STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

ERIC BOYETTE
SECRETARY

October 14, 2022

MEMORANDUM TO: Chad Kimes, P.E.
Division Engineer

ATTENTION: Katie Hite, P.E.
Division Project Development Engineer

FROM: David T. Herring, P.E.
Assistant State Geotechnical Engineer

DS JRB

DocuSigned by: David T. Herring 5A82AFE05A0E460...

STATE PROJECT: 45587.1.1 (B-5632)
F.A. PROJECT: BRZ-1828(001)
COUNTY: Duplin

DESCRIPTION: Bridge No. 187 on SR 1828 over Cypress Creek

SUBJECT: Geotechnical Report - Design and Construction Recommendations

The Geotechnical Engineering Unit (GEU) has completed a subsurface investigation for this project and presents the following recommendations.

I. Slope/Embankment Stability

A. Slope/Embankment Stability

Recommend all roadway slopes be constructed no steeper than 3:1 (H:V) except the area where rock plating is recommended as described in Section I.D.

B. Undercut for Embankment Stability

Recommend a quantity of 250 cubic yards of Undercut Excavation be included in the project contract for the areas near the bridge End Bent No. 1 at -L- Sta. 16+39.48. The soils in this area are loose soils with moderate organic to muck and typically cause settlement and/or instability of the proposed embankment and should be undercut. For illustration purpose, this area is drawn on page #10 of this report. The begin and end stations based on the four corner points of this parallelogram area are as follows:

Begin Station	15+98±, 33'± LT	and	16+35±, 33'± RT
End Station	16+28±, 33'± LT	and	16+65±, 33'± RT

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT – EASTERN REGIONAL OFFICE
1570 MAIL SERVICE CENTER
RALEIGH, NC 27699-1570

Telephone: (984) 920-8900
Customer Service: 1-877-368-4968
Website: www.ncdot.gov

Location:
3301 JONES SAUSAGE RD. SUITE 100
GARNER, NC 27529

The recommended undercut sections are shown by a double hatch (XXXX) symbol on page # 11 of this report. Please re-draw this undercut in the roadway cross section sheet for the contract document.

Recommend 100 cubic yards of Undercut Excavation for embankment stability be included in the contract as a contingency item to be used at the direction of the Engineer.

C. Geotextile for Soil Stabilization

Include 100 square yards of Geotextile for Soil Stabilization in the contract as a contingency item to be used at the discretion of the Engineer.

D. Rock Plating

The GEU recommends using the Rock Plating in the following areas where roadway side slope is steeper than 2.5:1 (H:V).

Line	Station (±)	Location
-L-	14+75 to 16+20	LT
-L-	15+75 to 16+38	RT
-L-	18+70 to 23+75	LT

The GEU recommends an estimated quantity of 960 square yards of Rock Plating to be included in the project contract. For Rock Plating, see Section 275 of the Standard Specifications and Contract Standard Drawing No. 275D01.

The following Rock Plating summary table will be included in 3G-1 plan sheet.

Line	Beginning Slope (H:V)	Approx. Station	Ending Slope (H:V)	Approx. Station	Location (LT/RT)	Rock Plating Detail No.	Riprap Class*	Rock Plating SY
-L-	2.5:1	14+75	1.5:1	16+20	LT	1	*	220
-L-	2.5:1	15+75	1.5:1	16+38	RT	1	*	90
-L-	1.5:1	18+70	2.5:1	23+75	LT	1	*	650
							TOTAL	960

*Use class 1, 2, or B riprap if riprap class is not shown for rock plating location.

II. Subgrade Stability

A. Undercut for Subgrade Stability

Include 200 cubic yards of Undercut Excavation in the contract as a contingency item to be used at the discretion of the Engineer.

B. Special Ditches

Due to seasonal high ground water and poor drainage conditions, a special ditch is recommended at the following location:

Line	Station (±)	Location
-L-	10+50 to 14+50	Left

The bottom of the ditch should be at least 6.0 feet below the subgrade or as deep as outfall will allow.

The preceding recommendations do not consider the relevant outfall and only list areas where Special Ditches are required to address high groundwater. It is recommended to have a Hydraulic Engineer evaluate ditches for outfall.

Subsurface Drains may be used in lieu of Special Ditches in areas where Right of Way is a concern.

C. Subsurface Drainage - Subsurface Drain

Recommend 400 linear feet of 6" Perforated Subdrain Pipe for subsurface drain (Roadway Standard Drawing 815.02) be included in the contract as a contingency item to be used at the discretion of the Engineer.

D. Geotextile for Soil Stabilization

Recommend 200 square yards of Geotextile for Soil Stabilization be included in the contract as a contingency item to be used in Section II A.

