANY 341 WHITE POND DRIVE AKRON, OH 44320		ROUNCLL AS SHOWN	
GAI FILE NUMBER:		GAI DRAWING NUMBER:		APPROVED BY:	
C150917-64-000-00-MAD001		MAD001		DITUAL 001 OF 001	
This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.					
ISSUING OFFICE: Pittsburgh 385 E. Waterfront Drive, Homestead, PA 15120				© 2024 GAI Consultants	
PLOTTED ON: 3/13/2026 8:48:39 AM PLOTTED BY: Kevin R. Apel PLOT FILE: GAI.stb					



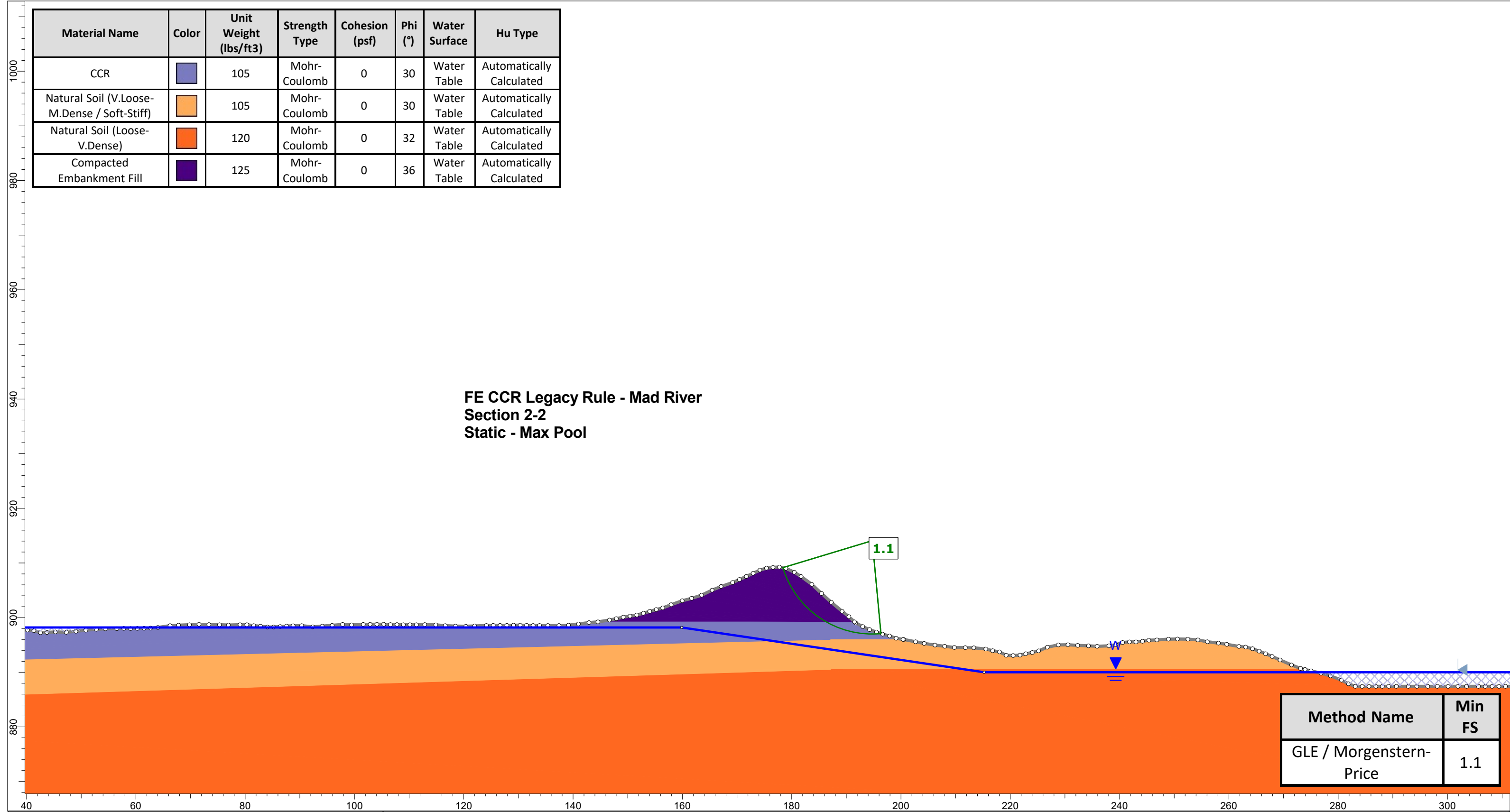
Material Name	Color	Unit Weight (lbs/ft ³)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR		105	Mohr-Coulomb	0	28	Water Table	Automatically Calculated
Natural Soil (V.Loose-M.Dense / Soft-Stiff)		105	Mohr-Coulomb	0	27	Water Table	Automatically Calculated
Natural Soil (Loose-V.Dense)		120	Mohr-Coulomb	0	32	Water Table	Automatically Calculated
Compacted Embankment Fill		125	Mohr-Coulomb	0	36	Water Table	Automatically Calculated



