INITIAL SAFETY FACTOR ASSESSMENT
PLANT SMITH ASH POND
GULF POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261), §257.73(e), requires the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. The owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) for the critical embankment section are achieved.

The CCR surface impoundment located at Gulf Power Company's Plant Smith, also referred to as the Plant Smith Ash Pond, is located on Plant Smith property near Southport, Florida. The CCR surface impoundment is formed by an embankment system comprised of both incised and dike configurations. The critical section of this CCR unit has been determined to be located on the eastern end of the northern dike.

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)	1.6	1.5
Maximum Surcharge Pool (Static)	1.6	1.4
Seismic	1.5	1.0

The embankments are constructed of soils that have potential susceptibility to liquefaction due to soil classification and grain size. The minimum calculated liquefaction safety factor is 1.2, which meets the required minimum safety factor of 1.2.

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. Part 257.73 (e)(1).

10/17/16

James C. Pegues, P.E.
Licensed State of Florida, PE No. 52519

JAMES C. PEGUES LICENSE No. 52519 ★ STATE OF FLORIDA PROFESSIONAL ENGINEER

SOUTHERN COMPANY

Engineering and Construction Services Calculation

Calculation Number: TV-SM-FPC165656-001

Project/Plant: Plant Smith Ash Pond	**Unit(s):** -	**Discipline/Area:** TS-ENVSFS
Title/Subject: Factor of Safety Analysis		
Purpose/Objective: Analyze Factor of Safety of the Ash Pond		
System or Equipment Tag Numbers: NA	**Originator:** Joshua A. Lippert, P.E.	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	JAL/10-5-16	GHM/10-5-16	JCP/10-5-16

Notes:

Purpose of Calculation

Gulf Power Company's Plant Smith operates a surface impoundment that has historically been used to manage coal combustion residuals (bottom ash and fly ash) and for water treatment. The impoundment, or ash pond, is constructed of a compacted soil and ash perimeter dike, with interior dikes used for material handling and management. This calculation is intended to calculate the stability of the perimeter dike of the ash pond.

Summary of Conclusions

The results of the analyses are summarized below. Output graphics are located in the body of the calculations. The analyses indicate that the exterior berms are stable with a factor of safety against sliding greater than the required minimum for all analyzed cases.

Condition	Minimum Required Factor of Safety	Calculated Factor of Safety
Static with Maximum Storage Pool	1.5	1.57
Static with Maximum Surcharge Pool	1.4	1.57
Seismic	1.0	1.51

Methodology

The calculation was performed using the following method and software:

SLOPE/W, Version 8.15, Copyright 1991-2016 GEO-SLOPE International Ltd., Calgary, Alberta, Canada, using the Morgenstern-Price method.

Strata (Version alpha, Revision 0.2.0), Geotechnical Engineering Center, Department of Civil, Architectural, and Environmental Engineering, University of Texas.

Assumptions

The slope stability model was run using the following assumptions:

- Based on previous analyses, the eastern portion of the north dike of the ash pond was identified as the critical section. While not the highest section of the dike, the

subgrade soils in this area are weaker than in other parts of the dike, leading to a comparatively reduced factor of safety.
- The top of the ponded ash is at EL18.
- Maximum storage pool is at EL18.
- Maximum surcharge pool is at EL20, the top of dike elevation.
- The properties of unit weight, phi angle, and cohesion of the soil and ash were taken from laboratory testing conducted for the April 2010 *Ash Pond Evaluation* report. Material properties are as follows:

Soil Type	Unit Weight, pcf	Cohesion, psf	Phi Angle, deg
Sand (berm and foundation soils)	120	0	30
Compacted Ash	80	100	27
Ash	70	50	24

Criteria

The slope stability analyses were based on the most recent design and as-built drawings available at the time of this calculation. Soil and ash properties were obtained from testing performed for the April 2010 *Ash Pond Evaluation, Plant Lansing Smith* by the Earth Science and Environmental Engineering (ES&EE) group of Southern Company Generation.

The following scenarios were evaluated for the fully stacked condition:
1. Static with Maximum Storage Pool
2. Static with Maximum Surcharge Pool
3. Seismic Loading – Maximum storage pool plus seismic loading of 0.012g

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 2008 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 0.012g for use as a horizontal acceleration in the stability analysis.

