

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4758	1	21

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 38530.1.1 (B-4758) F.A. PROJ. BRZ-2824(5)
COUNTY Guilford
PROJECT DESCRIPTION Bridge No. 159 on SR 2824 (Creekview Road)
over North Buffalo Creek

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	TEST SITE PLAN
4	PROFILE
5-8	CROSS SECTIONS
9-19	BORELOGS , CORELOGS, CORE PHOTOS
20	ROCK TEST RESULTS
21	SITE PHOTOGRAPHS

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL

C. Manning

J. Gilchrist

M. Renza

D. Pennington

INVESTIGATED BY F&R, Inc.

CHECKED BY P. Alton, P.E.

SUBMITTED BY F&R, Inc.

DATE March 2012

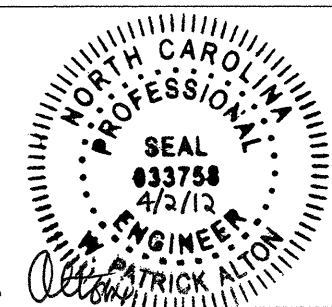
ID: B-4758

PROJECT: 38530.1.1

DRAWN BY: D. Racey

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT A RESULT OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIM FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.



Patrick Alton

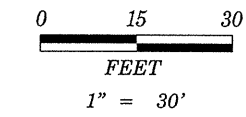
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT**

