ARKANSAS DEPARTMENT OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. 100633

FEDERAL AID PROJECT NO. STPF-0028(60)

PARAGOULD – NORTH (S)

STATE HIGHWAY 49 **SECTION** 2

IN GREENE **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

October 28, 2019

TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 100633
Paragould - North (S)
Route 49 Section 2
Greene County

Based on soil information from projects in the surrounding area, an estimated R-Value of less than five is appropriate for pavement design.

Listed below is the additional information requested for use in developing the plans:

Asphalt Concrete Hot Mix

Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	5.0	95.0
Binder Course	4.1	95.9
Base Course	3.9	96.1

Michael C. Benson
Materials Engineer

MCB:pt:bjj
Attachment
cc: State Constr. Eng. – Master File Copy
District 10 Engineer
System Information and Research Div.
G. C. File

ARKANSAS DEPARTMENT OF TRANSPORTATION
ARDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

November 30, 2022

TO: Mr. Rick Ellis, Bridge Engineer

SUBJECT: Job No. 100633
Paragould-North (S)
Greene County
Routes 49, Section 2

Introduction

Submitted herein are the results of the subsurface investigation and geotechnical recommendations for the proposed bridges planned on Highway 49 in Greene County.

This project consists of constructing two (2) structures; one bridge to replace the existing bridge over Jacks Creek and one bridge to replace the existing bridge over Locust Creek. The bridges will be constructed at the current locations and widened to the northwest. Site 1, the new Jacks Creek Bridge will be a Single Integral W-beam unit. It will have a total length of 100 feet and an out-to-out width of 78 feet. Site 2, the new Locust Creek bridge will be three (3) span Continuous Integral W-beam units (50'-65'-50'). It will have a total length of 166 feet and an out-to-out width of 78 feet.

2-Horizontal to 1-vertical (2H:1V) end slopes and (3H:1V) side slopes are planned at West embankment on Jacks Creek and (2H:1V) on East embankment on Jacks Creek. Locust Creek is (3H:1V) side slopes. Embankment height varies from 14 feet to 15 feet on Site 1. Embankment height varies from 12 to 16 feet on Site 2. A Seismic Operational Classification of "Essential" is assigned to the two (2) replacement bridges.

Field Investigation

A subsurface investigation was requested on September 9, 2021, by Bridge Division to develop recommendations for bridge foundations and to verify the suitability of bridge abutment embankment configuration. The subsurface investigation was performed based on the plans provided to the Geotechnical Section on the date mentioned above. Ten (10) borings were requested, and four (4) borings were completed.

Site 1 subsurface conditions were investigated by two (2) borings at accessible locations. The originally planned boring locations were inaccessible due to steep banks. Borings were drilled in the existing roadway.

Similarly, Site 2 subsurface conditions were investigated by two (2) borings at accessible locations. The originally planned boring locations were inaccessible due to steep banks. Borings were drilled in the existing roadway.

The approximate locations of the borings are presented in the Plan of Borings included in Attachment A1 for Jacks Creek and Attachment A2 for Locust Creek, respectively. The borings were advanced with a CME 75 rotary drill rig using a combination of hollow-stem auger and rotary wash. The respective boring logs, showing the subsurface conditions encountered in the borings and the results of field and laboratory tests, are also included in Attachment A1 and A2,

immediately following the Plan of Borings. A Legend is attached after the boring logs to interpret / explain the symbols, terms, and conventions used on the logs. Standard Penetration Tests (SPT) were conducted in accordance with ASTM D1586 for field-testing and soil sampling. The correction factor for the hammer is indicated on the boring logs. Liners were not used inside the standard split-barrel samplers.

The number of blows required to drive the standard split-barrel sampler for each 6-inch increment of the total 18-inch drive were measured and recorded on the boring logs. SPT N-values are defined as the total number of blows required to advance the split barrel sampler the final 12 inches of the total 18-inch drive depth. The SPT N-values indicated on the logs are raw (uncorrected) blow counts measured in field.

Lab Investigation

All samples were brought to the Materials laboratory for further evaluation and testing. Soil samples were tested to evaluate index properties and to verify soil type and classification. Lab tests were performed on representative soil samples to determine moisture content, Atterberg limits, and / or gradation. Tested soils were classified by experienced professionals in accordance with both USCS and AASHTO soil classification systems. The laboratory test and their corresponding ASTM and / or AASHTO test methods are listed below in Table 1.

Table 1: Summary of Laboratory Tests and Methods

Laboratory	ASTM	AASHTO	Denotation on Logs
Moisture Content	D2216	T 265	Solid Circle Symbol (●)
Grain Size Analysis by Sieving	D6913	T 88	Whole Number in the "- No. 200 %" Column (e.g., 12)
Atterberg Limits	D4318	T 89	Plus, Symbol (+) on the Right for Liquid Limit
		T 90	Plus, Symbol (+) on the Left for Plastic Limit

The particle size through which 50% of particles by weight passing, D_{50}, is summarized below in Table 2. Detailed particle size distribution curves used for D_{50} determination is included in Attachment B.

Table 2: Summary of D_{50} for Scour Analysis

Bridge	Station	Sample Type	Location	D_{50}, mm
Site 1 (Jacks Creek)	150+00, 35' Lt.	Bulk	Creek Bank	3.0
Site 2 (Locust Creek)	196+20, 46' Lt.	Bulk	Creek Bank	<0.075

Site Conditions

Site 1 – Jacks Creek. The existing bridge over Jacks Creek is 31.5 feet wide (25.8 feet clear roadway) and 92 feet long and consists of three (3) steel I-beam spans supported by concrete pile bents. The existing bridge is located approximately in the same location as the proposed bridge.

Site 2 – Locust Creek. The existing bridge over Locust Creek is 31.5 feet wide (25.8 clear roadway) and 153 feet long and consists of five (5) steel I-beam spans supported by concrete pile bents. The existing bridge is located at approximately the same location as the proposed bridge. The end slopes of the existing bridge have riprap plating.

Both sites are in a wooded valley as well as farmland on highway 49. Jacks Creek flows from the northwest to the east. Locust Creek flows from the northwest to the southeast. Overhead power lines only parallel Site 1 on the northwest side of Highway 49. Images of both sites can be viewed in Attachment C1 for Site 1 and C2 for Site 2.

Site Geology/Generalized subsurface conditions

The project alignment is in the mapped outcrop of Quaternary terrace deposits. In general, terrace deposits consist of a complex sequence of unconsolidated gravels, sandy gravels, sands, silty sands, silts, silty clays, and clays. At 110 feet below ground level (Site 1), the Eocene Wilcox Group (**Zone 6)** was encountered. The Wilcox Group at Site 1 is composed of dark brown silty clay, sandy clay, and silt with sand. Some samples in this zone contained a trace of lignite. The formation representing the Wilcox Group at this site may be the Flour Island Formation. In **Zone 4** of Site 2 the Wilcox Group was encountered. The Wilcox Group at Site 2 consists of light gray silt to silty fine sand. This zone had several cemented seams. The formation representing the Wilcox Group at site may be the Fort Pillow Formation.

See generalized subsurface profile in Attachment D1 for Site 1 and Attachment D2 for Site 2 for more understanding of zones.

Seismic Conditions

Considering the average subsurface conditions as revealed by the borings, a Seismic Site Class E (Soft Soil profile) is calculated for the project sites. Utilizing the **Seismic Site Class E** and the approximate GPS coordinates of the project sites, the following design peak ground acceleration coefficients (A_S), design short-period spectral acceleration coefficients (S_{DS}), as well as design long-period spectral acceleration coefficients (S_{D1}), are determined. These seismic coefficients are summarized in Table 3a for Site 1 and Table 3b for Site 2. Design Response Spectrum is presented in Attachment E1 for Site 1 and Attachment E2 for Site 2.

Table 3a: Summary of Design Ground Motion Acceleration Response Coefficients

Jacks Creek (Site 1)	
Acceleration Coefficient	Value (g)
A_S (Site PGA)	0.479
S_{DS} (0.2 sec)	0.908
S_{D1} (1 sec)	0.733

Table 3b: Summary of Design Ground Motion Acceleration Response Coefficients

Locust Creek (Site 2)	
Acceleration Coefficient	Value (g)
A_S (Site PGA)	0.480
S_{DS} (0.2 sec)	0.907
S_{D1} (1 sec)	0.734

For the design long-period spectral acceleration coefficient (S_{D1}) of 0.733 for Site 1 and (S_{D1}) of 0.734 for Site 2, a **Seismic Performance Zone 4** is considered applicable for both sites.

Liquefaction potential of the subsurface soils were evaluated based on the results of the borings and utilizing the current Microsoft Excel© spreadsheet developed by University of Arkansas for ARDOT. An Earthquake Moment Magnitude (M_W) of 7.5 and the design peak ground acceleration coefficient (As) of 0.479 for Site 1 and 0.480 for Site 2 were modelled in the analysis. The results of Boring 2 for Site 1 and Boring 4 for Site 2 were chosen for the liquefaction analyses due to more abundant laboratory data performed for these borings. These borings were advanced more than 100 ft. and located near the bridge ends of the proposed alignments. The results of liquefaction analyses are presented in Attachment F1 for Site 1 and Attachment F2 for Site 2, respectively as a plot of calculated factor of safety against liquefaction versus depth below ground surface at the boring location. The analyses indicated **Potential of Liquefaction** for both project sites.

Embankment Configuration

Settlement Potential- The foundation soils in the widening section mainly comprise of granular silts and sand. It is anticipated that most of the settlement will be elastic settlement and will take place shortly after embankment loading is applied. Long-Term consolidation settlement is expected to be minimal.

Embankment Analysis- Stability analyses have been performed to evaluate the design abutment configuration. Slope stability analyses were performed utilizing a commercial computer program Slide2 (Version 2021) developed by RocScience. Spencer analysis method was utilized to analyze the east and west abutment. Three (3) general loading conditions were analyzed with respect to slope stability: Short Term / End of Construction Condition, Long Term Condition, and

Seismic / Pseudo-Static Condition. A horizontal acceleration coefficient (K_h) of 0.2395 (0.479 A_s/g) for Site 1 and (K_h) of 0.24 (0.480 A_s/g) for Site 2 were utilized for analysis of the Seismic / Psuedo-Satic Condition. A surcharge of 250 psf is included to model the live load under long term condition.

Results of the Analyses are stated in Table 4a and 4b. The Analyses images are shown in Attachment G1 for Site 1 and Attachment G2 for Site 2.

Table 4a: Results of Slope Stability analyses for Site 1 – Jacks Creek

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Bent 1 (West Embankment)	Short Term	2.26	1.3
	Long Term	1.40	1.5
	Seismic (k_h = 0.2395)	1.13	1.1
2H:1V End Slope – Bent 2 (East Embankment)	Short Term	1.72	1.3
	Long Term	1.39	1.5
	Seismic (k_h = 0.2395)	0.82	1.1

Table 4b. Results of Slope Stability Analyses for Site 2- Locust Creek

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Bent 1 (West Embankment	Short Term	1.89	1.3
	Long Term	1.49	1.5
	Seismic (k_h = 0.24)	0.97	1.1
2H:1V End Slope – Bent 4 (East Embankment)	Short Term	2.49	1.3
	Long Term	1.60	1.5
	Seismic (k_h = 0.24)	1.00	1.1

Ground Improvements

Results of the analyses show that plan configuration for 2H: 1V end slopes is not suitable. In addition, analyses indicate potential of liquefaction. Ground improvements are necessary to mitigate the liquefaction potential and to satisfy the minimum factors of safety. **Timber piles are recommended for mitigation.** Reinforcing embankment using geosynthetics is not a viable option due to the widened embankment comprised of existing embankment and new embankment.

Timber Piles- To mitigate the liquefaction potential and to improve embankment stability, timber compaction piles are recommended for ground densification and reinforcement. Materials and construction of timber compaction piles should conform to the requirements specified in the project Special Provision “Timber Piling for Soil Densification” (Attachment H) and the recommendations provided in this geotechnical report.

Additional slope analyses have been performed to aid in design of timber compaction piles (pile strength, dimensions, layout, limits, etc.). Based on the results of the slope stability analyses, the following pile design parameters are recommended (see Table 5a for Site 1 and Table 5b for

Site 2) to achieve embankment stability. Ground improvements design and slope stability analyses have been performed based on the assumed use of South Yellow Pile or Douglas Fir compaction piles. A rectangular pile layout is recommended. Recommended limits of the pile reinforcements are shown on the Timber Compaction Pile Layout included in Attachment I1 for Site 1 and I2 for Site 2.

Table 5a: Recommended Design Parameters for Timber Compaction Piles – Jacks Creek

Abutment (Bent No.)	Min. Pile Length, ft.	Min. Butt Diameter, in.	Min. Tip Diameter, in.	Longitudinal Spacing, ft.	Transverse Spacing, ft.
South Abutment (Bent 1)	45	13	6	6	6
North Abutment (Bent 2)	45	13	6	6	6

Table 5b: Recommended Design Parameters for Timber Compaction Piles – Locust Creek

Abutment (Bent No.)	Min. Pile Length, ft.	Min. Butt Diameter, in.	Min. Tip Diameter, in.	Longitudinal Spacing, ft.	Transverse Spacing, ft.
South Abutment (Bent 1)	45	13	6	8	8
North Abutment (Bent 4)	45	13	6	8	8

Slope stability has been performed on the more critical embankment configuration at East abutment (Bent 2) of the Jacks Creek site. At the Locust Creek site, the more critical East abutment (Bent 4) was analyzed. The slope stability analysis with improvements is summarized below in Table 6a for Site 1 and Table 6b for Site 2 below. Detailed graphic plots of the slope stability analyses are included in Attachment J1 for Site 1 and J2 for Site 2.

Table 6a: Slope Stability of Embankments on Improved Ground – Jacks Creek

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Bent 2	Short Term	Not Analyzed	1.3
	Long Term	1.63	1.5
	Seismic (k_h = 0.2395)	1.10	1.1
2H:1V Side Slope – Bent 2 (Right Side)	Short Term	Not Analyzed	1.3
	Long Term	1.52	1.5
	Seismic (k_h = 0.2395)	1.28	1.1

Table 6b: Slope Stability of Embankments on Improved Ground – Locust Creek

Slope	Loading Condition	Calculated Min. F.S.	Recommended Min. F.S.
2H:1V End Slope – Bent 4	Short Term	Not Analyzed	1.3
	Long Term	1.60	1.5
	Seismic (k_h = 0.24)	1.12	1.1
3H:1V Side Slope – Bent 4 (Right Side)	Short Term	Not Analyzed	1.3
	Long Term	3.17	1.5
	Seismic (k_h = 0.24)	1.68	1.1

The results summarized in Table 6 indicate the plan embankment configuration is suitable with respect to the recommended ground improvements. The conditions "Not Analyzed" were due to the planned configuration being acceptable before improvements were made.

Foundation Recommendations

Axial Capacities- Based on the request made by Bridge Division, it is understood that both sites will be concrete filled steel shell piles to support the foundation loads. It is also understood 16-in.-diameter piles are tentatively planned at the abutments to achieve the design nominal axial compression pile capacity of 130 to 195 tons per pile. At the intermediate bents, design nominal axial compression pile capacity of 235 tons per pile is required and 24-in.-diameter piles are considered. The Geotechnical Section recommends 18" piles for both abutments at each site and 24" piles for intermediate bents at Locust Creek.

Nominal axial capacities (compression and uplift) vs. pile tip penetration / elevation curves for single, 18-Inch and 24-inch diameter concrete filled steel shell piles are provided in Attachment K1 for Site 1 and Attachment K2 for Site 2, respectively. For single, isolated foundations, a resistance factor (φ_{stat}) of 0.45 is recommended or calculating factored compression resistance and a resistance factor (φ_{up}) of 0.35 is recommended for determining factored uplift resistance. Tables 7a and 7b indicate the recommended pile length for both job sites.

Table 7a: Recommended Pile Length / Penetration- Jacks Creek

Bent No.	Required Nominal Axial Resistance, Tons	Pile Diameter, Inch	Recommended Pile Length, Feet
1	195	18	70
2	195	18	70

Table 7b: Recommended Pile Length / Penetration- Locust Creek

Bent No.	Required Nominal Axial Resistance, Tons	Pile Diameter, Inch	Recommended Pile Length, Feet
1	130	18	55
2	235	24	60
3	235	24	70
4	130	18	70

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

Considering the construction sequence of piles at the abutments being driven after the embankment is in place, down drag on piling is expected to be negligible. In addition, these capacities are determined for piles driven to the required penetration / elevation. If jetting or other methods are used to assist in advancing the piles, re-evaluation of these pile capacities will be warranted.

The piles are expected to be tipped in the predominantly sandy / silty soils that are likely to be liquefied during driving with considerable resistance loss at the end of initial drive. If the required nominal bearing capacity has not been obtained when top of piles is 6 inches above plan grade, considerations may be given to restriking the piles with a warmed-up hammer after a minimum 24-hour waiting time.

Geotechnical Input Parameters for Lateral Load Analysis using Lpile - Lateral load analysis will be performed by the structural engineer using commercial computer program Lpile. The geotechnical input parameters are in Attachment L1 for Site 1 and L2 for Site 2.

Pile Installation - Piles should be installed in accordance with Section 805 (2014 Edition). Prior to piling, hammer systems furnished by the Contractor should be evaluated and approved by the Engineer.

Prebore is not anicipated to be required. Water jetting, vibrating, or other means for the purpose of assisting pile penetration are generally not expected. If warranted by specific subsurface conditions, the use of water jetting or virbrating would require review and approval by the Engineer. In addition, the final 5 feet of pile penetratin should be achieved by driving.

Piling should be observed and recorded by the Engineer. Test piles are not required, but the contractor may pursue for information purposes. Nominal bearing capacity should be determined in accordance with Subsection 805.09(b), "Method B- Wave Equation Analysis (WEAP)".

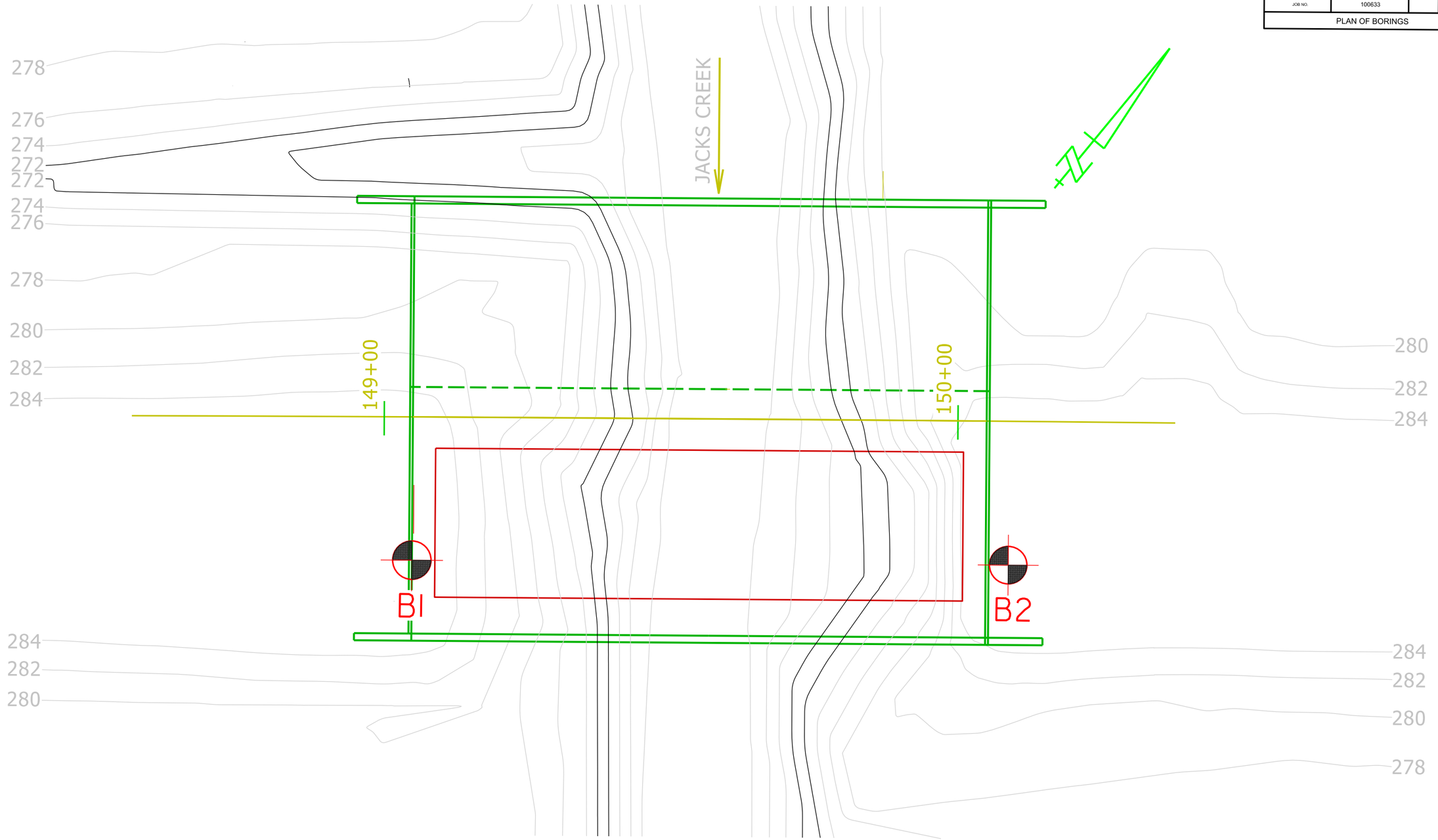
If there are any questions concerning these recommendations, please contact the Geotechnical Section.

Paul Tinsley
Materials Engineer

PT:yz:mbb:cs
cc: State Construction Engineer
District 10 Engineer
G. C. File

Attachment A1

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		100633		
PLAN OF BORINGS				



Boring	Station	Offset
1	149+05	25' RT
2	150+09	25' RT

PLAN OF BORINGS	
Paragould- North (S) ROUTE 49, SECTION 2 GREENE COUNTY FED. AID PROJECT	
JOB NO. 100633	SHEET 1/1

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 1 Jacks Creek
PAGE 1 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 149+05
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 21 and 28, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Asphalt						
5			Moist, Medium Stiff, Brown and Gray Silty Clay				2 3-3		
10			Wet, Very Loose, Brown and Gray Silt				3 2-2		
15			Wet, Medium Dense, Brown and Gray Silt				2 5-10		
20			Wet, Loose, Brown and Gray Silt with Sand				2 3-4		
25			Wet, Medium Dense, Brown and Gray Sandy Silt				5 6-8		
30			Wet, Very Loose, Dark Gray Silt				0 1-1		
35									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 1 Jacks Creek
PAGE 2 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 149+05
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 21 and 28, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 285.6						
40			Wet, Loose, Dark Gray Silt				2 2-3		
45			Wet, Very Loose, Dark Gray Silt				1 1-3		
50			Wet, Loose, Dark Gray Silt with Some Organic Matter (Wood)				3 4-4		
55			Wet, Loose, Dark Gray Silt with Some Organic Matter (Wood)				2 3-5		
60			Wet, Loose, Dark Gray Silt				1 5-4		
65			Wet, Very Loose, Dark Gray Silt with Trace Organic Matter (Wood)				1 1-1		
70			Wet, Loose, Gray Silty Sand				4 5-5		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 1 Jacks Creek
PAGE 3 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 149+05
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 21 and 28, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 285.6	SOIL GROUP	MOISTURE CONTENT (%) PL — LL (10 20 30 40 50 60 70)	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
75			Wet, Medium Dense, Brown Sand with Silt and Some Gravel				14 16-14		
80			Wet, Dense, Brown Sand with Silt				12 19-16		
85			Wet, Dense, Reddish Brown Sand with Silt and Gravel				18 20-27		
90			Wet, Loose, Dark Gray Silt				4 4-5		
95			Wet, Medium Dense, Dark Gray Silt				1 7-5		
100			Wet, Loose, Dark Gray Silt with Some Organic Matter (Wood)				0 2-3		
105			Wet, Very Dense, Brown Sand with Silt and Some Gravel				14 30-35		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 1 Jacks Creek
PAGE 4 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 149+05
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Anthony Nicholson

DATE: June 21 and 28, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 285.6						
							21 31-27		
110				-					
			Moist, Very Stiff, Dark Brown Silty Sand with Trace Lignite (Wilcox Group)	SM		49	4 7-9		
115									
			Moist, Very Hard, Dark Brown Clay with Sand and Layers of Silt with Trace Lignite	-		58	17 39-28		
120									
			Moist, Medium Dense, Dark Brown Silty Sand	SM		35	6 5-8		
			Boring Terminated						
125									
130									
135									
140									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 2 Jacks Creek
PAGE 1 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 150+09
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Stanley Bates and Anthony Nicholson

DATE: June 15 and 21, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	%TCR	%RQD
			Asphalt						
				-					
5			Moist, Soft, Brown Silty Clay	CL-ML		99	1 2-2		
				-					
10			Moist, Medium Dense, Light Gray Silt	ML		98	5 12-13		
				-					
15			Wet, Loose, Brown Silt	ML		98	4 4-3		
				-					
20			Wet, Medium Stiff, Brown Lean Clay	CL		87	2 3-3		
				-					
25			Wet, Medium Dense, Brown Poorly Graded Sand with Silt	SP-SM		12	9 13-12		
				-					
30			Wet, Medium Dense, Dark Gray Silt with Some Sand and Some Organic Matter (Wood)	ML		87	2 6-8		
				-					
35									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 2 Jacks Creek
PAGE 2 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 150+09
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Stanley Bates and Anthony Nicholson

DATE: June 15 and 21, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	%TCR	%RQD
			SURFACE ELEVATION: 285.6						
40			Wet, Very Soft, Dark Gray Lean Clay	CL -		100	0 0-0		
45			Wet, Very Loose, Dark Gray Silt	ML -		100	0 1-2		
50			Wet, Very Loose, Dark Gray Silt with Trace Organic Matter (Wood)	ML -		100	0 2-2		
55				ML -		99	1 2-2		
60				ML -		99	0 1-3		
65			Wet, Very Loose, Dark Gray Silt with Sand	ML -		72	0 0-1		
70			Wet, Medium Dense, Gray Silty Sand	SM -		26	6 9-8		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 2 Jacks Creek
PAGE 3 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 150+09
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Stanley Bates and Anthony Nicholson

DATE: June 15 and 21, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	%TCR	%RQD
75			Wet, Medium Dense, Brown Well Graded Sand with Silt and Some Gravel	SW-SM / -		10	7 / 13-16		
80			Wet, Dense, Brown Poorly Graded Sand with Silt and Trace Gravel	SP-SM / -		7	11 / 23-22		
85			Wet, Dense, Brown Poorly Graded Sand with Gravel with Some Clay Layers.	SP-SC / -		7	15 / 18-15		
90			Moist, Stiff, Brown Lean Clay	CL / -		99	2 / 4-7		
95			Moist, Medium Stiff, Brown Lean Clay	CL / -		99	2 / 3-3		
100			Moist, Stiff, Brown Sandy Silty Clay with Trace Organic Matter (Wood)	CL-ML / -		59	1 / 6-8		
105			Wet, Dense, Brown Silty Sand with Some Gravel	SP-SM / -		6	12 / 20-17		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 2 Jacks Creek
PAGE 4 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 150+09
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Stanley Bates and Anthony Nicholson

DATE: June 15 and 21, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 121.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 285.6	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	%TCR	%RQD
110			Wet, Very Dense, Sand with Silt and Gravel	SP-SM -		5	20 31-30		
115			Moist, Medium Dense, Dark Brown Silt with Trace Lignite (Wilcox Group)	-			6 9-13		
120			Moist, Medium Dense, Dark Brown Silty Sand	SM -	H	47	9 11-15		
			Moist, Dense, Dark Brown Silt with Sand	ML		85	10 15-19		
125			Boring Terminated						
130									
135									
140									

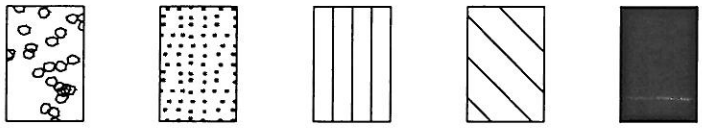
REMARKS:

LEGEND

SOIL TYPES

(SHOWN IN SYMBOL COLUMN)

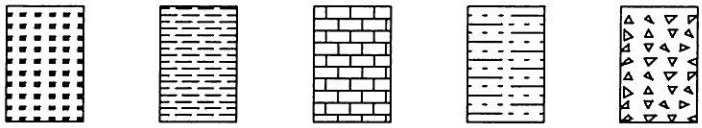
(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL | SAND | SILT | CLAY | ORGANIC MATTER

ROCK TYPES

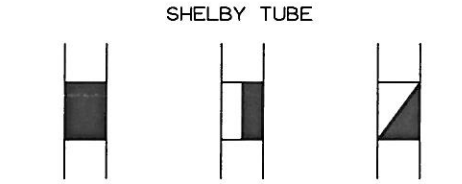
(SHOWN IN SYMBOL COLUMN)



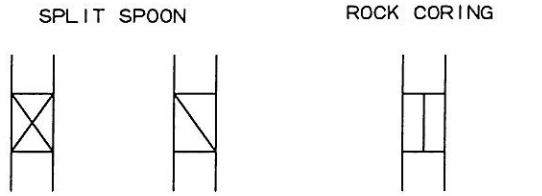
SANDSTONE | SHALE or SILTSTONE | LIMESTONE or DOLOMITE | ALTERNATING LAYERS of SHALE and SANDSTONE | OTHER

SAMPLER TYPES

(SHOWN IN SAMPLE COLUMN)



UNDISTURBED SAMPLE RECOVERY | DISTURBED SAMPLE RECOVERY | NO RECOVERY



SAMPLE RECOVERY | NO RECOVERY | % RECOVERY INDICATED ON LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

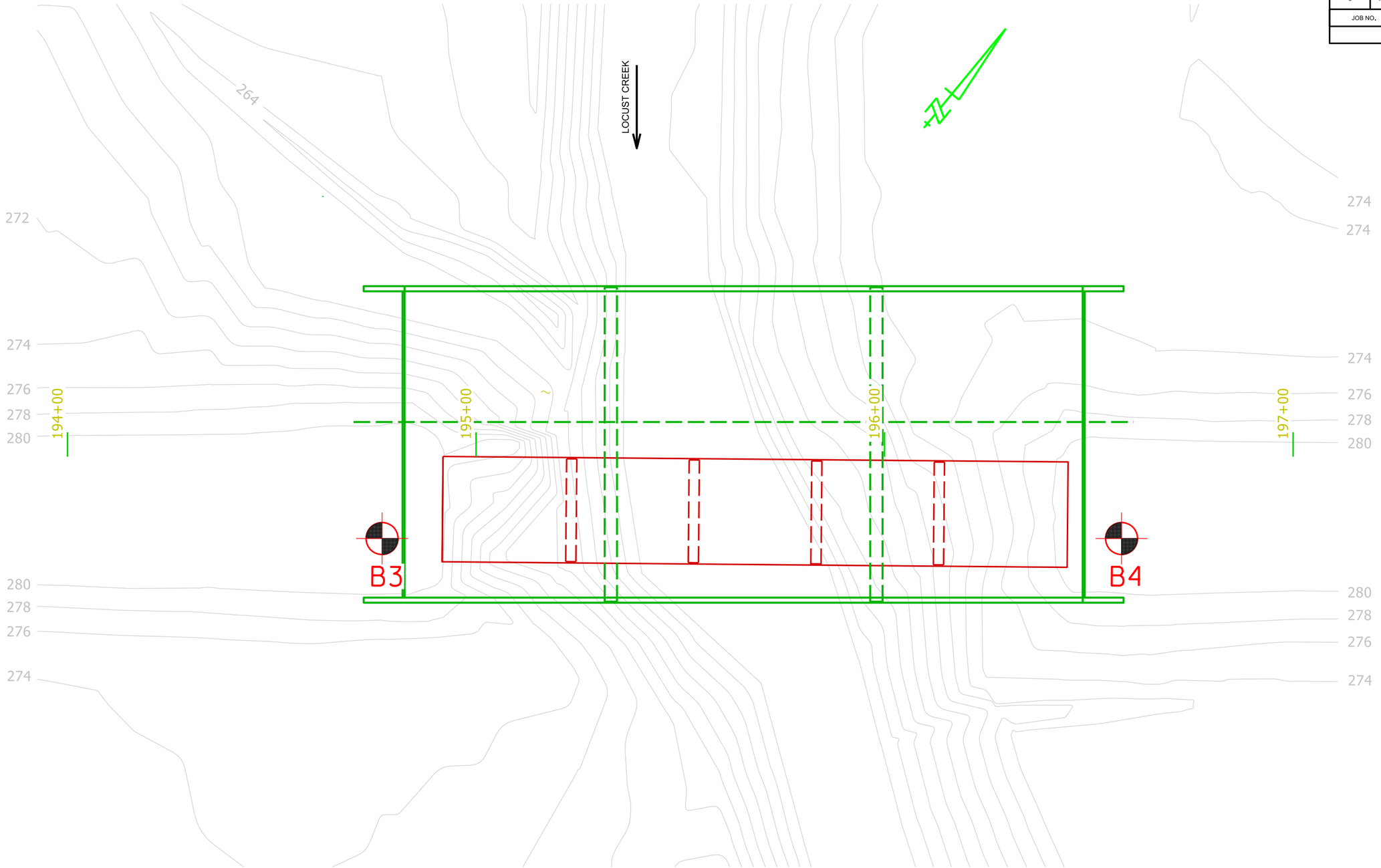
GRANULAR SOIL		CLAY		CLAY-SHALE		SHALE	
'N' Value	Density	'N' Value	Consistency	'N' Value	Consistency	'N' Value	Consistency
0-4	Very Loose	0-1	Very Soft	0-1	Very Soft		
5-10	Loose	2-4	Soft	2-4	Soft	31-60	Soft
11-30	Medium Dense	5-8	Medium Stiff	5-8	Medium Stiff	Over 60	
31-50	Dense	9-15	Stiff	9-15	Stiff	More than 2'	
Over 50	Very Dense	16-30	Very Stiff	16-30	Very Stiff	Penetration	
		31-60	Hard	31-60	Hard	in 60 Blows:	Medium Hard
		Over 60	Very Hard	Over 60	Very Hard	Less than 2'	
						Penetration	
						in 60 Blows:	Hard

1. Ground water elevations indicated on boring logs represent ground water elevations at date or time shown on boring log. Absence of water surface implies that no ground water data is available but does not necessarily mean that ground water will not be encountered at locations or within the vertical reaches of these borings.
2. Borings represent subsurface conditions at their respective locations for their respective depths. Variations in conditions between or adjacent to boring locations may be encountered.
3. Terms used for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System.

Standard Penetration Test – Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and performing the test are recorded for each 6 inches of penetration on the drill log. The field "N" Value (N_f) can be obtained by adding the bottom two numbers for example: $\frac{6}{8-9} \Rightarrow 8+9=17 blows/ft$. The "N" Value corrected to 60% efficiency (N_{60}) can be obtained by multiplying N_f by the hammer correction factor published on the boring log.

Attachment A2

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		100633		
PLAN OF BORINGS				



Boring	Station	Offset
3	194+77	23' RT
4	196+58	23' RT

PLAN OF BORINGS

PARGOULD- NORTH (S)
ROUTE 49, SECTION 2
GREENE COUNTY
FED. AID PROJECT

JOB NO. 100633 | SHEET 1/1

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 3 Locust Creek
PAGE 1 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 194+77
LOCATION: 23' Right of Construction Centerline
LOGGED BY: Stanley Bates and Carson Sloan

DATE: June 14, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 105.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Asphalt						
5			Moist, Medium Stiff, Brown and Gray Silty Clay		•		3 2-4		
10			Moist, Loose, Brown Silt		•		2 3-7		
15			Wet, Loose, Brown Silt				2 4-6		
20			Wet, Medium Dense, Sandy Silt				10 11-7		
25			Wet, Loose, Brown and Gray Silty Sand with Layers of Stiff, Silty Clay				5 6-4		
30							1 2-1		
35									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 3 Locust Creek
PAGE 2 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 194+77
LOCATION: 23' Right of Construction Centerline
LOGGED BY: Stanley Bates and Carson Sloan

DATE: June 14, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 105.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
40			Wet, Very Loose, Dark Gray Silt				1 2-1 0 0-0		
45							0 0-0		
50									
55			Wet, Very Loose, Dark Gray Silt with Organic Matter (Wood)				2 1-2		
60			Wet, Loose, Dark Gray Silt with Some Organic Matter (Wood)				1 3-4		
65			Wet, Loose, Dark Gray Silt				3 3-3		
70			Wet, Loose, Gray Sandy Silt				2 3-4		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 3 Locust Creek
PAGE 3 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 194+77
LOCATION: 23' Right of Construction Centerline
LOGGED BY: Stanley Bates and Carson Sloan

DATE: June 14, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 105.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 280.7	SOIL GROUP	MOISTURE CONTENT (%) PL — LL 10 20 30 40 50 60 70	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
75			Wet, Medium Dense, Gray Sandy Silt				6 5-6		
			Wet, Dense, Brown and Gray Sand with Silt and Trace Gravel				11 17-15		
80			Wet, Medium Dense, Brown and Gray Sand with Silt and Gravel				10 12-11		
85			Moist, Medium Dense, Light Gray Cemented Silt (Wilcox Group)						
90			Moist, Very Dense, Light Gray Cemented Sand				60 (5")		
95			Wet, Very Dense, Light Gray Silty Sand				50 36-60 (8")		
100			Wet, Dense, Light Gray Silty Sand				20 24-9		
105			Wet, Very Dense, Light Gray Silty Sand				22 60 (5")		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 3 Locust Creek
PAGE 4 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 194+77
LOCATION: 23' Right of Construction Centerline
LOGGED BY: Stanley Bates and Carson Sloan

DATE: June 14, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 105.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL — LL (10 20 30 40 50 60 70)	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 280.7						
			Boring Terminated				60 (4")		
110									
115									
120									
125									
130									
135									
140									

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 4 Locust Creek
PAGE 1 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 196+58
LOCATION: 23' Right of Existing Centerline
LOGGED BY: Stanley Bates

DATE: June 1, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 120.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Asphalt						
				-					
5			Moist, Very Stiff, Gray Silty Clay	CL-ML		96	5 7-10		
				-					
10				CL-ML		97	2 5-9		
			Moist, Stiff, Gray Silty Clay	-					
15									
				ML		99	6 13-12		
			Wet, Medium Dense, Gray Silt	-					
20									
				ML		95	4 6-6		
			Wet, Medium Dense, Light Brown Silt	-					
25									
				CL-ML		82	4 3-3		
			Wet, Medium Stiff, Brown Silty Clay with Sand	-					
30									
				CL-ML		73	1 1-1		
			Wet, Soft, Brown Silty Clay with Sand	-					
35									

REMARKS: * Sample was not taken at the 100' depth

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 4 Locust Creek
PAGE 2 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 196+58
LOCATION: 23' Right of Existing Centerline
LOGGED BY: Stanley Bates

DATE: June 1, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 120.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
40			SURFACE ELEVATION: 280.7						
			Wet, Soft, Dark Gray Lean Clay	CL		99	1 2-2		
				-					
45				ML		98	1 1-2		
				-					
50				ML		100	0 1-1		
				-					
55				ML		99	0 1-2		
				-					
60			Wet, Very Loose, Dark Gray Silt	ML		96	0 1-1		
				-					
65				ML		94	0 0-1		
				-					
70				ML		94	0 0-1		
				-					

REMARKS: * Sample was not taken at the 100' depth

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 4 Locust Creek
PAGE 3 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 196+58
LOCATION: 23' Right of Existing Centerline
LOGGED BY: Stanley Bates

DATE: June 1, 2022
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 120.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	%TCR	%RQD
75			Wet, Stiff, Gray Silty Clay with Sand	CL-ML -		80	3 5-7		
80			Wet, Dense, Brown Poorly Graded Sand with Silt and Trace Gravel	SP-SM -		11	14 20-21		
85			Wet, Loose, Brown Poorly Graded Sand with Trace Gravel	SP -		4	3 4-3		
90			Wet, Medium Dense, Brown Poorly Graded Gravel with Sand	GP -		1	2 5-7		
95			Wet, Very Loose, Brown Poorly Graded Gravel with Sand	GP -		2	4 2-1		
100			Wet, Loose, Brown Poorly Graded Gravel with Sand*	GP -		0	2 4-2		
105									

REMARKS: * Sample was not taken at the 100' depth

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SECTION

BORING NO. 4 Locust Creek
PAGE 4 OF 4

JOB NO. 100633 Greene County
JOB NAME: Paragould - North (S)
Route 49, Section 2
STATION: 196+58
LOCATION: 23' Right of Existing Centerline
LOGGED BY: Stanley Bates

DATE: June 1, 2022
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: CME 75
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 120.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	MOISTURE CONTENT (%) PL 10 20 30 40 50 60 70 LL	PERCENT PASSING NO. 200 SIEVE	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 280.7						
			Wet, Very Dense, Light Gray Silt with Sand and Poorly Cemented Seams (Wilcox Group)	ML		81	60 (5")		
				-					
110				NT			60 (2")		
				-					
115			Wet, Very Dense, Light Gray Silty Fine Sand	SM		18	60 (4")		
				-					
120				SM		49	60 (5")		
			Boring Terminated						
125									
130									
135									
140									

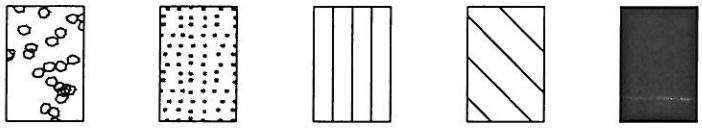
REMARKS: * Sample was not taken at the 100' depth

LEGEND

SOIL TYPES

(SHOWN IN SYMBOL COLUMN)

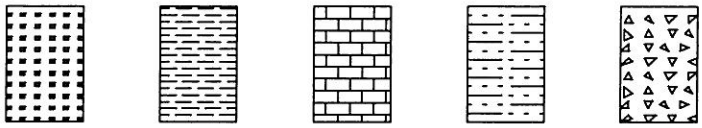
(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL | SAND | SILT | CLAY | ORGANIC MATTER

ROCK TYPES

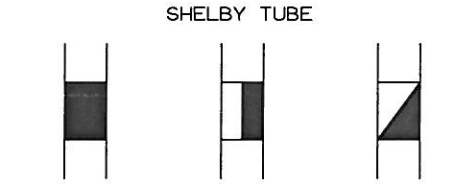
(SHOWN IN SYMBOL COLUMN)



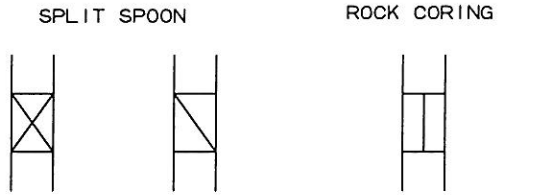
SANDSTONE | SHALE or SILTSTONE | LIMESTONE or DOLOMITE | ALTERNATING LAYERS of SHALE and SANDSTONE | OTHER

SAMPLER TYPES

(SHOWN IN SAMPLE COLUMN)



UNDISTURBED SAMPLE RECOVERY | DISTURBED SAMPLE RECOVERY | NO RECOVERY



SAMPLE RECOVERY | NO RECOVERY | % RECOVERY INDICATED ON LOGS

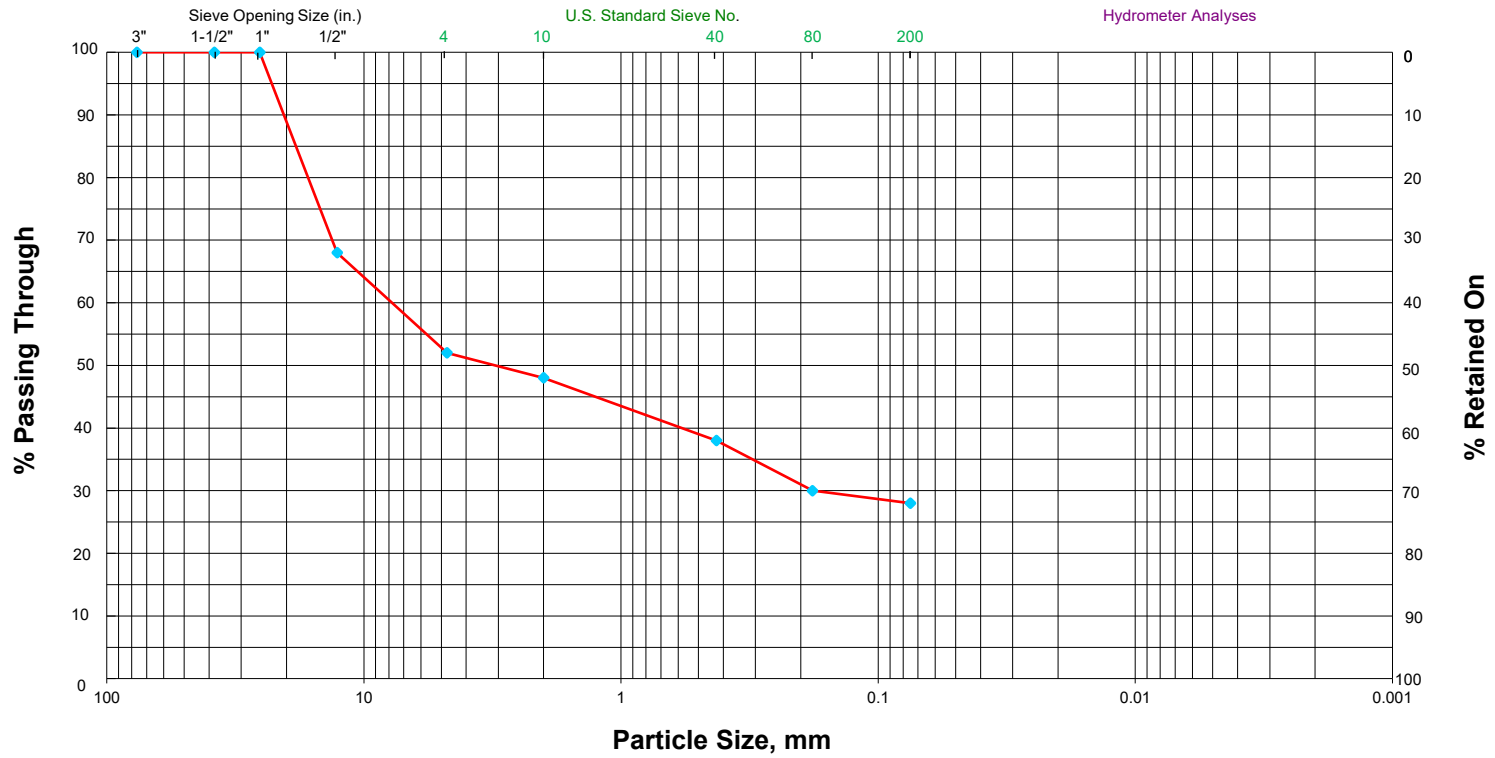
TERMS DESCRIBING CONSISTENCY OR CONDITION

GRANULAR SOIL		CLAY		CLAY-SHALE		SHALE	
'N' Value	Density	'N' Value	Consistency	'N' Value	Consistency	'N' Value	Consistency
0-4	Very Loose	0-1	Very Soft	0-1	Very Soft		
5-10	Loose	2-4	Soft	2-4	Soft	31-60	Soft
11-30	Medium Dense	5-8	Medium Stiff	5-8	Medium Stiff	Over 60	
31-50	Dense	9-15	Stiff	9-15	Stiff	More than 2'	
Over 50	Very Dense	16-30	Very Stiff	16-30	Very Stiff	Penetration	
		31-60	Hard	31-60	Hard	in 60 Blows:	Medium Hard
		Over 60	Very Hard	Over 60	Very Hard	Less than 2'	
						Penetration	
						in 60 Blows:	Hard

1. Ground water elevations indicated on boring logs represent ground water elevations at date or time shown on boring log. Absence of water surface implies that no ground water data is available but does not necessarily mean that ground water will not be encountered at locations or within the vertical reaches of these borings.
2. Borings represent subsurface conditions at their respective locations for their respective depths. Variations in conditions between or adjacent to boring locations may be encountered.
3. Terms used for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System.

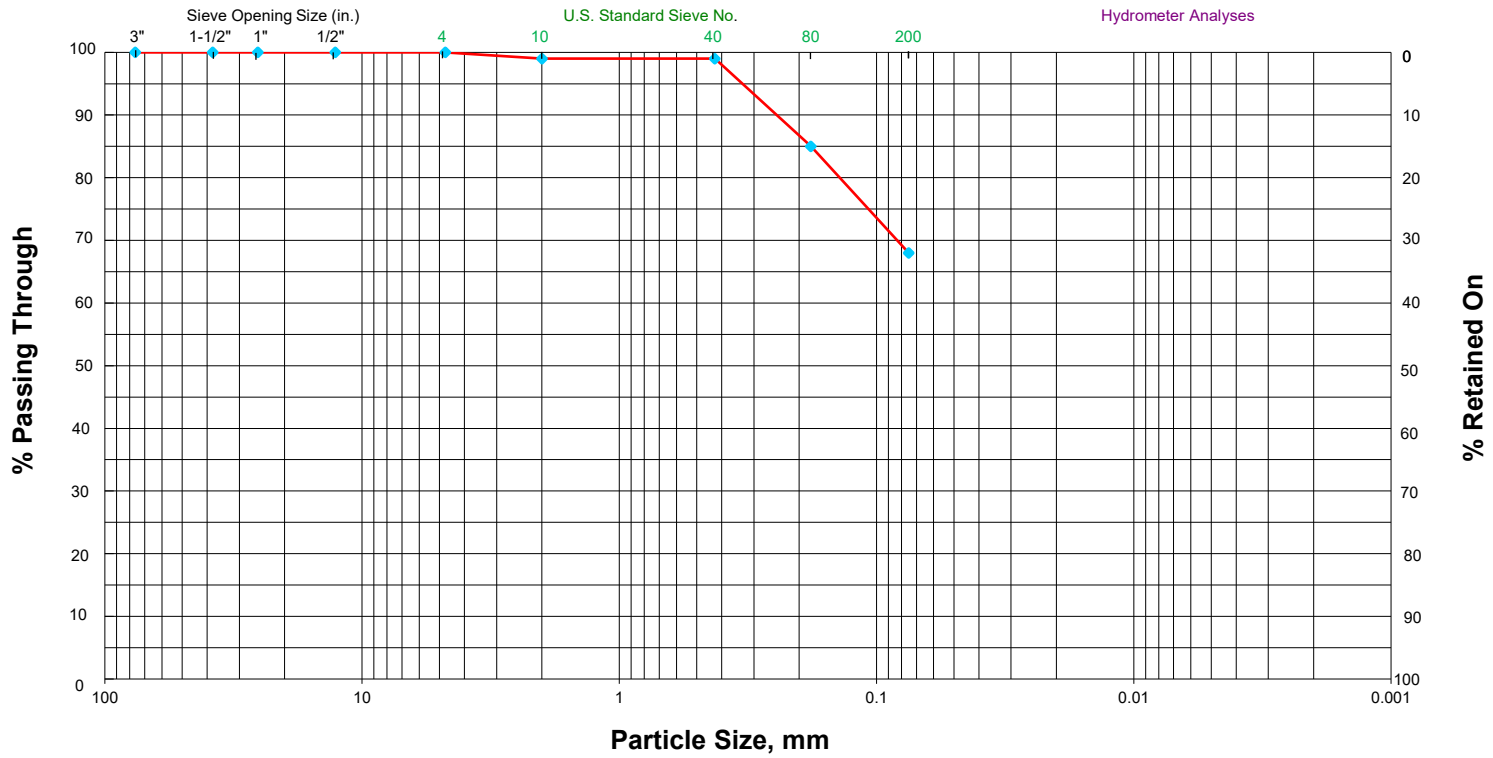
Standard Penetration Test – Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and performing the test are recorded for each 6 inches of penetration on the drill log. The field "N" Value (N_f) can be obtained by adding the bottom two numbers for example: $\frac{6}{8-9} \Rightarrow 8+9=17 blows/ft$. The "N" Value corrected to 60% efficiency (N_{60}) can be obtained by multiplying N_f by the hammer correction factor published on the boring log.

Attachment B



Particle Size Distribution Curve - Jacks Creek

Station 150+00/35' Lt of CL



Particle Size Distribution Curve - Locust Creek

Station 196+20/46' Lt of CL

Attachment C1

SITE PICTURES

Job No.: 100633
Job Name: Paragould – North (S)

Site 1-Jacks Creek looking west (upstream) at the east side of the bridge (June 2022)
Silty Clay exposed in channel

SITE PICTURES

Job No.: 100633
Job Name: Paragould – North (S)

Site 1-Jacks Creek north end bridge abutment (June 2022)

Attachment C2

SITE PICTURES

Job No.: 100633
Job Name: Paragould – North (S)

Site 2-Locust Creek east side of the bridge (June 2022)

SITE PICTURES

Job No.: 100633
Job Name: Paragould – North (S)

Site 2-Locust Creek slide at the south abutment in silty clay

SITE PICTURES

Job No.: 100633
Job Name: Paragould – North (S)

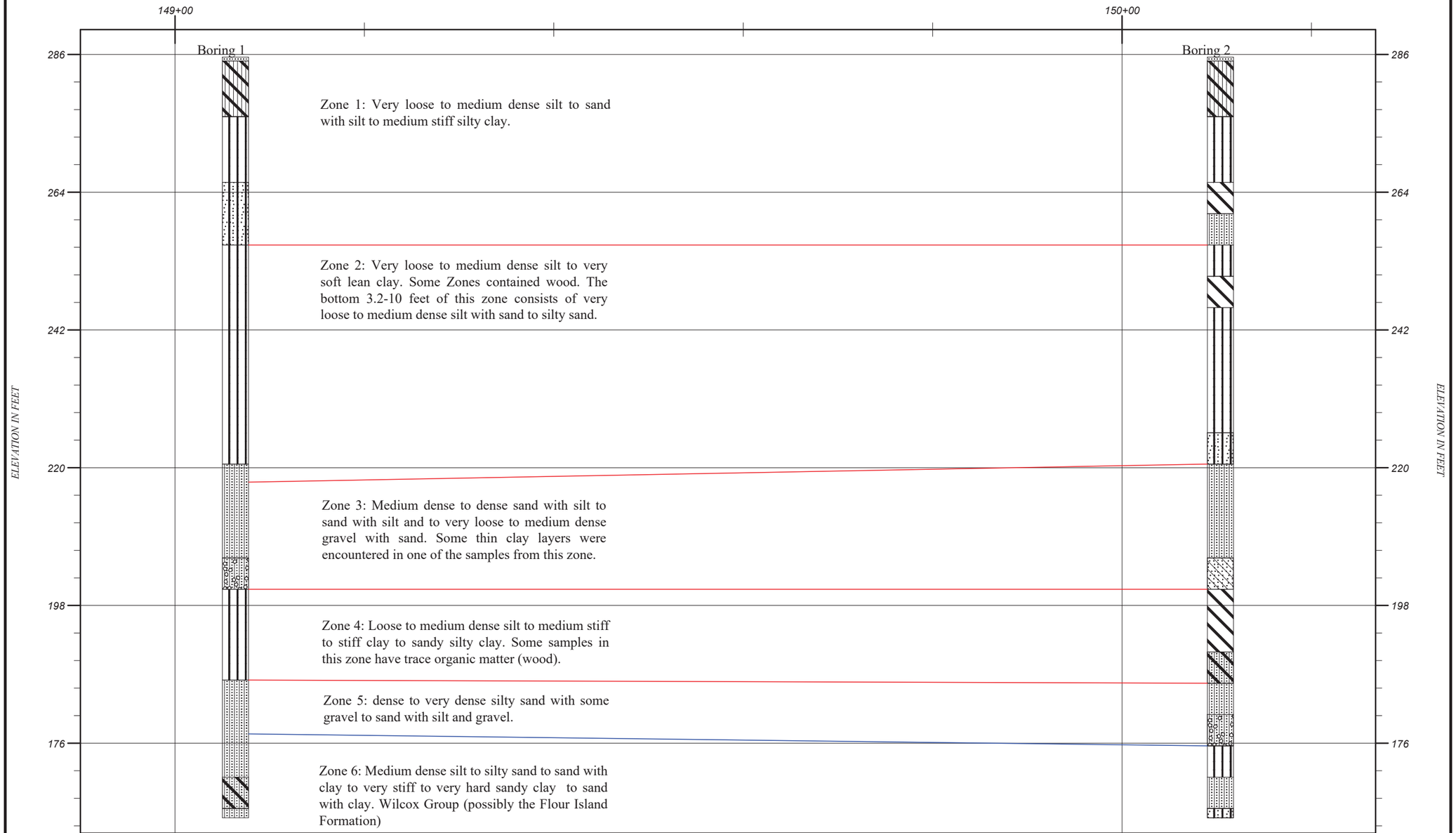
Site 2-Locust Creek another view of failed soil under south abutment

SITE PICTURES

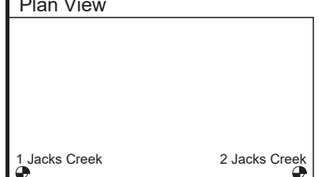
Job No.: 100633
Job Name: Paragould – North (S)

Site 2-Locust Creek slope at the north abutment

Attachment D1



Plan View



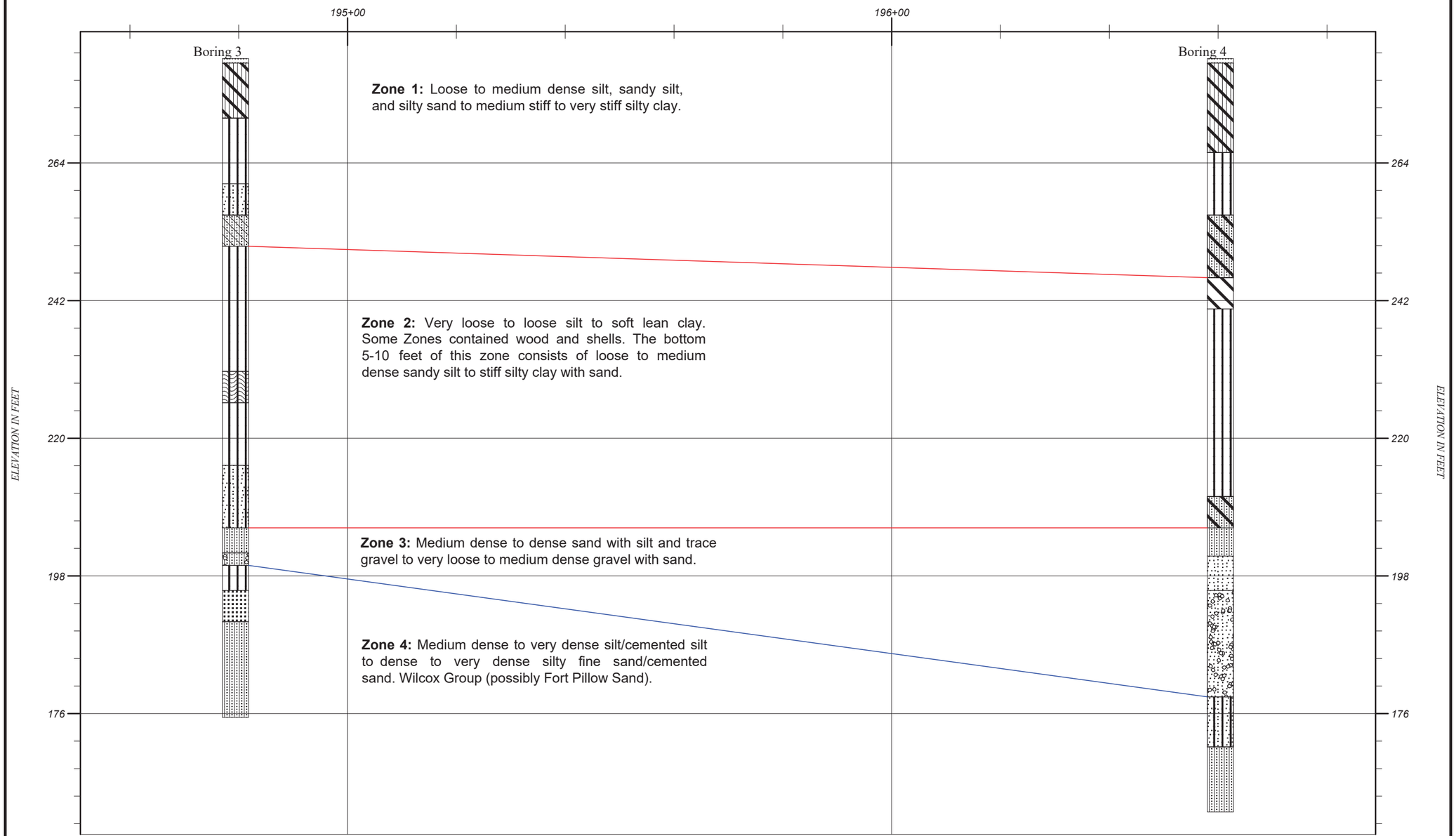
Strata symbols

- Asphalt
- silty clay
- silt/cemented silt
- sandy silt
- silty sand
- silty sand with gravel
- sandy, silty clay
- clay
- clayey sand

GENERALIZED SUBSURFACE PROFILE

HORIZONTAL SCALE: Not to scale VERTICAL SCALE: Not to scale	Site 1 Jacks Creek	DATE DRAWN 7/19/2022
Paragould - North (S) Route 49, Section 2		
PROJECT NO. 100633 Greene County		FIGURE NUMBER

Attachment D2



Plan View

3 Locust Creek

4 Locust Creek

Strata symbols

- Asphalt
- silty clay
- silt/cemented silt
- sandy silt
- silty, clayey sand
- silt with organic matter/lignite
- silty sand
- silty sand with gravel
- cemented sand/sandstone
- sandy, silty clay
- clay
- sand
- sand and gravel

GENERALIZED SUBSURFACE PROFILE

HORIZONTAL SCALE: Not to scale VERTICAL SCALE: Not to scale	Site 2 Locust Creek	DATE DRAWN 15 2022

Paragould - North (S)

Route 49, Section 2

PROJECT NO. 100633

Greene County

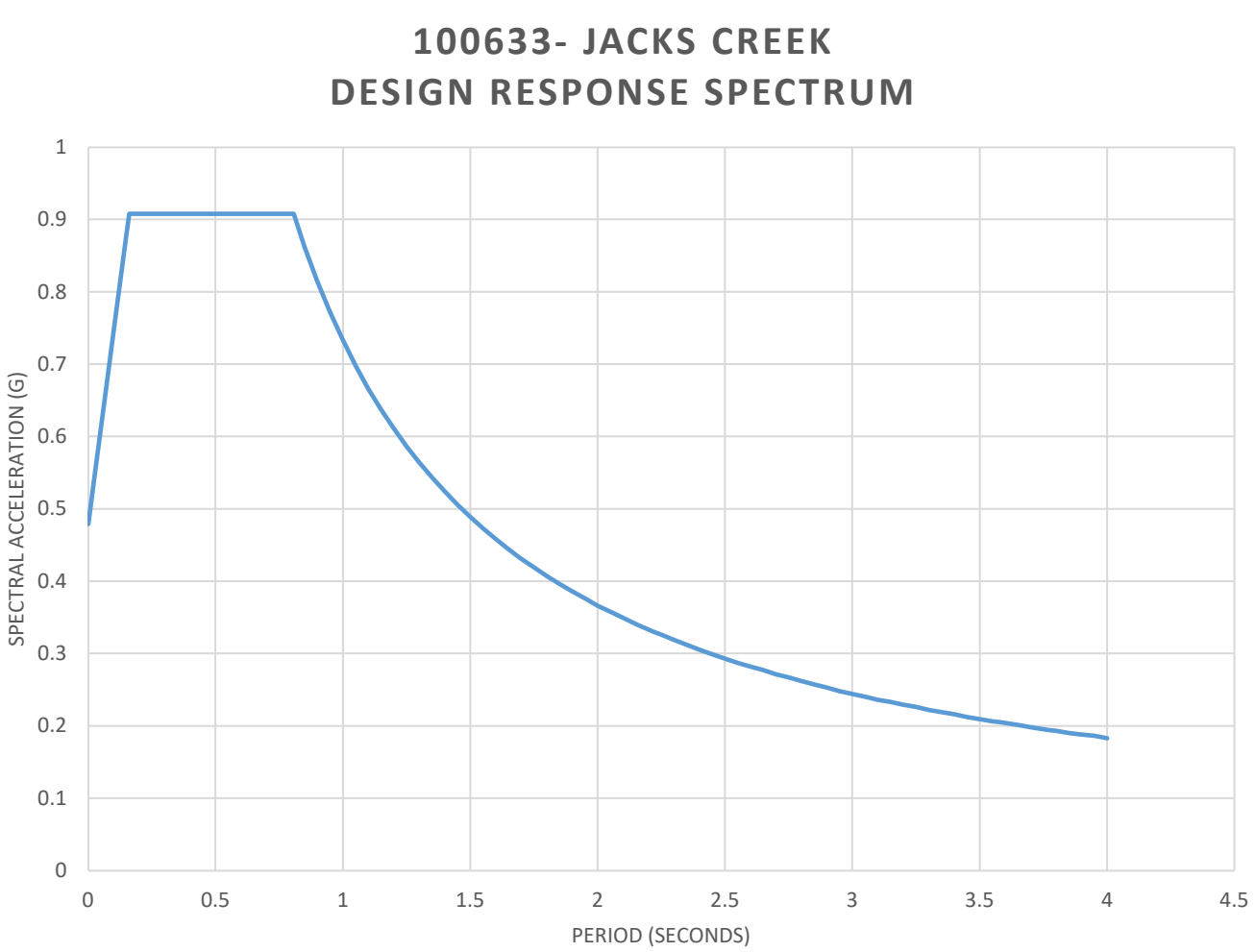
FIG RE N MBER

Attachment E1

Title:	100633- Jacks Creek
Latitude:	36.100097
Longitude:	-90.459332
Site Class	E

Get USGS Data

PGA:	0.532
F_{PGA}:	0.9
A_S:	0.479
S_S:	0.97
F_A:	0.936
S_{DS}:	0.908
S_1:	0.242
F_V:	3.033
S_{D1}:	0.733
S_{Dc}:	D
T_S:	0.807
T_0:	0.161

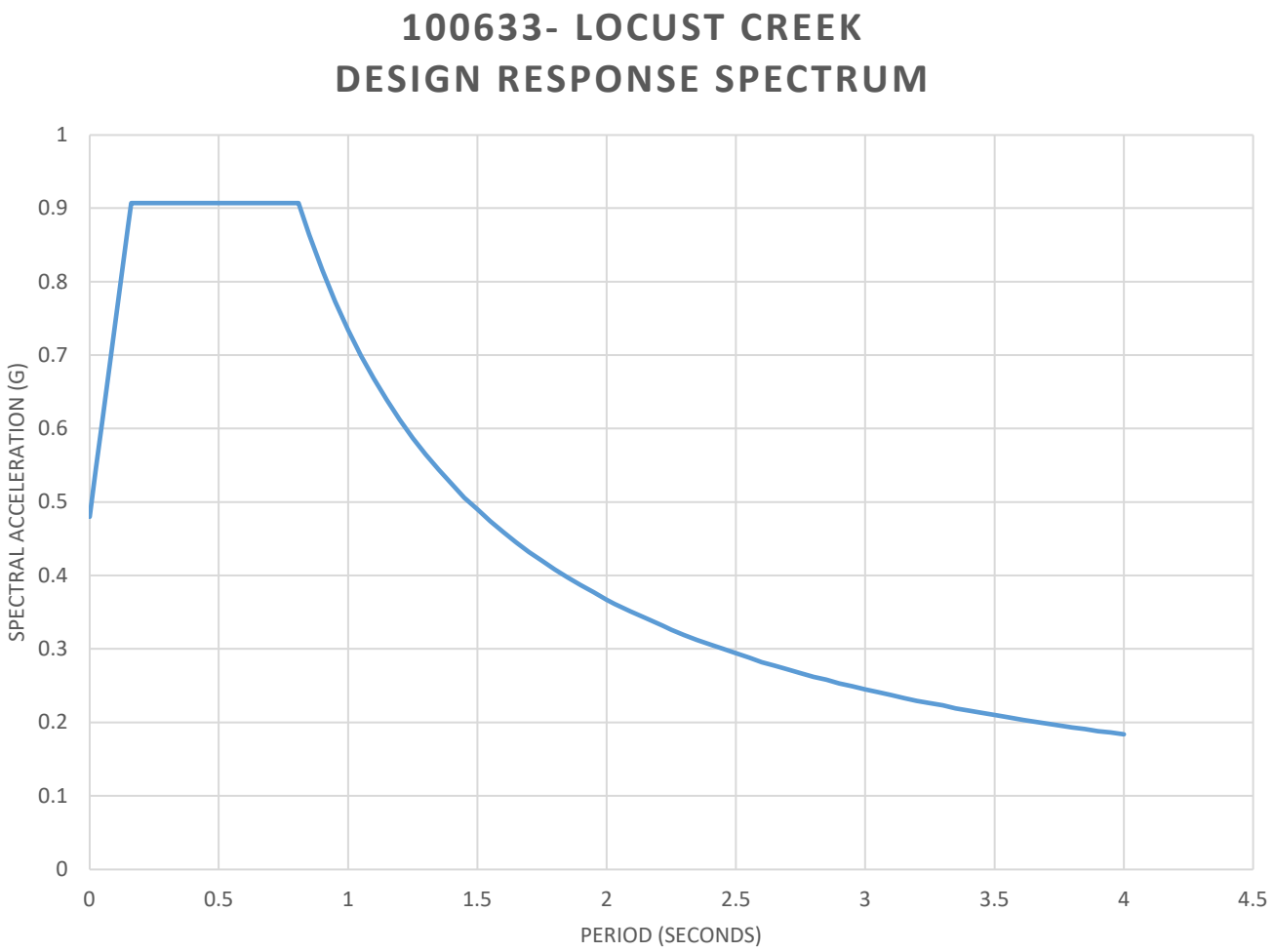


Attachment E2

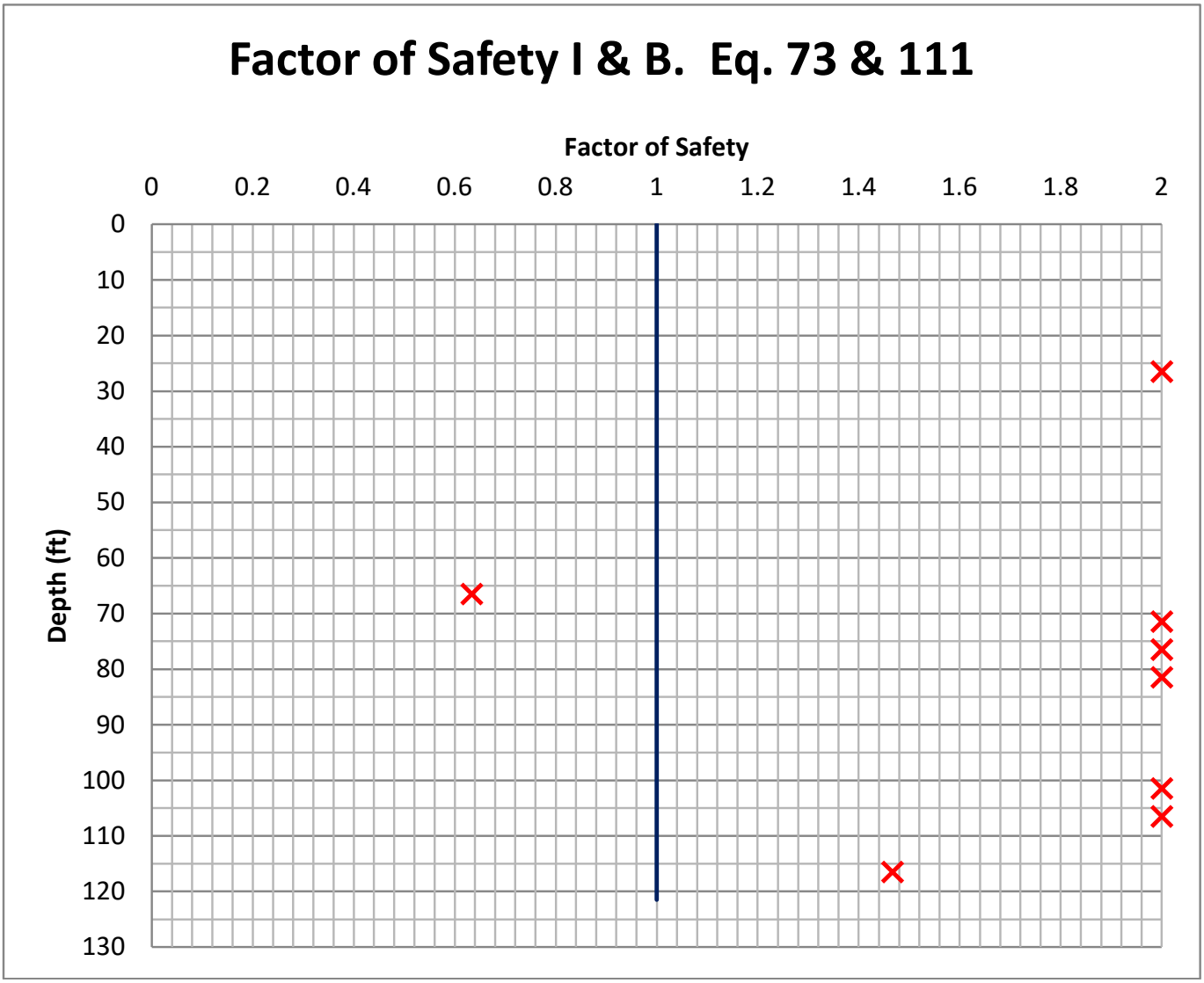
Title:	100633- Locust Creek
Latitude:	36.107887
Longitude:	-90.447172
Site Class	E

Get USGS Data

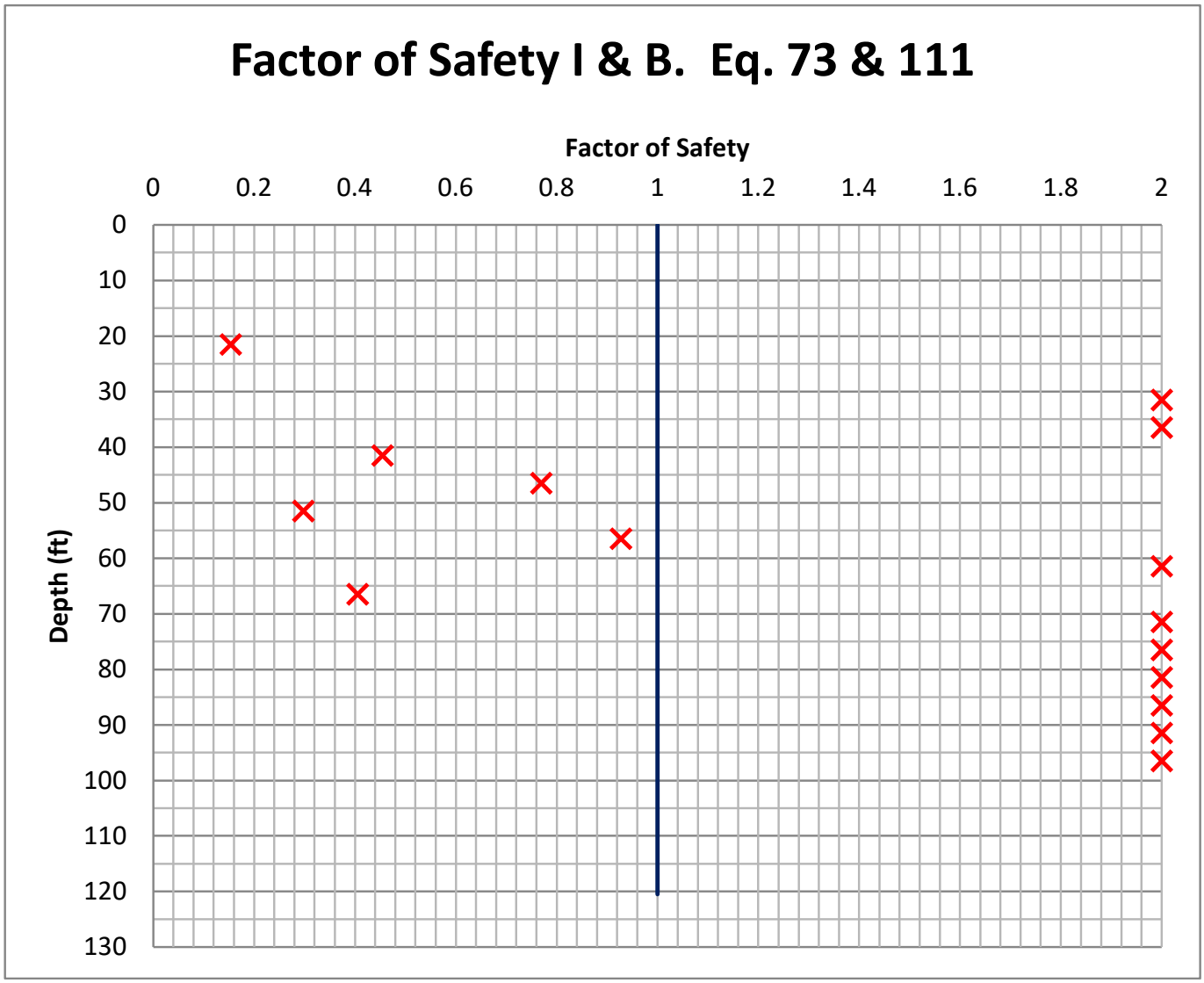
PGA:	0.534
F_{PGA}:	0.9
A_S:	0.48
S_S:	0.973
F_A:	0.933
S_{DS}:	0.907
S_1:	0.242
F_V:	3.031
S_{D1}:	0.734
S_{Dc}:	D
T_S:	0.809
T_0:	0.162



Attachment F1

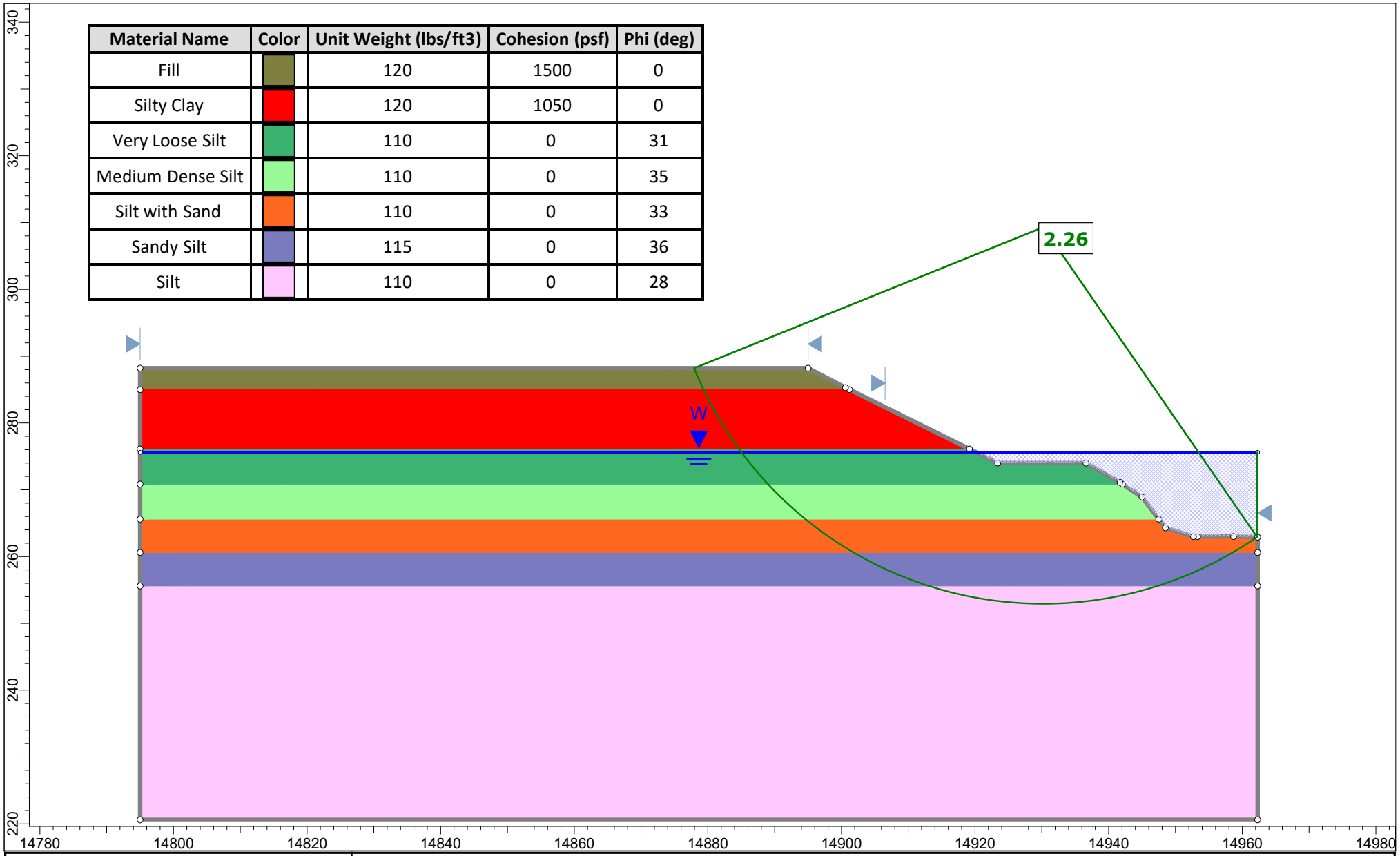

Factor of Safety I & B. Eq. 73 & 111
Factor of Safety
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
120
130

Attachment F2


Factor of Safety I & B. Eq. 73 & 111
Factor of Safety
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
120
130

Attachment G1

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		120	1050	0
Very Loose Silt		110	0	31
Medium Dense Silt		110	0	35
Silt with Sand		110	0	33
Sandy Silt		115	0	36
Silt		110	0	28

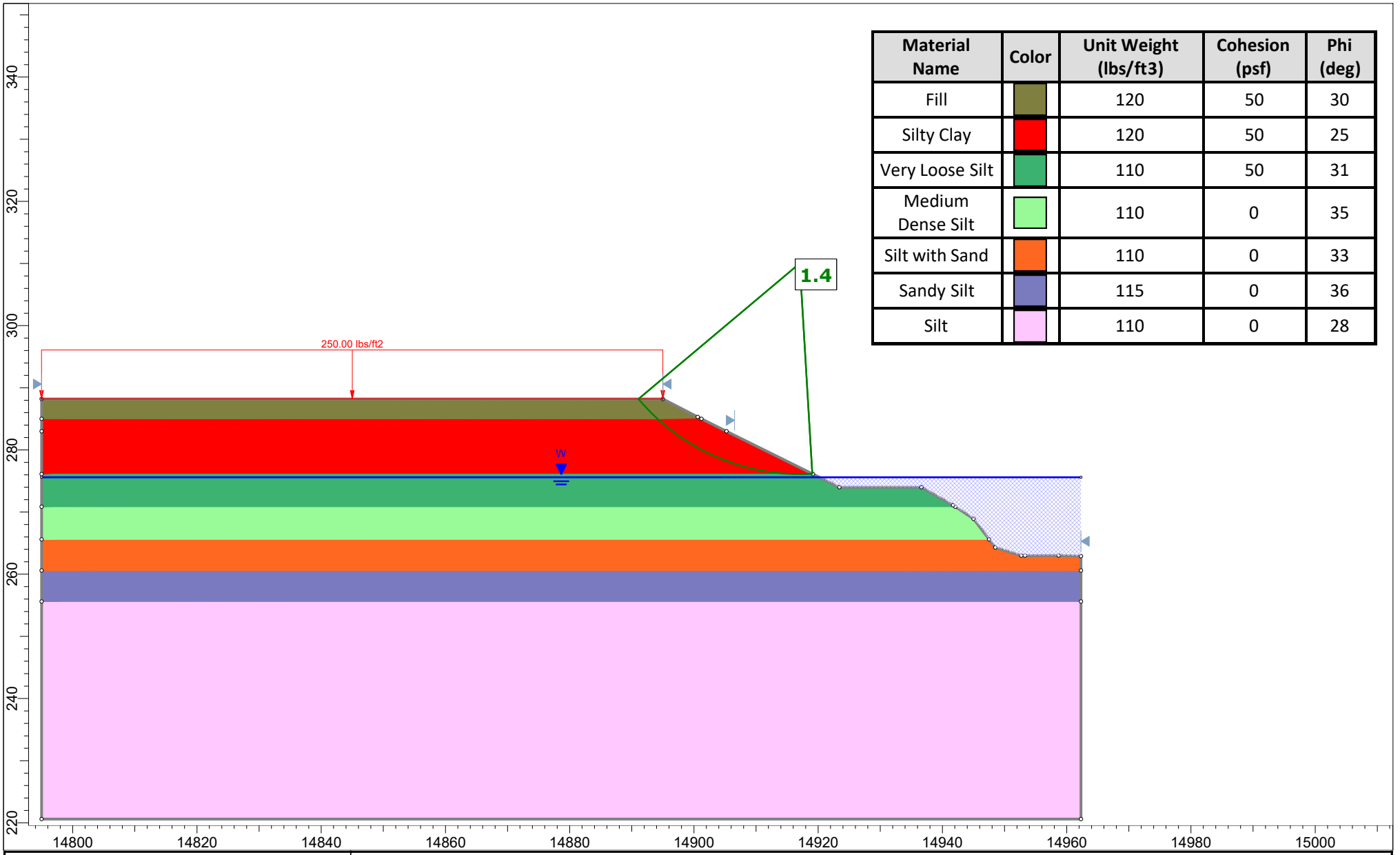


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Short
Analyzed By	MBB	Configuration	West Brdige End, 1V: 2H End Slope
Date	11/16/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Silty Clay		120	50	25
Very Loose Silt		110	50	31
Medium Dense Silt		110	0	35
Silt with Sand		110	0	33
Sandy Silt		115	0	36
Silt		110	0	28

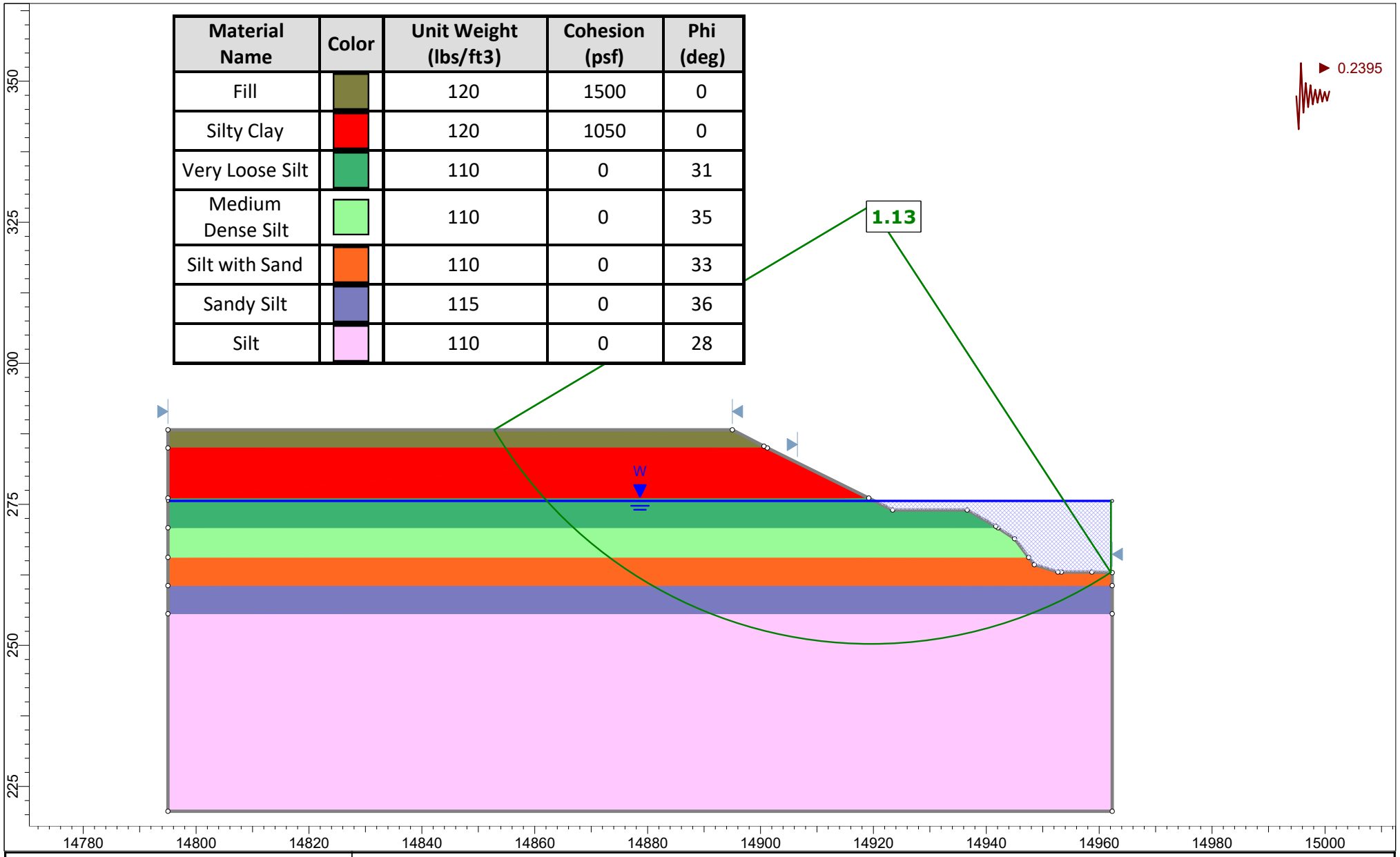


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	West Bridge End, 1V: 2H End Slope
Date	11/16/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		120	1050	0
Very Loose Silt		110	0	31
Medium Dense Silt		110	0	35
Silt with Sand		110	0	33
Sandy Silt		115	0	36
Silt		110	0	28

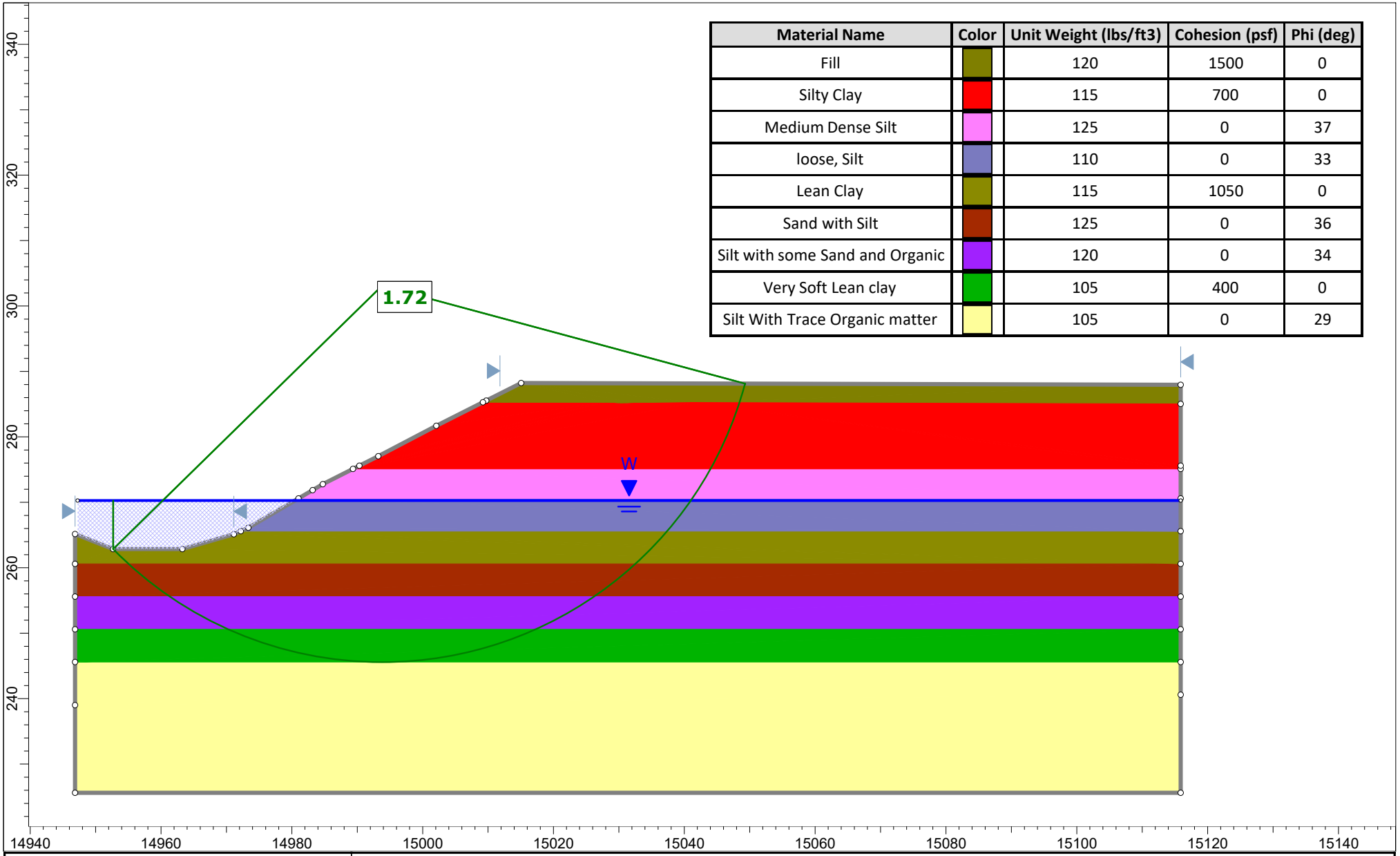


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	West Brdige End, 1V: 2H End Slope
Date	11/16/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		115	700	0
Medium Dense Silt		125	0	37
loose, Silt		110	0	33
Lean Clay		115	1050	0
Sand with Silt		125	0	36
Silt with some Sand and Organic		120	0	34
Very Soft Lean clay		105	400	0
Silt With Trace Organic matter		105	0	29

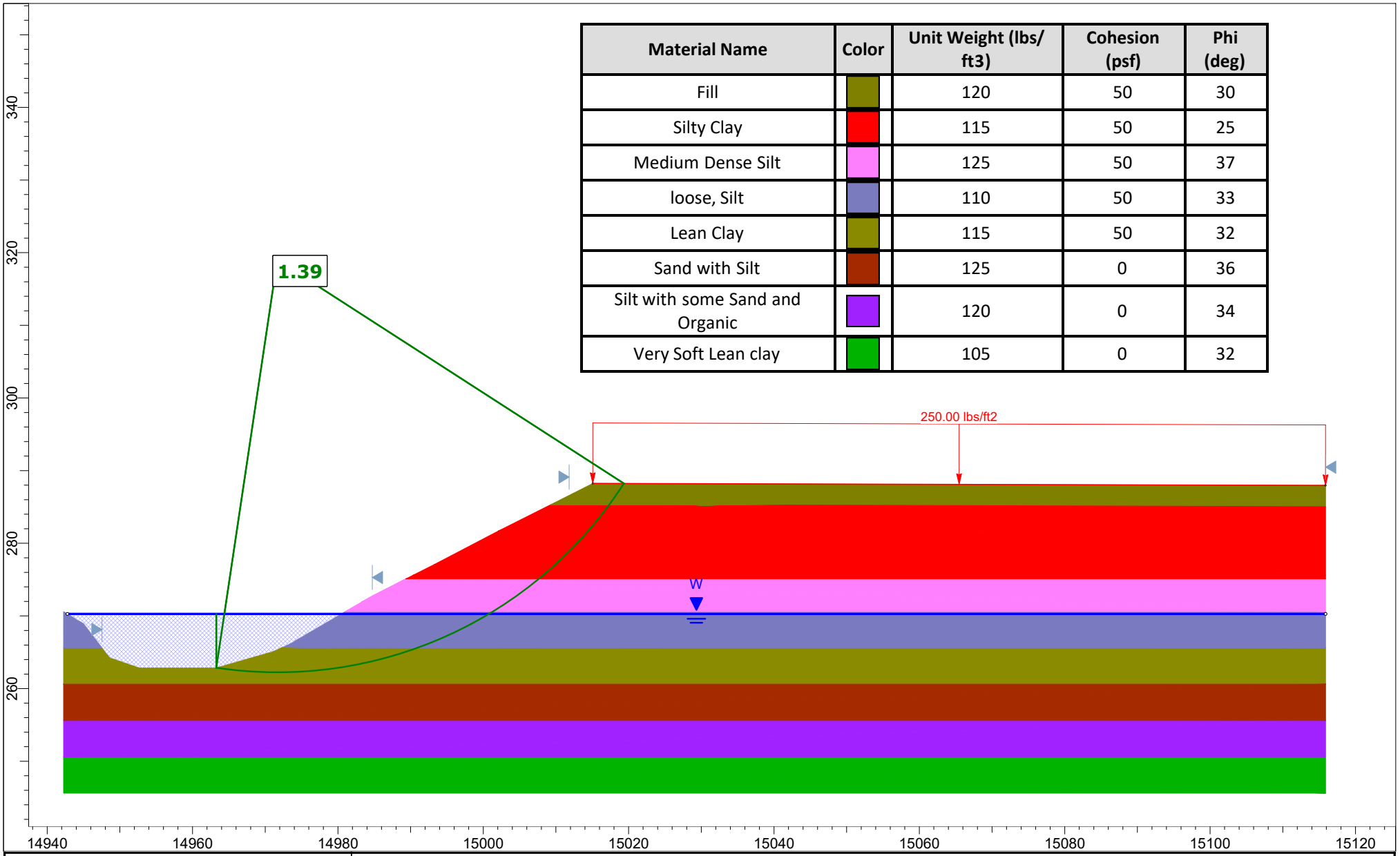


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Short Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End slope
Date	11/29/2022		

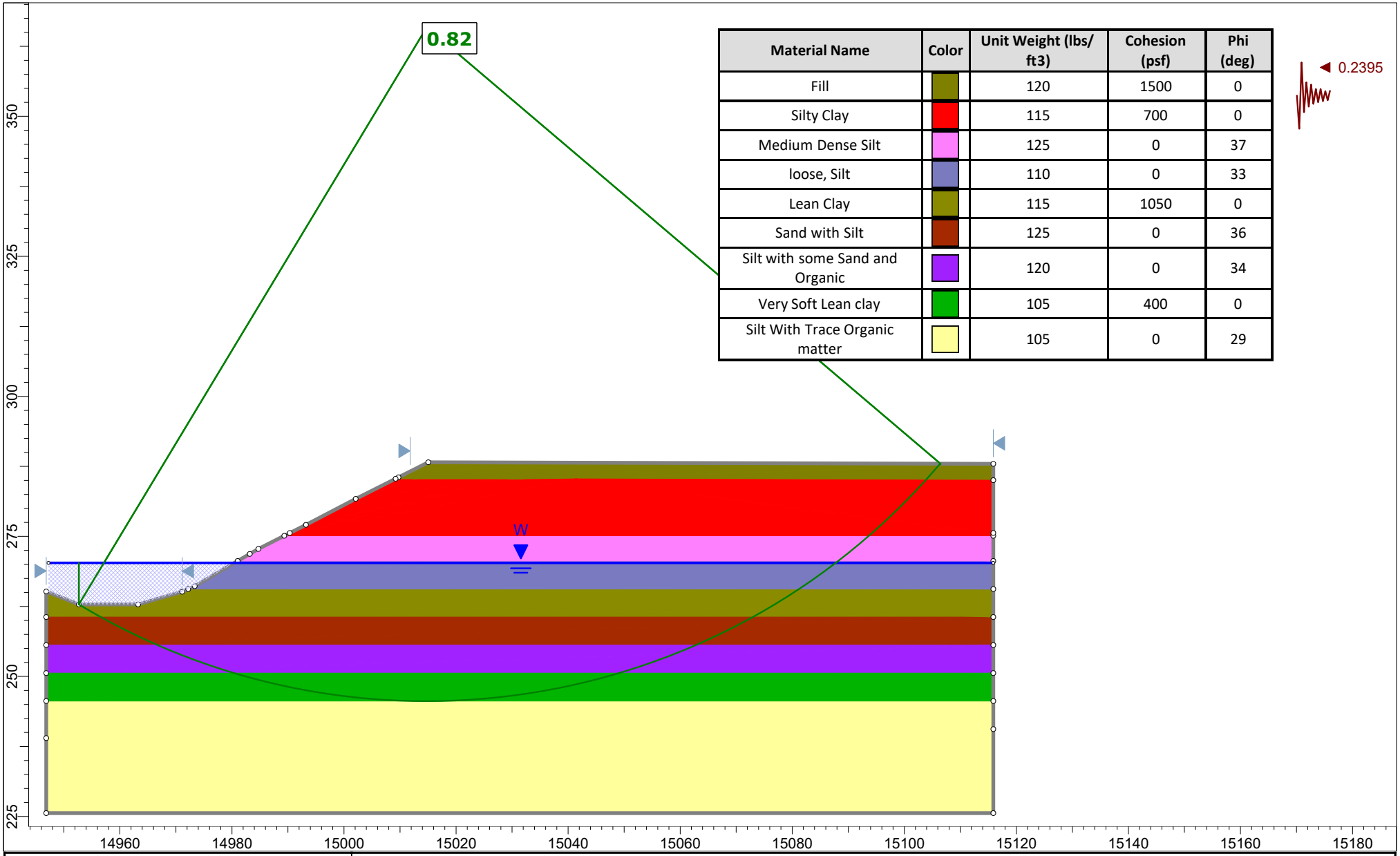
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Silty Clay		115	50	25
Medium Dense Silt		125	50	37
loose, Silt		110	50	33
Lean Clay		115	50	32
Sand with Silt		125	0	36
Silt with some Sand and Organic		120	0	34
Very Soft Lean clay		105	0	32



rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slopes
Date	11/16/2022		



Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		115	700	0
Medium Dense Silt		125	0	37
loose, Silt		110	0	33
Lean Clay		115	1050	0
Sand with Silt		125	0	36
Silt with some Sand and Organic		120	0	34
Very Soft Lean clay		105	400	0
Silt With Trace Organic matter		105	0	29

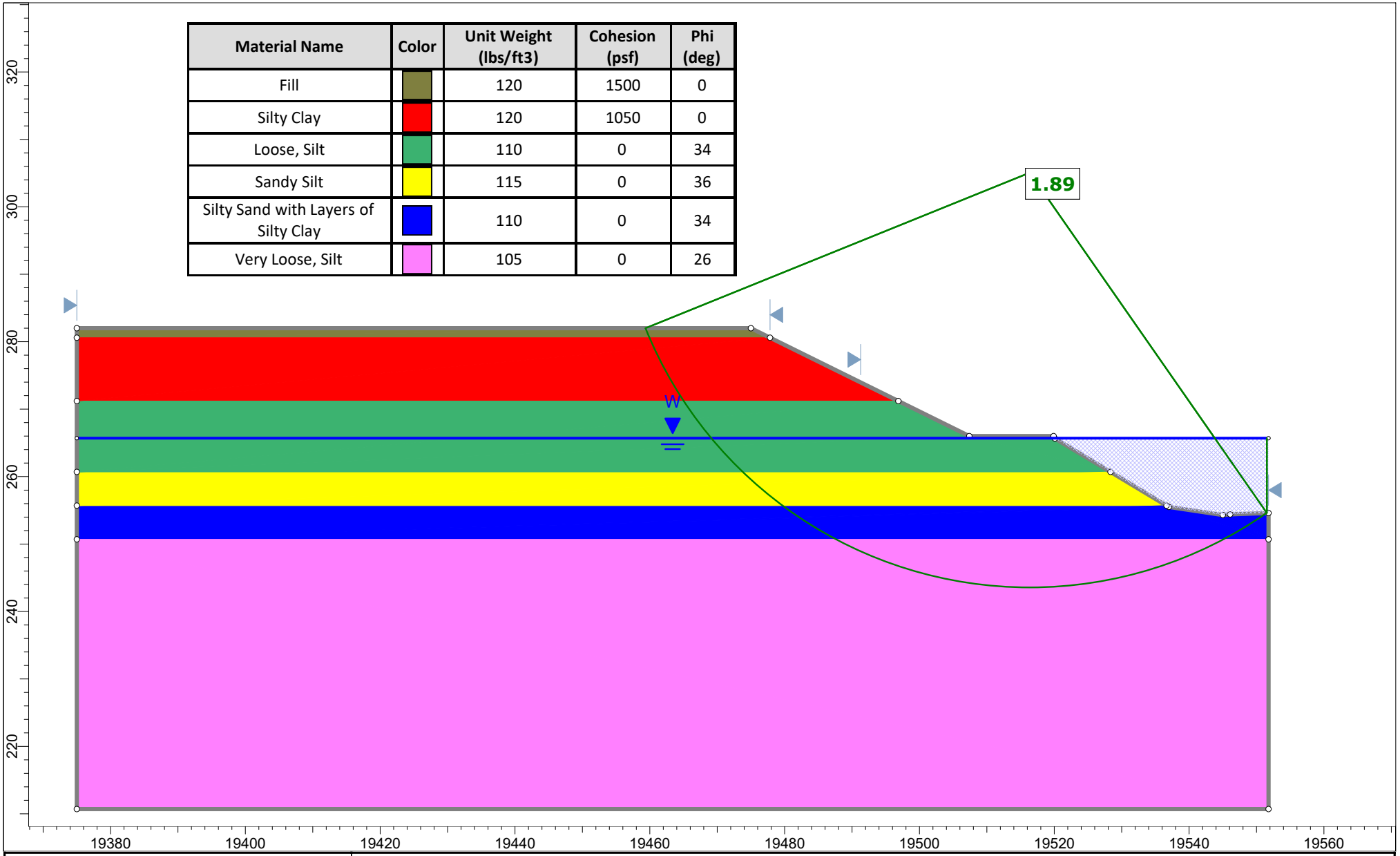
rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End slope
Date	11/29/2022		

Attachment G2

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		120	1050	0
Loose, Silt		110	0	34
Sandy Silt		115	0	36
Silty Sand with Layers of Silty Clay		110	0	34
Very Loose, Silt		105	0	26

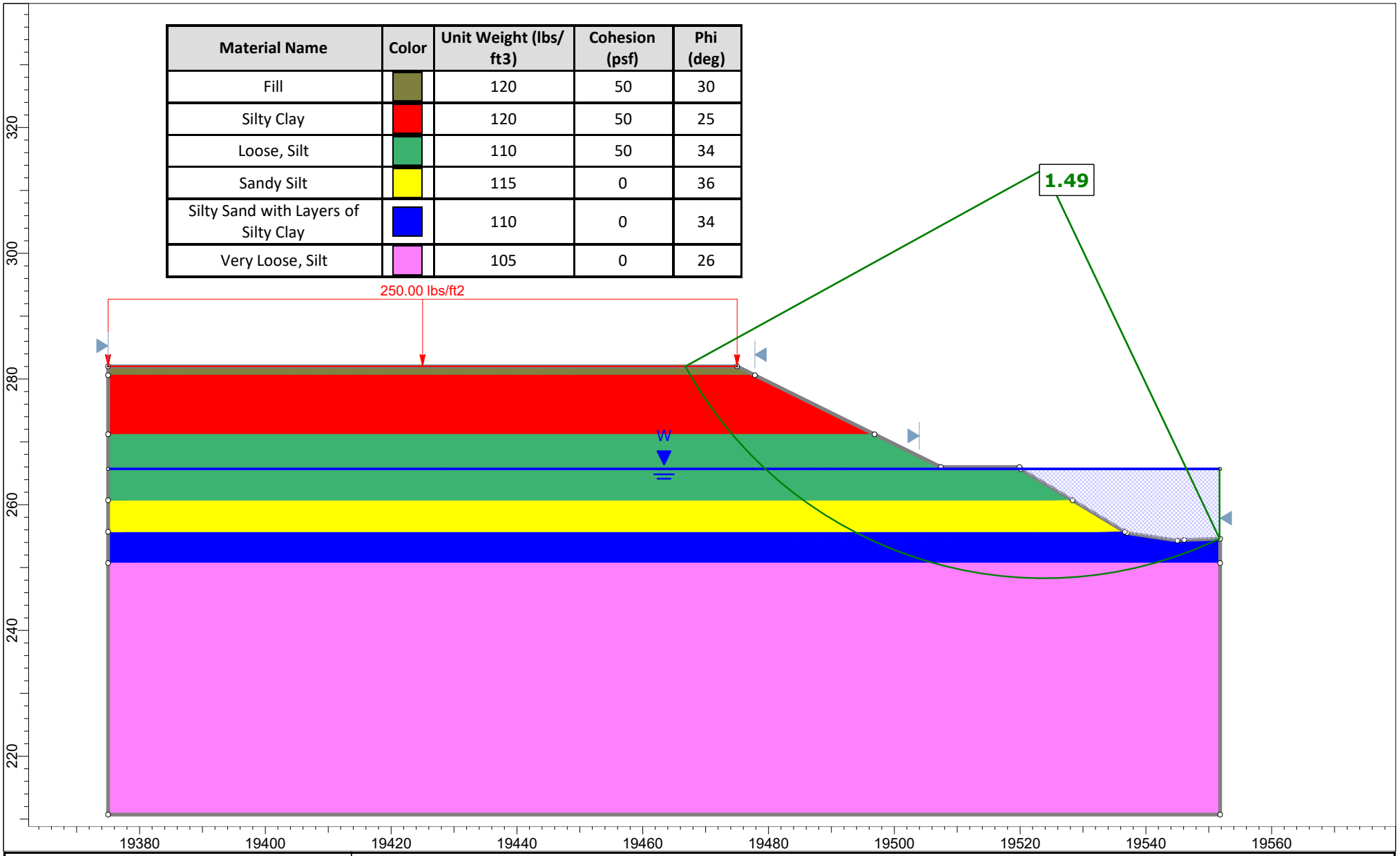


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Short Term
Analyzed By	MBB	Configuration	West Bridge End, 1V : 2H End Slope
Date	11/16/2022		

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Silty Clay		120	50	25
Loose, Silt		110	50	34
Sandy Silt		115	0	36
Silty Sand with Layers of Silty Clay		110	0	34
Very Loose, Silt		105	0	26

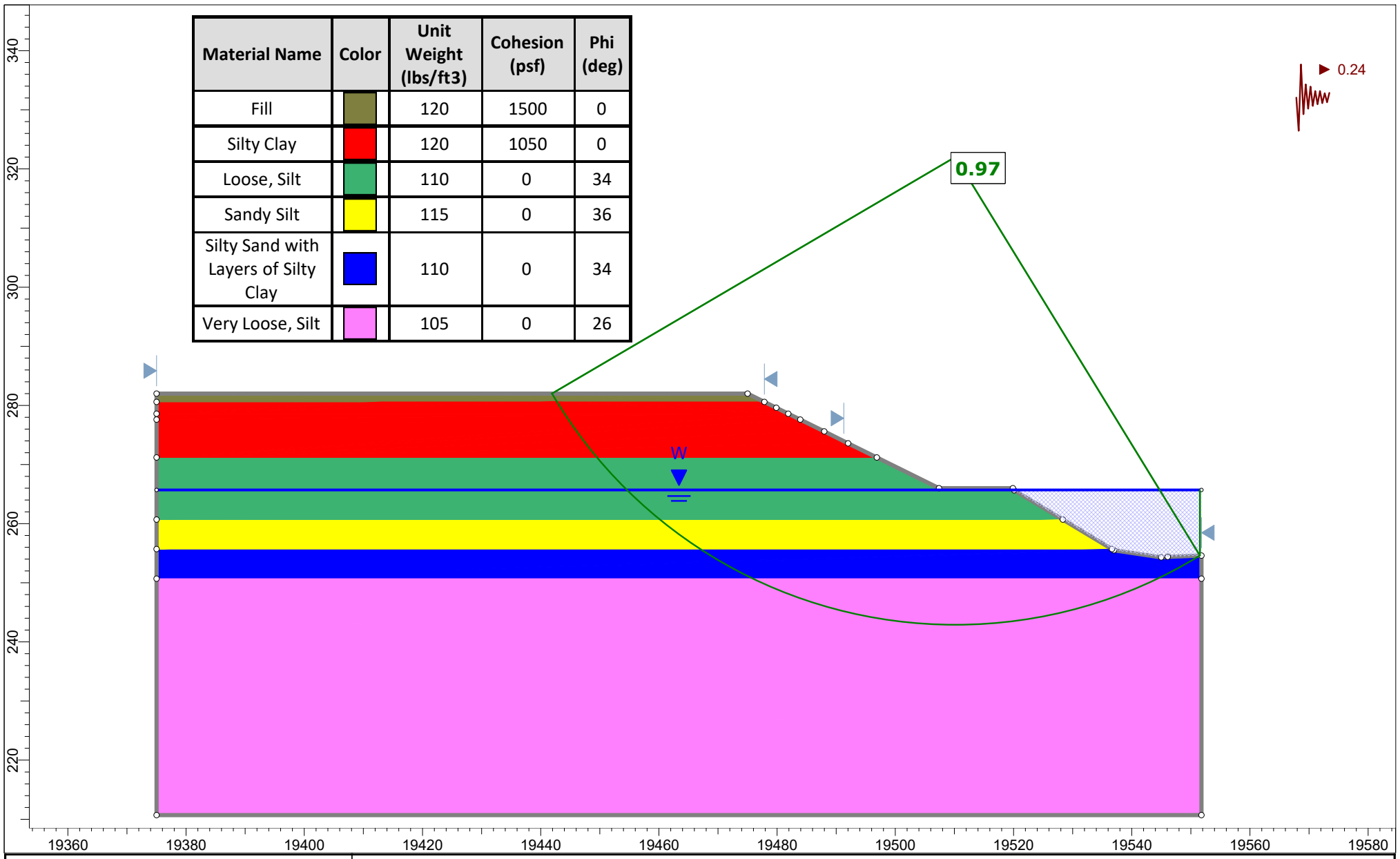


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	West Bridge End, 1V : 2H End Slope
Date	11/16/2022		

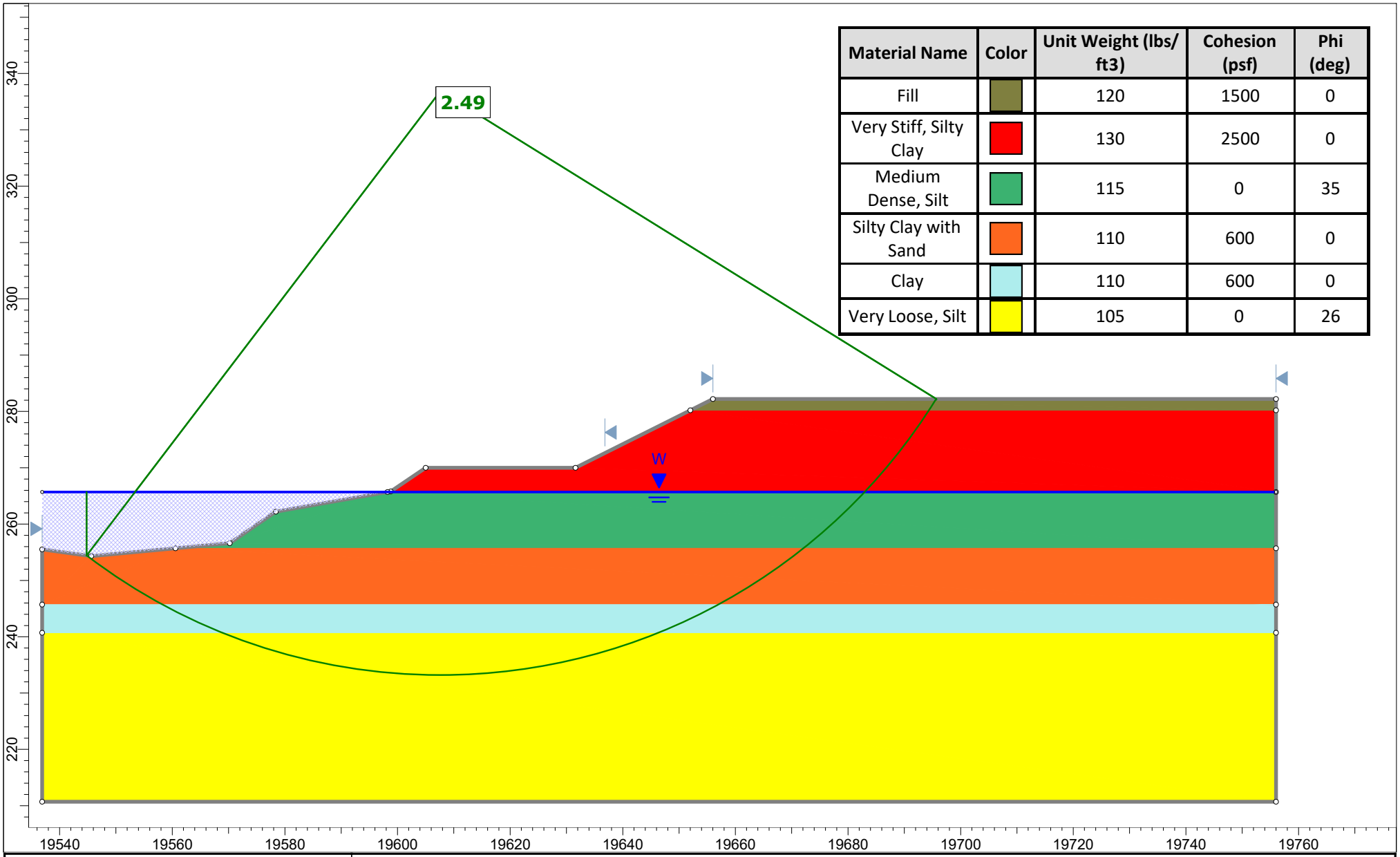
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		120	1050	0
Loose, Silt		110	0	34
Sandy Silt		115	0	36
Silty Sand with Layers of Silty Clay		110	0	34
Very Loose, Silt		105	0	26



rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	West Bridge End, 1V : 2H End Slope
Date	11/16/2022		



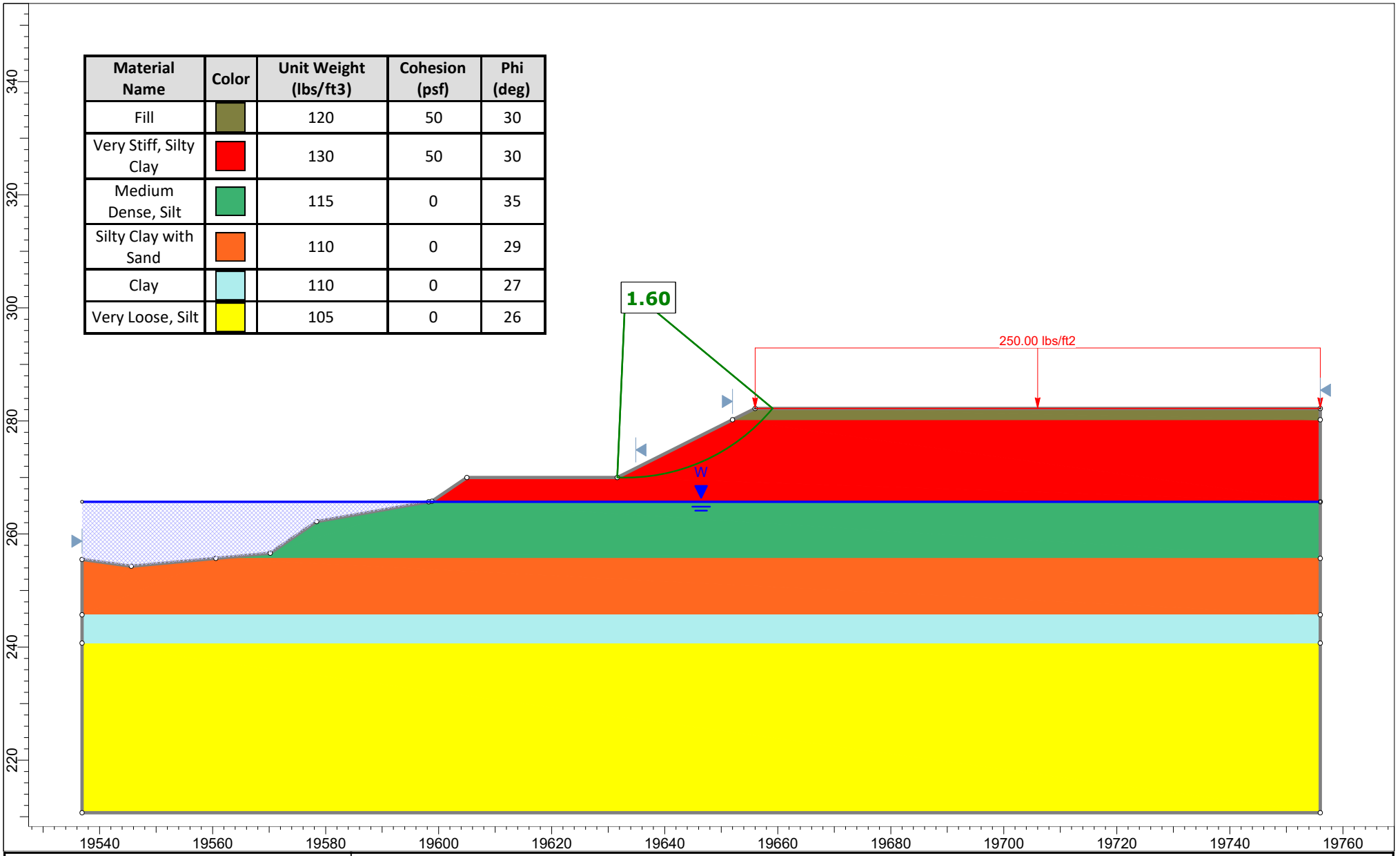
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Very Stiff, Silty Clay		130	2500	0
Medium Dense, Silt		115	0	35
Silty Clay with Sand		110	600	0
Clay		110	600	0
Very Loose, Silt		105	0	26

rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Short Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End slope
Date	11/29/2022		

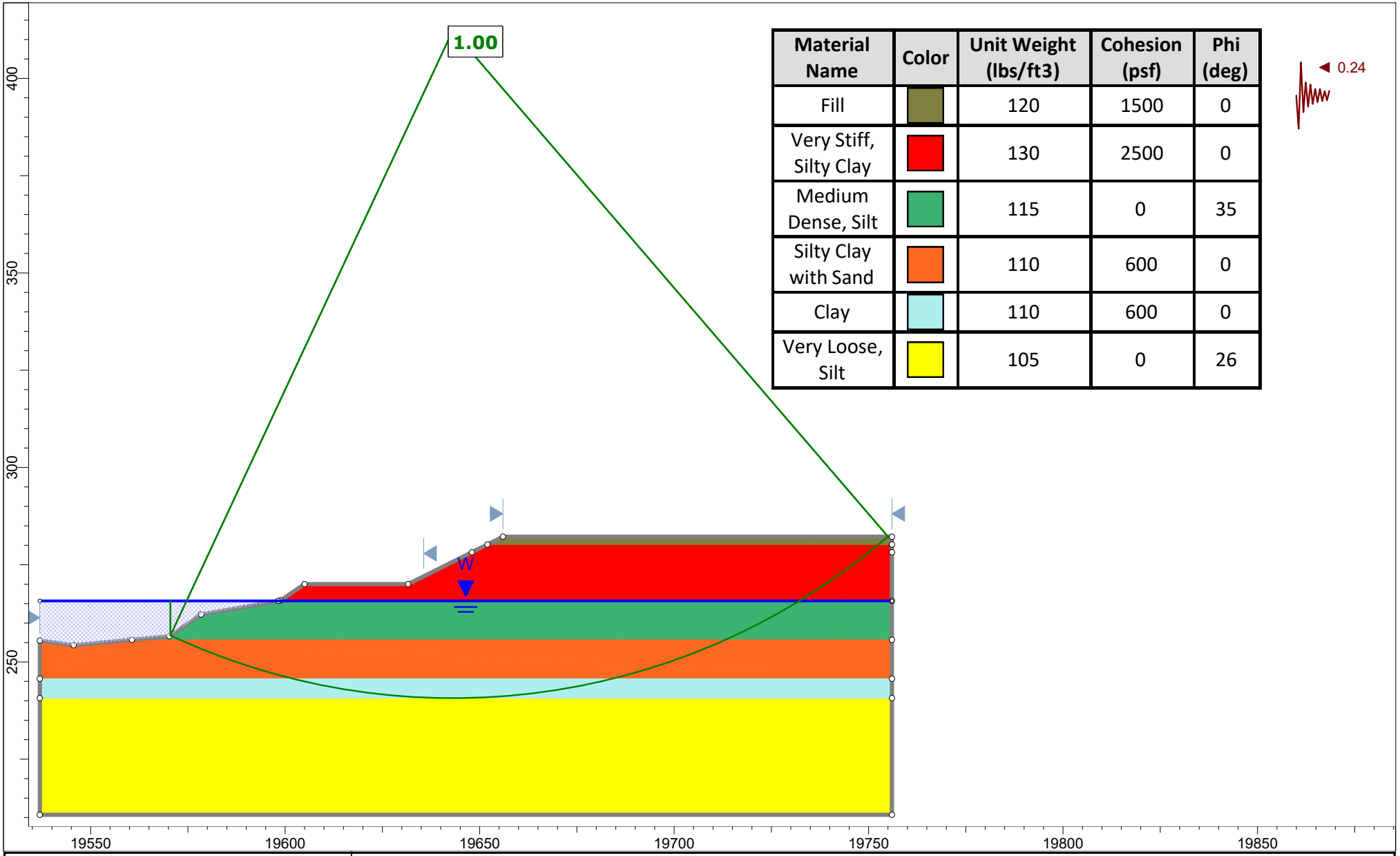
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Very Stiff, Silty Clay		130	50	30
Medium Dense, Silt		115	0	35
Silty Clay with Sand		110	0	29
Clay		110	0	27
Very Loose, Silt		105	0	26



rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End slope
Date	11/3/2022		



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Very Stiff, Silty Clay		130	2500	0
Medium Dense, Silt		115	0	35
Silty Clay with Sand		110	600	0
Clay		110	600	0
Very Loose, Silt		105	0	26

rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slope
Date	11/29/2022		

Attachment H

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 100633

TIMBER PILING FOR SOIL DENSIFICATION AND REINFORCEMENT

Description. This Special Provision (SP) covers Timber Piles driven through or under roadway embankments or bridge approach embankments, around intermediate bents, or at locations shown on the plans for the purpose of soil densification and/or reinforcement. This item shall consist of furnishing and driving treated piling according to this SP and conforming to the lines, grades, and spacing shown on the plans.

Materials. Materials for timber piling shall conform to the following requirements.

1. Piling shall be treated timber piles of Southern Yellow Pine or Douglas Fir.
2. Piles shall be of sound wood, free from decay or insect damage. Treated piling shall have a minimum amount of red heart. Sound knots shall be no larger than 4" or 1/3 of the diameter of the pile at the point where they occur, whichever is the smaller. The size of a knot shall be its diameter measured at right angles to the length of the pile. Piles may have unsound knots not exceeding 1/2 the permitted size of a sound knot, provided that the unsoundness extends to not more than 1 ½" depth, and that the adjacent areas of the trunk are not affected. Cluster knots consisting of two or more knots grouped together, the fibers of the wood being deflected around the entire unit, are prohibited. The sum of sizes of all knots in any foot of length of the pile shall not exceed six times the size of the largest permitted single knot.
    a. Holes of 1/2" or less in average diameter will be permitted, provided the sum of the average diameters of all holes in any square foot of pile surface does not exceed 1½".
    b. Twist of spiral grain in any 20' of length shall not exceed 1/2 of the circumference at the midpoint of the length measured.
    c. Splits shall be no longer than the butt diameter. The length of any shake in the outer half of the radius of the butt of the pile, when measured along the curve of the annual ring, shall not exceed 1/3 of the circumference of the butt of the pile. The butts and tips shall be sawed square. The tips may be tapered to a point not less than 4" in diameter.
    d. All piles shall be peeled by removing all rough bark and at least 80% of the inner bark. No strip of the inner bark remaining on the pile shall be over 3/4" wide and there shall be at least 1" of clean wood surface between any two such strips. At least 80% of the surface of any circumference shall be clean wood.
    e. Timber to be used for piling shall be cut above the ground swell and shall taper from butt to tip. A line from the center of the tip to the center of the butt shall not fall outside of the center of the pile at any point more than 1% of the length of the pile. In short bends, the distance from the center of the pile to a line stretched from the center of the pile above the bend to the center of the pile below the bend

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 100633

TIMBER PILING FOR SOIL DENSIFICATION AND REINFORCEMENT

shall not exceed 4% of the length of the bend or a maximum of 2½". Knots shall be trimmed flush with the body of the pile.

3. Piles shall have a minimum diameter at the tip, measured under the bark, as follows:

Length of Pile	Tip Diameter
Less than 40'	8"
40' to 60'	6"

4. The minimum diameter of piles at sections 3' from the butt, measured under the bark, shall be as follows:

Length of Pile	Diameter of Pile
20' to 30'	12"
30' to 40'	12"
Over 40'	13"

The diameter of the pile at the butt shall not exceed 20". The diameter of a pile in cases where the tree is not exactly round shall be determined either by measuring the circumference and dividing the number of inches by 3.14 or by taking the average of the maximum and minimum diameters at the location specified.

Storage and Protection of Materials. Timber piles shall be stacked on supports at least 12" above the ground surface to avoid absorption of ground moisture. Piles shall be closely-stacked to prevent warping or sagging. The ground underneath and in the vicinity of material stacks shall be kept reasonably clear of vegetation.

Preservation Treatment of Timber Piles. Preservation treatment of timber piles shall be accomplished according to the requirements of Subsection 817.04 of the Standard Specifications.

Driving. Prior to beginning pile-driving operations the Contractor, shall field verify the location of all underground utilities and obtain approval from the Engineer to begin. The Contractor shall be responsible for all damages and/or claims arising out of the installation of Timber Piling for Soil Densification and/or Reinforcement. Driving equipment that damages the piling shall not be used. Hammers shall be capable of driving to the plan tip elevations or to refusal without damage to the pile. Driving shall be considered complete once the pile has reached the tip elevation shown on the plans or refusal in rock or intermediate geotechnical materials (IGM) is encountered, whichever is shallower.

1. **Hammers:** All piling shall be driven with an air, steam, or diesel hammer. Gravity hammers will be permitted only when shown on the plans or as elsewhere allowed by the specifications. Hammers shall develop a total energy of not less than 12,500 ft.-lbs.

    a. The plant and equipment furnished for air or steam hammers shall have sufficient capacity to maintain, under working conditions, the pressure at the hammer specified by the manufacturer. Accurate pressure gauges shall be placed at the

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 100633

TIMBER PILING FOR SOIL DENSIFICATION AND REINFORCEMENT

boiler or tank and at the hammer so that the drop in pressure between the gauges can be determined.

b. When a single acting diesel hammer is used, it shall be equipped with a stroke indicator or the Contractor must furnish a method approved by the Engineer for determining the actual stroke. When a double acting diesel hammer is used, it shall be equipped with a bounce chamber pressure gauge in good working order mounted near ground level so as to be conveniently read by the Engineer when monitoring energy output of the hammer. The Contractor shall provide charts that equate the chamber pressure to equivalent energy.

2. **Hammer Cushions:** All impact pile driving equipment except gravity hammers shall be equipped with a hammer cushion of suitable thickness to prevent damage to the hammer or pile and to ensure uniform driving behavior. Hammer cushions shall be made of durable, manufactured materials, complying with the hammer manufacturer's guidelines except that all wood, wire rope, and asbestos hammer cushions are specifically prohibited. A striker plate as recommended by the hammer manufacturer shall be placed on the hammer cushion to ensure uniform compression of the cushion material. The hammer cushion shall be inspected in the presence of the Engineer before beginning pile driving at each structure or after each 100 hours of pile driving, whichever is more frequent. When the thickness of a hammer cushion is reduced by more than 25% of its original thickness, the Contractor shall replace it before driving is permitted to continue.

3. **Pile Drive Head:** A pile driven with an impact hammer requires an adequate drive head to distribute the hammer blow to the pile head. The drive head shall be axially aligned with the hammer and the pile. The drive head shall be guided by the leads and shall not be free swinging. The drive head shall fit around the pile head in a manner that will prevent transfer of torsional forces during driving while maintaining proper alignment of hammer and pile. The pile heads shall be cut squarely and a drive head, as recommended by the hammer manufacturer, shall be provided to hold the axis of the pile in line with the axis of the hammer.

4. **Driving Equipment Information:** The Contractor shall submit to the Engineer, for information and record purposes, pile driving equipment information at least 30 days before driving piles. The information shall be submitted on a Pile and Driving Equipment Data Form, which will be supplied by the Engineer. Any change in the driving system will require the Contractor to submit a new Pile and Driving Equipment Data Form.

5. **Additional Equipment:** In case the required penetration is not obtained with a hammer complying with the above minimum requirements, the Contractor shall provide a different hammer and/or sufficient additional equipment at no cost to the Department. Additional equipment not otherwise provided for herein shall be approved by the

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 100633

TIMBER PILING FOR SOIL DENSIFICATION AND REINFORCEMENT

Engineer prior to its use. Pile tips shall be used where it may be required to reach the minimum tip elevation and shall be at no additional cost to the Department.

6. **Leads:** Pile driver leads shall be constructed in such a manner as to provide freedom for vertical movement of the hammer and shall be held in position in such a manner as to ensure adequate support to the pile during driving. The axis of the leads and hammer shall coincide with the axis of the pile as nearly as practicable.
7. **Accuracy of Driving:** Pile shall be driven with a variation of not more than ¼" per foot from the vertical. Piles spacing shall not differ from those shown on the plans by 1 foot. Piling shall be driven under the observation of the Engineer or his representative so that data may be obtained for determining the penetration.

Order List for Piles. The Contractor shall furnish piles according to an itemized list, which will be furnished by the Engineer, showing the number and length of piles. In determining lengths of piles for ordering and for quantities to be included in the Contract, the lengths given in the order list shall be based on the lengths that are assumed to be driven to minimum penetration and cut off at the elevation shown on the plans. The Contractor may, at no cost to the Department, increase the lengths given to provide for fresh heading and for such additional length as may be necessary to suit the Contractor's method of operation.

Defective Piles. The Contractor shall not subject piles to excessive abuse that will produce cracking, crushing, splitting, or deformation of the pile. Manipulation of piles to force them into proper position, considered by the Engineer to be excessive, will not be permitted. Any pile damaged because of internal defects or improper driving, or any pile driven out of its proper location or driven below the elevation fixed by the plans or the Engineer, shall be corrected at no cost to the Department by one of the following methods, as approved by the Engineer:

1. The pile may be withdrawn and replaced by a new, and if necessary, longer pile.
2. A second pile may be driven adjacent to the defective or low pile.
3. The pile may be spliced or built up as otherwise provided herein.

Piles pushed up by the driving of adjacent piles or by any other cause shall be re-driven to grade. Any crushed or damaged portion of piling may be cut off and built up or the pile completely replaced, as approved by the Engineer. Cutoff, buildup, and/or replacement of damaged piles shall be at no cost to the Department.

Cutting Off Timber Piles. Cut-offs shall be a minimum of 2 feet below roadway surface and embankment side slope faces. In addition, cut-off length shall be sufficient to permit the complete removal of any material damaged by driving.

Method of Measurement. Timber Piling will be measured by the actual number of linear feet of accepted pile remaining in the finished work after all cut-offs or build-ups have been made, based upon lengths shown on the plans or established by the Engineer.

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. 100633

TIMBER PILING FOR SOIL DENSIFICATION AND REINFORCEMENT

In case piles are driven to refusal in resistant rock or IGM that is present shallower than the plan tip elevations shown on plans, timber piles will be measured and paid by the plan lengths shown on plans, including any cut-off length.

No allowance for cut-off will be made on piling for any length in excess of the lengths shown on the plans or established by the Engineer. For piles furnished according to the lengths shown on the plans or established by the Engineer that are found to be too short and are spliced according to details shown in the plans, an allowance of 4 linear feet of piling will be made for each timber pile splice in addition to the actual length of accepted pile in place.

No allowance will be made for cut-off or build-up of any portion of a pile that has been damaged, for splices made for the convenience of the Contractor, for extra length ordered for the Contractor's convenience, or for cutback necessary for splicing. Cut-off material shall become the property and responsibility of the Contractor.

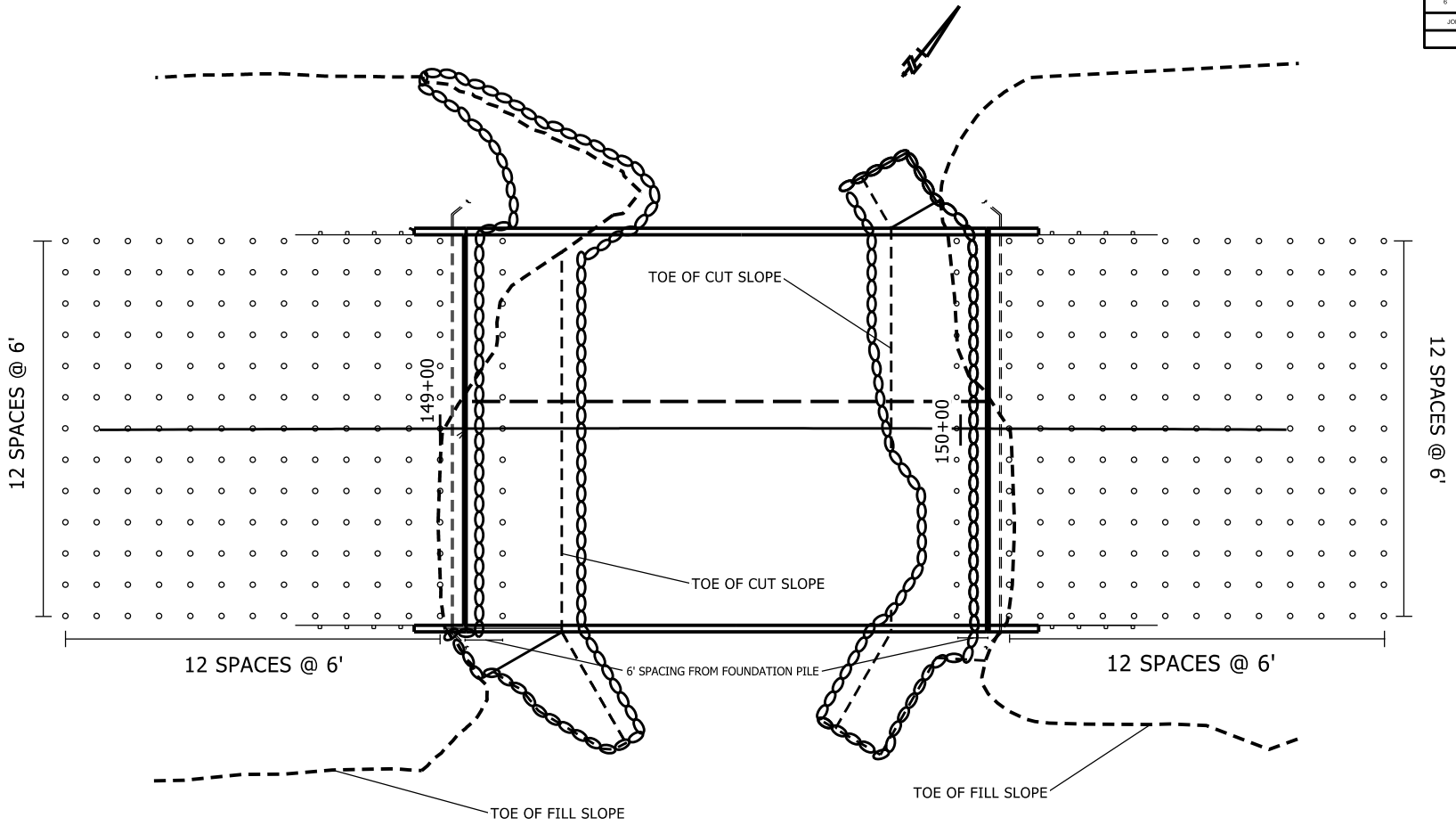
Basis of Payment. Work completed and accepted and measured as provided above will be paid for at the contract unit price bid per linear foot for Timber Piling, which price shall be full compensation for furnishing, transporting, handling and storing material, driving, drilling, and excavation, for cut-off, splicing, and build-up in accordance with the requirements of these Specifications, and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Timber Piling	Linear Foot

Attachment I1

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		100633		
PLAN OF TIMBER PILES				

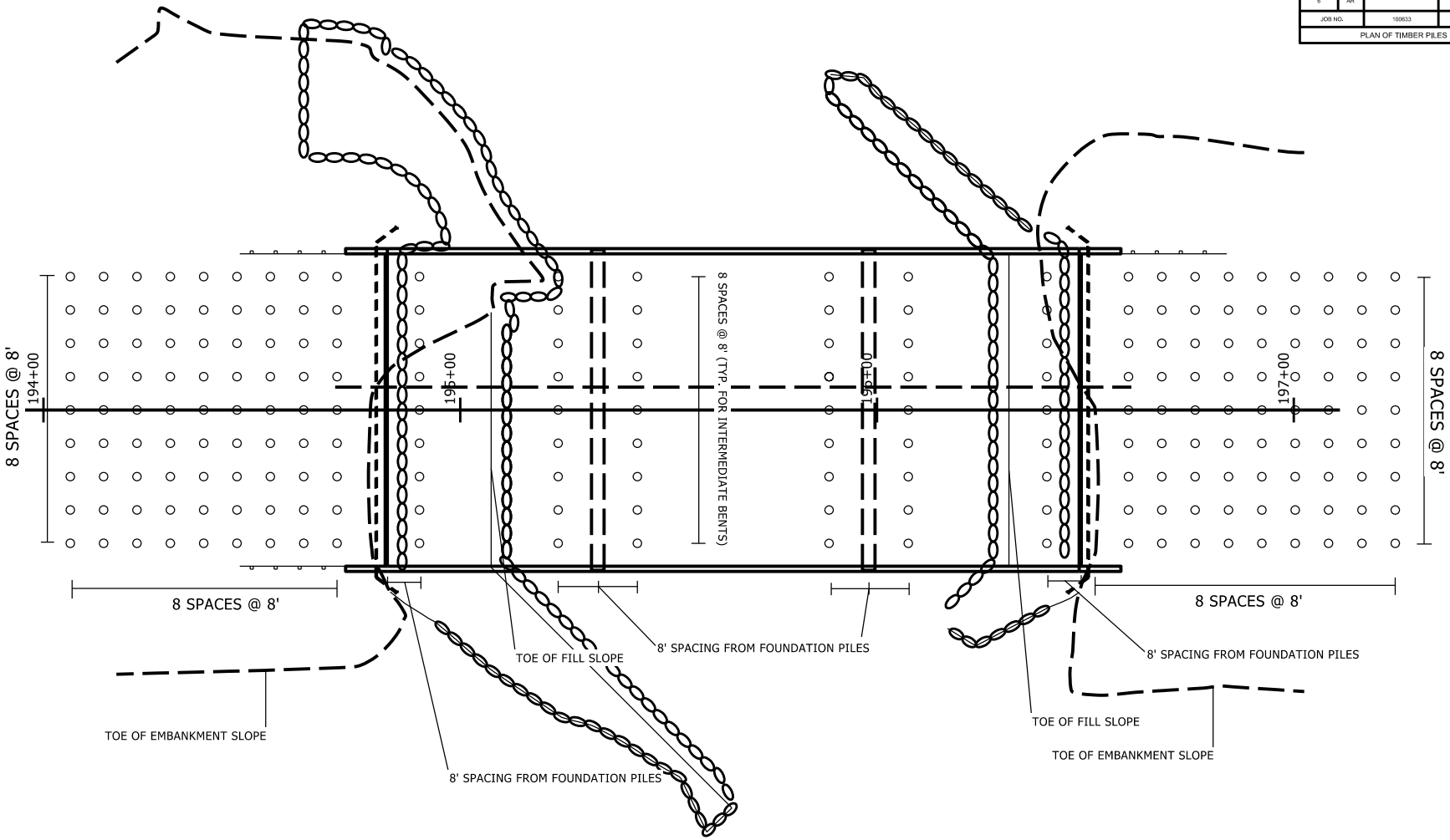


PLAN OF TIMBER PILES	
PARAGOULD- NORTH (S) ROUTE 49, SECTION 2 GREENE COUNTY FED. AID PROJECT	
JOB NO. 100633	SHEET 1/1
Jacks Creek (Site 1)	

Attachment I2

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
6	AR			
JOB NO.		100633		

PLAN OF TIMBER PILES



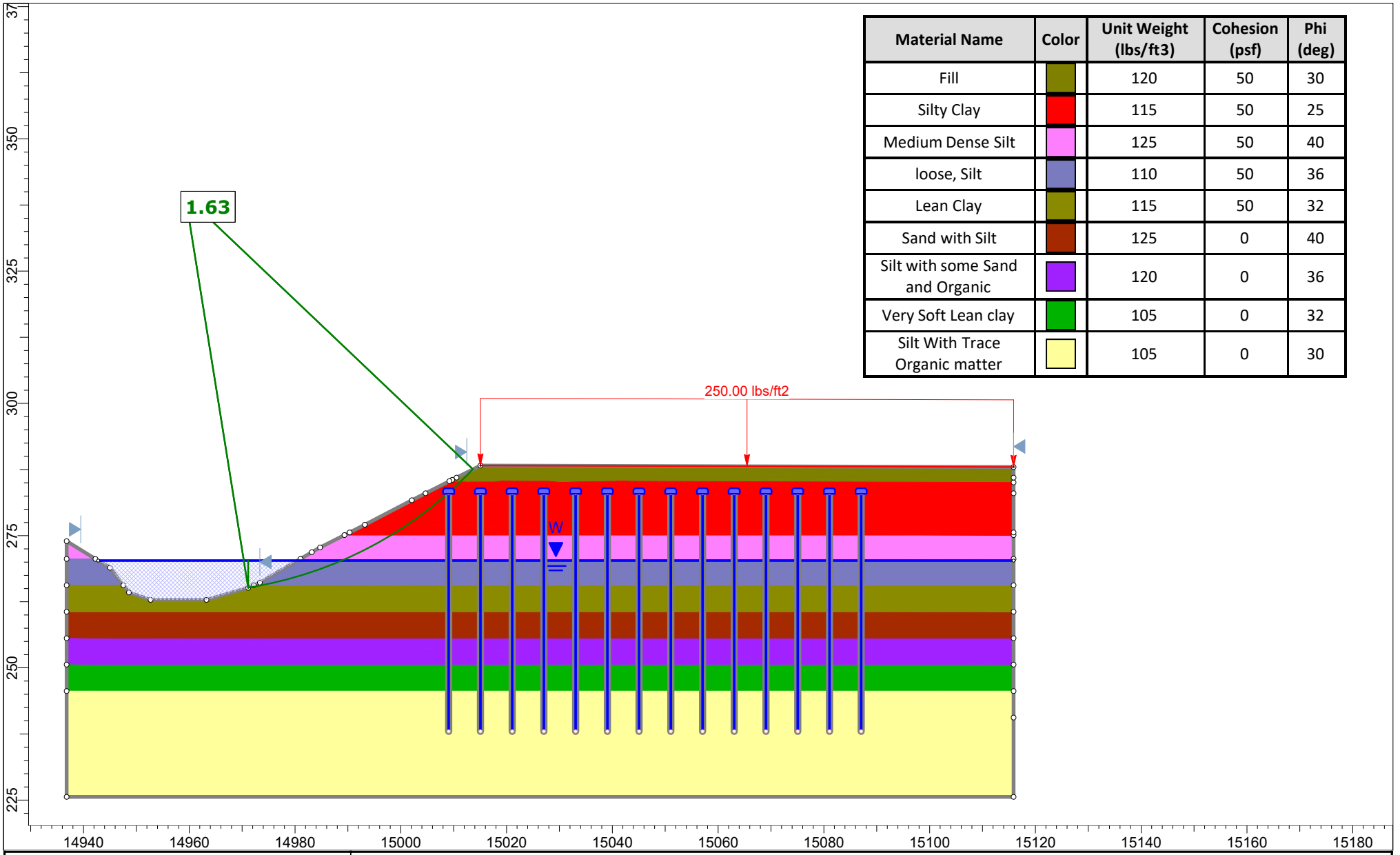
PLAN OF BORINGS

PARAGOULD- NORTH (S)
ROUTE 49, SECTION 2
GREENE COUNTY
FED. AID PROJECT

JOB NO. 100633	SHEET 1/1

Locust Creek (Site 2)

Attachment J1

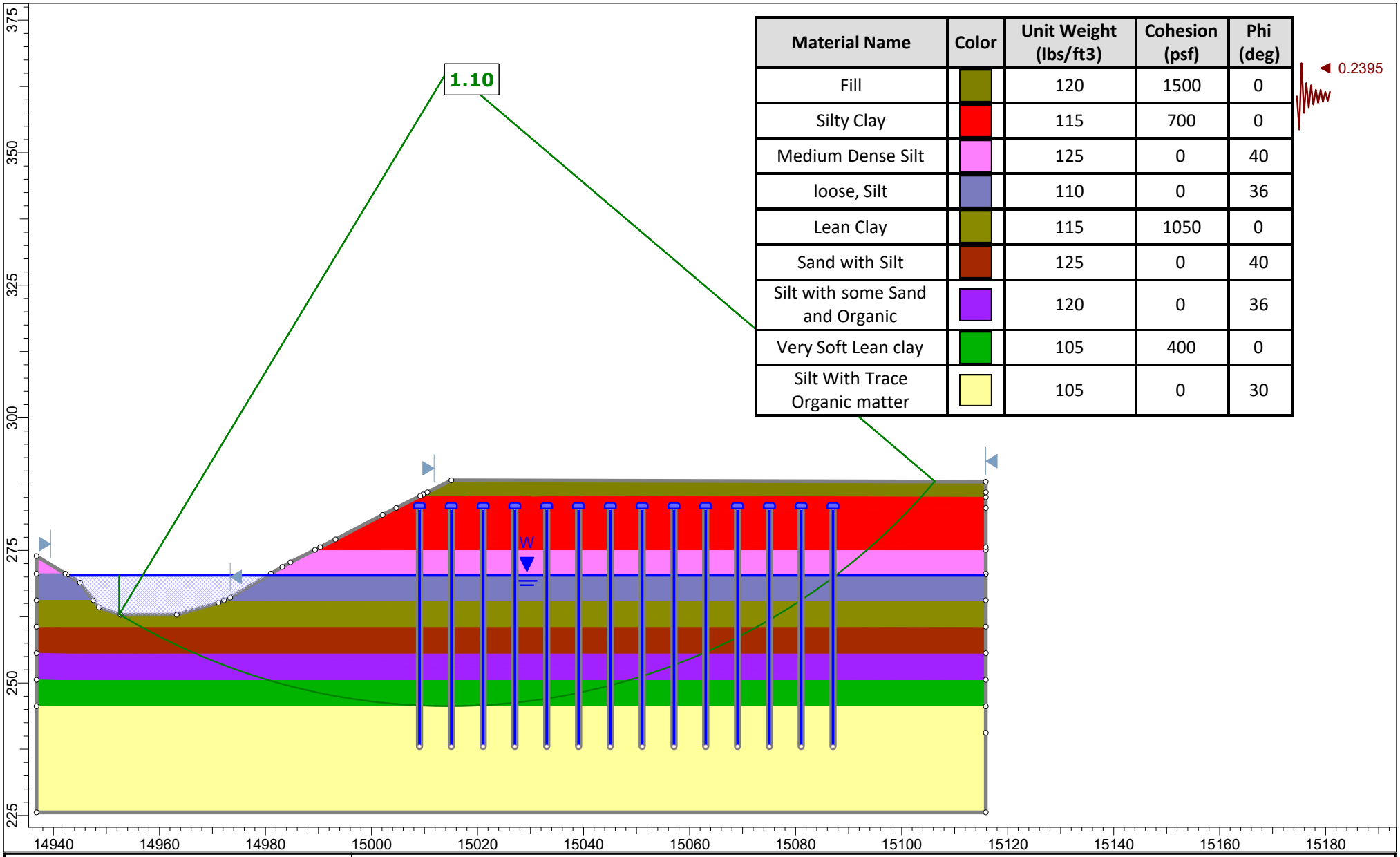


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Silty Clay		115	50	25
Medium Dense Silt		125	50	40
loose, Silt		110	50	36
Lean Clay		115	50	32
Sand with Silt		125	0	40
Silt with some Sand and Organic		120	0	36
Very Soft Lean clay		105	0	32
Silt With Trace Organic matter		105	0	30

rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slopes
Date	11/29/2022		



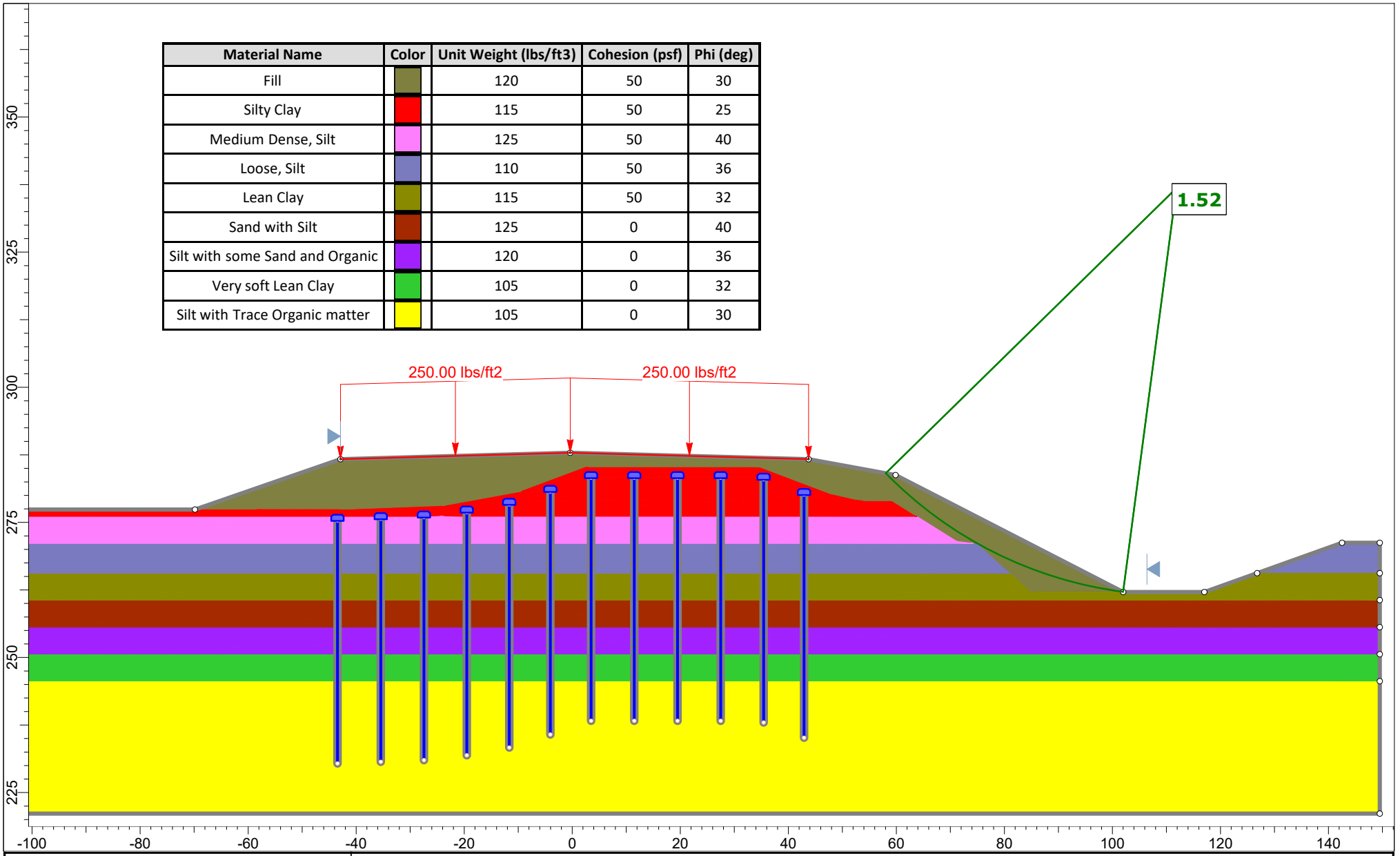
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		115	700	0
Medium Dense Silt		125	0	40
loose, Silt		110	0	36
Lean Clay		115	1050	0
Sand with Silt		125	0	40
Silt with some Sand and Organic		120	0	36
Very Soft Lean clay		105	400	0
Silt With Trace Organic matter		105	0	30

rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slopes
Date	11/29/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Silty Clay		115	50	25
Medium Dense, Silt		125	50	40
Loose, Silt		110	50	36
Lean Clay		115	50	32
Sand with Silt		125	0	40
Silt with some Sand and Organic		120	0	36
Very soft Lean Clay		105	0	32
Silt with Trace Organic matter		105	0	30

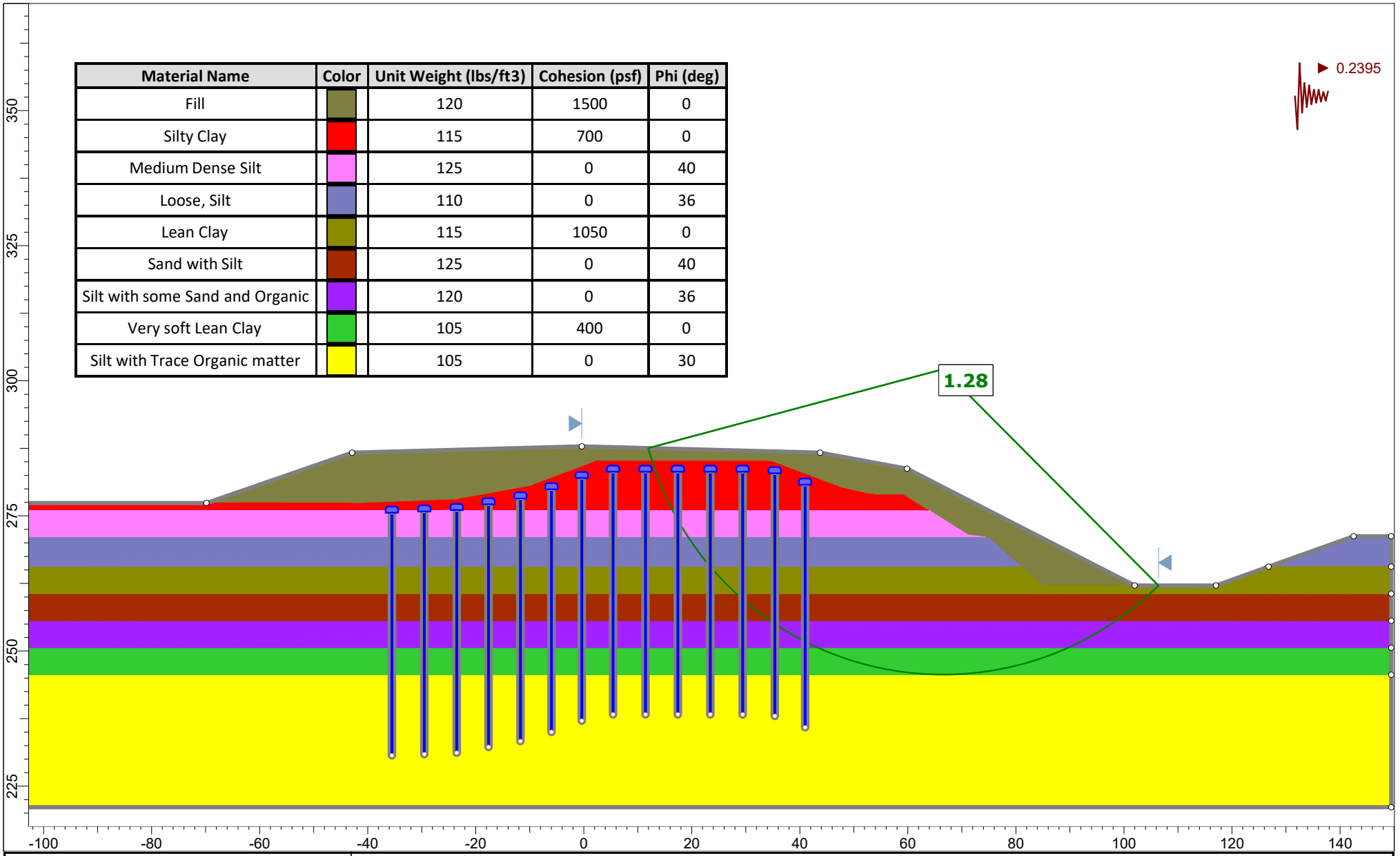


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- NOrth (S)		
Site	Jacks Creek (Site 1) Sta. 151+00	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Slope Cross Section, 1V: 2H Side Slope
Date	11/29/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Silty Clay		115	700	0
Medium Dense Silt		125	0	40
Loose, Silt		110	0	36
Lean Clay		115	1050	0
Sand with Silt		125	0	40
Silt with some Sand and Organic		120	0	36
Very soft Lean Clay		105	400	0
Silt with Trace Organic matter		105	0	30



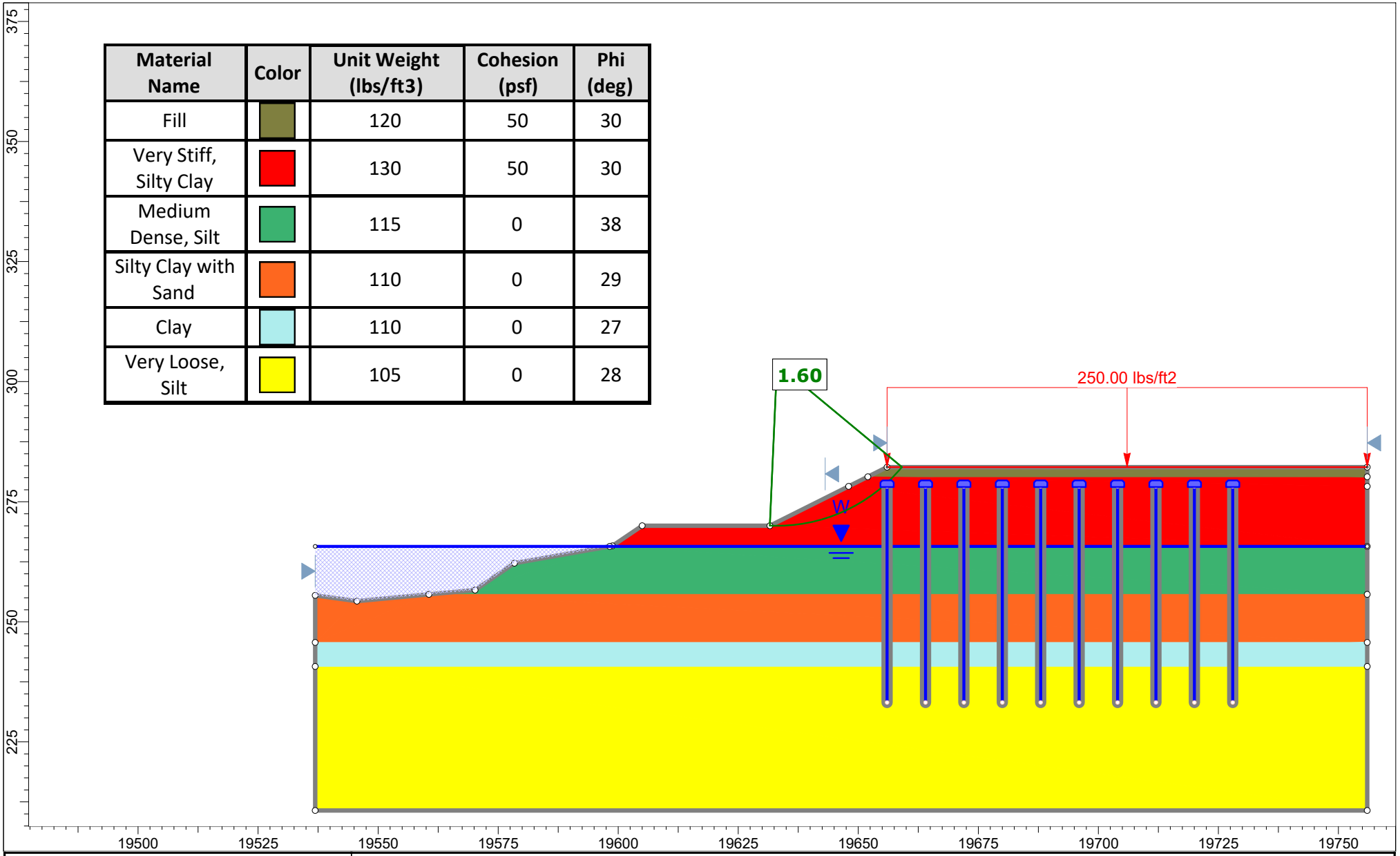
rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Jacks Creek (Site 1) Sta. 151+00	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Slope Cross Section, 1V : 2H Side Slope
Date	11/29/2022		

Attachment J2

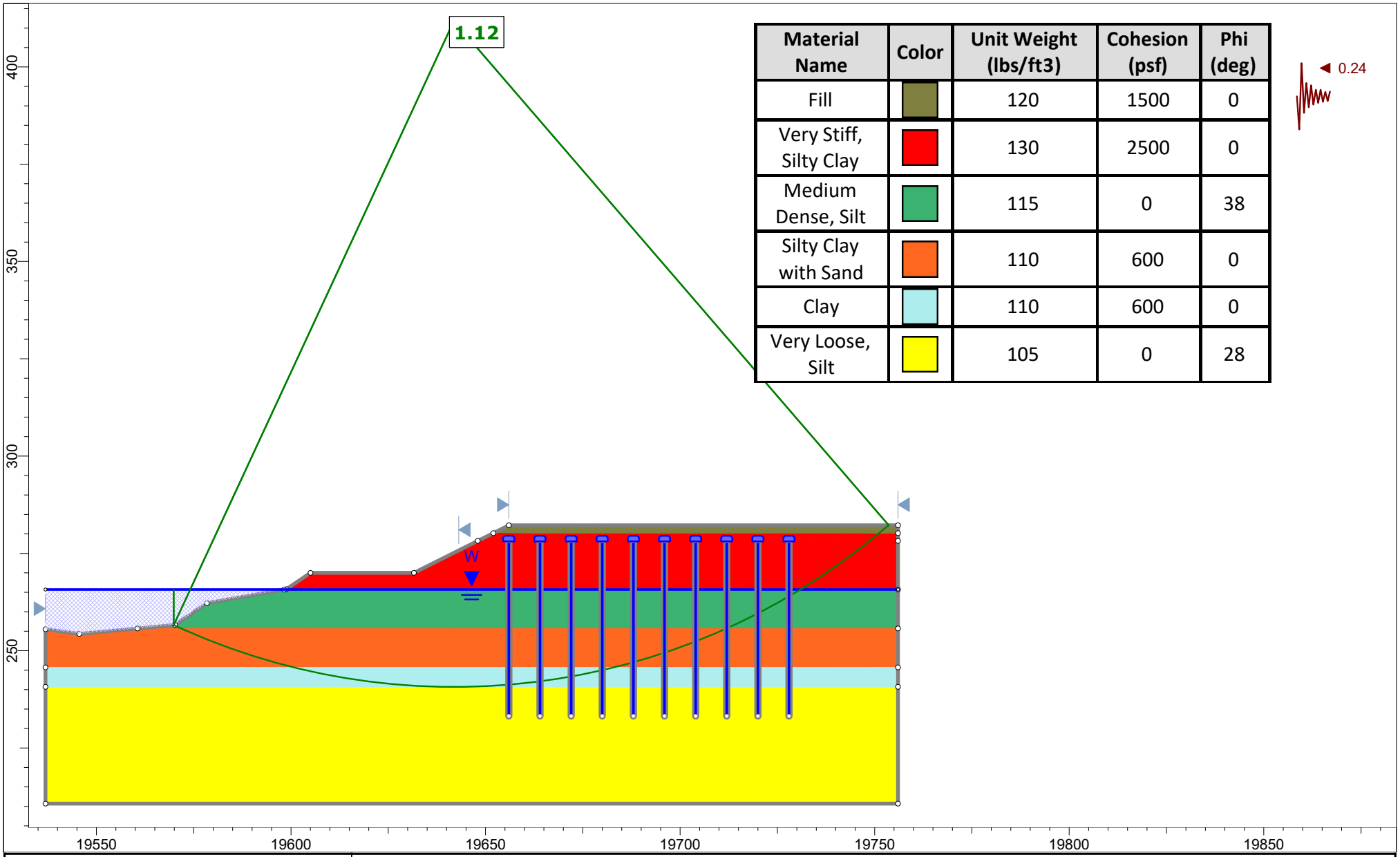
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Very Stiff, Silty Clay		130	50	30
Medium Dense, Silt		115	0	38
Silty Clay with Sand		110	0	29
Clay		110	0	27
Very Loose, Silt		105	0	28



rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slope
Date	11/29/2022		



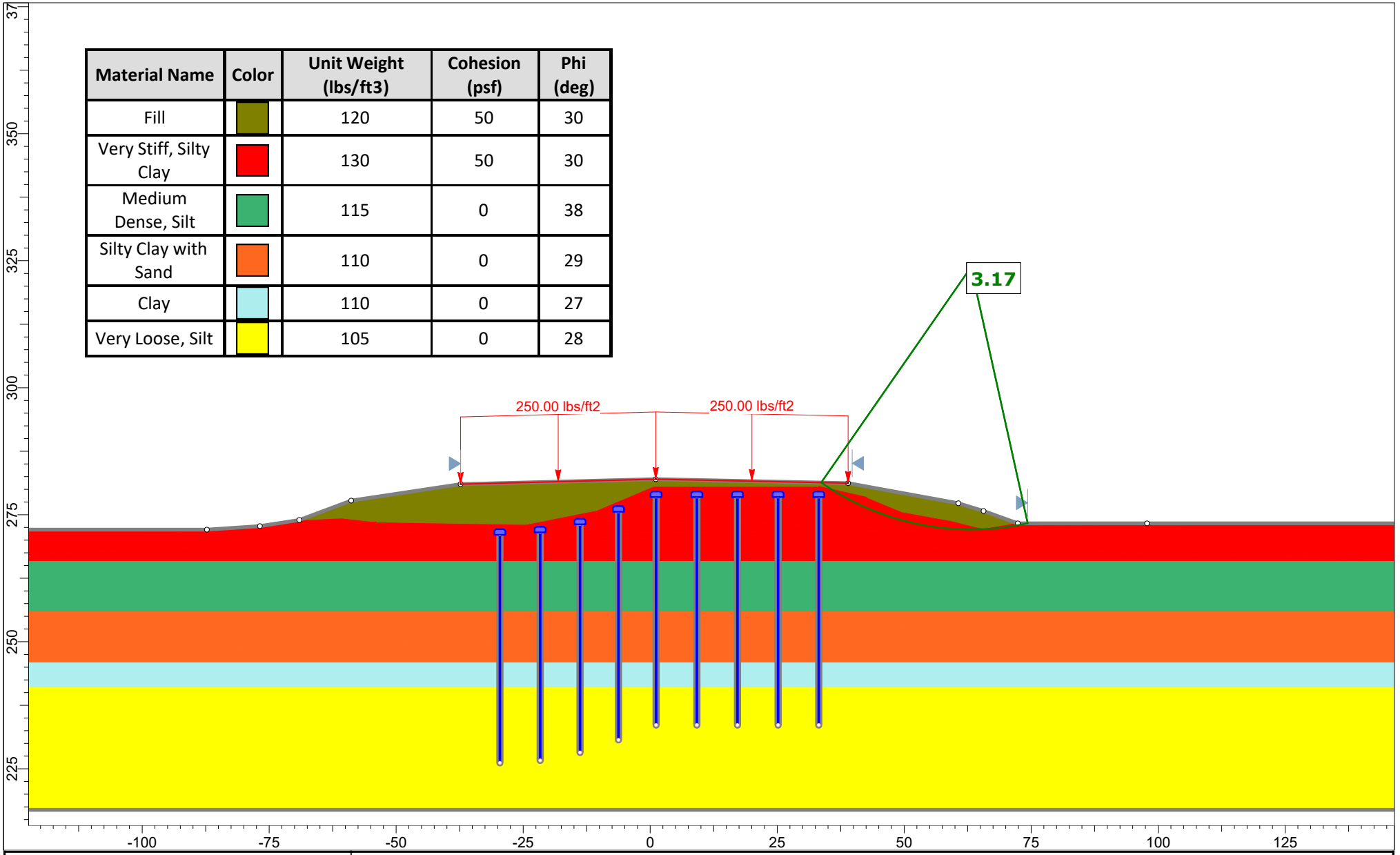
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Very Stiff, Silty Clay		130	2500	0
Medium Dense, Silt		115	0	38
Silty Clay with Sand		110	600	0
Clay		110	600	0
Very Loose, Silt		105	0	28

rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2)	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Bridge End, 1V: 2H End Slope
Date	11/29/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	50	30
Very Stiff, Silty Clay		130	50	30
Medium Dense, Silt		115	0	38
Silty Clay with Sand		110	0	29
Clay		110	0	27
Very Loose, Silt		105	0	28

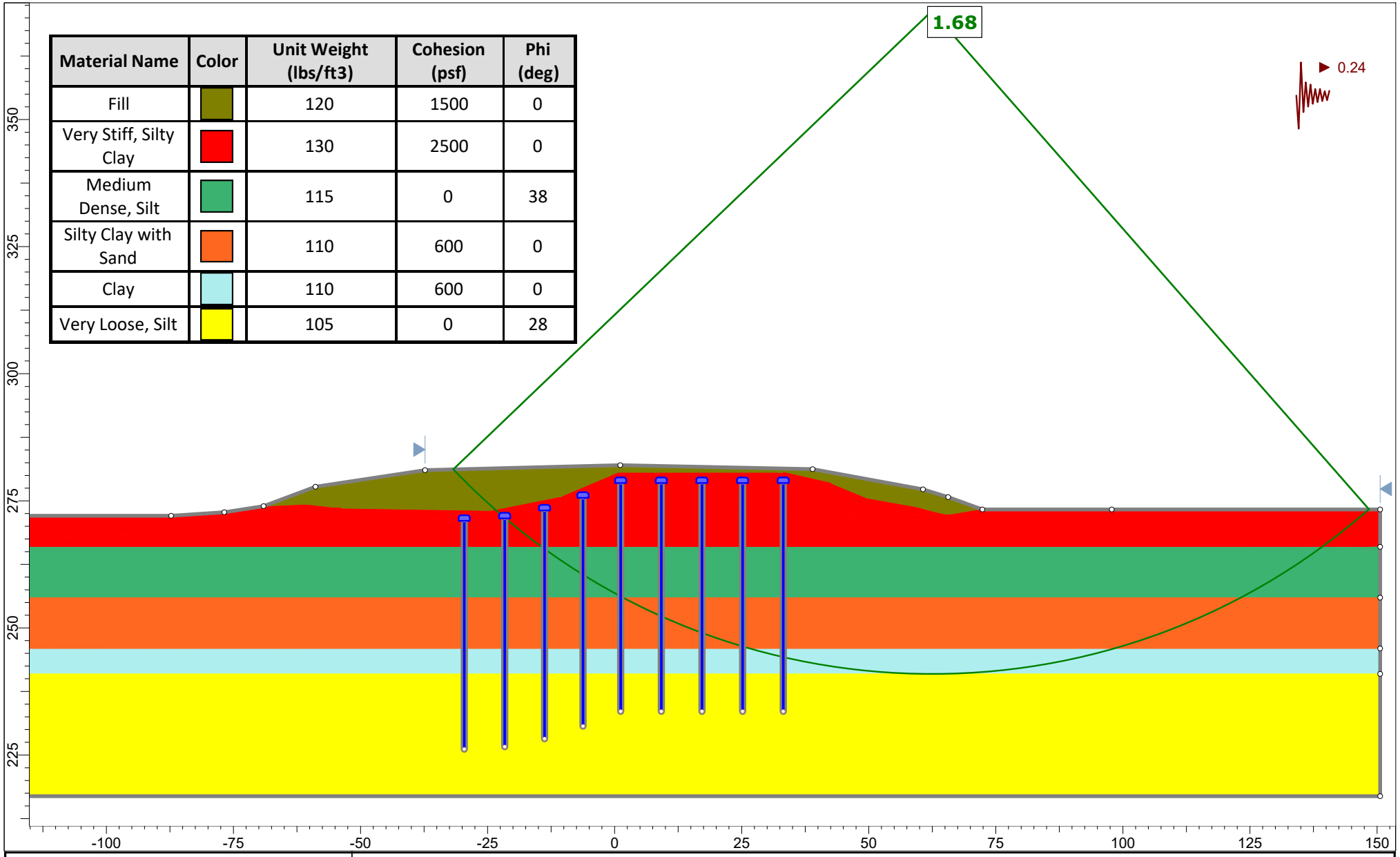


rocscience

SLIDEINTERPRET 9.019

Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2) Sta. 197+00	Analysis Type	Long Term
Analyzed By	MBB	Configuration	East Slope Cross Section, 1V : 3H Side Slope
Date	11/29/2022		

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Fill		120	1500	0
Very Stiff, Silty Clay		130	2500	0
Medium Dense, Silt		115	0	38
Silty Clay with Sand		110	600	0
Clay		110	600	0
Very Loose, Silt		105	0	28

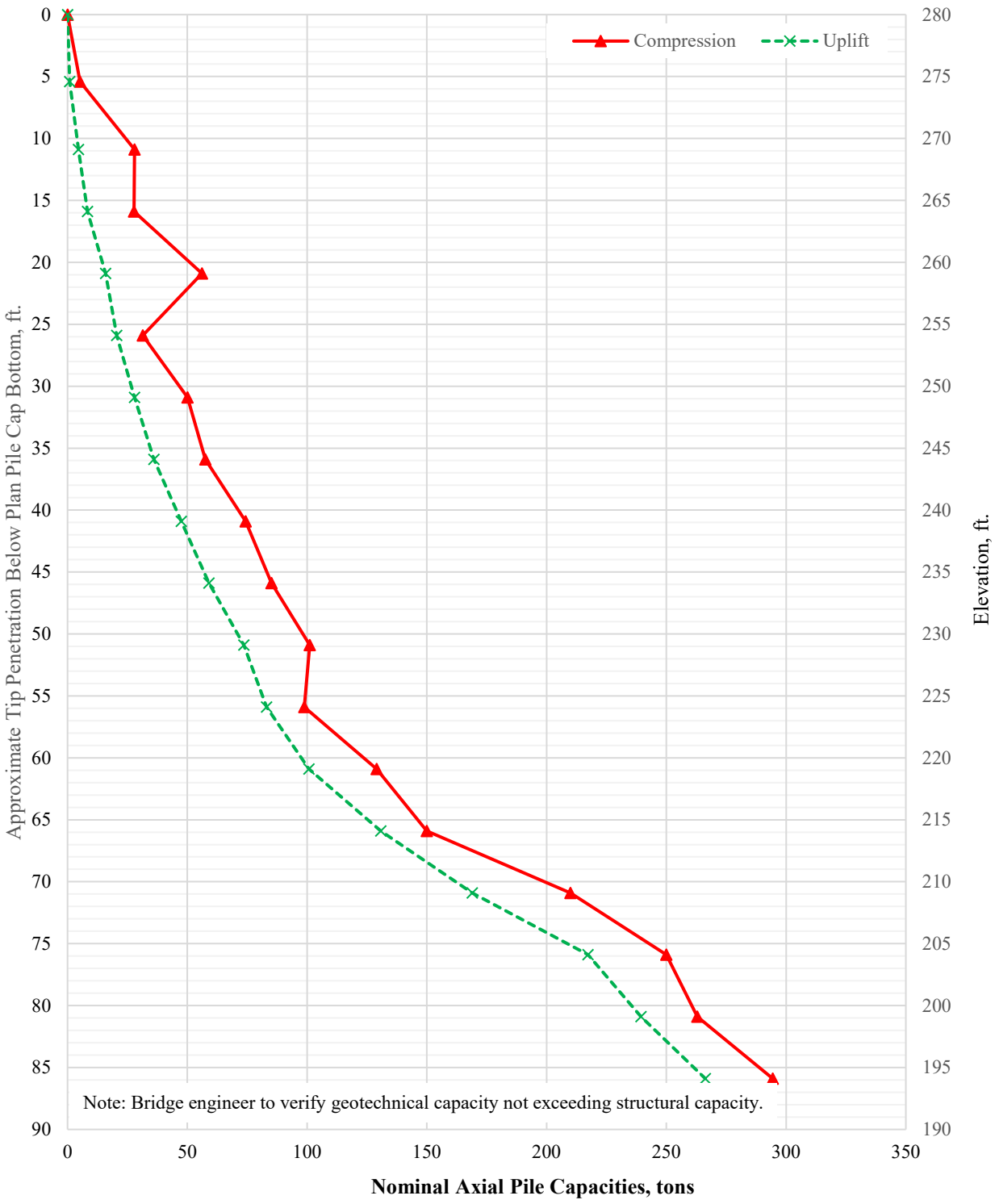


rocscience

SLIDEINTERPRET 9.019

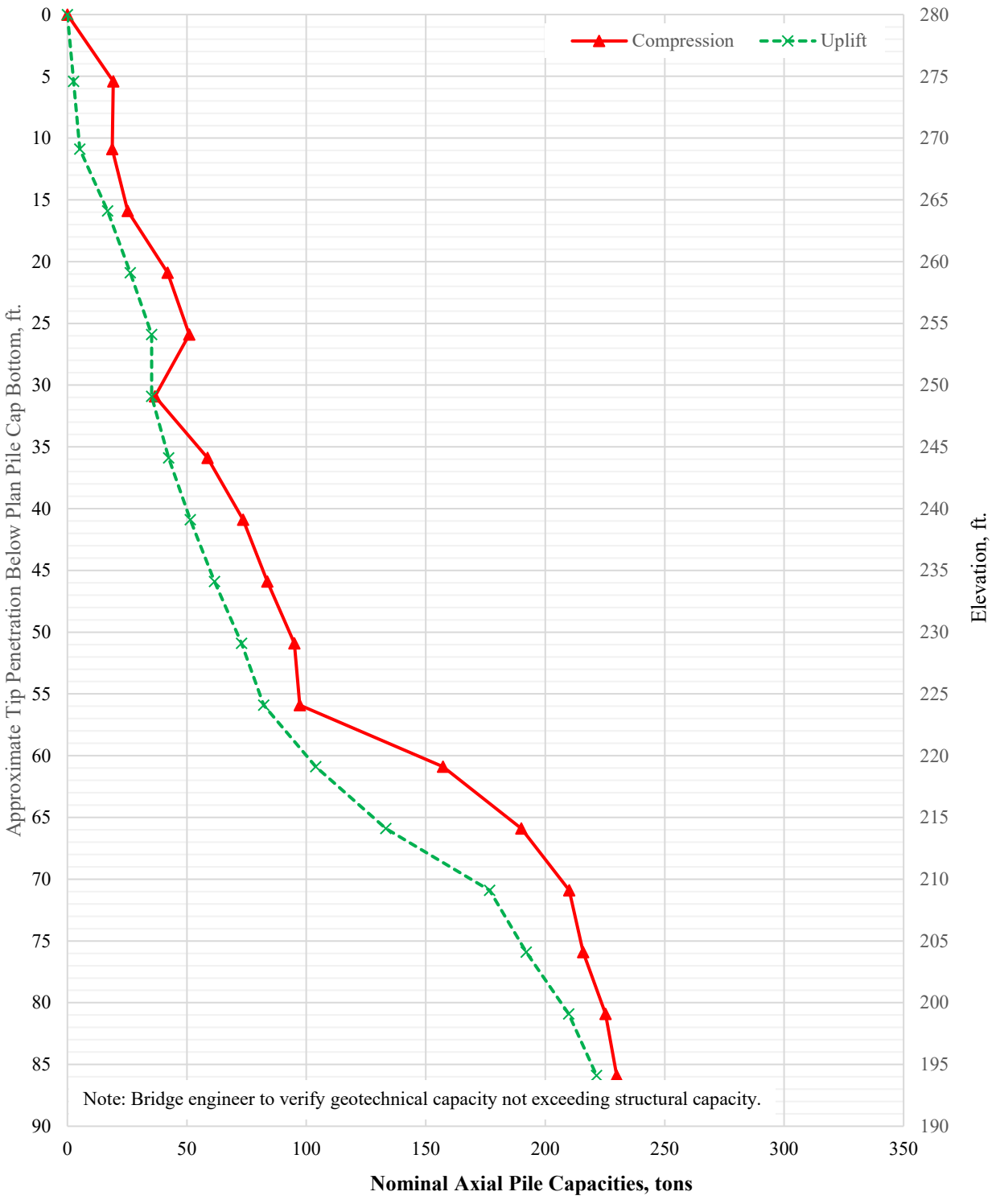
Project	100633 Paragould- North (S)		
Site	Locust Creek (Site 2) Sta. 197+00	Analysis Type	Seismic
Analyzed By	MBB	Configuration	East Slope Cross Section, 1V : 3H Side Slope
Date	11/29/2022		

Attachment K1



SINGLE 18"-DIAMETER CONCRETE FILLED STEEL SHELL PILE

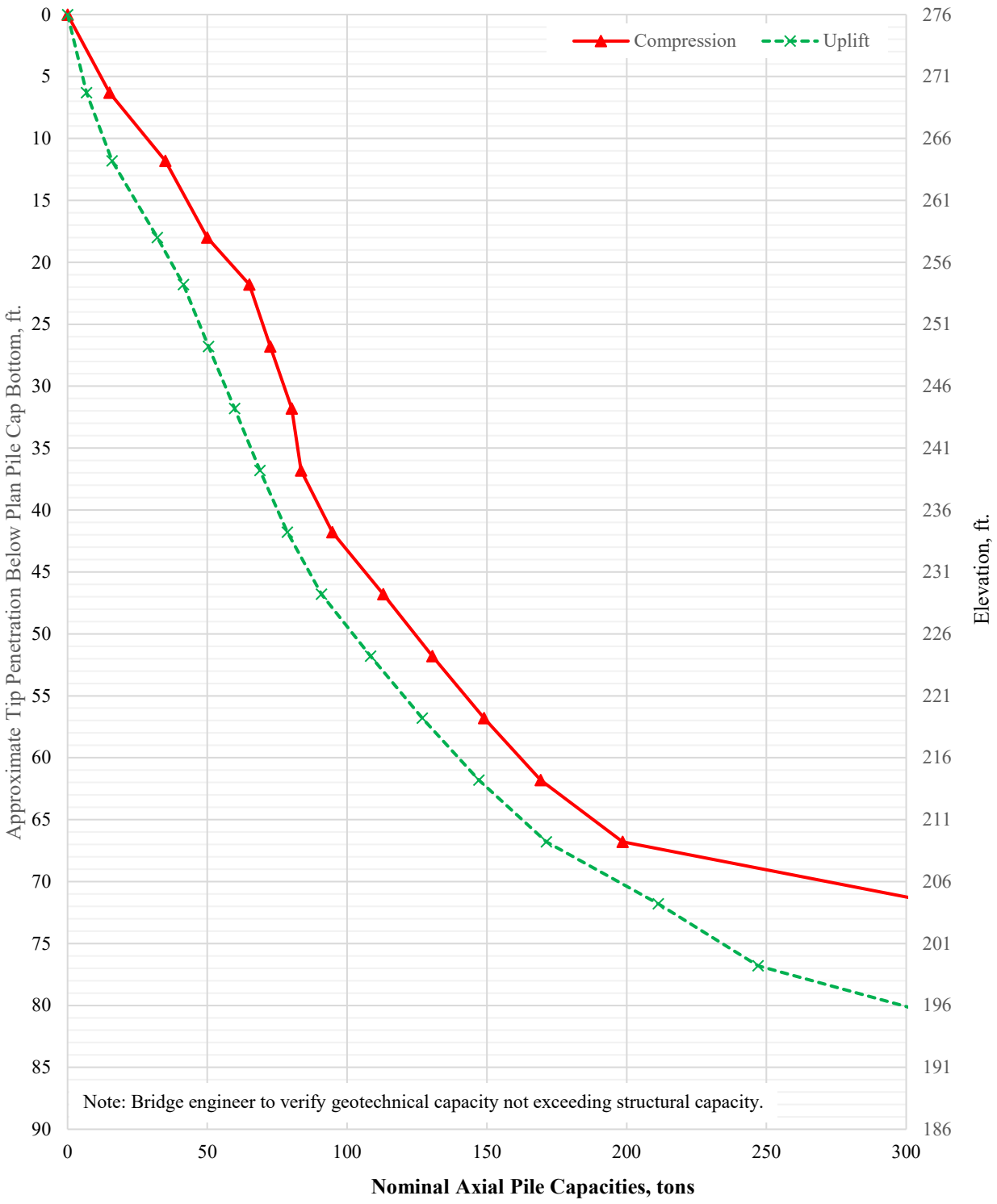
Bent 1 - Sta. 149+05, CL
Site No. 1 - Highway 49 over Jacks Creek
Project No.: 100633
Location: Greene County



SINGLE 18"-DIAMETER CLOSED-END STEEL SHELL PILE

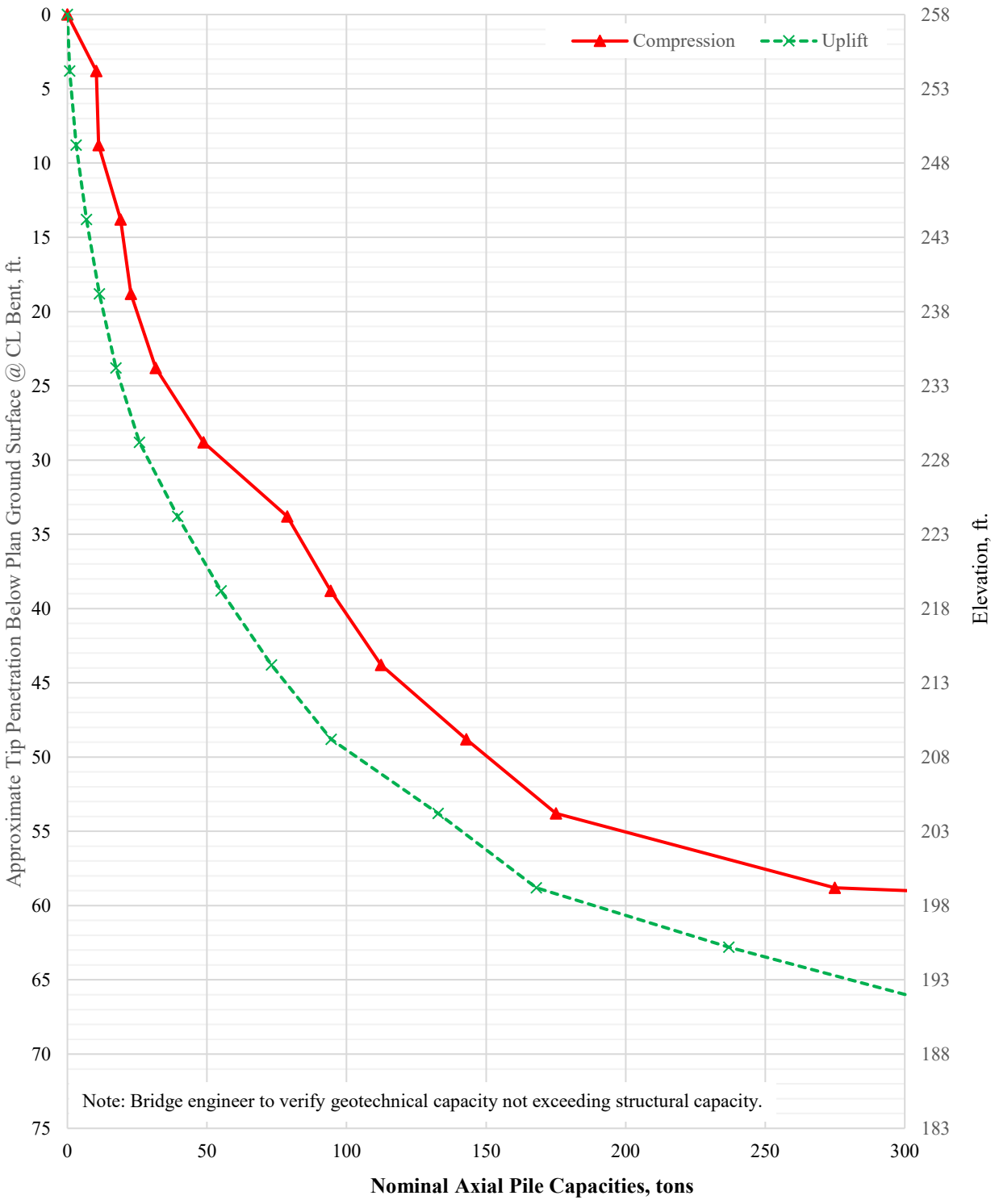
Bent 2 - Sta. 150+05, CL
Site No. 1 - Highway 49 Over Jacks Creek
Project No.: 100633
Location: Greene County

Attachment K2



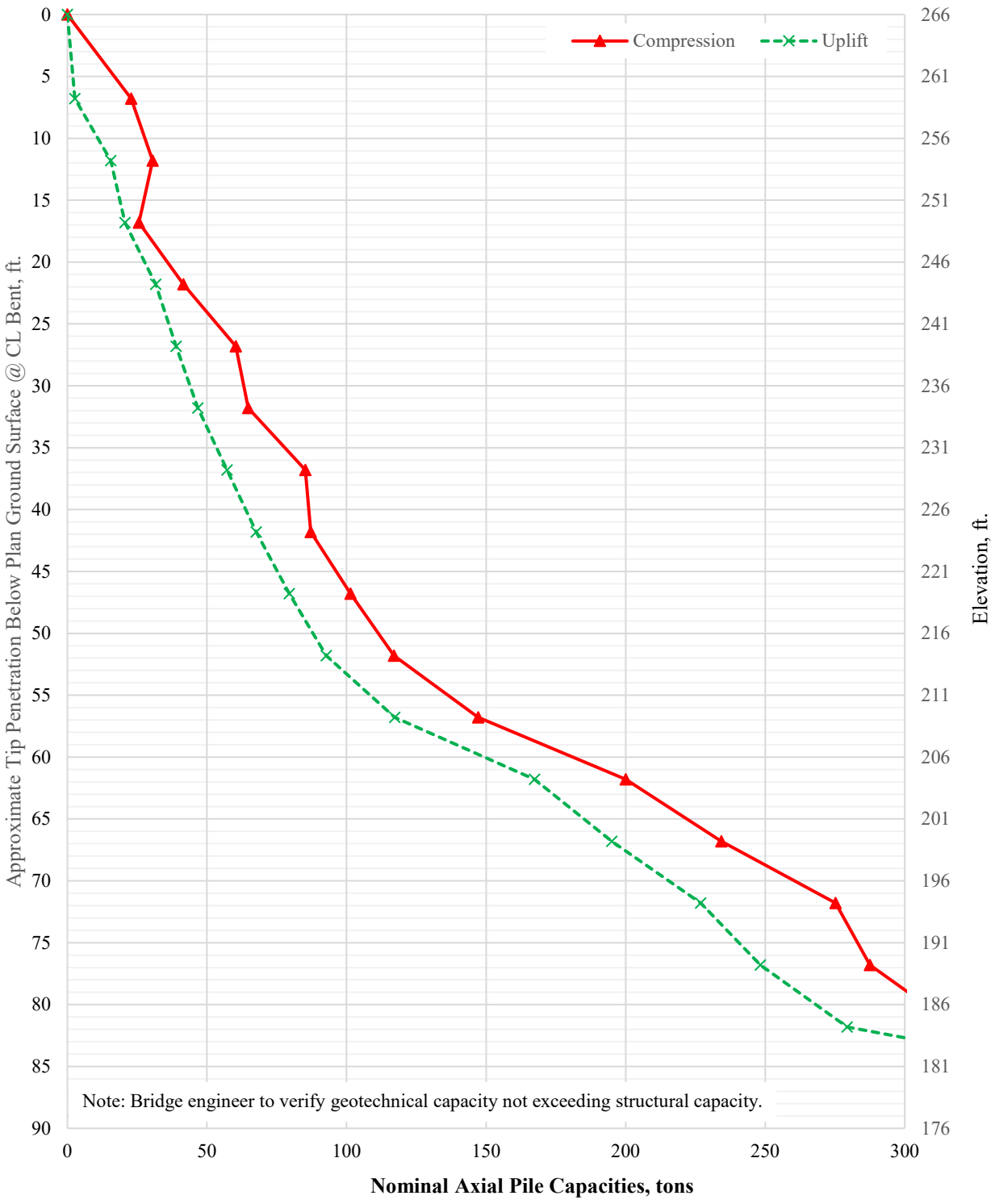
SINGLE 18"-DIAMETER CONCREE FILLED STEEL SHELL PILE

Bent 1 - Sta. 194+82.5, CL
Site No. 2 - Highway 49 Over Locust Creek
Project No.: 100633
Location: Greene County



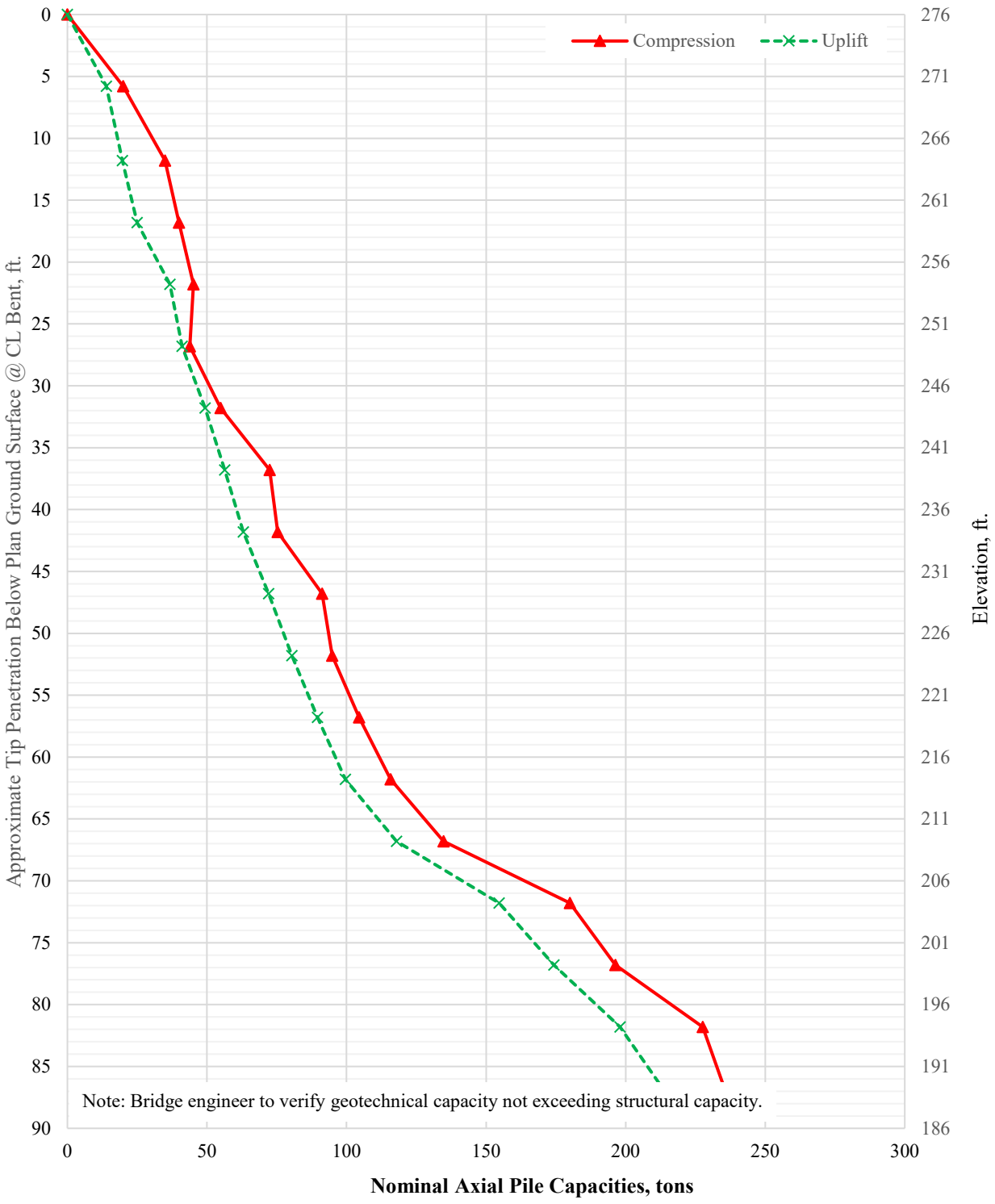
SINGLE 24"-DIAMETER CONCRETE FILLED STEEL SHELL PILE

Bent 2 - Sta. 195+33, CL
Site No. 2 - Highway 49 over Locust Creek
Project No.: 100633
Location: Greene County



SINGLE 24"-DIAMETER CONCRETE FILLED STEEL SHELL PILE

Bent 3 - Sta. 195+98, CL
Site No. 2 - Highway 49 over Locust Creek
Project No.: 100633
Location: Greene County



SINGLE 18"-DIAMETER CONCRETE FILLED STEEL SHELL PILE

Bent 4 - Sta. 196+48.5, CL
Site No. 2 - Highway 49 over Locust Creek
Project No.: 100633
Location: Greene County

Attachment L1

Recommended Geotechnical Parameters for Lpile Analysis- Bents 1 & 2 for Site 1

Bent 1						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Above Ground (Fill)	Soft Clay (Matlock)	120	750	0.01	NA	NA
Ground Level to 276	Stiff Clay w/o Free Water	115	1050	0.007	NA	NA
276 to 267	Sand (Reese)	62	NA	NA	32	40
267 to 256	Sand (Reese)	63	NA	NA	32	40
256 to 216	Sand (Reese)	59	NA	NA	29	20
Below 216	Sand (Reese)	80	NA	NA	36	90

Bent 2						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Above Ground (Fill)	Soft Clay (Matlock)	120	750	0.01	NA	NA
Ground Level to 276	Soft Clay (Matlock)	110	700	0.01	NA	NA
276 to 271	Sand (Reese)	125	NA	NA	36	145
271 to 266	Sand (Reese)	60	NA	NA	31	25
266 to 261	Stiff Clay with Free Water	53	1050	0.007	NA	NA
261 to 251	Sand (Reese)	69	NA	NA	35	75
251 to 246	Soft Clay (Matlock)	45	250	0.02	NA	NA
246 to 216	Sand (Reese)	58	NA	NA	27	20
Below 216	Sand (Reese)	75	NA	NA	36	90

Attachment L2

Recommended Geotechnical Parameters for Lpile Analysis- Bents 1-4 for Site 2

Bent 1						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Above Ground (Fill)	Soft Clay (Matlock)	120	750	0.01	NA	NA
Ground Level to 271	Stiff Clay w/o Water Table	115	1050	0.007	NA	NA
271 to 266	Sand (Reese)	110	NA	NA	32	55
266 to 261	Sand (Reese)	62	NA	NA	32	40
261 to 256	Sand (Reese)	67	NA	NA	35	75
256 to 251	Sand (Reese)	62	NA	NA	32	40
251 to 231	Sand (Reese)	57	NA	NA	23	20
231 to 206	Sand (Reese)	59	NA	NA	26	20
Below 206	Sand (Reese)	80	NA	NA	36	90

Bent 2						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Ground Level to 256	Sand (Reese)	67	NA	NA	35	75
256 to 251	Sand (Reese)	62	NA	NA	32	40
251 to 231	Sand (Reese)	57	NA	NA	23	20
231 to 206	Sand (Reese)	59	NA	NA	26	20
Below 206	Sand (Reese)	80	NA	NA	36	90

Bent 3						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Ground to 256	Sand (Reese)	68	NA	NA	33	75
256 to 241	Soft Clay (Matlock)	50	700	0.02	NA	NA
Below 241	Sand (Reese)	57	NA	NA	26	20

Bent 4						
Elevation, ft	p-y Curve Model	Effective Unit Weight, γ', pcf	Undrained Shear Strength, Cu, psf	Strain Factor, ε_{50}	Friction Angle, ϕ, ◦	Soil Modulus, k, pci
Above Ground (Fill)	Soft Clay (Matlock)	120	750	0.01	NA	NA
281 to 266	Stiff Clay w/o Free Water	128	2000	0.007	NA	NA
266 to 256	Sand (Reese)	68	NA	NA	33	75
256 to 241	Soft Clay (Matlock)	50	700	0.02	NA	NA
Below 241	Sand (Reese)	57	NA	NA	26	20