Submitted to
Southern Indiana
Gas & Electric Company
(SIGECO)
dba CenterPoint Energy
Indiana South
211 Northwest Riverside
Drive, Evansville, IN 47708

Submitted by
AECOM
9400 Amberglen Boulevard
Austin, Texas 78729

October 13, 2021

CCR Certification:
Periodic Safety Factor Assessment
§257.73 (e)

for the

East Ash Pond

at the

F.B. Culley Generating Station

Revision 0

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1 Introduction

The purpose of the Safety Factor Assessment is to document that the requirements specified in 40 Code of Federal Regulations (CFR) §257.73 (e) have been met to support the certification required under each of the applicable regulatory provisions for the F.B. Culley Generating Station (Culley) East Ash Pond. The East Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the specified documentation and assessments for an existing CCR surface impoundment be prepared within five years of the placement of the previous assessment in the facility's operating record. Since the Initial Safety Factor Assessment was placed in the facility's operating record on October 13, 2016, the deadline for completing this 5-year update is October 13, 2021.

An initial safety factor assessment was performed in October 2016. As part of the periodic assessment, an updated analysis has been performed to document that the calculated factors of safety for the East Ash Pond achieve the minimum factors of safety listed in § 257.73(e)(1)(i) through (iv).

2 Periodic Safety Factor Assessment

Regulatory Citation: 40 CFR §257.73 (e); Periodic safety factor assessments. (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for 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. The safety factor assessments must be supported by appropriate engineering calculations.

An initial safety factor assessment was performed in October 2016. That assessment included slope stability analyses of multiple cross-sections of the dike structure that were considered to be most critical (i.e. most susceptible), based on rigorous field and laboratory testing and appropriate engineering considerations and calculations.

As part of this periodic assessment, an updated analysis has been performed to document that the calculated factors of safety for the East Ash Pond achieve the minimum factors of safety listed in § 257.73(e)(1)(i) through (iv). The analyses used subsurface information collected from historical subsurface investigations and laboratory testing data, and included consideration of any changes to the configuration of the structures that has occurred since the time of the initial assessment. Upon review of the existing configuration (which included data gathered from various site visits and inspections that have occurred since 2016 and on the most recent August 2020 survey data), it is noted that very minor (and mostly beneficial) changes to the East Ash Pond have occurred – Specifically, the storage pool elevation and ash impounded elevation have been lowered. There were no changes to the East Ash Pond dike geometry.

Given this, it was concluded that the cross-sections selected for analysis in the 2016 initial safety factor assessment are still pertinent critical locations, and therefore were retained for the current evaluation. The above minor changes were incorporated into the selected cross-sections, and engineering properties for the various material strata were selected based on the results of available field and laboratory data. The results of the safety factor assessment are presented in the continuing subsections.

2.1 Results of Slope Stability Analyses

Regulatory Citation: 40 CFR §257.73 (e)(1);

- *(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 have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.*

Limit equilibrium slope stability analyses were performed for two (2) critical cross-sections (AECOM B1 and B2, located as shown in the **Attachment A**) under each of the above loading conditions and using the computer program

SLOPE/W. The results of the slope stability analyses for each load case are summarized in **Table 2-1**. The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in **Appendix B**.

Table 2-1 – Summary of Minimum Slope Stability Factors of Safety

Load Case	Criteria	Cross-Section AECOM B1	Cross-Section AECOM B2
Steady State (Normal Pool)	FS ≥ 1.50	1.88	1.93
Surcharge Pool (Flood Pool)	FS ≥ 1.40	1.68	1.77
Seismic (Pseudo-static)	FS ≥ 1.00	1.13	1.03
Post-liquefaction	FS ≥ 1.20	1.70	1.78

The calculated factors of safety are greater than the minimum values required in §257.73(e)(1)(i) through (iv) and thereby satisfy the regulatory requirement.

3 Conclusions

The calculated factors of safety from the limit equilibrium slope stability analysis satisfy the CCR Rule §257.73 (e) requirements for all the load cases analyzed at the critical analysis section for the embankment that comprises the perimeter of the impoundment. Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool, seismic (pseudo-static), and static post-liquefaction.

4 Certification

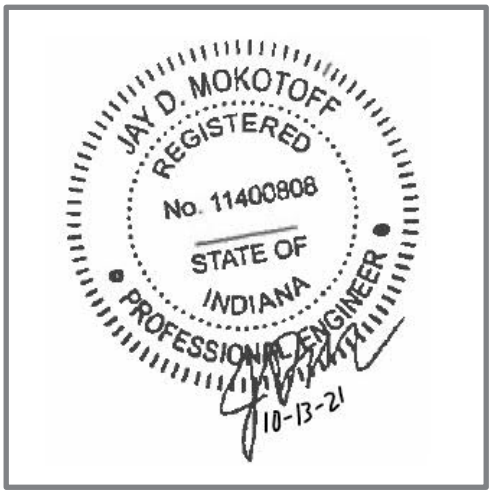
This Certification Statement documents that the East Ash Pond at the F. B. Culley Generating Station meets the Safety Factor Assessment requirements specified in 40 CFR §257.73 (e). The East Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the specified documentation and assessments for an existing CCR surface impoundment be prepared within five years of the placement of the previous assessment in the facility's operating record. Since the Initial Safety Factor Assessment was placed in the facility's operating record on October 13, 2016, the deadline for completing this 5-year update is October 13, 2021.