Design Inputs/References

Southern Company Services, Inc., 2010, *Ash Pond Evaluation, Plant Lansing Smith*, Birmingham, AL

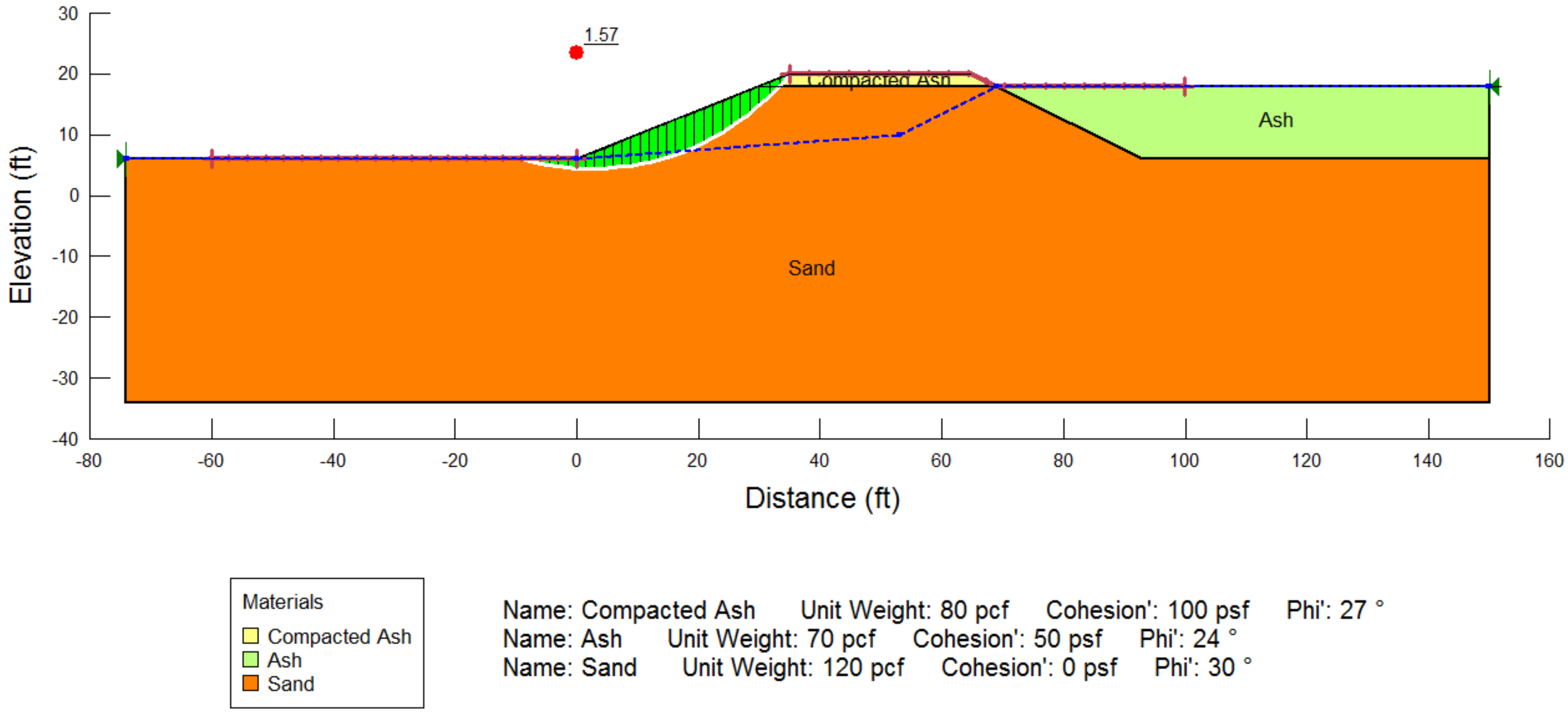
