

REFERENCE: R-3421B

PROJECT: 34542

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY RICHMOND  
PROJECT DESCRIPTION US 220 BYPASS FROM 0.3 MILES OF  
SR 1104 (OLD CHARLOTTE HWY) TO 0.2 MILES SW OF  
SR 1304 (HARRINGTON RD)  
SITE DESCRIPTION BRIDGE NO. 243 OVER US 220 BYPASS (-L-)  
ON SR 1140 (-Y3-) BETWEEN US 74 BUS AND SR 1141  
STA. 140 + 97.00

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	BORING LOGS
8	SOIL TEST RESULTS
9	SITE PHOTOGRAPHS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-3421B	1	9

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:
1. 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.
  2. 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.

PERSONNEL

- B. KEANEY
- B. HOWEY
- C. JONES
- D. TIGNOR
- C. MYERS

INVESTIGATED BY HDR ENGINEERING, INC.  
F & R, INC.

DRAWN BY CGM

CHECKED BY BDK

SUBMITTED BY HDR ENGINEERING, INC.

DATE 7/2015

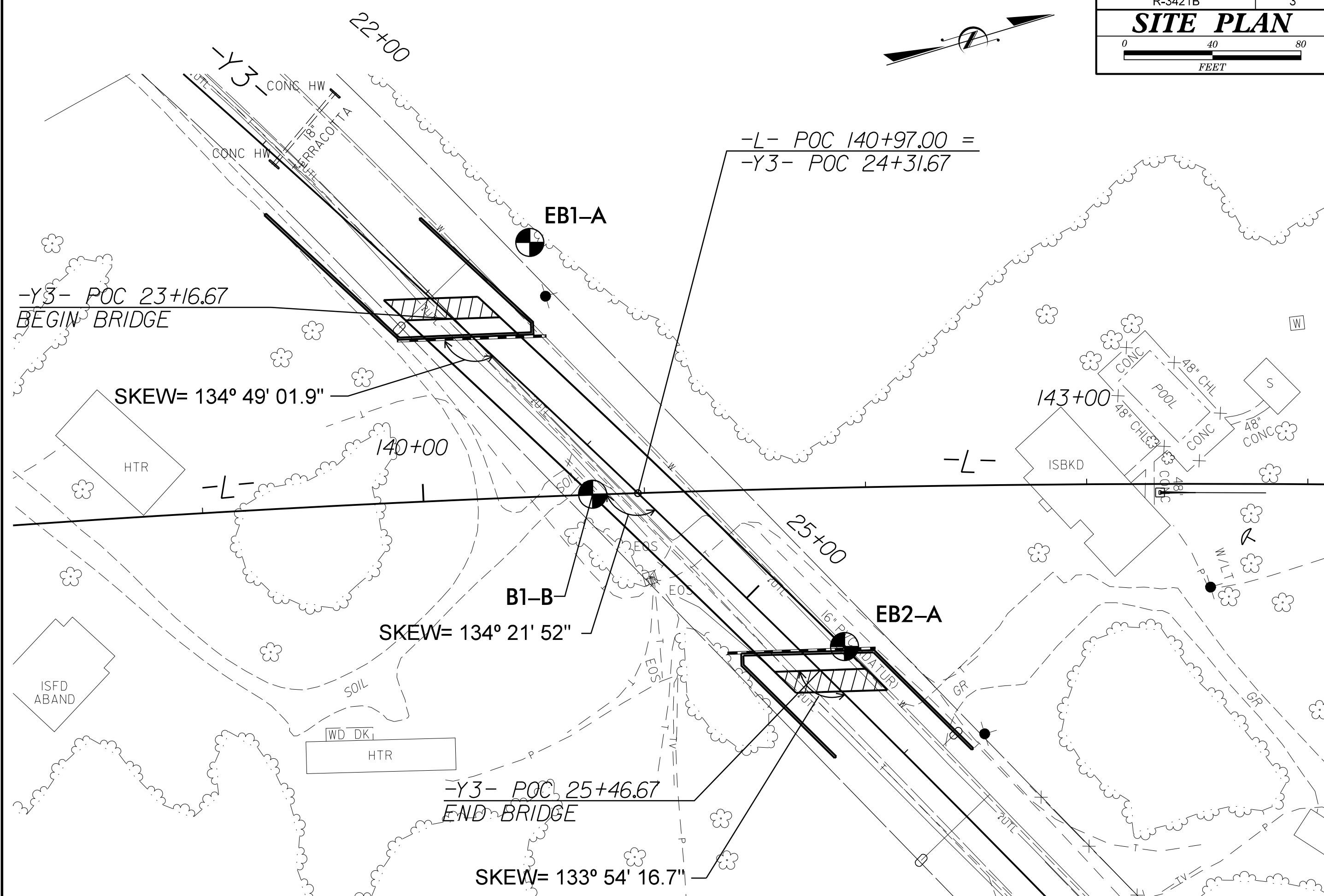


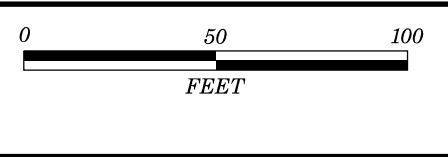
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SIGNATURE DATE

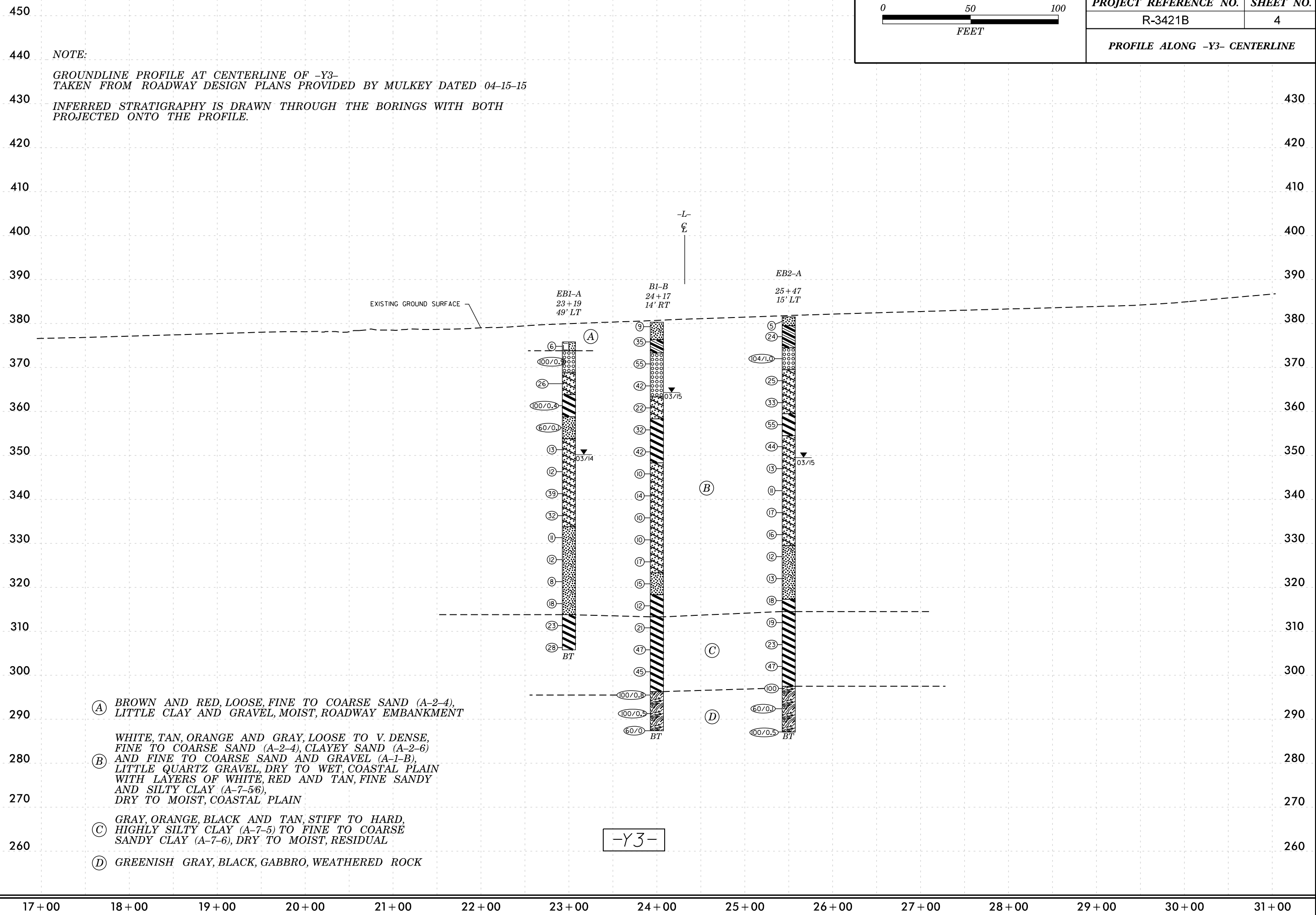
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
SUBSURFACE INVESTIGATION  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																												
<p>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></p>										<p><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.</p>										<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 (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>SLICKENISE</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>																																																																												
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>ANGULARITY OF GRAINS</b>										<b>WEATHERED ROCK (WR)</b>										<b>CRYSTALLINE ROCK (CR)</b>																																																																												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="5">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="5">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="5">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th colspan="5"></th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="5"></td> </tr> <tr> <th>% PASSING #10 #40 #200</th> <td>50 MX 30 MX 15 MX</td> <td>50 MX 25 MX 10 MX</td> <td>51 MN 35 MX 35 MX</td> <td>40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN</td> <td>36 MN 36 MN 36 MN</td> <td>36 MN 36 MN 36 MN</td> <td>36 MN 36 MN 36 MN</td> <td>36 MN 36 MN 36 MN</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td colspan="5">MUCK, PEAT</td> </tr> </table>										GRANULAR MATERIALS (≤ 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)					ORGANIC MATERIALS					GROUP CLASS.	A-1	A-3	A-2	A-2	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7						SYMBOL																		% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX 10 MX	51 MN 35 MX 35 MX	40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT					<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</b></p>										<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>										<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>									
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<b>MINERALOGICAL COMPOSITION</b>										<b>COMPRESSION</b>										<b>NON-CRYSTALLINE ROCK (NCR)</b>										<b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b>																																																																												
<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p>										<p>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.</p>										<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>																																																																												
<b>PERCENTAGE OF MATERIAL</b>										<b>GROUND WATER</b>										<b>WEATHERING</b>										<b>MISCELLANEOUS SYMBOLS</b>																																																																												
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GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005																																																																																																			
	IN.	12	3																																																																																																							
<b>PLASTICITY</b>										<b>ABBREVIATIONS</b>										<b>FRACTURE SPACING</b>										<b>BEDDING</b>																																																																												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NON PLASTIC</th> <th colspan="2">PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> <tr> <td>SLIGHTLY PLASTIC</td> <td>0-5</td> <td></td> <td>VERY LOW</td> </tr> <tr> <td>MODERATELY PLASTIC</td> <td>6-15</td> <td></td> <td>SLIGHT</td> </tr> <tr> <td>HIGHLY PLASTIC</td> <td>16-25</td> <td></td> <td>MEDIUM</td> </tr> <tr> <td></td> <td>26 OR MORE</td> <td></td> <td>HIGH</td> </tr> </table>										NON PLASTIC	PLASTICITY INDEX (PI)		DRY STRENGTH	SLIGHTLY PLASTIC	0-5		VERY LOW	MODERATELY PLASTIC	6-15		SLIGHT	HIGHLY PLASTIC	16-25		MEDIUM		26 OR MORE		HIGH	<p>DRILL UNITS: <input type="checkbox"/> CME-45C <input checked="" type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST</p>										<p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE _____ * STEEL TEETH <input type="checkbox"/> TRICONE _____ * TUNG-CARB. <input type="checkbox"/> CORE BIT</p>										<p>TERMS: 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</p>										<p>TERMS: 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 &lt; 0.008 FEET</p>																																														
NON PLASTIC	PLASTICITY INDEX (PI)		DRY STRENGTH																																																																																																							
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	26 OR MORE		HIGH																																																																																																							
<b>COLOR</b>										<b>EQUIPMENT USED ON SUBJECT PROJECT</b>										<b>INDURATION</b>										<b>NOTES</b>																																																																												
<p>DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p>										<p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> -B _____ <input type="checkbox"/> -H _____ <input type="checkbox"/> -N _____ HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>										<p>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.</p>										<p>BENCH MARK: _____ ELEVATION: _____ FEET NOTES: BORING AND GROUND SURFACE ELEVATIONS OBTAINED FROM NCDOT - PROVIDED DTM FILE</p>																																																																												





PROJECT REFERENCE NO.	SHEET NO.
R-3421B	4
PROFILE ALONG -Y3- CENTERLINE	



NOTE:  
 GROUNDLINE PROFILE AT CENTERLINE OF -Y3-  
 TAKEN FROM ROADWAY DESIGN PLANS PROVIDED BY MULKEY DATED 04-15-15  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH  
 PROJECTED ONTO THE PROFILE.