SLIDEINTERPRET 9.041

Project		FE CCR Legacy - Mad River	
Group	Max Pool (L to R)	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Mad River Section 1-1.slmd

Figure A-3

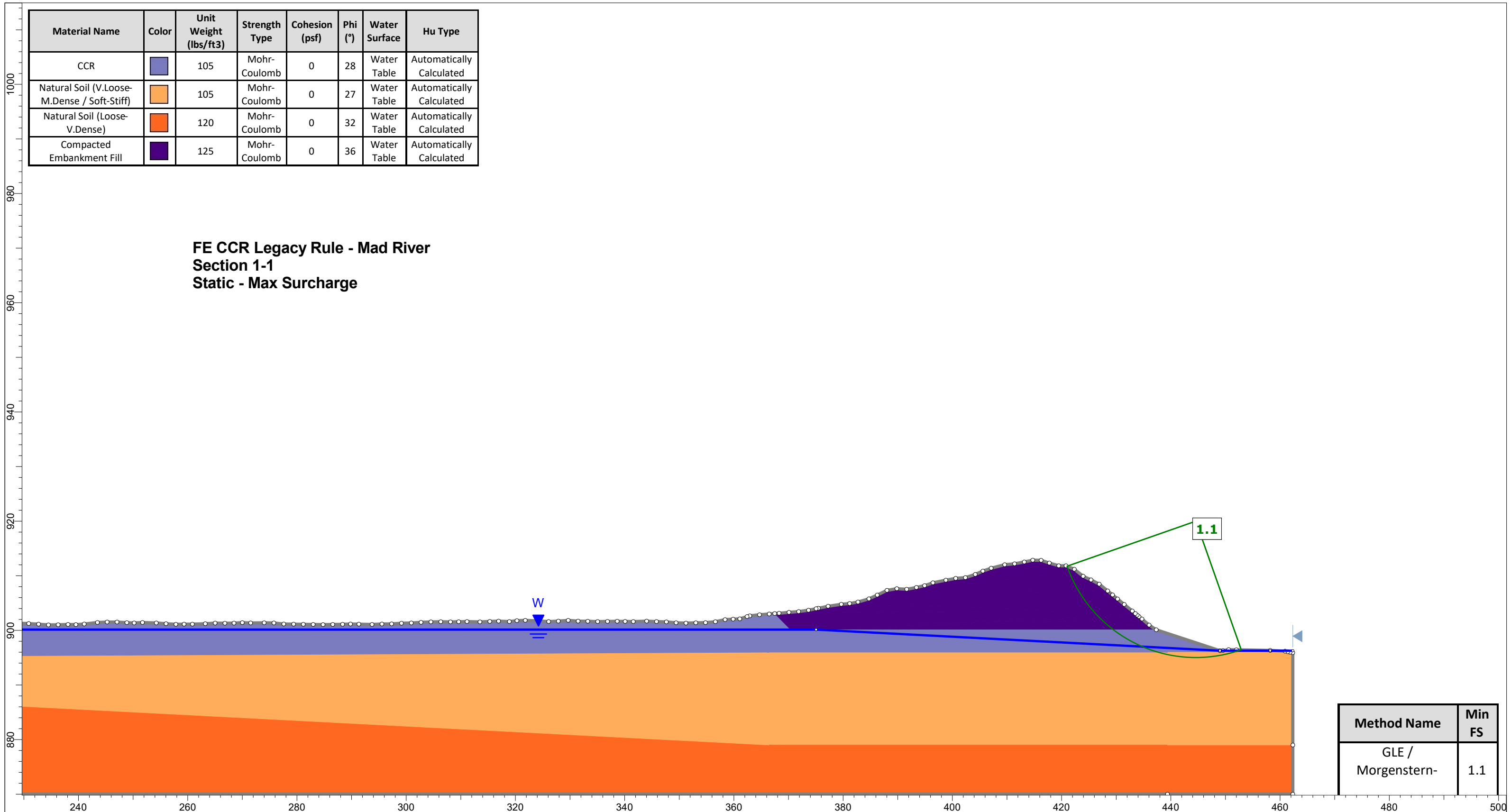


Material Name	Color	Unit Weight (lbs/ft ³)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR	■	105	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Natural Soil (V.Loose-M.Dense / Soft-Stiff)	■	105	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Natural Soil (Loose-V.Dense)	■	120	Mohr-Coulomb	0	32	Water Table	Automatically Calculated
Compacted Embankment Fill	■	125	Mohr-Coulomb	0	36	Water Table	Automatically Calculated





Method Name	Min FS
GLE / Morgenstern-Price	1.1

	Project		FE CCR Legacy - Mad River	
	Group		Max Pool (L to R)	
	Drawn By		RRJ	
	Date		3/16/2026, 8:38:25 AM	
		Scenario		Master Scenario
		Company		GAI Consultants, Inc
		File Name		FE Mad River Section 2-2.slmd