CCR Unit: Southern Indiana Gas & Electric Company; F. B. Culley Generating Station; East Ash Pond

I, Jay Mokotoff, being a Registered Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the Safety Factor Assessment dated October 13, 2021 meets the requirements of 40 CFR §257.73 (e).

Jay Mokotoff
Printed Name

10-13-2021
Date



5 Limitations

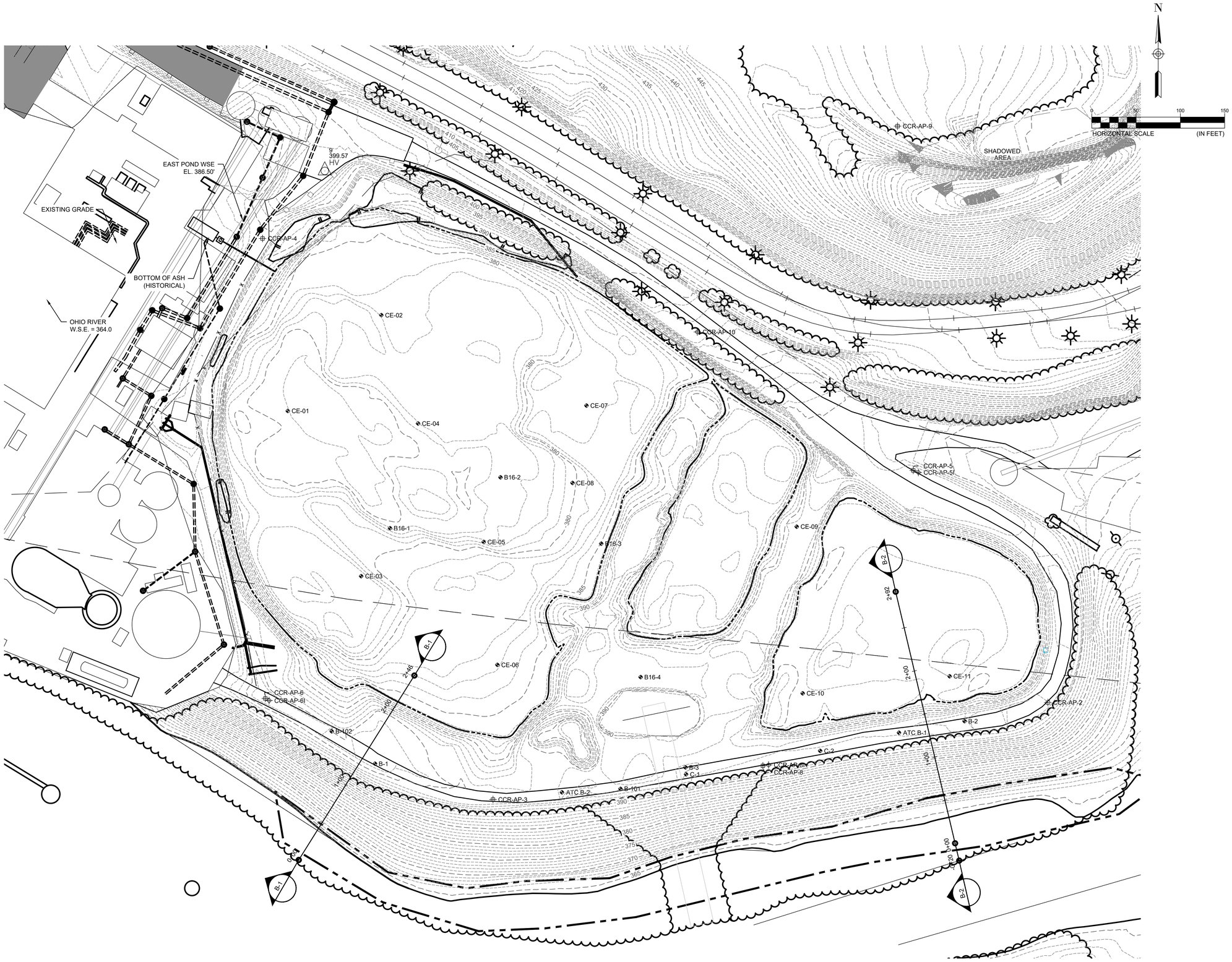
Background information, design basis, and other data have been furnished to AECOM by SIGECO. AECOM has used this data in preparing this report. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information. Our recommendations are based on available information from previous and current investigations. These recommendations may be updated as future investigations are performed.

Borings were performed as part of historical investigations at the East Pond (including work performed by AECOM as part of the 2015 and 2016 initial safety factor assessment) and were spaced as closely as economically feasible, but variations in soil properties between borings, that may become evident at a later date, are possible. The conclusions developed in this report are based on the assumption that the subsurface soil, rock, and groundwater conditions do not deviate appreciably from those encountered in the site-specific exploratory borings. If any variations or undesirable conditions are encountered in any future exploration, we should be notified so that additional analyses can be made, if necessary.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by Client. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the findings, and revise the report if necessary.

This periodic assessment and all previous related geotechnical investigations and analyses were performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the geological and geotechnical engineering profession. The conclusions presented in this report are professional opinions based on the indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

Appendix A
Cross-Section Location



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F.B. CULLEY GENERATING STATION

CCR CERTIFICATION
EAST ASH POND

ISSUED FOR CERTIFICATION

ISSUED FOR BIDDING	DATE	BY
ISSUED FOR CONSTRUCTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60442676
DRAWN BY:	
DESIGNED BY:	
CHECKED BY:	
DATE CREATED:	
PLOT DATE:	10/13/2021
SCALE:	
ACAD VER:	2019

SHEET TITLE

CROSS-SECTION
LAYOUT PLAN

FIGURE 1

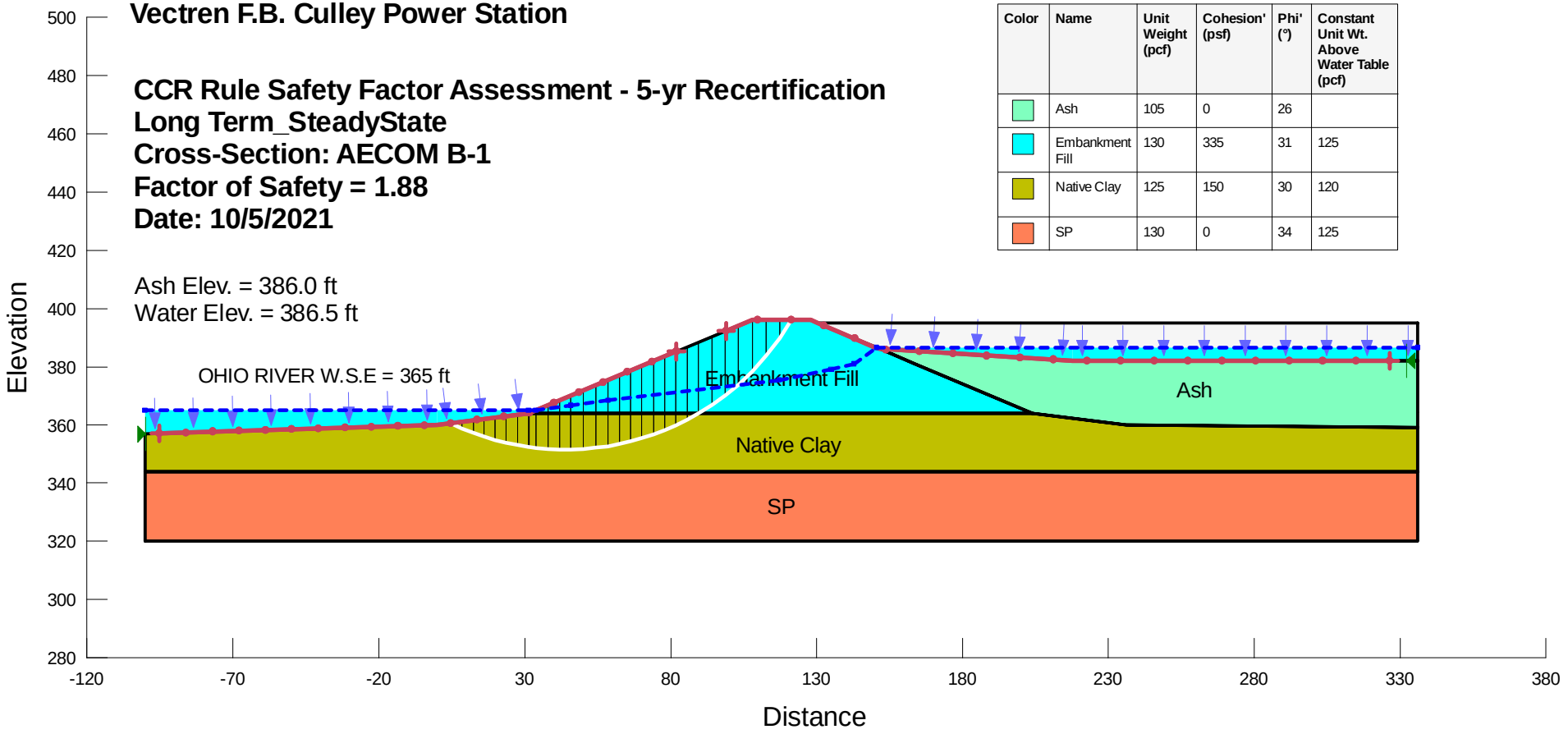
Appendix B
Slope Stability Analysis Calculations

East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Long Term_SteadyState
Cross-Section: AECOM B-1
Factor of Safety = 1.88
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	26	
	Embankment Fill	130	335	31	125
	Native Clay	125	150	30	120
	SP	130	0	34	125