- (A) BROWN AND RED, LOOSE, FINE TO COARSE SAND (A-2-4), LITTLE CLAY AND GRAVEL, MOIST, ROADWAY EMBANKMENT
- (B) WHITE, TAN, ORANGE AND GRAY, LOOSE TO V. DENSE, FINE TO COARSE SAND (A-2-4), CLAYEY SAND (A-2-6) AND FINE TO COARSE SAND AND GRAVEL (A-1-B), LITTLE QUARTZ GRAVEL, DRY TO WET, COASTAL PLAIN WITH LAYERS OF WHITE, RED AND TAN, FINE SANDY AND SILTY CLAY (A-7-5/6), DRY TO MOIST, COASTAL PLAIN
- (C) GRAY, ORANGE, BLACK AND TAN, STIFF TO HARD, HIGHLY SILTY CLAY (A-7-5) TO FINE TO COARSE SANDY CLAY (A-7-6), DRY TO MOIST, RESIDUAL
- (D) GREENISH GRAY, BLACK, GABBRO, WEATHERED ROCK

H:\0621\AM\0621\0621\0621\Y3\_HDR\_bridg-psh43.dgn  
 11/15/15 10:00 AM  
 11/15/15 10:00 AM



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 23+19		OFFSET 49 ft LT		ALIGNMENT -Y3-										
COLLAR ELEV. 375.8 ft		TOTAL DEPTH 70.0 ft		NORTHING 441,607		EASTING 1,745,655										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/09/14		COMP. DATE 03/09/14		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						
380																
375	375.8	0.0	1	2	4											375.8 GROUND SURFACE 0.0
	372.3	3.5	24	40	60/0.4											373.8 ROADWAY EMBANKMENT 2.0
	367.3	8.5	9	11	15											368.8 COASTAL PLAIN 7.0
	362.3	13.5	49	100/0.4												363.8 White and red, fine sandy CLAY (A-7-6) 12.0
	357.3	18.5	60/0.1													358.8 White, partially cemented fine to coarse SAND (A-2-4), 17.0
	352.3	23.5	6	6	7											353.8 Tan, orange, white and gray, fine to coarse clayey SAND (A-2-7) 22.0
	347.3	28.5	4	5	7											
	342.3	33.5	10	14	25											
	337.3	38.5	9	12	20											
	332.3	43.5	4	5	6											
	327.3	48.5	7	6	6											
	322.3	53.5	4	4	4											
	317.3	58.5	7	8	10											
	312.3	63.5	11	11	12											
	307.3	68.5	10	13	15											

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)									
BORING NO. B1-B		STATION 24+17		OFFSET 14 ft RT		ALIGNMENT -Y3-										
COLLAR ELEV. 380.3 ft		TOTAL DEPTH 92.9 ft		NORTHING 441,631		EASTING 1,745,757										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/05/15		COMP. DATE 03/06/15		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						
385																
380	380.3	0.0	4	5	4											380.3 GROUND SURFACE 0.0
	376.8	3.5	10	15	20											376.3 COASTAL PLAIN 4.0
	371.8	8.5	21	26	29											373.3 Orange and tan, fine sandy silty CLAY (A-6) 7.0
	366.8	13.5	16	20	22											363.3 Red, orange and white, fine to coarse SAND (A-1-b) and gravel 17.0
	361.8	18.5	8	8	14											358.3 White, tan and orange, fine to coarse clayey SAND (A-2-7) 22.0
	356.8	23.5	8	14	18											
	351.8	28.5	9	14	28											
	346.8	33.5	3	5	5											
	341.8	38.5	5	7	7											
	336.8	43.5	3	5	5											
	331.8	48.5	4	5	5											
	326.8	53.5	6	7	10											
	321.8	58.5	10	7	8											
	316.8	63.5	5	6	6											
	311.8	68.5	5	10	11											
	306.8	73.5	14	20	27											

NCDOT BORE DOUBLE R-3421B\_BRIDGES.GPJ\_NC\_DOT.GDT 8/19/15

SS-51 27%

SS-36 19%

Boring Terminated at Elevation 305.8 ft IN CLAY (RESIDUAL)

Notes  
1) 0.2" Topsoil

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones								
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)							
BORING NO. B1-B		STATION 24+17		OFFSET 14 ft RT		ALIGNMENT -Y3-								
COLLAR ELEV. 380.3 ft		TOTAL DEPTH 92.9 ft		NORTHING 441,631		EASTING 1,745,757								
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER D. Tignor		START DATE 03/05/15		COMP. DATE 03/06/15		SURFACE WATER DEPTH 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				
305														
300	301.8	78.5	14	19	26							<b>RESIDUAL</b> Orange, black, tan and greenish gray, fine to coarse sandy CLAY (A-7-5)(3) with some silt and rock fragments, saprolitic <i>(continued)</i>		
295	296.8	83.5	28	51	49/0.3									<b>WEATHERED ROCK</b> Greenish gray, GABBRO
290	291.8	88.5	100/0.5											
	287.4	92.9	60/0											

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones								
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)							
BORING NO. EB2-A		STATION 25+47		OFFSET 15 ft LT		ALIGNMENT -Y3-								
COLLAR ELEV. 381.5 ft		TOTAL DEPTH 94.4 ft		NORTHING 441,721		EASTING 1,745,856								
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER D. Tignor		START DATE 03/04/15		COMP. DATE 03/05/15		SURFACE WATER DEPTH 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				
385														
380	381.5	0.0	2	3	2									GROUND SURFACE 0.0 <b>COASTAL PLAIN</b> Brown, fine to coarse SAND (A-2-6) with little clay
375	378.0	3.5	9	11	13									
370	373.0	8.5	24	34	70									White and orange, fine to coarse SAND AND GRAVEL (A-1-b)
365	368.0	13.5	11	12	13									
360	363.0	18.5	7	14	19									Gray and tan, silty CLAY (A-7-6)
355	358.0	23.5	13	23	32									
350	353.0	28.5	13	19	25									Gray to greenish gray and brown, fine to coarse sandy, highly silty CLAY (A-7-5)(12) with rock fragments, saprolitic
345	348.0	33.5	3	6	7									
340	343.0	38.5	3	5	6									Black, CLAY (A-7-6)
335	338.0	43.5	6	8	9									
330	333.0	48.5	6	7	9									Black, CLAY (A-7-6)
325	328.0	53.5	4	6	6									
320	323.0	58.5	3	5	8									Black, CLAY (A-7-6)
315	318.0	63.5	10	9	9									
310	313.0	68.5	5	9	10									Black, CLAY (A-7-6)
305	308.0	73.5	9	9	14									
														SS-16 34%

NCDOT BORE DOUBLE R-3421B\_BRIDGES.GPJ\_NC\_DOT.GDT 8/19/15

# GEOTECHNICAL BORING REPORT BORE LOG

<b>WBS</b> 34542.1.FR4		<b>TIP</b> R-3421B		<b>COUNTY</b> RICHMOND		<b>GEOLOGIST</b> C. Jones									
<b>SITE DESCRIPTION</b> Bridge No. 243 on SR 1140 over US 220							<b>GROUND WTR (ft)</b>								
<b>BORING NO.</b> EB2-A		<b>STATION</b> 25+47		<b>OFFSET</b> 15 ft LT		<b>ALIGNMENT</b> -Y3-									
<b>COLLAR ELEV.</b> 381.5 ft		<b>TOTAL DEPTH</b> 94.4 ft		<b>NORTHING</b> 441,721		<b>EASTING</b> 1,745,856									
<b>DRILL RIG/HAMMER EFF./DATE</b> F&R3495 CME-55 73% 02/05/2015				<b>DRILL METHOD</b> H.S. Augers		<b>HAMMER TYPE</b> Automatic									
<b>DRILLER</b> D. Tignor		<b>START DATE</b> 03/04/15		<b>COMP. DATE</b> 03/05/15		<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)	
305												M	RESIDUAL Gray to greenish gray and brown, fine to coarse sandy, highly silty CLAY (A-7-5)(12) with rock fragments, saprolitic (continued)		
303.0	78.5	15	22	25	Match Line										
300															
298.0	83.5	20	35	65/0.5						100				297.5	84.0
295														WEATHERED ROCK Greenish black, GABBRO	
293.0	88.5	36	60/0.1							96/0.6					
290															
288.0	93.5	23	100/0.5							100/0.5			287.1	94.4	
Boring Terminated with Standard Penetration Test Refusal at Elevation 287.1 ft IN WEATHERED ROCK (GABBRO)															
Notes 1) 0.2' Topsoil 2) Strata break in split spoon at 64.2'															

NCDOT BORE DOUBLE R-3421B\_BRIDGES.GPJ NC\_DOT.GDT 8/19/15

**North Carolina Department of Transportation  
Division of Highways  
Materials and Test Unit  
Soils Laboratory**

T.I.P. ID NO.: R-3421B  
DESCRIPTION: US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT:	<u>34542.1.FR4</u>	COUNTY:	<u>Richmond</u>
DATE SAMPLED:	<u>3/4/15 - 3/9/15</u>	RECEIVED:	<u>3/4/15 - 3/9/15</u>
SAMPLED FROM:	<u>Y3</u>	REPORTED:	<u>3/4/15 - 3/9/15</u>
SUBMITTED BY:	<u>B. Howey, P.E.</u>	BY:	<u>D. Jenks</u> Cert No. 101-02-0603

**TEST RESULTS**

PROJ. SAMPLE NO.	SS-51	SS-36	SS-16												
BORING NO.	EB1-A	B1-B	EB2-A												
Retained #4 Sieve %	5.0	9.4	7.1												
Passing #10 Sieve %	90.3	84.9	86.8												
Passing #40 Sieve %	67.3	65.9	75.3												
Passing #200 Sieve %	52.6	39.5	60.6												

SOIL MORTAR - 100%															
Coarse Sand Ret - #60 %	32.1	33.8	16.6												
Fine Sand Ret - #270 %	11.6	23.8	18.5												
Silt 0.053 - 0.010 mm %	21.1	26.4	41.4												
Clay < 0.010 mm %	35.2	16.0	23.5												
L.L.	81	64	62												
P.L.	30	45	43												
P.I.	51	19	19												
AASHTO Classification	A-7-6 (23)	A-7-5 (3)	A-7-5 (12)												
Station	-Y3- 23+19	-Y3- 24+17	-Y3- 25+47												
Offset	49' LT	14' RT	15' LT												
Depth (ft)	63.5	73.5	73.5												
to	65.0	75.0	75.0												
Moisture Content (%)	26.6	19.4	34.3												
Organic Content (%)	NT	NT	NT												

NP=Not plastic  
NT=Not tested  
ND = Not Determined  
CL = Centerline

W.P. Alton, PE  
Soils Engineer





**1. View looking East along -Y3- from EB1 to EB2.**



**2. View looking North across End Bent 1**



**3. View looking North across End Bent 2.**





REFERENCE: R-3421B

PROJECT: 34542

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY RICHMOND  
PROJECT DESCRIPTION US 220 BYPASS FROM 0.3 MILES OF  
SR 1104 (OLD CHARLOTTE HWY) TO 0.2 MILES SW OF  
SR 1304 (HARRINGTON RD)  
SITE DESCRIPTION BRIDGE NOS. 244 (LEFT LANE) &  
245 (RIGHT LANE) OVER SR 1005 (-Y5-) ON US 220 BYPASS (-L-)  
BETWEEN SR 1141 AND SR 1303 AT -L- STA. 301+83.52

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-6	CROSS SECTION(S)
7-9	BORINGS LOGS
10-11	SOIL TEST RESULTS
12	SITE PHOTOGRAPHS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-3421B	1	12

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:
1. 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.
  2. 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.

PERSONNEL

- B. KEANEY
- B. HOWEY
- C. JONES
- D. TIGNOR
- C. MYERS

INVESTIGATED BY HDR ENGINEERING, INC.  
F & R, INC.

DRAWN BY CGM

CHECKED BY BDK

SUBMITTED BY HDR ENGINEERING, INC.

DATE 7/2015



79CD97E4882C436...

SIGNATURE DATE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

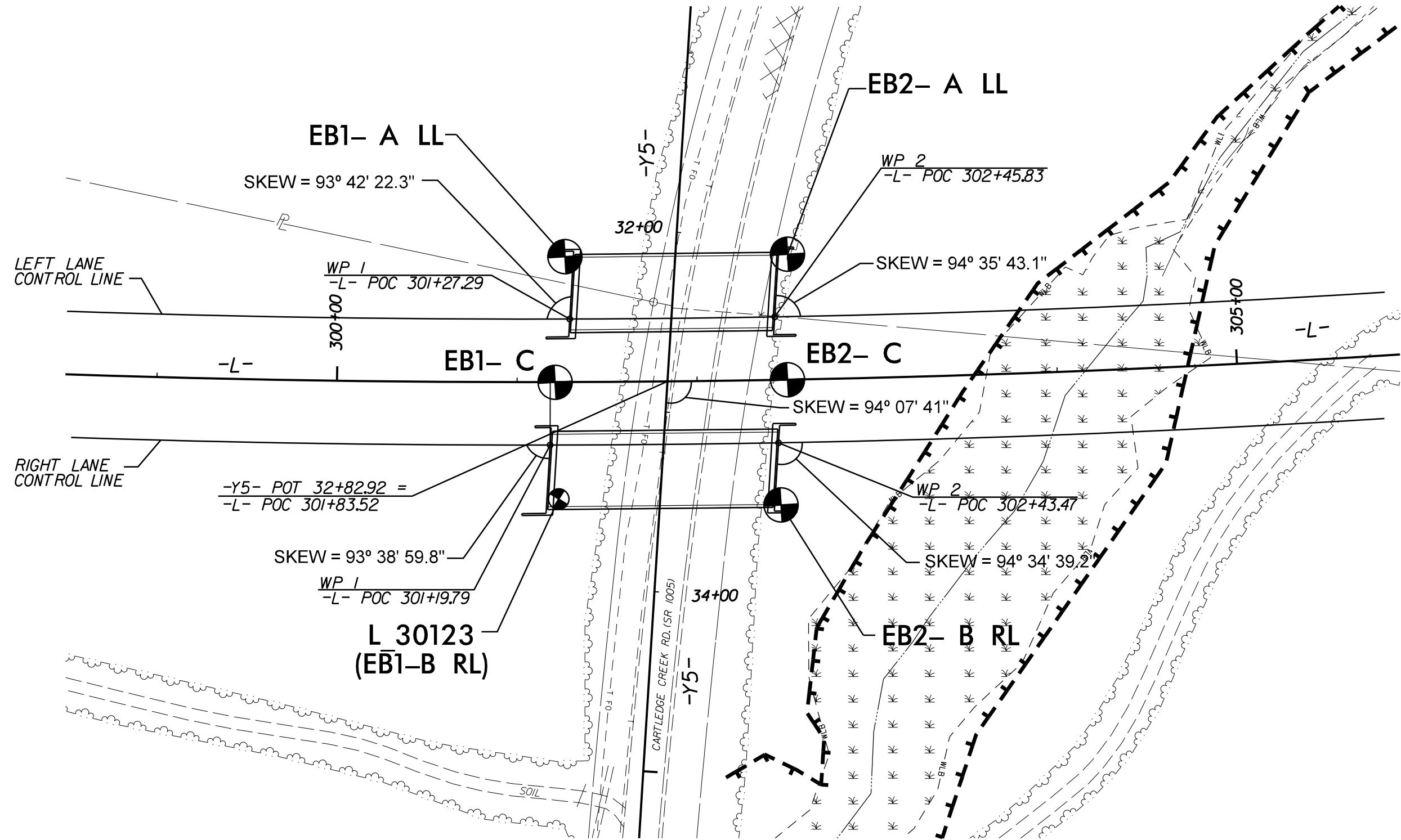
SUBSURFACE INVESTIGATION

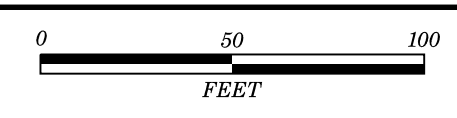
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

Table with 4 main columns: SOIL DESCRIPTION, GRADATION, ROCK DESCRIPTION, and TERMS AND DEFINITIONS. Includes sub-sections like SOIL LEGEND AND AASHTO CLASSIFICATION, MINERALOGICAL COMPOSITION, WEATHERING, and MISCELLANEOUS SYMBOLS.

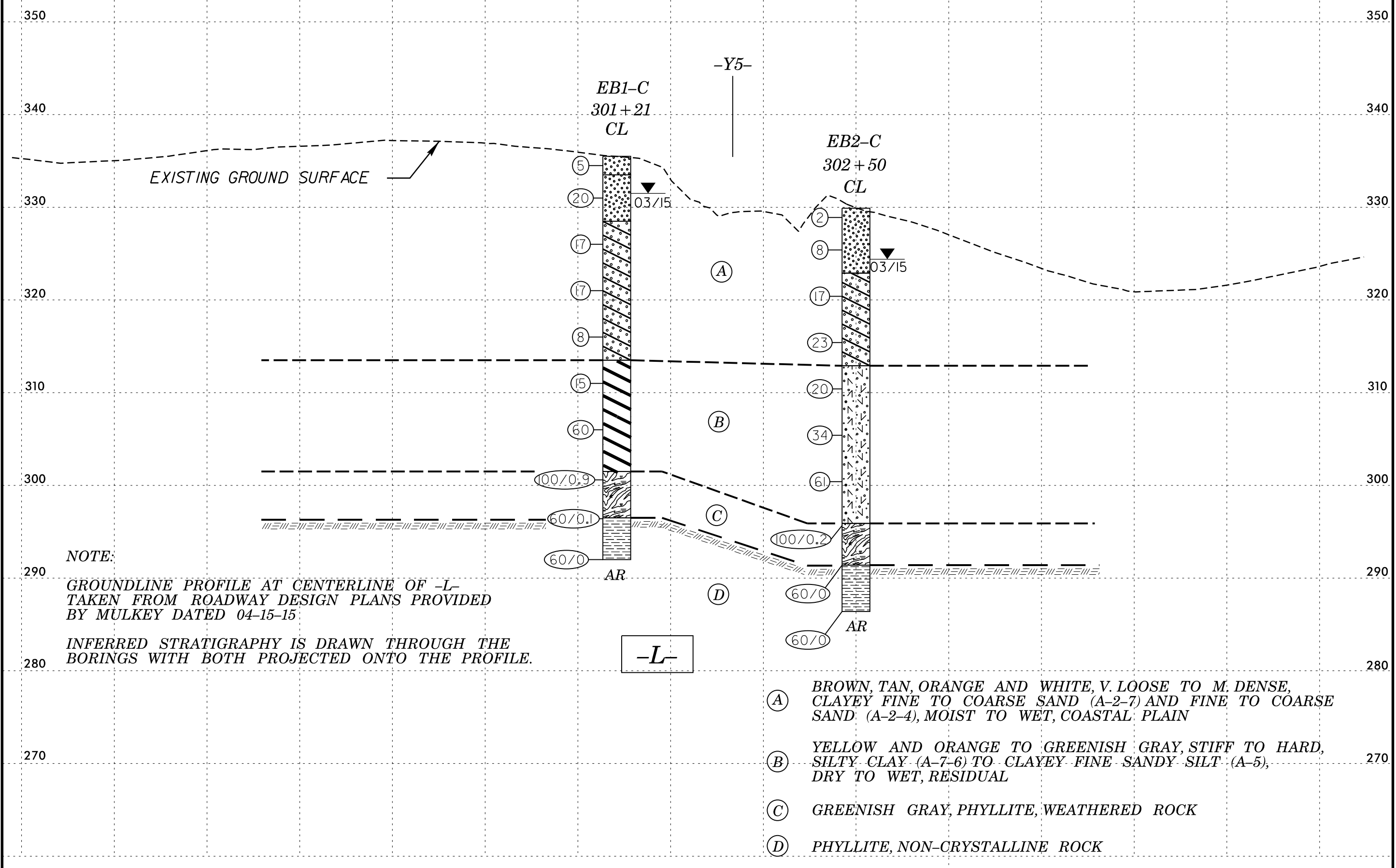


NOTE:  
 SMALLER SCALED BORING AT L 30123 IS DESIGNATED  
 AS EB1-B RL WAS PERFORMED BY NCDOT IN 2005.





PROJECT REFERENCE NO.	SHEET NO.
R-3421B	4
PROFILE ALONG -L- CENTERLINE	



NOTE:  
 GROUNDLINE PROFILE AT CENTERLINE OF -L-  
 TAKEN FROM ROADWAY DESIGN PLANS PROVIDED  
 BY MULKEY DATED 04-15-15  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE  
 BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

- (A) BROWN, TAN, ORANGE AND WHITE, V. LOOSE TO M. DENSE, CLAYEY FINE TO COARSE SAND (A-2-7) AND FINE TO COARSE SAND (A-2-4), MOIST TO WET, COASTAL PLAIN
- (B) YELLOW AND ORANGE TO GREENISH GRAY, STIFF TO HARD, SILTY CLAY (A-7-6) TO CLAYEY FINE SANDY SILT (A-5), DRY TO WET, RESIDUAL
- (C) GREENISH GRAY, PHYLLITE, WEATHERED ROCK
- (D) PHYLLITE, NON-CRYSTALLINE ROCK

299+00      300+00      301+00      302+00      303+00      304+00      305+00

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

# SECTION THROUGH END BENT 1

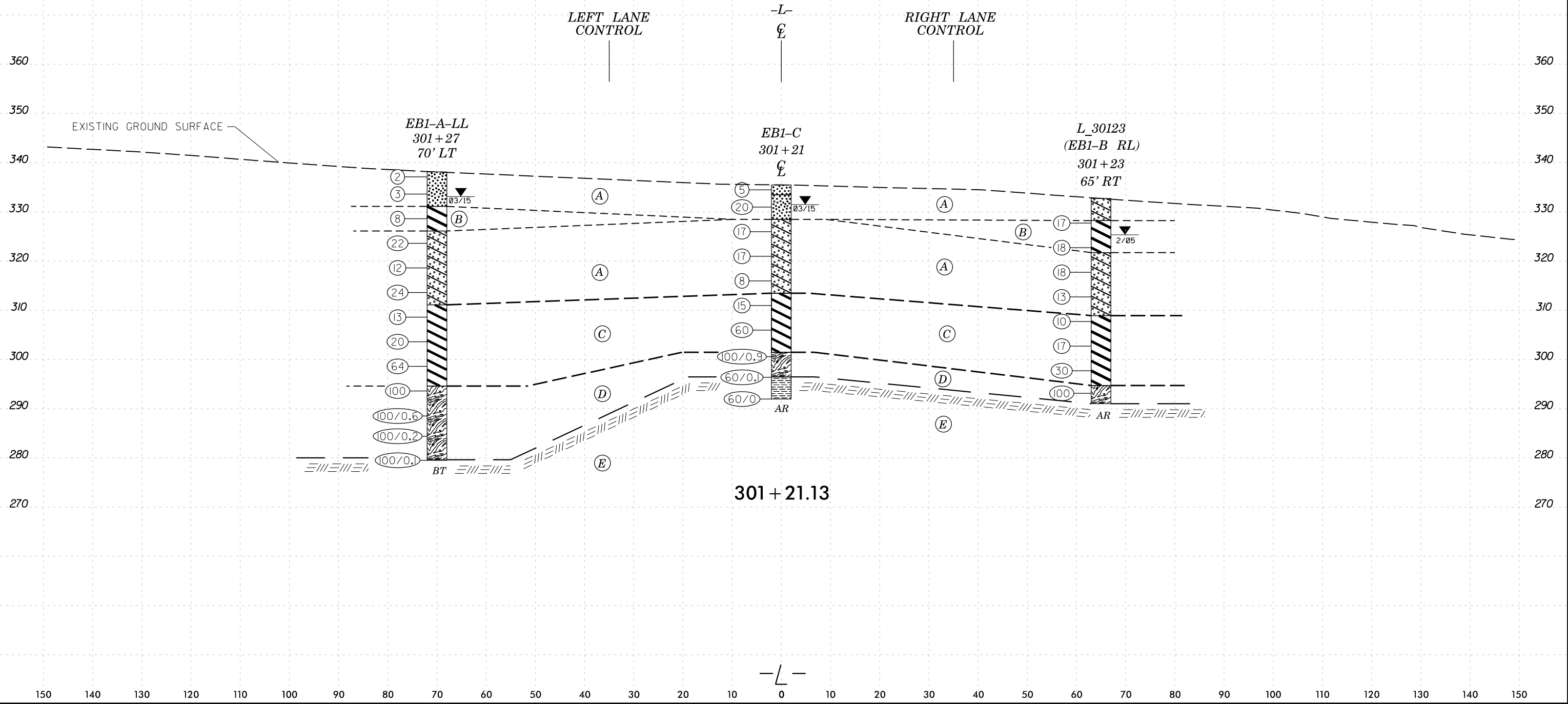
**NOTE:**

-L- GROUNDLINE TAKEN FROM ROADWAY DESIGN PLANS PROVIDED BY MULKEY DATED 04-15-15

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING WITH BOTH PROJECTED ON THE SECTION.

BORING L\_30123 WAS PERFORMED BY NCDOT IN 2005. STRATIGRAPHY INFERRED BASED ON BORING LOG PROVIDED.

