



# Five-Year Periodic Safety Factor Assessment

Fly Ash Reservoir II  
Brilliant, Ohio

October 2021

**Prepared For:**

Cardinal Operating Company  
306 County Road 7E  
Brilliant, Ohio 43913

**Prepared By:**

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A handwritten signature in black ink, appearing to read "Shawn McGee".

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Office Practice Leader

A handwritten signature in blue ink, appearing to read "Nakia Addison".

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Nakia Addison  
Project Manager

A handwritten signature in black ink, appearing to read "Jonathan Hotstream".

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Jonathan Hotstream  
Senior Scientist



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## 1.0 Introduction

The Cardinal Power Plant (Plant) is located in Wells Township, Jefferson County, near the town of Brilliant in eastern Ohio. The Plant is owned by Buckeye Power and AEP Generation Resources (GENCO). The Plant is operated by Cardinal Operating Company. The Plant operates the Fly Ash Reservoir II (FAR II) surface impoundments for storing coal combustion residuals (CCR). The FAR II is subject to the requirements of the United States Environmental Protection Agency's (USEPA) final CCR rule Title 40 Code of Federal Regulations (40 CFR) Part 257 Subpart D - "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." The initial safety factor assessment system plan was completed and placed into the Plant's operating record on October 9, 2016. A periodic safety factor assessment is required every 5 years pursuant to 40 CFR 257.73(e)(3).

The FAR II is impounded behind a dam that is approximately 250-feet high with a 30-foot-wide crest. The most recent dam modification was in 2013 where it was raised to its current height using back-to-back mechanically stabilized earth walls. The dam has had no major modifications since 2016, and conditions evaluated in the initial Safety Factor Assessment are representative of current conditions.

### 1.1 Federal Regulations

Pursuant to 40 CFR 257.73(e), the calculated factors of safety for the critical cross section of a CCR unit must meet the following requirements:

- 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; and
- iv. the calculated liquefaction factor of safety must equal or exceed 1.20.

## 2.0 Objective

This report was prepared by TRC Engineers, Inc. (TRC) to fulfill requirements of the periodic Safety Factor Assessment (40 CFR 257.73(e)), documenting whether the calculated factors of safety the FAR II achieve the minimum requirements. This is the first 5-year periodic assessment.

To develop the periodic assessment TRC performed the following scope:

- Reviewed historical documents including:
  - Initial Safety Factor Assessment (S&ME, 2015)
  - Components of the FAR II Dam Permit Modification Application (S&ME, 2012)
    - Appendix D-3: Slope Stability Shear Strength Parameter Justification and Seismic Parameter Justification
    - Appendix D-4: Slope Stability Analysis
  - 2020 FAR II annual inspection (Amanda Graphics, LLC, 2021)
- Performed a site visit to observe current conditions on September 1, 2021
- Developed a 5-year periodic Safety Factor Assessment

### 3.0 Factor of Safety Calculations

The Dam Permit Modification Application (S&ME, 2012) provides the slope stability calculations for the FAR II dam representing the current configuration of the dam. These calculations provide support for the shear strength parameters used to model the dam features. TRC performed a cursory review of the model input parameters and determined that the parameters were consistent with good and accepted engineering practices.

These slope stability analyses for the Initial Safety Factor Assessment (S&ME, 2015) determined the factor of safety for the following conditions: end-of-construction, maximum storage pool, maximum surcharge pool, seismic, and liquefaction. The results are presented in the table below.

Condition	Minimum Safety Factor (40 CFR 257.73(e))	Calculated Safety Factor
End-of-Construction	N/A	1.58
Steady-State, maximum storage pool	1.5	1.75
Steady-state, maximum surcharge pool	1.4	1.68
Seismic loading	1.0	1.11
Embankment Liquefaction	1.2	Non-liquefiable <sup>(1)</sup>

Footnotes:

- (1) The foundation soils were determined to be non-liquefiable by S&ME because the dam embankment is founded on bedrock.

Factor of safety results were obtained using the Spencer Method of slope-stability analysis. Supporting results are provided in the Initial Safety Factor Assessment, reproduced in Appendix A.

### 3.1 Site Visit

TRC performed a site visit on September 1, 2021 to observe the current conditions of the FAR II dam. Based on the observations made during the site visit, the conditions presented in the global stability analysis included in the Initial Safety Factor Assessment appear to be representative of the current conditions of the FAR II dam.

## 4.0 Conclusions

Based on the document review and site visit, TRC determined that the conditions modeled in the Initial Safety Factor Assessment (S&ME, 2015) represent the current conditions of the FAR II. These global stability calculations developed by others meet the criteria of 40 CFR 257.73(e) based on the currently available data reviewed, and that the information reviewed is accurate and correct.

This Assessment has been completed in compliance with the requirements set forth in 40 CFR 257.73(e). This document will be placed in the operating record, posted to the publicly accessible website, and government notifications will be provided.

A Safety Factor Assessment must be performed every 5 years. The next periodic assessment is required by October 2026.

## 5.0 Limitations

The observations, assessment, and recommendations presented in this Report are based on our limited scope of work and on information disclosed by our visual observations, the conditions of the site at the time of the September 1, 2021 inspection, the design information available at the time of this investigation, and only apply to the Cardinal FAR II Dam. This work has been performed in accordance with our authorized scope of work and is based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other warranties, expressed or implied, are made or intended by this Report. These services were intended to provide an indication of the current, observable conditions of the dam at the time of the visual observations on the date indicated in this Report. Such a limited visual review does not account for other non-visible, hidden, subsurface or material condition analyses, and the professional services rendered are not guaranteed to be a representation by TRC of inaccessible and unobservable site conditions or actual conditions subsequent to the date of TRC's site visit. Therefore, the evaluations, conclusions, recommendations and opinions provided in this Report are subject to change as a result of future natural or manmade processes and as a result of an additional comprehensive, intrusive investigation and engineering analyses beyond TRC's visual observations. TRC is not responsible for any conclusions or opinions drawn by others from the data included herein, nor are the recommendations specifically presented in this Report intended for use or reliance as construction specifications.

## 6.0 Certification

I, the undersigned Ohio Professional Engineer, hereby certify that I am familiar with the technical requirements of 40 CFR 257 Subpart D. I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, that the information in this demonstration is in accordance with current good and accepted engineering practice(s) and standard(s) and meets the requirements of 40 CFR 257.73(e).

For the purpose of this document, “certify” and “certification” shall be interpreted and construed to be a “statement of professional opinion.” The certification is understood and intended to be an expression of my professional opinion as a Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

Shawn D. McGee, P.E.  
Name



Signature of Professional Engineer

PE.68761  
Engineer License Number

10/8/2021  
Date



## 7.0 References

Amanda Graphics, LLC. 2021. 2020 Annual Dam and Dike Inspection Report: Cardinal Plant – Fly Ash Dams 1, 2 & Bottom Ash Complex. January 2021.

S&ME. 2015. Safety Factor Assessment for the Fly Ash Reservoir II Dam at the Cardinal Power Plant. Brilliant, Ohio.

S&ME. 2012. Permit Modification Application for the Fly Ash Reservoir II Dam at the Cardinal Power Plant. Brilliant, Ohio.



## Appendix A: Initial Safety Factor Assessment

**Fly Ash Reservoir II Dam  
Initial Safety Factor Assessment**

**Cardinal Power Plant  
Brilliant, Ohio  
S&ME Project No. 7217-15-006A**



Prepared for:  
American Electric Power  
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Prepared by:  
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September 18, 2015



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## 1.0 Introduction

### 1.1 Background

In April of 2015, the US EPA formally published national regulations for disposal of coal combustion residuals (CCR) from electric facilities. As part of the rule, the owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that aspects of the CCR impoundments are in accordance with the rules. Based on our understanding of the Request for Fee Estimate received from AEP on April 29, 2015, AEP specifically requested P.E. certification to fulfill the requirements of 40 CFR § 257.73(e), *Periodic Safety Factor Assessments*. S&ME performed the design and construction administration for the dam raising completed in 2014. Due to our familiarity with the site, S&ME was selected to perform the Safety Factor Assessment for this facility. S&ME understands that certification and/or documentation for other structural integrity criteria will be performed by AEP or other consultants.