III. Borrow Specifications

A. Borrow Criteria

Common borrow for embankment construction to subgrade shall meet Coastal Plain specifications outlined in the Standard Specifications, Article 1018-2(B).

B. Select Granular Material

Recommend 550 cubic yards of Select Granular Material be included in the contract for backfill as a contingency item for Section I. B. and II. A.

Select granular material for embankment/backfill for geotextile for soil stabilization if required, or backfill in water shall meet the criteria outlined in the Standard Specifications, Article 1016-3, Class II and/or III.

C. Shrinkage Factor

A shrinkage factor of 25 percent is recommended for calculation of earthwork on this project.

D. Borrow Reconnaissance and Availability

Sandy soils with good to excellent engineering properties are available in nearby areas.

IV. Miscellaneous

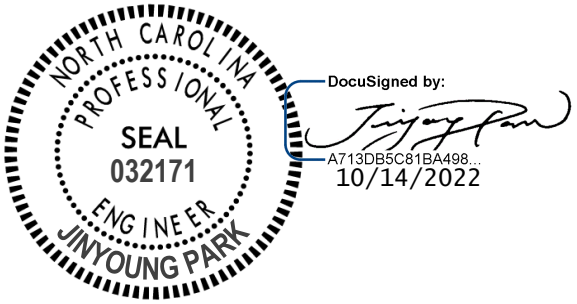
A. Reduction of Unclassified Excavation - Loss Due to Clearing and Grubbing

No significant loss of unclassified excavation is anticipated due to clearing and grubbing.

B. Reduction of Unsuitable Unclassified Excavation - Unsuitable Waste

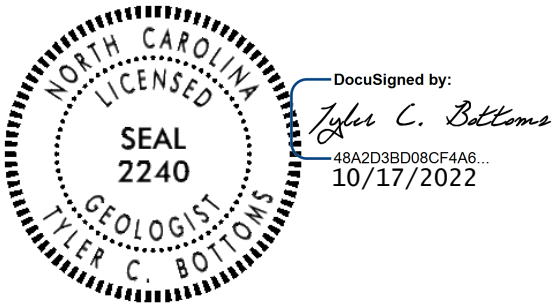
Based on the current roadway plans, unclassified excavation along this project will be primarily derived from shallow subgrade cuts and ditch excavation. These areas contain granular soils which are suitable for subgrade construction.

Prepared By:



Jinyoung Park, P.E.
Senior Geotechnical Engineer

Prepared By:



Tyler C. Bottoms, L.G.
Project Geological Engineer

See Page 5 for Summary of Quantities
See Pages 6-8 for Bore Logs
See Page 9 for Soil Test Results
See Page 10 for Plan View of Undercut
See Page 11 for Cross Section of Undercut

DTH/JRB/JYP/TCB

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
Summary of Quantities

WBS Number: 45587.1.1 County: DUPLIN Project Engineer: JINYOUNG PARK
TIP Number: B-5632 Field Office: GREENVILLE Project Geologist: TYLER BOTTOMS
Description: BRIDGE NO. 187 ON -L- (SR 1828) OVER BACK SWAMP (NINE MILE CREEK)

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
0036000000-E	Undercut Excavation	225 - Roadway Excavation	I. B	Contingency	N/A	N/A	100	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	I. B	-L-	15+98.00	16+65.00	250	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. A	Contingency	N/A	N/A	200	CY
						Total Quantity of Undercut Excavation =	**550**	**CY**
0195000000-E	Select Granular Material	265 - Select Granular Material	III. B	Contingency	N/A	N/A	550	CY
						Total Quantity of Select Granular Material =	**550**	**CY**
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. C	Contingency	N/A	N/A	100	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. D	Contingency	N/A	N/A	200	SY
						Total Quantity of Geotextile for Soil Stabilization =	**300**	**SY**
0223000000-E	Rock Plating	275 - Rock Plating	I. D	-L-	14+75.00	16+20.00	220	SY
0223000000-E	Rock Plating	275 - Rock Plating	I. D	-L-	15+75.00	16+38.00	90	SY
0223000000-E	Rock Plating	275 - Rock Plating	I. D	-L-	18+70.00	23+75.00	650	SY
						Total Quantity of Rock Plating =	**960**	**SY**
2044000000-E	6" Perforated Subdrain Pipe	815 - Subsurface Drainage	II. C	Contingency	N/A	N/A	400	LF
						Total Quantity of 6" Perforated Subdrain Pipe =	**400**	**LF**

These Items Only Impact Earthwork Totals								
N/A	Shrinkage Factor	235 - Embankments	III. C	N/A	N/A	N/A	25	%