- (A) BROWN, TAN, WHITE AND ORANGE, V. LOOSE TO M. DENSE, FINE TO COARSE SAND (A-2-4) AND CLAYEY CSE SAND (A-2-67), LITTLE QUARTZ GRAVEL, MOIST TO WET, COASTAL PLAIN
- (B) TAN AND MAROON, V. STIFF, CLAY (A-7-5) WITH SOME ROUNDED GRAVEL, MOIST
- (C) YELLOW, ORANGE, TAN AND GREENISH GRAY, STIFF TO HARD, HIGHLY SILTY CLAY (A-7-5/6), SOME FINE SAND AND ROCK FRAGMENTS, DRY TO WET, SAPROLITIC, RESIDUAL
- (D) GREENISH GRAY, PHYLLITE, WEATHERED ROCK
- (E) PHYLLITE, NON CRYSTALLINE ROCK



8/23/99

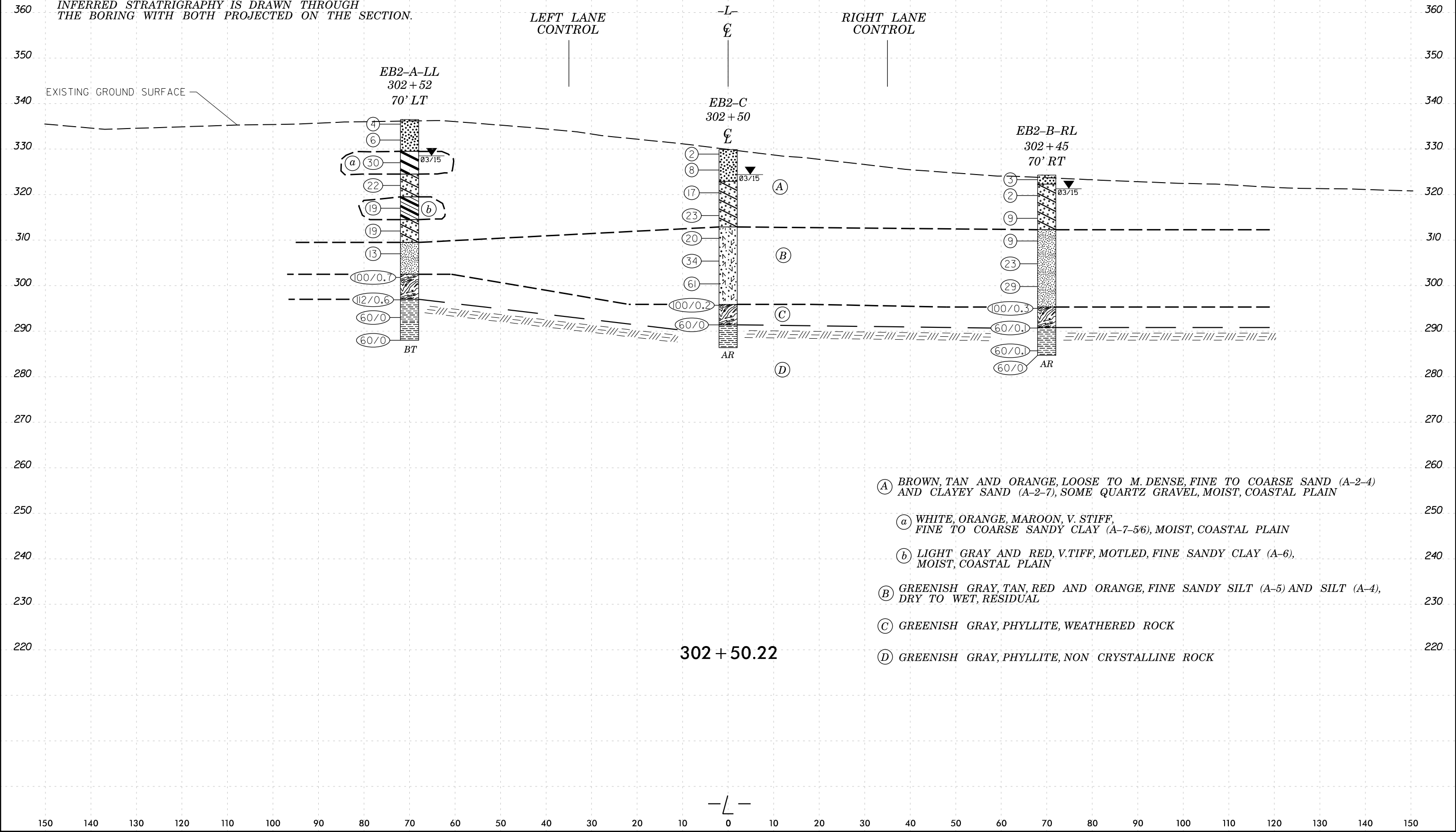
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NOTE:

-L- GROUNDLINE TAKEN FROM ROADWAY DESIGN PLANS PROVIDED BY MULKEY DATED 04-15-15

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING WITH BOTH PROJECTED ON THE SECTION.

# SECTION THROUGH END BENT 2



- (A) BROWN, TAN AND ORANGE, LOOSE TO M. DENSE, FINE TO COARSE SAND (A-2-4) AND CLAYEY SAND (A-2-7), SOME QUARTZ GRAVEL, MOIST, COASTAL PLAIN
- (a) WHITE, ORANGE, MAROON, V. STIFF, FINE TO COARSE SANDY CLAY (A-7-5/6), MOIST, COASTAL PLAIN
- (b) LIGHT GRAY AND RED, V. TUFF, MOTLED, FINE SANDY CLAY (A-6), MOIST, COASTAL PLAIN
- (B) GREENISH GRAY, TAN, RED AND ORANGE, FINE SANDY SILT (A-5) AND SILT (A-4), DRY TO WET, RESIDUAL
- (C) GREENISH GRAY, PHYLLITE, WEATHERED ROCK
- (D) GREENISH GRAY, PHYLLITE, NON CRYSTALLINE ROCK

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-L-

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# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones								
SITE DESCRIPTION Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005							GROUND WTR (ft)							
BORING NO. EB1-A-LL		STATION 301+27		OFFSET 70 ft LT		ALIGNMENT -L-	0 HR. 8.0							
COLLAR ELEV. 337.9 ft		TOTAL DEPTH 58.6 ft		NORTHING 449,447		EASTING 1,758,759								
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic								
DRILLER D. Tignor		START DATE 03/02/15		COMP. DATE 03/02/15		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				
340	337.9	0.0	1	1	1	2	...	...	...	...		M	GROUND SURFACE COASTAL PLAIN Tan, fine to coarse SAND (A-2-4) with trace to little clay, little roots	0.0
335	334.4	3.5	1	1	2	3	...	...	...	...		M		3.5
330	329.4	8.5	3	3	5	8	...	...	...	...		M	Tan and maroon, CLAY (A-7-5) with some rounded gravel	7.0
325	324.4	13.5	8	10	12	12	...	...	...	...		W	White, tan and orange, fine to coarse clayey SAND (A-2-7) with some quartz gravel, trace mica	12.0
320	319.4	18.5	4	5	7	12	...	...	...	...		W		18.5
315	314.4	23.5	8	10	14	14	...	...	...	...		W		23.5
310	309.4	28.5	4	5	8	8	...	...	...	...		W		28.5
305	304.4	33.5	7	9	11	11	...	...	...	...		M	Tan, orange and bluish green, highly silty CLAY (A-7-5)(32) with little fine sand and rock fragments	27.0
300	299.4	38.5	14	16	48	11	...	...	...	...		D	RESIDUAL Yellow and orange to greenish gray, highly silty CLAY (A-7-6)(21) with some fine sand, saprolitic	32.0
295	294.4	43.5	53	47/0.5	100/1.0	8	...	...	...	...		D	WEATHERED ROCK Greenish gray, PHYLLITE	34.0
290	289.4	48.5	29	60	40/0.1	11	...	...	...	...		D	WEATHERED ROCK Greenish gray, PHYLLITE	39.0
285	284.4	53.5	100/0.2		100/0.2	12	...	...	...	...		W	NON-CRYSTALLINE ROCK PHYLLITE	43.5
280	279.4	58.5	100/0.1		100/0.1	13	...	...	...	...		W	NON-CRYSTALLINE ROCK PHYLLITE Boring Terminated with Standard Penetration Test Refusal at Elevation 292.0 ft IN NON CRYSTALLINE ROCK (PHYLLITE)	43.5
													Notes 1) Auger refusal at 43.5'	

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones								
SITE DESCRIPTION Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005							GROUND WTR (ft)							
BORING NO. EB1-C		STATION 301+21		OFFSET CL		ALIGNMENT -L-	0 HR. 26.0							
COLLAR ELEV. 335.5 ft		TOTAL DEPTH 43.5 ft		NORTHING 449,386		EASTING 1,758,792								
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic								
DRILLER D. Tignor		START DATE 03/02/15		COMP. DATE 03/03/15		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				
340	335.5	0.0	1	2	3	5	...	...	...	...		M	GROUND SURFACE COASTAL PLAIN Brown, fine to coarse SAND (A-2-4) with tree roots	0.0
335	332.0	3.5	4	10	10	10	...	...	...	...		W	Tan, fine to coarse SAND (A-2-4) with little clay and quartz gravel	2.0
330	327.0	8.5	4	6	11	11	...	...	...	...		M	White and orange, fine to coarse clayey SAND (A-2-7) with little quartz gravel	7.0
325	322.0	13.5	5	8	9	9	...	...	...	...		M		13.5
320	317.0	18.5	3	3	5	5	...	...	...	...		W		18.5
315	312.0	23.5	4	7	8	8	...	...	...	...		W		23.5
310	307.0	28.5	14	29	31	31	...	...	...	...		D		28.5
305	302.0	33.5	28	50	50/0.4	31	...	...	...	...		D		33.5
300	297.0	38.5	38	60/0.1	60/0.1	32	...	...	...	...		W		38.5
295	292.0	43.5	60/0		60/0	33	...	...	...	...		W		43.5
													Notes 1) Auger refusal at 43.5'	

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005							GROUND WTR (ft)									
BORING NO. EB2-A-LL		STATION 302+52		OFFSET 70 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 336.5 ft		TOTAL DEPTH 48.5 ft		NORTHING 449,515		EASTING 1,758,863										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/04/15		COMP. DATE 03/04/15		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						
340																
335	336.5	0.0	WOH	2	2											
	333.0	3.5		3	3											
330																
	328.0	8.5		8	12	18										
325																
	323.0	13.5		7	9	13										
320																
	318.0	18.5		3	5	14										
315																
	313.0	23.5		7	8	11										
310																
	308.0	28.5		5	5	8										
305																
	303.0	33.5		22	50	50/0.2										
300																
	298.0	38.5		25	52	60/0.1										
295																
	293.0	43.5		60/0												
290																
	288.0	48.5		60/0												

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005							GROUND WTR (ft)									
BORING NO. EB2-C		STATION 302+50		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 329.9 ft		TOTAL DEPTH 43.5 ft		NORTHING 449,456		EASTING 1,758,900										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/03/15		COMP. DATE 03/03/15		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						
330	329.9	0.0	1	1	1											
	326.4	3.5	2	4	4											
325																
	321.4	8.5	5	7	10											
320																
	316.4	13.5	4	10	13											
315																
	311.4	18.5	5	8	12											
310																
	306.4	23.5	8	14	20											
305																
	301.4	28.5	12	24	37											
300																
	296.4	33.5	63	100/0.2												
295																
	291.4	38.5	60/0													
290																
	286.4	43.5	60/0													

NCDOT BORE DOUBLE R-3421B\_BRIDGES.GPJ\_NC\_DOT.GDT 8/19/15

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones											
SITE DESCRIPTION Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005							GROUND WTR (ft)										
BORING NO. EB2-B-RL		STATION 302+45		OFFSET 70 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 324.3 ft		TOTAL DEPTH 39.6 ft		NORTHING 449,395		EASTING 1,758,935											
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/05/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/03/15		COMP. DATE 03/03/15		SURFACE WATER DEPTH 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)			
325	324.3	0.0												324.3	0.0	GROUND SURFACE	
			1	1	2								M	322.3	2.0	<b>COASTAL PLAIN</b> Brown and red mottled, fine to coarse SAND (A-2-4), trace silt, some roots	
320	320.8	3.5	1	1	1								W			Tan, white and orange, fine to coarse clayey SAND (A-2-6), trace roots	
													W				
315	315.8	8.5	3	4	5												
310	310.8	13.5	2	3	6								M	312.3	12.0	<b>RESIDUAL</b> Orange, dark gray and greenish gray, SILT (A-4) with rock fragments	
													M				
305	305.8	18.5	9	11	12								M				
													M				
300	300.8	23.5	10	12	17								M				
295	295.8	28.5	29	100/0.3										295.3	29.0	<b>WEATHERED ROCK</b> Greenish gray, PHYLLITE	
290	290.8	33.5	60/0.1											290.8	33.5	<b>NON-CRYSTALLINE ROCK</b> Greenish gray, PHYLLITE	
285	285.8	38.5	60/0.1											284.7	39.6	Boring Terminated with Standard Penetration Test Refusal at Elevation 284.7 ft IN NON CRYSTALLINE ROCK (PHYLLITE)	
	284.7	39.6	60/0													Notes 1) Auger refusal at 39.6'	

NCDOT BORE DOUBLE R-3421B\_BRIDGES.GPJ\_NC\_DOT.GDT 8/19/15



**North Carolina Department of Transportation  
Division of Highways  
Materials and Test Unit  
Soils Laboratory**

T.I.P. ID NO.: R-3421B  
DESCRIPTION: Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT:	<u>34542.1.FR4</u>	COUNTY:	<u>Richmond</u>
DATE SAMPLED:	<u>3/2/15 - 3/4/15</u>	RECEIVED:	<u>3/2/15 - 3/4/15</u>
SAMPLED FROM:	<u>L</u>	REPORTED:	<u>3/2/15 - 3/4/15</u>
SUBMITTED BY:	<u>B. Howey, P.E.</u>	BY:	<u>D. Jenks</u> Cert No. 101-02-0603