E&CS Drawings ES1840S1, ES1840S2

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

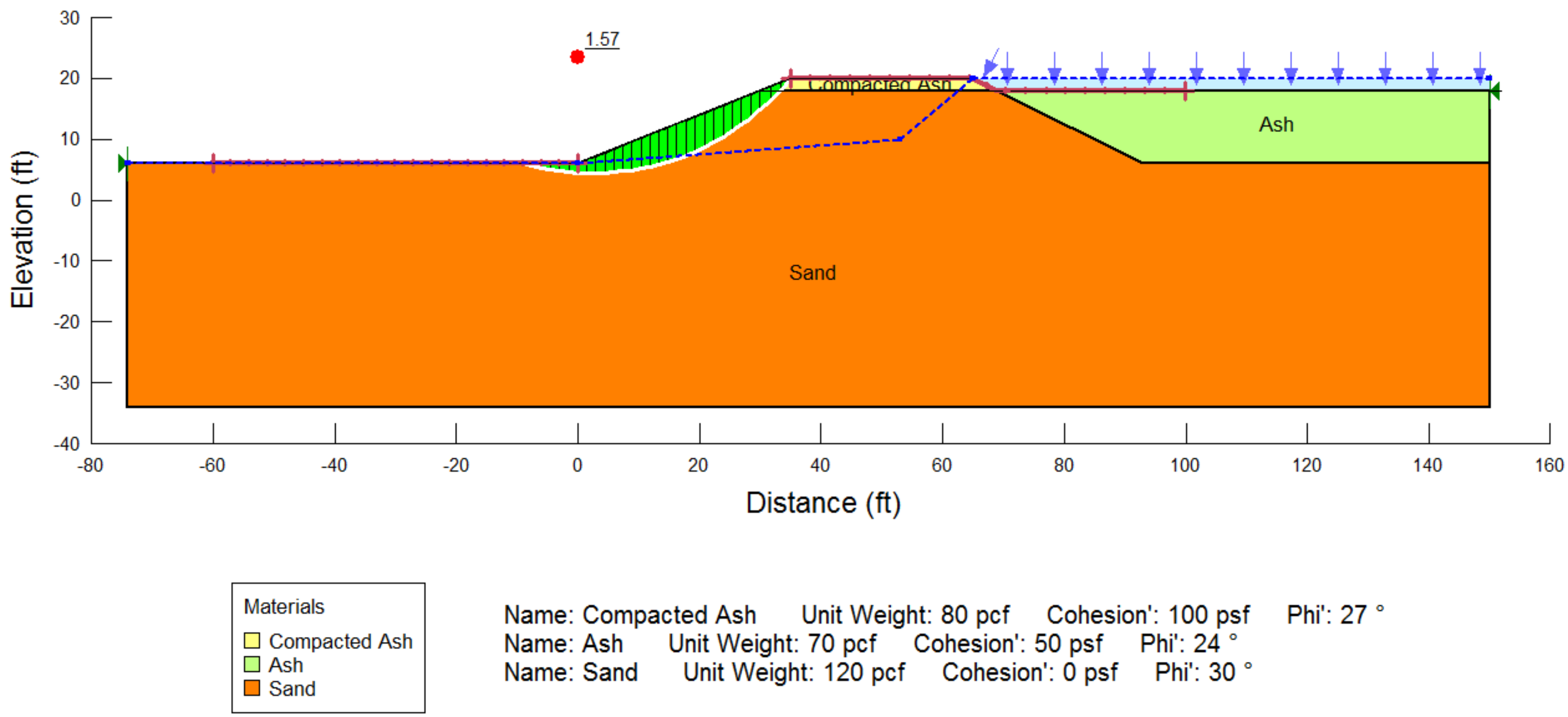
See following pages.

