

REFERENCE: SF-230259

PROJECT: 17BP.6.R.79

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-230259	1	9

**STATE OF NORTH CAROLINA**  
**DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**

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**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY COLUMBUS  
PROJECT DESCRIPTION BRIDGE NO. 259 ON SR 1836  
(BYRDVILLE-FREEMAN RD.) OVER MILLS CREEK

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE
5-8	BORE LOG(S)

PERSONNEL

M. ARNOLD  
S. DAVIS  
T. SHARPE

INVESTIGATED BY F&R, Inc.  
DRAWN BY T.T. WALKER  
CHECKED BY C. WANG  
SUBMITTED BY R. RIVENBARK  
DATE MAY 2017

**CAUTION NOTICE**


THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.



GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:

- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
- BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

SINCE *Prepared in the Office of:*  
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SIGNATURE \_\_\_\_\_ DATE 5/22/17  
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS  
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION																																																																								
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.																																																																								
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COLOR										DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																																																																								





**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT**

# SUBSURFACE INVESTIGATION

## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

### ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

### WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SL.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i>
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

### ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.

### FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

### BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

### INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

### TERMS AND DEFINITIONS

<b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
<b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.
<b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
<b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
<b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
<b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
<b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
<b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
<b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
<b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
<b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
<b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
<b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
<b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
<b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
<b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
<b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
<b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
<b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
<b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
<b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
<b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
<b>ROCK QUALITY DESIGNATION (RQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
<b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
<b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
<b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
<b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
<b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
<b>STRATA ROCK QUALITY DESIGNATION (SROD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
<b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

**BENCH MARK:** BL-101: N: 202310.8930, E: 2206781.4790, STA. -BL- II+38.76

**ELEVATION:** 38.99 FEET

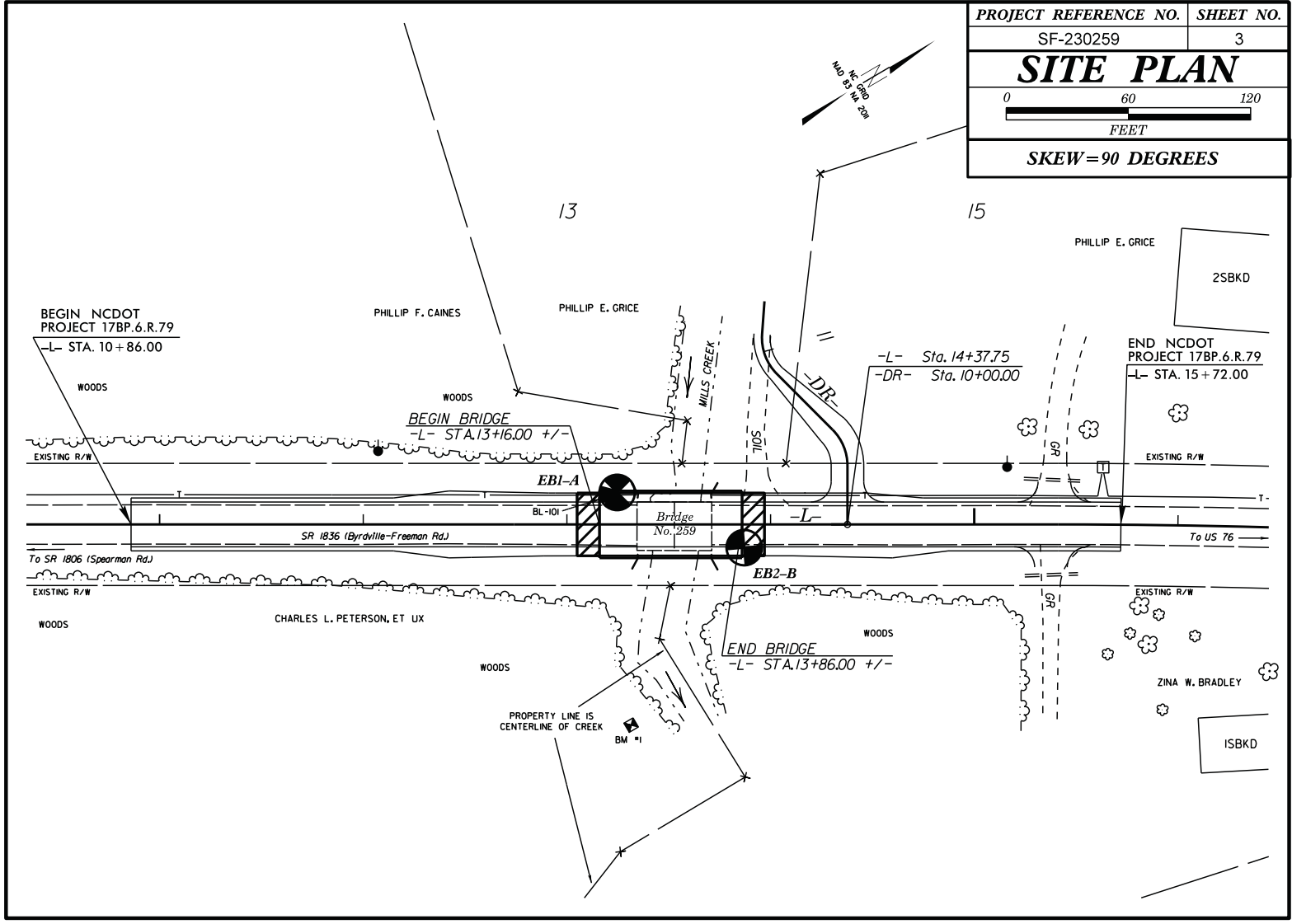
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NM = NOT MEASURED