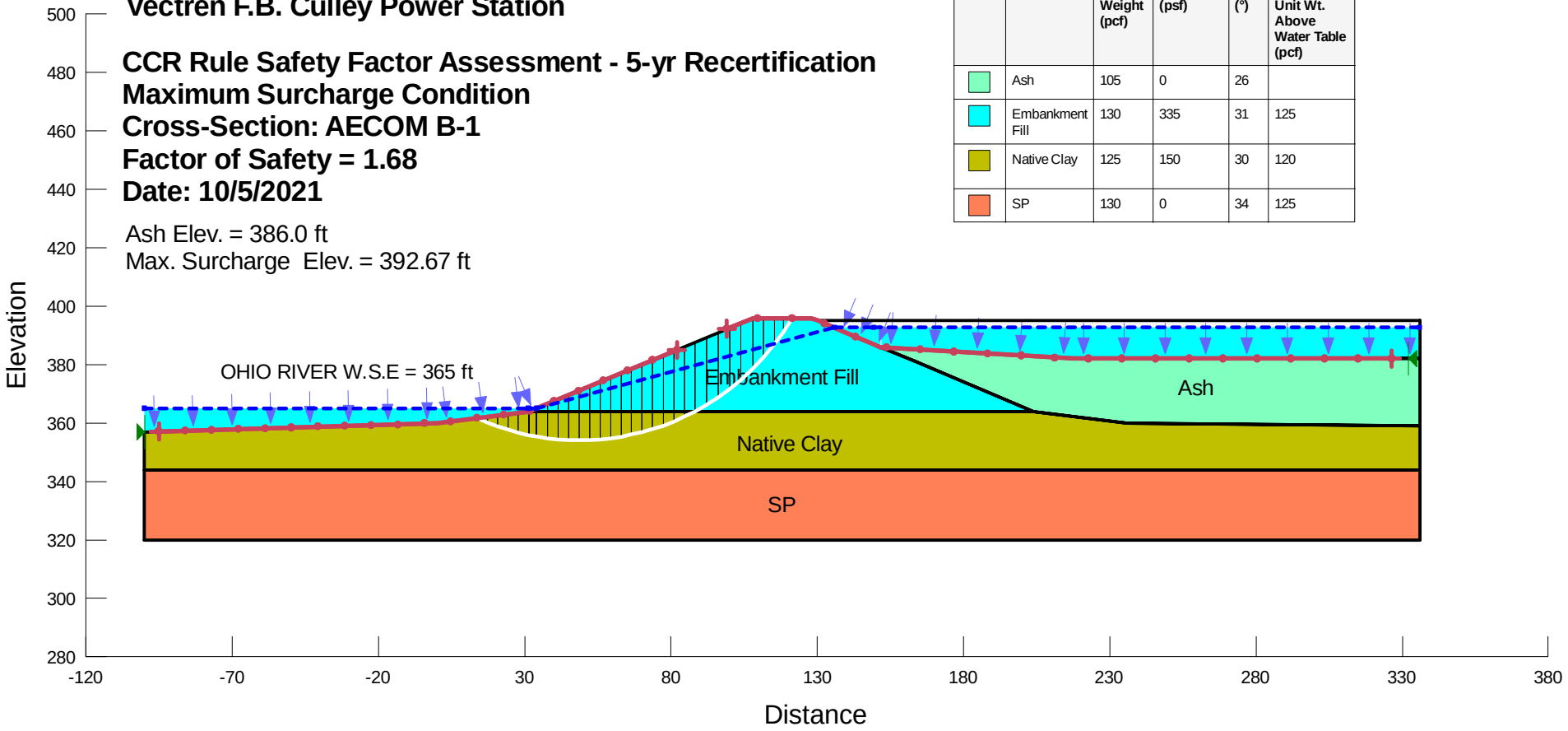


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Maximum Surcharge Condition
Cross-Section: AECOM B-1
Factor of Safety = 1.68
Date: 10/5/2021

Ash Elev. = 386.0 ft
Max. Surcharge Elev. = 392.67 ft

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	26	
	Embankment Fill	130	335	31	125
	Native Clay	125	150	30	120
	SP	130	0	34	125