### 1.2 Location and Historic Overview

The Cardinal Power Plant is located along the Ohio River, approximately 8 miles south of Steubenville in Jefferson County. Then Fly Ash Reservoir II is an on-stream reservoir within the east branch of Blockhouse Run, located approximately, three-quarters of a mile north of the plant. Completed in 1986, the original earth fill dam, referred to as Stage 1, consisted of a 180 feet high arched dam constructed as a conventional zoned earth embankment. At 925 feet NGVD, the dam featured a 70-foot wide by 1,055-foot long crest. The maximum operating pool that could be achieved with the original configuration was El. 913. Construction of the first dam raising, referred to as Stage 2, was completed in 1997 which brought the dam to a maximum height of 225 feet with a 30 foot wide crest at Elevation 970 feet and a maximum operating pool Elevation of 960 feet. The dam raising was achieved through the use of an upstream soil cement block (cement stabilized bottom ash) in conjunction with a downstream earth fill along with extensions of the upstream bottom ash filter, clay core, chimney drain and downstream mine spoil shell. At the completion of the 1997 raising, the upper portion of the entire dam crest consisted of a minimum of 9 feet of RCC to both protect the dam from erosion and serve as a roadway. In 2013, the dam was raised an additional 13 feet with the construction of a double-sided mechanically stabilized earth (MSE) wall system on top of the RCC, raising the maximum operating pool to Elevation 974 feet. To control seepage, a cement-bentonite slurry wall was constructed which penetrated into the existing clay core. A non-structural vinyl sheet pile wall was then inserted full depth through the slurry wall and extended to the top of the raised dam in between the MSE reinforced zones. The raised dam also includes a modified auxiliary spillway composed of mass concrete, and a precast service spillway extension.

**Figure 1-1 – Location Map**

### **1.3 Previous Investigations and Design Work**

In 2010, the undersigned senior engineer, when in the employment of BBC&M Engineering, Inc., completed a supplemental geotechnical assessment of the FAR-II Dam. The assessment consisted of performing slope stability analysis for various steady-state, seismic, rapid drawdown, and surcharge loading cases load cases which were not previously addressed.

S&ME began design work for the FAR-II dam raising in 2011. In support of the design, S&ME conducted a subsurface investigation consisting of soil borings, test pits, and core samples of the soil cement block. S&ME then worked closely with AEP and state dam safety officials to permit this unique structure,

including evaluating a variety of seepage and stability failure modes as well as the potential for corrosion of the reinforced concrete wall panels. S&ME then served in a construction administration role for the duration of construction. Upon completion of the project in April of 2014, S&ME issued an Engineering Certification Letter to the Ohio Department of Natural Resources, Division of Soil and Water. S&ME also completed a First Filling Plan and updated the Operation, Maintenance, and Inspection Manual and Emergency Action Plan.

## 2.0 Scope of Work

In accordance with AEP's request, the following work items were performed by S&ME:

1. S&ME completed a cursory review of the previously conducted design work for the recent dam raising, as well as a previous design reports and construction documents made available by AEP.
2. S&ME visited the site along with personnel from AEP to observe the facility. It should be noted that the ODNR Division of Soil and Water, Dam Safety Section conducted the 1-year inspection of the dam in June of 2015 and concluded that construction was performed in accordance with the terms of the permit, plans, specifications, and approved changes.
3. Action values relating to instrumentation measurements were determined based on slope stability analyses using the critical cross-section and examination of historical piezometer readings provided by AEP.
4. Upon completing Tasks 1 through 4, S&ME's determined that there was sufficient information to certify the structural integrity of the surface impoundment in accordance with the requirements of 40 CFR § 257.73(e). A separate letter has been prepared to this effect.

## 3.0 Information Review and Site Visit

To support the safety factor assessment, S&ME conducted a cursory review of previous documents relating to the FAR-II Dam and conducted a site visit at the facility. While not a comprehensive list, AEP provided S&ME with the following documents during the course of our involvement with this facility:

- ◆ Design Report: Proposed Dam for Fly Ash Retention Pond II, December 1984
- ◆ Construction Plans, Fly Ash Dam 2
- ◆ Final Design Report: Proposed Earth Fill-Roller Compacted Concrete Raising of Dam for Fly Ash Retention Pond II, March, 1997
- ◆ Construction Plans, Dam Raising of Fly Ash Retention Dam II, March 1997
- ◆ RCC QA/QC Plan for 1997 Raising, July 1998
- ◆ 1997 Failure Repair Report
- ◆ 1999 Post Construction Performance Report
- ◆ 2004 Seepage Report

On August 18, 2015, the undersigned S&ME personnel met with Dr. Mohammad Ajlouni (AEP Civil Engineering) and Mr. Randy Sims (Landfill Operations) at the Cardinal Plant and conducted a site visit at the FAR-II Dam. The participants observed the site and discussed recent monitoring results, as well as

tentative plans to raise the pool level by adding additional stop logs. S&ME observed slight rutting along the wheel path on top of the dam, as well as minor settlement of the granular infill adjacent to the panels. Instrumentation readings from 12 tiltmeter sensors placed on the MSW wall panels indicate that both the upstream and downstream MSE wall panels are leaning outward slightly, however the rate of movement has now generally leveled off. This outward tilt appears to be an expression of the rotational movement needed to fully engage the geogrid reinforcement. S&ME understands that AEP is closely monitoring the ongoing instrumentation readings. While the site visit was not a formal inspection, visual observations of the FAR-II Dam did not reveal any dam safety concerns, and the downstream slopes appear to be in a similar condition as observed during construction of the recent dam raising.

## 4.0 Safety Factor Assessment

As part of the safety factor assessment, S&ME completed Parts 1 and 2 of Section 257.73(e) of the Final Rules for the Disposal of Coal Combustion Residuals from Electric Utilities published on April 17, 2015 in the Federal Register. In accordance with the Rule, the analysis was performed for the critical cross-section(s) that are anticipated to be most susceptible of all cross-sections to structural failure based on appropriate engineering considerations. The Rule specified the following loading conditions for analysis:

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

### 4.1 Limit Equilibrium Analyses

Our 2013 Dam Raising Design Report discusses in detail the subsurface investigation, laboratory testing, parameter justification, seepage analyses and limit equilibrium slope stability analyses that were performed to develop safety factors for the FAR-II Dam Raising design. S&ME focused on evaluating the cross-section through the high point of the dam with additional slope stability runs performed for the section through the existing emergency spillway. Two dimensional slope stability analyses were performed under End of Construction, Long Term Maximum Pool (Static), Maximum Surcharge Pool, Rapid Drawdown, and seismic loading conditions in conformance with the US Army Corps of Engineers Manual 1110-2-1902 entitled Slope Stability. The phreatic surface was modeled based on current piezometer data collected from at the site and the results of the finite element seepage analysis. However, the phreatic surface was entered manually to minimize the potential for computation uncertainty as compared to directly using the finite element analysis output pressures.

Shear strength parameters representing the existing dam zones were developed by AEP and their consultants for the design of the Stage 1 and Stage 2 dams. These values were used as the starting point for the Stage 3 global stability analyses but were modified in some cases to reflect the results of the current investigation or to investigate particular failure modes. Additionally, the Stage 3 raising included several new material zones: the MSE wall reinforced zone (No. 57 stone), ODOT Item 304 surface course,

the cement-bentonite slurry wall, and the vinyl sheet pile wall. The shear strength parameters for these new materials were estimated based on past experience. It should also be noted that the strength of these materials does not appreciably impact the global stability analyses. Additional discussion of the shear strength values for the most critical zones is provided in the 2013 Final Design Report.