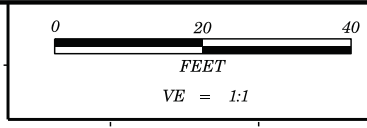
FIAD = FILLED IMMEDIATELY AFTER DRILLING



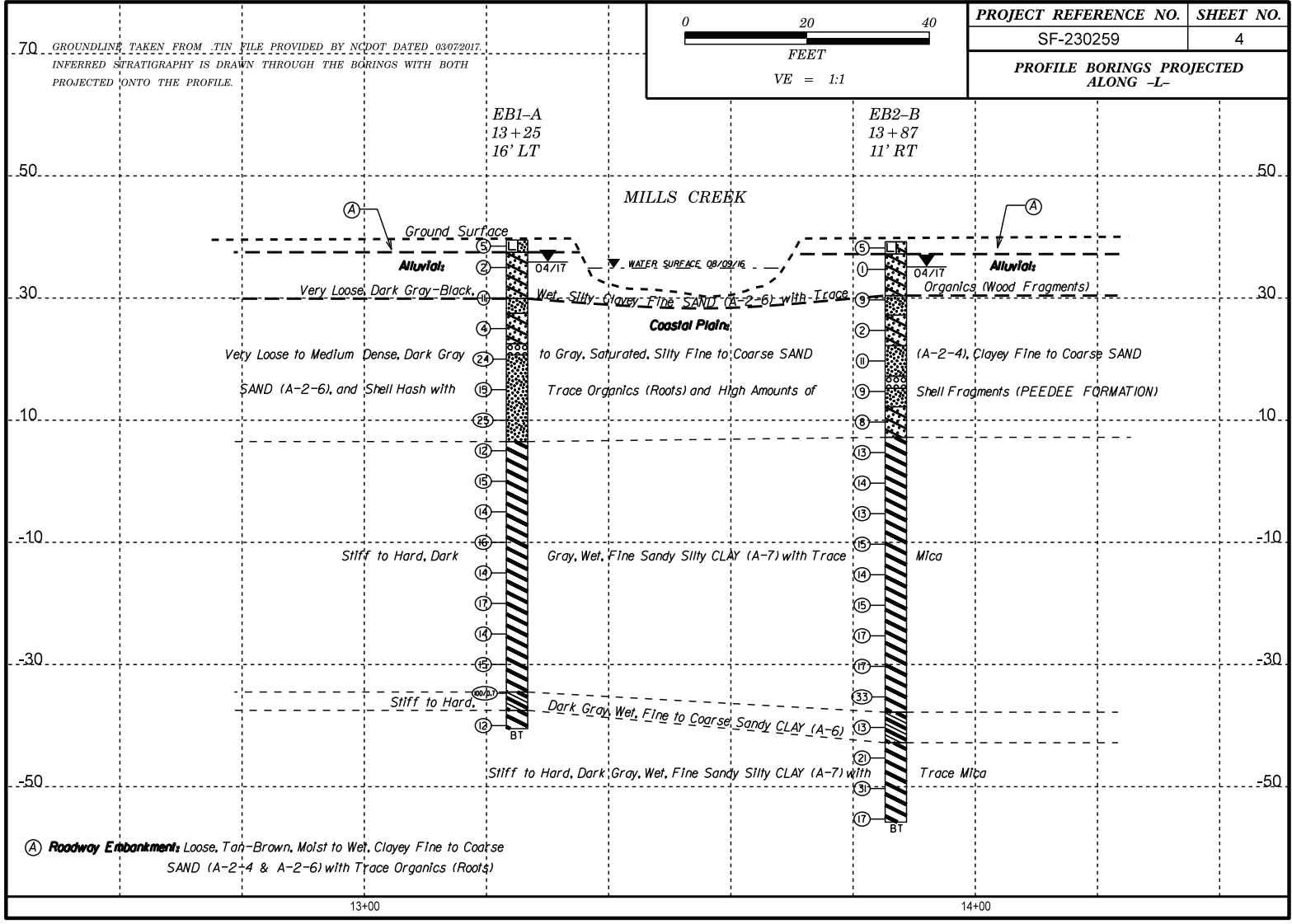
PROJECT REFERENCE NO.	SHEET NO.
SF-230259	3
<b>SITE PLAN</b>	
 FEET	
<b>SKEW=90 DEGREES</b>	