**TEST RESULTS**

PROJ. SAMPLE NO.	SS-8	SS-18	SS-35													
BORING NO.	EB1-A LL	EB1-C	EB2-C													
Retained #4 Sieve %	0.0	3.3	0.0													
Passing #10 Sieve %	100.0	95.4	100.0													
Passing #40 Sieve %	97.8	94.5	99.4													
Passing #200 Sieve %	87.3	79.9	86.3													

SOIL MORTAR - 100%																
Coarse Sand Ret - #60 %	4.2	2.0	1.6													
Fine Sand Ret - #270 %	11.3	25.5	25.9													
Silt 0.053 - 0.010 mm %	43.8	41.3	50.6													
Clay < 0.010 mm %	40.7	31.2	21.9													
L.L.	70	52	46													
P.L.	41	27	37													
P.I.	29	25	9													
AASHTO Classification	A-7-5 (32)	A-7-6 (21)	A-5 (11)													
Station	-L- 301+27	-L- 301+21	-L- 302+50													
Offset	70 ft LT	CL	CL													
Depth (ft)	33.5	23.5	18.5													
to	35.0	25.0	20.0													
Moisture Content (%)	37.5	32.4	24.2													
Organic Content (%)	NT	NT	NT													

NP=Not plastic  
NT=Not tested  
ND = Not Determined  
CL = Centerline

W.P. Alton, PE  
Soils Engineer

T.I.P. ID NO.: R-3421B

DESCRIPTION: Dual Bridges (No. 244 and 245) on US 220 Bypass over SR 1005

<i>EB1-B RL</i>		<b>SOIL TEST RESULTS</b>													
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-674	65RT	301 +23	4.00-5.50	A-2-6(1)	31	16	55.9	18.7	5.2	20.3	88	53	24	-	-
SS-675	65RT	301 +23	9.00-10.50	A-7-6(12)	60	39	37.2	18.3	4.0	40.6	99	79	45	-	-
SS-676	65RT	301 +23	14.00-15.50	A-2-7(4)	52	31	54.4	13.6	4.7	27.4	96	58	32	-	-
SS-677	65RT	301 +23	19.00-20.50	A-2-7(2)	60	32	63.8	10.8	3.1	22.3	96	59	25	-	-
SS-678	65RT	301 +23	24.00-25.50	A-7-5(69)	104	59	1.8	6.1	23.1	69.0	100	99	94	-	-
SS-679	65RT	301 +23	29.00-30.50	A-7-6(61)	83	61	5.5	8.7	29.0	56.8	100	97	90	-	-
SS-680	65RT	301 +23	34.00-35.50	A-7-6(42)	66	39	1.2	13.6	44.6	40.6	100	99	94	-	-





**1. View looking Northeast along -L- across -Y5- from EB1 to EB2.**



**2. View looking Northwest along End Bent 1. -Y5- (SR 1005) to the Right.**



**3. View looking Northeast along End Bent 2. -Y5- (SR 1005) to the left.**





REFERENCE: R-3421B

PROJECT: 34542

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY RICHMOND  
PROJECT DESCRIPTION US 220 BYPASS FROM 0.3 MILES S OF  
SR 1140 (OLD CHARLOTTE HWY) TO 0.2 MILES SW OF  
SR 1304 (HARRINGTON RD)  
SITE DESCRIPTION CULVERT AT -L- STA. 236+33.6  
ON US-73/74 OVER CARTLEDGE CREEK TRIBUTARY 1

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-6	BORING LOGS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-3421B	1	6

**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.

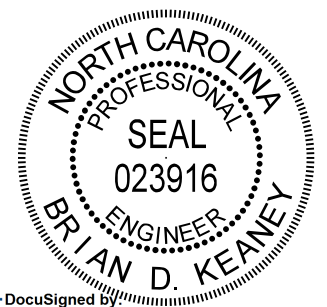
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE CONTRACTOR 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:
1. 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.
  2. 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.

PERSONNEL

- B. KEANEY
- B. HOWEY
- C. JONES
- C. MYERS
- M. JOHNSON
- R. DeLOST
- M. MORGAN

**HDR ENGINEERING, INC.**  
INVESTIGATED BY ICA, INC.  
DRAWN BY CGM  
CHECKED BY BDK  
SUBMITTED BY HDR ENGINEERING, INC.  
DATE 9/2015



DocuSigned by:  
*Brian D. Keaney*

79CD97E4882C436... 10/1/2015  
SIGNATURE DATE

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

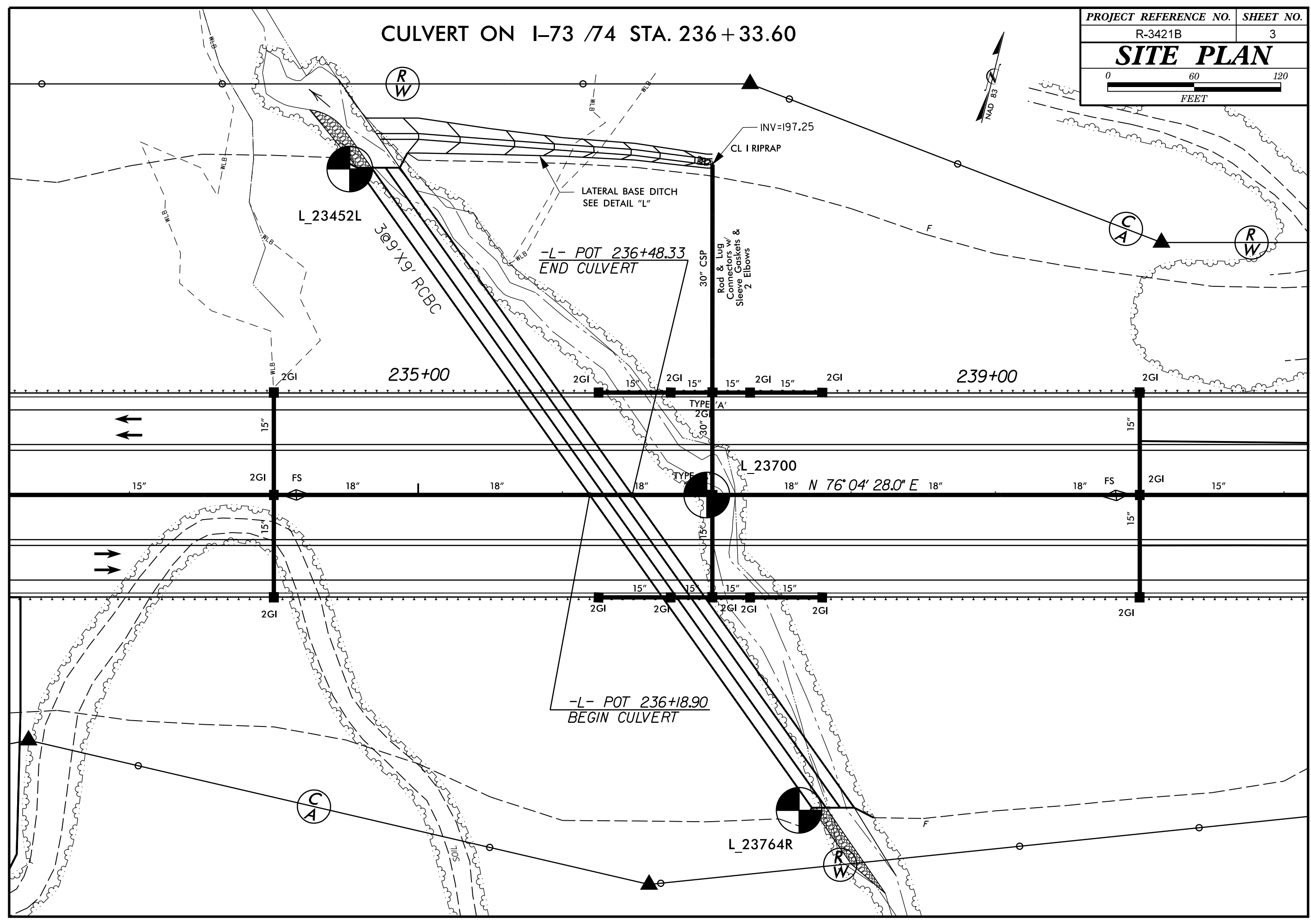
## SUBSURFACE INVESTIGATION

### SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION		GRADATION			ROCK DESCRIPTION		TERMS AND DEFINITIONS																																																																																																																																																																
<p>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></p>		<p>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.</p>			<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 DISLOADED 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 (ROQ)</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>SLICKENISES</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 (SROQ)</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>																																																																																																																																																																
<p><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-7</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th></th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1-a</td> <td>A-1-b</td> <td>A-2-4</td> <td>A-2-5</td> <td>A-2-6</td> <td>A-2-7</td> <td>A-4</td> <td>A-5</td> <td>A-6</td> <td>A-7</td> <td></td> <td></td> </tr> <tr> <td>SYMBOL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>% PASSING #10 #40 #200</td> <td>50 30 15</td> <td>30 25 10</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>40 10 5</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> </tr> <tr> <td>MATERIAL PASSING #40</td> <td>LL</td> <td>PI</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>GROUP INDEX</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. 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ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p><b>COMPRESSIBILITY</b> SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p> <p><b>PERCENTAGE OF MATERIAL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>&gt; 10%</td> <td>&gt; 20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table> <p><b>GROUND WATER</b></p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p> <p><b>MISCELLANEOUS SYMBOLS</b></p> <p> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p> SOIL SYMBOL</p> <p> ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p> INFERRED SOIL BOUNDARY</p> <p> INFERRED ROCK LINE</p> <p> ALLUVIAL SOIL BOUNDARY</p> <p> DIP &amp; DIP DIRECTION OF ROCK STRUCTURES</p> <p> TEST BORING</p> <p> AUGER BORING</p> <p> CORE BORING</p> <p> MONITORING WELL</p> <p> PIEZOMETER INSTALLATION</p> <p> SLOPE INDICATOR INSTALLATION</p> <p> CONE PENETROMETER TEST</p> <p> SOUNDING ROD</p> <p> TEST BORING WITH CORE</p> <p> SPT N-VALUE</p>				GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	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	<p><b>TEXTURE OR GRAIN SIZE</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>U.S. STD. 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# CULVERT ON I-73 /74 STA. 236 + 33.60

PROJECT REFERENCE NO.	SHEET NO.
R-3421B	3
<b>SITE PLAN</b>	



L\_23452L

3 @ 9' X 9' RCBC

-L- POT 236+48.33  
END CULVERT

30" CSP  
Rod & Lug  
Connectors w/  
Sleeve Gaskets &  
2 Elbows

INV=197.25  
CL I RIPRAP

LATERAL BASE DITCH  
SEE DETAIL "L"

235+00

239+00

TYPE 'A'

L 23700

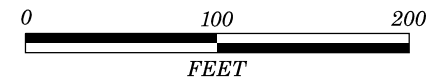
18" N 76° 04' 28.0" E 18"

-L- POT 236+18.90  
BEGIN CULVERT

L\_23764R

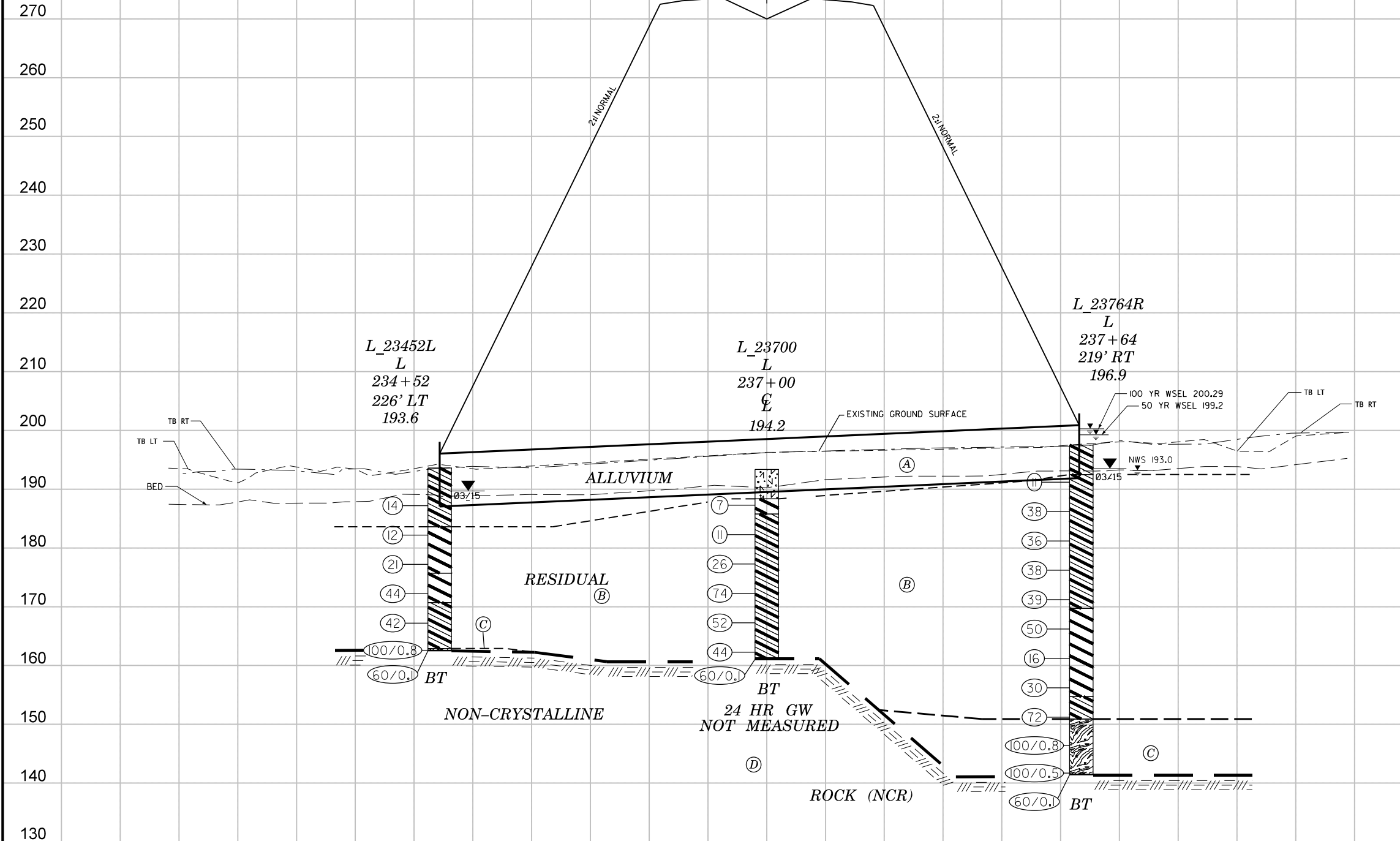


# PROFILE ALONG CULVERT CENTERLINE



<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
R-3421B	4
<b>PROFILE ALONG CULVERT CENTERLINE</b>	