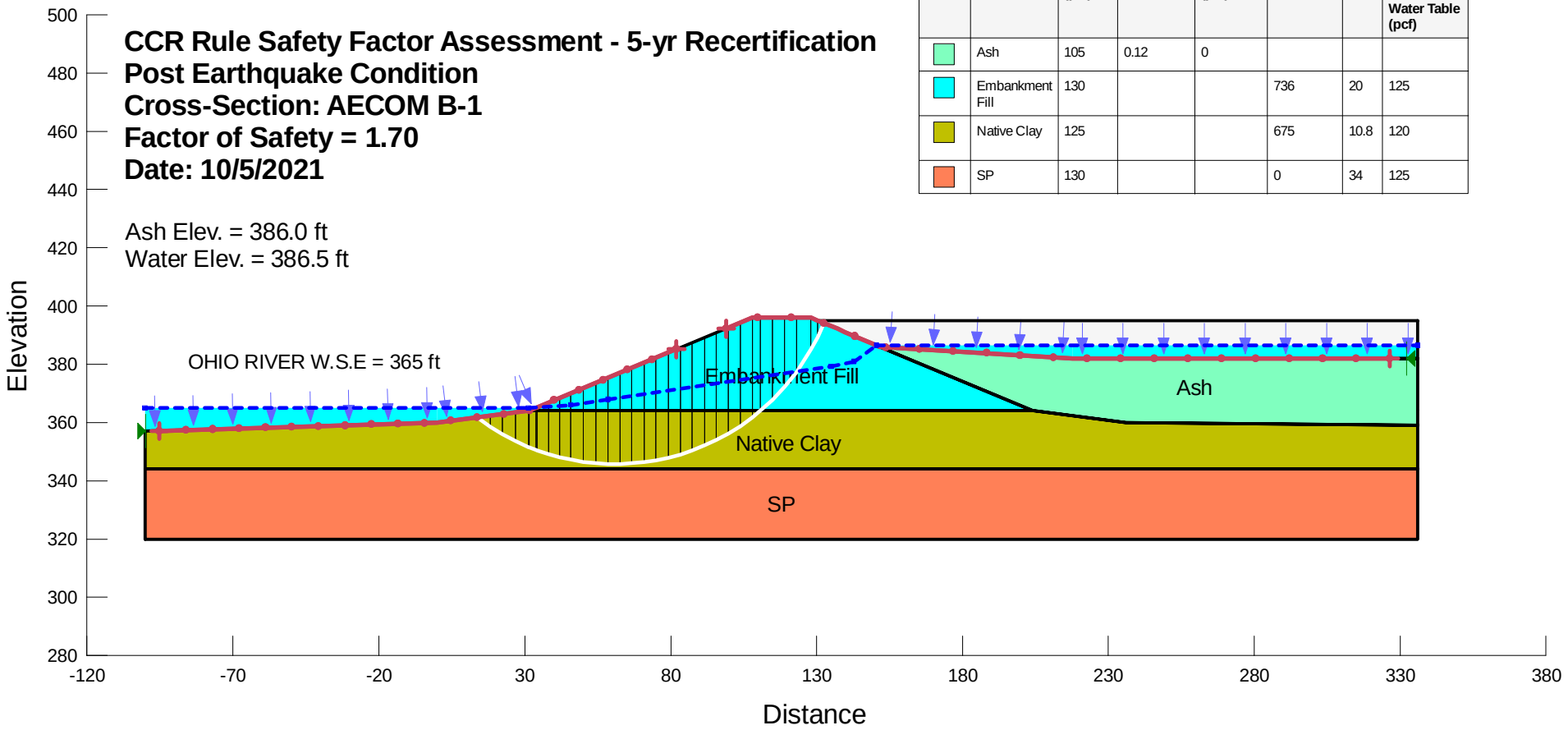


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Post Earthquake Condition
Cross-Section: AECOM B-1
Factor of Safety = 1.70
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft

Color	Name	Unit Weight (pcf)	Tau/Sigma Ratio	Minimum Strength (psf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0.12	0			
	Embankment Fill	130			736	20	125
	Native Clay	125			675	10.8	120
	SP	130			0	34	125