PROJECT REFERENCE NO. B-4758	SHEET NO. 2
---------------------------------	----------------

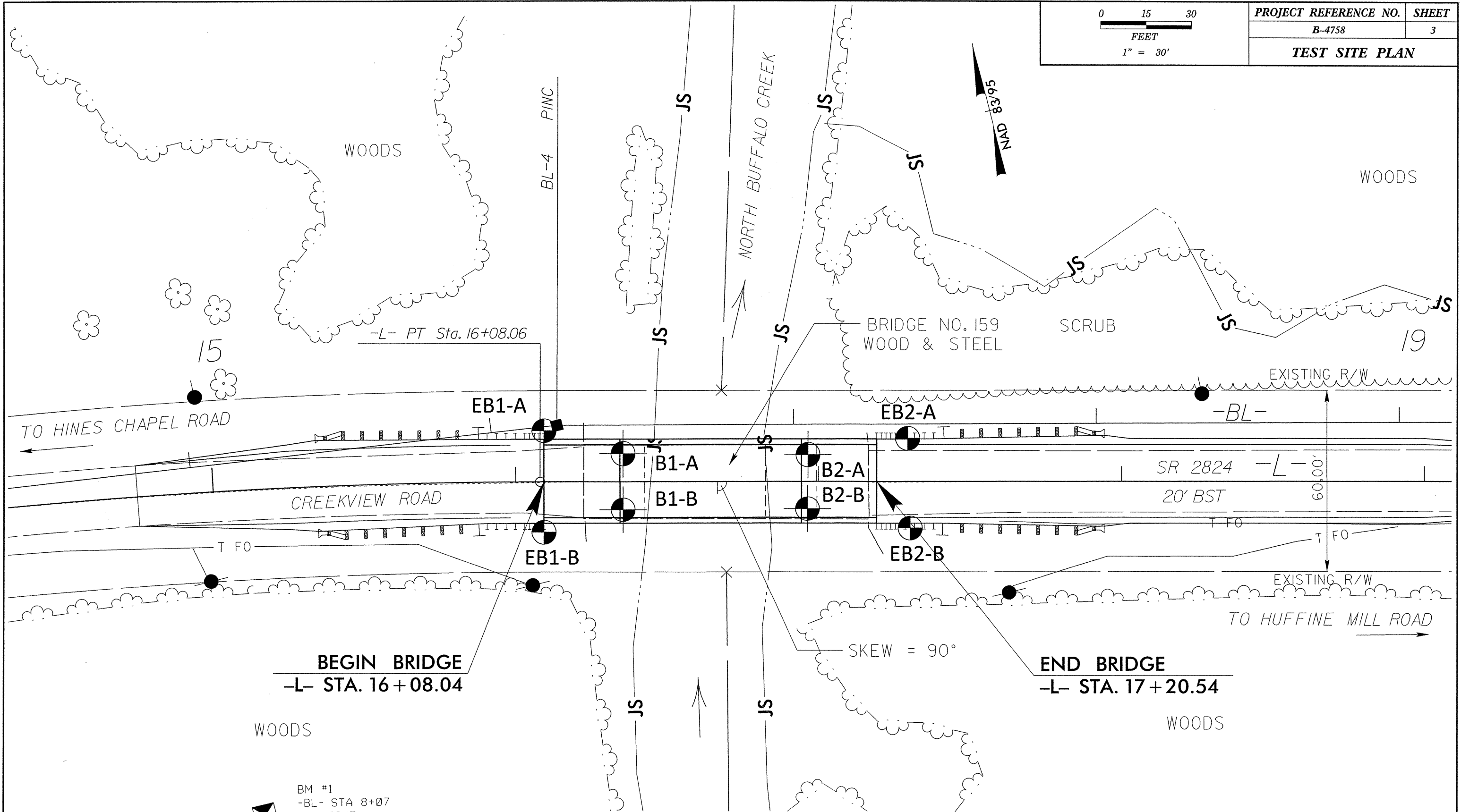
SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION			GRADATION			ROCK DESCRIPTION			TERMS AND DEFINITIONS																																																																																				
<p>SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T200, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRM, SILTY CLM, 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. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>			<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, 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, 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 (ROQ) - 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.</p>																																																																																				
<p>SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1"> <tr> <th>GENERAL CLASS.</th> <th>GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th>SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th>ORGANIC MATERIALS</th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1, A-2, A-3, A-4, A-5, A-6, A-7</td> <td>A-1, A-2, A-3, A-4, A-5, A-6, A-7</td> <td>A-4, A-5, A-6, A-7</td> </tr> <tr> <td>SYMBOL</td> <td>[Patterns]</td> <td>[Patterns]</td> <td>[Patterns]</td> </tr> <tr> <td>% PASSING</td> <td>10, 20, 40, 60, 80, 100</td> <td>10, 20, 40, 60, 80, 100</td> <td>10, 20, 40, 60, 80, 100</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>6, 10, 15, 20, 25, 30, 35, 40, 45, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> </tr> <tr> <td>PLASTIC INDEX</td> <td>0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> </tr> <tr> <td>GROUP INDEX</td> <td>0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> <td>10, 15, 20, 25, 30, 35, 40, 45, 50</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS, GRAVEL, AND SAND</td> <td>FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS, CLAYEY SOILS</td> </tr> <tr> <td>GENERAL RATING AS A SUBGRADE</td> <td>EXCELLENT TO GOOD</td> <td>FAIR TO POOR</td> <td>FAIR TO POOR, POOR, UNSUITABLE</td> </tr> </table>			GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)	SILT-CLAY MATERIALS (> 35% PASSING #200)	ORGANIC MATERIALS	GROUP CLASS.	A-1, A-2, A-3, A-4, A-5, A-6, A-7	A-1, A-2, A-3, A-4, A-5, A-6, A-7	A-4, A-5, A-6, A-7	SYMBOL	[Patterns]	[Patterns]	[Patterns]	% PASSING	10, 20, 40, 60, 80, 100	10, 20, 40, 60, 80, 100	10, 20, 40, 60, 80, 100	LIQUID LIMIT	6, 10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	PLASTIC INDEX	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	GROUP INDEX	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND	FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS, CLAYEY SOILS	GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD	FAIR TO POOR	FAIR TO POOR, POOR, UNSUITABLE	<p>MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p>COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p>PERCENTAGE OF MATERIAL</p> <table border="1"> <tr> <th>ORGANIC MATERIAL</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</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>>10%</td> <td>>20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table>			ORGANIC MATERIAL	GRANULAR SOILS	SILT-CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	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>WEATHERING FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V SLI) 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 (SLI) 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, YIELDS SPT N VALUES > 100 BPF</i> VERY SEVERE (V SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 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.</p>																															
GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)	SILT-CLAY MATERIALS (> 35% PASSING #200)	ORGANIC MATERIALS																																																																																										
GROUP CLASS.	A-1, A-2, A-3, A-4, A-5, A-6, A-7	A-1, A-2, A-3, A-4, A-5, A-6, A-7	A-4, A-5, A-6, A-7																																																																																										
SYMBOL	[Patterns]	[Patterns]	[Patterns]																																																																																										
% PASSING	10, 20, 40, 60, 80, 100	10, 20, 40, 60, 80, 100	10, 20, 40, 60, 80, 100																																																																																										
LIQUID LIMIT	6, 10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50																																																																																										
PLASTIC INDEX	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50																																																																																										
GROUP INDEX	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	10, 15, 20, 25, 30, 35, 40, 45, 50	10, 15, 20, 25, 30, 35, 40, 45, 50																																																																																										
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND	FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS, CLAYEY SOILS																																																																																										
GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD	FAIR TO POOR	FAIR TO POOR, POOR, UNSUITABLE																																																																																										
ORGANIC MATERIAL	GRANULAR SOILS	SILT-CLAY SOILS	OTHER MATERIAL																																																																																										
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE																																																																																										
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>CONSISTENCY OR DENSENESS</p> <table border="1"> <tr> <th>PRIMARY SOIL TYPE</th> <th>COMPACTNESS OR CONSISTENCY</th> <th>RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)</th> <th>RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)</th> </tr> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESIVE)</td> <td>VERY LOOSE, LOOSE, MEDIUM DENSE, DENSE, VERY DENSE</td> <td><4, 4 to 10, 10 to 30, 30 to 50, >50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT, SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD</td> <td><2, 2 to 4, 4 to 8, 8 to 15, 15 to 30, >30</td> <td><0.25, 0.25 to 0.50, 0.5 to 1.0, 1 to 2, 2 to 4, >4</td> </tr> </table>			PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)	GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE, LOOSE, MEDIUM DENSE, DENSE, VERY DENSE	<4, 4 to 10, 10 to 30, 30 to 50, >50	N/A	GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT, SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD	<2, 2 to 4, 4 to 8, 8 to 15, 15 to 30, >30	<0.25, 0.25 to 0.50, 0.5 to 1.0, 1 to 2, 2 to 4, >4	<p>MISCELLANEOUS SYMBOLS</p> <ul style="list-style-type: none"> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES SPT TEST BORING TEST BORING W/ CORE TEST BORING W/ VALUE SPT REFUSAL MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD 			<p>ROCK HARDNESS VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.</p>																																																																											
PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)																																																																																										
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE, LOOSE, MEDIUM DENSE, DENSE, VERY DENSE	<4, 4 to 10, 10 to 30, 30 to 50, >50	N/A																																																																																										
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT, SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD	<2, 2 to 4, 4 to 8, 8 to 15, 15 to 30, >30	<0.25, 0.25 to 0.50, 0.5 to 1.0, 1 to 2, 2 to 4, >4																																																																																										
<p>TEXTURE OR GRAIN SIZE</p> <table border="1"> <tr> <th>U.S. STD. SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.00</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CS. SD.)</th> <th>FINE SAND (F SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td>GRAIN SIZE</td> <td>MM 305, IN. 12</td> <td>75, 3</td> <td>2.0, 0.25</td> <td>0.075, 0.005</td> <td>0.075, 0.005</td> <td>0.005</td> </tr> </table>			U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270		4.76	2.00	0.42	0.25	0.075	0.053	BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)	GRAIN SIZE	MM 305, IN. 12	75, 3	2.0, 0.25	0.075, 0.005	0.075, 0.005	0.005	<p>ABBREVIATIONS</p> <table border="1"> <tr> <td>AR - AUGER REFUSAL</td> <td>CL - CLAY</td> <td>CPT - CONE PENETRATION TEST</td> <td>CSE. - COARSE</td> <td>DNT - DILATOMETER TEST</td> <td>DPT - DYNAMIC PENETRATION TEST</td> <td>F - FINE</td> <td>FOSS. - FOSSILIFEROUS</td> <td>FRAC. - FRACTURED, FRACTURES</td> <td>FRAGS. - FRAGMENTS</td> <td>HI. - HIGHLY</td> <td>MED. - MEDIUM</td> <td>MICA - MICA</td> <td>MOD. - MODERATELY</td> <td>MOD. - MODERATELY</td> <td>ORG. - ORGANIC</td> <td>PMT - PRESSUREMETER TEST</td> <td>R.E. - ROADWAY EMBANKMENT</td> <td>SAP. - SAPROLITIC</td> <td>SD. - SAND, SANDY</td> <td>SL. - SILT, SILTY</td> <td>SLI. - SLIGHTLY</td> <td>TCR - TRICONE REFUSAL</td> <td>W - MOISTURE CONTENT</td> <td>V - VERY</td> <td>VST - VANE SHEAR TEST</td> <td>WEAL - WEATHERED</td> <td>W - UNIT WEIGHT</td> <td>W_d - DRY UNIT WEIGHT</td> </tr> </table>			AR - AUGER REFUSAL	CL - CLAY	CPT - CONE PENETRATION TEST	CSE. - COARSE	DNT - DILATOMETER TEST	DPT - DYNAMIC PENETRATION TEST	F - FINE	FOSS. - FOSSILIFEROUS	FRAC. - FRACTURED, FRACTURES	FRAGS. - FRAGMENTS	HI. - HIGHLY	MED. - MEDIUM	MICA - MICA	MOD. - MODERATELY	MOD. - MODERATELY	ORG. - ORGANIC	PMT - PRESSUREMETER TEST	R.E. - ROADWAY EMBANKMENT	SAP. - SAPROLITIC	SD. - SAND, SANDY	SL. - SILT, SILTY	SLI. - SLIGHTLY	TCR - TRICONE REFUSAL	W - MOISTURE CONTENT	V - VERY	VST - VANE SHEAR TEST	WEAL - WEATHERED	W - UNIT WEIGHT	W _d - DRY UNIT WEIGHT	<p>TEXTURE OR GRAIN SIZE</p> <table border="1"> <tr> <th>U.S. STD. SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.00</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CS. SD.)</th> <th>FINE SAND (F SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td>GRAIN SIZE</td> <td>MM 305, IN. 12</td> <td>75, 3</td> <td>2.0, 0.25</td> <td>0.075, 0.005</td> <td>0.075, 0.005</td> <td>0.005</td> </tr> </table>			U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270		4.76	2.00	0.42	0.25	0.075	0.053	BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)	GRAIN SIZE	MM 305, IN. 12	75, 3	2.0, 0.25	0.075, 0.005	0.075, 0.005	0.005
U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270																																																																																							
	4.76	2.00	0.42	0.25	0.075	0.053																																																																																							
BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)																																																																																							
GRAIN SIZE	MM 305, IN. 12	75, 3	2.0, 0.25	0.075, 0.005	0.075, 0.005	0.005																																																																																							
AR - AUGER REFUSAL	CL - CLAY	CPT - CONE PENETRATION TEST	CSE. - COARSE	DNT - DILATOMETER TEST	DPT - DYNAMIC PENETRATION TEST	F - FINE	FOSS. - FOSSILIFEROUS	FRAC. - FRACTURED, FRACTURES	FRAGS. - FRAGMENTS	HI. - HIGHLY	MED. - MEDIUM	MICA - MICA	MOD. - MODERATELY	MOD. - MODERATELY	ORG. - ORGANIC	PMT - PRESSUREMETER TEST	R.E. - ROADWAY EMBANKMENT	SAP. - SAPROLITIC	SD. - SAND, SANDY	SL. - SILT, SILTY	SLI. - SLIGHTLY	TCR - TRICONE REFUSAL	W - MOISTURE CONTENT	V - VERY	VST - VANE SHEAR TEST	WEAL - WEATHERED	W - UNIT WEIGHT	W _d - DRY UNIT WEIGHT																																																																	
U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270																																																																																							
	4.76	2.00	0.42	0.25	0.075	0.053																																																																																							
BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CS. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)																																																																																							
GRAIN SIZE	MM 305, IN. 12	75, 3	2.0, 0.25	0.075, 0.005	0.075, 0.005	0.005																																																																																							
<p>SOIL MOISTURE - CORRELATION OF TERMS</p> <table border="1"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL - LIQUID LIMIT</td> <td>- SATURATED - (SAT.)</td> <td>USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PL - PLASTIC LIMIT</td> <td>- WET - (W)</td> <td>SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td>OM - OPTIMUM MOISTURE</td> <td>- MOIST - (M)</td> <td>SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td>SL - SHRINKAGE LIMIT</td> <td>- DRY - (D)</td> <td>REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> </table>			SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION	LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE	PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE	OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE	SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE	<p>EQUIPMENT USED ON SUBJECT PROJECT</p> <table border="1"> <tr> <td><input type="checkbox"/> MOBILE B-51</td> <td><input type="checkbox"/> CLAY BITS</td> <td><input checked="" type="checkbox"/> AUTOMATIC HAMMER</td> </tr> <tr> <td><input type="checkbox"/> BK-51</td> <td><input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER</td> <td><input type="checkbox"/> MANUAL HAMMER</td> </tr> <tr> <td><input type="checkbox"/> CME-45C</td> <td><input checked="" type="checkbox"/> 8" HOLLOW AUGERS</td> <td><input type="checkbox"/> CORE SIZE: B, N, 0.3, H</td> </tr> <tr> <td><input type="checkbox"/> CME-55</td> <td><input type="checkbox"/> HARD FACED FINGER BITS</td> <td><input type="checkbox"/> HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST</td> </tr> <tr> <td><input type="checkbox"/> PORTABLE HOIST</td> <td><input checked="" type="checkbox"/> TUNG-CARBIDE INSERTS</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> CASING W/ ADVANCER</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> TRICONE STEEL TEETH</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> TRICONE TUNG-CARB.</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> ASPHALT CORE BIT</td> <td></td> </tr> </table>			<input type="checkbox"/> MOBILE B-51	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC HAMMER	<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	<input type="checkbox"/> MANUAL HAMMER	<input type="checkbox"/> CME-45C	<input checked="" type="checkbox"/> 8" HOLLOW AUGERS	<input type="checkbox"/> CORE SIZE: B, N, 0.3, H	<input type="checkbox"/> CME-55	<input type="checkbox"/> HARD FACED FINGER BITS	<input type="checkbox"/> HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST	<input type="checkbox"/> PORTABLE HOIST	<input checked="" type="checkbox"/> TUNG-CARBIDE INSERTS			<input type="checkbox"/> CASING W/ ADVANCER			<input type="checkbox"/> TRICONE STEEL TEETH			<input type="checkbox"/> TRICONE TUNG-CARB.			<input type="checkbox"/> ASPHALT CORE BIT		<p>FRACTURE SPACING</p> <table border="1"> <tr> <th>TERM</th> <th>SPACING</th> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> <td>VERY THICKY BEDDED</td> <td>> 4 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> <td>THICKY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> <td>VERY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td></td> <td></td> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> </table>			TERM	SPACING	TERM	THICKNESS	VERY WIDE	MORE THAN 10 FEET	VERY THICKY BEDDED	> 4 FEET	WIDE	3 TO 10 FEET	THICKY BEDDED	1.5 - 4 FEET	MODERATELY CLOSE	1 TO 3 FEET	VERY BEDDED	0.16 - 1.5 FEET	CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET			THINLY LAMINATED	< 0.008 FEET															
SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION																																																																																											
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE																																																																																											
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE																																																																																											
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE																																																																																											
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE																																																																																											
<input type="checkbox"/> MOBILE B-51	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC HAMMER																																																																																											
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	<input type="checkbox"/> MANUAL HAMMER																																																																																											
<input type="checkbox"/> CME-45C	<input checked="" type="checkbox"/> 8" HOLLOW AUGERS	<input type="checkbox"/> CORE SIZE: B, N, 0.3, H																																																																																											
<input type="checkbox"/> CME-55	<input type="checkbox"/> HARD FACED FINGER BITS	<input type="checkbox"/> HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST																																																																																											
<input type="checkbox"/> PORTABLE HOIST	<input checked="" type="checkbox"/> TUNG-CARBIDE INSERTS																																																																																												
	<input type="checkbox"/> CASING W/ ADVANCER																																																																																												
	<input type="checkbox"/> TRICONE STEEL TEETH																																																																																												
	<input type="checkbox"/> TRICONE TUNG-CARB.																																																																																												
	<input type="checkbox"/> ASPHALT CORE BIT																																																																																												
TERM	SPACING	TERM	THICKNESS																																																																																										
VERY WIDE	MORE THAN 10 FEET	VERY THICKY BEDDED	> 4 FEET																																																																																										
WIDE	3 TO 10 FEET	THICKY BEDDED	1.5 - 4 FEET																																																																																										
MODERATELY CLOSE	1 TO 3 FEET	VERY BEDDED	0.16 - 1.5 FEET																																																																																										
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET																																																																																										
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET																																																																																										
		THINLY LAMINATED	< 0.008 FEET																																																																																										
<p>PLASTICITY</p> <table border="1"> <tr> <th>NONPLASTIC</th> <th>LOW PLASTICITY</th> <th>MED. PLASTICITY</th> <th>HIGH PLASTICITY</th> </tr> <tr> <td>0-5</td> <td>6-15</td> <td>16-25</td> <td>26 OR MORE</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>			NONPLASTIC	LOW PLASTICITY	MED. PLASTICITY	HIGH PLASTICITY	0-5	6-15	16-25	26 OR MORE									<p>INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <table border="1"> <tr> <th>TERM</th> <th>DESCRIPTION</th> </tr> <tr> <td>FRIABLE</td> <td>RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</td> </tr> <tr> <td>MODERATELY INDURATED</td> <td>GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</td> </tr> <tr> <td>INDURATED</td> <td>GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</td> </tr> <tr> <td>EXTREMELY INDURATED</td> <td>SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</td> </tr> </table>			TERM	DESCRIPTION	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>BENCH MARK: BM #2: R/R SPIKE IN ROOT OF 36' POPLAR -BL- STA. 14+63 97' L.T. N: 865,547,5073 E: 1,799,999,3302 ELEVATION: 686.25 FT.</p> <p>NOTES:</p>																																																													
NONPLASTIC	LOW PLASTICITY	MED. PLASTICITY	HIGH PLASTICITY																																																																																										
0-5	6-15	16-25	26 OR MORE																																																																																										
TERM	DESCRIPTION																																																																																												
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>COLOR DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p>			<p>REVISIONS</p> <table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>DESCRIPTION</th> </tr> <tr> <td>1</td> <td></td> <td>ISSUED FOR CONSTRUCTION</td> </tr> </table>			NO.	DATE	DESCRIPTION	1		ISSUED FOR CONSTRUCTION	<p>REVISED 09/23/09</p>																																																																																	
NO.	DATE	DESCRIPTION																																																																																											
1		ISSUED FOR CONSTRUCTION																																																																																											