LINE -L-	PROJECT B-5632 DATE 7/6/2022 COUNTY DUPLIN NOTES BY MILLER				EST.
STATION	DEPTH	SAMP	DESCRIPTION	MOI.	CLASS
15+00	0.0-1.0		LOOSE BROWN AND TAN SILTY SAND (ROADWAY EMBANKMENT)	M-S	A-2-4
30' RT	1.0-2.5		LOOSE TAN CLAYEY SAND WITH WOOD FRAGMENTS (ALLUVIAL)	S	A-2-6
	2.5-3.5		LOOSE BROWN AND TAN SILTY SAND WITH WOOD FRAGMENTS	S	A-2-4
24 hr: 0.5'	3.5-5.0		MEDIUM STIFF GRAY SANDY CLAY (UCP)	W	A-6
	5.0-6.0		LOOSE GRAY SILTY SAND	S	A-2-4
15+00	0.0-1.0		LOOSE BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
30' LT	1.0-6.0		LOOSE ORANGE, TAN, AND GRAY SILTY SAND (UCP)	S	A-2-4
24 hr: 0.4'					
14+50	0.0-2.0		LOOSE BROWN AND TAN SILTY SAND (ALLUVIAL)	M-S	A-2-4
34' LT	2.0-6.0		LOOSE GRAY AND TAN SILTY SAND (UCP)	S	A-2-4
24 hr: 0.5'					
13+00	0.0-3.0		LOOSE GRAY, TAN, AND ORANGE SILTY SAND (UCP)	M-S	A-2-4
17' LT	3.0-6.0		MEDIUM DENSE GRAY AND TAN SILTY SAND WITH WOOD FRAGMENTS	S	A-2-4
24 hr: 0.1'					
12+00	0.0-2.0		LOOSE GRAY AND TAN SILTY SAND (UCP)	M-S	A-2-4
40' RT	2.0-6.0		LOOSE GRAY SILTY SAND	S	A-2-4
24 hr: 1.9'					
12+00	0.0-2.0		LOOSE TAN AND BROWN SILTY SAND (UCP)	M-S	A-2-4
32' LT	2.0-3.0		MEDIUM DENSE GRAY AND ORANGE CLAYEY SAND (UCP)	S	A-2-6
	3.0-6.0		MEDIUM STIFF GRAY AND ORANGE SANDY CLAY	W	A-6
24 hr: 1.3'					
11+00	0.0-4.0		LOOSE GRAY, ORANGE, AND TAN SILTY SAND (UCP)	M-S	A-2-4
35' RT	4.0-6.0		MEDIUM STIFF GRAY AND ORANGE SANDY CLAY	W	A-6
24 hr: 2.9'					
11+00	0.0-2.0		LOOSE TAN AND BROWN SILTY SAND (ROADWAY EMBANKMENT)	M-S	A-2-4
13' RT	2.0-6.0	S-2	MEDIUM STIFF GRAY, ORANGE, AND TAN SANDY CLAY (UCP)	24%	A-6
24 hr: 1.3'					
11+00	0.0-2.0		LOOSE TAN AND BROWN SILTY SAND (UCP)	M-S	A-2-4
28' LT	2.0-6.0		MEDIUM STIFF GRAY, ORANGE, AND TAN SANDY CLAY	W	A-6
24 hr: 0.5'					