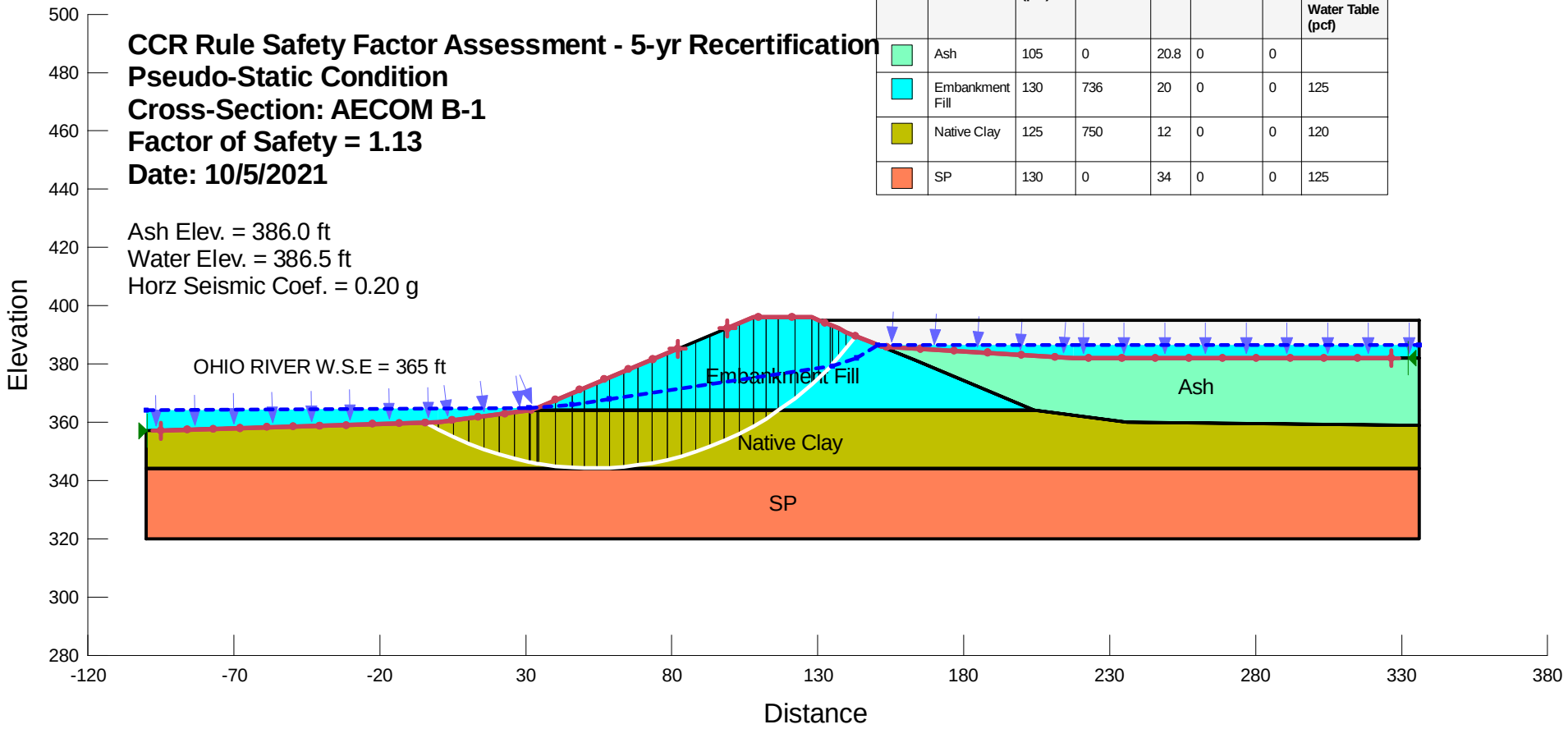


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Pseudo-Static Condition
Cross-Section: AECOM B-1
Factor of Safety = 1.13
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft
Horz Seismic Coef. = 0.20 g

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Cohesion R (psf)	Phi R (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	20.8	0	0	
	Embankment Fill	130	736	20	0	0	125
	Native Clay	125	750	12	0	0	120
	SP	130	0	34	0	0	125