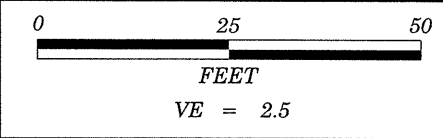
PROJECT REFERENCE NO.	SHEET
B-4758	3
TEST SITE PLAN	



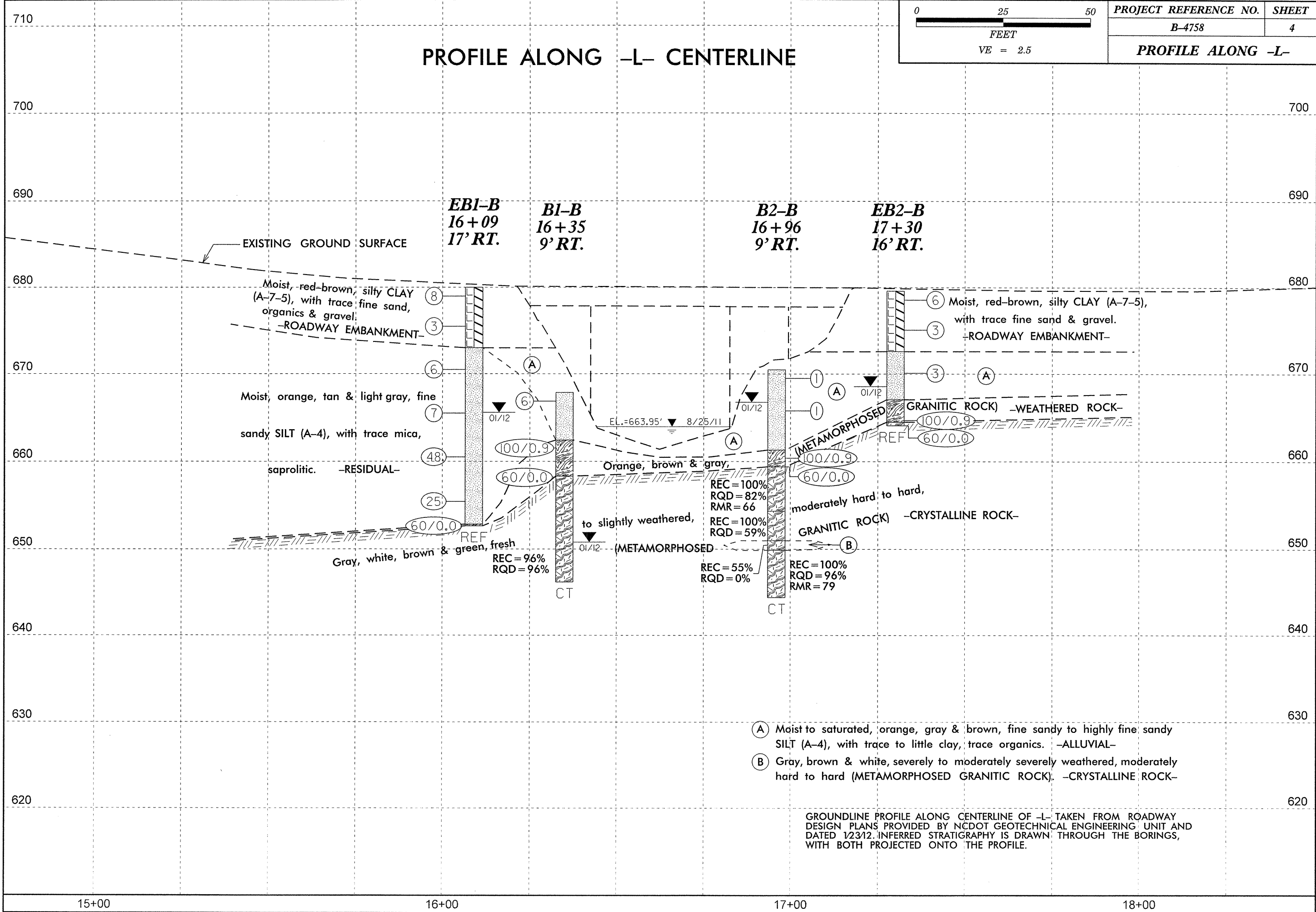
BM #1
 -BL- STA 8+07
 118' RIGHT
 ELEV = 681.90'
 R/R SPIKE IN ROOT OF 18" BEECH