#### 4.2 Liquefaction Potential of Embankment Soils

S&ME reviewed the material and compaction specifications of the embankment fill for the original dam construction and subsequent raisings. The dam was constructed entirely of engineered materials and was designed in accordance with the methods used to design conventional water reservoirs. The embankment fill consists of fine grained overburden soil and mine spoil fill from near the project site. With the exception of the blanket drain, chimney drain, and rip rap zone, all earthen material was compacted to 100% of the standard proctor compaction test. Based on this understanding, the embankment soils are considered non-liquefiable. Furthermore, liquefaction of the foundation soils is not a concern as the overburden beneath the dam was removed prior to fill placement, with the dam supported directly on bedrock.

#### 4.3 Summary of Results

Based on our previous investigations and current assessment of the Bottom Ash Pond facility, S&ME certifies that this assessment meets the requirements of 40 CFR § 257.73(e), *Periodic Safety Factor Assessments*. A summary of the computed safety factors for the critical cross-section is provided in Table 5-1. Also included in the table are the minimum values defined in 40 CFR § 257.73(e)(1) subparts (i) through (iv). Graphical output corresponding to the analysis cases are presented in Appendix II.

**Table 4-1 – Safety Factor Summary**

Analysis Case	Minimum Safety Factor	Computed Safety Factor
Long-term, maximum storage pool	1.50	1.75
Maximum surcharge pool	1.40	1.68
Pseudo-static seismic loading	1.00	1.11
Embankment Liquefaction	1.20	Non-liquefiable



## 5.0 Certification

Based on our previous investigation, design, and construction administration work associated with the Fly Ash Reservoir II Dam, S&ME certifies that this assessment meets the requirements of 40 CFR § 257.73(e), *Periodic Safety Factor Assessments*. A summary of the computed safety factors for the critical cross-section is provided in the table below. Also included in the table are the minimum values defined in 40 CFR § 257.73(e)(1) subparts (i) through (iv).



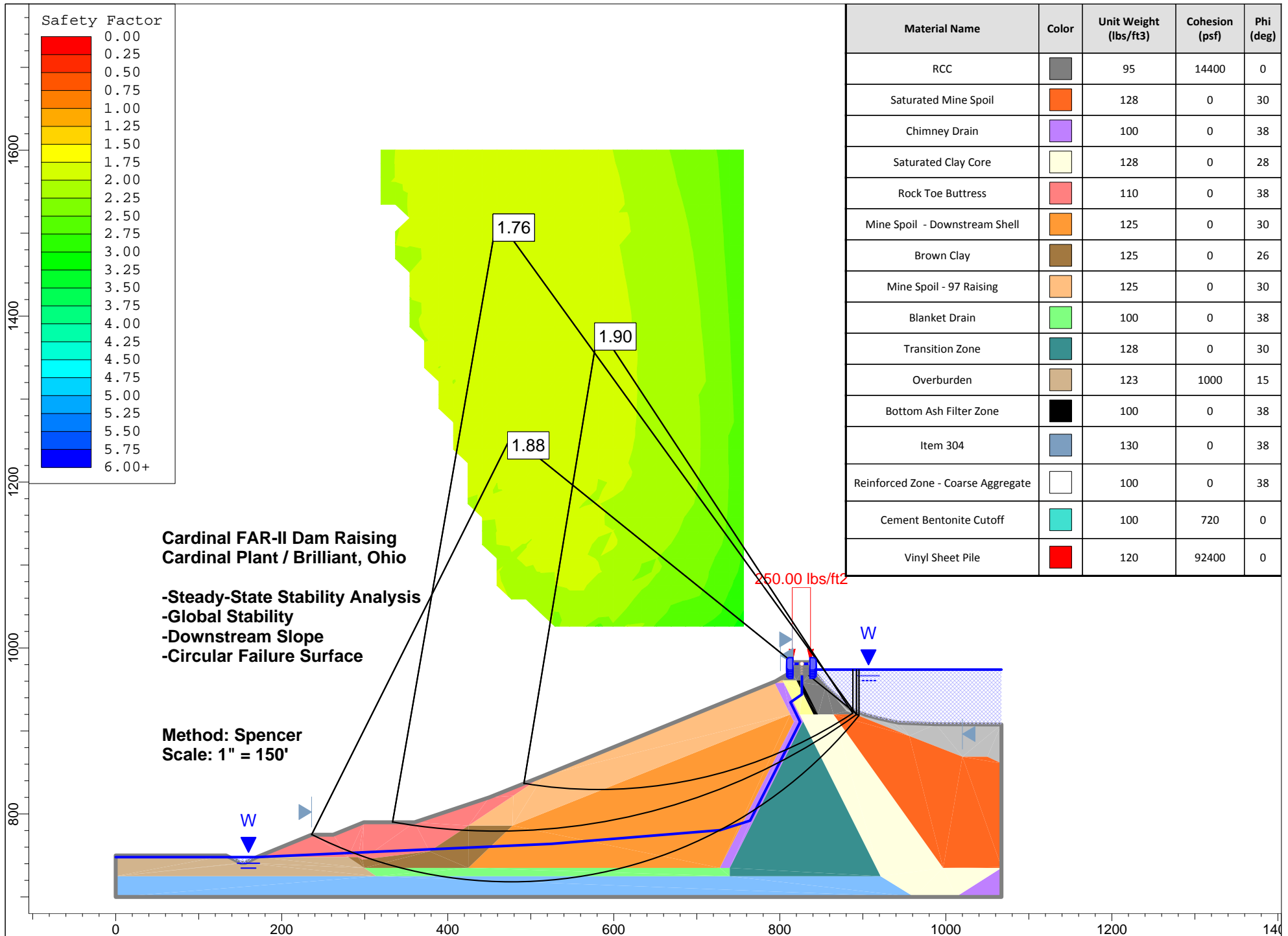
Michael T. Romanello, P.E.  
Project Engineer  
Registration No. 74384