70 GROUNDLINE TAKEN FROM TIN FILE PROVIDED BY NCDOT DATED 03/07/2017.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE.



PROJECT REFERENCE NO.	SHEET NO.
SF-230259	4
PROFILE BORINGS PROJECTED ALONG -L-	



(A) Roadway Embankment: Loose, Tan-Brown, Moist to Wet, Clayey Fine to Coarse SAND (A-2-4 & A-2-6) with Trace Organics (Roots)

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.79	TIP SF-230259	COUNTY COLUMBUS	GEOLOGIST M. Arnold
SITE DESCRIPTION Bridge No. 259 on SR 1836 (Byrdville Freeman Rd.) over Mills Creek			GROUND WTR (ft)
BORING NO. EB1-A	STATION 13+25	OFFSET 16 ft LT	ALIGNMENT -L-
COLLAR ELEV. 39.5 ft	TOTAL DEPTH 80.0 ft	NORTHING 202,316	EASTING 2,206,783
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 04/04/17	COMP. DATE 04/04/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
50																
45																
40	39.5	0.0	1	2	3										39.5	GROUND SURFACE
35	36.0	3.5	2	1	1										37.5	ROADWAY EMBANKMENT Tan-Brown, Clayey Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)
30	31.0	8.5	1	3	8										29.9	ALLUVIAL Dark Gray-Black, Silty Clayey Fine SAND (A-2-6) with Trace Organics (Wood Fragments)
25	26.0	13.5	2	2	2										27.5	COASTAL PLAIN Dark Gray, Silty Fine SAND (A-2-4) with Trace Organics (Roots) (PEEDEE FORMATION)
20	21.0	18.5	8	13	11										22.5	Dark Gray, Clayey Fine to Coarse SAND (A-2-6) with High Amount of Shell Fragments
15	16.0	23.5	6	6	9										20.7	Shell Hash
10	11.0	28.5	9	11	14											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
5	6.0	33.5	4	5	7											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
0	1.0	38.5	4	7	8											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-5	-4.0	43.5	4	6	8											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-10	-9.0	48.5	5	6	10											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-15	-14.0	53.5	5	6	8											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-20	-19.0	58.5	5	8	9											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-25	-24.0	63.5	6	6	8											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments
-30	-29.0	68.5	5	7	8											Dark Gray, Silty Fine to Coarse SAND (A-2-4) with High Amount of Shell Fragments

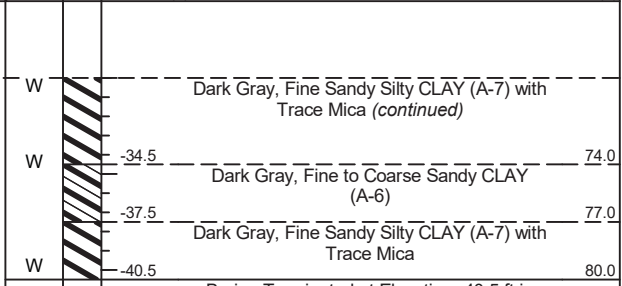
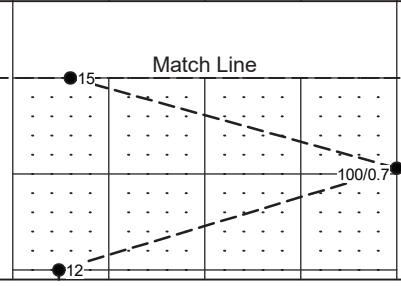
NCDOT BORE SINGLE SF230259 GEO\_BH\_BRD0259.GPJ NC\_DOT.GDT 5/22/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.79			TIP SF-230259			COUNTY COLUMBUS			GEOLOGIST M. Arnold							
SITE DESCRIPTION Bridge No. 259 on SR 1836 (Byrdville Freeman Rd.) over Mills Creek										GROUND WTR (ft)						
BORING NO. EB1-A			STATION 13+25			OFFSET 16 ft LT			ALIGNMENT -L-							
COLLAR ELEV. 39.5 ft			TOTAL DEPTH 80.0 ft			NORTHING 202,316			EASTING 2,206,783							
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER S. Davis			START DATE 04/04/17			COMP. DATE 04/04/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)	
-30																
-35	-34.0	73.5	46	54/0.2												
-40	-39.0	78.5	3	5	7											