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

TEST SITE PLAN		
PROJECT REFERENCE NO.: 38530.1.1	F&R PROJECT NO.: 66N-0161	
I.D. NO.: B-4758	F.A. PROJECT NO.: BRZ-2824(5)	COUNTY: Guilford
PROJECT DESCRIPTION: Bridge No. 159 on SR 2824 (Creekview Road) over North Buffalo Creek		
SITE DESCRIPTION: N/A		
DRAWN BY: D. Racey	CHECKED BY: P. Alton, P.E.	
DATE: March 2012	SCALE: 1"=30'	



PROFILE ALONG -L- CENTERLINE



15+00

16+00

17+00

18+00

710

700

690

680

670

660

650

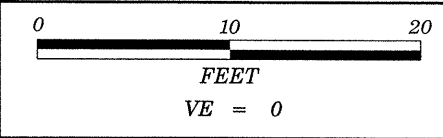
640

630

620

SECTION ALONG PROPOSED END BENT 1

GROUNDLINE AT -L- STATION 16+08.04 TAKEN FROM ROADWAY DESIGN PLANS DATED 1/23/12. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING, WITH BOTH PROJECTED ON THE SECTION.



PROJECT REFERENCE NO.	SHEET
B-4758	5
PROPOSED END BENT 1	

700

690

680

670

660

650

640

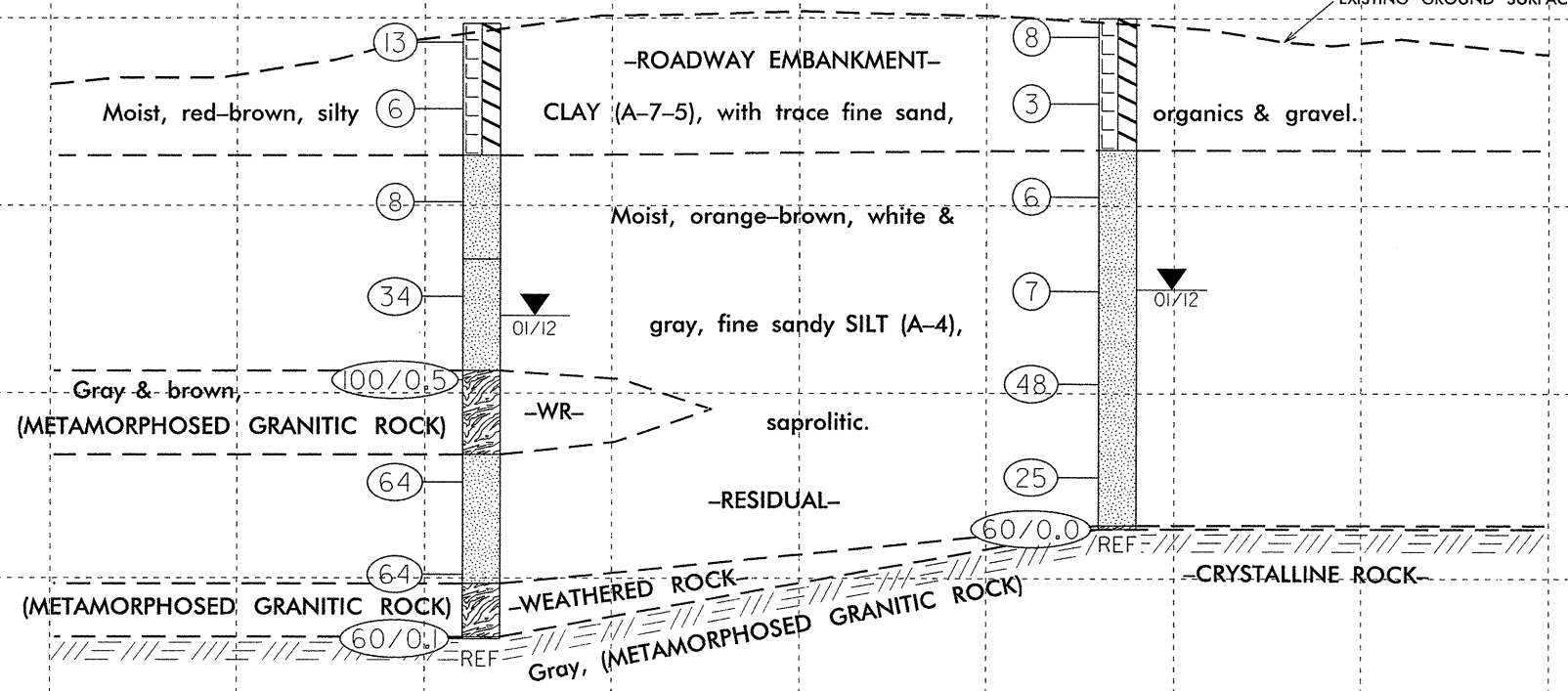
630

620

EBI-A
16+09
17' LT.

EBI-B
16+09
17' RT.

EXISTING GROUND SURFACE

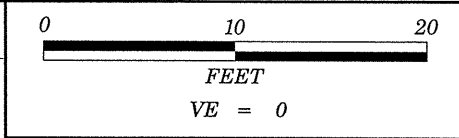


16+08.04

-L-

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

710



PROJECT REFERENCE NO.	SHEET
B-4758	6
PROPOSED BENT 1	

SECTION ALONG PROPOSED BENT 1

GROUNDLINE AT -L- STATION 16+34.23 TAKEN FROM ROADWAY DESIGN
PLANS DATED 1/23/12. INFERRED STRATIGRAPHY IS DRAWN THROUGH
THE BORING, WITH BOTH PROJECTED ON THE SECTION.