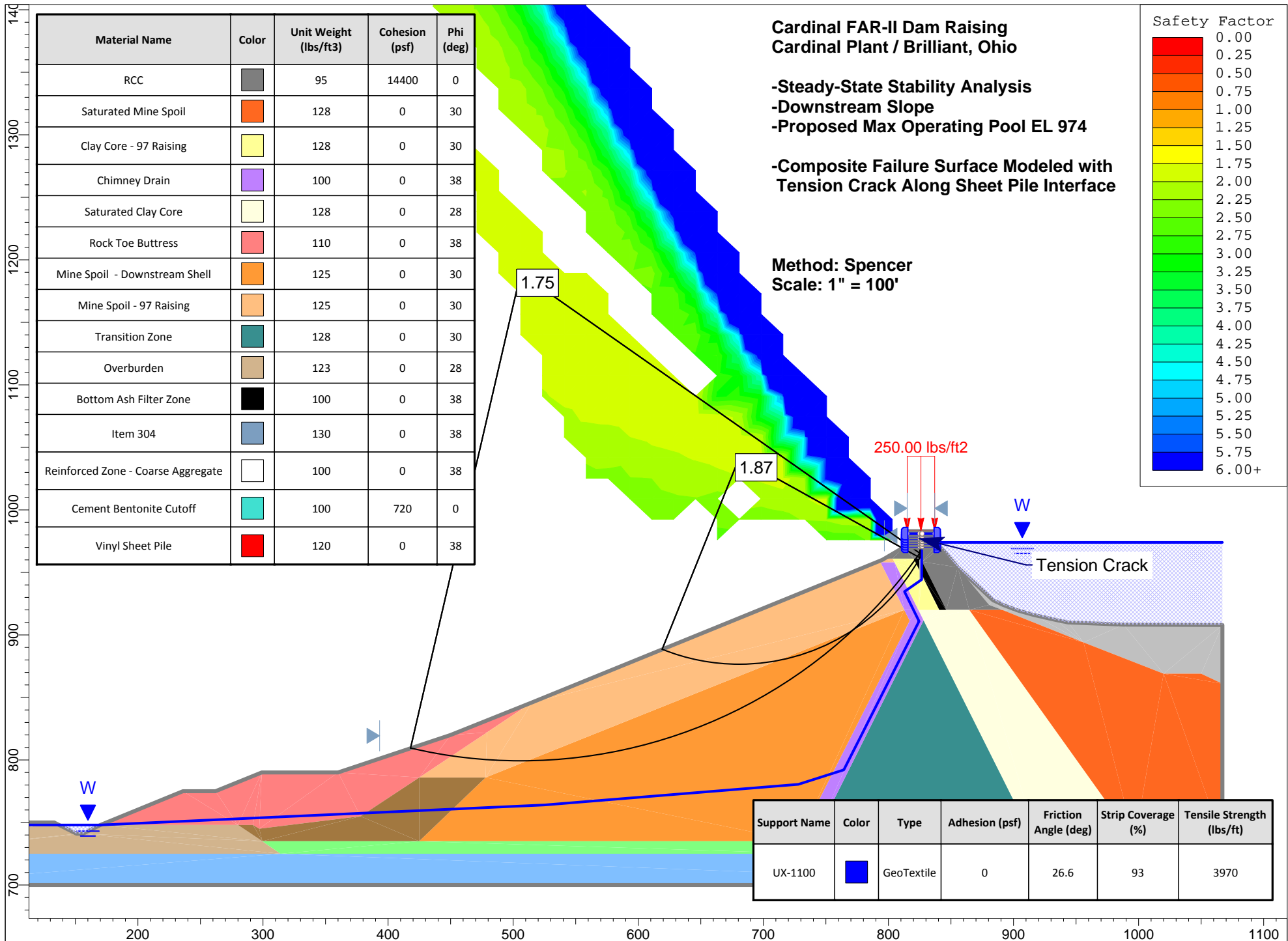


Michael G. Rowland, P.E.  
Senior Engineer  
Registration No. 65559

## **Appendices**

## **Appendix I – Safety Factor Assessment Figures**



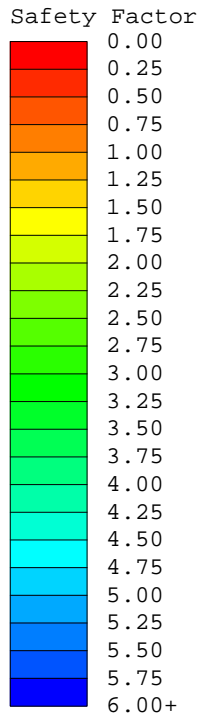


**Cardinal FAR-II Dam Raising  
Cardinal Plant / Brilliant, Ohio**

**-Steady-State Stability Analysis  
-Downstream Slope  
-Proposed Max Operating Pool EL 974**

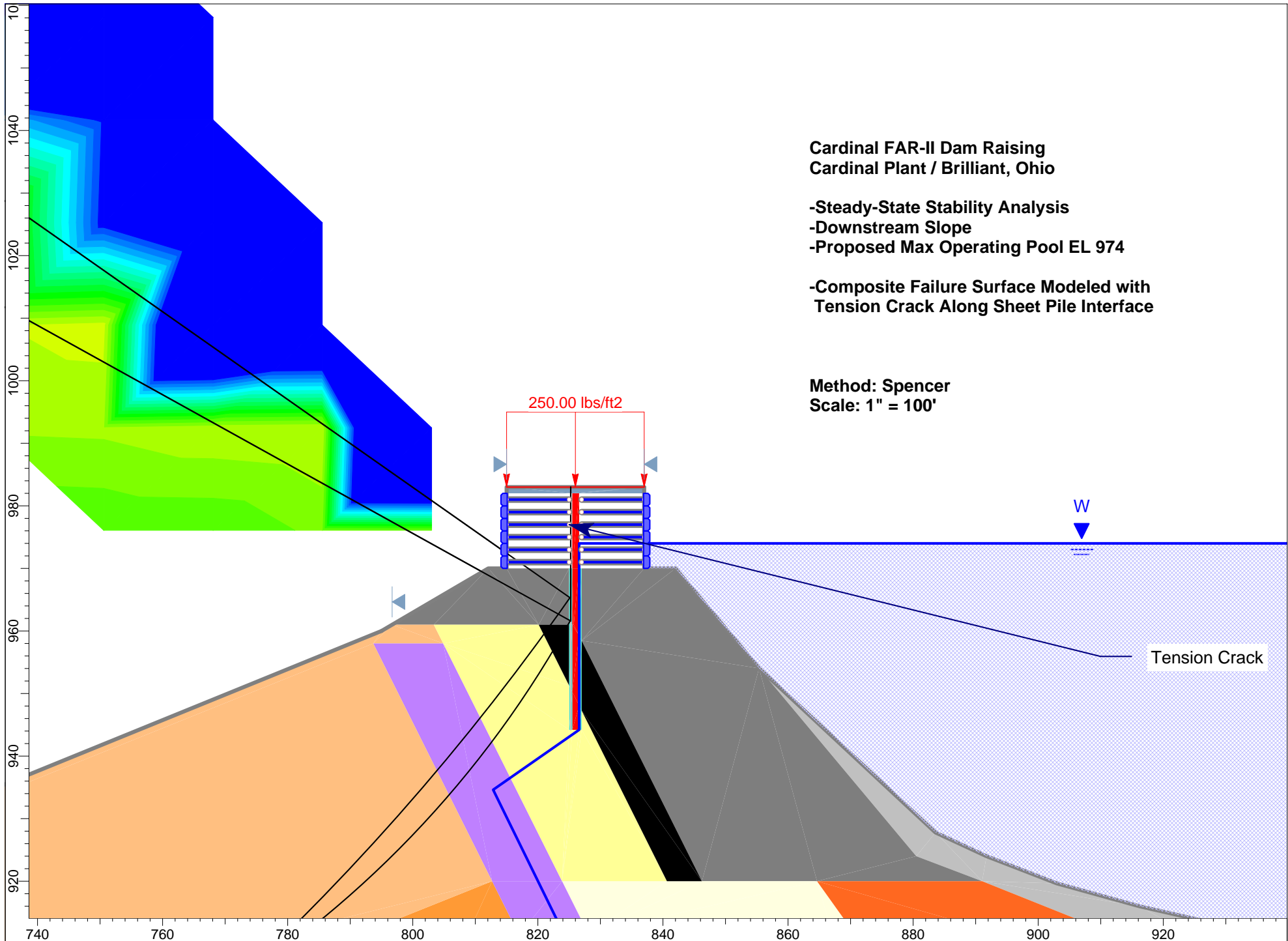
**-Composite Failure Surface Modeled with  
Tension Crack Along Sheet Pile Interface**

**Method: Spencer  
Scale: 1" = 100'**



Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Cohesion (psf)	Phi (deg)
RCC	Grey	95	14400	0
Saturated Mine Spoil	Orange	128	0	30
Clay Core - 97 Raising	Yellow	128	0	30
Chimney Drain	Purple	100	0	38
Saturated Clay Core	Light Yellow	128	0	28
Rock Toe Buttress	Red	110	0	38
Mine Spoil - Downstream Shell	Dark Orange	125	0	30
Mine Spoil - 97 Raising	Light Orange	125	0	30
Transition Zone	Dark Green	128	0	30
Overburden	Brown	123	0	28
Bottom Ash Filter Zone	Black	100	0	38
Item 304	Blue-Gray	130	0	38
Reinforced Zone - Coarse Aggregate	White	100	0	38
Cement Bentonite Cutoff	Cyan	100	720	0
Vinyl Sheet Pile	Red	120	0	38

