PRELIMINARY GEOTECHNICAL SUBSURFACE DATA REPORT

US 176 REPLACEMENT BRIDGE OVER CANNONS CREEK

NEWBERRY COUNTY, SOUTH CAROLINA

PREPARED FOR

Mr. Trapp Harris, P.E.
Design-Build Section
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29201

PREPARED BY

F&ME Consultants, Inc.
3112 Devine Street
Columbia, South Carolina 29205

OCTOBER 12, 2015

SCDOT Project ID. P029279
F&ME Project No. G5500.07

F&ME CONSULTANTS

October 12, 2015

Mr. Trapp Harris, P.E.
Geotechnical Design Engineer
SCDOT Design-Build Section
955 Park Street
Columbia, South Carolina 29202

Re: Preliminary Geotechnical Subsurface Data Report
Emergency Design-Build
US 176 Replacement Bridge over Cannons Creek
Newberry County, South Carolina
SCDOT Project ID: P029279
F&ME Project No.: G5500.07

Dear Mr. Harris:

Submitted herein is the preliminary geotechnical subsurface data report for the above referenced project. Included is a general project description, a summary of the performed field investigation(s), and the results from the field investigation and laboratory testing.

Please notify us if there are any questions or if we may be of further assistance.

Sincerely,

F&ME CONSULTANTS

John F. Hamilton, PE
Geotechnical Design Manager

Attachments

JFH/jfh

3112 Devine Street Columbia, South Carolina 29205 P 803.254.4540 F 803.254.4542 www.fmecol.com

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1. INTRODUCTION

1.1 General

The bridge project is located on US 176 over Cannons Creek in Newberry County, South Carolina. A site location plan is presented in Section 1 of the Appendix. It is our understanding that the project will include the demolition/removal of existing bridge structure and the replacement with a new bridge on the existing horizontal alignment.

1.2 Scope

F&ME performed a preliminary geotechnical subsurface investigation and laboratory testing for the US 176 Replacement Bridge over Cannons Creek. The South Carolina Department of Transportation (SCDOT) request and scope for the geotechnical subsurface investigation and laboratory testing was issued on October 9, 2015.

The field investigation included two (2) soil test borings (STB) with rock coring. Laboratory testing was performed on rock core specimens collected from the test borings. All exploration methods and laboratory procedures were conducted in general accordance with the most recent American Association of State Highway and Transportation Officials (AASHTO), American Society of Testing and Materials (ASTM) Standards, and the 2010 SCDOT Geotechnical Design Manual (GDM). This report was prepared in general accordance with the 2010 SCDOT Geotechnical Design Manual (GDM), Version 1.1.

1.3 Site Description

In general, the site consists of an existing concrete slab bridge supported on square, concrete piles. The existing bridge length is approximately 180 feet. Due to heavy flooding, the existing bridge has washed away.

Cannon Creek generally runs east to west. The bridge approach embankments are relatively flat moving away from the bridge. The existing embankment heights are on the order of ten (10) feet. The surrounding terrain consists of thick vegetation and trees.

Photographs of the drilling equipment at the site are provided below.

Photo 1. Drill Rig at B-1

Photo 2. Drill Rig at B-2

2. SUBSURFACE INVESTIGATION

On October 11, 2015, two (2) soil test borings (designated as B-1 and B-2) were performed. Soil test boring B-1 was performed near the southern end of the existing bridge, and soil test boring B-2 was performed near the northern end of the existing bridge. The locations of the preliminary soil test borings are provided in Section 2 of the Appendix.

The soil test borings were advanced utilizing a CME 550X drill rig. Rotary wash drilling techniques were used to maintain a stable borehole. Standard Penetration Tests (SPTs) were continuously obtained in the top ten (10) feet of each test boring. Following the continuous sampling, SPT samples were obtained at regular, five (5) foot intervals throughout the remaining depths of the borings. SPT samples were performed in general accordance with ASTM D-1586 to determine the relative densities and consistencies of the subsurface soils and to collect subsurface soil samples.

All borings were advanced to auger refusals. The borings were then advanced into rock using NQ rock coring techniques and subsequently terminated. During SPT testing of the encountered soils, an automatic hammer system was used. The energy ratio for the CME 550 hammer is 86.5%.