700

700

690

690

680

680

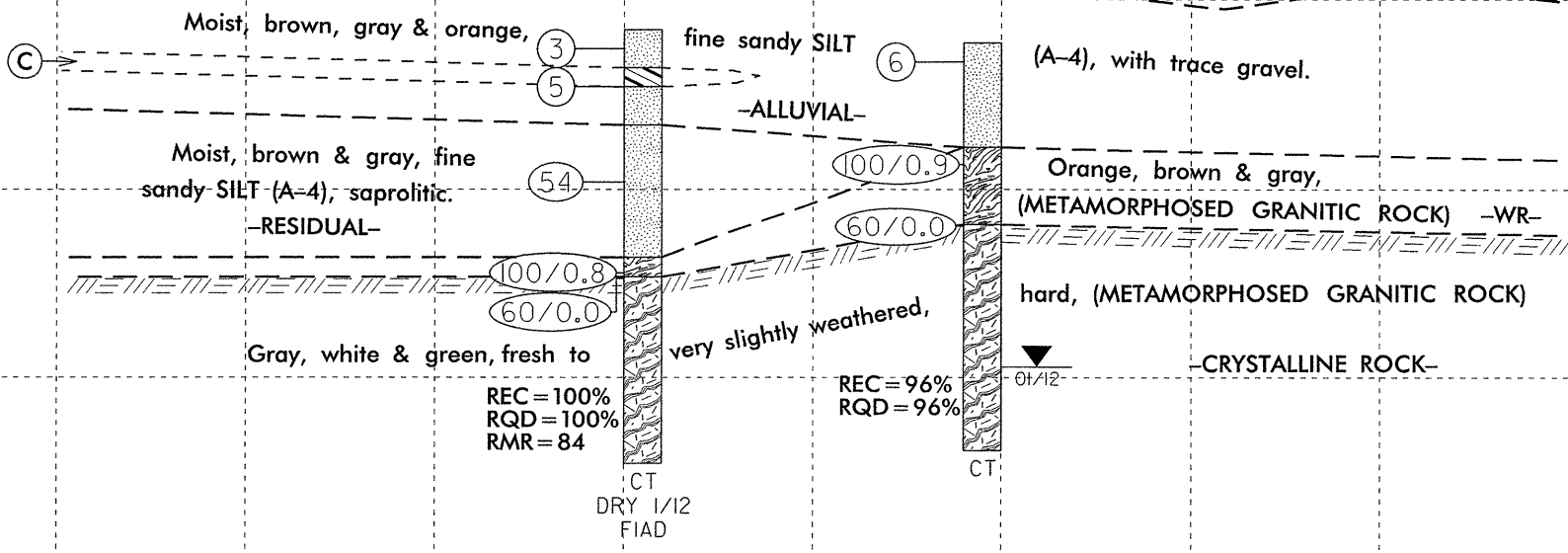
BI-A
16+35
9' LT.

BI-B
16+35
9' RT.

EXISTING GROUND SURFACE

670

670



660

660

650

650

640

640

16 + 34.23

-L-

Ⓢ Moist, brown, highly sandy CLAY (A-6). -ALLUVIAL-

630

630

620

620

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

710

700

690

680

670

660

650

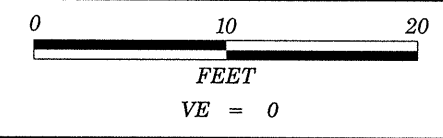
640

630

620

SECTION ALONG PROPOSED BENT 2

GROUNDLINE AT -L- STATION 16+94.35 TAKEN FROM ROADWAY DESIGN PLANS DATED 1/23/12. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING, WITH BOTH PROJECTED ON THE SECTION.



PROJECT REFERENCE NO.	SHEET
B-4758	7
PROPOSED BENT 2	

700

690

680

670

660

650

640

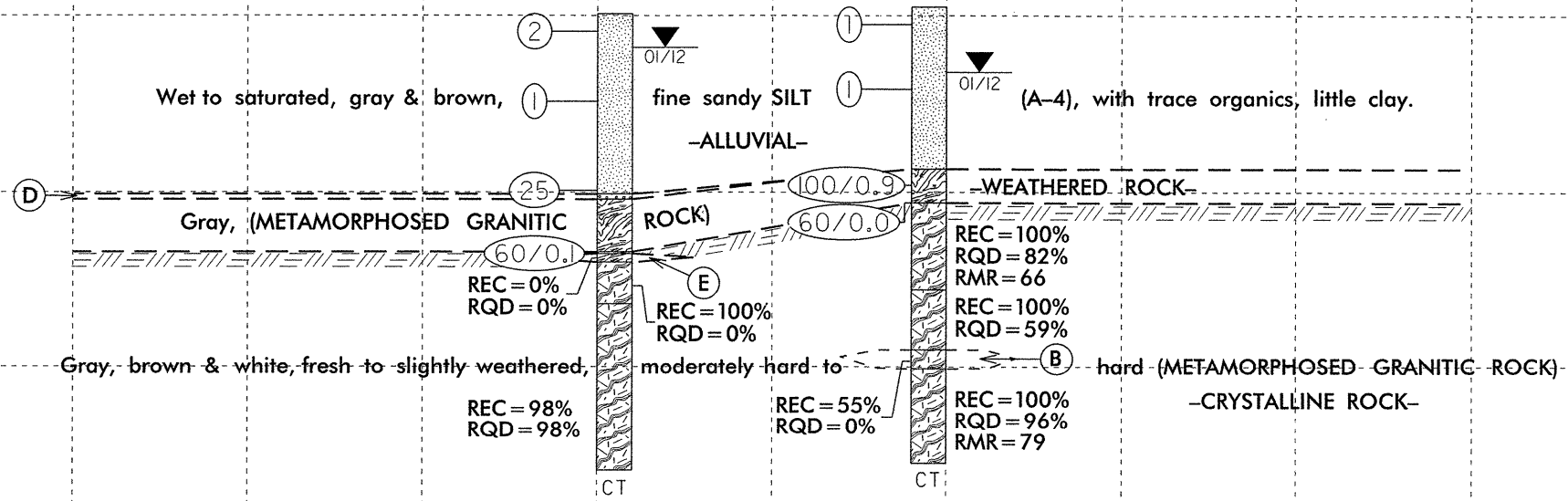
630

620

B2-A
16+96
9' LT.

B2-B
16+96
9' RT.

EXISTING GROUND SURFACE

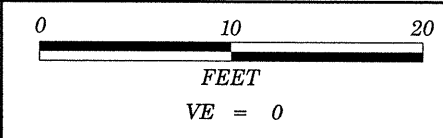


16+94.35

- (B) Gray, brown & white, severely to moderately severely weathered, moderately hard to hard (METAMORPHOSED GRANITIC ROCK). -CRYSTALLINE ROCK-
- (D) Saturated, gray, silty fine to coarse SAND (A-2-4), with trace gravel. -RESIDUAL-
- (E) Gray & white, (METAMORPHOSED GRANITIC ROCK). -WEATHERED ROCK-

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

710



PROJECT REFERENCE NO.	SHEET
B-4758	8
PROPOSED END BENT 2	

SECTION ALONG PROPOSED END BENT 2

GROUNDLINE AT -L- STATION 17+20.54 TAKEN FROM ROADWAY DESIGN PLANS DATED 1/23/12. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORING, WITH BOTH PROJECTED ON THE SECTION.

700

700

690

690

EB2-A
17+29
14' LT.

EB2-B
17+30
16' RT.