Support Name	Color	Type	Adhesion (psf)	Friction Angle (deg)	Strip Coverage (%)	Tensile Strength (lbs/ft)
UX-1100	Blue	GeoTextile	0	26.6	93	3970



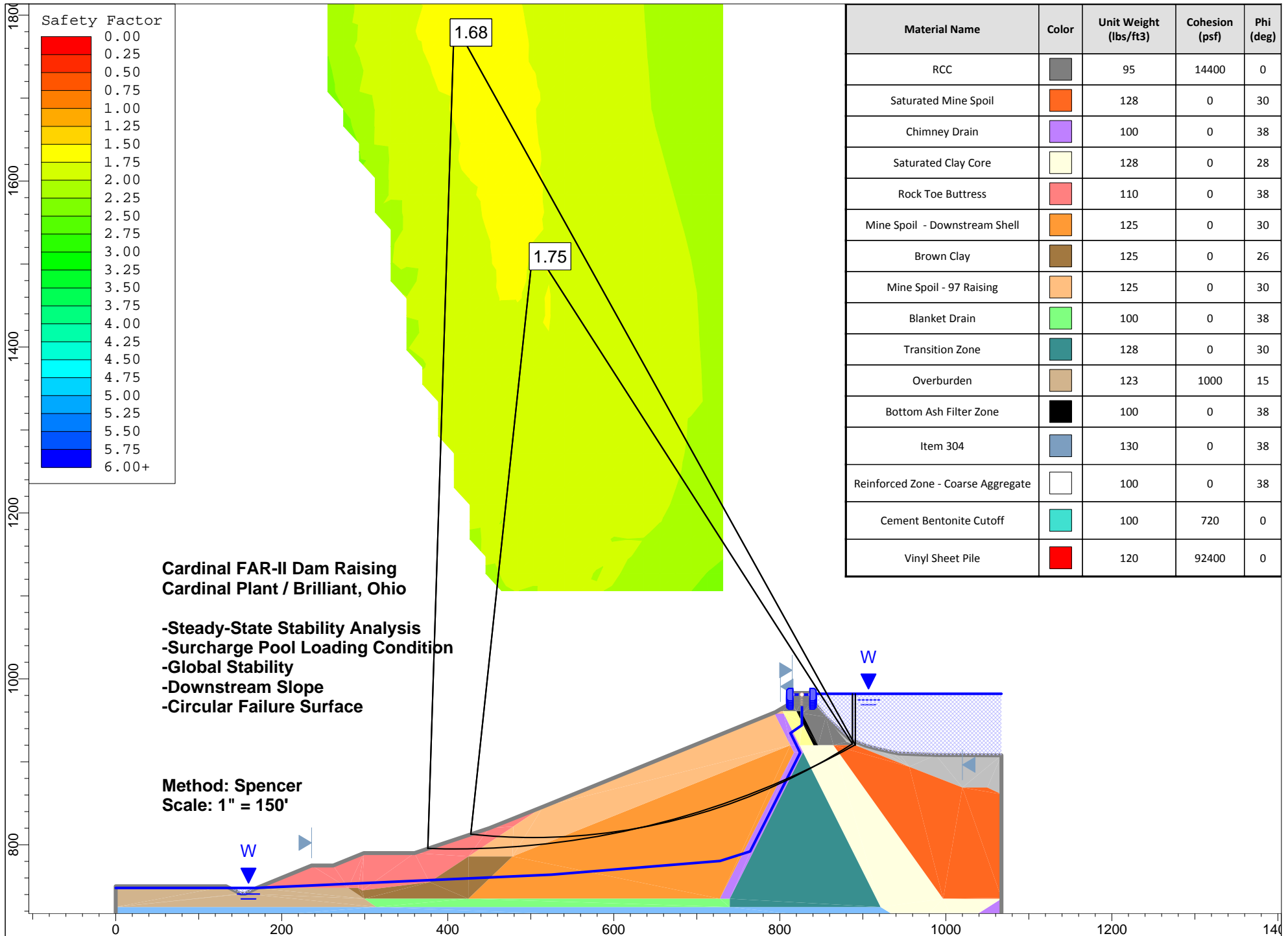
**Cardinal FAR-II Dam Raising  
Cardinal Plant / Brilliant, Ohio**

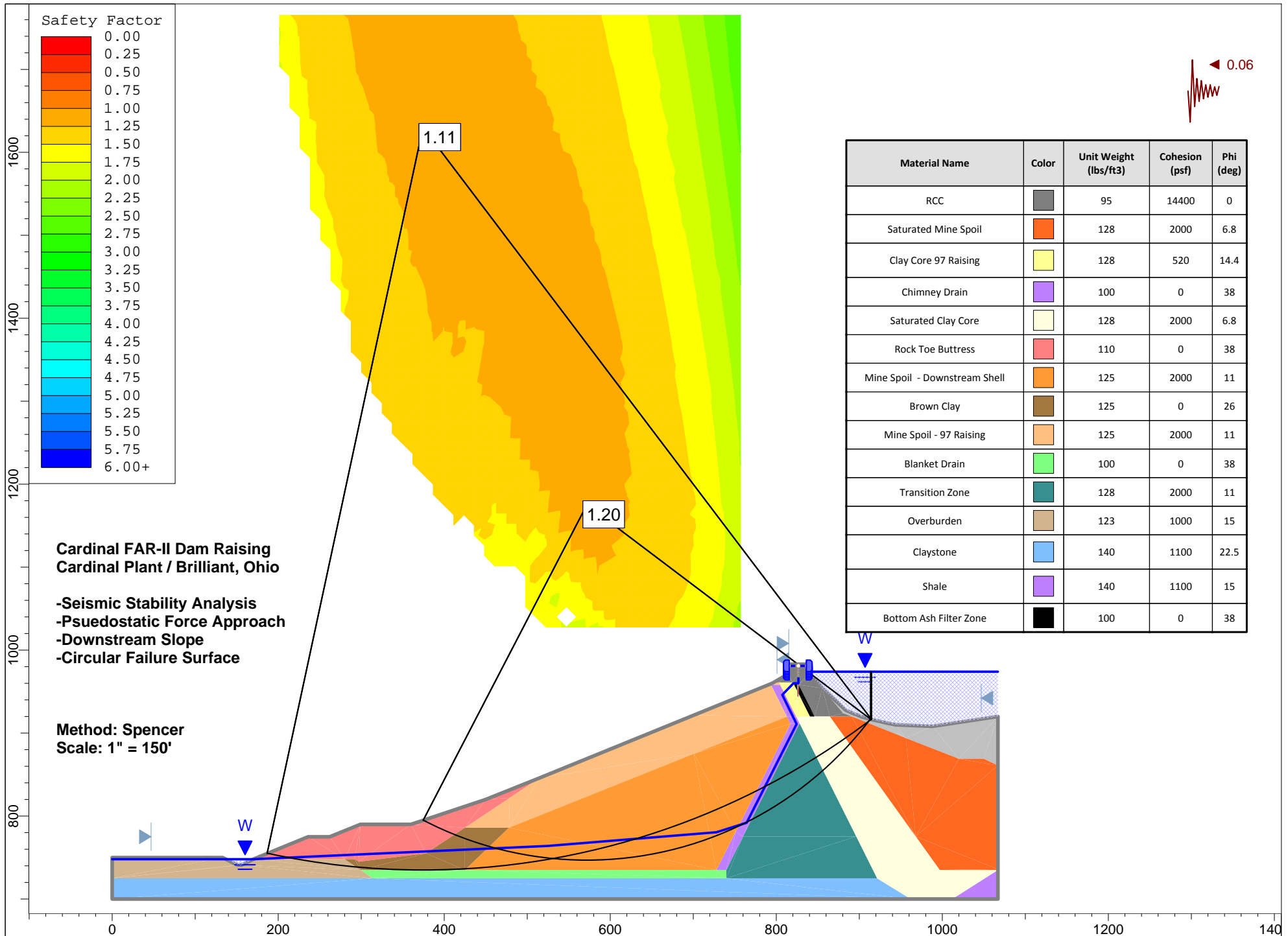
- Steady-State Stability Analysis
- Downstream Slope
- Proposed Max Operating Pool EL 974