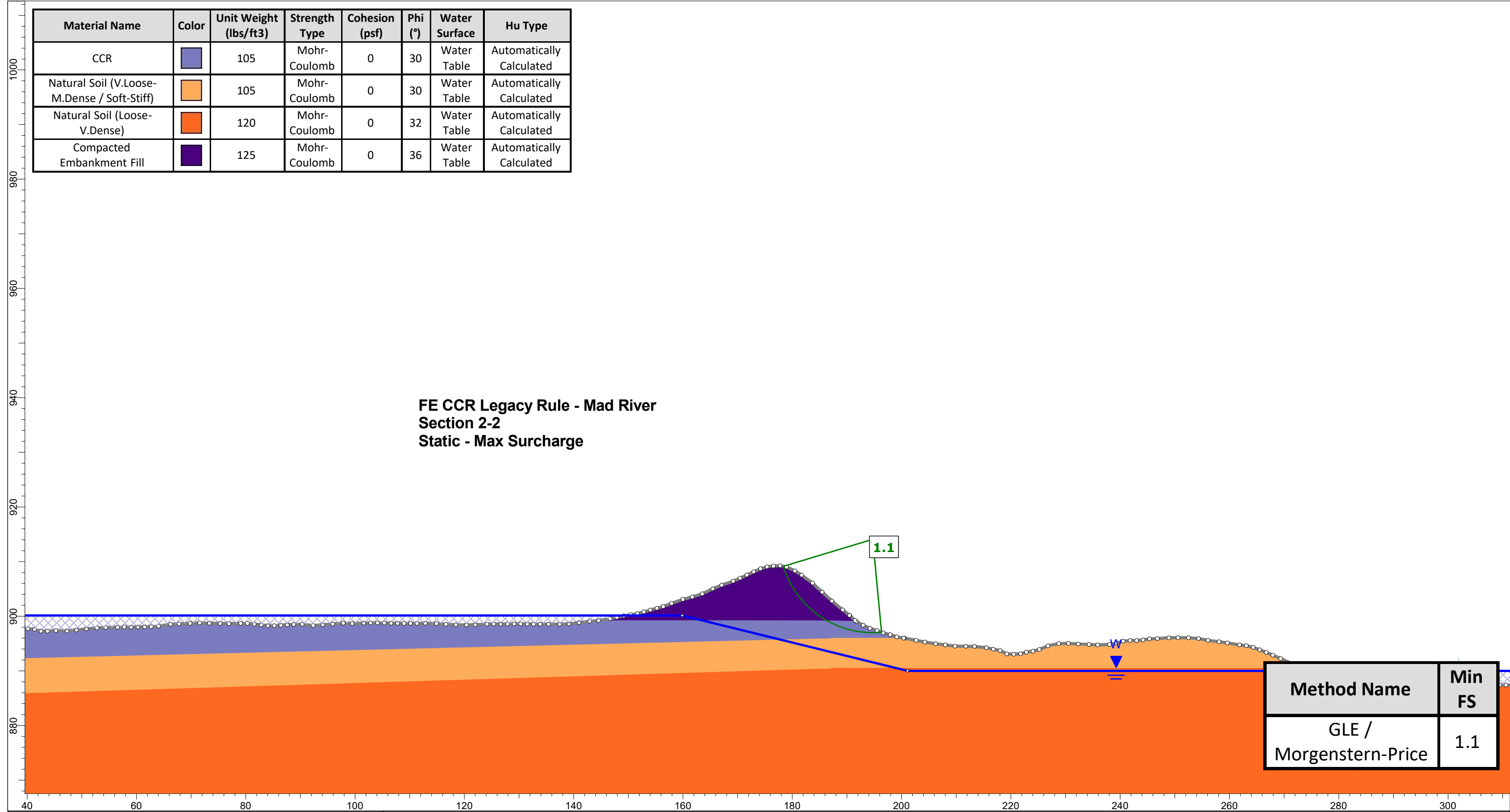
Figure A-4



	Project FE CCR Legacy - Mad River	Scenario Master Scenario
	Group Max Surcharge (L to R)	Company GAI Consultants, Inc
	Drawn By RRJ	File Name FE Mad River Section 1-1.slmd
	Date 3/16/2026, 8:38:25 AM	

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type
CCR		105	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Natural Soil (V.Loose-M.Dense / Soft-Stiff)		105	Mohr-Coulomb	0	30	Water Table	Automatically Calculated
Natural Soil (Loose-V.Dense)		120	Mohr-Coulomb	0	32	Water Table	Automatically Calculated
Compacted Embankment Fill		125	Mohr-Coulomb	0	36	Water Table	Automatically Calculated

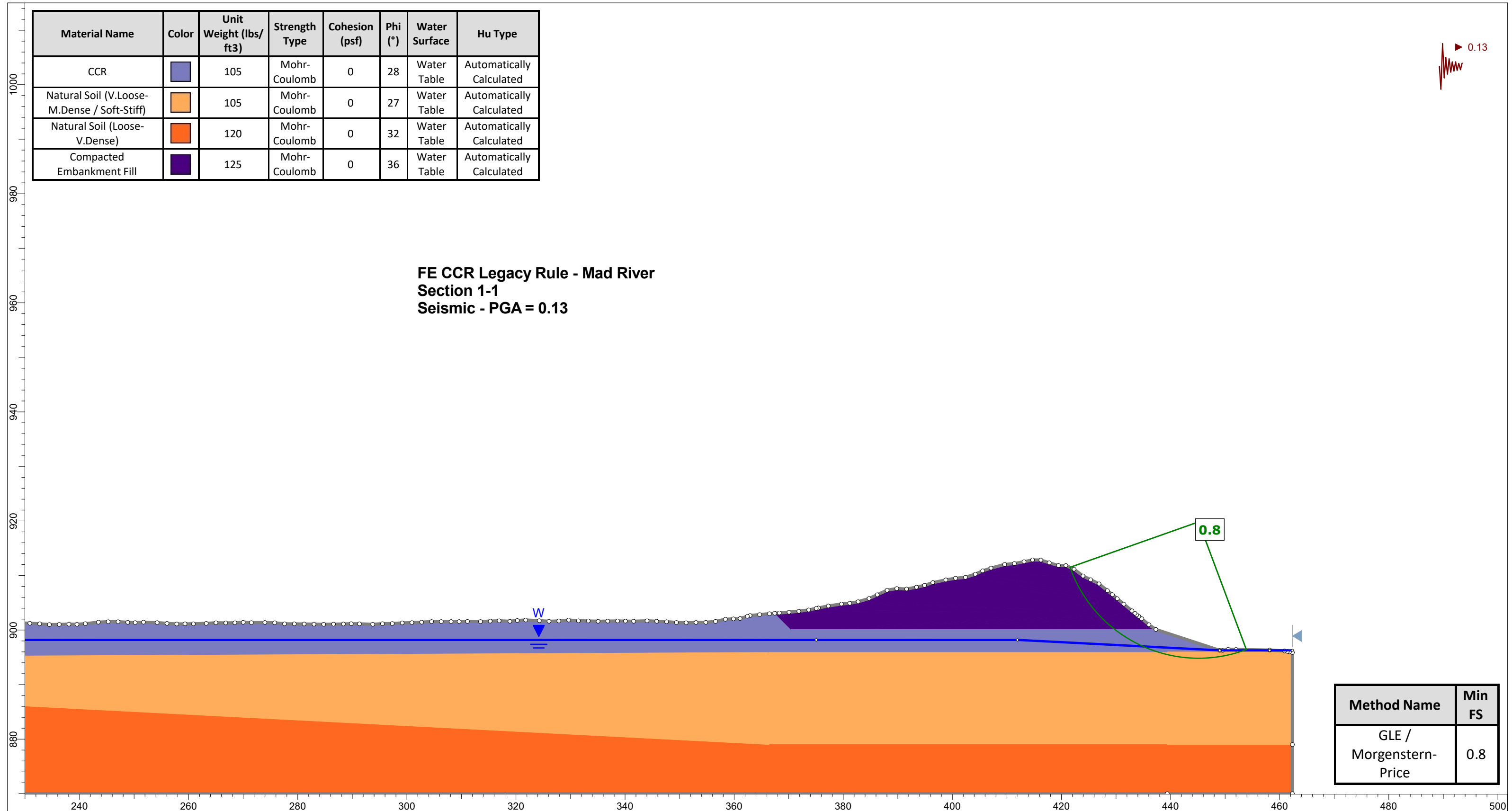
**FE CCR Legacy Rule - Mad River
Section 2-2
Static - Max Surcharge**



