

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.6.R.101	1	14

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

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**ROADWAY**  
**SUBSURFACE INVESTIGATION**

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COUNTY ROBESON  
PROJECT DESCRIPTION BRIDGE NOS. 399 AND 400 ON  
SR 1740 (OLD STAGE ROAD) OVER BIG MARSH  
SWAMP

**REFERENCE:**

**PROJECT: 17BP.6.R.101**

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PERSONNEL

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SUBMITTED BY K. PLUMMER, LG  
DATE NOVEMBER 2018

**CAUTION NOTICE**

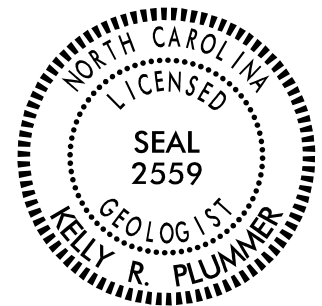
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DocuSigned by:  
Kelly Plummer 11/13/2018  
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SIGNATURE DATE

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
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**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									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A-2, A-4, A-5, A-6, A-7										MINERALOGICAL COMPOSITION									
SYMBOL										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
% PASSING #10, #40, #200										COMPRESSIBILITY									
MATERIAL PASSING #40 LL, PI										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
GROUP INDEX										PERCENTAGE OF MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
GEN. RATING AS SUBGRADE										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
CONSISTENCY OR DENSENESS										GROUND WATER									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )										WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING STATIC WATER LEVEL AFTER 24 HOURS PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA SPRING OR SEEP									
TEXTURE OR GRAIN SIZE										MISCELLANEOUS SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4, 10, 40, 60, 200, 270										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
BOULDER (BLDR.), COBBLE (COB.), GRAVEL (GR.), COARSE SAND (CSE. SD.), FINE SAND (F SD.), SILT (SL.), CLAY (CL.)										DIP & DIP DIRECTION OF ROCK STRUCTURES TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE									
GRAIN SIZE MM, IN.										RECOMMENDATION SYMBOLS									
SOIL MOISTURE - CORRELATION OF TERMS										UNDERCUT, UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE, UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL, SHALLOW UNDERCUT, UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										ABBREVIATIONS									
LL LIQUID LIMIT, PL PLASTIC LIMIT, OM OPTIMUM MOISTURE SHRINKAGE LIMIT										AR - AUGER REFUSAL, BT - BORING TERMINATED, CL - CLAY, CPT - CONE PENETRATION TEST, CSE. - COARSE, DMT - DILATOMETER TEST, DPT - DYNAMIC PENETRATION TEST, e - VOID RATIO, F - FINE, FOSS. - FOSSILIFEROUS, FRAC. - FRACTURED, FRACTURES, FRAGS. - FRAGMENTS, HI. - HIGHLY, MED. - MEDIUM, MICA - MICACEOUS, MOD. - MODERATELY, NP - NON PLASTIC, ORG. - ORGANIC, PMT - PRESSUREMETER TEST, SAP. - SAPROLITIC, SD. - SAND, SANDY, SL. - SILT, SILTY, SLI. - SLIGHTLY, TCR - TRICONE REFUSAL, w - MOISTURE CONTENT, v - VERY, VST - VANE SHEAR TEST, WEA. - WEATHERED, ? - UNIT WEIGHT, ? - DRY UNIT WEIGHT									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
NON PLASTIC, SLIGHTLY PLASTIC, MODERATELY PLASTIC, HIGHLY PLASTIC										DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, ADVANCING TOOLS: CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING w/ ADVANCER, TRICONE STEEL TEETH, TRICONE TUNG-CARB., CORE BIT, HAMMER TYPE: AUTOMATIC, MANUAL, CORE SIZE: B, H, N, HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST									
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  
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# SUBSURFACE INVESTIGATION

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

ROCK DESCRIPTION		TERMS AND DEFINITIONS
<p>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:</p>		<p><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 (ROD)</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.</p>
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 GROOVED 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 FINGERNAIL.
FRACTURE SPACING		BEDDING
TERM	SPACING	TERM
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED
WIDE	3 TO 10 FEET	THICKLY BEDDED
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED
		THINLY LAMINATED
		4 FEET
		1.5 - 4 FEET
		0.16 - 1.5 FEET
		0.03 - 0.16 FEET
		0.008 - 0.03 FEET
		< 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.
		BENCH MARK: BMI AT STA. 12+75 -BL-, 10.5 FT RT
		ELEVATION: 146.62 FEET
		<b>NOTES:</b>
		TIN FILES USED FOR GROUND SURFACE ELEVATIONS AT BORING LOCATIONS L-1945, L-2250, AND L-2600.
		DATE: 8-15-14



# STEWART

November 13, 2018

STATE PROJECT: 17BP.6.R.101  
 COUNTY: Robeson  
 DESCRIPTION: Bridge No. 399 and 400 on SR 1740 (Old Stage Rd) over Big Marsh Swamp  
 SUBJECT: Geotechnical Report – Inventory

## Project Description

This project consists of the construction of two, new two-span bridges over Big Marsh Swamp along the existing two-lane Old Stage Road, just southwest of St. Pauls in Robeson County, NC. Roadway improvements will entail minor grade adjustments to the roadway, embankment/shoulders, and slopes/ditches along Old Stage Road. Cuts and fill will range up to 0.5 feet and 2 feet, respectively. The alignment(s) investigate include the following:

<u>Alignment</u>	<u>Begin Project Station</u>	<u>End Project Station</u>
-L-	19+25.00	26+25.00

The project is located in the Coastal Plain region of Eastern North Carolina. The project area is wooded swamp land. The right-of-way extends to 40 feet on both sides of (parallel to) the centerline

The geotechnical fieldwork was performed over a period of five days from October 8 to October 15, 2018. The drilling activities were conducted by Carolina Drilling based in Wilmington, North Carolina and overseen by Stewart. A truck-mounted CME-55 drill machine with an automatic hammer was used during the subsurface exploration. Seven Standard Penetration Test (SPT) borings were performed at the site with one boring being performed at each bent location and one additional boring performed between the two bridges. Split spoon soil samples were collected and visually classified in the field by a geotechnical engineer from Stewart. Additionally, two hand auger borings were also performed along the roadway. No laboratory testing was performed.

## Physiography & Geology

The project site is located in Robeson County, near the town of St. Pauls, North Carolina. The surrounding land is primarily wetlands. Geologically, the site is situated within the Coastal Plain geologic province of North Carolina. This area is characterized by interbedded layers of sands and clays of the Black Creek Formation.

## Soil Properties

Soils encountered at the site include roadway embankment, alluvial, and Coastal Plain soils.

The roadway embankment primarily consists of moist, very loose to loose silty sand (A-2-4). This material is associated with the construction of Old Stage Rd.

Alluvial soils related to Big Marsh Swamp were encountered at each boring location. The alluvium primarily consists of wet to saturated, very loose to medium dense, clayey sand (A-2-6) and silty sand (A-2-4) and, very soft sandy silt (A-5); however, some muck and wood were also encountered. The deeper alluvium contained zones of trace to moderate organics, as well as wood fragments.

The deeper, native Coastal Plain soil consists of wet to saturated, very loose to very dense silty sand (A-2-4) and clayey sand (A-2-6) and stiff to very stiff silty clay (A-7). These deposits are part of the Black Creek Formation.

### Groundwater

Groundwater was encountered in all borings performed along the proposed alignment. The depths at which groundwater was encountered ranged from approximately 4 to 5.9 feet below the existing grade (el. 139.9 to 140.3 feet). Artesian conditions were also encountered at both end bents of Bridge 399 with 24-hour water level depths of +1 foot (above existing grade) and 0.1 foot at End Bents Nos. 1 and 2, respectively. The corresponding elevations are 146.3 feet and 145.3 feet.

### Areas of Special Geotechnical Interest

Groundwater – Groundwater along the alignment was determined to be relatively shallow (4-5.9 feet).

Artesian Conditions – Since artesian conditions were encountered in the borings at Bridge 399, Similar conditions may be encountered during pile driving.

Organic-laden Soil – Soil with elevated organic content were encountered along the alignment; however, we do not anticipate them being problematic due to their depth below the existing/proposed grade.

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101			TIP B-5511			COUNTY ROBESON			GEOLOGIST K. Plummer						
SITE DESCRIPTION Bridge Nos. 399 and 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp									GROUND WTR (ft)						
BORING NO. L_1945			STATION 19+45			OFFSET 15 ft LT			ALIGNMENT -L-						
COLLAR ELEV. 144.0 ft			TOTAL DEPTH 5.5 ft			NORTHING 382,309			EASTING 2,004,008						
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Hand Auger			HAMMER TYPE N/A						
DRILLER N/A			START DATE 10/15/18			COMP. DATE 10/15/18			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)
145														144.0 GROUND SURFACE 0.0	
														143.0 ROADWAY EMBANKMENT 1.0	
140														139.5 Tan, Silty Sand with Trace Clay and Trace Organics 4.5	
														138.5 ALLUVIAL 5.5	
														Gray, Moderately Organic, Silty Sand with Some Clay	
														Boring Terminated at Elevation 138.5 ft In Moderately Organic Silty Sand	

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101	TIP B-5511	COUNTY ROBESON	GEOLOGIST K.Plummer
SITE DESCRIPTION Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp			GROUND WTR (ft)
BORING NO. EB1-B (BRDG0399)	STATION 20+73	OFFSET 14 ft RT	ALIGNMENT -L-
COLLAR ELEV. 145.3 ft	TOTAL DEPTH 85.2 ft	NORTHING 382,362	EASTING 2,004,127
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Anderson	START DATE 10/08/18	COMP. DATE 10/08/18	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)		
150																	
145	144.3	1.0	4	5	6										145.3	GROUND SURFACE	0.0
	141.6	3.7	2	1	1										142.3	ROADWAY EMBANKMENT Tan, Silty Sand	3.0
140	137.8	7.5	1	0	1										138.8	ALLUVIAL Brown, Silty Sand	6.5
	135.4	9.9	WOH	WOH	WOH										135.8	Dark Brown, Clayey Muck	9.5
135	131.6	13.7	4	2	5										132.3	Dark Brown, Moderately Organic, Clayey Sand	13.0
130	126.6	18.7	1	2	2											COASTAL PLAIN Dark Gray, Silty Sand [Black Creek Formation]	
125	121.6	23.7	2	4	5												
120	116.6	28.7	5	5	5												
115	111.6	33.7	2	4	6												
110	106.6	38.7	3	3	7												
105	101.6	43.7	6	9	11												
100	96.6	48.7	7	8	9												
95	91.6	53.7	10	15	18												
90	86.4	58.9	10	23	31												
85	81.6	63.7	11	14	19												
80	76.6	68.7	7	8	11												
75	71.6	73.7	9	14	15												

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101		TIP B-5511		COUNTY ROBESON		GEOLOGIST K.Plummer								
SITE DESCRIPTION Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)							
BORING NO. EB1-B (BRDG0399)		STATION 20+73		OFFSET 14 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 145.3 ft		TOTAL DEPTH 85.2 ft		NORTHING 382,362		EASTING 2,004,127								
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic								
DRILLER J. Anderson		START DATE 10/08/18		COMP. DATE 10/08/18		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				
70						Match Line								
65	66.6	78.7	8	12	16								Gray, Silty Sand with Trace Clay and Trace Organics [Black Creek Formation] (continued)	
	61.6	83.7	8	10	17									
														Boring Terminated at Elevation 60.1 ft in Silty Sand  Note: Artesian Ground Water Measured at Elevation 146.28 Feet 48 Hours after Drilling. Boring Sealed with Grout and Bentonite.

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18



# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.101		<b>TIP</b> B-5511		<b>COUNTY</b> ROBESON		<b>GEOLOGIST</b> K.Plummer	
<b>SITE DESCRIPTION</b> Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp							<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-B (BRDG0399)		<b>STATION</b> 21+82		<b>OFFSET</b> 14 ft RT		<b>ALIGNMENT</b> -L-	
<b>COLLAR ELEV.</b> 145.4 ft		<b>TOTAL DEPTH</b> 90.3 ft		<b>NORTHING</b> 382,427		<b>EASTING</b> 2,004,214	
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018				<b>DRILL METHOD</b> H.S. Augers		<b>HAMMER TYPE</b> Automatic	
<b>DRILLER</b> J. Anderson		<b>START DATE</b> 10/08/18		<b>COMP. DATE</b> 10/08/18		<b>SURFACE WATER DEPTH</b> 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						
150																
145	145.4	0.0	3	5	3									145.4	GROUND SURFACE	0.0
140	141.6	3.8	1	0	1										<b>ROADWAY EMBANKMENT</b> Tan and Dark Brown, Silty Sand	
135	138.6	6.8	WOH	WOH	1									139.4	<b>ALLUVIAL</b> Dark Brown, Clayey Muck With Wood Fragments	6.0
130	136.6	8.8	WOH	WOH	WOH											
125	131.6	13.8	1	4	4									131.1	<b>COASTAL PLAIN</b> Tan, Silty Sand [Black Creek Formation]	14.3
120	126.6	18.8	3	4	2											
115	121.6	23.8	2	6	7											
110	116.6	28.8	4	8	11											
105	111.6	33.8	4	5	9										With Trace Clay from 33.8 Feet to 58.0 Feet	
100	106.6	38.8	4	5	8											
95	101.6	43.8	5	8	9											
90	96.6	48.8	6	12	12											
85	91.6	53.8	4	6	10										With Trace Organics from 53.8 Feet to 66.0 Feet	
80	86.6	58.8	7	9	11										With Some Clay from 58.0 Feet to 63.0 Feet	
75	81.6	63.8	9	15	24											
70	76.6	68.8	10	12	13									79.4	Gray, Silty Clay [Black Creek Formation]	66.0
	71.6	73.8	4	12	12									73.4	Gray, Silty Sand with Trace Organics [Black Creek Formation]	72.0

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT BORE LOG

WBS 17BP.6.R.101		TIP B-5511		COUNTY ROBESON		GEOLOGIST K.Plummer												
SITE DESCRIPTION Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)											
BORING NO. EB2-B (BRDG0399)		STATION 21+82		OFFSET 14 ft RT		ALIGNMENT -L-												
COLLAR ELEV. 145.4 ft		TOTAL DEPTH 90.3 ft		NORTHING 382,427		EASTING 2,004,214												
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER J. Anderson		START DATE 10/08/18		COMP. DATE 10/08/18		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)		
70						Match Line												
65	66.6	78.8	10	12	14								Gray, Silty Sand with Trace Organics [Black Creek Formation] (continued)					
60	61.6	83.8	8	12	21												W	
	56.6	88.8	8	9	11												W	
														57.4	88.0			
														55.1	90.3			
Boring Terminated at Elevation 55.1 ft In Silty Sand																		
Note: Artesian Ground Water Measured at Elevation 145.27 Feet 24 Hours after Drilling. Boring Sealed with Grout and Bentonite.																		

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT BORE LOG

<b>WBS</b> 17BP.6.R.101			<b>TIP</b> B-5511			<b>COUNTY</b> ROBESON			<b>GEOLOGIST</b> K. Plummer							
<b>SITE DESCRIPTION</b> Bridge Nos. 399 and 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp										<b>GROUND WTR (ft)</b>						
<b>BORING NO.</b> L_2250			<b>STATION</b> 22+50			<b>OFFSET</b> 16 ft RT			<b>ALIGNMENT</b> -L-							
<b>COLLAR ELEV.</b> 145.0 ft			<b>TOTAL DEPTH</b> 11.2 ft			<b>NORTHING</b> 382,467			<b>EASTING</b> 2,004,272							
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018						<b>DRILL METHOD</b> H.S. Augers			<b>HAMMER TYPE</b> Automatic							
<b>DRILLER</b> J. Anderson			<b>START DATE</b> 10/12/18			<b>COMP. DATE</b> 10/12/18			<b>SURFACE WATER DEPTH</b> N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G MOI	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
145	145.0	0.0	1	3	3									145.0	0.0	GROUND SURFACE
140	140.6	4.4	1	0	0							M				<b>ROADWAY EMBANKMENT</b> Tan, Silty Sand
	137.5	7.5	1	1	1							Sat.				
135	135.3	9.7	2	1	2							Sat.		135.5	9.5	
												Sat.		134.3	10.7	
												Sat.		133.8	11.2	
																<b>ALLUVIAL</b> Brown, Sandy Muck Tan, Silty Sand with Some Roots and Trace Organics Boring Terminated at Elevation 133.8 ft In Silty Sand

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.101		<b>TIP</b> B-5511		<b>COUNTY</b> ROBESON		<b>GEOLOGIST</b> K. Plummer	
<b>SITE DESCRIPTION</b> Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp							<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB1-A (BRDG0400)		<b>STATION</b> 23+29		<b>OFFSET</b> 15 ft LT		<b>ALIGNMENT</b> -L-	
<b>COLLAR ELEV.</b> 145.8 ft		<b>TOTAL DEPTH</b> 85.3 ft		<b>NORTHING</b> 382,537		<b>EASTING</b> 2,004,315	
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018				<b>DRILL METHOD</b> H.S. Augers		<b>HAMMER TYPE</b> Automatic	
<b>DRILLER</b> J. Anderson		<b>START DATE</b> 10/09/18		<b>COMP. DATE</b> 10/09/18		<b>SURFACE WATER DEPTH</b> 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						
150																
145	145.8	0.0												145.8	GROUND SURFACE	0.0
			1	2	3										<b>ROADWAY EMBANKMENT</b> Tan, Silty Sand with Trace Clay	
140	142.0	3.8	1	1	1											
	139.1	6.7	WOH	WOH	1									139.8	<b>ALLUVIAL</b>	6.0
	137.0	8.8	WOH	WOH	1									137.3	Dark Brown, Sandy Muck	8.5
135															Dark Gray, Moderately Organic, Silty Sand	
	132.0	13.8	6	6	9									133.3	<b>COASTAL PLAIN</b>	12.5
130															Gray and Tan, Silty Sand With Trace Organics [Black Creek Formation]	
	127.0	18.8	2	2	3											
125																
	122.0	23.8	2	4	7											
120																
	117.0	28.8	1	1	2											
115																
	112.0	33.8	3	12	16											
110																
	107.0	38.8	2	6	8											
105																
	102.0	43.8	4	7	8											
100																
	97.0	48.8	4	9	17											
95																
	92.0	53.8	8	13	18											
90																
	87.0	58.8	8	15	19											
85																
	82.0	63.8	4	15	19											
80																
	77.0	68.8	6	7	11											
75																
	72.0	73.8	8	11	16											
70																

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT BORE LOG

<b>WBS</b> 17BP.6.R.101			<b>TIP</b> B-5511			<b>COUNTY</b> ROBESON				<b>GEOLOGIST</b> K. Plummer					
<b>SITE DESCRIPTION</b> Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp										<b>GROUND WTR (ft)</b>					
<b>BORING NO.</b> EB1-A (BRDG0400)			<b>STATION</b> 23+29			<b>OFFSET</b> 15 ft LT			<b>ALIGNMENT</b> -L-			0 HR. N/A			
<b>COLLAR ELEV.</b> 145.8 ft			<b>TOTAL DEPTH</b> 85.3 ft			<b>NORTHING</b> 382,537			<b>EASTING</b> 2,004,315			24 HR. 5.9			
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018						<b>DRILL METHOD</b> H.S. Augers			<b>HAMMER TYPE</b> Automatic						
<b>DRILLER</b> J. Anderson			<b>START DATE</b> 10/09/18			<b>COMP. DATE</b> 10/09/18			<b>SURFACE WATER DEPTH</b> N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)	
70						Match Line									
65	67.0	78.8	9	9	14						W		68.8	77.0	Gray, Silty Sand with Trace Organics [Black Creek Formation]
	62.0	83.8	5	8	15						W		60.5	85.3	Boring Terminated at Elevation 60.5 ft In Silty Sand

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101	TIP B-5511	COUNTY ROBESON	GEOLOGIST K. Plummer
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp			GROUND WTR (ft)
BORING NO. EB2-A (BRDG0400)	STATION 24+32	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 145.9 ft	TOTAL DEPTH 80.4 ft	NORTHING 382,598	EASTING 2,004,399
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Anderson	START DATE 10/09/18	COMP. DATE 10/09/18	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)	
150																
145	145.9	0.0	1	3	3									145.9	GROUND SURFACE	0.0
															<b>ROADWAY EMBANKMENT</b>	
															Tan, Silty Sand	
140	142.0	3.9	1	2	1											
	139.4	6.5	WOH												<b>ALLUVIAL</b>	
	137.0	8.9	3	5	7									139.9	Dark Brown, Sandy Muck	6.0
														138.9	Brown, Silty Sand, With Trace Organics	7.0
														137.4	Wood	8.5
135	132.0	13.9	7	5	4											
														132.4	<b>COASTAL PLAIN</b>	13.5
															Tan, Silty Sand	
															[Black Creek Formation]	
130	127.0	18.9	9	8	3											
														126.0	Tan, Silty Clay	19.9
															[Black Creek Formation]	
125	122.0	23.9	2	4	6									123.4	Tan, Silty Sand	22.5
															[Black Creek Formation]	
120	117.0	28.9	5	9	11											
115	112.0	33.9	13	30	32											
110	107.0	38.9	3	6	10											
														108.9	Gray, Silty Clay	37.0
															[Black Creek Formation]	
105	102.0	43.9	5	10	10									103.9	Gray, Silty Sand	42.0
															[Black Creek Formation]	
100	97.0	48.9	8	12	15											
95	92.0	53.9	11	12	16											
90	87.0	58.9	10	15	18											
85	82.0	63.9	8	16	18											
80	77.0	68.9	8	14	28											
75	72.0	73.9	8	12	15											

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101			TIP B-5511			COUNTY ROBESON			GEOLOGIST K. Plummer					
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp										GROUND WTR (ft)				
BORING NO. EB2-A (BRDG0400)			STATION 24+32			OFFSET 14 ft LT			ALIGNMENT -L-					
COLLAR ELEV. 145.9 ft			TOTAL DEPTH 80.4 ft			NORTHING 382,598			EASTING 2,004,399					
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic					
DRILLER J. Anderson			START DATE 10/09/18			COMP. DATE 10/09/18			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 ELEV. (ft) DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
70						Match Line								
	67.0	78.9	8	13	16								68.9	77.0
													Gray, Clayey Sand [Black Creek Formation]	
													65.5	80.4
												Boring Terminated at Elevation 65.5 ft In Clayey Sand		
												Note: Water Circulation Loss Observed from 36.0 Feet to 38.0 Feet.		

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101			TIP B-5511			COUNTY ROBESON			GEOLOGIST K. Plummer							
SITE DESCRIPTION Bridge Nos. 399 and 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp										GROUND WTR (ft)						
BORING NO. L_2600			STATION 26+00			OFFSET 25 ft RT			ALIGNMENT -L-		0 HR. 4.0					
COLLAR ELEV. 144.7 ft			TOTAL DEPTH 5.0 ft			NORTHING 382,666			EASTING 2,004,555		24 HR. FIAD					
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Hand Auger			HAMMER TYPE N/A							
DRILLER N/A			START DATE 10/15/18			COMP. DATE 10/15/18			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)	
145														144.7	GROUND SURFACE	0.0
														142.2	<b>ROADWAY EMBANKMENT</b> Tan, Silty Sand	2.5
140														139.7	<b>ALLUVIAL</b> Tan and Gray, Moderately Organic, Silty Sand with Some Clay	5.0
															Boring Terminated at Elevation 139.7 ft In Moderately Organic Silty Sand	

NCDOT BORE SINGLE 17BP.6.101\_RDWY.GPJ\_NC\_DOT.GDT 11/8/18



REFERENCE: SF-770399

PROJECT: 17BP.6.R.101

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY ROBESON  
PROJECT DESCRIPTION BRIDGE NO. 399 ON SR 1740  
(OLD STAGE RD.) OVER BIG MARSH SWAMP

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5,6,7	BORE LOGS
8	SITE PHOTOGRAPH

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-770399	1	8

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PERSONNEL

K. PLUMMER, LG

CAROLINA DRILLING

J. ANDERSON

S. ANDERSON

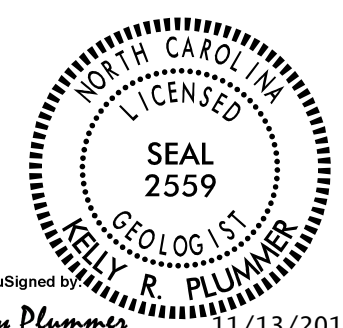
INVESTIGATED BY K. PLUMMER, LG

DRAWN BY K. PLUMMER

CHECKED BY D. BROWN, PE

SUBMITTED BY K. PLUMMER, LG

DATE NOVEMBER 2018



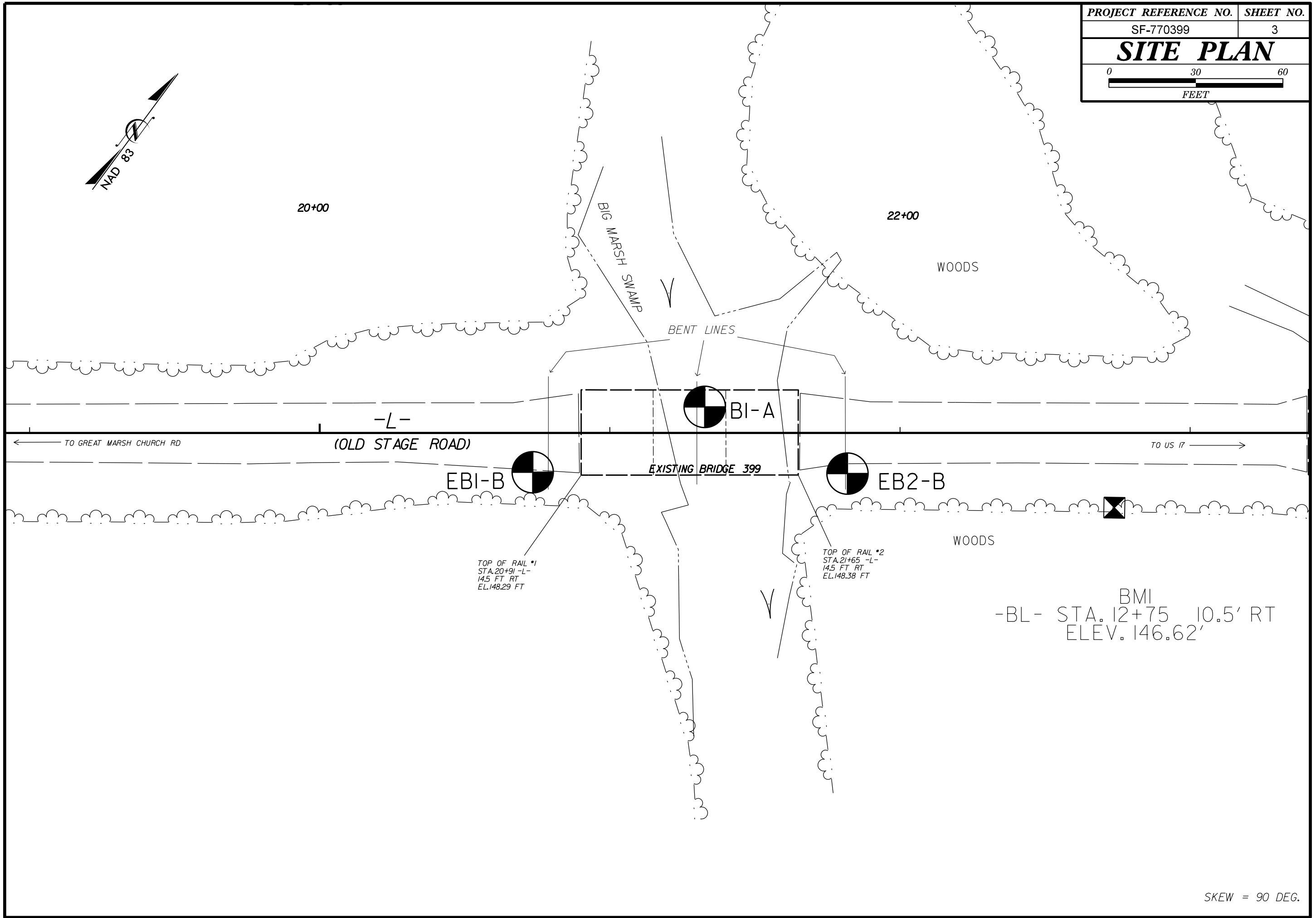
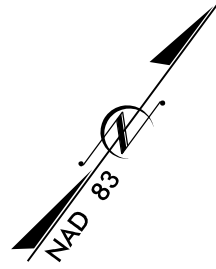
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Kelly Plummer 11/13/2018  
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SIGNATURE DATE

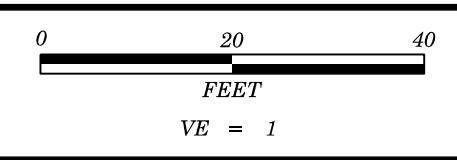
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UNLESS ALL SIGNATURES COMPLETED**



PROJECT REFERENCE NO.	SHEET NO.
SF-770399	3
<b>SITE PLAN</b>	
 0                      30                      60 FEET	



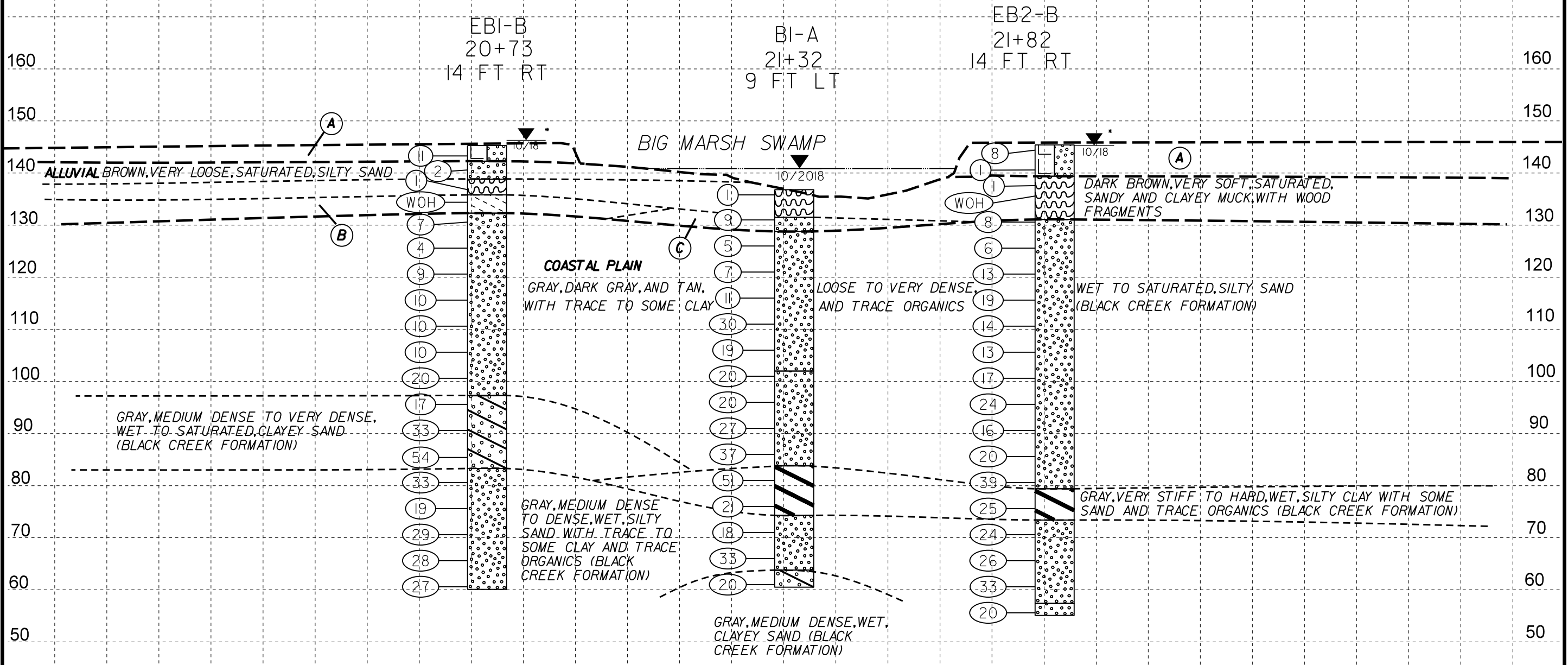
SKEW = 90 DEG.



<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
SF-770399	4
<b>PROFILE ALONG -L- CENTERLINE</b>	

- (A) ROADWAY EMBANKMENT TAN AND DARK BROWN, VERY LOOSE TO LOOSE, MOIST TO WET, SILTY SAND
- (B) ALLUVIAL DARK BROWN, VERY LOOSE, SATURATED, MODERATELY ORGANIC, CLAYEY SAND
- (C) ALLUVIAL TAN, LOOSE, SATURATED, SILTY SAND

\* APPROXIMATE ELEVATION OF ARTESIAN HEAD



NOTE: EXISTING GROUND SURFACE SHOWN WAS TAKEN FROM ELECTRONIC TIN FILE (DATED SEPTEMBER 2017). INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- PROFILE.

20+00

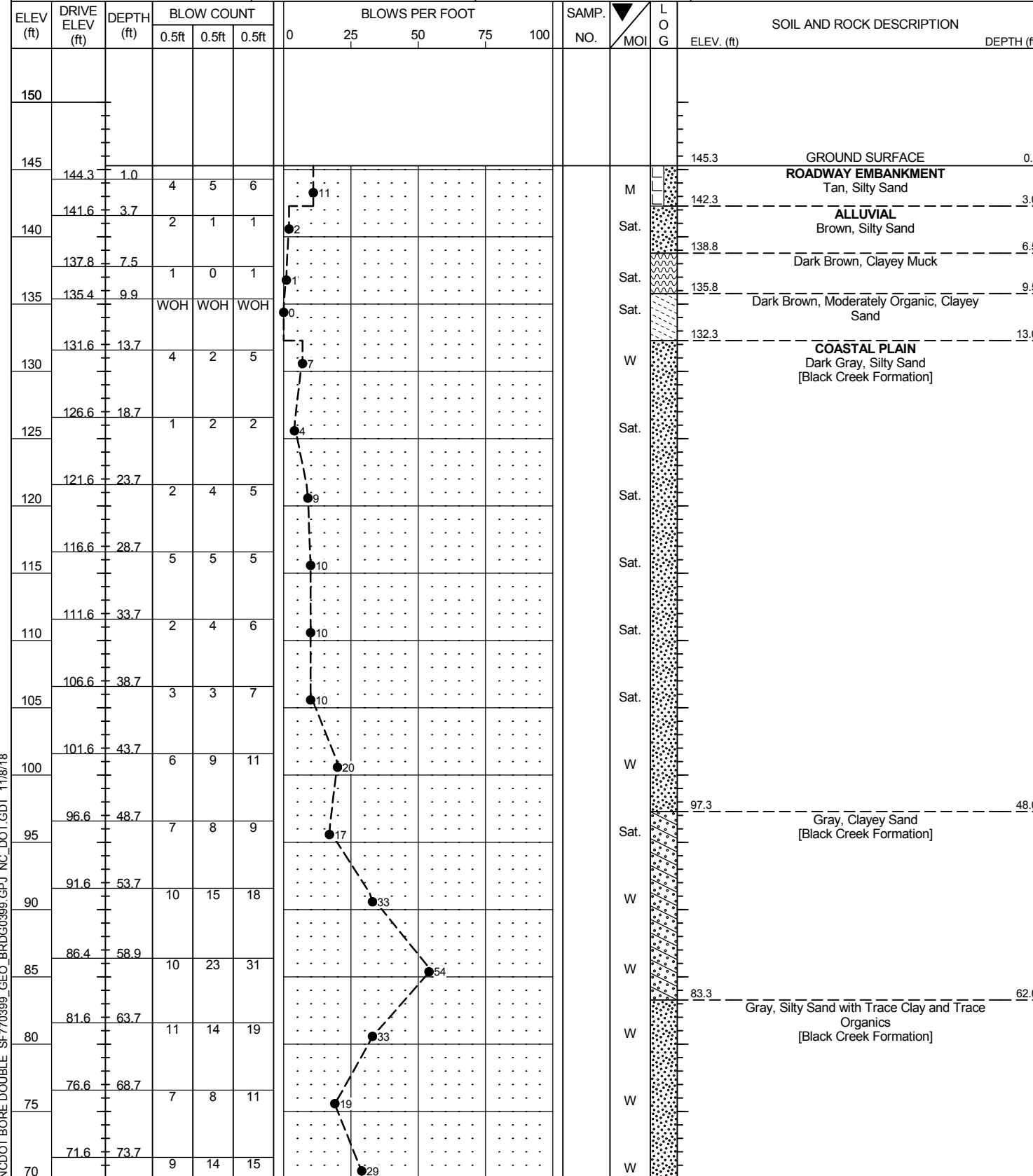
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22+00