STA. 236+33.6 -L-  
 ELEV. 273.379  
 SKEW 55  
 PROP. 3' x 9' RCBC  
 w/ SILLS



**NOTES:**  
 BORING LOCATION AND OFFSET ARE RELATIVE TO CENTERLINE -L-  
 GROUND LINE PROFILE OF CULVERT TAKEN FROM CULVERT SURVEY & HYDRAULIC  
 DESIGN REPORT DATED 8/10/2015.  
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS  
 WITH THE THREE PROJECTED ONTO THE PROFILE

- (A) TAN AND GRAY/BROWN, STIFF, SILTY SANDY CLAY (A-6) WITH ROOTS AND GRAVEL, MICACEOUS, MOIST TO WET, ALLUVIAL
- (B) ORANGE, TAN AND GRAY-GREEN, M. STIFF TO HARD, SANDY CLAY (A-6) TO SILTY CLAY (A-7-5) WITH ROCK FRAGMENTS, MICACEOUS, SAPROLITIC, MOIST TO WET, RESIDUAL
- (C) PHYLLITE, WEATHERED ROCK
- (D) PHYLLITE, NON-CRYSTALLINE ROCK



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST R. DeLost										
SITE DESCRIPTION US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304							GROUND WTR (ft)									
BORING NO. L_23452L		STATION 234+52		OFFSET 226 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 193.6 ft		TOTAL DEPTH 31.1 ft		NORTHING N/A		EASTING N/A										
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER M. Morgan		START DATE 03/22/15		COMP. DATE 03/25/15		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						
195														193.6	0.0	GROUND SURFACE
190	188.2	5.4	3	9	5								M			ALLUVIAL Red and tan, fine to coarse sandy CLAY (A-6)(7) with little silt, micaceous
185	183.2	10.4	4	5	7								M			RESIDUAL Orange, tan and red, silty CLAY (A-7-6), saprolitic, micaceous
180	178.2	15.4	5	6	15								M			RESIDUAL Orange, tan, and black, silty CLAY (A-7-5) with rock fragments, micaceous, saprolitic
175	173.2	20.4	17	20	24								M			RESIDUAL Orange, tan, black, and olive, coarse sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
170	168.2	25.4	8	11	31								M			RESIDUAL Orange, tan, black, and olive, coarse sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
165			26	74/0.3									M			WEATHERED ROCK PHYLLITE
			60/0.1										M			NON-CRYSTALLINE ROCK PHYLLITE
																Notes 1) Auger refusal at 31'

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST R. DeLost										
SITE DESCRIPTION US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304							GROUND WTR (ft)									
BORING NO. L_23700		STATION 237+00		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 194.2 ft		TOTAL DEPTH 32.3 ft		NORTHING N/A		EASTING N/A										
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER M. Morgan		START DATE 03/23/15		COMP. DATE 03/23/15		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						
195														194.2	0.0	GROUND SURFACE
190	189.1	5.1	2	3	4								W			ALLUVIAL Tan and gray, silty CLAY (A-6) with gravel
185	184.1	10.1	5	5	6								M			RESIDUAL Tan, orange, green and gray, silty CLAY (A-7-5), micaceous, saprolitic
180	179.1	15.1	12	14	12								M			RESIDUAL Gray, green, tan and white, fine sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
175	174.1	20.1	29	38	36								M			RESIDUAL Gray, green, tan and white, fine sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
170	169.1	25.1	14	24	28								M			RESIDUAL Gray, green, tan and white, fine sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
165	164.1	30.1	8	16	28								M			RESIDUAL Gray, green, tan and white, fine sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
	162.0	32.2	60/0.1										M			NON-CRYSTALLINE ROCK PHYLLITE
																Notes Boring Terminated with Standard Penetration Test Refusal at Elevation 161.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST R. DeLost										
SITE DESCRIPTION US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304							GROUND WTR (ft)									
BORING NO. L_23764R		STATION 237+64		OFFSET 219 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 196.9 ft		TOTAL DEPTH 56.1 ft		NORTHING N/A		EASTING N/A										
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER M. Morgan		START DATE 03/25/15		COMP. DATE 03/25/15		SURFACE WATER DEPTH 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)		
200														196.9	0.0	GROUND SURFACE
195														191.9	5.0	ALLUVIAL Tan and orange, silty sandy CLAY (A-6) with gravel, micaceous
190	191.6	5.3	5	5	6											RESIDUAL Orange, tan, gray and green, fine sandy silty CLAY (A-6) with rock fragments, micaceous, saprolitic
185	186.6	10.3	16	18	20											
180	181.6	15.3	14	17	19											
175	176.6	20.3	16	21	17											
170	171.6	25.3	13	18	21											
165	166.6	30.3	18	24	26									169.1	27.8	Gray, tan, orange and black, silty CLAY (A-7-5) with rock fragments, saprolitic
160	161.6	35.3	5	7	9											
155	156.6	40.3	8	13	17											
150	151.6	45.3	15	18	54									154.1	42.8	Olive, tan and white, silty coarse sandy CLAY (A-6) with rock fragments, micaceous, saprolitic
145			47	53/0.3										150.3	46.6	WEATHERED ROCK PHYLLITE
														140.9	56.0	NON-CRYSTALLINE ROCK PHYLLITE
														140.8	56.1	NON-CRYSTALLINE ROCK PHYLLITE Boring Terminated with Standard Penetration Test Refusal at Elevation 140.8 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT BORE DOUBLE TEST.GPJ NC\_DOT.GDT 9/29/15

REFERENCE: R-3421B

PROJECT: 34542

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY RICHMOND  
PROJECT DESCRIPTION US 220 BYPASS FROM 0.3 MILES S OF  
SR 1140 (OLD CHARLOTTE HWY) TO 0.2 MILES SW OF  
SR 1304 (HARRINGTON RD)  
SITE DESCRIPTION BRIDGE NO. 243 OVER US 220 BYPASS (-L-)  
ON SR 1140 (-Y3- STA. 140+97.00)  
RETAINING WALLS #1 AND #2

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-5	PROFILE
6-9	BORING LOGS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-3421B	1	9

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.

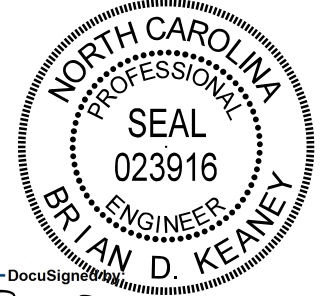
THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT 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:
1. 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.
  2. 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.

PERSONNEL

- B. KEANEY
- B. HOWEY
- C. JONES
- C. MYERS
- M. JOHNSON
- M. COOGAN
- D. TIGNOR

**HDR ENGINEERING, INC.**  
 INVESTIGATED BY F & R, INC., MAD  
 DRAWN BY CGM /D. CHAPMAN  
 CHECKED BY BDK  
 SUBMITTED BY HDR ENGINEERING, INC.  
 DATE 9/2015



DocuSign  
 Brian D. Keaney

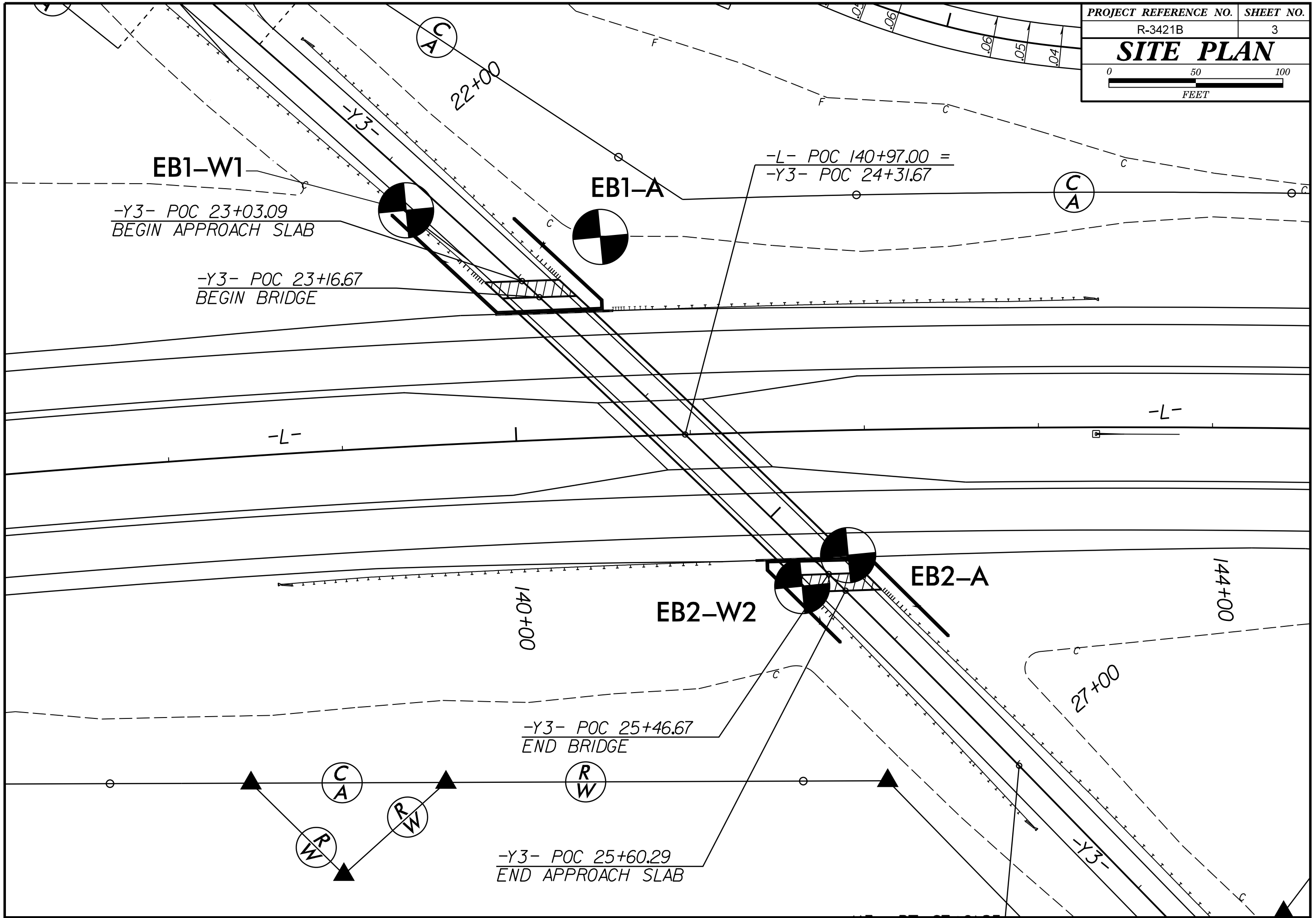
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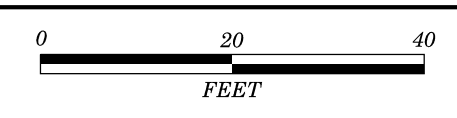
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SIGNATURE DATE

