PERIODIC SAFETY FACTOR ASSESSMENT
PLANT GREENE COUNTY ASH POND
ALABAMA POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261) and the State of Alabama's ADEM Admin. Code Chapter 335-13-15 require the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. Per §257.73(e) and ADEM Admin. Code r. 335-13-15-.04(4)(e), the owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1)(i) through (iv) for the critical embankment section are achieved. In addition, §257.73(f)(3) and ADEM Admin. Code r. 335-13-15-.04(4)(f)3. require a subsequent assessment be performed within 5 years of the previous assessment.

The CCR surface impoundment located at Alabama Power Company's Plant Greene County also referred to as the Plant Greene County Ash Pond is located on Plant Greene County property, near Forkland and north of Demopolis, Alabama. The CCR surface impoundment is formed by an engineered perimeter embankment. The critical section of this CCR unit had previously been determined to be located on the south embankment, near the discharge area. The surface impoundment is currently undergoing closure and some CCR relocation as a part of the planned CCR footprint consolidation has begun. A review of recent changes within the impoundment has determined that the critical section remains on the south embankment.

The analyses used to determine the minimum safety factor for the critical section resulted in the following minimum safety factors:

Loading Condition	Minimum Calculated Safety Factor	Minimum Required Safety Factor
Long-term Maximum Storage Pool (Static)	3.7	1.5
Maximum Surcharge Pool (Static)	3.7	1.4
Seismic	3.0	1.0

The embankments are constructed of clays and clayey sands that are not susceptible to liquefaction. Therefore, a minimum liquefaction safety factor determination was not required.

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. §257.73 (e)(1) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1).

10/05/2021

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Southern Company

Technical and Project Solutions Calculation

Calculation Number:
TV-GC-APC795201-001

Project/Plant:	Unit(s):	Discipline/Area:
Plant Greene County Ash Pond	--	Env. Solutions
Title/Subject: Periodic Factor of Safety Assessment for CCR Rule		
Purpose/Objective: Determine the Factor of Safety of the Ash Pond Dike		
System or Equipment Tag Numbers: n/a	**Originator:** Jacob A. Jordan, P.E.	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	JAJ/07-08-21	JCP/07-08-21	JCP/07-08-21

Notes:

Purpose of Calculation

Stability analyses were previously performed in conjunction with the EPA site inspection in 2010, and in 2016 for the CCR Rule. The purpose of this calculation is to update the 2016 stability analysis of the Ash Pond Dike.

Summary of Conclusions

The following table lists the factors of safety for various slope stability failure conditions. All conditions are steady state except where noted. Construction cases were not considered. The analyses indicate that in all cases the factor of safety is at or above the require minimum.

Load Conditions	Computed Factor of Safety	Required Minimum Factor of Safety
Long-term Maximum Storage (Static)	3.7	1.5
Maximum Surcharge Pool (Static)	3.7	1.4
Seismic	3.0	1.0

Methodology

The calculation was performed using the following methods and software:

- GeoStudio 2021 R2 version 11.1.1.22085 Copyright 1991-2021, GEO-SLOPE International, Ltd.
- Strata (Version 0.8.0), University of Texas, Austin
- Morgenstern-Price analytical method

Criteria and Assumptions

The slope stability models were run using the following assumptions and design criteria:

- Seismic site response was determined using a one-dimensional equivalent linear site response analysis. The analysis was performed using Strata and utilizing random vibration theory. The input motion consisted of the USGS published 2014 Uniform Hazard Response Spectrum (UHRS) for Site Class B/C at a 2% Probability of Exceedance in 50 years. The UHRS was converted to a Fourier Amplitude Spectrum, and propagated through a representative one-dimensional soil column using linear wave propagation with strain-dependent dynamic soil properties. The input soil properties and layer thickness were randomized based on defined statistical distributions to perform Monte Carlo simulations for 100 realizations, which were used to generate a median estimate of the surface ground motions.
- The median surface ground motions were then used to calculate a pseudostatic seismic coefficient for utilization in the stability analysis using the approach suggested by Bray and Tavasarou (2009). The procedure calculates the seismic coefficient for an allowable seismic displacement and a probability exceedance of the displacement. For this analysis, an allowable displacement of 0.5 ft, and a probability of exceedance of 16% were conservatively selected, providing a seismic coefficient of 0.062g for use as a horizontal acceleration in the stability analysis.

- The current required minimum criteria (factors of safety) were taken from the Structural Integrity Criteria for existing CCR surface impoundment from 40 CFR 257.73, published April 17, 2015.

Ash Pond Dike

- The soil properties of unit weight, phi angle, and cohesion were obtained from laboratory test results, including triaxial shear testing performed on UD samples from borings drilled on the Ash Pond dike in June 2016.
- Dike geometry was determined by reviewing section drawings from the design phase of construction, and from LiDAR and bathymetric surveys.