680

680

670

670

660

660

650

650

640

640

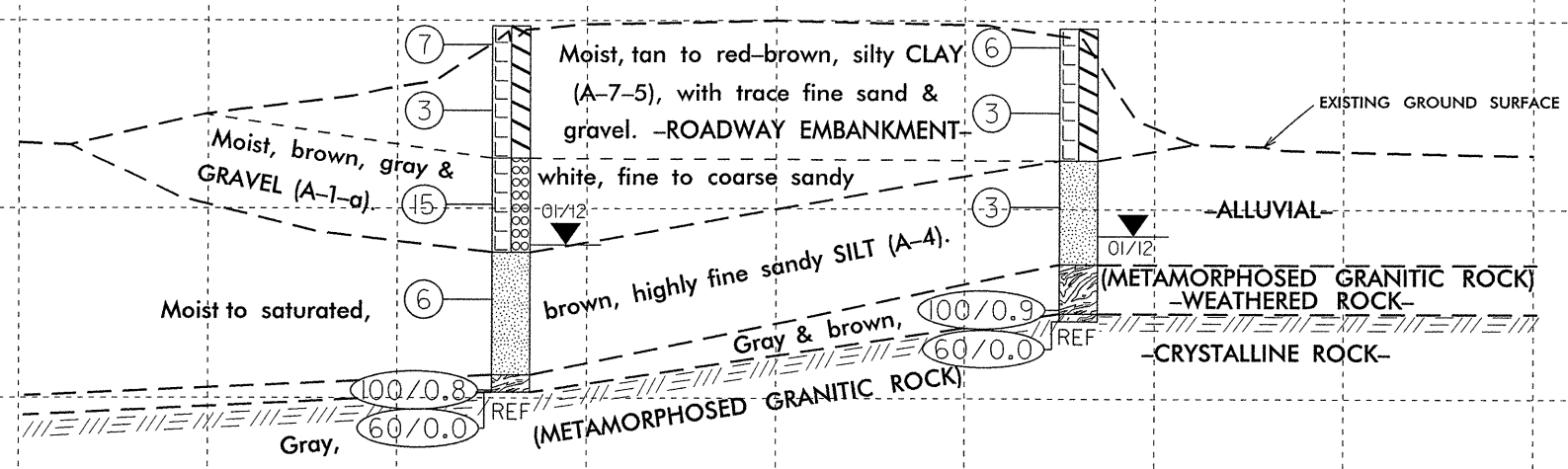
630

630

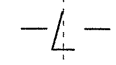
620

620

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



17+20.54



WBS 38530.1.1		TIP B-4758		COUNTY GUILFORD		GEOLOGIST C. Manning								
SITE DESCRIPTION Bridge #159 on SR 2824 over North Buffalo Creek							GROUND WTR (ft)							
BORING NO. EB1-A	STATION 16+09	OFFSET 17 ft LT	ALIGNMENT -L-		0 HR. 26.3									
COLLAR ELEV. 679.7 ft	TOTAL DEPTH 33.0 ft	NORTHING 865,583	EASTING 1,799,441		24 HR. 15.5									
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011			DRILL METHOD 2.25" ID HSA		HAMMER TYPE Automatic									
DRILLER J. Gilchrist		START DATE 01/24/12	COMP. DATE 01/24/12		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
680	679.7	0.0	1	3	10							M	GROUND SURFACE ROADWAY EMBANKMENT Red-brown, silty CLAY (A-7-5), with trace fine sand, organics & gravel.	0.0
	676.2	3.5	3	3	3							M		
675												M		
	671.2	8.5	2	3	5							M	RESIDUAL Orange-brown, fine sandy SILT (A-4).	7.0
670												M		
	666.2	13.5	2	8	26							M	Brown, white & gray, fine sandy SILT (A-4), saprolitic.	12.5
665												M		
	661.2	18.5	17	83/0.0								M	WEATHERED ROCK Gray & brown, (METAMORPHOSED GRANITIC ROCK).	18.5
660												M		
	656.2	23.5	25	32	32							D	RESIDUAL Gray & brown, fine to coarse sandy SILT (A-4), with little gravel, saprolitic at 29.7'.	23.0
655												D		
	651.2	28.5	13	28	36							D		
650												D		
	646.8	32.9	60/0.1									D	WEATHERED ROCK (METAMORPHOSED GRANITIC ROCK)	30.0
	646.8											D	WEATHERED ROCK (METAMORPHOSED GRANITIC ROCK)	32.9
	646.7											D	CRYSTALLINE ROCK Gray, (METAMORPHOSED GRANITIC ROCK). Boring Terminated with Standard Penetration Test Refusal at Elevation 646.7 ft in CRYSTALLINE ROCK (METAMORPHOSED GRANITIC ROCK)	33.0

WBS 38530.1.1		TIP B-4758		COUNTY GUILFORD		GEOLOGIST C. Manning									
SITE DESCRIPTION Bridge #159 on SR 2824 over North Buffalo Creek							GROUND WTR (ft)								
BORING NO. EB1-A	STATION 16+09	OFFSET 17 ft LT	ALIGNMENT -L-		0 HR. 26.3										
COLLAR ELEV. 679.7 ft	TOTAL DEPTH 33.0 ft	NORTHING 865,583	EASTING 1,799,441		24 HR. 15.5										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011			DRILL METHOD 2.25" ID HSA		HAMMER TYPE Automatic										
DRILLER J. Gilchrist		START DATE 01/24/12	COMP. DATE 01/24/12		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
640														Match Line	
NOTES: 1) 0.0-0.1' = Surficial Organic Soils 2) Driller indicates harder drilling at depths of 12.5' & 30.0'. 3) Driller indicates softer drilling at a depth of 23.0'. 4) Auger refusal at a depth of 32.9'.															

NCDOT BORE DOUBLE B4758 GEO_BORELOGS_BRD00159.GPJ NC_DOT_GDT 3/30/12



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 38530.1.1	TIP B-4758	COUNTY GUILFORD	GEOLOGIST C. Manning
SITE DESCRIPTION Bridge #159 on SR 2824 over North Buffalo Creek			GROUND WTR (ft)
BORING NO. EB1-B	STATION 16+09	OFFSET 17 ft RT	ALIGNMENT -L-
COLLAR ELEV. 680.0 ft	TOTAL DEPTH 27.3 ft	NORTHING 865,551	EASTING 1,799,433
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		DRILL METHOD 2.25" ID HSA	HAMMER TYPE Automatic
DRILLER J. Gilchrist	START DATE 01/24/12	COMP. DATE 01/24/12	SURFACE WATER DEPTH N/A

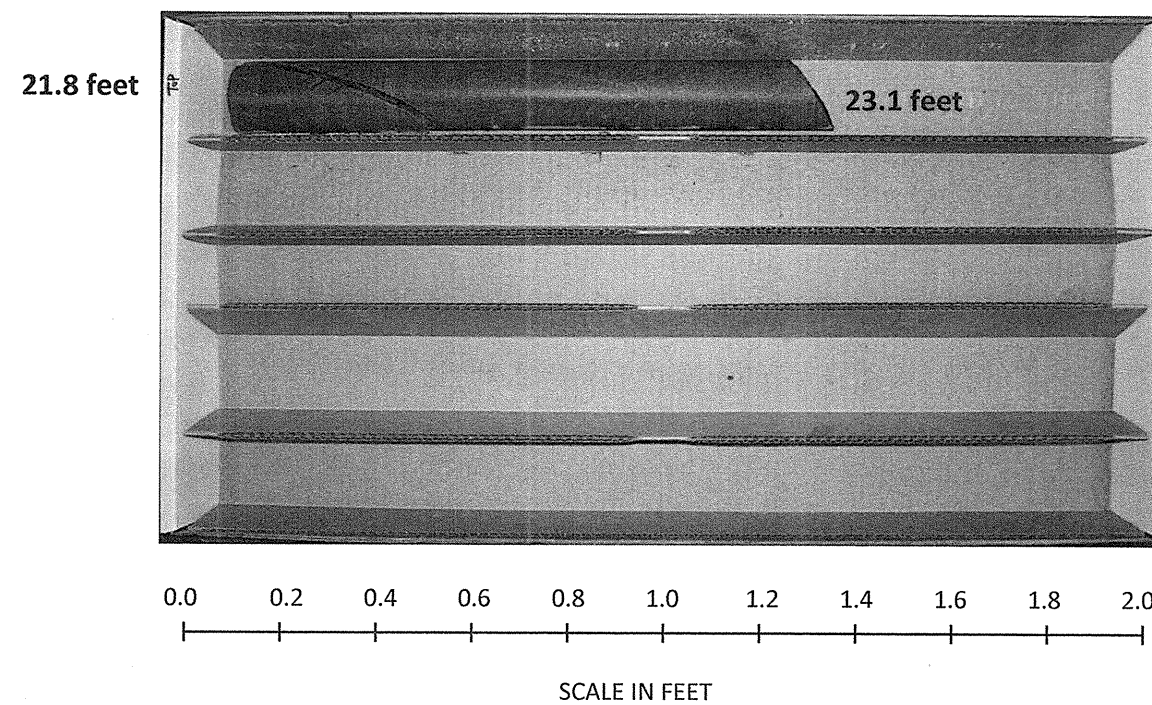
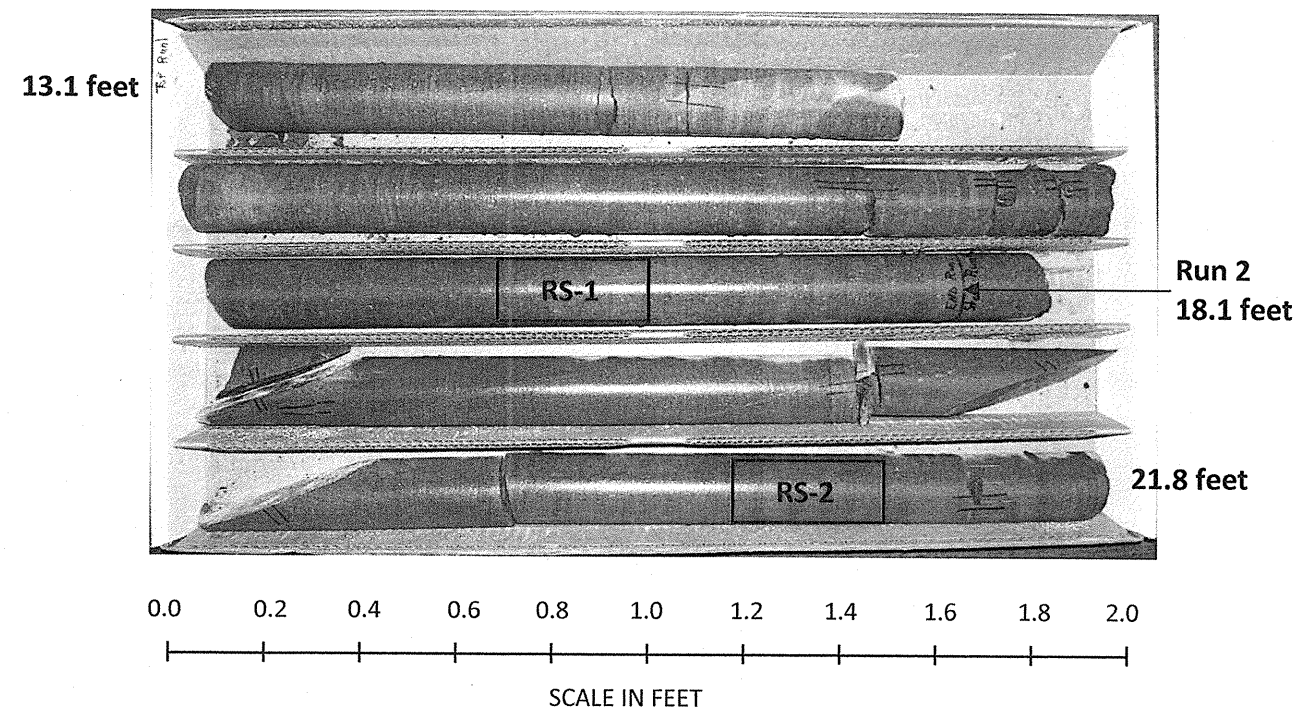
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
680	680.0	0.0	2	3	5								GROUND SURFACE	0.0
													ROADWAY EMBANKMENT Red-brown, silty CLAY (A-7-5), with trace fine sand, organics & gravel.	
675	676.5	3.5	1	1	2									
													RESIDUAL Orange, tan & light gray, fine sandy SILT (A-4), with trace mica, saprolitic.	
670	671.5	8.5	2	2	4									
665	666.5	13.5	6	3	4									
660	661.5	18.5	2	16	32									
655	656.5	23.5	12	10	15									
	652.7	27.3	60/0.0										WEATHERED ROCK (METAMORPHOSED GRANITIC ROCK) Boring Terminated with Standard Penetration Test Refusal at Elevation 652.7 ft on CRYSTALLINE ROCK (METAMORPHOSED GRANITIC ROCK)	27.1 27.3