**-Composite Failure Surface Modeled with  
Tension Crack Along Sheet Pile Interface**

**Method: Spencer  
Scale: 1" = 100'**

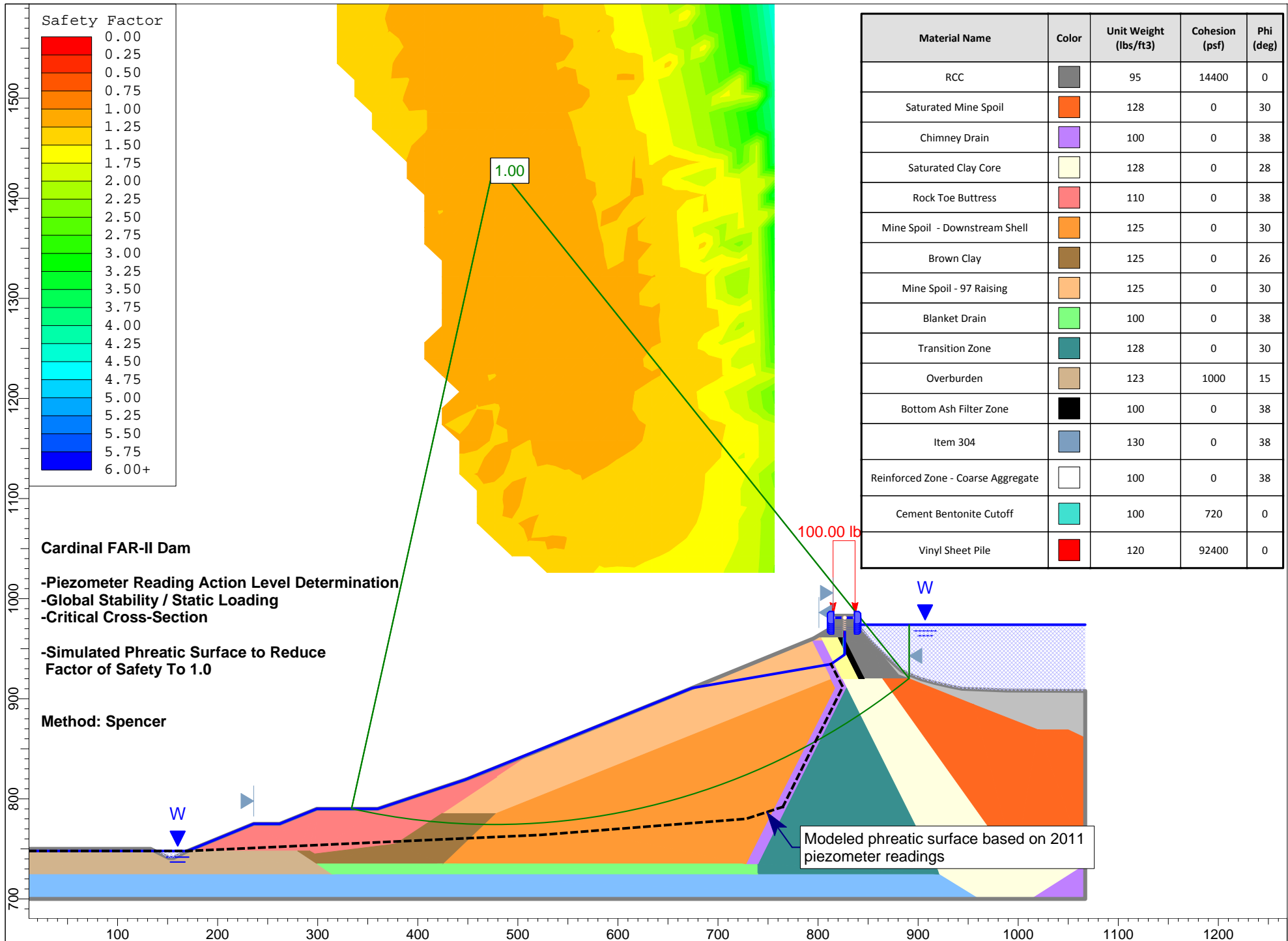
Tension Crack







## **Appendix II – Action Value Recommendation Figures**



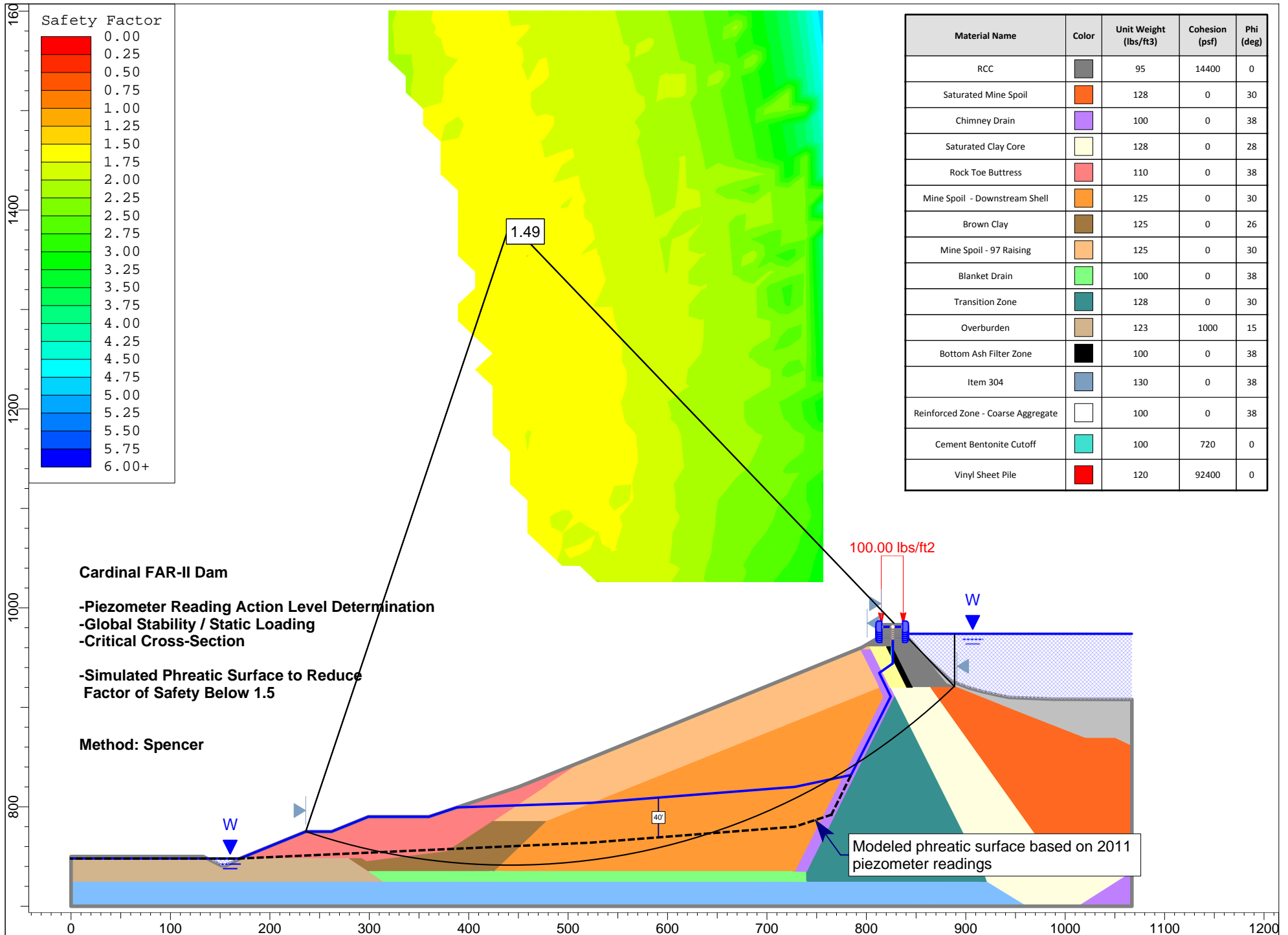
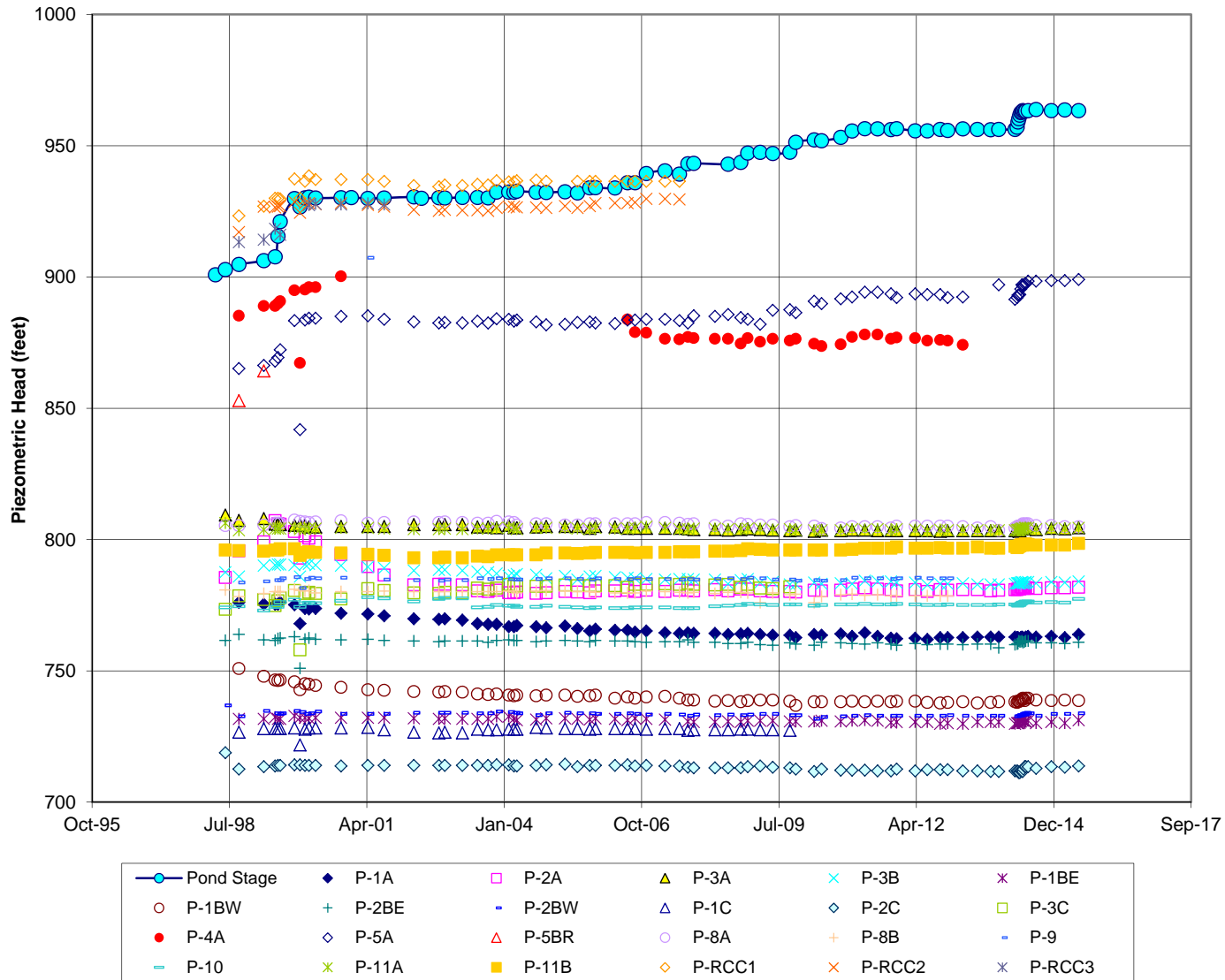
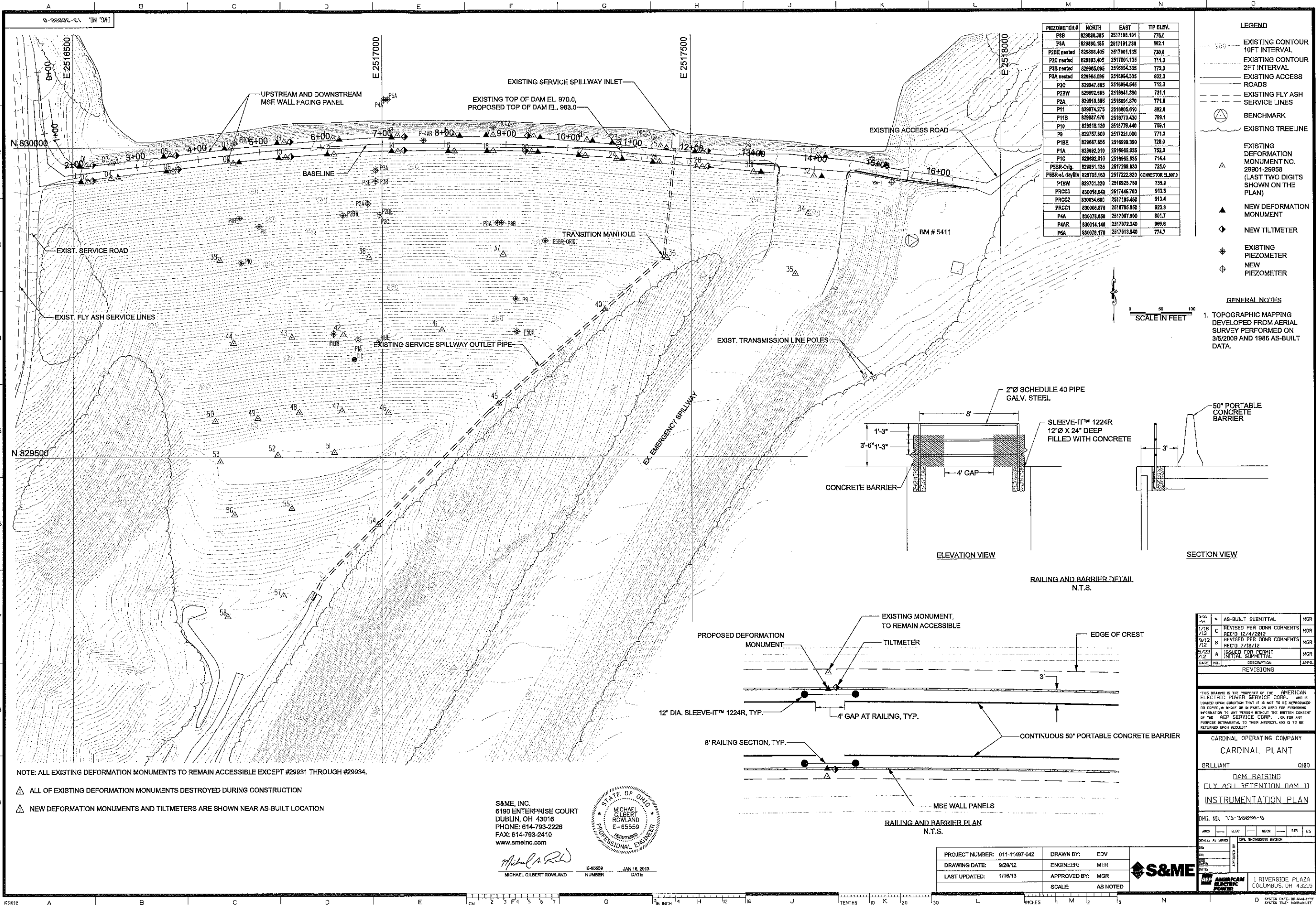