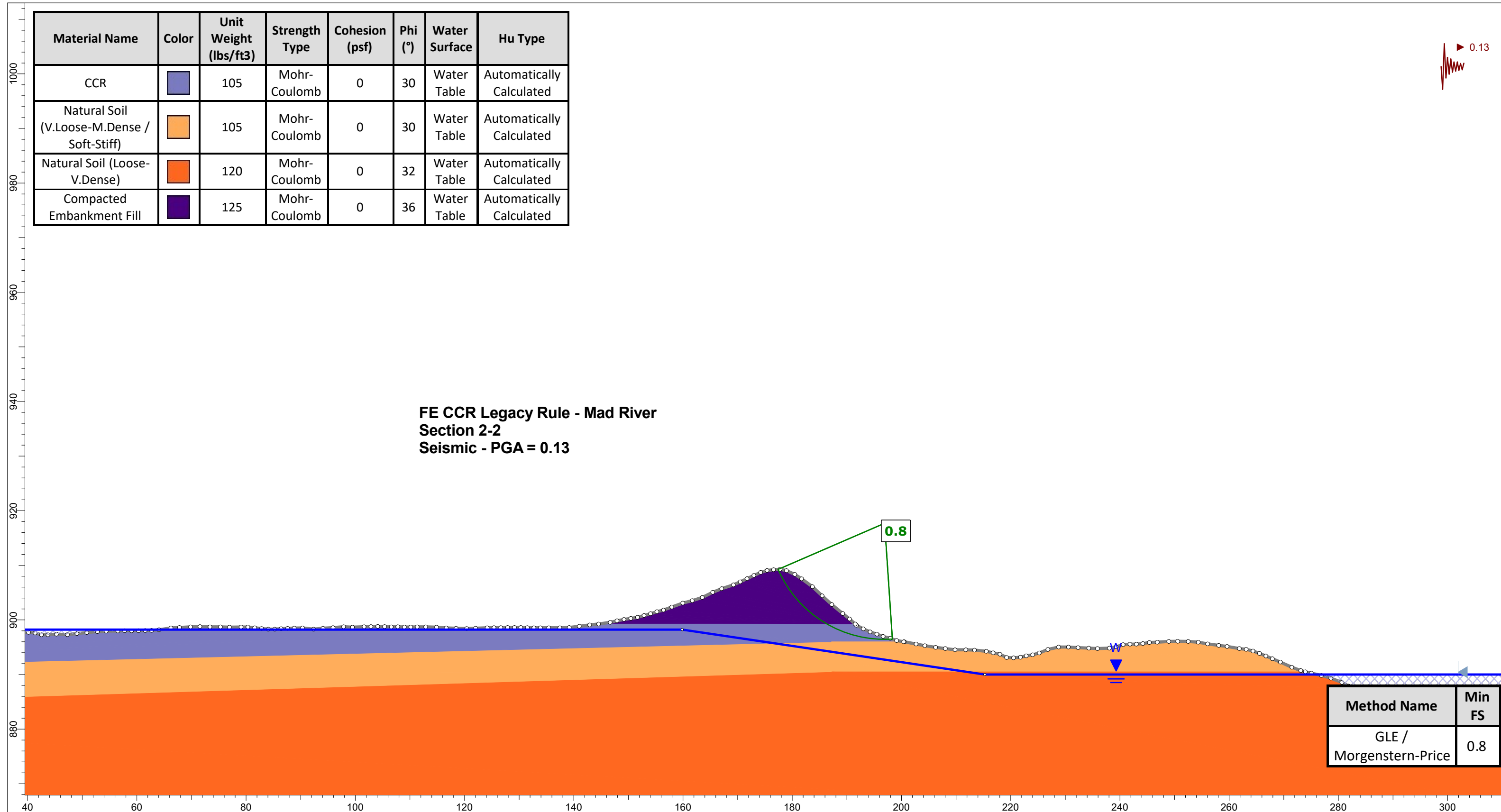
Method Name	Min FS
GLE / Morgenstern-Price	1.1



Project		FE CCR Legacy - Mad River	
Group	Max Surcharge (L to R)	Scenario	Master Scenario
Drawn By	RRJ	Company	GAI Consultants, Inc
Date	3/16/2026, 8:38:25 AM	File Name	FE Mad River Section 2-2.slmd



	Project FE CCR Legacy - Mad River		
	Group Seismic (L to R)	Scenario Master Scenario	
	Drawn By RRJ	Company GAI Consultants, Inc	
	Date 3/16/2026, 8:38:25 AM	File Name FE Mad River Section 1-1.slmd	



	Project FE CCR Legacy - Mad River	
	Group Seismic (L to R)	Scenario Master Scenario
	Drawn By RRJ	Company GAI Consultants, Inc
	Date 3/16/2026, 8:38:25 AM	File Name FE Mad River Section 2-2.slmd

G.S. Elev. = 899.4
γ_{overburden} = 100.0 (pcf)