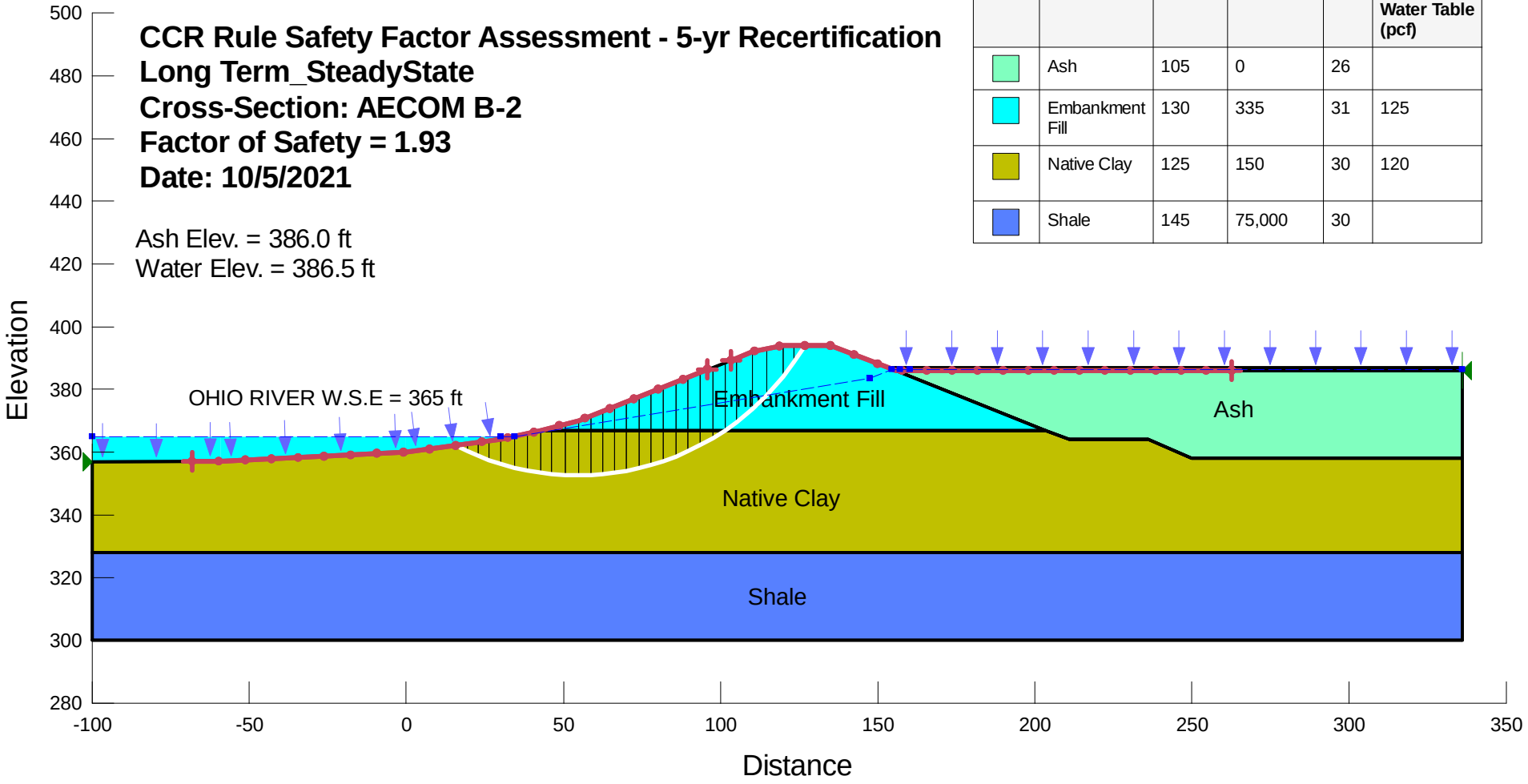


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Long Term_SteadyState
Cross-Section: AECOM B-2
Factor of Safety = 1.93
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	26	
	Embankment Fill	130	335	31	125
	Native Clay	125	150	30	120
	Shale	145	75,000	30	

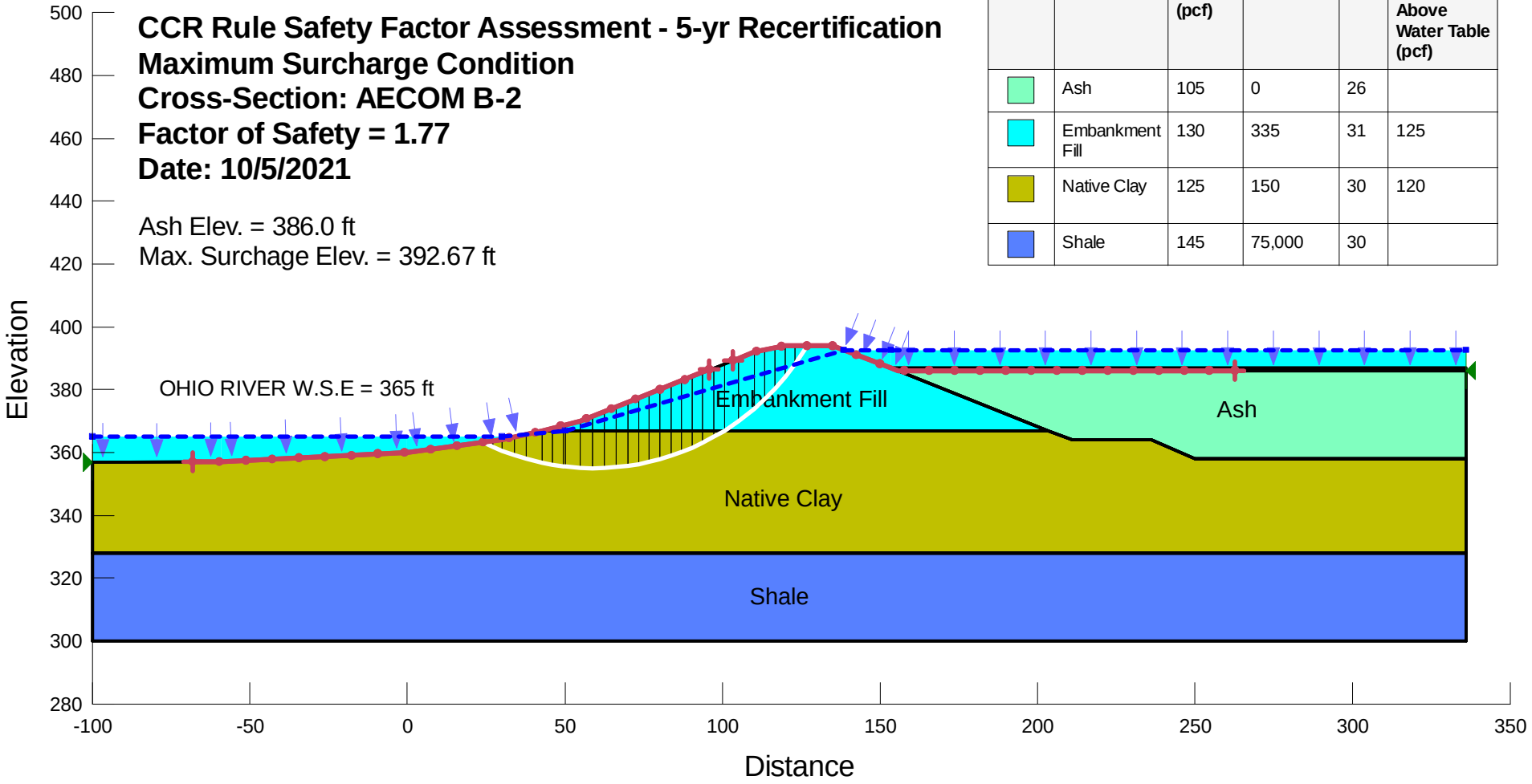


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Maximum Surcharge Condition
Cross-Section: AECOM B-2
Factor of Safety = 1.77
Date: 10/5/2021