The locations of the borings performed during the subsurface investigation are provided in the following table.

Table 1. Soil Testing Location Table							
Test Number	Test Hole Locale	Station	Offset from CL (ft)	Elevation (ft-MSL)	Depth (ft)	Northing	Easting
B-1	Bridge/Roadway	N/A	CL	295.2	46.5	890107.00	1869569.84
B-2	Bridge/Roadway	N/A	CL	295.2	66.5	890262.49	1869400.44

All of the collected soil samples performed for the subsurface investigation were examined and logged in the field by F&ME personnel, sealed in plastic bags, and transported to our laboratory for further examination and analyses. The soils were visually classified in the field based upon the Unified Soil Classification System.

Rock cores collected from the test borings were also transported to our laboratory for visual inspection and determinations of rock recovery ratios (REC), Rock Quality Designation (RQD) and unconfined compressive (UC) rock strength testing. Photos of the recovered rock core specimens are provided in Section 4 of the Appendix.

24-hour groundwater readings were collected at test boring B-2 location. Due to time limitations, 24-hour groundwater measurements could not be collected at test boring B-1 location. At test boring B-1 location, we collected groundwater readings immediately following completion of the boring.

We have provided a boring location plan in Section 2 of the Appendix displaying the locations of the borings.

3. LABORATORY TESTING PROGRAM

Select rock core specimens from the borings were tested in our laboratory to determine the unconfined compressive rock strength. The rock laboratory testing was conducted in general accordance with applicable ASTM standards.

The type and number of laboratory tests are summarized in the following table.

Table 2. Laboratory Test Program	
Type of Test	Number of Tests
Rock UC Strength	3

The summary of the rock core compressive strength testing is provided in the following table.

Table 3. Summary of Rock Core Compressive Strength Testing

Boring No.	Core Number	Depth[1] (ft)	Rock Type	Unit Weight (pcf)	REC (%)	RQD (%)	RMR	Compressive Strength (psi)
B-1	NQ-1	43.3-43.6	Granite	171.26	79	59	62	20,850
B-2	NQ-2	59.1-59.4	Gneiss	175.71	100	62	42	19,030
	NQ-3	63.7-64.1	Gneiss	175.79	96	96	59	15,910

[1]Depth referenced from top of boring

Data sheets presenting the results of the rock core compressive strength testing are provided in Section 5 of the Appendix.

APPENDIX

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SECTION 1

SITE LOCATION PLAN

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD / ROUTE NO.	SHEET NO.
3	SC	NEWBERRY	P029279	USC 196	

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REV. NO.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1			

TOPO. _____ DATE _____
DWG. JSH DATE 10/12/2015
R/W _____ DATE _____
GROUP ____ - ____

US 176 BRIDGE OVER CANNONS CREEK

SITE LOCATION PLAN

HRZ SCALE = NTS
VRT SCALE = NTS

FIGURE 1

APPENDIX

SECTION 2

BORING LOCATION PLAN

FED. RD. DIV. NO.	STATE	COUNTY	PROJECT ID	ROAD / ROUTE NO.	SHEET NO.
3	SC	NEWBERRY	P029279	US 176	

B-2

B-1

-N-

LEGEND

SOIL TEST
BORING LOCATION

REV. NO.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1			

TOPO. _____ DATE _____
DWG. JFH DATE 10.11.15
R/W _____ DATE _____
GROUP ___ - ___

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US 176 BRIDGE OVER CANNONS CREEK