# GEOTECHNICAL BORING REPORT

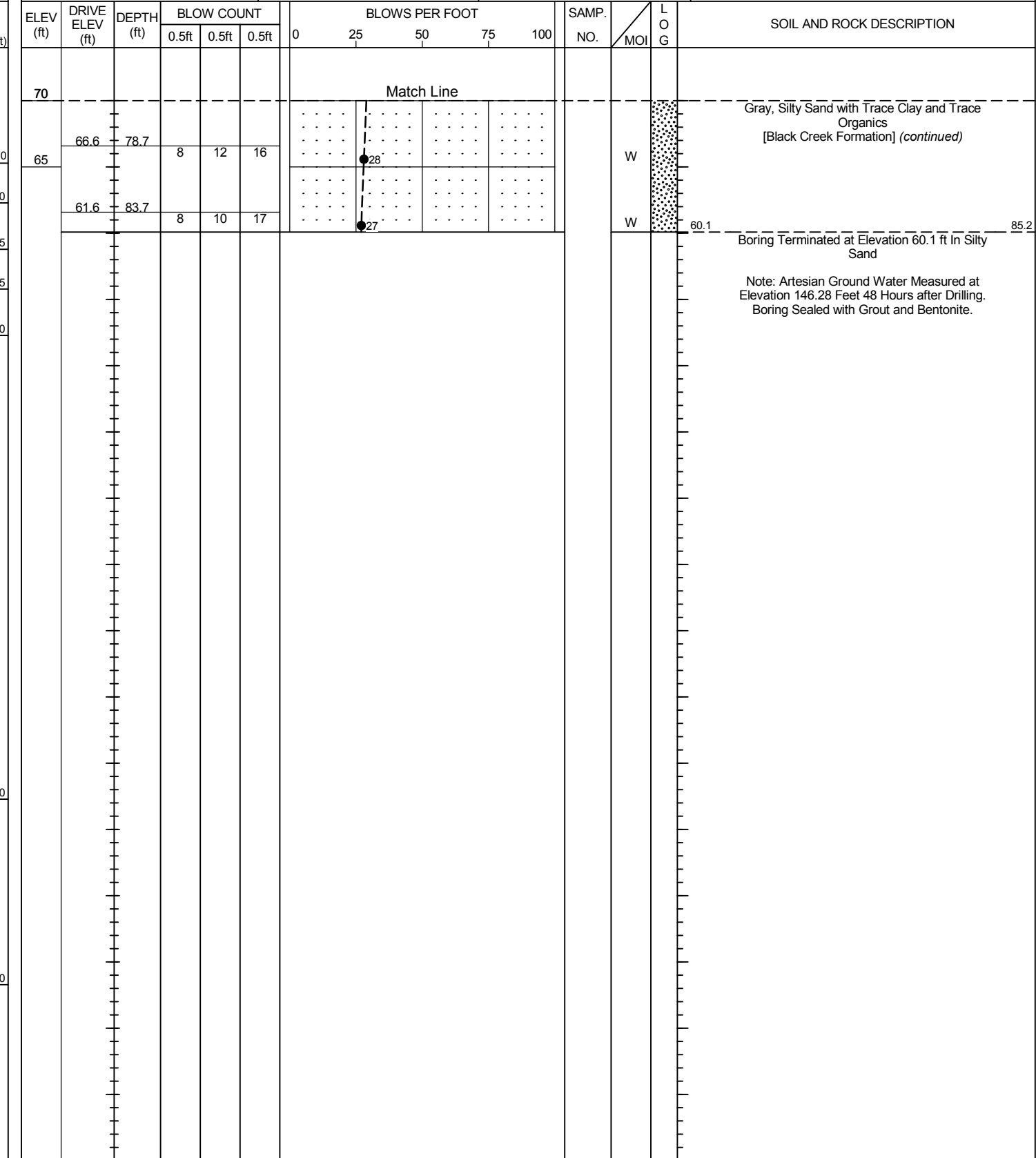
## BORE LOG

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770399	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K.Plummer
<b>SITE DESCRIPTION</b> Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB1-B	<b>STATION</b> 20+73	<b>OFFSET</b> 14 ft RT	<b>ALIGNMENT</b> -L-
<b>COLLAR ELEV.</b> 145.3 ft	<b>TOTAL DEPTH</b> 85.2 ft	<b>NORTHING</b> 382,362	<b>EASTING</b> 2,004,127
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018		<b>DRILL METHOD</b> H.S. Augers	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> J. Anderson	<b>START DATE</b> 10/08/18	<b>COMP. DATE</b> 10/08/18	<b>SURFACE WATER DEPTH</b> N/A