NCDOT BORE SINGLE SF230259\_GEO\_BH\_BRDG259.GPJ NC\_DOT.GDT 5/22/17



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.79	TIP SF-230259	COUNTY COLUMBUS	GEOLOGIST M. Arnold
SITE DESCRIPTION Bridge No. 259 on SR 1836 (Byrdville Freeman Rd.) over Mills Creek			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+87	OFFSET 11 ft RT	ALIGNMENT -L-
COLLAR ELEV. 39.2 ft	TOTAL DEPTH 95.0 ft	NORTHING 202,356	EASTING 2,206,838
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 04/06/17	COMP. DATE 04/06/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100								
40																		
	39.2	0.0	1	2	3										39.2	GROUND SURFACE	0.0	
35	35.7	3.5	2	0	1										37.2	<b>ROADWAY EMBANKMENT</b> Tan-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)	2.0	
30	30.7	8.5	3	5	4													
25	25.7	13.5	2	1	1													
20	20.7	18.5	3	4	7													
15	15.7	23.5	5	5	4													
10	10.7	28.5	4	4	4													
5	5.7	33.5	5	5	8													
0	0.7	38.5	5	5	9													
-5	-4.3	43.5	5	6	7													
-10	-9.3	48.5	5	6	9													
-15	-14.3	53.5	5	6	8													
-20	-19.3	58.5	5	7	8													
-25	-24.3	63.5	5	8	9													
-30	-29.3	68.5	5	7	10													
-35	-34.3	73.5	6	8	25													
-40	-39.3	78.5																

NCDOT BORE SINGLE SF230259 GEO\_BH\_BRD0259.GPJ NC\_DOT.GDT 5/22/17



# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.79		<b>TIP</b> SF-230259		<b>COUNTY</b> COLUMBUS		<b>GEOLOGIST</b> M. Arnold	
<b>SITE DESCRIPTION</b> Bridge No. 259 on SR 1836 (Byrdville Freeman Rd.) over Mills Creek							<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-B		<b>STATION</b> 13+87		<b>OFFSET</b> 11 ft RT		<b>ALIGNMENT</b> -L-	<b>0 HR.</b> NM
<b>COLLAR ELEV.</b> 39.2 ft		<b>TOTAL DEPTH</b> 95.0 ft		<b>NORTHING</b> 202,356		<b>EASTING</b> 2,206,838	<b>24 HR.</b> 4.1
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R2175 CME-55 88% 02/11/2017				<b>DRILL METHOD</b> Mud Rotary		<b>HAMMER TYPE</b> Automatic	
<b>DRILLER</b> S. Davis		<b>START DATE</b> 04/06/17		<b>COMP. DATE</b> 04/06/17		<b>SURFACE WATER DEPTH</b> N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
-40						Match Line									
-45	-44.3	83.5	5	6	7	13						W		Dark Gray, Fine to Coarse Sandy CLAY (A-6) (continued)	82.0
-45			8	10	11	21						W		Dark Gray, Fine Sandy Silty CLAY (A-7) with Trace Mica	
-50	-49.3	88.5	8	12	19	31						W			
-55	-54.3	93.5	7	8	9	17						W		Boring Terminated at Elevation -55.8 ft in Clay (PEEDEE FORMATION)	95.0

NCDOT BORE SINGLE SF230259\_GEO\_BH\_BRDG259.GPJ NC\_DOT.GDT 5/22/17

REFERENCE: SF-230262

PROJECT: 17BP.6.R.72

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-230262	1	9

**STATE OF NORTH CAROLINA**  
**DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**

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**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY COLUMBUS  
PROJECT DESCRIPTION BRIDGE NO. 262 ON SR 1836  
(BYRDVILLE-FREEMAN RD.) OVER DANS CREEK

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE
5-8	BORE LOG(S)

PERSONNEL

M. ARNOLD

S. DAVIS

T. SHARPE

INVESTIGATED BY F&R, Inc.