BORING LOCATION PLAN

HRZ SCALE = NTS

VRT SCALE = NTS

APPENDIX

SECTION 3

BORING LOGS

SCDOT Soil Test Log

Project ID:	P029279			**County:**	Newberry	**Boring No.:**	B-1
Site Description:	US 176 Bridge Replacement over Cannons Creek					**Route:**	US 176
Eng./Geo.:	L. Harrelson	**Boring Location:**	N/A	**Offset:**	CL	**Alignment:**	Ex. CL
Elev.:	295.2 ft	**Latitude:**	34.2790343	**Longitude:**	-81.4318038	**Date Started:**	10/12/2015
Total Depth:	46.5 ft	**Soil Depth:**	42 ft	**Core Depth:**	4.5 ft	**Date Completed:**	10/12/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	86%
Core Size:	NQ	**Driller:**	Independence	**Groundwater:**	**TOB** 14.5 ft	**24HR**	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0	Asphalt								
	0.5	**ASPHALT**		0.0	SS-1		16	8	24	4th 6 Inches=7
		Loose to Medium Dense, Dry, Dark Yellowish Brown, Non-Plastic, Silty Fine to Medium SAND (SM/A-2-4), Munsell=10YR 5/3 & 7.5YR 4/6		2.0	SS-2	4	4	3	7	4th 6 Inches=4
290.2				4.0	SS-3	4	4	4	8	4th 6 Inches=4
		=> Moist		6.0	SS-4	2	3	5	8	4th 6 Inches=5
	8.0			8.0	SS-5	1	2	4	6	4th 6 Inches=6
285.2		Stiff, Moist, Red/Brown, Low Plasticity, Fine Sandy CLAY (CL/A-6), Munsell=2.5YR 3/6 & 2.5Y 4/4								
	12.0			13.5	SS-6	4	4	4	8	
280.2		Loose, Moist, Black, Non-Plastic, Silty Fine to Medium SAND (SM/A-2-46), Munsell=10YR 5/3 & 7.5YR 4/6								
	17.0			18.5	SS-7	WOH/12"		2	2	
275.2		Soft, Wet, Dark Gray, High Plasticity, Fine Sandy CLAY (CL/A-6), Munsell=5Y 4/1								
	22.0			23.5	SS-8	1	1	4	5	
270.2		Loose, Wet, Black, Moderate Plasticity, Clayey Fine SAND (SC/A-2-6), Munsell=GLEY 4/1								
	27.0			28.5	SS-9	5	8	16	24	
265.2		Medium Dense, Wet, White/Gray/Black, Non-Plastic, Fine to Coarse SAND (SP/A-3), Munsell=GLEY 6/1								
	34.0			33.5	SS-10	11	50/4.5"		100+	>>
260.2		Very Dense, Moist, Brown/White, Non-Plastic, Silty Fine to Medium SAND (SM/A-2-4), Munsell=5Y 4/1								

Continued Next Page

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Log

Project ID:	P029279			**County:**	Newberry	**Boring No.:**	B-1
Site Description:	US 176 Bridge Replacement over Cannons Creek					**Route:**	US 176
Eng./Geo.:	L. Harrelson	**Boring Location:**	N/A	**Offset:**	CL	**Alignment:**	Ex. CL
Elev.:	295.2 ft	**Latitude:**	34.2790343	**Longitude:**	-81.4318038	**Date Started:**	10/12/2015
Total Depth:	46.5 ft	**Soil Depth:**	42 ft	**Core Depth:**	4.5 ft	**Date Completed:**	10/12/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	86%
Core Size:	NQ	**Driller:**	Independence	**Groundwater:**	**TOB** 14.5 ft	**24HR**	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				38.5	SS-11	50/3"	100+	>>
255.2	42.0	**GRANITE**		42.0				
		Quartz, Feldspar, Biotite. Gray, Pink, and White. Few Very Close, Very Tight, Rough Joints. Joints Typically Dip 45 Degrees. Fresh, Very Strong Rock. UC Strength = 20,850 psi.			NQ-1			REC=79% RQD=59% RMR=62
250.2	46.5	Boring Terminated at 46.5 Feet						
245.2								
240.2								
235.2								
230.2								
225.2								

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT G5500.06 - US176 CANNONS CREEK.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 10/12/15