NCDOT BORE SINGLE B4758 GEO. BORELOGS. BRDG0159.GPJ NC_DOT.GDT 3/30/12

- NOTES:
- 1) 0.0-0.1' = Surficial Organic Soils
 - 2) Driller indicates harder drilling at a depth of 27.1'.
 - 3) Auger refusal at a depth of 27.3'.

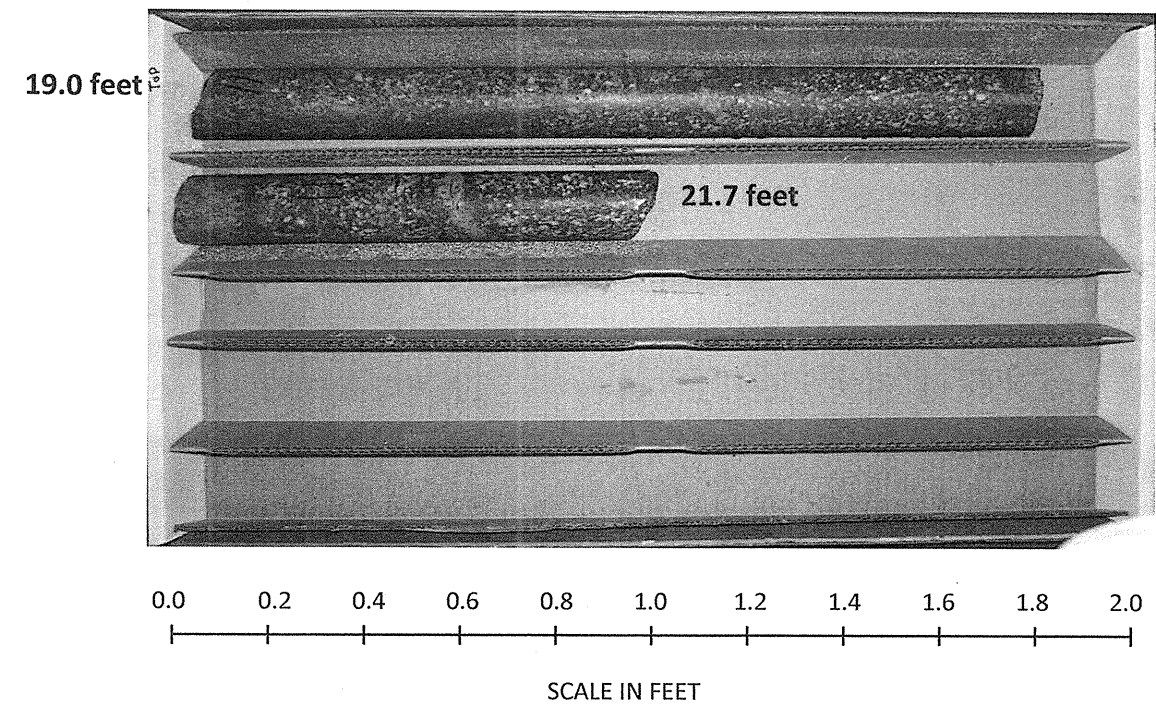
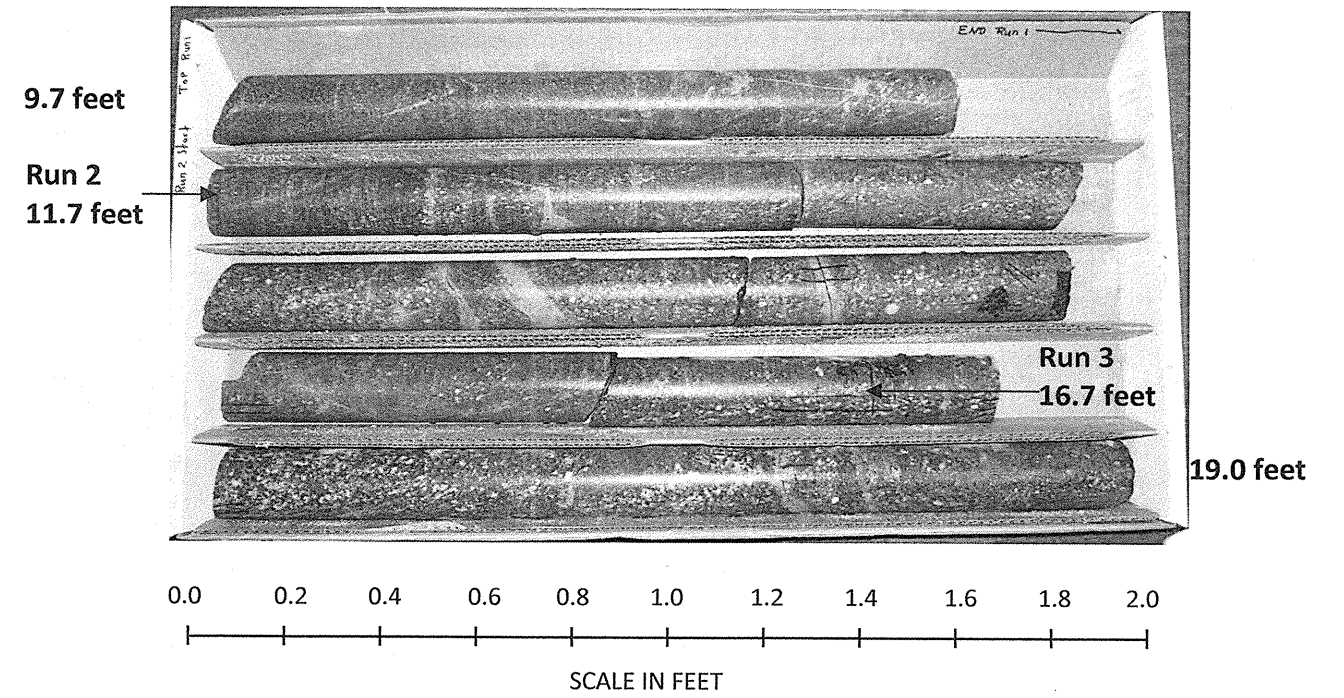


CORE PHOTOGRAPHS: Bridge No. 159 on SR 2824 over North Buffalo Creek, B1-A: Station 16+35, 9' LT