DRAWN BY T.T. WALKER

CHECKED BY C. WANG

SUBMITTED BY R. RIVENBARK

DATE MAY 2017

**CAUTION NOTICE**


THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.


THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.


- NOTES:
- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
  - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

SINCE *Prepared in the Office of:*



**FROEHLING & ROBERTSON, INC.**  
*Engineering Stability Since 1881*  
310 Hubert Street  
Raleigh, North Carolina 27603-2302 | USA  
T 919.828.3441 | F 919.828.5751  
www.fandr.com




5/22/17  
SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS  
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION																																																											
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.																																																											
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.																																																											
MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										COMPRESSIONIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50																																																											
PERCENTAGE OF MATERIAL										GROUND WATER																																																											
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PLASTICITY										DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																																																											
<table border="1"> <thead> <tr> <th>NON PLASTIC</th> <th>SLIGHTLY PLASTIC</th> <th>MODERATELY PLASTIC</th> <th>HIGHLY PLASTIC</th> </tr> </thead> <tbody> <tr> <td>0-5</td> <td>6-15</td> <td>16-25</td> <td>26 OR MORE</td> </tr> </tbody> </table>										NON PLASTIC	SLIGHTLY PLASTIC	MODERATELY PLASTIC	HIGHLY PLASTIC	0-5	6-15	16-25	26 OR MORE	<table border="1"> <thead> <tr> <th>DRY STRENGTH</th> <th>VERY LOW</th> <th>SLIGHT</th> <th>MEDIUM</th> <th>HIGH</th> </tr> </thead> <tbody> <tr> <td>0-5</td> <td>6-15</td> <td>16-25</td> <td>26 OR MORE</td> <td></td> </tr> </tbody> </table>										DRY STRENGTH	VERY LOW	SLIGHT	MEDIUM	HIGH	0-5	6-15	16-25	26 OR MORE																																	
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
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT**

# SUBSURFACE INVESTIGATION

## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

### ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

### WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SL.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i>
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

### ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.

### FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

### BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

### INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

### TERMS AND DEFINITIONS

<b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
<b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.
<b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
<b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
<b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
<b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
<b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
<b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
<b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
<b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
<b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
<b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
<b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
<b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
<b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
<b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
<b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
<b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
<b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
<b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
<b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
<b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
<b>ROCK QUALITY DESIGNATION (RQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
<b>SAPROLITE (SAP)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
<b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
<b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
<b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
<b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
<b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
<b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