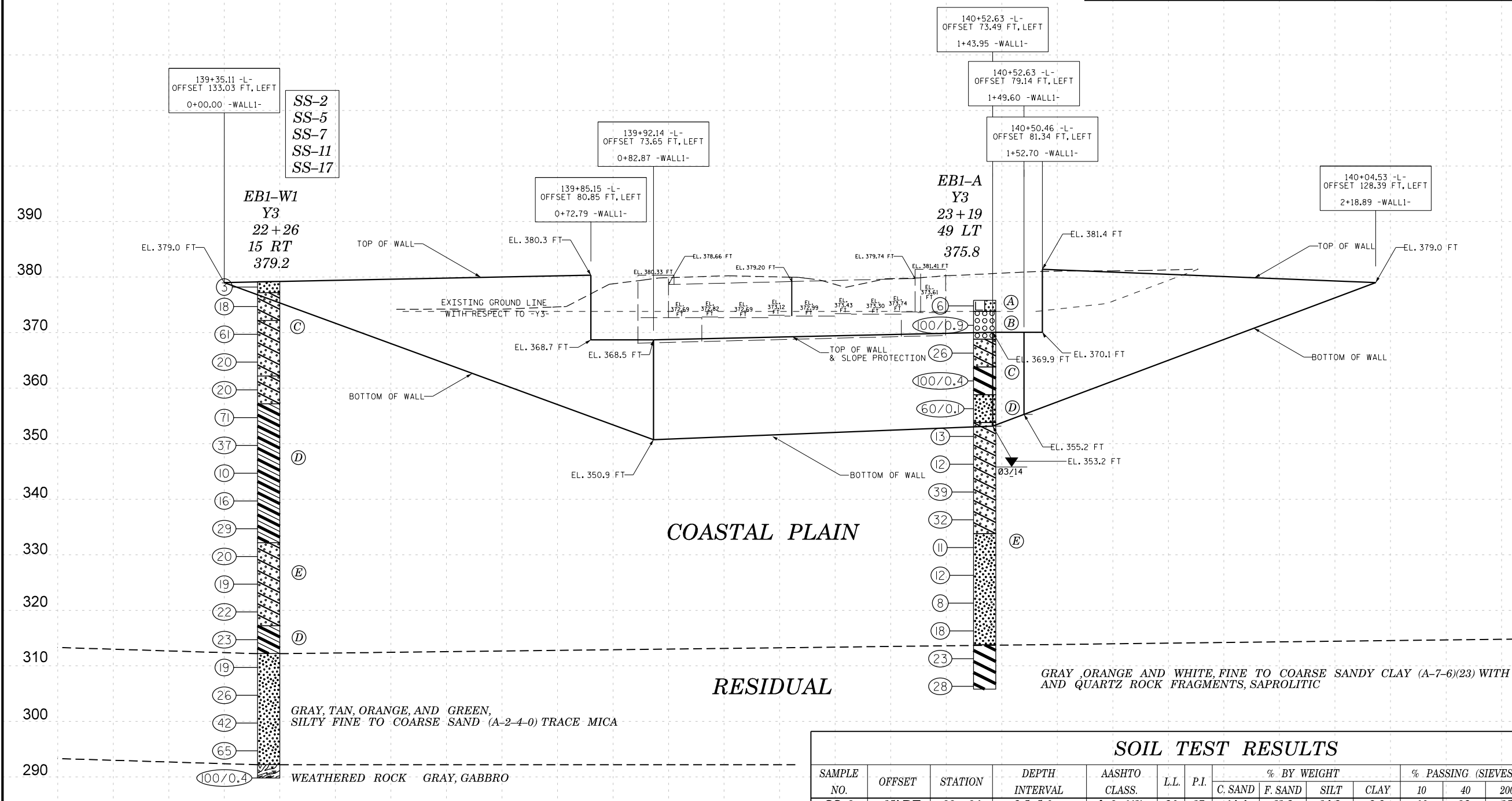
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
**SUBSURFACE INVESTIGATION**  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																																																																						
<p>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></p>										<p>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.</p>										<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>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - 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. ARTESIAN - 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. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - 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. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - 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. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - 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. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - 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. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																						
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERED ROCK (WR)										NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.																																																																																																																																																						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>GENERAL CLASS.</th> <th colspan="5">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th> <th colspan="5">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="5">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-2-4</th> <th>A-2-5</th> <th>A-2-6</th> <th>A-2-7</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>% PASSING #10 #40 #200</th> <td>50 MX 30 MX 15 MX</td> <td>50 MX 25 MX</td> <td>51 MN 35 MX 35 MX</td> <td>40 MX 35 MX</td> <td>41 MN 35 MX</td> <td>41 MN 35 MX</td> <td>41 MN 35 MX</td> <td>40 MX 36 MN</td> <td>41 MN 36 MN</td> <td>40 MX 36 MN</td> <td>41 MN 36 MN</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td>MUCK, PEAT</td> </tr> <tr> <th>MATERIAL PASSING #40 LL PI</th> <td colspan="11"></td> <td colspan="2">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td colspan="2">HIGHLY ORGANIC SOILS</td> </tr> <tr> <th>GROUP INDEX</th> <td colspan="11"></td> <td colspan="2">0</td> <td colspan="2">0</td> </tr> <tr> <th>USUAL TYPES OF MAJOR MATERIALS</th> <td colspan="2">STONE FRAGS. GRAVEL, AND SAND</td> <td colspan="2">FINE SAND</td> <td colspan="2">SILTY OR CLAYEY GRAVEL AND SAND</td> <td colspan="2">SILTY SOILS</td> <td colspan="2">CLAYEY SOILS</td> <td colspan="5"></td> </tr> <tr> <th>GEN. RATING AS SUBGRADE</th> <td colspan="5">EXCELLENT TO GOOD</td> <td colspan="5">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> </tr> <tr> <td colspan="16" style="text-align: center;">PI OF A-7-5 SUBGROUP IS &lt;= LL - 30 ; PI OF A-7-6 SUBGROUP IS &gt; LL - 30</td> </tr> </table>										GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)					ORGANIC MATERIALS					GROUP CLASS.	A-1	A-3	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	SYMBOL																% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 35 MX 35 MX	40 MX 35 MX	41 MN 35 MX	41 MN 35 MX	41 MN 35 MX	40 MX 36 MN	41 MN 36 MN	40 MX 36 MN	41 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT	MATERIAL PASSING #40 LL PI												SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS		GROUP INDEX												0		0		USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS							GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD					FAIR TO POOR					FAIR TO POOR	POOR	UNSATURABLE	PI OF A-7-5 SUBGROUP IS <= LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30																<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										<p>CRYSTALLINE ROCK (CR)</p> <p>NON-CRYSTALLINE ROCK (NCR)</p> <p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p>																			
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<p>DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p>																																																																																																																																																																																				





PROJECT REFERENCE NO.	SHEET NO.
R-3421B	4
RETAINING WALL #1 END BENT #1	

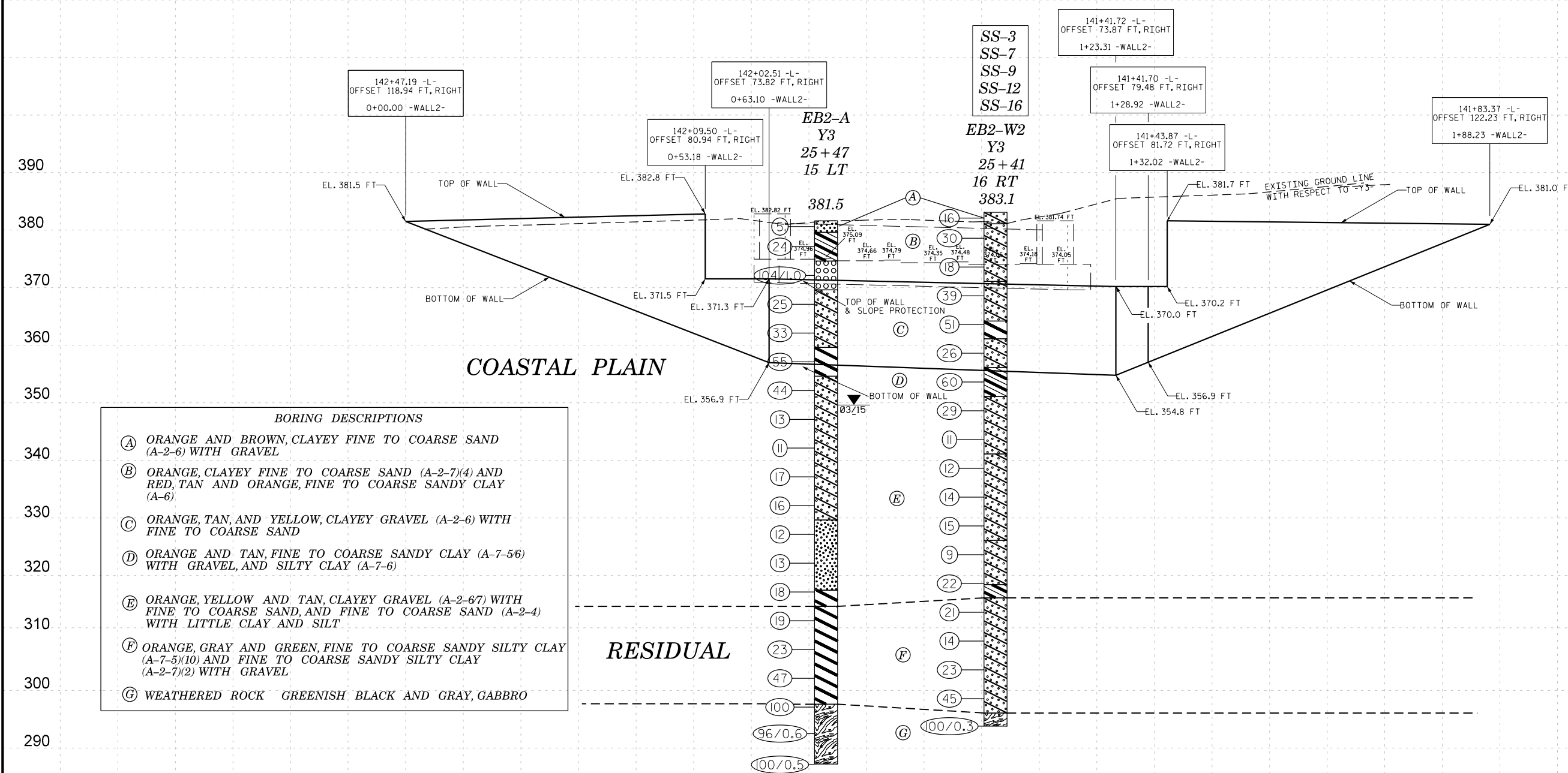
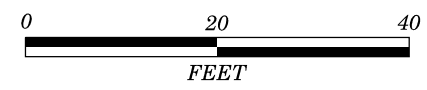


- BORING DESCRIPTIONS**
- (A) ROADWAY EMBANKMENT BROWN AND RED, FINE TO COARSE SAND (A-2-4) WITH LITTLE CLAY AND GRAVEL
  - (B) WHITE AND RED, FINE TO COARSE GRAVELLY SAND AND GRAVEL (A-1-B)
  - (C) ORANGE, TAN, GRAY AND BROWN, SILTY CLAYEY FINE TO COARSE SAND (A-2-67) AND SILTY FINE TO COARSE SAND (A-2-5)
  - (D) WHITE, RED, PINK, AND ORANGE, FINE TO COARSE SANDY CLAY (A-6) AND FINE SANDY CLAY (A-7-6)
  - (E) TAN, ORANGE, GRAY, AND WHITE, FINE TO COARSE CLAYEY SAND (A-2-7) AND FINE TO COARSE SAND (A-2-4)

**SOIL TEST RESULTS**

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	LL	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-2	15' RT	22+26	3.5-5.0	A-2-6(1)	30	17	64.4	11.3	14.3	9.9	60	28	15		
SS-5	15' RT	22+26	18.5-20.0	A-2-7(5)	59	23	58.7	10.2	3.0	28.1	96	56	31		
SS-7	15' RT	22+26	28.5-30.0	A-6(3)	40	20	50.6	13.1	10.6	25.7	97	58	37		
SS-11	15' RT	22+26	48.5-50.0	A-2-7(4)	50	21	71.9	7.3	4.9	15.9	90	33	20		
SS-17	15' RT	22+26	78.5-80.0	A-2-4(0)	NP	NP	32.9	47.9	16.3	2.9	87	72	23		

R-3421B01 EB 1 & WALL 1:  
VIEWED DOWN STATION, WITH WALL UNFOLDED



**BORING DESCRIPTIONS**

(A) ORANGE AND BROWN, CLAYEY FINE TO COARSE SAND (A-2-6) WITH GRAVEL

(B) ORANGE, CLAYEY FINE TO COARSE SAND (A-2-7)(4) AND RED, TAN AND ORANGE, FINE TO COARSE SANDY CLAY (A-6)

(C) ORANGE, TAN, AND YELLOW, CLAYEY GRAVEL (A-2-6) WITH FINE TO COARSE SAND

(D) ORANGE AND TAN, FINE TO COARSE SANDY CLAY (A-7-5/6) WITH GRAVEL, AND SILTY CLAY (A-7-6)

(E) ORANGE, YELLOW AND TAN, CLAYEY GRAVEL (A-2-6/7) WITH FINE TO COARSE SAND, AND FINE TO COARSE SAND (A-2-4) WITH LITTLE CLAY AND SILT