NCDOT BORE DOUBLE SF770399\_GEO\_BRDGO399.GPJ NC\_DOT.GDT 11/8/18

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770399	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K.Plummer
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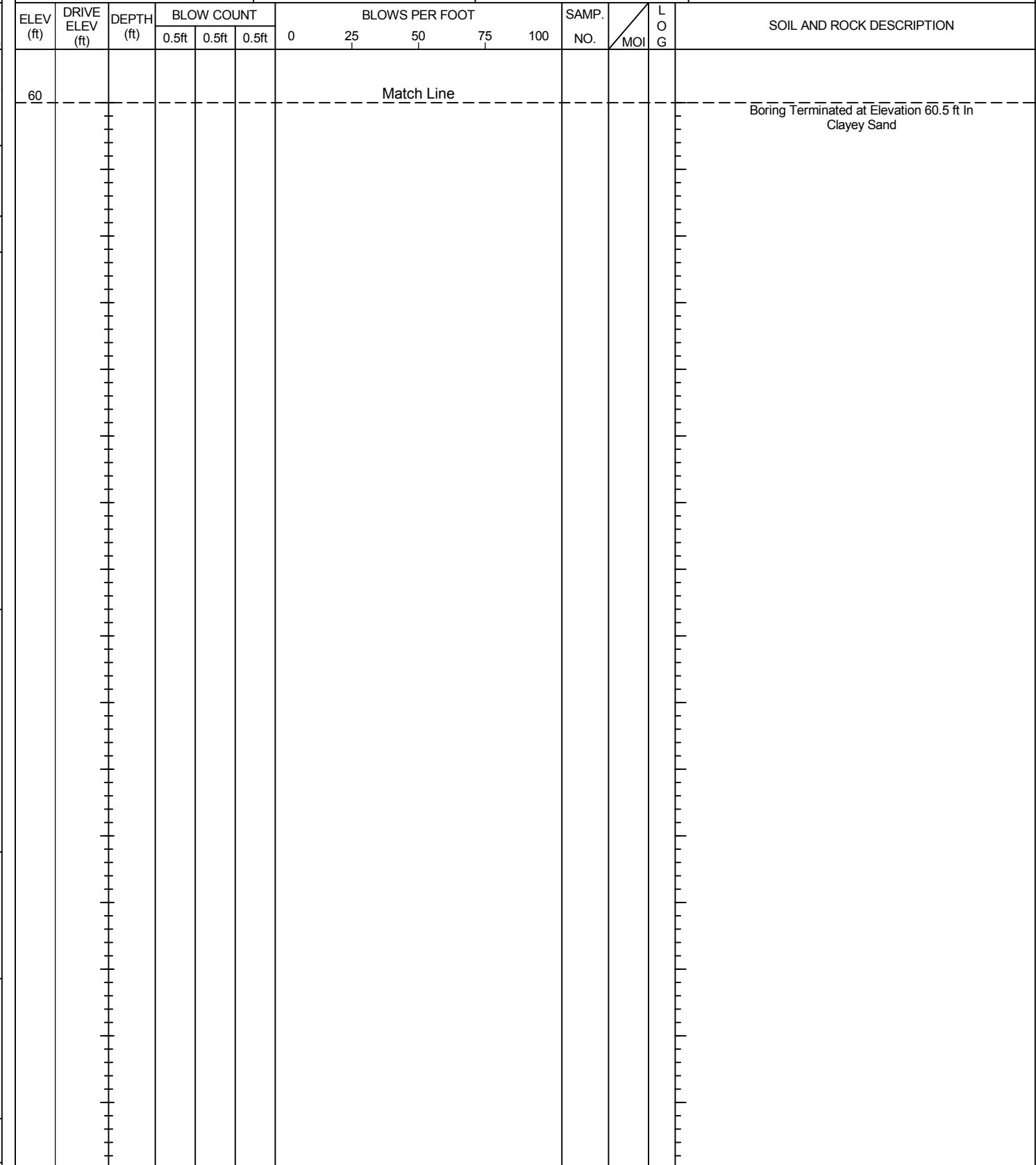
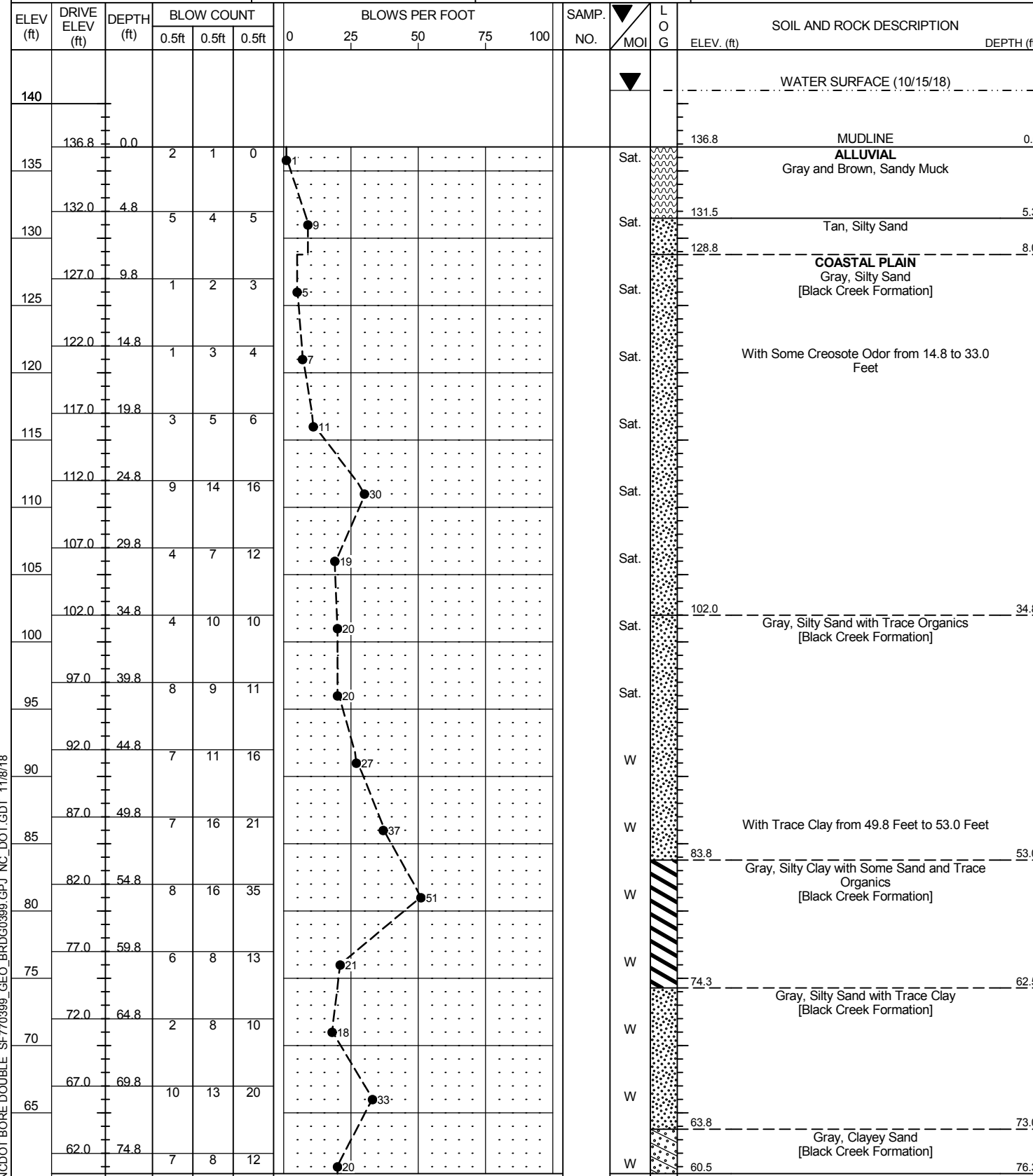


# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770399	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K.Plummer
<b>SITE DESCRIPTION</b> Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> B1-A	<b>STATION</b> 21+32	<b>OFFSET</b> 9 ft LT	<b>ALIGNMENT</b> -L-
<b>COLLAR ELEV.</b> 136.8 ft	<b>TOTAL DEPTH</b> 76.3 ft	<b>NORTHING</b> 382,416	<b>EASTING</b> 2,004,161
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018		<b>DRILL METHOD</b> H.S. Augers	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> J. Anderson	<b>START DATE</b> 10/15/18	<b>COMP. DATE</b> 10/15/18	<b>SURFACE WATER DEPTH</b> 4.2ft

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770399	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K.Plummer
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<b>DRILLER</b> J. Anderson	<b>START DATE</b> 10/15/18	<b>COMP. DATE</b> 10/15/18	<b>SURFACE WATER DEPTH</b> 4.2ft



NCDOT BORE DOUBLE SF770399\_GEO\_BRDG0399.GPJ NC\_DOT.GDT 11/8/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101		TIP SF-770399		COUNTY ROBESON		GEOLOGIST K.Plummer									
SITE DESCRIPTION Bridge No. 399 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 21+82		OFFSET 14 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 145.4 ft		TOTAL DEPTH 90.3 ft		NORTHING 382,427		EASTING 2,004,214									
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER J. Anderson		START DATE 10/08/18		COMP. DATE 10/08/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
150															
145	145.4	0.0	3	5	3								M	GROUND SURFACE	0.0
140	141.6	3.8	1	0	1								W	ROADWAY EMBANKMENT	
	138.6	6.8	WOH	WOH	1								Sat.	ALLUVIAL	6.0
135	136.6	8.8	WOH	WOH	WOH								Sat.	Dark Brown, Clayey Muck With Wood Fragments	
130	131.6	13.8	1	4	4								Sat.	COASTAL PLAIN	14.3
125	126.6	18.8	3	4	2								Sat.	Tan, Silty Sand [Black Creek Formation]	
120	121.6	23.8	2	6	7								Sat.		
115	116.6	28.8	4	8	11								Sat.		
110	111.6	33.8	4	5	9								Sat.	With Trace Clay from 33.8 Feet to 58.0 Feet	
105	106.6	38.8	4	5	8								Sat.		
100	101.6	43.8	5	8	9								Sat.		
95	96.6	48.8	6	12	12								Sat.		
90	91.6	53.8	4	6	10								W	With Trace Organics from 53.8 Feet to 66.0 Feet	
85	86.6	58.8	7	9	11								W	With Some Clay from 58.0 Feet to 63.0 Feet	
80	81.6	63.8	9	15	24								W		
75	76.6	68.8	10	12	13								W	Gray, Silty Clay [Black Creek Formation]	66.0
70	71.6	73.8	4	12	12								W	Gray, Silty Sand with Trace Organics [Black Creek Formation]	72.0

NCDOT BORE DOUBLE SF770399\_GEO\_BRDGO399.GPJ NC\_DOT.GDT 11/8/18

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DRILLER J. Anderson		START DATE 10/08/18		COMP. DATE 10/08/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
70															
65	66.6	78.8	10	12	14								W	Match Line	
60	61.6	83.8	8	12	21								W	Gray, Silty Sand with Trace Organics [Black Creek Formation] (continued)	
	56.6	88.8	8	9	11								W	Gray, Silty Sand with Trace Clay [Black Creek Formation]	88.0
														Boring Terminated at Elevation 55.1 ft In Silty Sand	90.3
														Note: Artesian Ground Water Measured at Elevation 145.27 Feet 24 Hours after Drilling. Boring Sealed with Grout and Bentonite.	