Design Inputs/References

- SCS Calculation TV-GC-APC390793-001
- USGS Earthquake Hazards website, *earthquake.usgs.gov/hazards/interactive*
- US Corps of Engineers Manual EM 1110-2-1902, October 2003
- Bray, J. D. and Travasarou, T., *Pseudostatic Coefficient for Use in Simplified Seismic Slope Stability Evaluation*, Journal of Geotechnical and Environmental Engineering, American Society of Civil Engineers, September 2009

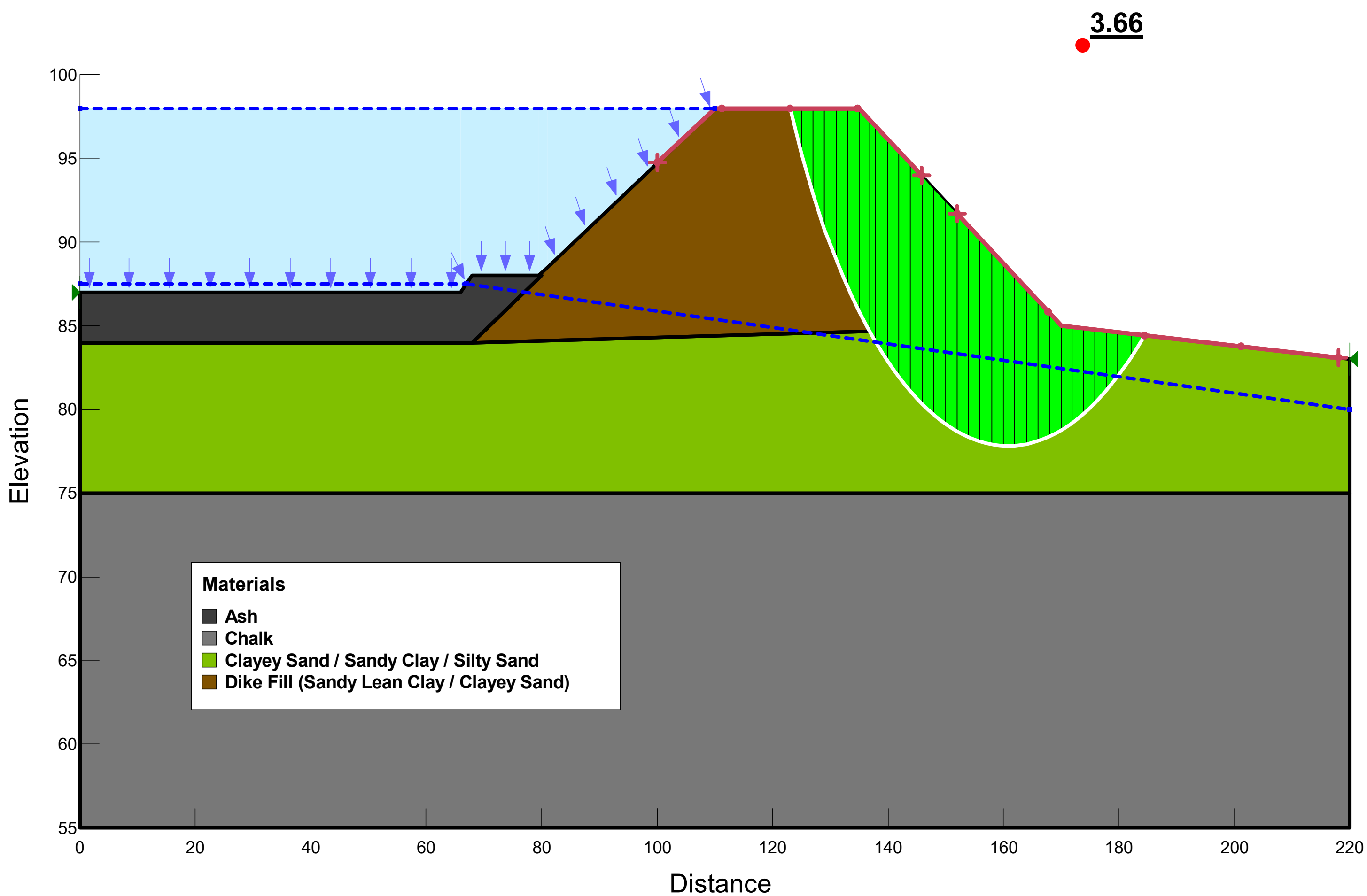
Body of Calculation

SLOPE/W modeling attached.