**BENCH MARK:** BL-101; N: 196787.4860, E: 2205768.6660, STA. -BL- 12+83.79

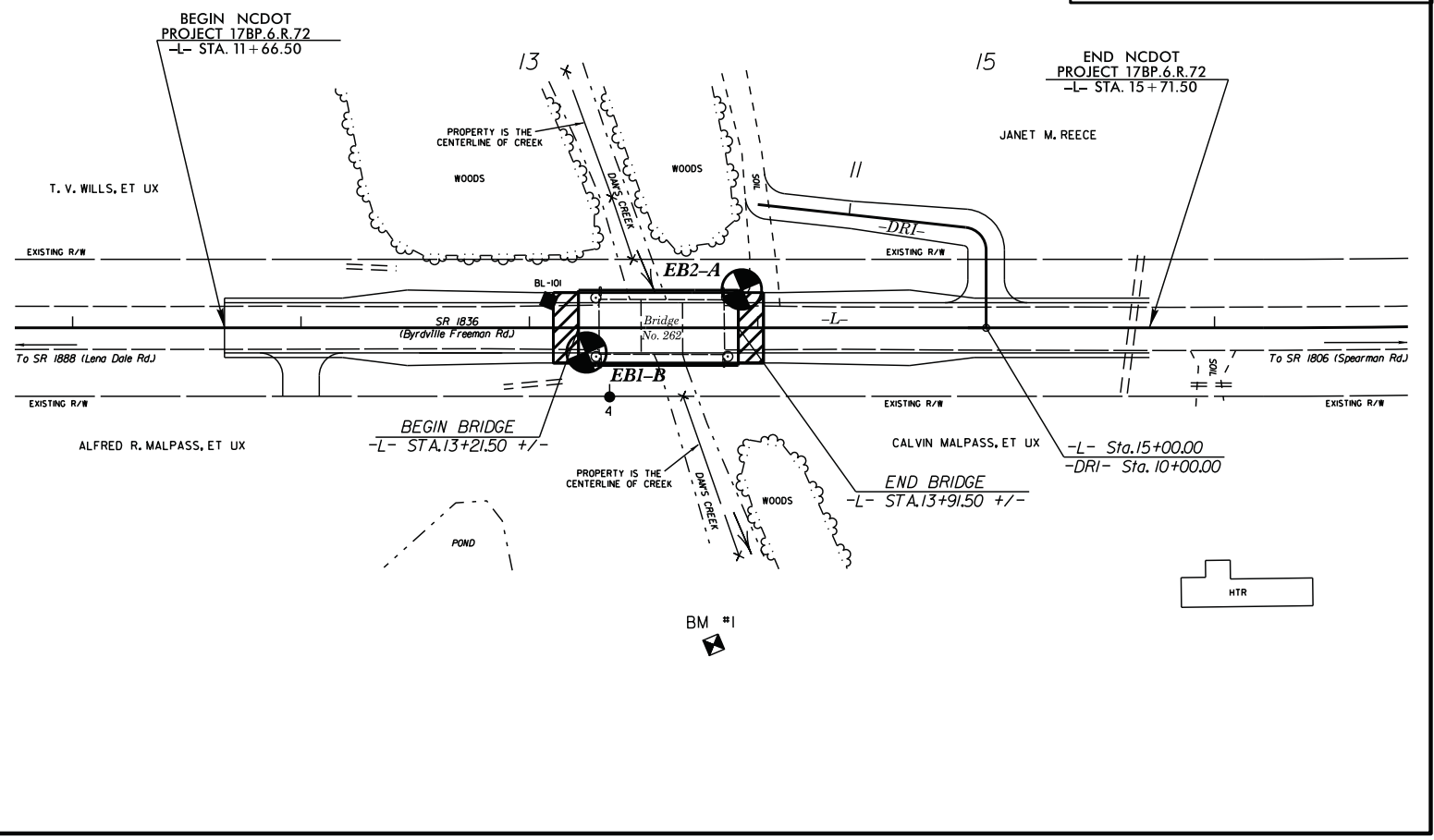
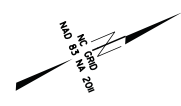
**ELEVATION: 36.88 FEET**

### NOTES:

NM = NOT MEASURED

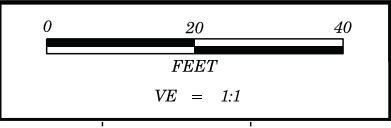
FIAD = FILLED IMMEDIATELY AFTER DRILLING

PROJECT REFERENCE NO.	SHEET NO.
SF-230262	3
<b>SITE PLAN</b>	
 0                      60                      120 FEET	
<b>SKEW=90 DEGREES</b>	





70 GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY NCDOT DATED 04/04/2017.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE.