***SITE PHOTOGRAPH***

**BRIDGE 399**



VIEW LOOKING WEST



REFERENCE: SF-770400

PROJECT: 17BP.6.R.101

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY ROBESON  
PROJECT DESCRIPTION BRIDGE NO. 400 ON SR 1740  
(OLD STAGE RD.) OVER BIG MARSH SWAMP

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5,6,7	BORE LOGS
8	SITE PHOTOGRAPH

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-770400	1	8

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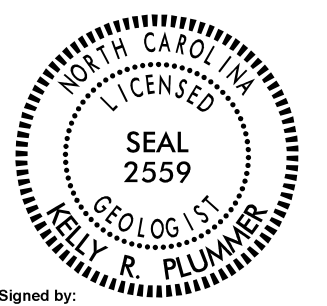
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PERSONNEL

K. PLUMMER, LG  
CAROLINA DRILLING  
J. ANDERSON  
S. ANDERSON

INVESTIGATED BY K. PLUMMER, LG  
DRAWN BY K. PLUMMER, LG  
CHECKED BY D. BROWN, PE  
SUBMITTED BY K. PLUMMER, LG  
DATE NOVEMBER 2018

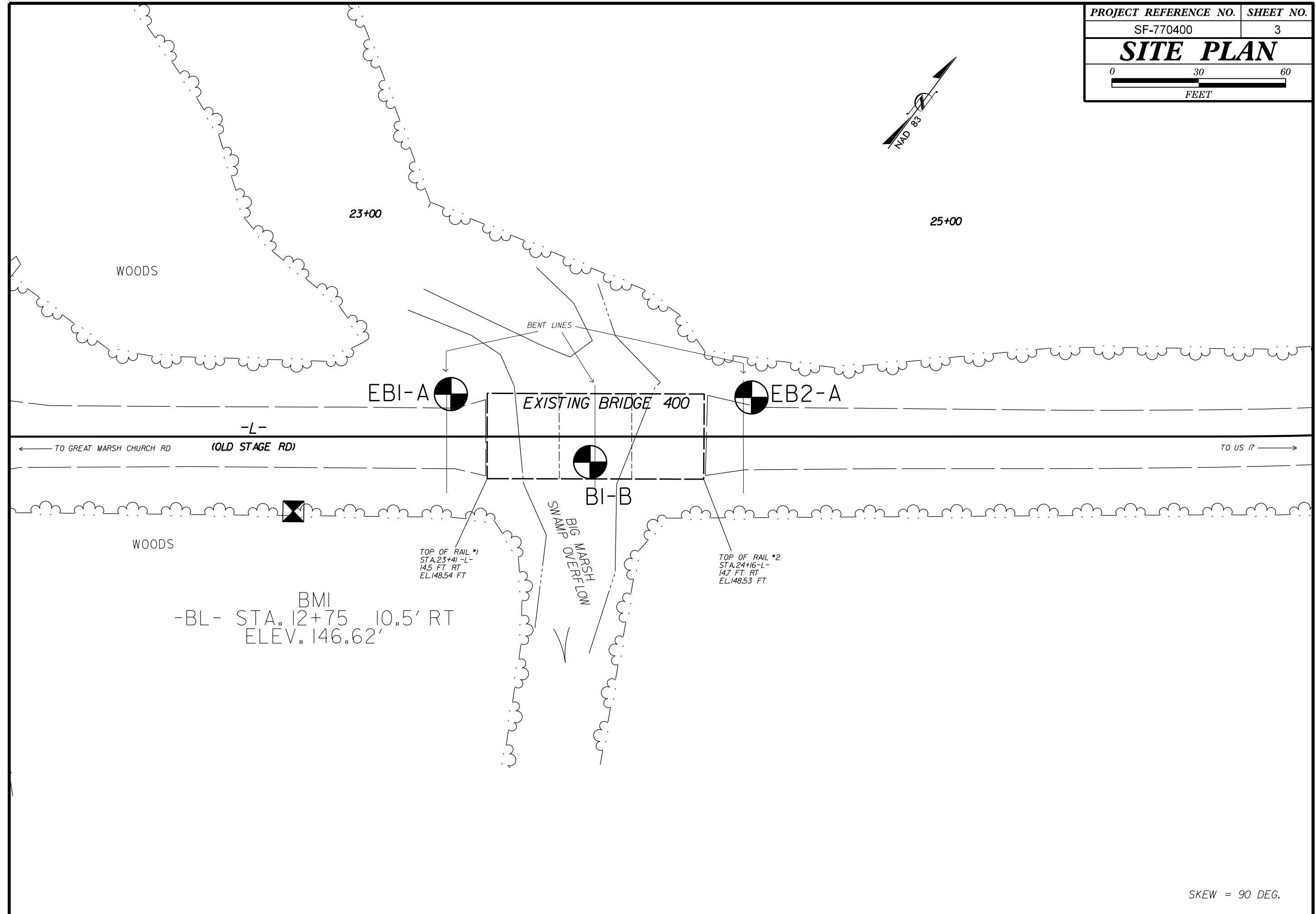
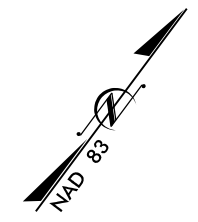


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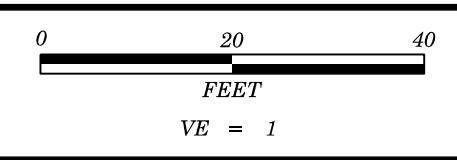
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**  
**SUBSURFACE INVESTIGATION**  
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION										GRADATION					ROCK DESCRIPTION					TERMS AND DEFINITIONS																											
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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										<b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.					<b>HARD ROCK</b> 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:					<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 DISLOGGED 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 (ROD)</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 (N 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.																											
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>ANGULARITY OF GRAINS</b> THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR</b> , <b>SUBANGULAR</b> , <b>SUBROUNDED</b> , OR <b>ROUNDED</b> .					<b>WEATHERED ROCK (WR)</b> 					<b>CRYSTALLINE ROCK (CR)</b> 					<b>NON-CRYSTALLINE ROCK (NCR)</b> 					<b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b> 																	
<b>MINERALOGICAL COMPOSITION</b> MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										<b>COMPRESSION</b> SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50					<b>WEATHERING</b> <b>FRESH</b> - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. <b>VERY SLIGHT (IV SL.)</b> - 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. <b>SLIGHT (SL.)</b> - 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. <b>MODERATE (MOD.)</b> - 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. <b>MODERATELY SEVERE (MOD. SEV.)</b> - 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> <b>SEVERE (SEV.)</b> - 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> <b>VERY SEVERE (IV SEV.)</b> - 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> <b>COMPLETE</b> - 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.																																
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<b>COLOR</b> 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.										<b>INDURATION</b> FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. <b>FRIABLE</b> - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. <b>MODERATELY INDURATED</b> - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. <b>INDURATED</b> - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. <b>EXTREMELY INDURATED</b> - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.																																					
<b>BENCH MARK: BMI AT STA. 12+75 -BL-, 10.5 FT RT</b> <b>ELEVATION: 146.62 FEET</b>										<b>NOTES:</b>																																					

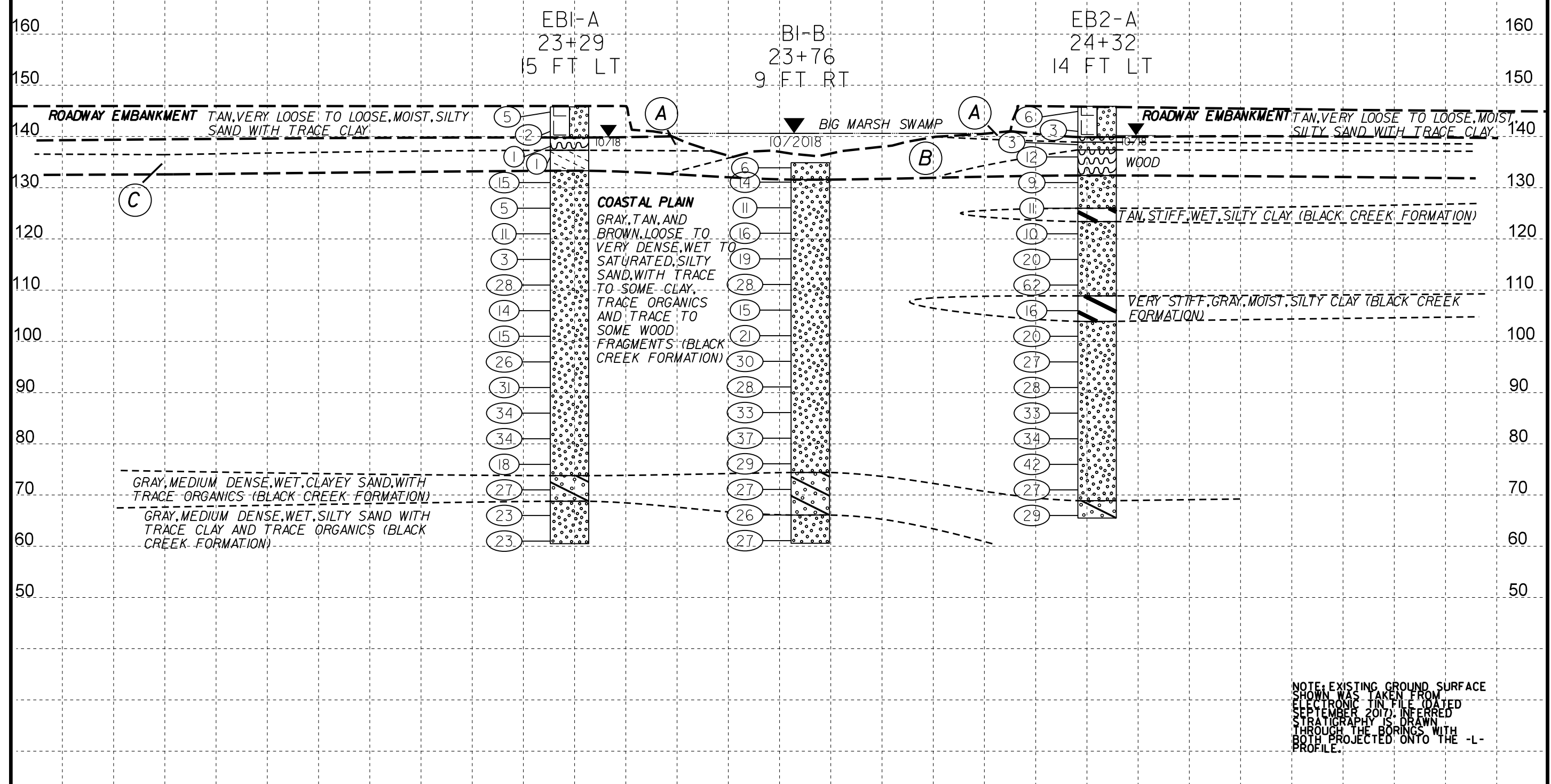


SKEW = 90 DEG.



<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
SF-770400	4
<b>PROFILE ALONG -L- CENTERLINE</b>	

- (A)** ALLUVIAL VERY SOFT, DARK BROWN, SATURATED, MUCK
- (B)** ALLUVIAL GRAY, AND BROWN, VERY LOOSE TO LOOSE, SATURATED, SILTY SAND, WITH TRACE ORGANICS
- (C)** ALLUVIAL DARK GRAY, VERY LOOSE, SATURATED, MODERATELY ORGANIC, SILTY SAND



NOTE: EXISTING GROUND SURFACE SHOWN WAS TAKEN FROM ELECTRONIC TIN FILE (DATED SEPTEMBER 2017). INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- PROFILE.

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770400	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K. Plummer
<b>SITE DESCRIPTION</b> Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB1-A	<b>STATION</b> 23+29	<b>OFFSET</b> 15 ft LT	<b>ALIGNMENT</b> -L-
<b>COLLAR ELEV.</b> 145.8 ft	<b>TOTAL DEPTH</b> 85.3 ft	<b>NORTHING</b> 382,537	<b>EASTING</b> 2,004,315
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018		<b>DRILL METHOD</b> H.S. Augers	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> J. Anderson	<b>START DATE</b> 10/09/18	<b>COMP. DATE</b> 10/09/18	<b>SURFACE WATER DEPTH</b> N/A
<b>0 HR.</b>	N/A	<b>24 HR.</b>	5.9

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
150																	
	145.8	0.0													145.8	0.0	GROUND SURFACE
145	142.0	3.8	1	2	3												ROADWAY EMBANKMENT Tan, Silty Sand with Trace Clay
140	139.1	6.7	1	1	1												
	137.0	8.8	WOH	WOH	1												
135			WOH	WOH	1												
	132.0	13.8															
130			6	6	9												
	127.0	18.8															
125			2	2	3												
	122.0	23.8															
120			2	4	7												
	117.0	28.8															
115			1	1	2												
	112.0	33.8															
110			3	12	16												
	107.0	38.8															
105			2	6	8												
	102.0	43.8															
100			4	7	8												
	97.0	48.8															
95			4	9	17												
	92.0	53.8															
90			8	13	18												
	87.0	58.8															
85			8	15	19												
	82.0	63.8															
80			4	15	19												
	77.0	68.8															
75			6	7	11												
	72.0	73.8															
70			8	11	16												

<b>WBS</b> 17BP.6.R.101	<b>TIP</b> SF-770400	<b>COUNTY</b> ROBESON	<b>GEOLOGIST</b> K. Plummer
<b>SITE DESCRIPTION</b> Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB1-A	<b>STATION</b> 23+29	<b>OFFSET</b> 15 ft LT	<b>ALIGNMENT</b> -L-
<b>COLLAR ELEV.</b> 145.8 ft	<b>TOTAL DEPTH</b> 85.3 ft	<b>NORTHING</b> 382,537	<b>EASTING</b> 2,004,315
<b>DRILL RIG/HAMMER EFF./DATE</b> BRI3895 CME-55 96% 04/19/2018		<b>DRILL METHOD</b> H.S. Augers	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> J. Anderson	<b>START DATE</b> 10/09/18	<b>COMP. DATE</b> 10/09/18	<b>SURFACE WATER DEPTH</b> N/A
<b>0 HR.</b>	N/A	<b>24 HR.</b>	5.9

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
70																	
	67.0	78.8	9	9	14												
65																	
	62.0	83.8	5	8	15												

NCDOT BORE DOUBLE SF770400\_GEO\_BRDG0400.GPJ NC\_DOT.GDT 11/13/18

# GEOTECHNICAL BORING REPORT BORE LOG

WBS 17BP.6.R.101		TIP SF-770400		COUNTY ROBESON		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)									
BORING NO. B1-B		STATION 23+76		OFFSET 9 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 134.9 ft		TOTAL DEPTH 74.3 ft		NORTHING 382,547		EASTING 2,004,367										
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER J. Anderson		START DATE 10/12/18		COMP. DATE 10/12/18		SURFACE WATER DEPTH 6.1ft										
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						
145																
														▼	WATER SURFACE (10/12/18)	
135	134.9	0.0	1	3	3								Sat.	134.9	MUDLINE	0.0
	132.1	2.8	12	7	7								Sat.	131.6	ALLUVIAL Gray, Silty Sand	3.3
130													Sat.	<b>COASTAL PLAIN</b> Gray and Brown, Silty Sand [Black Creek Formation]		
	127.1	7.8	5	5	6								Sat.			
125													Sat.			
	122.1	12.8	3	6	10								Sat.			
120													W			
	117.1	17.8	3	9	10								W			
115													W			
	112.1	22.8	7	13	15								W			
110													W			
	107.1	27.8	4	5	10								W		With Some Wood Fragments from 27.8 Feet to 32.0 Feet	
105													W			
	102.1	32.8	4	10	11								W			
100													W			
	97.1	37.8	6	11	19								W		With Some Wood Fragments from 37.8 Feet to 60.5 Feet	
95													W			
	92.1	42.8	7	10	18								W			
90													W			
	87.1	47.8	12	16	17								W			
85													W			
	82.1	52.8	6	17	20								W		With Some Clay from 52.8 Feet to 60.5 Feet	
80													W			
	77.1	57.8	11	16	13								W			
75													W			
	72.1	62.8	6	12	15								W			
70													W			
	67.1	67.8	4	11	15								W			
65													W			

WBS 17BP.6.R.101		TIP SF-770400		COUNTY ROBESON		GEOLOGIST K. Plummer											
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)										
BORING NO. B1-B		STATION 23+76		OFFSET 9 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 134.9 ft		TOTAL DEPTH 74.3 ft		NORTHING 382,547		EASTING 2,004,367											
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER J. Anderson		START DATE 10/12/18		COMP. DATE 10/12/18		SURFACE WATER DEPTH 6.1ft											
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							
65																	
														▼	WATER SURFACE (10/12/18)		
	62.1	72.8	9	12	15									W	Match Line		
															60.6	Gray, Silty Sand with Trace Organics and Trace Clay [Black Creek Formation] (continued) Boring Terminated at Elevation 60.6 ft In Silty Sand	74.3

NCDOT BORE DOUBLE SF770400\_GEO\_BRD60400.GPJ NC\_DOT.GDT 11/13/18

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.6.R.101		TIP SF-770400		COUNTY ROBESON		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 24+32		OFFSET 14 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 145.9 ft		TOTAL DEPTH 80.4 ft		NORTHING 382,598		EASTING 2,004,399										
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER J. Anderson		START DATE 10/09/18		COMP. DATE 10/09/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
150																
	145.9	0.0													145.9	GROUND SURFACE
145			1	3	3											ROADWAY EMBANKMENT
	142.0	3.9	1	2	1											Tan, Silty Sand
140																
	139.4	6.5	WOH	1	2											ALLUVIAL
	137.0	8.9														Dark Brown, Sandy Muck
135			3	5	7											Brown, Silty Sand, With Trace Organics
	132.0	13.9														Wood
130			7	5	4											COASTAL PLAIN
	127.0	18.9														Tan, Silty Sand
125			9	8	3											[Black Creek Formation]
	122.0	23.9	2	4	6											
120																
	117.0	28.9	5	9	11											
115																
	112.0	33.9	13	30	32											
110																
	107.0	38.9	3	6	10											
105																
	102.0	43.9	5	10	10											
100																
	97.0	48.9	8	12	15											
95																
	92.0	53.9	11	12	16											
90																
	87.0	58.9	10	15	18											
85																
	82.0	63.9	8	16	18											
80																
	77.0	68.9	8	14	28											
75																
	72.0	73.9	8	12	15											
70																

WBS 17BP.6.R.101		TIP SF-770400		COUNTY ROBESON		GEOLOGIST K. Plummer										
SITE DESCRIPTION Bridge No. 400 on SR 1740 (Old Stage Road) over Big Marsh Swamp							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 24+32		OFFSET 14 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 145.9 ft		TOTAL DEPTH 80.4 ft		NORTHING 382,598		EASTING 2,004,399										
DRILL RIG/HAMMER EFF./DATE BRI3895 CME-55 96% 04/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER J. Anderson		START DATE 10/09/18		COMP. DATE 10/09/18		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
70																
	67.0	78.9	8	13	16										68.9	
															77.0	
															65.5	

Boring Terminated at Elevation 65.5 ft In Clayey Sand  
 Note: Water Circulation Loss Observed from 36.0 Feet to 38.0 Feet.

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***SITE PHOTOGRAPH***

**BRIDGE 400**



VIEW LOOKING NORTH