Plant Smith Ash Pond
Name: Static - Maximum Storage Pool
Method: Morgenstern-Price
Horz Seismic Coef.:



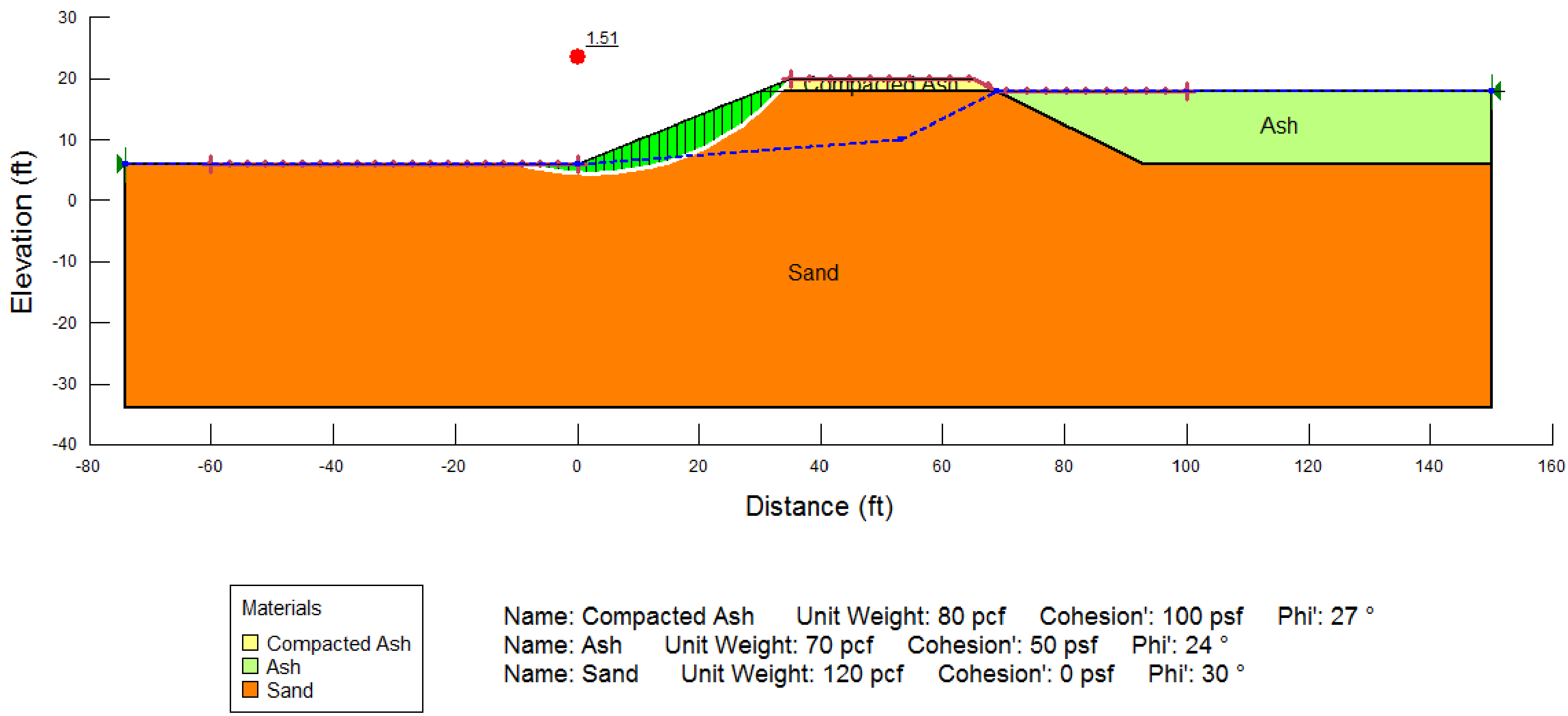
Name: Compacted Ash Unit Weight: 80 pcf Cohesion': 100 psf Phi': 27 °
Name: Ash Unit Weight: 70 pcf Cohesion': 50 psf Phi': 24 °
Name: Sand Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °

Plant Smith Ash Pond
Name: Static - Maximum Surcharge Pool
Method: Morgenstern-Price
Horz Seismic Coef.:



Name: Compacted Ash Unit Weight: 80 pcf Cohesion': 100 psf Phi': 27 °
Name: Ash Unit Weight: 70 pcf Cohesion': 50 psf Phi': 24 °
Name: Sand Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °

Plant Smith Ash Pond
Name: Seismic
Method: Morgenstern-Price
Horz Seismic Coef.: 0.012



Name: Compacted Ash Unit Weight: 80 pcf Cohesion': 100 psf Phi': 27 °
Name: Ash Unit Weight: 70 pcf Cohesion': 50 psf Phi': 24 °
Name: Sand Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °