FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: 713) 778 5522
Fax: 713) 778 5542

Report No. 04.10120193-3 – Revision No. 3,
May 14, 2015

Lockwood, Andrews & Newnam, Inc. 2925
Briarpark Drive, Suite 400
Houston, Texas 77042-3720

Attention: Mr. Jon Jelinek, P.E.
Associate, Facilities Team Leader

Additional Geotechnical Consultation Services
Berth 6 Expansion
Port of Port Arthur
Port Arthur, Texas

Introduction

Fugro Consultants, Inc. (Fugro) is pleased to present this supplement report regarding additional geotechnical consultation services for the proposed Port of Port Arthur Berth 6 Expansion in Port Arthur, Texas. Mr. Percy R. James, P.E. with Lockwood, Andres & Newman, Inc. (LAN) requested our additional services in an e-mail to Mr. Nathan S. Daniels, P.E. of Fugro on November 21, 2014. Mr. Dennis J. Turner, P.E. and Ms. Julia P. Clarke, P.E. met with LAN representatives on December 2, 2014 to discuss the additional services. An additional meeting between Mr. Turner and Mr. James was held on March 4, 2015 to discuss revisions to our previous supplement reports. Our additional services were authorized under *Work Authorization No. 120-10849-016-000, Additional Services Authorization No. 3*, dated December 4, 2014. Our additional services were performed in general accordance with Fugro Proposal No. 04.10120193-4p-Rev 2 dated December 3, 2014.

This revised supplement report supersedes our previous supplement reports, should be used along with the recommendations presented in Fugro Report No. 04.10120193 dated April 11, 2013 and Fugro Report No. 04.10120193-2 dated November 5, 2013, and not as a stand-alone document.

Project Description. We understand that the Port of Port Arthur is planning to expand an existing wharf located along the Sabine-Neches Ship Channel in Port Arthur, Texas. The expansion will include construction of Berth 6, a 61.5-foot wide, 600-foot long extension of the existing wharf and additional bulkhead wall with an accompanying anchor wall. The project also includes modifications to approximately 200 feet of existing bulkhead and anchor wall system that falls within the footprint of the Berth 6 expansion. We understand that the existing bulkhead retrofit will include a new combination wall 18-inch H-Piles and steel sheet piles. The proposed new bulkhead will include a combination wall with 48-inch diameter steel pipe piles and infilled steel sheet piles.

In addition, LAN has requested that we include the existing relieving platform piles and proposed wharf piles in our global stability analysis. We recommend LAN consider the potential effects on these piles from any loads applied by the bulkhead and retained soil. The various pile types and material properties are presented in Table 1 below:

Table 1. Global Stability Analysis – Pile Properties

Piles	***Transverse Spacing (ft)***	***Pile Shear Strength (lbs)***
16-inch Square Concrete Piles	9.5	35,000
24-inch Square Prestressed Concrete Piles	14	82,000
54-inch Diameter Prestressed Concrete Piles	14	78,000
18-inch H-Piles	8.25	249,000
48-inch Diameter Steel Pipe Piles	8.8	1,447,000

We further understand that a future pavement section will be constructed for the laydown area behind the bulkhead structure. The pavement will likely be composed of a 12-inch thick reinforced concrete section overlying 30-inch thick light weight aggregate (LWA) or a conventional granular backfill (*e.g*. sand).

The requested additional global stability analysis cases are grouped as follows:

- Case A – Proposed Retrofit of Existing Bulkhead with Relieving Platform
    - LWA Pavement Subgrade
- Case B – Proposed Retrofit of Existing Bulkhead with Relieving Platform
    - Conventional Pavement Subgrade
- Case C – Proposed Retrofit of Existing Bulkhead without Relieving Platform
    - LWA Pavement Subgrade
- Case D – Proposed Retrofit of Existing Bulkhead without Relieving Platform
    - Conventional Pavement Subgrade
- Case E – Proposed New Bulkhead
    - LWA Pavement Subgrade
- Case F – Proposed New Bulkhead
    - Conventional Pavement Subgrade

Global Stability Analysis

Our additional global stability analyses were performed using the SLIDE software program with the soil parameters presented in Fugro Report Nos. 04.10120193 and 04.10120193-2, and information provided to us by LAN regarding the pile and sheet pile configurations and material properties. Please note that assessments of the condition and structural design of the existing bulkhead structure or the structural design of the proposed bulkhead structure are beyond the scope of our services.

The selection of geotechnical parameters and our method of analyses are in general accordance with the guidelines outlined in the United States Army Corps of Engineers (USACE) EM 1110-2-2504[1], Naval Facilities Engineering Command (NAVFAC) DM 7.2[2], and our experience with similar structures and subsurface conditions. The proposed bulkhead wall should be evaluated for short-term, long-term, and rapid drawdown conditions. Our experience has shown that long-term conditions are often the most critical. For satisfactory performance, the proposed dredge slope underneath the deck and shoreline slope should have an acceptable factor of safety during their entire projected time of service. Factors of safety for all potential loading conditions and modes of failure should be considered. The following paragraphs discuss each stability condition that should be analyzed.

Short-Term (Undrained). Short-term (undrained) loading conditions models the soil condition during and immediately following construction. EM 1110-2-2504 indicates that the end of construction usually represents the critical short-term (undrained) loading condition for bulkhead walls. For this loading condition, any excess pore pressures developed during construction activities have not had the opportunity to dissipate. A factor of safety of at least 2 should be applied to the passive soil pressures for this loading condition according to EM 1110-2-2504. In general accordance with USACE EM 1110-2-1913[3], we recommend a minimum factor of safety of 1.3 for global stability in short-term conditions. We performed our analysis with an assumed water surface elevation at El. +0.83 feet at the bulkhead wall sloping to the ground surface at El. +15 feet behind the face of the wall.

Long-Term (Drained). The long-term (drained) loading condition models the soils after excess pore water pressures have dissipated to post-construction equilibrium and post-construction consolidation of the cohesive soils has taken place. EM 1110-2-2504 indicates that a factor of safety of 1.5 should be applied to the passive soils pressures for long-term conditions. In general

[1] Design of Sheet Pile Walls, EM 1110-2-2504, 31 March 1994, United States Army Corps of Engineers.

[2] Foundations and Earth Structures, DM 7.2, 1 September 1986, Naval Facilities Engineering Command.

[3] Design and Construction of Levees, EM 1110-2-1902, 30 April 2000, United States Army Corps of Engineers, Washington, D.C.

accordance with USACE EM 1110-2-1913, we recommend a minimum factor of safety of 1.5 for global stability in long-term conditions. Our long-term analysis modeled the depth-of-water using the same assumptions as used in our short-term analyses. It should be noted that relatively minor differences in the selected soil parameters for long-term analysis can have a significant impact on the results of our analyses.

Rapid Drawdown. Under certain circumstances, many slopes along rivers, creeks, bayous, channels, and basins are subject to rapid drops in the water level. This condition is known as rapid drawdown and causes seepage stresses in the slope that require special attention. Long-term (drained) soil parameters are used in evaluating this loading condition. In general accordance with USACE EM 1110-2-1913, we recommend a minimum factor of safety of 1.0 for global stability in rapid drawdown conditions. In our rapid drawdown analysis, it is assumed that the water surface elevation is at El. +15 feet behind the face of the bulkhead wall and suddenly drops down to El. +0.83 feet at the bulkhead wall.

Combination Wall – Infill Steel Sheet Piles. LAN also requested Fugro recommend minimum tip elevations for the infilled steel sheet pile sections based on global stability for the existing and proposed bulkhead walls as provided in Fugro Report No. 04.10120193 for previously considered design cases. As indicated in Fugro Report 04.10120193, we recommend that the steel sheet pile section extend to a depth to provide a minimum factor of safety for global stability (without King Piles) of 1.0 for short-term conditions and 1.1 for long term conditions. We also recommend that steel sheet piles extend at least 10 feet below the planned future dredge depth of the channel in front of the bulkhead wall, which we understand to be El. +50 feet.

Please note that in our analysis for the retrofit of the existing bulkhead structure, the steel sheet piling was required to extend to the same tip elevation as the H-Piles, which coincides with embedding the sheet piles and H-Piles approximately 5 feet into the sand layer anticipated at El. -83 feet.

Global Stability Analysis Results Summary. A summary of our global stability analyses are presented below in Table 2. Please note that internal design requirements, other structural loading conditions, and minimum embedment depths may control the design of the bulkhead walls and minimum pile tip elevations.

Table 2. Global Stability Analysis Summary

Analysis Case	***Controlling Load Condition***	***Minimum Sheet Pile Tip Elevation (feet)***	***Minimum King Pile Tip Elevation (feet)***
Case A – Existing Bulkhead	Long-Term	El. -88	El. -88
Case B – Existing Bulkhead	Long-Term	El. -88	El. -88
Case C – Existing Bulkhead	Long-Term	El. -88	El. -88
Case D – Existing Bulkhead	Long-Term	El. -88	El. -88
Case E – Proposed Bulkhead	Long-Term	El. -62	El. -89
Case F – Proposed Bulkhead	Long-Term	El. -62	El. -90

Use of Lightweight Aggregate (LWA)

Our sensitivity analysis of various combinations of lightweight aggregate (LWA) and conventional backfill indicates that there is minimal impact to global stability with the use of lightweight aggregate in the active wedge behind the bulkhead wall and as a pavement subgrade. However, based on our experience, the use of lightweight aggregate will have a greater impact to the required steel sheet pile section, anchor loads, long-term settlements, and project costs.

Fugro previously performed a settlement analysis for the proposed laydown area or storage yard behind the proposed Berth 6 to evaluate the impact of the site grade raise and a design live load of 1,000 psf on the laydown area and anchor rods. Based on our review of our previous analysis and current understanding of replacing approximately 3.5 feet of material with a pavement structure, we do not anticipate a significant increase in settlements beyond those presented in Fugro Report No. 04.10120193-2 dated November 5, 2013.

The following appendices of our global stability analyses are attached and complete this report:

Closing

We appreciate the opportunity to be of continued service to Lockwood, Andrews & Newnam, Inc. Please call us at 713-369-5400 if you have any questions concerning this supplement letter report.

Sincerely,
FUGRO CONSULTANTS, INC.
TBPE Firm Registration No. F-299

Rani. Jaafar

For Luis Perez-Milicua, E.I.T.
Senior Project Professional

Dennis J. Turner, P.E.
Engineering Manager

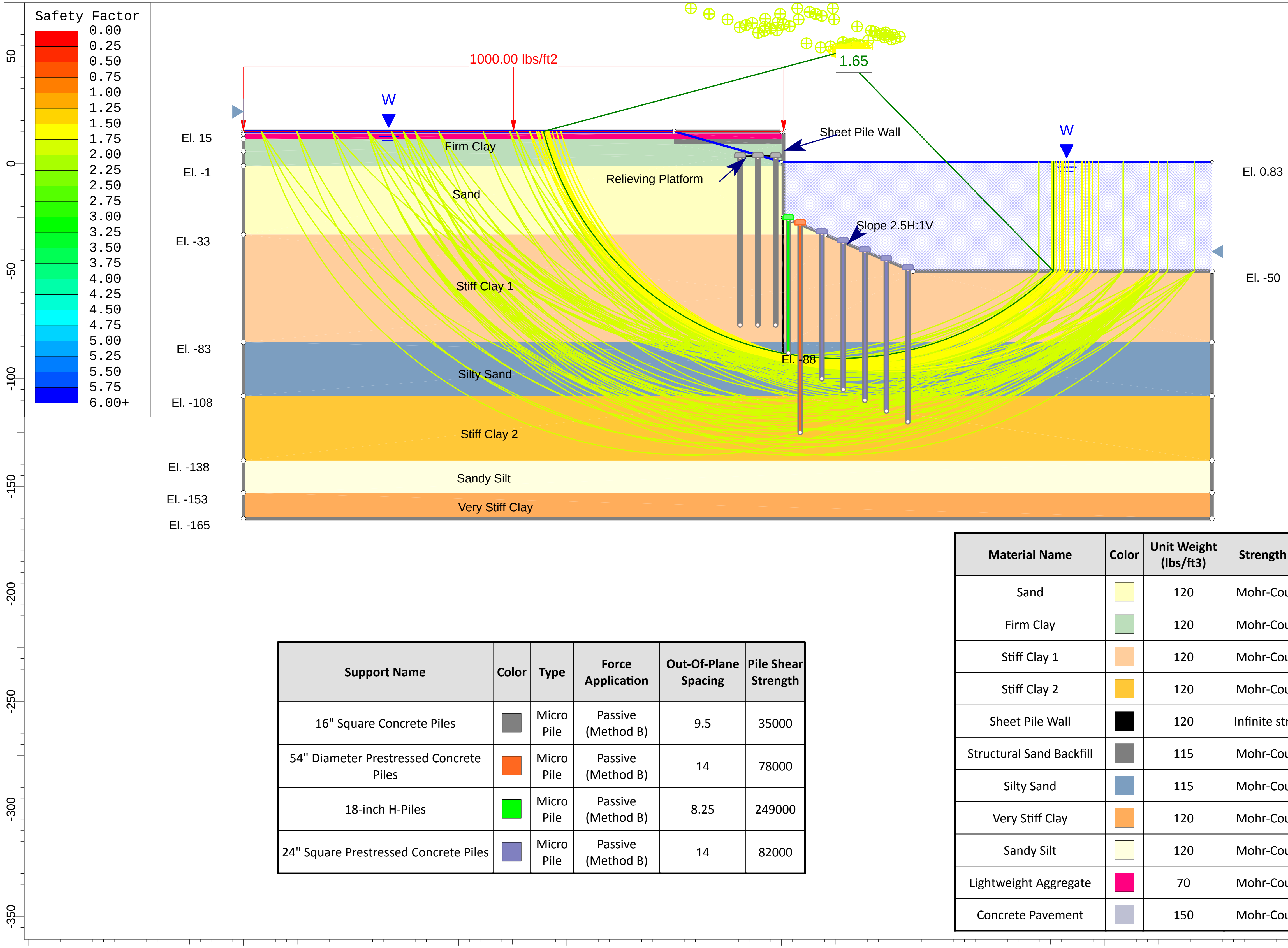
STATE OF TEXAS
DENNIS J. TURNER
97276
LICENSED
PROFESSIONAL ENGINEER
14 MAY 2015

Copies Submitted: Electronic PDF Document (1)

DJT
R:\04100\2012 Projects\04.10120193\Additional Services - Phase 4\Reporting\04 10120193-3r - REV3.doc

APPENDIX A

EXISTING BULKHEAD RETROFIT, RELIEVING PLATFORM, LWA PAVEMENT SUBGRADE

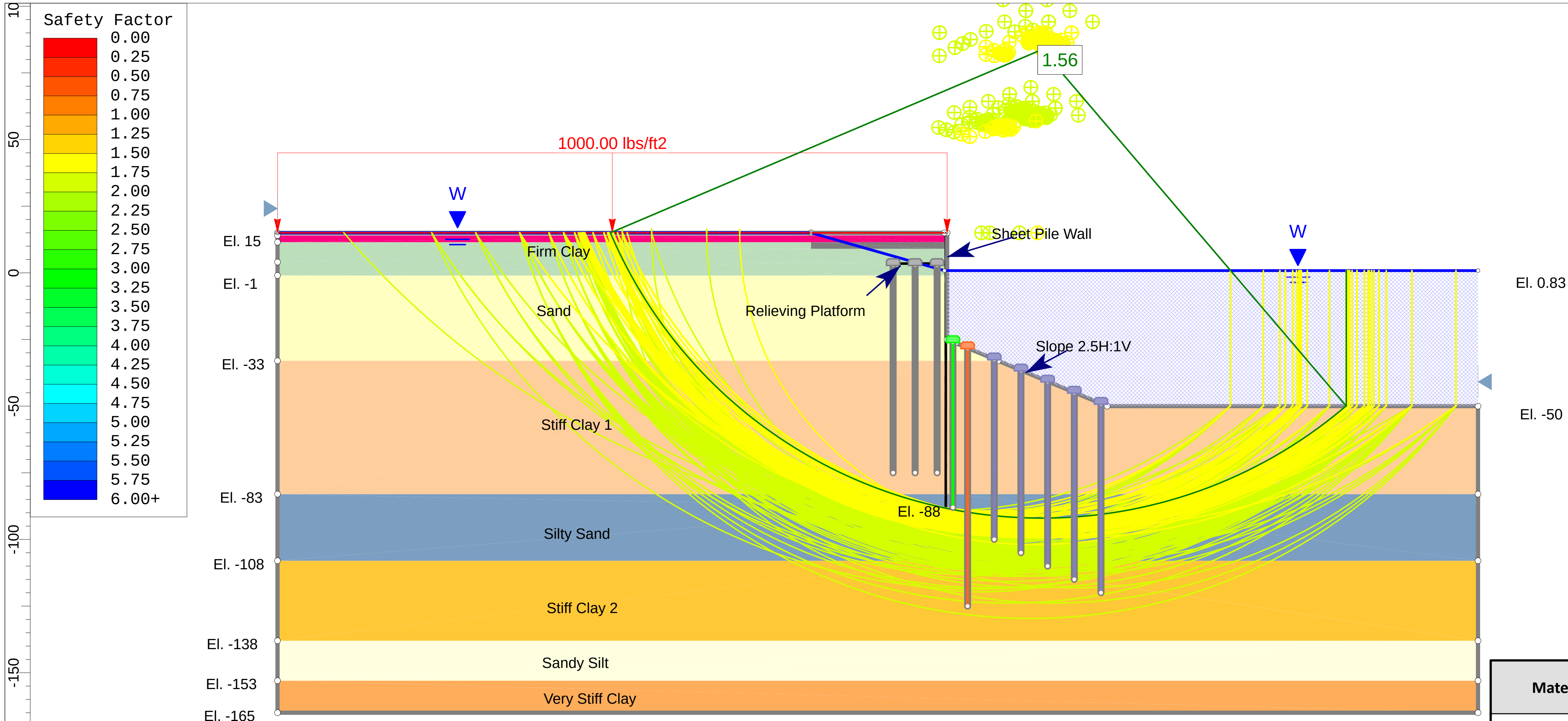


Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1500	0	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	2000	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	2500	0	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Short Term - Combination Wall - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE A-1



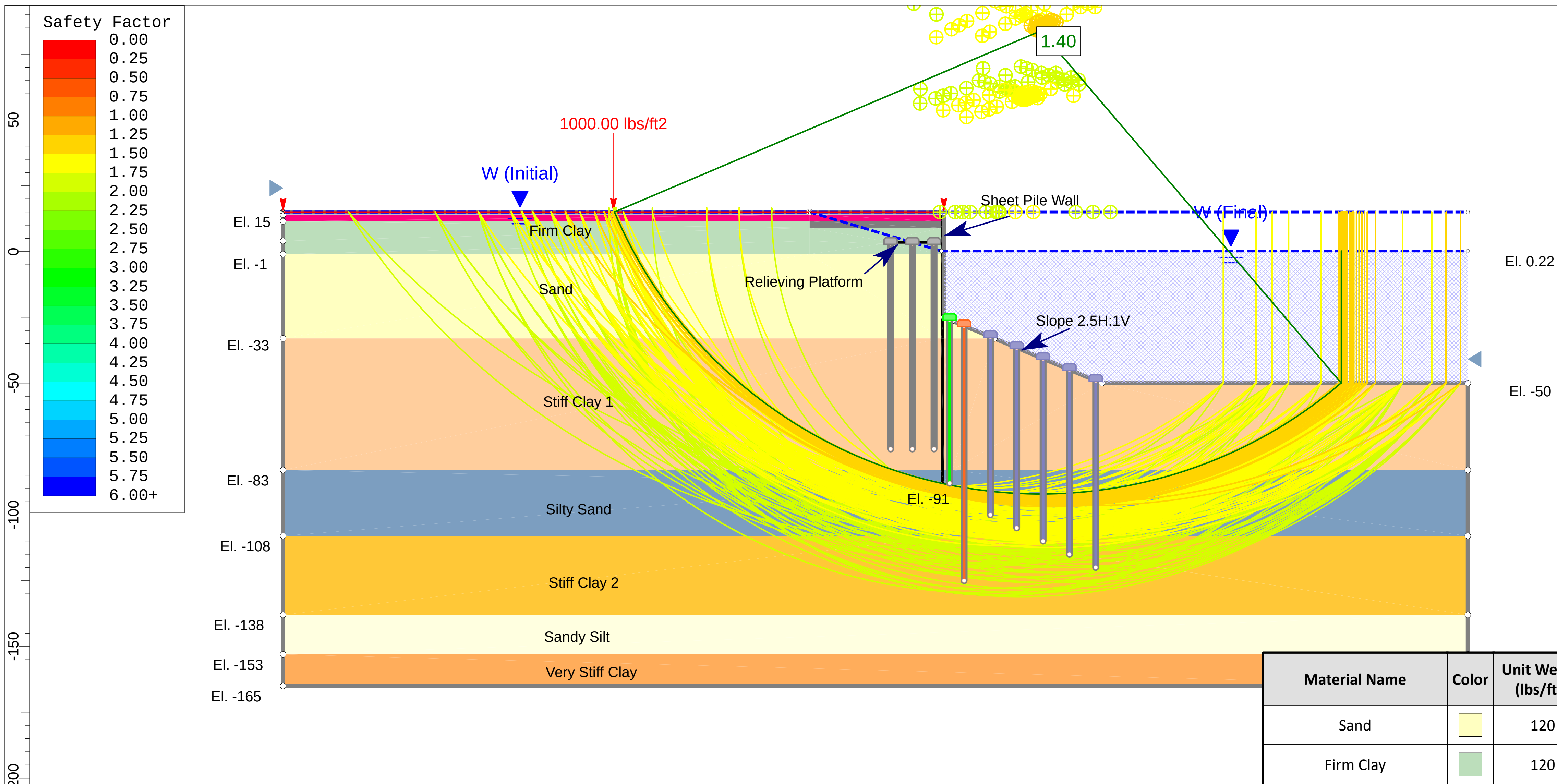
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

Project	BERTH 6 EXPANSION		
Analysis Description	Global Stability - Existing Retrofit - Long Term - Combination Wall - Lightweight Aggregate		
Drawn By: Dennis Turner, P.E.	Scale: 1:600	Company: Fugro Consultants, Inc.	
Date: March 12, 2015		Plate: PLATE A-2	

SLIDEINTERPRET 6.011



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles	Gray	Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles	Orange	Micro Pile	Passive (Method B)	7	78000
18-inch H-Piles	Green	Micro Pile	Passive (Method B)	9	249000
24" Square Prestressed Concrete Piles	Purple	Micro Pile	Passive (Method B)	14	82000

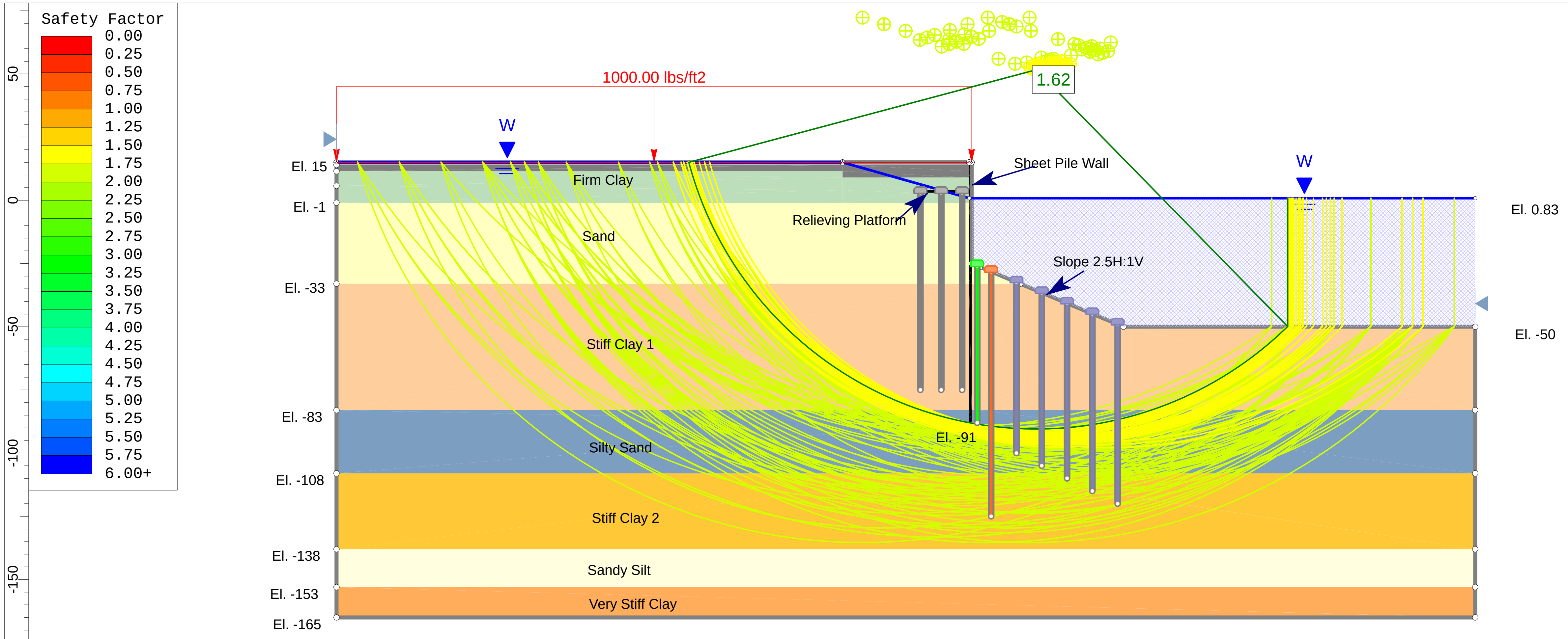
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Sand	Light yellow	120	Mohr-Coulomb	0	30	Yes	Water Surface
Firm Clay	Light green	120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1	Peach	120	Mohr-Coulomb	150	20	Yes	Water Surface
Stiff Clay 2	Gold	120	Mohr-Coulomb	200	22	Yes	Water Surface
Sheet Pile Wall	Black	120	Infinite strength			No	None
Structural Sand Backfill	Gray	115	Mohr-Coulomb	0	28	Yes	Water Surface
Silty Sand	Blue	115	Mohr-Coulomb	0	28	Yes	Water Surface
Very Stiff Clay	Orange	120	Mohr-Coulomb	250	22	Yes	Water Surface
Sandy Silt	Cream	120	Mohr-Coulomb	0	30	Yes	Water Surface
Lightweight Aggregate	Magenta	70	Mohr-Coulomb	0	35	No	Water Surface
Concrete Pavement	Lavender	150	Mohr-Coulomb	5000	0	No	Water Surface

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Rapid Draw Down - Combination Wall - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE A-3

SLIDEINTERPRET 6.011

APPENDIX B

EXISTING BULKHEAD RETROFIT, RELIEVING PLATFORM, SAND PAVEMENT SUBGRADE

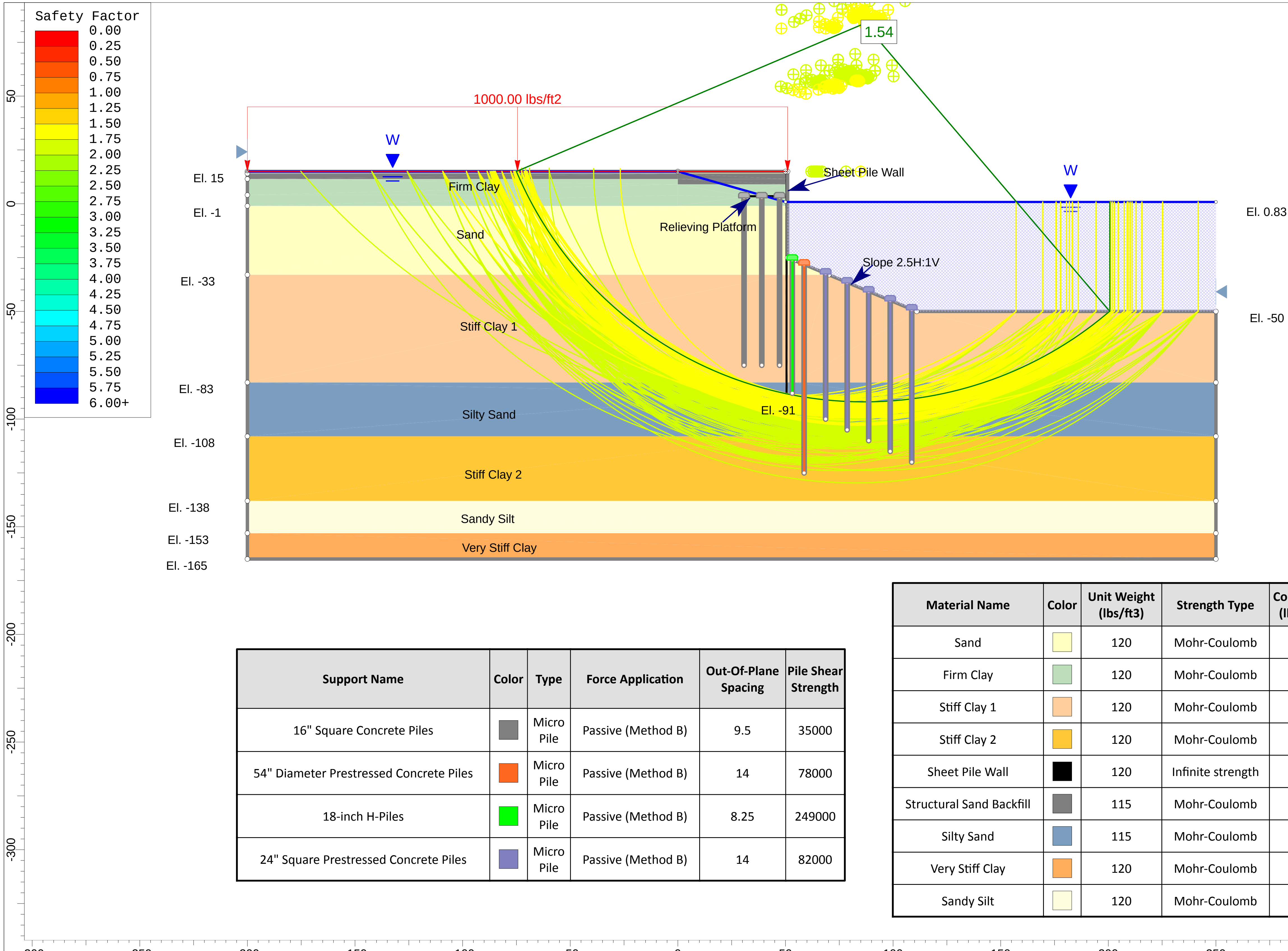


Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1500	0	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	2000	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	2500	0	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface

-300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450

FUGRO	Project: BERTH 6 EXPANSION		
	Analysis Description: Global Stability - Existing Retrofit - Short Term - Combination Wall - Structural Sand Backfill		
	Drawn By: Dennis Turner, P.E.	Scale: 1:600	Company: Fugro Consultants, Inc.
SLIDEINTERPRET 6.011	Date: March 12, 2015		Plate: PLATE B-1



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface

FUGRO

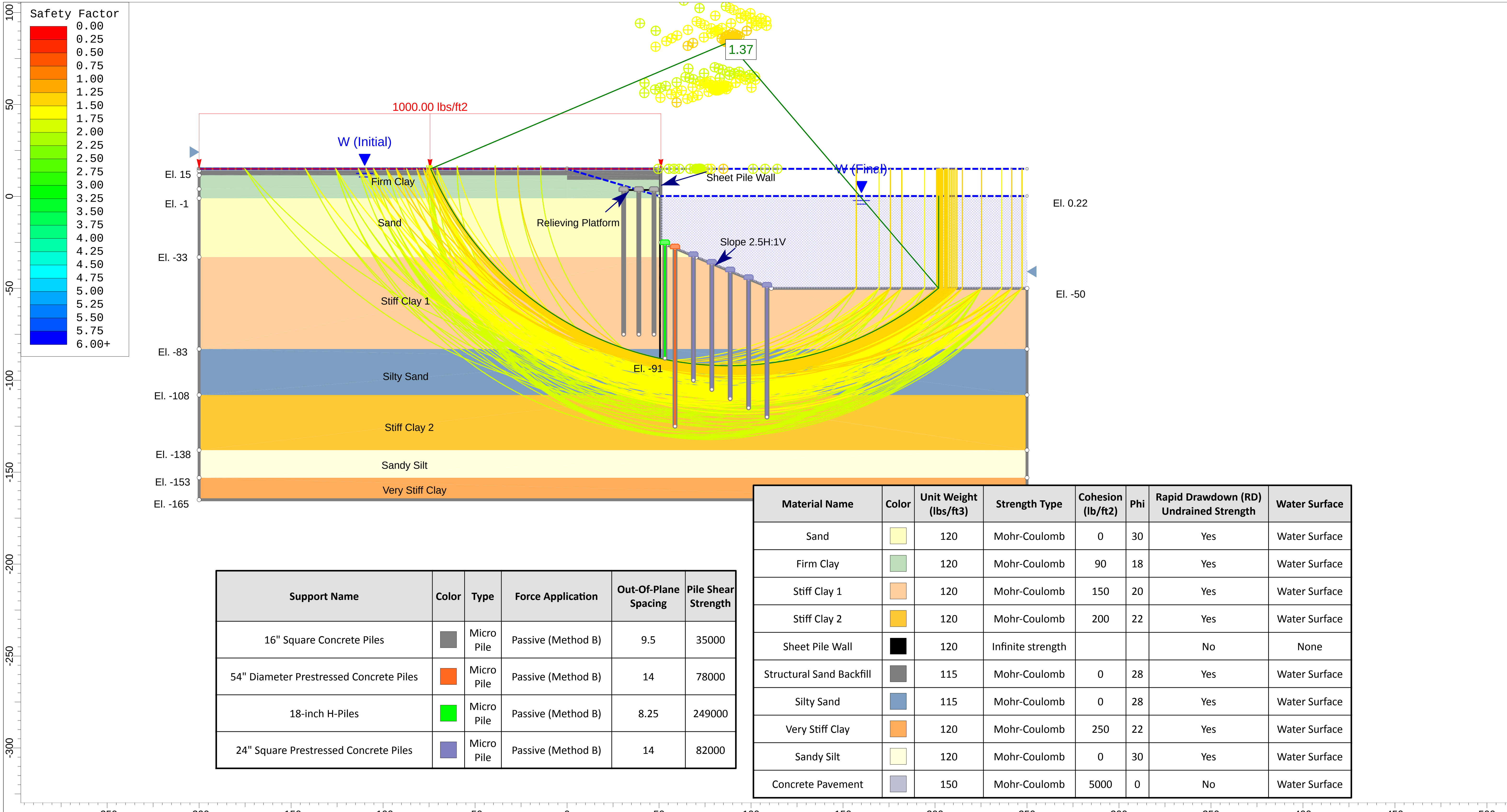
Project
BERTH 6 EXPANSION

Analysis Description
Global Stability - Existing Retrofit - Long Term - Combination Wall - Structural Sand Backfill

Drawn By Dennis Turner, P.E. | *Scale* 1:600 | *Company* Fugro Consultants, Inc.

Date March 12, 2015 | *Plate* PLATE B-2

SLIDEINTERPRET 6.011



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Sand		120	Mohr-Coulomb	0	30	Yes	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Yes	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Yes	Water Surface
Sheet Pile Wall		120	Infinite strength			No	None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Yes	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Yes	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Yes	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Yes	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	No	Water Surface

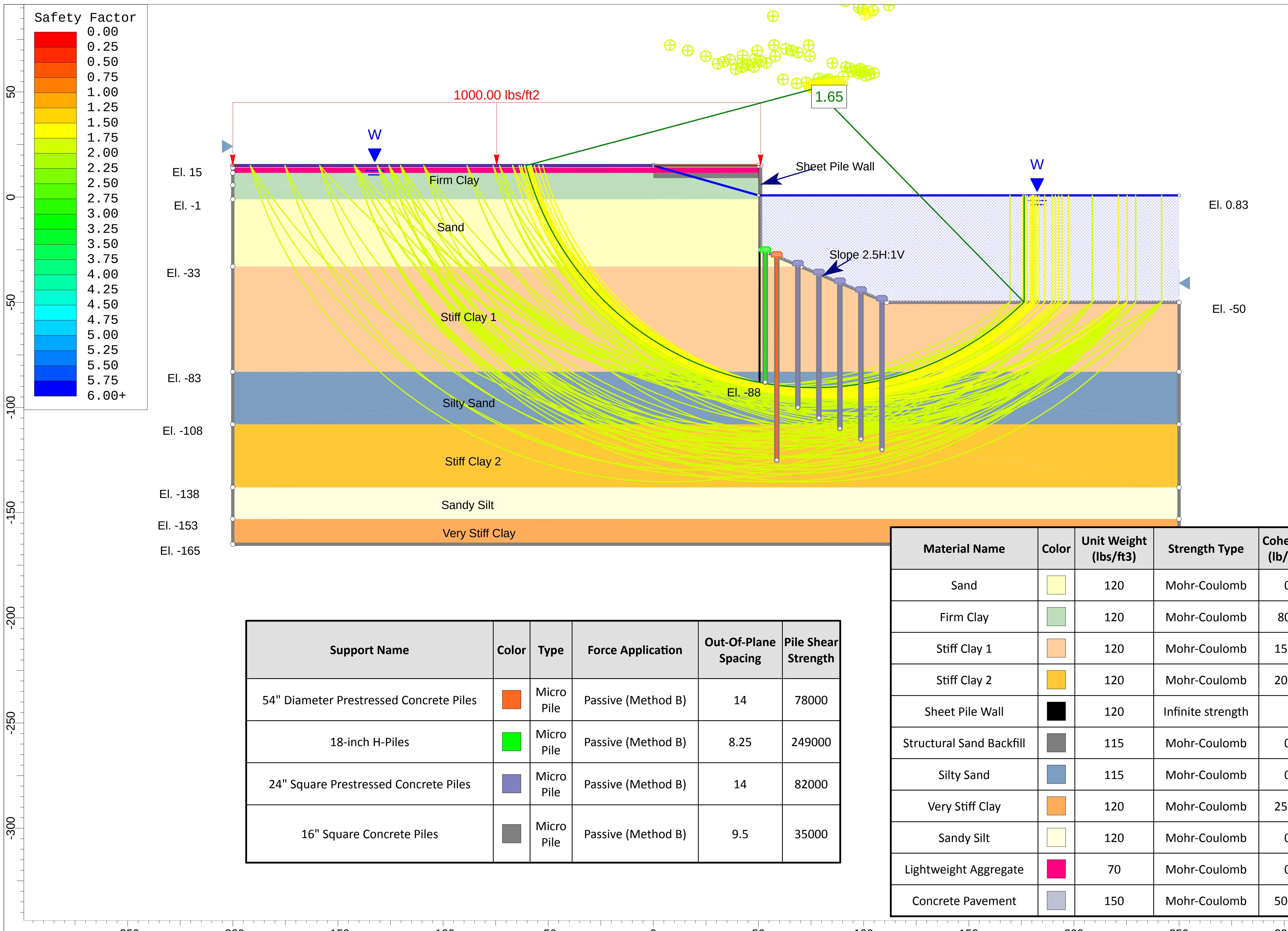
FUGRO

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Rapid Draw Down - Combination Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE B-3

SLIDEINTERPRET 6.011

APPENDIX C

EXISTING BULKHEAD RETROFIT, NO RELIEVING PLATFORM, LWA PAVEMENT SUBGRADE



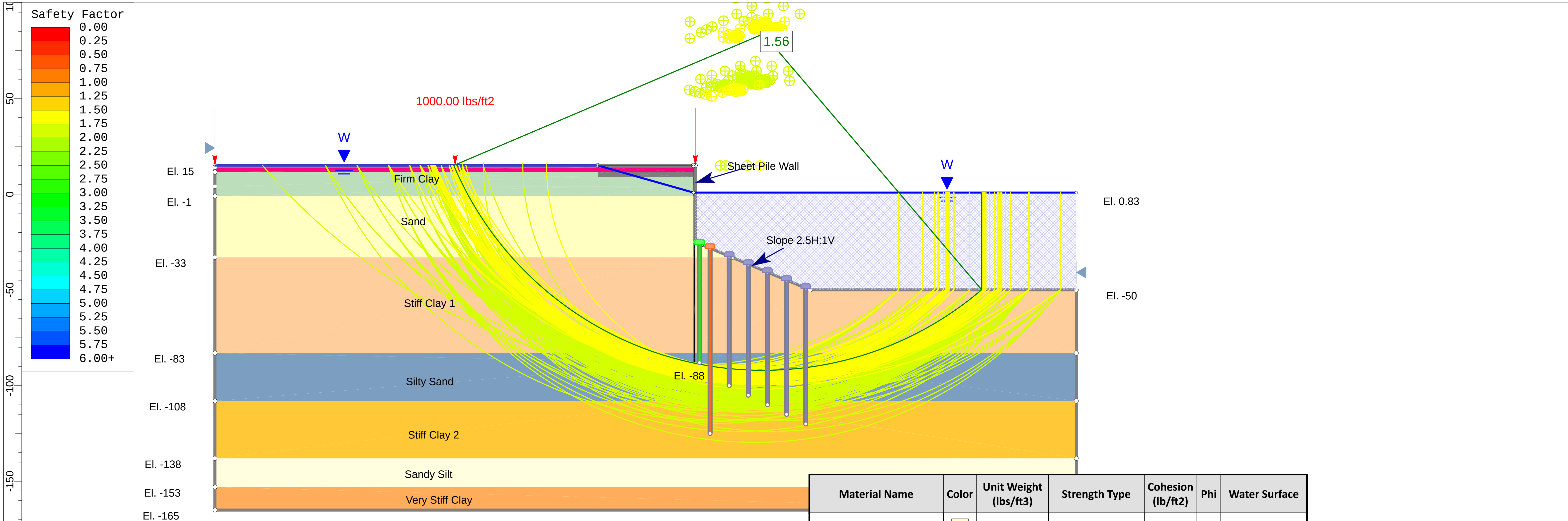
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1500	0	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	2000	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	2500	0	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Short Term - Combination Depth - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE C-1



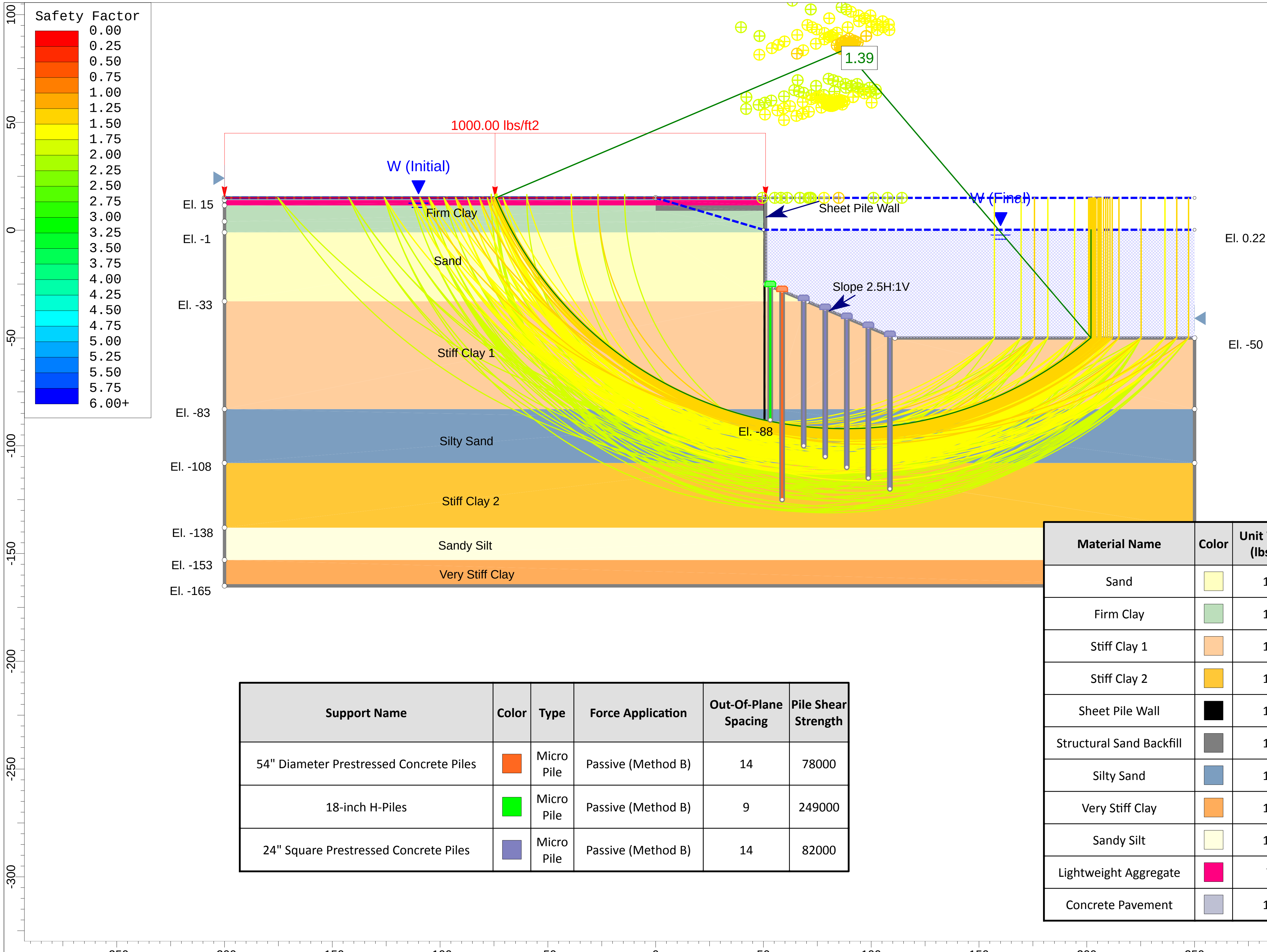
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Long Term - Combination Wall - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE C-2

SLIDEINTERPRET 6.011



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	9	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Sand		120	Mohr-Coulomb	0	30	Yes	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Yes	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Yes	Water Surface
Sheet Pile Wall		120	Infinite strength			No	None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Yes	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Yes	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Yes	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Yes	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	No	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	No	Water Surface

FUGRO

Project: BERTH 6 EXPANSION

Analysis Description: Global Stability - Existing Retrofit - Rapid Draw Down - Combination Wall - Lightweight Aggregate

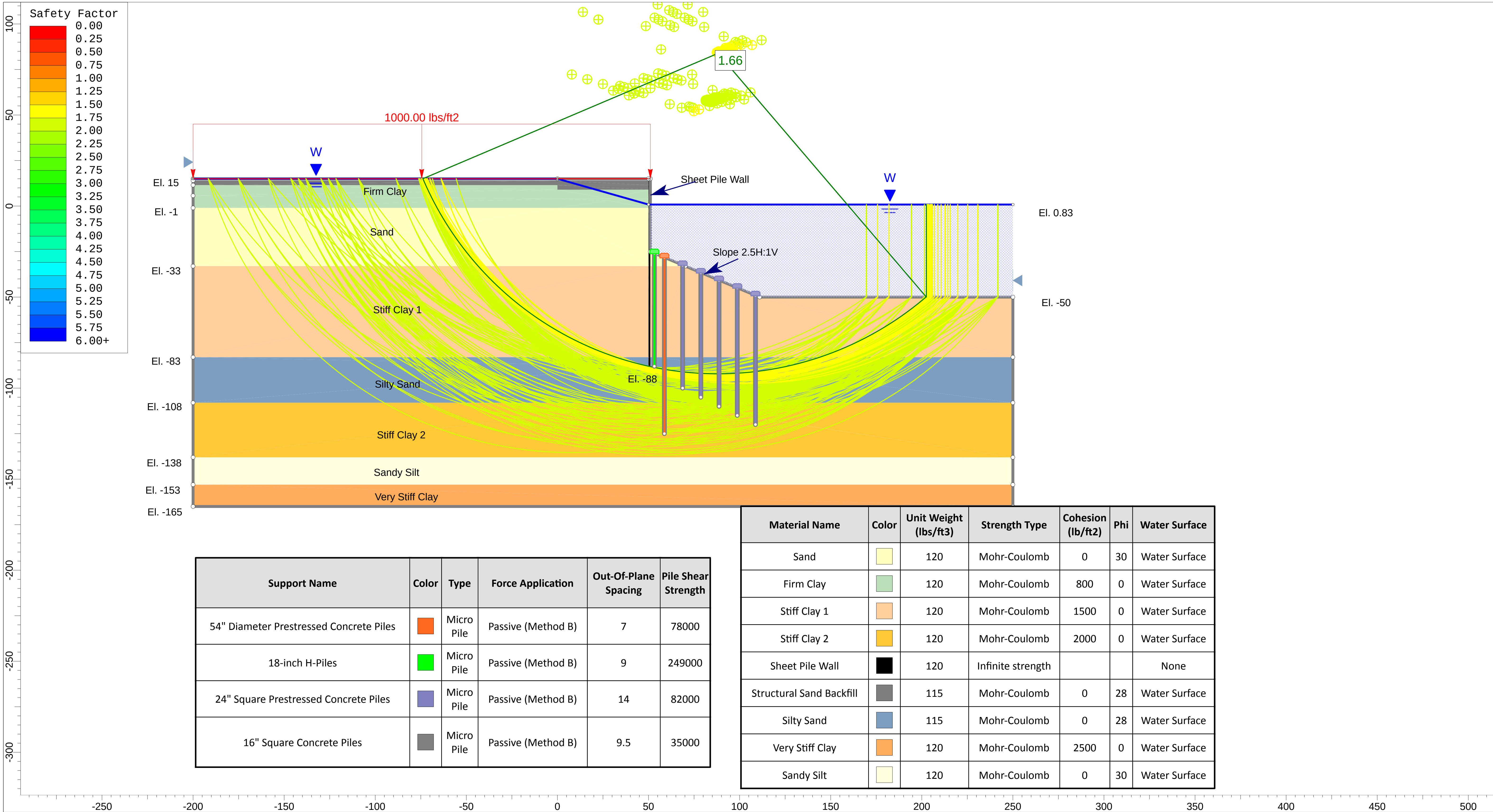
Drawn By: Dennis Turner, P.E. | Scale: 1:600 | Company: Fugro Consultants, Inc.

Date: March 12, 2015 | Plate: PLATE C-3

SLIDEINTERPRET 6.011

APPENDIX D

EXISTING BULKHEAD RETROFIT, NO RELIEVING PLATFORM, SAND PAVEMENT SUBGRADE

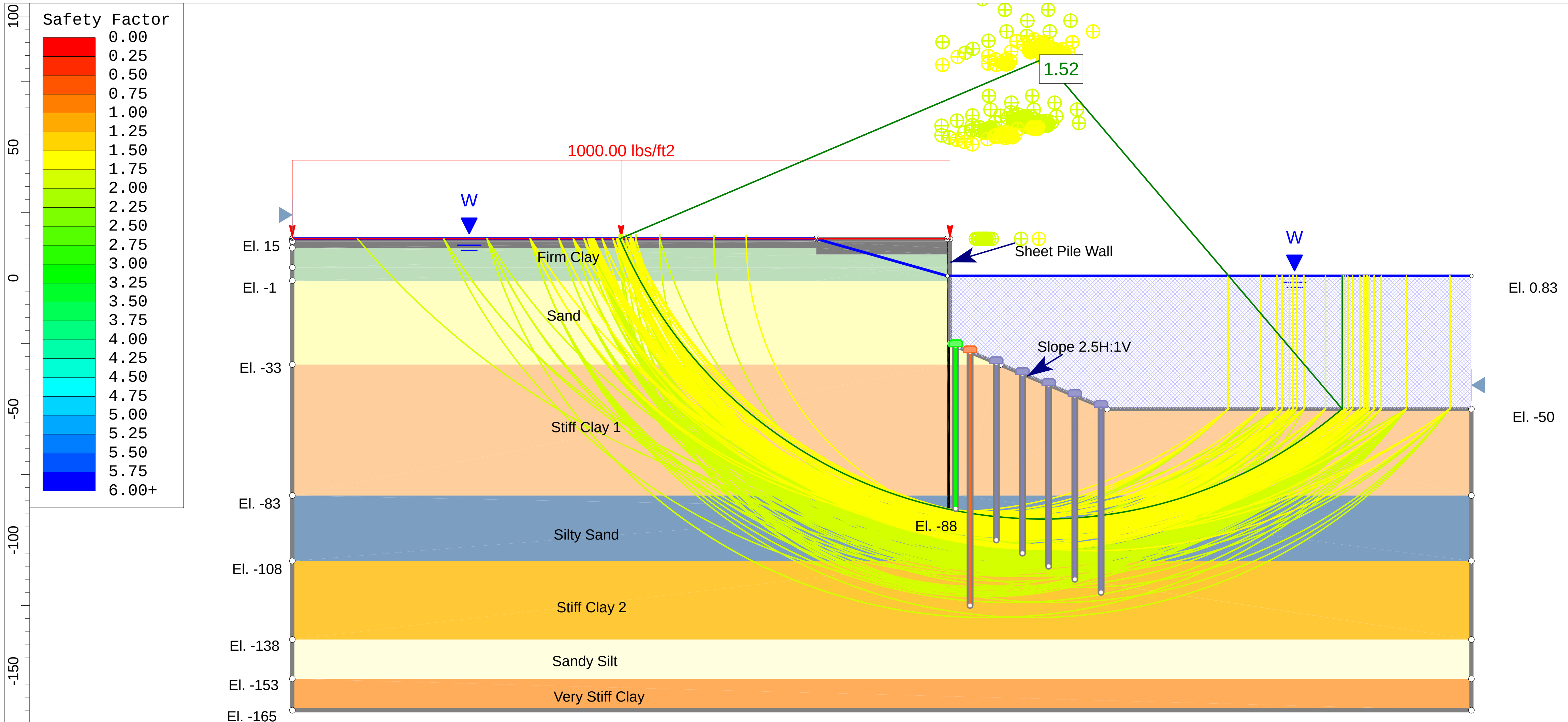


Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	7	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	9	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1500	0	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	2000	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	2500	0	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Short Term - Combination Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE D-1

SLIDEINTERPRET 6.011



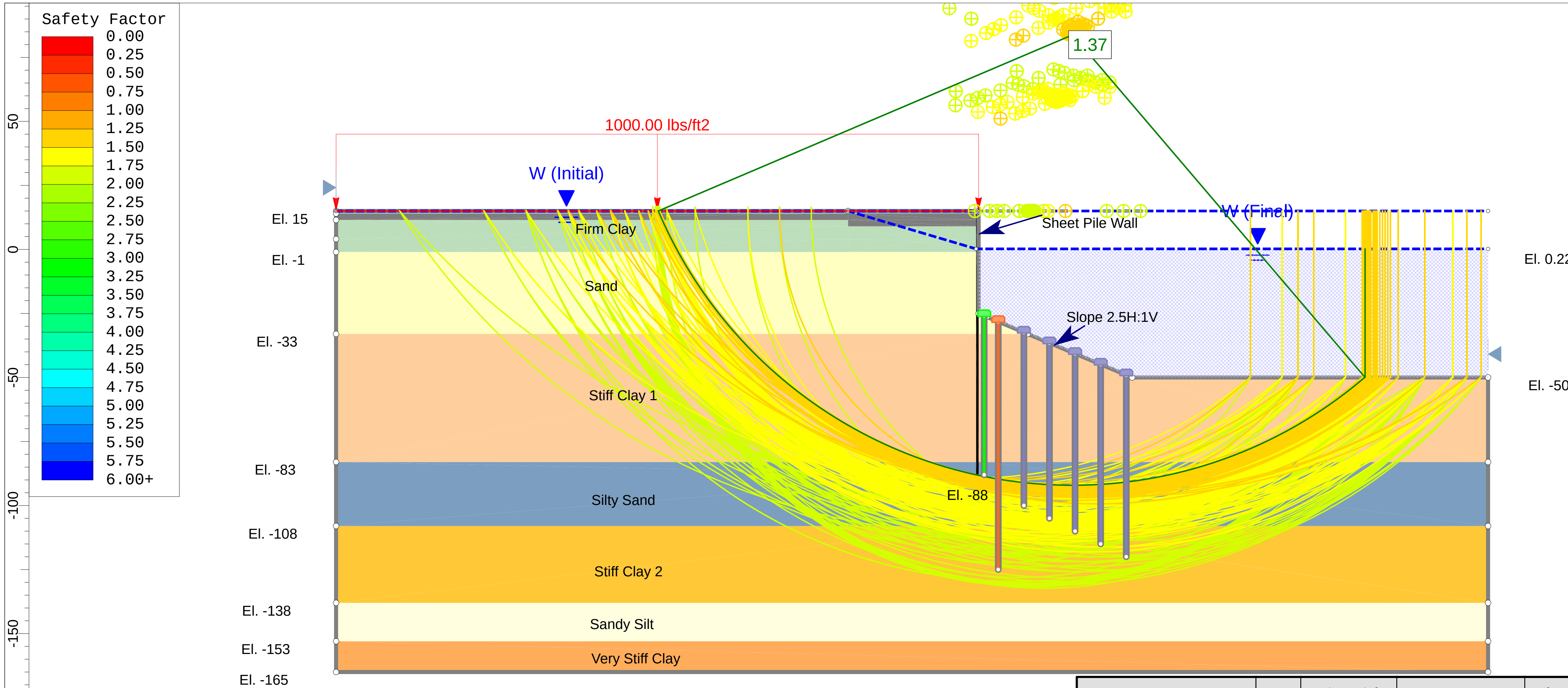
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
16" Square Concrete Piles		Micro Pile	Passive (Method B)	9.5	35000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Sand		120	Mohr-Coulomb	0	30	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Water Surface

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Existing Retrofit - Long Term - Combination Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE D-2



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Sand		120	Mohr-Coulomb	0	30	Yes	Water Surface
Firm Clay		120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	150	20	Yes	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Yes	Water Surface
Sheet Pile Wall		120	Infinite strength			No	None
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Yes	Water Surface
Silty Sand		115	Mohr-Coulomb	0	28	Yes	Water Surface
Very Stiff Clay		120	Mohr-Coulomb	250	22	Yes	Water Surface
Sandy Silt		120	Mohr-Coulomb	0	30	Yes	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	No	Water Surface

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
18-inch H-Piles		Micro Pile	Passive (Method B)	8.25	249000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

-300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450

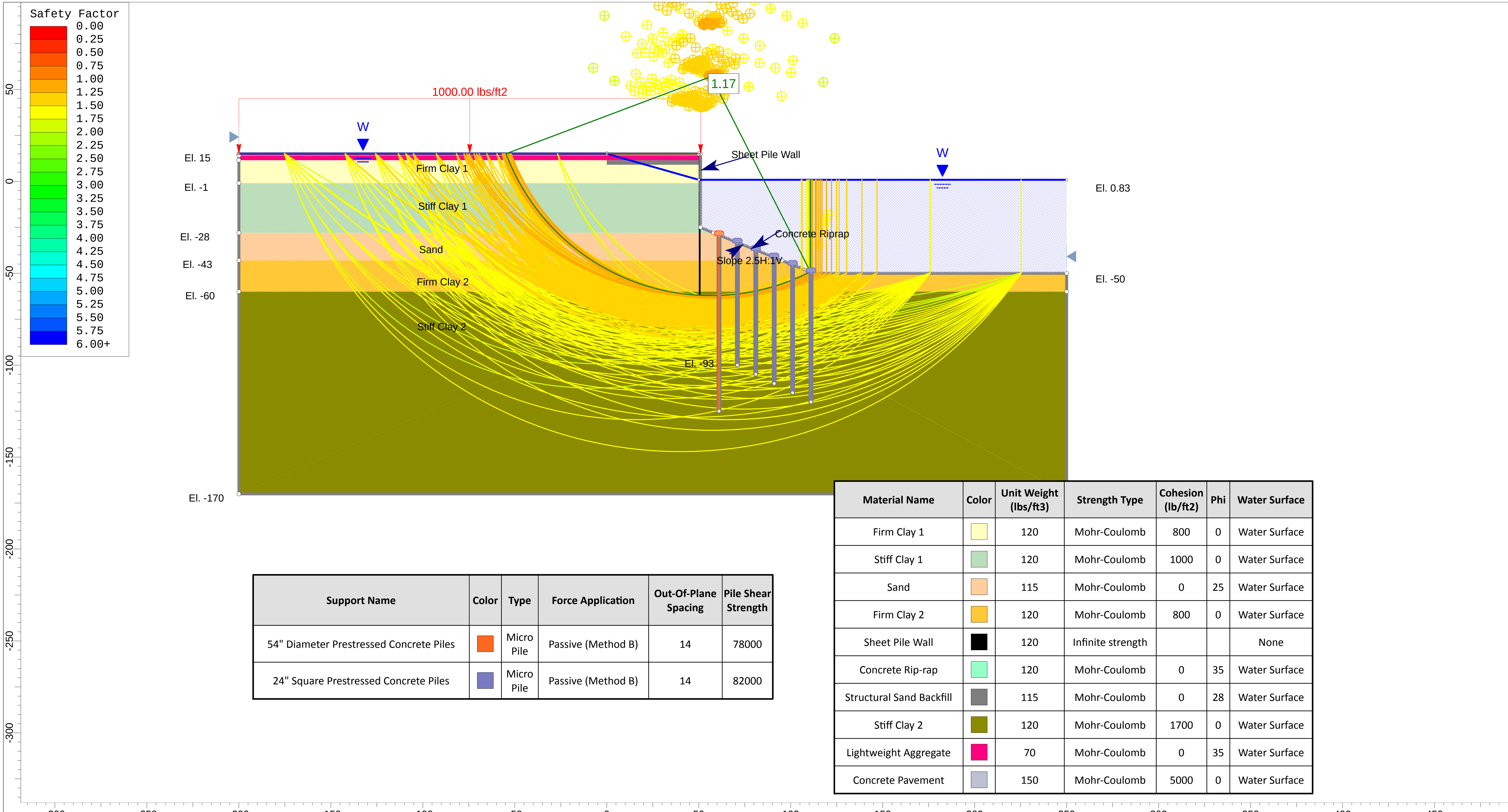
Project	BERTH 6 EXPANSION		
Analysis Description	Global Stability - Existing Retrofit - Rapid Draw Down - Combination Wall - Structural Sand Backfill		
Drawn By: Dennis Turner, P.E.	Scale: 1:600	Company	Fugro Consultants, Inc.
Date: March 12, 2015		Plate	PLATE D-3

FUGRO

SLIDEINTERPRET 6.011

APPENDIX E

PROPOSED BULKHEAD, LWA PAVEMENT SUBGRADE



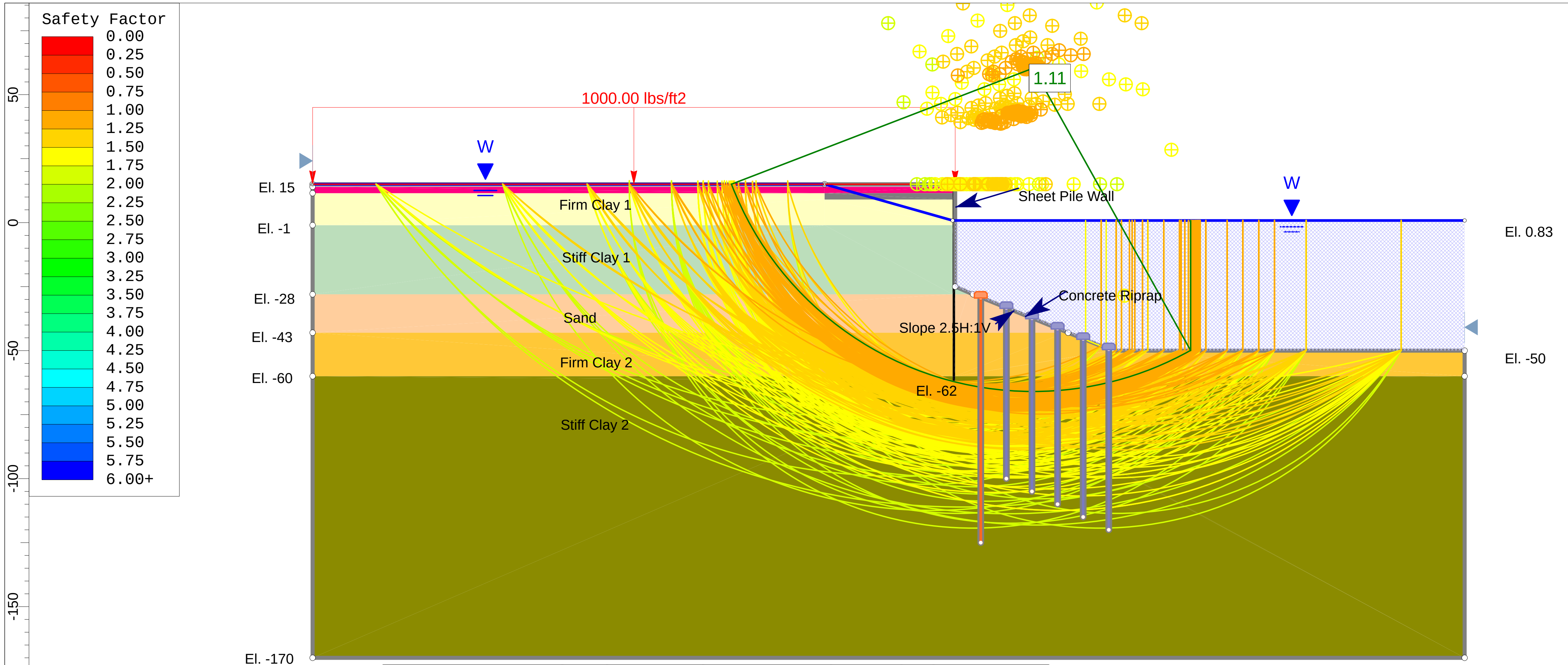
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1000	0	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	800	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	1700	0	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION		
Analysis Description	Global Stability - Proposed Structure - Short Term - Sheet Pile Wall - Lightweight Aggregate		
Drawn By Dennis Turner, P.E.	*Scale* 1:600	*Company* Fugro Consultants, Inc.	
Date March 12, 2015		*Plate* PLATE E-1	

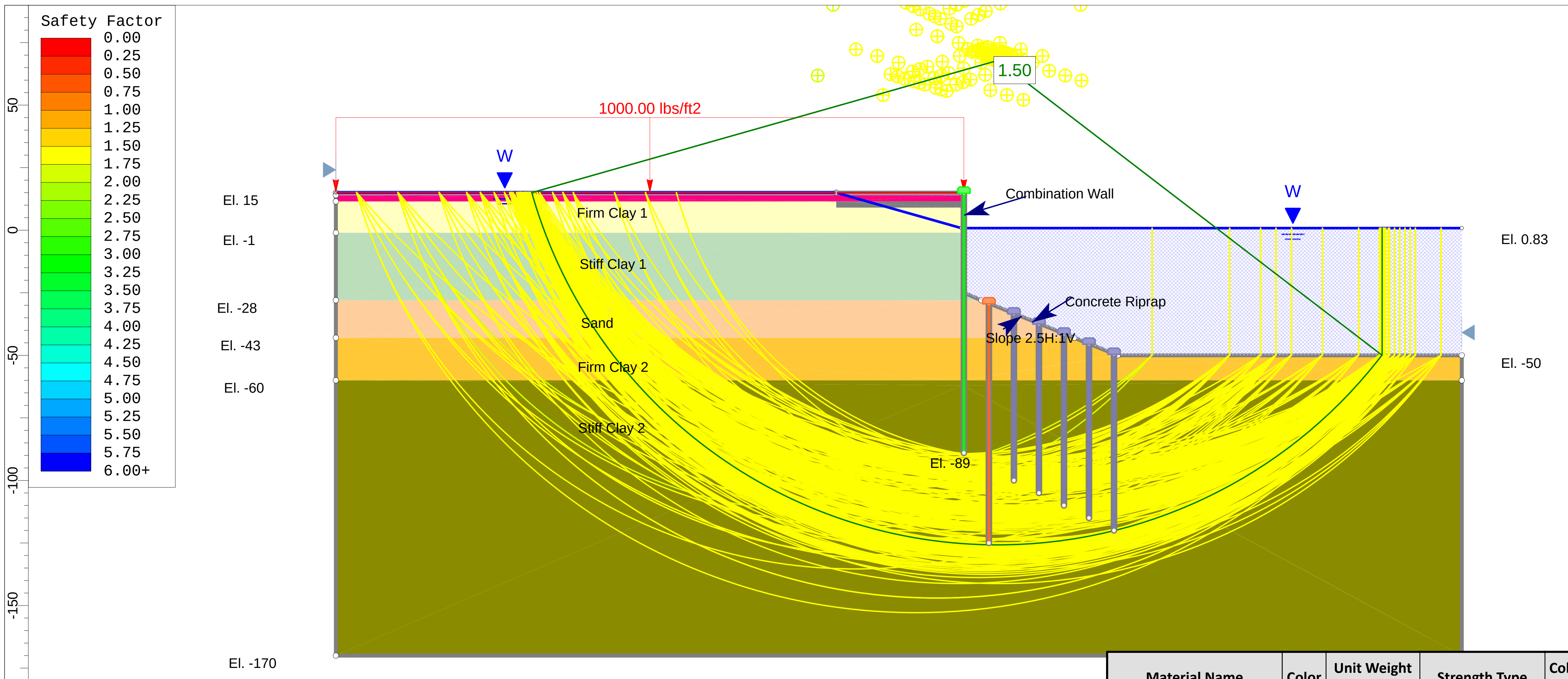


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	100	22	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	90	18	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Project	BERTH 6 EXPANSION		
Analysis Description	Global Stability - Proposed Structure - Long Term - Sheet Pile Wall - Lightweight Aggregate		
Drawn By Dennis Turner, P.E.	*Scale* 1:600	*Company*	Fugro Consultants, Inc.
Date March 12, 2015		*Plate*	PLATE E-2

SLIDEINTERPRET 6.011

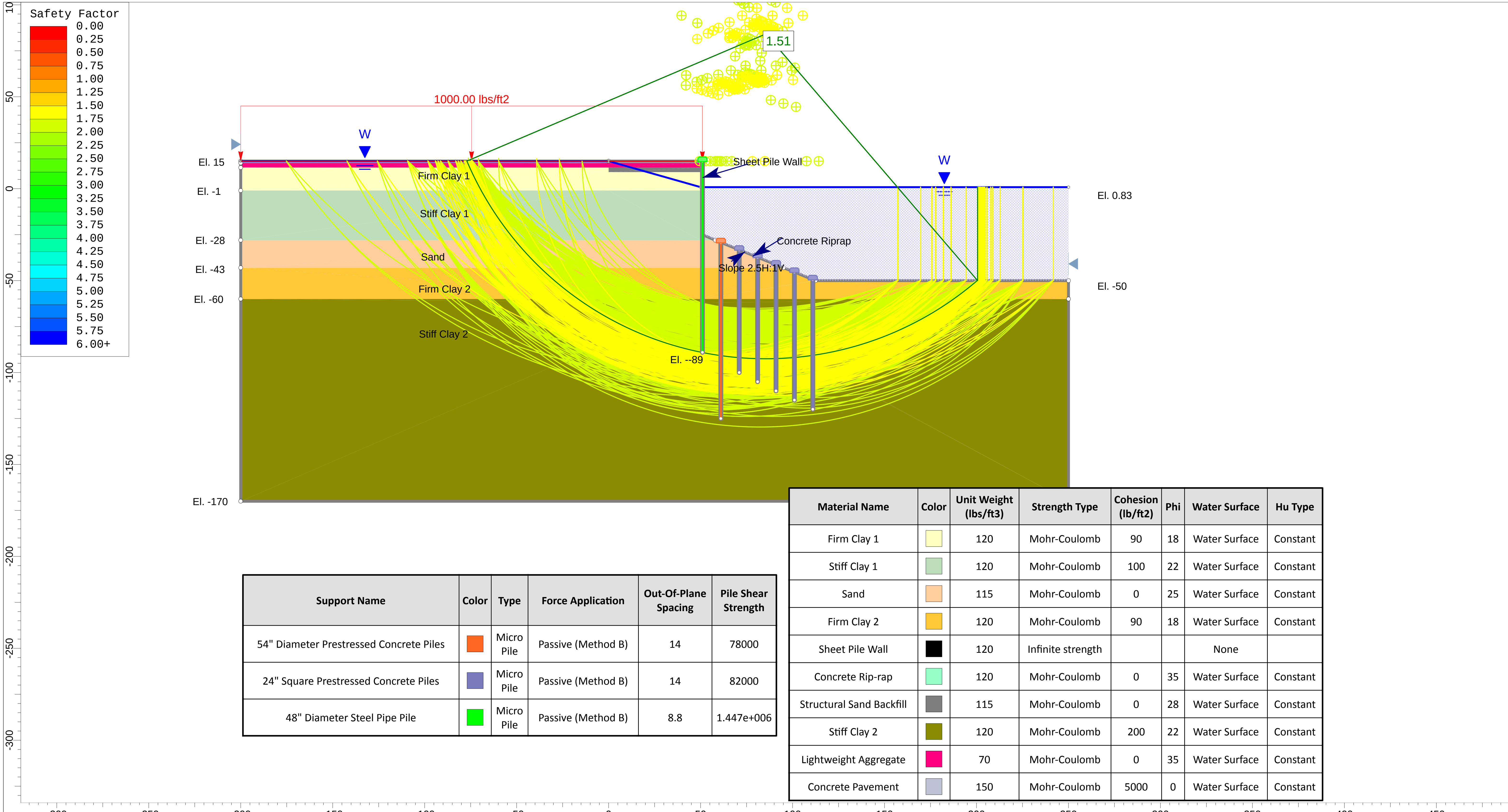


Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1000	0	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	800	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	1700	0	Water Surface
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Short Term -Combination Wall - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE E-3

SLIDEINTERPRET 6.011



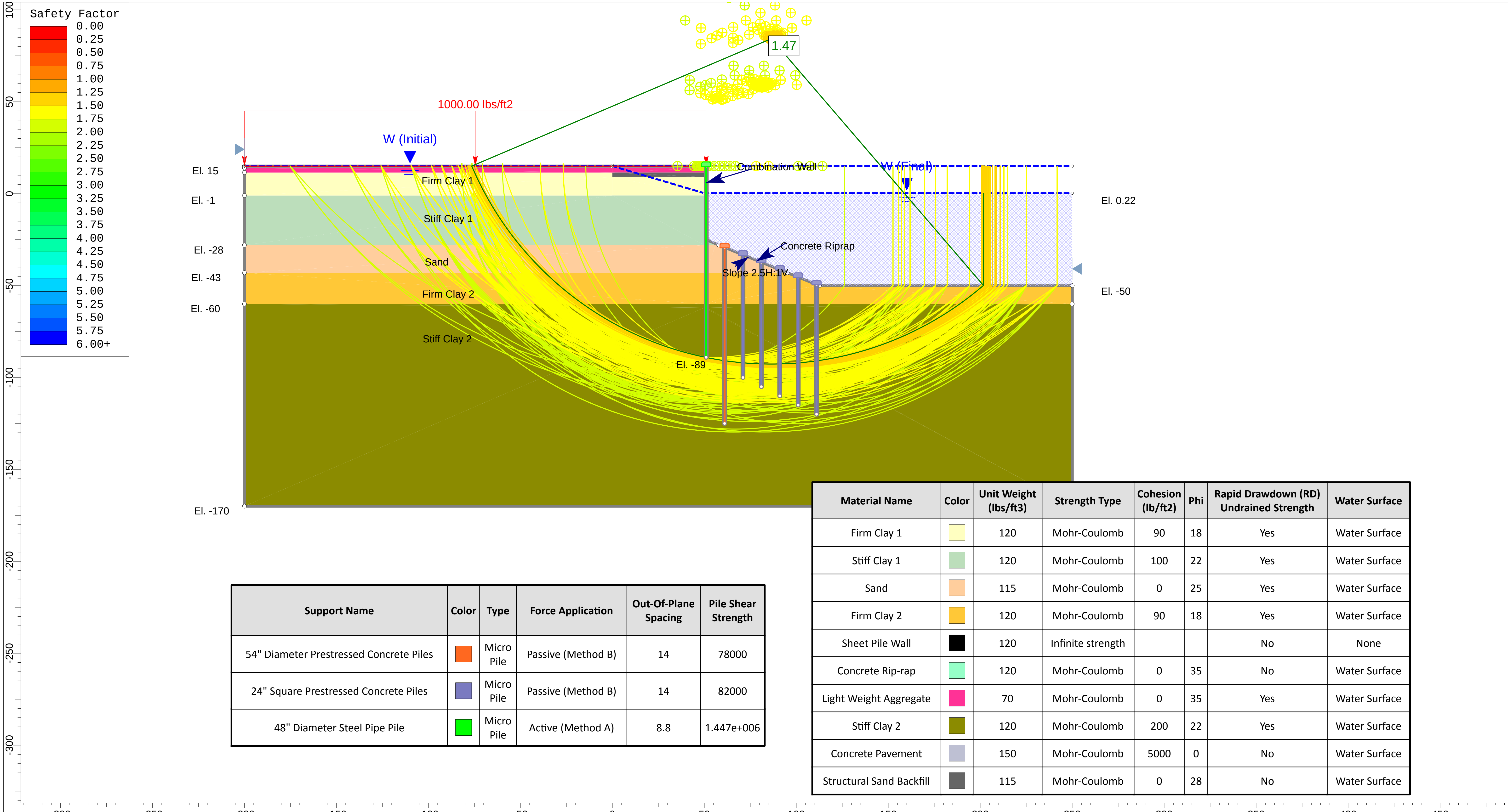
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
48" Diameter Steel Pipe Pile		Micro Pile	Passive (Method B)	8.8	1.447e+006

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type
Firm Clay 1		120	Mohr-Coulomb	90	18	Water Surface	Constant
Stiff Clay 1		120	Mohr-Coulomb	100	22	Water Surface	Constant
Sand		115	Mohr-Coulomb	0	25	Water Surface	Constant
Firm Clay 2		120	Mohr-Coulomb	90	18	Water Surface	Constant
Sheet Pile Wall		120	Infinite strength			None	
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface	Constant
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface	Constant
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface	Constant
Lightweight Aggregate		70	Mohr-Coulomb	0	35	Water Surface	Constant
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface	Constant

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Long Term -Combination Wall - Lightweight Aggregate
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE E-4



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
48" Diameter Steel Pipe Pile		Micro Pile	Active (Method A)	8.8	1.447e+006

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Firm Clay 1		120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	100	22	Yes	Water Surface
Sand		115	Mohr-Coulomb	0	25	Yes	Water Surface
Firm Clay 2		120	Mohr-Coulomb	90	18	Yes	Water Surface
Sheet Pile Wall		120	Infinite strength			No	None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	No	Water Surface
Light Weight Aggregate		70	Mohr-Coulomb	0	35	Yes	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Yes	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	No	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	No	Water Surface

SLIDEINTERPRET 6.011

Project BERTH 6 EXPANSION

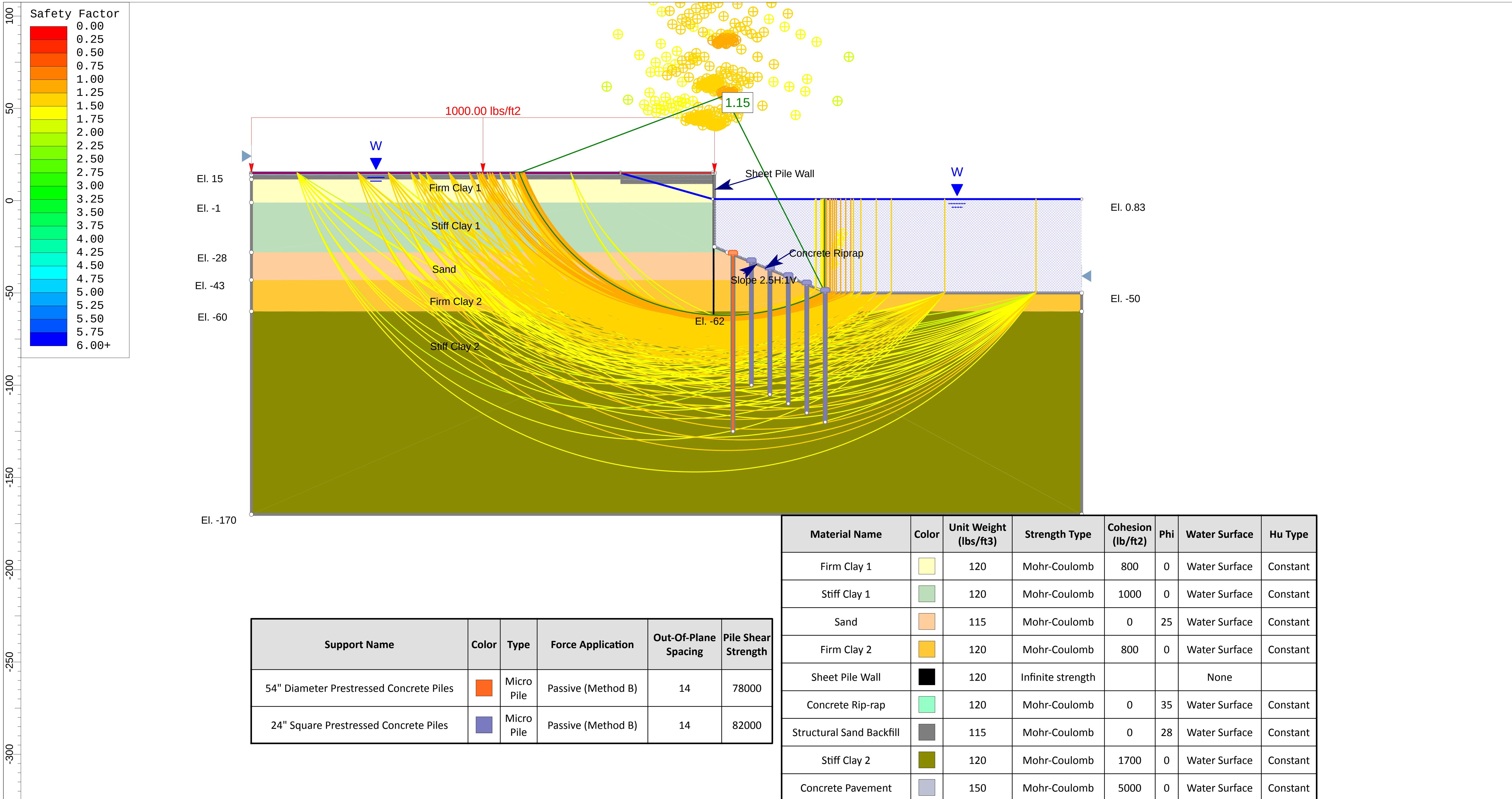
Analysis Description Global Stability - Proposed Structure - Rapid Draw Down -Combination Wall - Lightweight Aggregate

Drawn By Dennis Turner, P.E. | *Scale* 1:600 | *Company* Fugro Consultants, Inc.

Date March 12, 2015 | *Plate* PLATE E-5

APPENDIX F

PROPOSED BULKHEAD, SAND PAVEMENT SUBGRADE



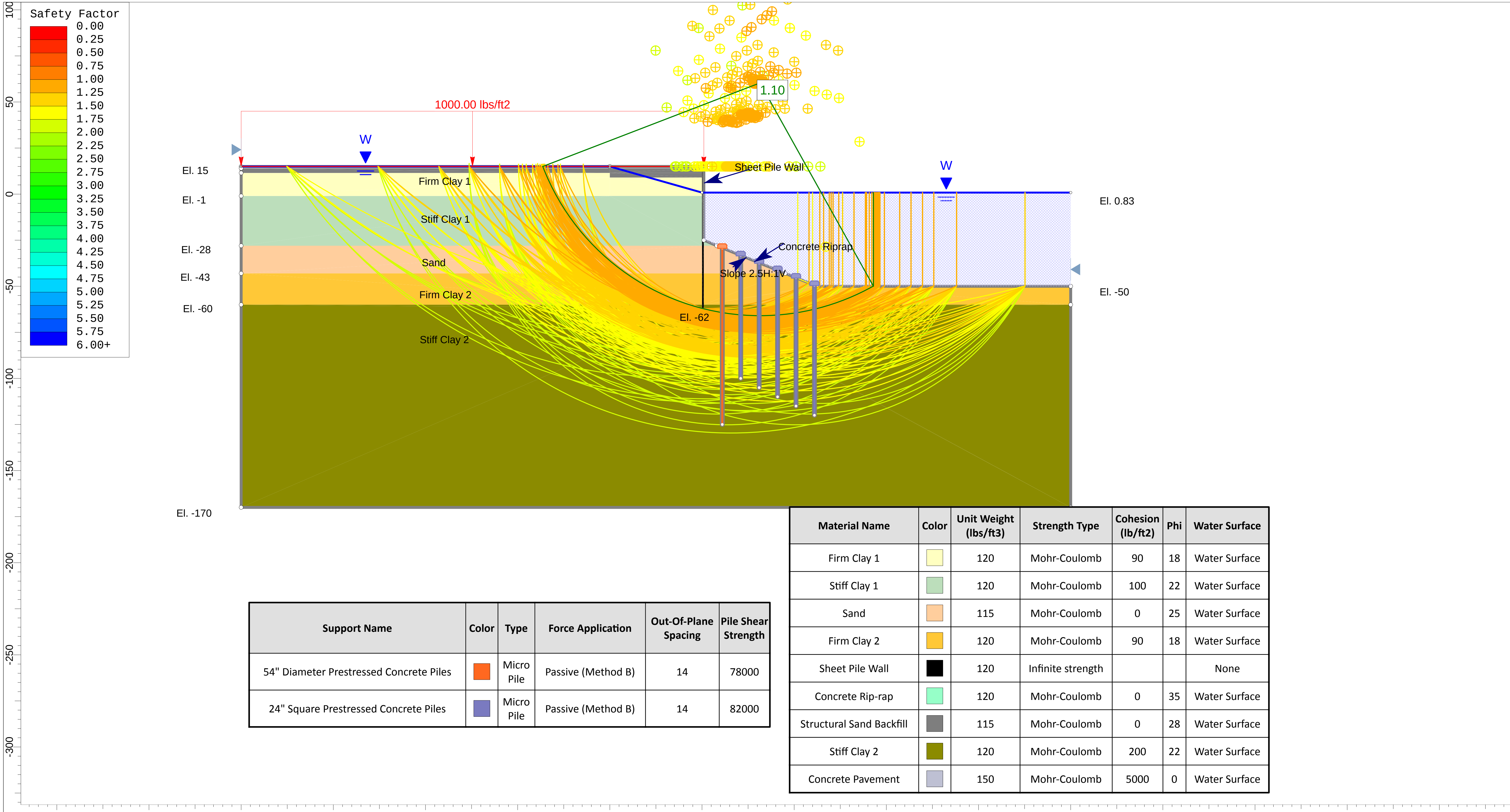
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type
Firm Clay 1		120	Mohr-Coulomb	800	0	Water Surface	Constant
Stiff Clay 1		120	Mohr-Coulomb	1000	0	Water Surface	Constant
Sand		115	Mohr-Coulomb	0	25	Water Surface	Constant
Firm Clay 2		120	Mohr-Coulomb	800	0	Water Surface	Constant
Sheet Pile Wall		120	Infinite strength			None	
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface	Constant
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface	Constant
Stiff Clay 2		120	Mohr-Coulomb	1700	0	Water Surface	Constant
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface	Constant

FUGRO

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Short Term - Sheet Pile Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE F-1

SLIDEINTERPRET 6.011



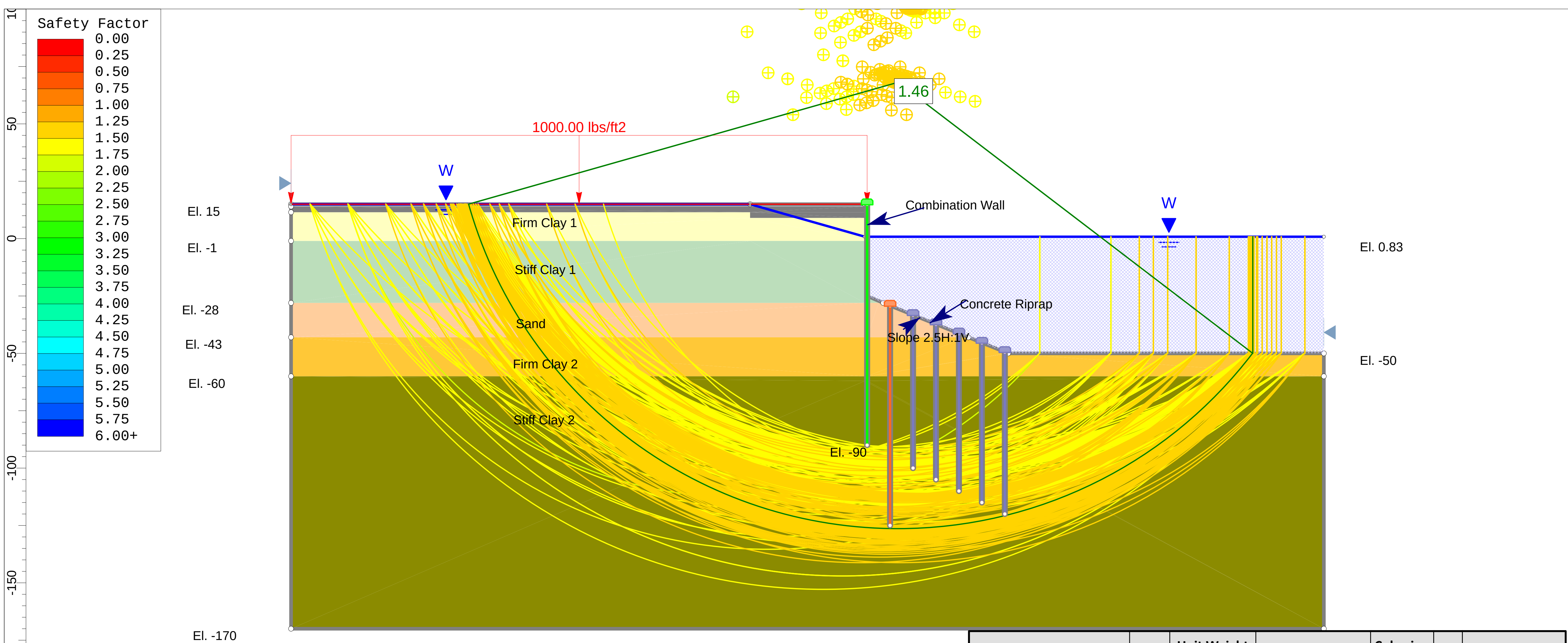
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	100	22	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	90	18	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Long Term - Sheet Pile Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE F-2

SLIDEINTERPRET 6.011



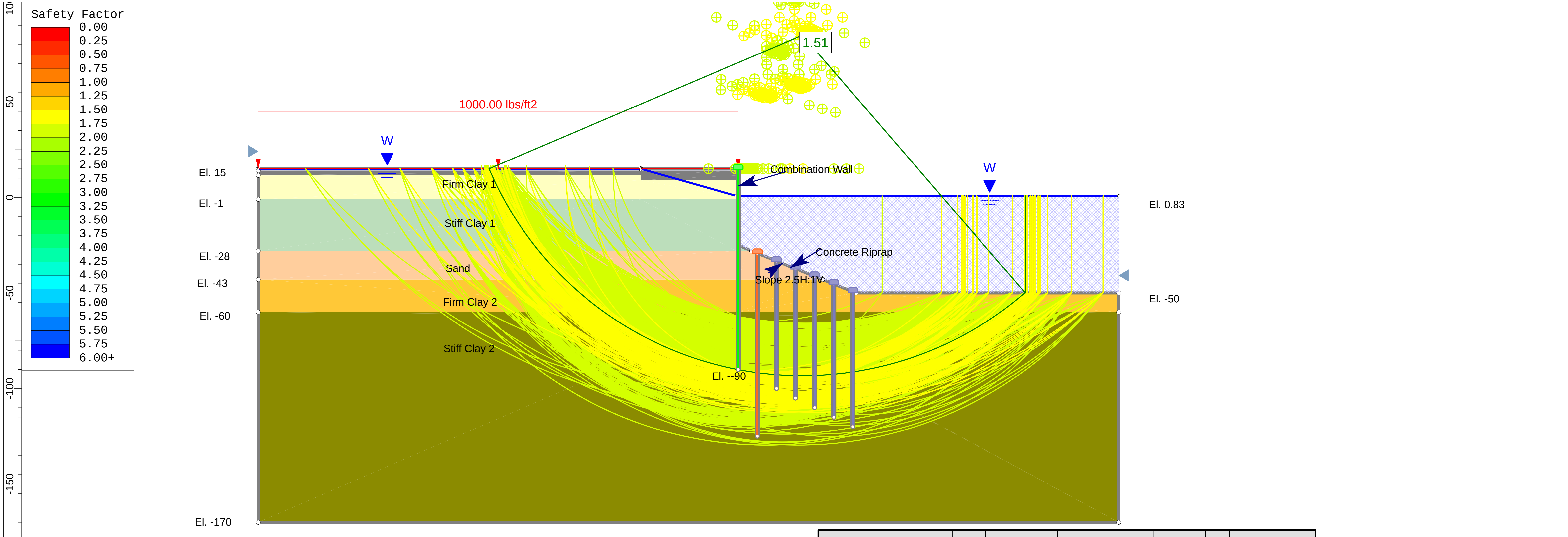
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
48" Diameter Steel Pipe Pile		Micro Pile	Active (Method A)	8.8	1.447e+006

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	800	0	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	1000	0	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	800	0	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	1700	0	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Short Term - Combination Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE F-3



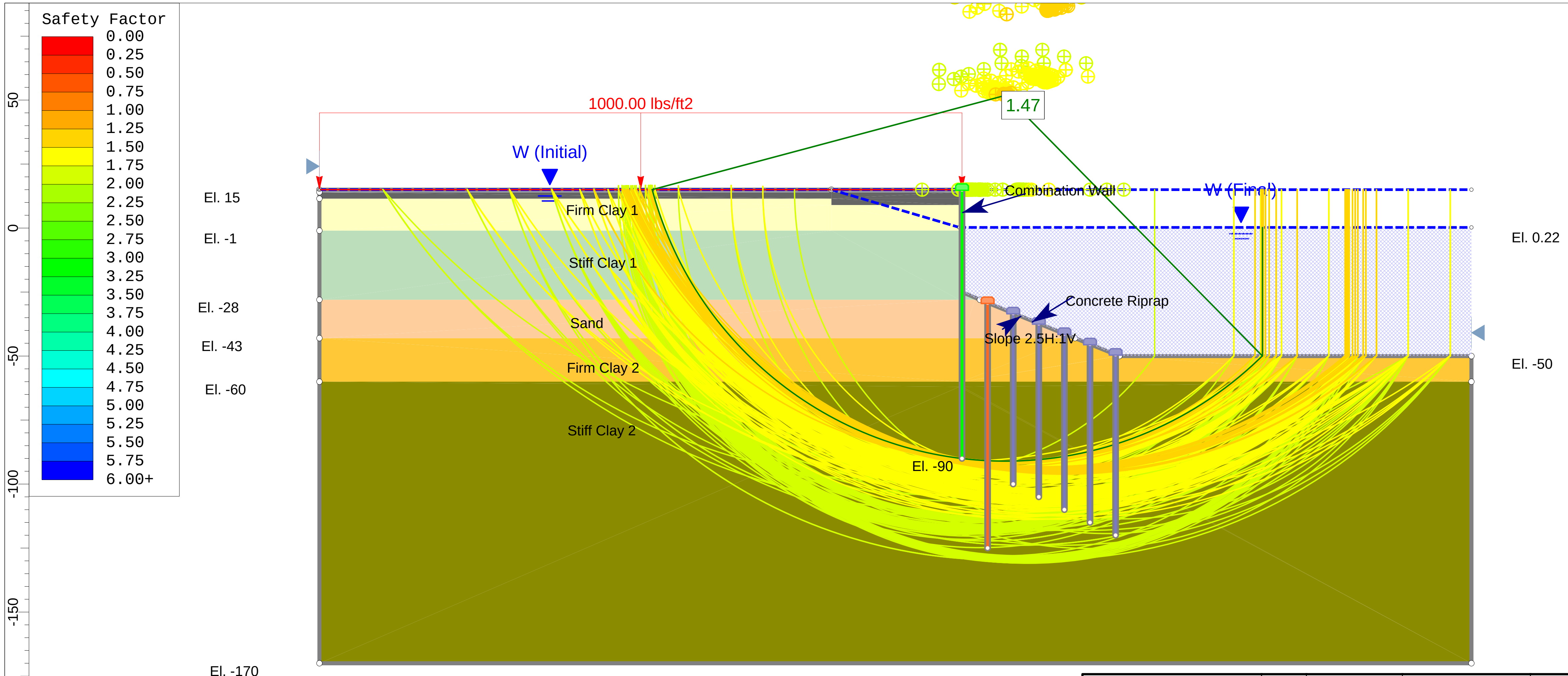
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
48" Diameter Steel Pipe Pile		Micro Pile	Passive (Method B)	8.8	1.447e+006

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface
Firm Clay 1		120	Mohr-Coulomb	90	18	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	100	22	Water Surface
Sand		115	Mohr-Coulomb	0	25	Water Surface
Firm Clay 2		120	Mohr-Coulomb	90	18	Water Surface
Sheet Pile Wall		120	Infinite strength			None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	Water Surface

FUGRO

SLIDEINTERPRET 6.011

Project	BERTH 6 EXPANSION
Analysis Description	Global Stability - Proposed Structure - Long Term - Combination Wall - Structural Sand Backfill
Drawn By	Dennis Turner, P.E.
Scale	1:600
Company	Fugro Consultants, Inc.
Date	March 12, 2015
Plate	PLATE F-4



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing	Pile Shear Strength
54" Diameter Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	78000
24" Square Prestressed Concrete Piles		Micro Pile	Passive (Method B)	14	82000
48" Diameter Steel Pipe Pile		Micro Pile	Active (Method A)	8.8	1.447e+006

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Rapid Drawdown (RD) Undrained Strength	Water Surface
Firm Clay 1		120	Mohr-Coulomb	90	18	Yes	Water Surface
Stiff Clay 1		120	Mohr-Coulomb	100	22	Yes	Water Surface
Sand		115	Mohr-Coulomb	0	25	Yes	Water Surface
Firm Clay 2		120	Mohr-Coulomb	90	18	Yes	Water Surface
Sheet Pile Wall		120	Infinite strength			No	None
Concrete Rip-rap		120	Mohr-Coulomb	0	35	No	Water Surface
Stiff Clay 2		120	Mohr-Coulomb	200	22	Yes	Water Surface
Concrete Pavement		150	Mohr-Coulomb	5000	0	No	Water Surface
Structural Sand Backfill		115	Mohr-Coulomb	0	28	No	Water Surface

-300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 50

FUGRO

SLIDEINTERPRET 6.011

Project
BERTH 6 EXPANSION

Analysis Description
Global Stability - Proposed Structure - Rapid Draw Down - Combination Wall - Structural Sand Backfill

Drawn By Dennis Turner, P.E.	*Scale* 1:600	*Company* Fugro Consultants, Inc.
Date March 12, 2015		*Plate* PLATE F-5