W.T. Elev. = 898.2
a_{max} = 0.13
Est. EQ Mag = 6

Bottom Elev. = 899.4
Top Elev. = 899.4

Boring BH-2

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
0.3	1.0	898.4	105.0	100.0	35.0	4	0.8	1.0	1.0	0.75	2	0.0500	0.0500	1.70	0.05	0.05	4	6	10	1.0041	0.0822	1.5	1.10	0.115205	0.188	
0.9	3.0	896.4	105.0	100.0	35.0	2	0.8	1.0	1.0	0.75	1	0.1545	0.0983	1.70	0.15	0.10	2	6	8	0.9953	0.1281	1.5	1.10	0.101663	0.166	
1.5	5.0	894.4	105.0	100.0	35.0	3	0.8	1.0	1.0	0.75	2	0.2595	0.1409	1.70	0.26	0.14	3	6	9	0.9857	0.1486	1.5	1.10	0.108316	0.177	
2.1	7.0	892.4	105.0	100.0	35.0	1	0.8	1.0	1.0	0.75	1	0.3645	0.1835	1.70	0.36	0.18	1	6	7	0.9753	0.1586	1.5	1.10	0.095253	0.155	
2.7	9.0	890.4	105.0	100.0	35.0	7	0.8	1.0	1.0	0.75	4	0.4695	0.2261	1.52	0.47	0.23	6	6	12	0.9643	0.1640	1.5	1.10	0.131748	0.215	
3.4	11.0	888.4	105.0	100.0	35.0	2	0.8	1.0	1.0	0.8	1	0.5745	0.2687	1.38	0.57	0.27	2	6	7	0.9526	0.1668	1.5	1.10	0.099902	0.163	
4.0	13.0	886.4	105.0	100.0	9.9	6	0.8	1.0	1.0	0.85	4	0.6795	0.3113	1.33	0.68	0.31	5	1	7	0.9404	0.1681	1.5	1.10	0.095101	0.155	0.92
4.6	15.0	884.4	105.0	100.0	9.9	9	0.8	1.0	1.0	0.85	6	0.7845	0.3539	1.28	0.78	0.35	8	1	9	0.9276	0.1684	1.5	1.10	0.110763	0.180	1.07
5.2	17.0	882.4	105.0	100.0	9.9	7	0.8	1.0	1.0	0.85	5	0.8895	0.3965	1.24	0.89	0.40	6	1	7	0.9143	0.1680	1.5	1.08	0.098161	0.157	0.93
5.8	19.0	880.4	105.0	100.0	9.9	18	0.8	1.0	1.0	0.85	12	0.9945	0.4391	1.20	0.99	0.44	15	1	16	0.9007	0.1671	1.5	1.10	0.163190	0.266	1.59
6.4	21.0	878.4	105.0	100.0	9.9	15	0.8	1.0	1.0	0.95	11	1.0995	0.4817	1.17	1.10	0.48	13	1	14	0.8866	0.1657	1.5	1.08	0.151329	0.243	1.47
7.0	23.0	876.4	105.0	100.0	9.9	12	0.8	1.0	1.0	0.95	9	1.2045	0.5243	1.14	1.20	0.52	10	1	11	0.8723	0.1641	1.5	1.07	0.128543	0.203	1.24
7.6	25.0	874.4	105.0	100.0	9.9	14	0.8	1.0	1.0	0.95	11	1.3095	0.5669	1.11	1.31	0.57	12	1	13	0.8577	0.1623	1.5	1.06	0.139198	0.219	1.35
9.1	30.0	869.4	105.0	100.0	9.9	16	0.8	1.0	1.0	0.95	12	1.5720	0.6734	1.05	1.57	0.67	13	1	14	0.8204	0.1568	1.5	1.05	0.146330	0.227	1.45
10.7	35.0	864.4	105.0	100.0	9.9	26	0.8	1.0	1.0	1.00	21	1.8345	0.7799	0.99	1.83	0.78	21	1	22	0.7827	0.1508	1.5	1.04	0.228836	0.353	2.34
12.2	40.0	859.4	105.0	100.0	9.9	13	0.8	1.0	1.0	1.00	10	2.0970	0.8864	0.95	2.10	0.89	10	1	11	0.7451	0.1444	1.5	1.02	0.124573	0.187	1.30
13.6	44.5	854.9	105.0	100.0	9.9	60	0.8	1.0	1.0	1.00	48	2.3333	0.9823	0.91	2.33	0.98	44	1	45	0.7121	0.1385	1.5	1.02	2.000000	3.013	21.75
15.2	50.0	849.4	105.0	100.0	9.9	10	0.8	1.0	1.0	1.00	8	2.6220	1.0994	0.87	2.62	1.10	7	1	8	0.6732	0.1315	1.5	1.00	0.104873	0.155	1.18

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} 0.92

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.