(F) ORANGE, GRAY AND GREEN, FINE TO COARSE SANDY SILTY CLAY (A-7-5)(10) AND FINE TO COARSE SANDY SILTY CLAY (A-2-7)(2) WITH GRAVEL

(G) WEATHERED ROCK GREENISH BLACK AND GRAY, GABBRO

**SOIL TEST RESULTS**

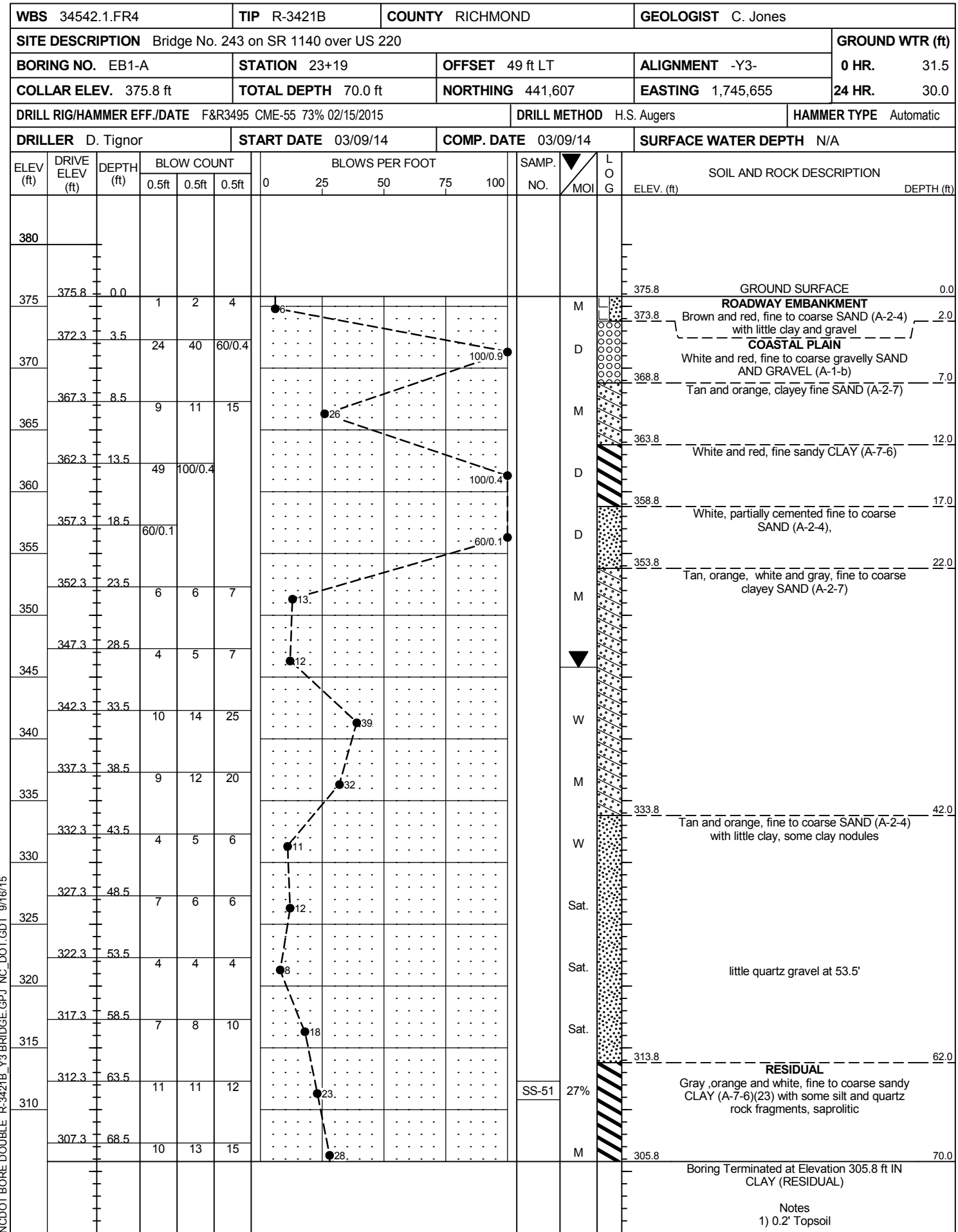
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							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-3	29' RT	24+82	8.5-10.0	A-2-7(4)	57	27	48.0	12.4	7.8	31.8	84	56	34		
SS-7	29' RT	24+82	28.5-30.0	A-6(10)	36	21	3.7	28.8	36.8	30.6	100	99	76		
SS-9	29' RT	24+82	38.5-40.0	A-2-6(1)	37	20	61.2	16.8	3.4	18.6	98	57	23		
SS-12	29' RT	24+82	53.5-55.0	A-2-7(3)	42	17	64.7	12.7	4.9	17.7	83	43	20		
SS-16	29' RT	24+82	73.5-75.0	A-2-7(2)	51	33	38.3	14.6	27.2	19.9	65	45	33		

R-3421B01 EB 2 & WALL 2:  
VIEWED UP STATION, WITH WALL UNFOLDED





# GEOTECHNICAL BORING REPORT BORE LOG



NCDOT BORE DOUBLE R-3421B\_Y3 BRIDGE.GPJ NC\_DOT.GDT 9/16/15

Notes  
1) 0.2' Topsoil

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 25+47		OFFSET 15 ft LT		ALIGNMENT -Y3-										
COLLAR ELEV. 381.5 ft		TOTAL DEPTH 94.4 ft		NORTHING 441,721		EASTING 1,745,856										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/15/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/04/15		COMP. DATE 03/05/15		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
385																
	381.5	0.0	2	3	2											381.5 GROUND SURFACE 0.0
380	378.0	3.5	9	11	13								M		379.5 COASTAL PLAIN Brown, fine to coarse SAND (A-2-6) with little clay 2.9	
375	373.0	8.5	24	34	70								M		374.5 Red, tan and orange, fine to coarse sandy CLAY (A-6) 7.0	
370	368.0	13.5	11	12	13								D		374.5 White and orange, fine to coarse SAND AND GRAVEL (A-1-b) 7.0	
365	363.0	18.5	7	14	19								M		369.5 Tan, orange and red, fine to coarse clayey SAND (A-2-6) with little quartz gravel 12.0	
360	358.0	23.5	13	23	32								M		359.5 Gray and tan, silty CLAY (A-7-6) 22.0	
355	353.0	28.5	13	19	25								M		354.5 Red, purple, orange and white, fine to coarse clayey SAND (A-2-6) 27.0	
350	348.0	33.5	3	6	7								M			
345	343.0	38.5	3	5	6								W			
340	338.0	43.5	6	8	9								W			
335	333.0	48.5	6	7	9								W			
330	328.0	53.5	4	6	6								W			
325	323.0	58.5	3	5	8								Sat.		329.5 Orange, fine to coarse SAND (A-2-4) with little clay 52.0	
320	318.0	63.5	10	9	9								Sat.			
315	313.0	68.5	5	9	10								M		317.3 Black, CLAY (A-7-6) 64.2	
310	308.0	73.5	9	9	14								M		314.5 RESIDUAL Gray to greenish gray and brown, fine to coarse sandy, highly silty CLAY (A-7-5)(12) with rock fragments, saprolitic 67.0	
305													SS-16	34%		

WBS 34542.1.FR4		TIP R-3421B		COUNTY RICHMOND		GEOLOGIST C. Jones										
SITE DESCRIPTION Bridge No. 243 on SR 1140 over US 220							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 25+47		OFFSET 15 ft LT		ALIGNMENT -Y3-										
COLLAR ELEV. 381.5 ft		TOTAL DEPTH 94.4 ft		NORTHING 441,721		EASTING 1,745,856										
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 73% 02/15/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER D. Tignor		START DATE 03/04/15		COMP. DATE 03/05/15		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
305																
	303.0	78.5	15	22	25											305 Match Line
300	298.0	83.5	20	35	65/0.5								M			300 RESIDUAL Gray to greenish gray and brown, fine to coarse sandy, highly silty CLAY (A-7-5)(12) with rock fragments, saprolitic (continued) 84.0
295	293.0	88.5	36	60/0.1												295 WEATHERED ROCK Greenish black, GABBRO 84.0
290	288.0	93.5	23	100/0.5												290 Boring Terminated at Elevation 287.1 ft IN WEATHERED ROCK (GABBRO) 94.4
																Notes 1) 0.2' Topsoil 2) Strata break in split spoon at 64.2'

NCDOT BORE DOUBLE R-3421B\_Y3 BRIDGE.GPJ\_NC\_DOT.GDT 9/16/15

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> 34542.1.FR4	<b>TIP</b> R-3421B	<b>COUNTY</b> RICHMOND	<b>GEOLOGIST</b> M. Johnson
<b>SITE DESCRIPTION</b> US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-W2	<b>STATION</b> 25+41	<b>OFFSET</b> 16 ft RT	<b>ALIGNMENT</b> -Y3- 0 HR Not recorded
<b>COLLAR ELEV.</b> 383.1 ft	<b>TOTAL DEPTH</b> 89.3 ft	<b>NORTHING</b> 441,691	<b>EASTING</b> 1,745,866 24 HR. FIAD
<b>DRILL RIG/HAMMER EFF./DATE</b> MID1904 CME-45B 80% 10/14/2014		<b>DRILL METHOD</b> Mud Rotary	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> M. Coogan	<b>START DATE</b> 03/24/15	<b>COMP. DATE</b> 03/24/15	<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	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
385															
383.1	383.1	0.0		5	8	8	16							GROUND SURFACE	0.0
380	379.6	3.5		10	14	16	20						M	COASTAL PLAIN Orange, clayey fine to coarse SAND (A-2-6) with gravel	2.9
375	374.6	8.5		5	7	11	16						M	Orange, clayey fine to coarse SAND (A-2-7)(4)	
370	369.6	13.5		17	18	21	24						SS-3		
365	364.6	18.5		16	23	28	31						M	Orange and yellow, clayey GRAVEL (A-2-6) with fine to coarse sand	12.0
360	359.6	23.5		9	14	12	18						W	Orange and tan, fine to coarse sandy CLAY (A-7-5/6) with gravel	18.9
355	354.6	28.5		9	22	38	45						W	Orange, yellow and tan, clayey GRAVEL (A-2-6) with fine to coarse sand	22.0
350	349.6	33.5		12	15	14	21						SS-7	Orange and tan, fine sandy CLAY (A-6)(10)	27.0
345	344.6	38.5		6	5	6	9						W	Tan, clayey fine to coarse SAND (A-2-6)(1)	32.0
340	339.6	43.5		7	5	7	10						SS-9	Tan and orange, clayey fine to coarse SAND (A-2-7)(3)	42.0
335	334.6	48.5		5	6	8	11						W		
330	329.6	53.5		4	6	9	12						SS-12		
325	324.6	58.5		8	4	5	7						Sat.	Orange and yellow, clayey fine to coarse SAND (A-2-6)	57.0
320	319.6	63.5		7	7	15	18						Sat.	Orange, fine to coarse sandy CLAY (A-6) with gravel	64.7
315	314.6	68.5		6	10	11	14						M	<b>RESIDUAL</b> Orange, gray and green, fine to coarse sandy silty CLAY (A-2-7)(2) with rock fragments	67.0
310	309.6	73.5		7	6	8	11						SS-16		

NCDOT BORE DOUBLE R-3421B\_Y3 BRIDGE.GPJ NC\_DOT.GDT 9/23/15

<b>WBS</b> 34542.1.FR4	<b>TIP</b> R-3421B	<b>COUNTY</b> RICHMOND	<b>GEOLOGIST</b> M. Johnson
<b>SITE DESCRIPTION</b> US 220 Bypass from 0.3 miles south of SR 1140 to 0.2 miles SW of SR 1304			<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB2-W2	<b>STATION</b> 25+41	<b>OFFSET</b> 16 ft RT	<b>ALIGNMENT</b> -Y3- 0 HR Not recorded
<b>COLLAR ELEV.</b> 383.1 ft	<b>TOTAL DEPTH</b> 89.3 ft	<b>NORTHING</b> 441,691	<b>EASTING</b> 1,745,866 24 HR. FIAD
<b>DRILL RIG/HAMMER EFF./DATE</b> MID1904 CME-45B 80% 10/14/2014		<b>DRILL METHOD</b> Mud Rotary	<b>HAMMER TYPE</b> Automatic
<b>DRILLER</b> M. Coogan	<b>START DATE</b> 03/24/15	<b>COMP. DATE</b> 03/24/15	<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	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
305	304.6	78.5														
300	299.6	83.5		14	20	25	30						M	<b>RESIDUAL</b> Orange, gray and green, fine to coarse sandy silty CLAY (A-2-7)(2) with rock fragments (continued)		
295	294.6	88.5		35	100	0.3							M	<b>WEATHERED ROCK</b> Gray, GABBRO	89.3	
													M	Boring Terminated at Elevation 293.8 ft IN WEATHERED ROCK (GABBRO)		
															Notes 1) 0.1' Topsoil	

NCDOT BORE DOUBLE R-3421B\_Y3 BRIDGE.GPJ NC\_DOT.GDT 9/23/15