SCDOT Soil Test Log

Project ID:	P029279			**County:**	Newberry	**Boring No.:**	B-2
Site Description:	US 176 Bridge Replacement over Cannons Creek					**Route:**	US 176
Eng./Geo.:	L. Harrelson	**Boring Location:**	N/A	**Offset:**	CL	**Alignment:**	Ex. CL
Elev.:	295.2 ft	**Latitude:**	34.2794597	**Longitude:**	-81.4323667	**Date Started:**	10/11/2015
Total Depth:	66.5 ft	**Soil Depth:**	52 ft	**Core Depth:**	14.5 ft	**Date Completed:**	10/11/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	86%
Core Size:	NQ	**Driller:**	Independence	**Groundwater:**	**TOB**	**24HR**	14.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0	Asphalt							
	0.5	**ASPHALT**	0.0	SS-1	16	14	13	27	4th 6 Inches=10
		Loose to Medium Dense, Dry, Dark Yellowish Brown, Non-Plastic, Silty Fine SAND (SM/A-2-4), Munsell=10YR 6/4	2.0	SS-2	6	6	7	13	4th 6 Inches=7
290.2			4.0	SS-3	3	5	5	10	4th 6 Inches=5
	7.0	=> Moist	6.0	SS-4	5	5	4	9	4th 6 Inches=6
		Firm to Stiff, Moist, Yellowish Brown, Low Plasticity, Fine to Medium Sandy CLAY (CL/A-6), Munsell=2.5YR 3/6	8.0	SS-5	5	5	7	12	4th 6 Inches=7
285.2									
		=> Wet, Dark Grayish Brown, Munsell=10YR 4/2	13.5	SS-6	1	2	3	5	
280.2									
	17.0	Very Soft, Wet, Dark Gray, Moderate Plasticity, CLAY (CL/A-6), Munsell=10YR 4/1	18.5	SS-7	WOH/18"			WOH	
275.2									
	22.0	Very Loose to Loose, Wet, Gray/Brown, Non-Plastic, Fine to Medium SAND (SP/A-3), Munsell=GLEY 15/	23.5	SS-8	3	6	4	10	
270.2									
			28.5	SS-9	WOH/12"		4	4	
265.2									
			33.5	SS-10	1	1	1	2	
260.2									

Continued Next Page

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Log

Project ID:	P029279			**County:**	Newberry	**Boring No.:**	B-2
Site Description:	US 176 Bridge Replacement over Cannons Creek					**Route:**	US 176
Eng./Geo.:	L. Harrelson	**Boring Location:**	N/A	**Offset:**	CL	**Alignment:**	Ex. CL
Elev.:	295.2 ft	**Latitude:**	34.2794597	**Longitude:**	-81.4323667	**Date Started:**	10/11/2015
Total Depth:	66.5 ft	**Soil Depth:**	52 ft	**Core Depth:**	14.5 ft	**Date Completed:**	10/11/2015
Bore Hole Diameter (in):	6	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME 550	**Drill Method:**	RW/RC	**Hammer Type:**	Automatic	**Energy Ratio:**	86%
Core Size:	NQ	**Driller:**	Independence	**Groundwater:**	**TOB**	**24HR**	14.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		=> with Some Low Plasticity Clay		38.5						
255.2					SS-11	1	2	4	6	●
	42.0	Very Dense, Wet, Yellow/Gray, Non-Plastic, Silty Fine to Coarse SAND (SM/A-2-4), Munsell=2.5Y 7/8 & 2.5Y 2/1		43.5						
250.2					SS-12	8	42	42	84	●
				48.5						
					SS-13	25	48	50*2"	100+	>>●
245.2										
	52.0	**GNEISS**		52.0						
		Quartz, Feldspar, Biotite. Gray, Pink, and White. Numerous Very Close, Very Tight, Rough Joints. Joints Typically Dip 20-70 Degrees. Highly Weathered, Strong Rock.			NQ-1					REC=100% RQD=13% RMR=19
240.2		@56.5'=> Slightly Weathered to Fresh, Very Strong Rock		56.5						
		@59.1'=> UC Strength=19,030 psi			NQ-2					REC=100% RQD=62% RMR=42
235.2				61.5						
		@63.7'=> UC Strength=15,910 psi			NQ-3					REC=96% RQD=96% RMR=59
230.2										
	66.5	Boring Terminated at 66.5 Feet								
225.2										

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

APPENDIX

SECTION 4

ROCK CORE SPECIMEN PHOTOS

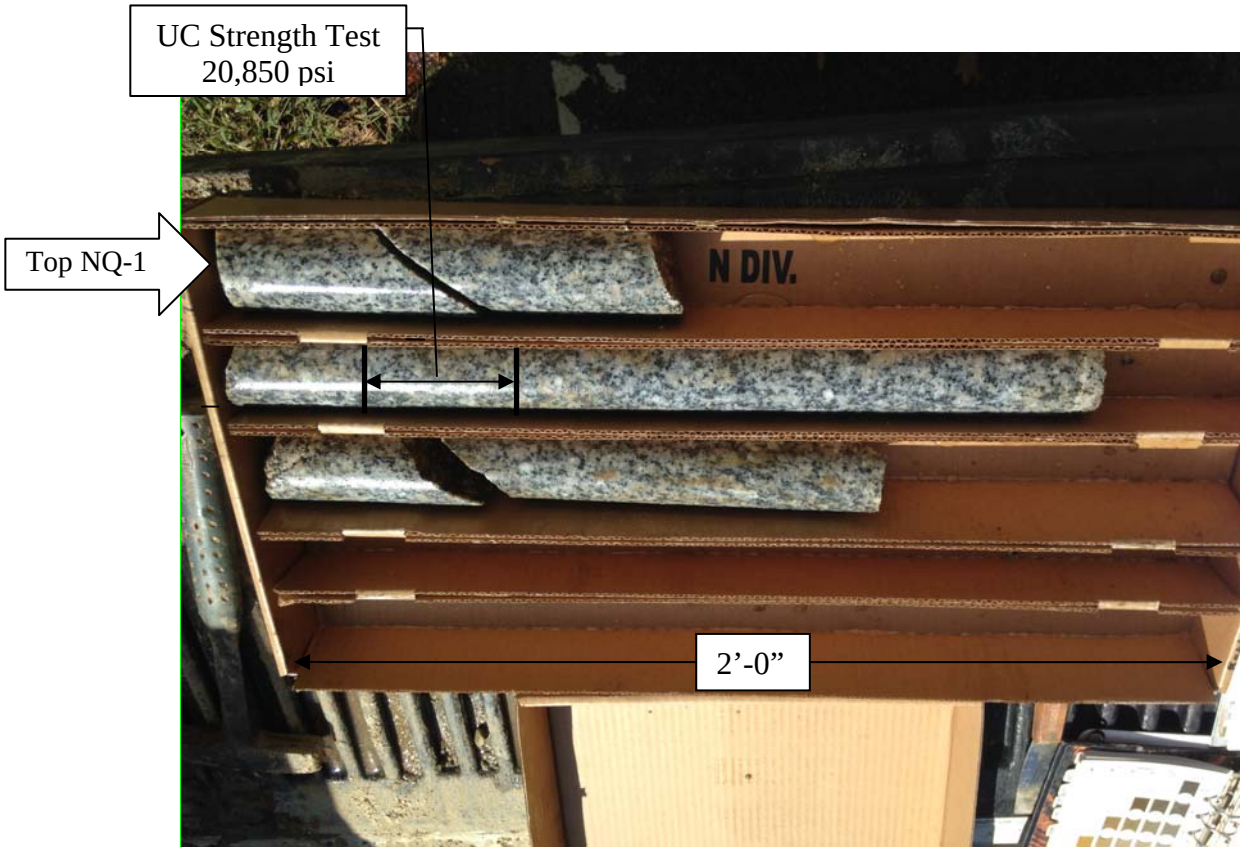

Photo 1. B-1 Rock Core Specimens NQ-1

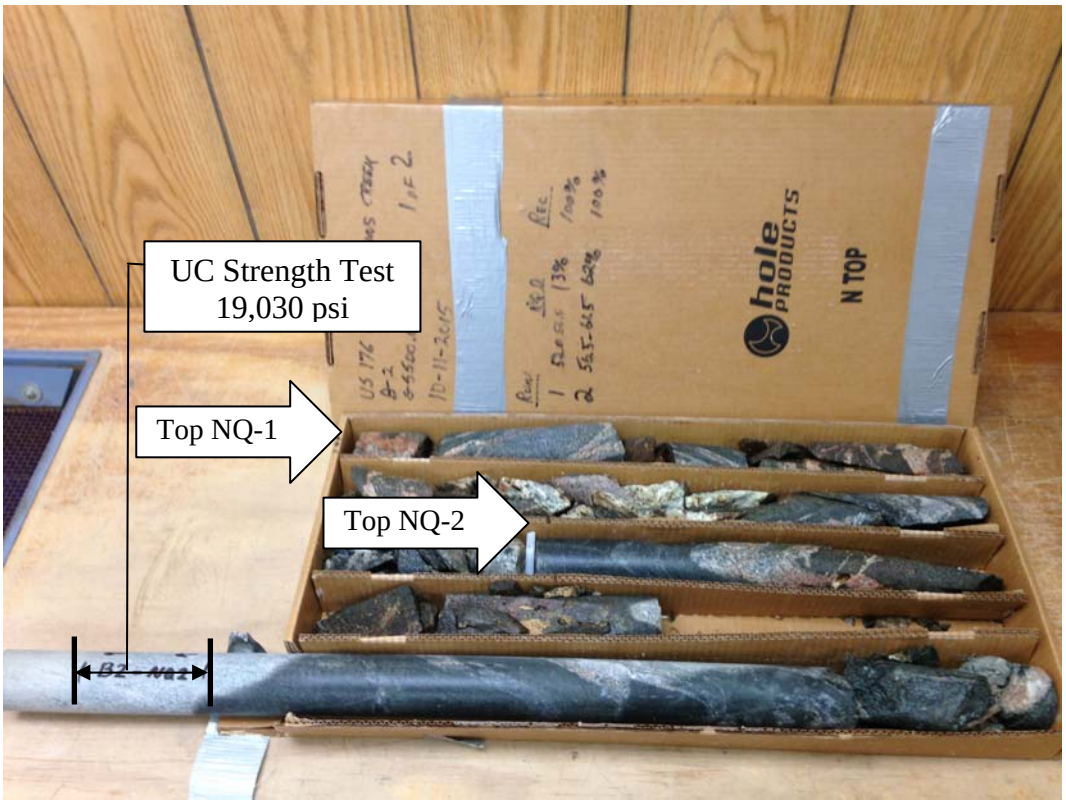

Photo 2. B-2 Rock Core Specimens NQ-1 & NQ-2

Photo 3. B-2 Rock Core Specimens NQ-3

APPENDIX

SECTION 5

LABORATORY TEST RESULTS

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3112 Devine Street
Columbia, South Carolina 29205
GEOTECHNICAL / ENVIRONMENTAL / MATERIALS

ROCK CORE COMPRESSION TEST

Project Name:	SC 176 RBO Cannon Creek	Project Number:	G 5500.07
Sampled By:	MT	Date Sampled:	10/12/2015
Tested By:	JH	Date Tested:	10/12/2015

Specimen Marking	B-1 15-1556					
Depth	NQ-1					
Length (in)	3.776					
Diameter (in)	1.979					
Mass (g)	522.04					
Cross Sectional Area (in^2)	3.076					
Load (lb)	64125					
Compressive Strength (psi)	20850					
Corrected Compressive Strength (psi)	20850					
Unit Weight (lb/ft^3)	171.26					

Signature: _____

Remarks: _____

F&ME

CONSULTANTS

3112 Devine Street
Columbia, South Carolina 29205
GEOTECHNICAL / ENVIRONMENTAL / MATERIALS

ROCK CORE COMPRESSION TEST

Project Name:	SC 176 RBO Cannon Creek	Project Number:	G 5500.07
Sampled By:	MT	Date Sampled:	10/11/2015
Tested By:	JH	Date Tested:	10/12/2015

Specimen Marking	B-2 15-1550A	B-2 15-1550B				
Depth	NQ-2	NQ-3				
Length (in)	3.885	3.911				
Diameter (in)	1.987	1.984				
Mass (g)	555.54	558.16				
Cross Sectional Area (in^2)	3.100	3.092				
Load (lb)	58995	49190				
Compressive Strength (psi)	19030	15910				
Corrected Compressive Strength (psi)	19030	15910				
Unit Weight (lb/ft^3)	175.71	175.79				

Signature: _____

Remarks: _____