Plant Greene County
Factor of Safey Assessment

Maximum Pool Surcharge

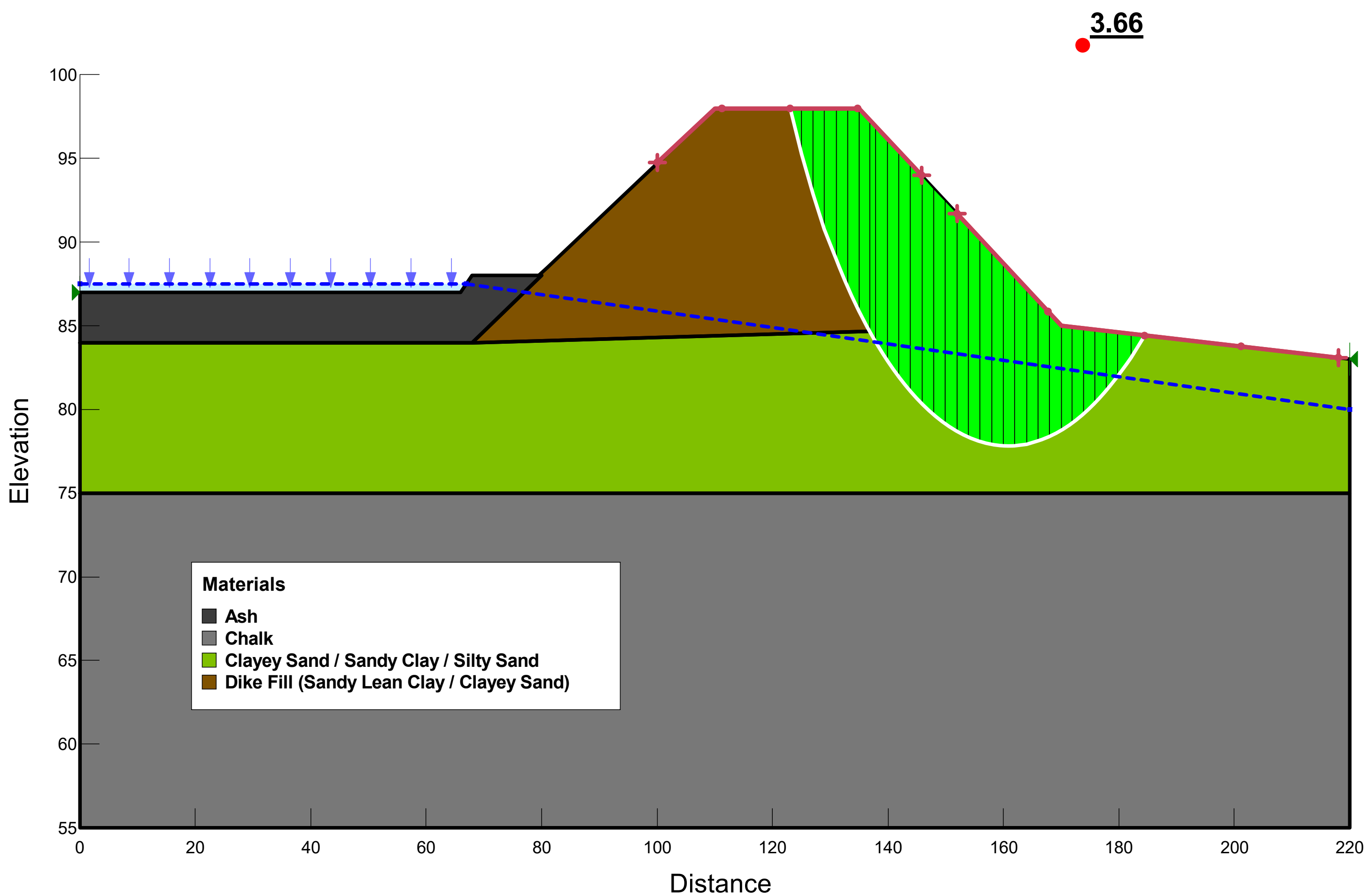
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Ash	Mohr-Coulomb	80	0	28
	Chalk	Bedrock (Impenetrable)			
	Clayey Sand / Sandy Clay / Silty Sand	Mohr-Coulomb	128	158	35
	Dike Fill (Sandy Lean Clay / Clayey Sand)	Mohr-Coulomb	115	250	35



Plant Greene County
Factor of Safey Assessment

Maximum Storage

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Ash	Mohr-Coulomb	80	0	28
	Chalk	Bedrock (Impenetrable)			
	Clayey Sand / Sandy Clay / Silty Sand	Mohr-Coulomb	128	158	35
	Dike Fill (Sandy Lean Clay / Clayey Sand)	Mohr-Coulomb	115	250	35



Plant Greene County
Factor of Safey Assessment

Seismic Loading
Horzontal Coefficient: 0.062g

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion R (psf)	Phi R (°)
	Ash	Mohr-Coulomb	80	0	28	0	0
	Chalk	Bedrock (Impenetrable)					
	Clayey Sand / Sandy Clay / Silty Sand	Mohr-Coulomb	128	158	35	0	0
	Dike Fill (Sandy Lean Clay / Clayey Sand)	Mohr-Coulomb	115	250	35	0	0