Ash Elev. = 386.0 ft
Max. Surchage Elev. = 392.67 ft

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	26	
	Embankment Fill	130	335	31	125
	Native Clay	125	150	30	120
	Shale	145	75,000	30	

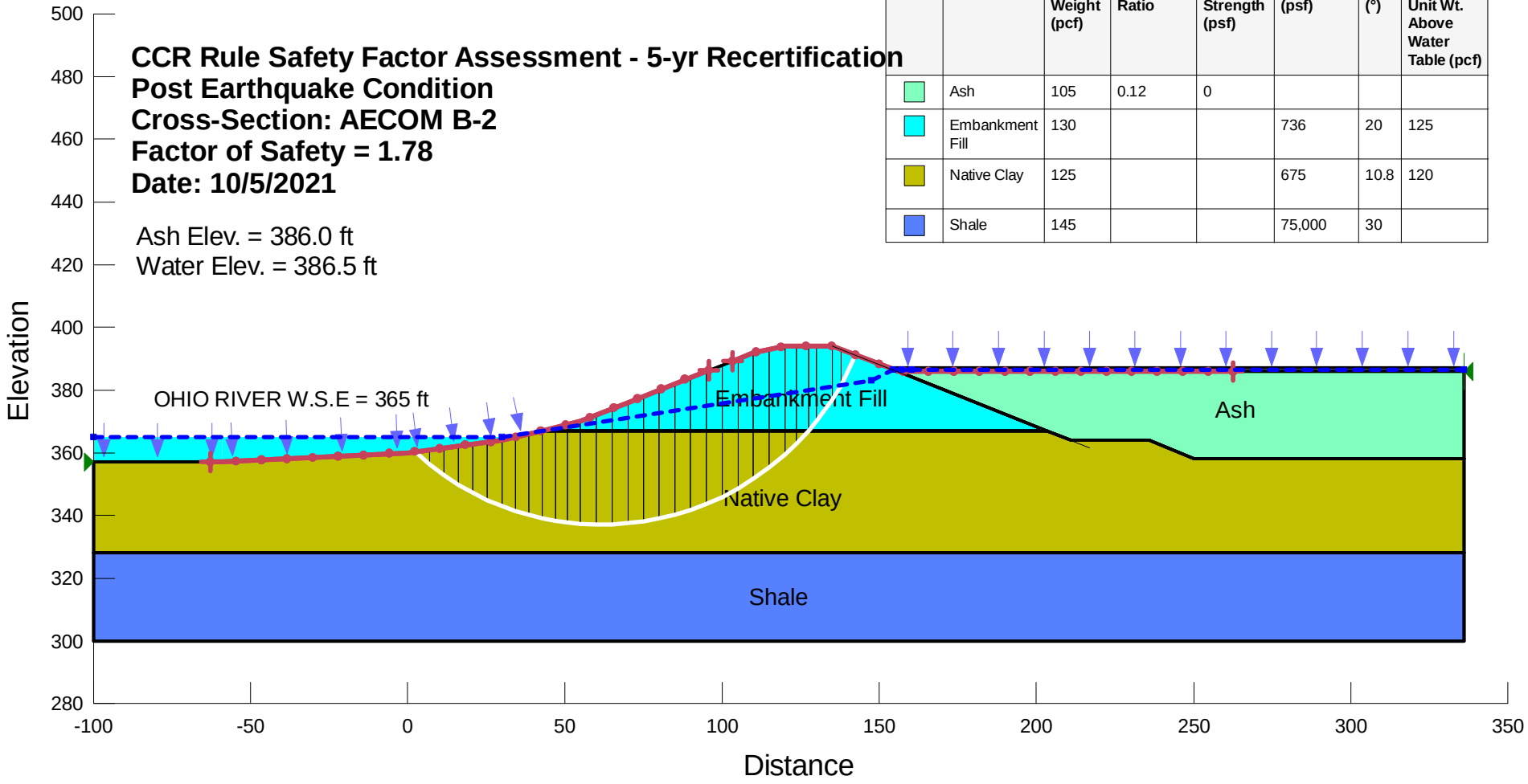


East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Post Earthquake Condition
Cross-Section: AECOM B-2
Factor of Safety = 1.78
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft

Color	Name	Unit Weight (pcf)	Tau/Sigma Ratio	Minimum Strength (psf)	Cohesion' (psf)	Phi' (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0.12	0			
	Embankment Fill	130			736	20	125
	Native Clay	125			675	10.8	120
	Shale	145			75,000	30	



East Ash Pond Evaluation
Vectren F.B. Culley Power Station

CCR Rule Safety Factor Assessment - 5-yr Recertification
Pseudo-Static Condition
Cross-Section: AECOM B-2
Factor of Safety = 1.03
Date: 10/5/2021

Ash Elev. = 386.0 ft
Water Elev. = 386.5 ft
Horz Seismic Coef. = 0.20 g

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Cohesion R (psf)	Phi R (°)	Constant Unit Wt. Above Water Table (pcf)
	Ash	105	0	20.8	0	0	
	Embankment Fill	130	736	20	0	0	125
	Native Clay	125	750	12	0	0	120
	Shale	145	75,000	30	0	0