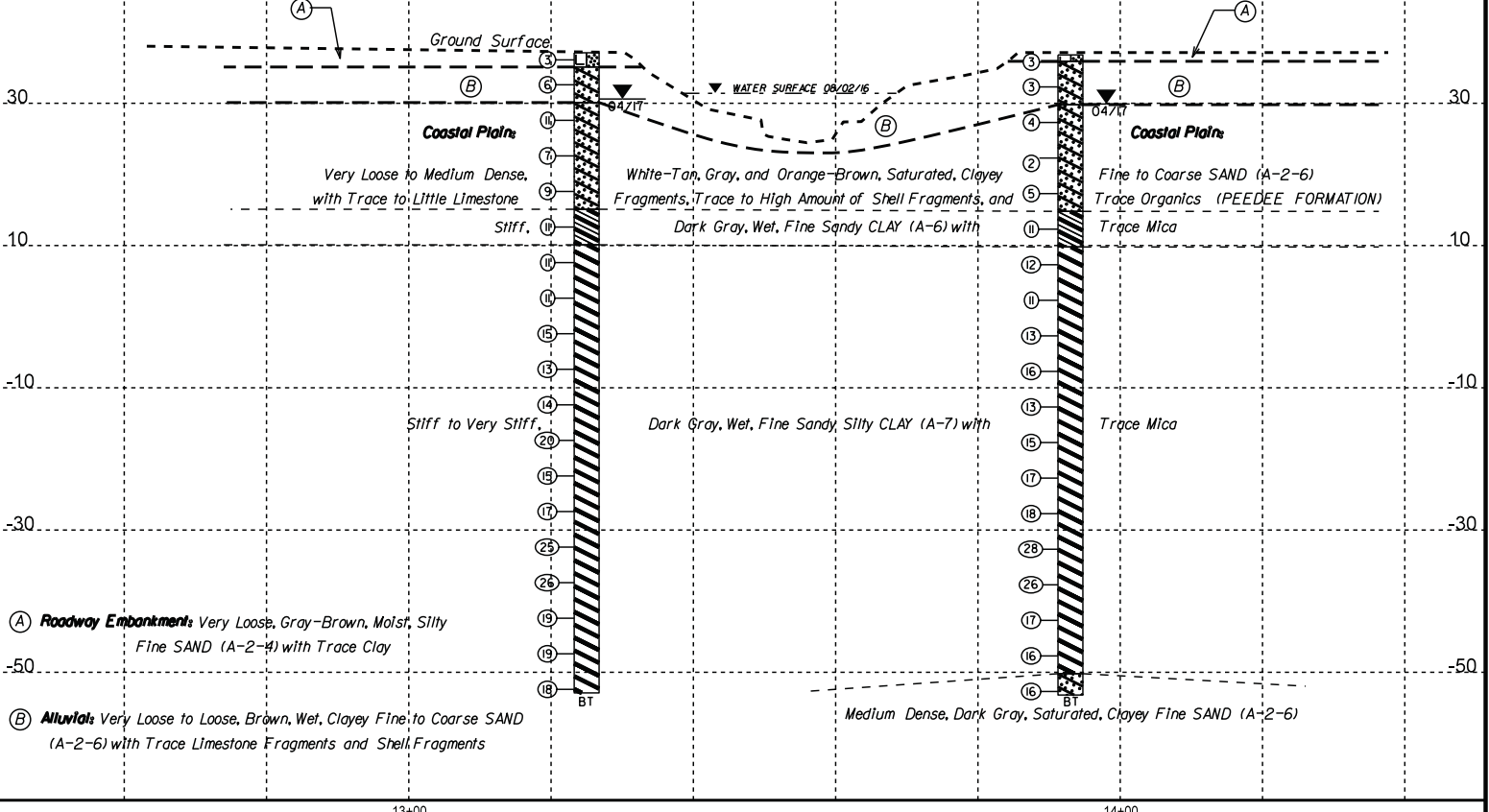


PROJECT REFERENCE NO.	SHEET NO.
SF-230262	4
PROFILE BORINGS PROJECTED ALONG -L-	

EB1-B  
 13+25  
 11' RT

EB2-A  
 13+93  
 17' LT

DANS CREEK



13+00

14+00

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.72	TIP SF-230262	COUNTY COLUMBUS	GEOLOGIST M. Arnold
SITE DESCRIPTION Bridge No. 262 on SR 1836 (Byrdville Freeman Rd.) over Dans Creek			GROUND WTR (ft)
BORING NO. EB1-B	STATION 13+25	OFFSET 11 ft RT	ALIGNMENT -L-
COLLAR ELEV. 37.1 ft	TOTAL DEPTH 90.0 ft	NORTHING 196,794	EASTING 2,205,796
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 04/04/17	COMP. DATE 04/04/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					ELEV. (ft)		
40																	
	37.1	0.0												37.1	GROUND SURFACE	0.0	
35			5	2	1	3						M		35.1	ROADWAY EMBANKMENT Gray-Brown, Silty Fine SAND (A-2-4) with Trace Clay	2.0	
	33.6	3.5	6	4	2	6						W			ALLUVIAL		
30														30.1	Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Limestone Fragments and Shell Fragments	7.0	
	28.6	8.5	5	6	5	11						Sat.			COASTAL PLAIN		
25															White-Tan and Gray, Clayey Fine to Coarse SAND (A-2-6) with Trace Limestone Fragments and High Amounts of Shell Fragments (PEEDEE FORMATION)		
	23.6	13.5	3	3	4	7						Sat.					
20																	
	18.6	18.5	8	6	3	9						Sat.					
15																	
	13.6	23.5	4	5	6	11						W		15.1	Dark Gray, Fine Sandy CLAY (A-6) with Trace Mica	22.0	
10																	
	8.6	28.5	4	5	6	11						W		10.1	Dark Gray, Fine Sandy Silty CLAY (A-7) with Trace Mica	27.0	
5																	
	3.6	33.5	3	5	6	11						W					
0																	
	-1.4	38.5	4	7	8	15						W					
-5																	
	-6.4	43.5	5	5	8	13						W					
-10																	
	-11.4	48.5	5	6	8	14						W					
-15																	
	-16.4	53.5	6	10	10	20						W					
-20																	
	-21.4	58.5	5	7	8	15						W					
-25																	
	-26.4	63.5	6	7	10	17						W					
-30																	
	-31.4	68.5	6	10	15	25						W					
-35																	
	-36.4	73.5	9	13	13	26						W					
-40																	