LINE -L-	PROJECT B-5632 DATE 7/6/2022 COUNTY DUPLIN NOTES BY MILLER				EST.
STATION	DEPTH	SAMP	DESCRIPTION	MOI.	CLASS
20+00	0.0-3.5		LOOSE TAN, BROWN, AND GRAY SILTY SAND WITH WOOD FRAGMENTS (ALLUVIAL)	M-S	A-2-4
27' LT	3.5-4.5		LOOSE GRAY CLAYEY SAND	S	A-2-6
	4.5-6.0		LOOSE GRAY AND TAN SILTY SAND	S	A-2-4
24 hr: 1.4'					
19+50	0.0-3.5		LOOSE TAN AND BROWN SILTY SAND (ROADWAY EMBANKMENT)	M	A-2-4
16' RT	3.5-6.0		LOOSE BROWN AND GRAY SILTY SAND WITH WOOD FRAGMENTS (ALLUVIAL)	M-S	A-2-4
24 hr: 4.6'					
19+50	0.0-4.0		LOOSE TAN, BROWN, AND GRAY SILTY SAND WITH WOOD FRAGMENTS (ALLUVIAL)	M-S	A-2-4
26' LT	4.0-5.0		LOOSE GRAY CLAYEY SAND	S	A-2-6
	5.0-7.5		SOFT GRAY SANDY CLAY	W	A-6
24 hr: 3.5'					
18+61	0.0-3.5		LOOSE TAN SILTY SAND (ARTIFICIAL FILL)	M	A-2-4
1' LT	3.5-7.5		LOOSE GRAY SILTY SAND (ALLUVIAL)	M-S	A-2-4
FIAD					
17+00	0.0-2.5	S-1	MEDIUM STIFF GRAY SANDY SILT (ROADWAY EMBANKMENT)	14%	A-4
50' RT	2.5-4.5		LOOSE BROWN AND GRAY SILTY SAND	M-S	A-2-4
	4.5-6.0		SOFT BROWN AND GRAY SANDY CLAY (ALLUVIAL)	W	A-6
24 hr: 4.0'					
16+41	0.0-2.0		LOOSE BROWN AND TAN SILTY SAND (ALLUVIAL)	M-S	A-2-4
30' RT	2.0-10.5		SOFT GRAY SILTY CLAY WITH WOOD FRAGMENTS	W	A-7-6
24 hr: 0.7'					
16+41	0.0-1.5	S-3	SOFT BROWN SANDY SILT WITH TRACE (4.1%) ORGANICS (ALLUVIAL)	M-W	A-4
30' LT	1.5-5.0		SOFT GRAY SANDY CLAY	W	A-6
	5.0-10.5		LOOSE GRAY SILTY SAND	S	A-2-4
24 hr: 0.1'					
16+00	0.0-2.0		LOOSE BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
30' RT	2.0-3.0		SOFT GRAY AND ORANGE SANDY CLAY (UCP)	W	A-6
	3.0-10.5		LOOSE GRAY SILTY SAND	M-S	A-2-4
24 hr: 0.1'					
16+00	0.0-2.0		LOOSE BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
30' LT	2.0-3.0		SOFT GRAY AND ORANGE SANDY CLAY (UCP)	W	A-6
	3.0-10.5		LOOSE GRAY SILTY SAND	S	A-2-4
24 hr: 0.1'					
15+50	0.0-1.0		LOOSE BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
28' LT	0.0-10.5		LOOSE GRAY SILTY SAND (UCP)	S	A-2-4
24 hr: 0.3'					

LINE -L-	PROJECT B-5632 DATE 7/6/2022 COUNTY DUPLIN NOTES BY MILLER				EST.
STATION	DEPTH	SAMP	DESCRIPTION	MOI.	CLASS
24+00	0.0-4.0		LOOSE BROWN AND TAN SILTY SAND (ROADWAY EMBANKMENT)	M-S	A-2-4
16' LT	4.0-6.0		LOOSE GRAY SILTY SAND (UCP)	S	A-2-4
24 hr: 2.7'					
23+50	0.0-6.0		LOOSE GRAY SILTY SAND (UCP)	M-S	A-2-4
29' LT					
24 hr: 0.1'					
23+00	0.0-6.0		LOOSE GRAY AND TAN SILTY SAND (UCP)	M-S	A-2-4
34' RT					
24 hr: 0.1'					
23+00	0.0-6.0		LOOSE GRAY SILTY SAND (UCP)	M-S	A-2-4
28' LT					
24 hr: 0.1'					
22+50	0.0-6.0		LOOSE GRAY AND TAN SILTY SAND (UCP)	M-S	A-2-4
27' LT					
24 hr: 0.1'					
22+00	0.0-1.5		LOOSE TAN AND BROWN SILTY SAND (ROADWAY EMBANKMENT)	M-S	A-2-4
28' RT	1.5-6.0		LOOSE GRAY SILTY SAND (UCP)	S	A-2-4
24 hr: 0.4'					
21+50	0.0-3.0		LOOSE TAN AND ORANGE SILTY SAND (ROADWAY EMBANKMENT)	M	A-2-4
11' LT	3.0-6.0		LOOSE BROWN AND GRAY SILTY SAND WITH WOOD FRAGMENTS (ALLUVIAL)	M-S	A-2-4
24 hr: 3.7'					
21+50	0.0-9.0		LOOSE GRAY AND BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
28' LT					
24 hr: 0.6'					
21+00	0.0-9.0		LOOSE TAN, GRAY, AND BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
27' LT					
24 hr: 3.2'					
20+50	0.0-9.0		LOOSE TAN, GRAY, AND BROWN SILTY SAND (ALLUVIAL)	M-S	A-2-4
27' LT					
24 hr: 1.8'					