Figure 5a  
Cardinal Far 2



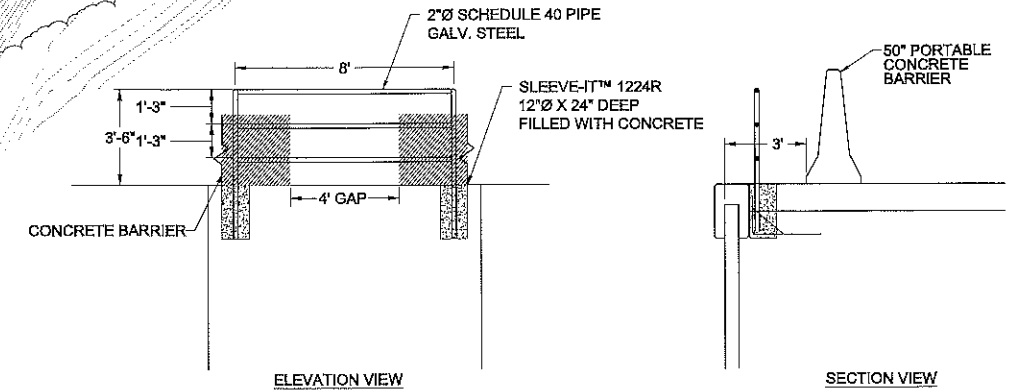


PIEZOMETER #	NORTH	EAST	TP ELEV.
P6B	829890.385	2517198.101	776.0
P4A	829890.185	2517191.730	802.1
P2BE tested	829893.405	2517001.135	730.0
P2C tested	829893.405	2517001.135	711.0
P3B tested	829895.095	2516994.335	772.3
P3A tested	829895.095	2516994.335	802.3
P3C	829847.885	2516994.545	712.3
P2BW	829892.885	2516941.590	731.1
P2A	829891.885	2516891.870	771.0
P11	829874.275	2516805.810	802.8
P11B	829847.870	2516773.430	789.1
P10	829815.120	2516778.440	759.1
P9	828787.800	2517221.000	771.2
P1BE	829887.855	2516999.390	728.9
P1A	829892.010	2516985.335	752.3
P1C	829892.010	2516985.335	714.4
P5BR-Orig.	829891.135	2517289.330	728.0
P5BR-1 day/11/11	829705.160	2517222.820	CONNECTOR ELEV. 728.0
P1BW	829701.320	2516825.780	735.9
PRCC3	830018.040	2517446.700	913.3
PRCC2	830034.680	2517185.460	913.4
PRCC1	830008.870	2516785.950	923.3
P4A	830078.650	2517007.900	801.7
P4R	830014.140	2517072.240	955.8
P5A	830078.170	2517013.840	774.7

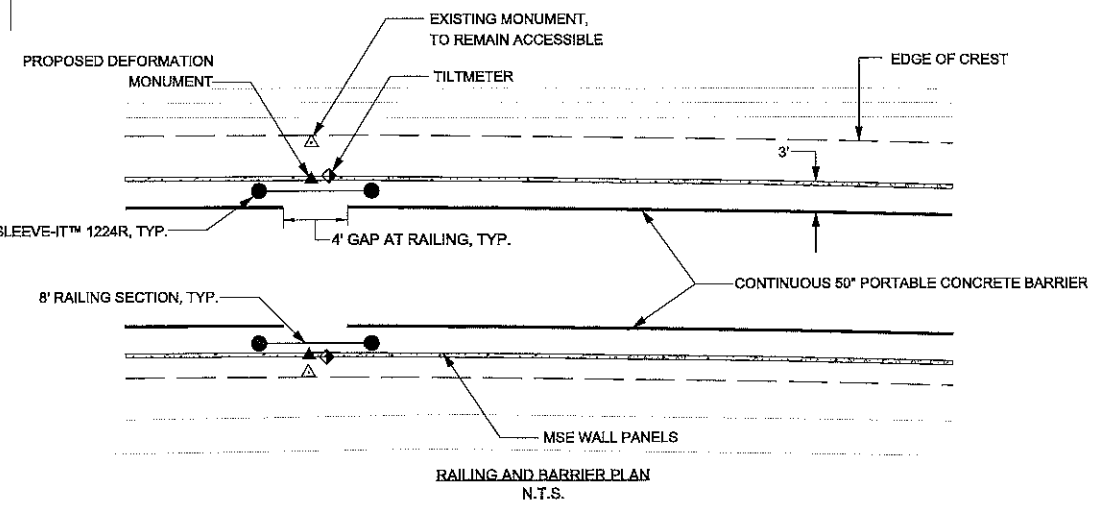
- LEGEND**
- 50' --- EXISTING CONTOUR 10FT INTERVAL
  - 2FT INTERVAL --- EXISTING CONTOUR 2FT INTERVAL
  - EXISTING ACCESS ROADS
  - EXISTING FLY ASH SERVICE LINES
  - SERVICE LINES
  - ⊕ BENCHMARK
  - △ EXISTING TREELINE
  - △ EXISTING DEFORMATION MONUMENT NO. 29901-29958 (LAST TWO DIGITS SHOWN ON THE PLAN)
  - ▲ NEW DEFORMATION MONUMENT
  - ◆ NEW TILTMETER
  - ⊕ EXISTING PIEZOMETER
  - ⊕ NEW PIEZOMETER

**GENERAL NOTES**

1. TOPOGRAPHIC MAPPING DEVELOPED FROM AERIAL SURVEY PERFORMED ON 3/5/2009 AND 1985 AS-BUILT DATA.



**RAILING AND BARRIER DETAIL**  
N.T.S.



NOTE: ALL EXISTING DEFORMATION MONUMENTS TO REMAIN ACCESSIBLE EXCEPT #29931 THROUGH #29934.

- △ ALL OF EXISTING DEFORMATION MONUMENTS DESTROYED DURING CONSTRUCTION
- ▲ NEW DEFORMATION MONUMENTS AND TILTMETERS ARE SHOWN NEAR AS-BUILT LOCATION

S&ME, INC.  
6190 ENTERPRISE COURT  
DUBLIN, OH 43016  
PHONE: 614-793-2228  
FAX: 614-793-2410  
www.smeinc.com



Michael A. Rowland  
MICHAEL GILBERT ROWLAND  
E-65559  
JAN 18, 2013  
DATE

PROJECT NUMBER: 011-11497-042	DRAWN BY: EDV
DRAWING DATE: 9/28/12	ENGINEER: MTR
LAST UPDATED: 1/16/13	APPROVED BY: MGR
SCALE: AS NOTED	



DATE	NO.	DESCRIPTION	APPR.
3/13	A	AS-BUILT SUBMITTAL	MGR
1/16	C	REVISED PER OWNER COMMENTS	MGR
9/12	B	REVISED PER OWNER COMMENTS	MGR
7/12	A	ISSUED FOR PERMIT INITIAL SUBMITTAL	MGR

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CARDINAL OPERATING COMPANY  
**CARDINAL PLANT**  
BRILLIANT OHIO  
DAM RAISING  
FLY ASH RETENTION DAM II  
INSTRUMENTATION PLAN

DWG. NO. 13-30898-8  
SCALE: AS SHOWN  
APPROVED BY: CIVIL ENGINEERING DIVISION  
PROJECT NO. 011-11497-042  
DATE: 1/16/13  
SCALE: AS NOTED  
1 RIVERSIDE PLAZA  
COLUMBUS, OH 43218