NCDOT BORE SINGLE SF230262\_GEO\_BH\_BRD262.GPJ NC\_DOT.GDT 5/22/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.72			TIP SF-230262			COUNTY COLUMBUS			GEOLOGIST M. Arnold							
SITE DESCRIPTION Bridge No. 262 on SR 1836 (Byrdville Freeman Rd.) over Dans Creek										GROUND WTR (ft)						
BORING NO. EB1-B			STATION 13+25			OFFSET 11 ft RT			ALIGNMENT -L-							
COLLAR ELEV. 37.1 ft			TOTAL DEPTH 90.0 ft			NORTHING 196,794			EASTING 2,205,796							
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER S. Davis			START DATE 04/04/17			COMP. DATE 04/04/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
-40						Match Line										
	-41.4	78.5	6	9	10								W		Dark Gray, Fine Sandy Silty CLAY (A-7) with Trace Mica (continued)	
	-46.4	83.5	7	8	11								W			
	-51.4	88.5	7	10	8								W		-52.9	
															Boring Terminated at Elevation -52.9 ft in Clay (PEEDEE FORMATION)	90.0

NCDOT BORE SINGLE\_SF230262\_GEO\_BH\_BRDG262.GPJ NC\_DOT.GDT 5/22/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.72		<b>TIP</b> SF-230262		<b>COUNTY</b> COLUMBUS		<b>GEOLOGIST</b> M. Arnold	
<b>SITE DESCRIPTION</b> Bridge No. 262 on SR 1836 (Byrdville Freeman Rd.) over Dans Creek							<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-A		<b>STATION</b> 13+93		<b>OFFSET</b> 17 ft LT		<b>ALIGNMENT</b> -L-	
<b>COLLAR ELEV.</b> 36.8 ft		<b>TOTAL DEPTH</b> 90.0 ft		<b>NORTHING</b> 196,867		<b>EASTING</b> 2,205,797	
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R2175 CME-55 88% 02/11/2017				<b>DRILL METHOD</b> Mud Rotary		<b>HAMMER TYPE</b> Automatic	
<b>DRILLER</b> S. Davis		<b>START DATE</b> 04/05/17		<b>COMP. DATE</b> 04/05/17		<b>SURFACE WATER DEPTH</b> N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
40																
	36.8	0.0														
35			1	1	2	3										
	33.3	3.5	2	2	1	3										
30																
	28.3	8.5	WOH	2	2	4										
25																
	23.3	13.5	2	1	1	2										
20																
	18.3	18.5	6	4	1	5										
15																
	13.3	23.5	5	5	6	11										
10																
	8.3	28.5	3	5	7	12										
5																
	3.3	33.5	4	5	6	11										
0																
	-1.7	38.5	5	5	8	13										
-5																
	-6.7	43.5	5	7	9	16										
-10																
	-11.7	48.5	5	5	8	13										
-15																
	-16.7	53.5	5	7	8	15										
-20																
	-21.7	58.5	6	7	10	17										
-25																
	-26.7	63.5	6	8	10	18										
-30																
	-31.7	68.5	8	11	17	28										
-35																
	-36.7	73.5	12	13	13	26										
-40																

NCDOT BORE SINGLE\_SF230262\_GEO\_BH\_BRDQ262.GPJ NC\_DOT.GDT 5/22/17

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.72			TIP SF-230262			COUNTY COLUMBUS			GEOLOGIST M. Arnold						
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DRILLER S. Davis			START DATE 04/05/17			COMP. DATE 04/05/17			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
-40						Match Line									
	-41.7	78.5	6	9	8	•						W	/	Dark Gray, Fine Sandy Silty CLAY (A-7) with Trace Mica (continued)	
-45												W	/		
	-46.7	83.5	6	7	9	•						W	/		
-50												Sat.	•	-50.2	87.0
	-51.7	88.5	6	7	9	•						Sat.	•	-53.2	90.0
														Boring Terminated at Elevation -53.2 ft in Sand (PEEDEE FORMATION)	