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
SOILS LABORATORY

T. I. P. No. B-5632

REPORT ON SAMPLES OF SOILS FOR QUALITY, MOISTURE, ORGANIC

Project 45587.1.1 **County** DUPLIN **Owner**

Date: Sampled 7/1/22 **Received** 7/13/22 **Reported** 7/15/22

Sampled from ROADWAY **By** TC BOTTOMS

Submitted by J L PILIPCHUK 2012 **Standard Specifications**

816610 TO 816612
10/6/22

TEST RESULTS

Proj. Sample No.		S-1	S-2	S-3			
Lab. Sample No.		816610	816611	816612			
Retained #4 Sieve	%	-	-	-			
Passing #10 Sieve	%	100	100	100			
Passing #40 Sieve	%	99	99	99			
Passing #200 Sieve	%	36	73	45			

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	4.4	2.2	2.2			
Fine Sand Ret - #270	%	65.7	34.2	62.8			
Silt 0.05 - 0.005 mm	%	9.8	27.3	22.9			
Clay < 0.005 mm	%	20.1	36.3	12.1			
Passing #40 Sieve	%	-	-	-			
Passing #200 Sieve	%	-	-	-			

L. L.		22	38	25			
P. I.		5	22	3			
AASHTO Classification		A-4(0)	A-6(14)	A-4(0)			
Station		17+00	11+00	16+41			
Offset		50' RT	13' RT	30' LT			
Alignment		L	L	L			
Location							
Depth (Ft)		0.00	2.00	0.00			
	to	2.50	6.00	1.50			
% Moisture		13.5	24.3				
% Organic				4.3			

cc: TC BOTTOMS

Soils Engineer

PROJECT REFERENCE NO.	SHEET NO.
B-5632	10

SITE PLAN

0 10 20

FEET

NAD 83/2001

WOODS

16

17

15+98±, 33′± LT

16+28±, 33′± LT

BACK SWAMP

J S MIT

← TO SR 1827

BR. NO. 187

–L– SR 1828

TO SR 1816 →

WLB

16+35±, 33′± RT

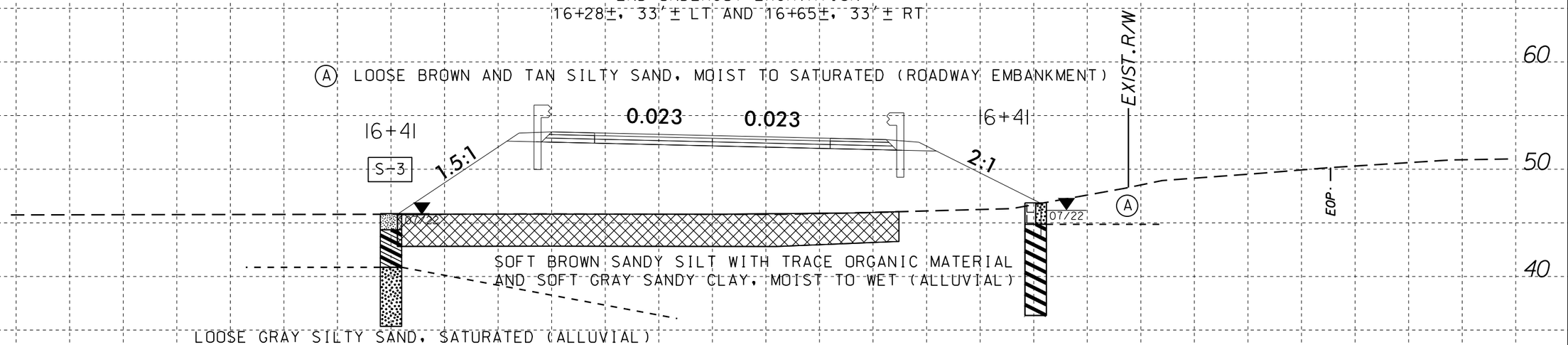
16+65±, 33′± RT

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-3	30' LT	16+41	0.0-1.5	A-4(0)	25	3	2.2	62.8	22.9	12.1	100	99	45	-	4.3

BEGIN BRIDGE 16+41.00

END UNDERCUT EXCAVATION
16+28±, 33'± LT AND 16+65±, 33'± RT



BEGIN UNDERCUT EXCAVATION
15+98±, 33'± LT AND 16+35±, 33'± RT

UNDERCUT EXCAVATION

16+25

70 60 50 40 30 20 10 0 10 20 30 40 50 60 70

13-OCT-2022 14:10
S:\TRANSMITTEDPROJECTS\B5632_GEO_ROW\CADD_GEOTECH\Site&Sub\B5632_rdy.xpl_Undercut.dgn
$$$$USERNAME$$$$