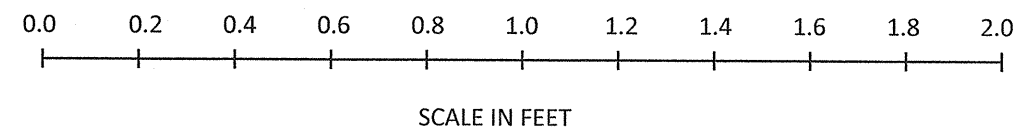
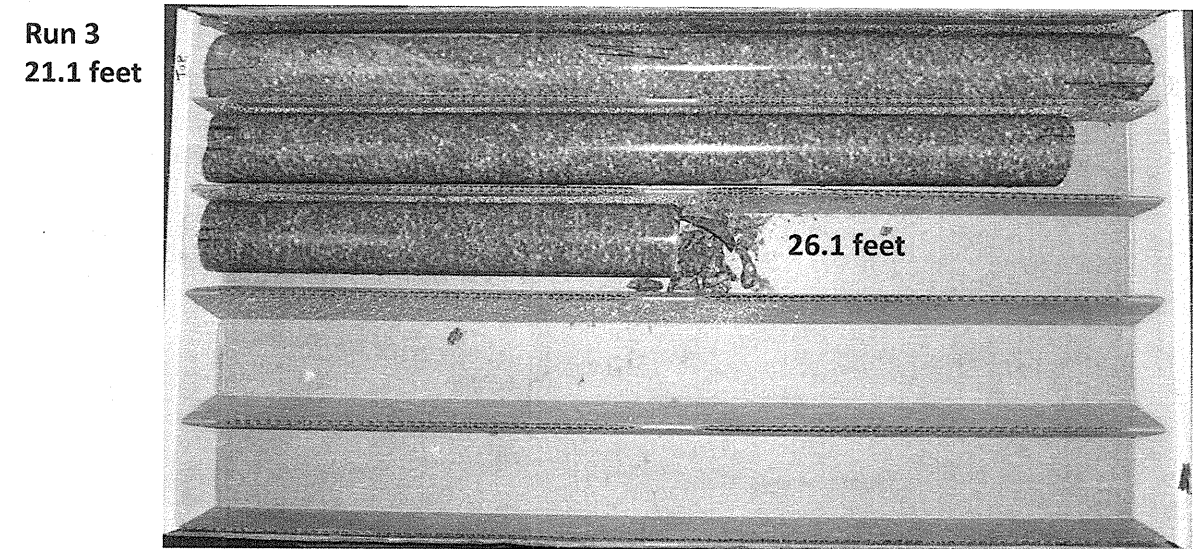
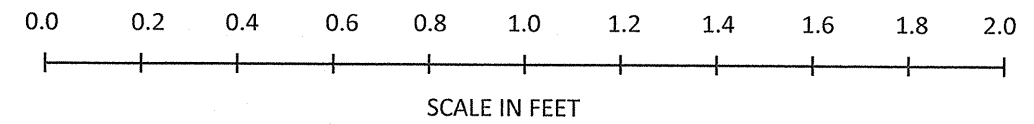
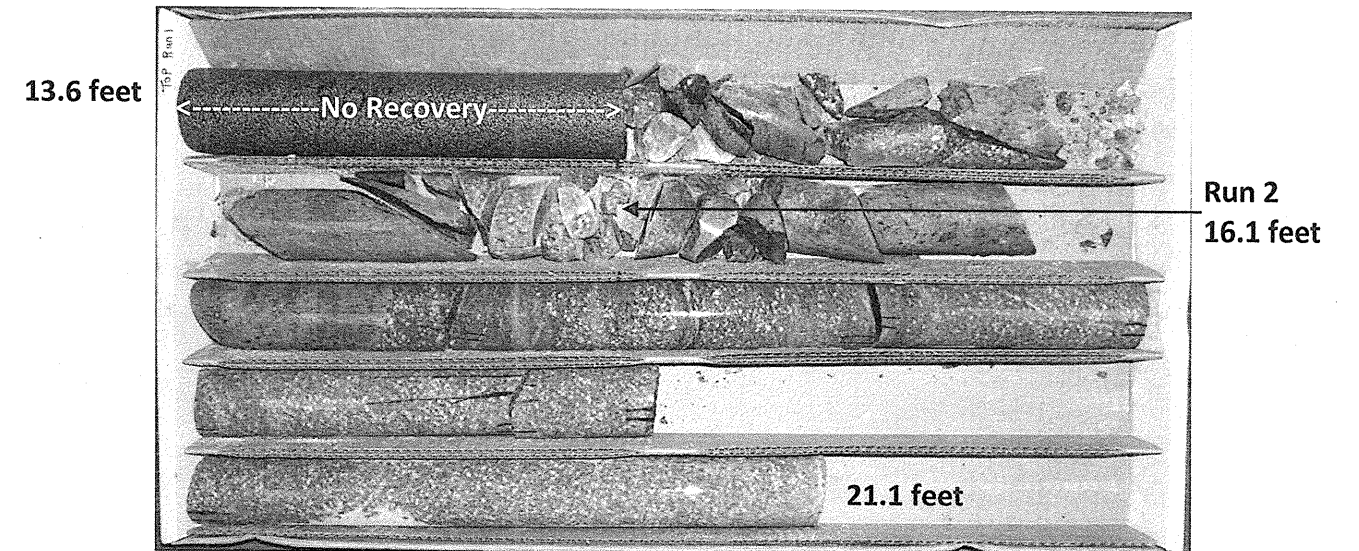


CORE PHOTOGRAPHS: Bridge No. 159 on SR 2824 over North Buffalo Creek, B1-B: Station 16+35, 9' RT



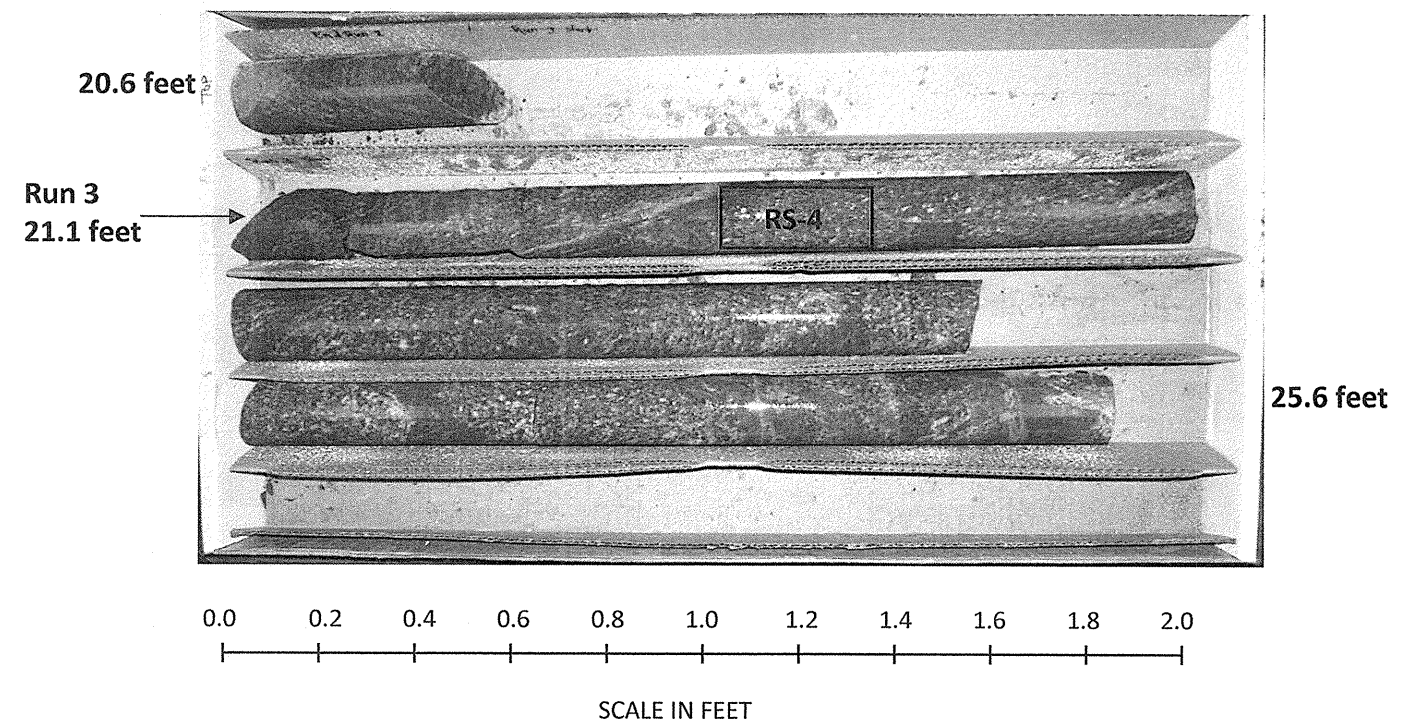
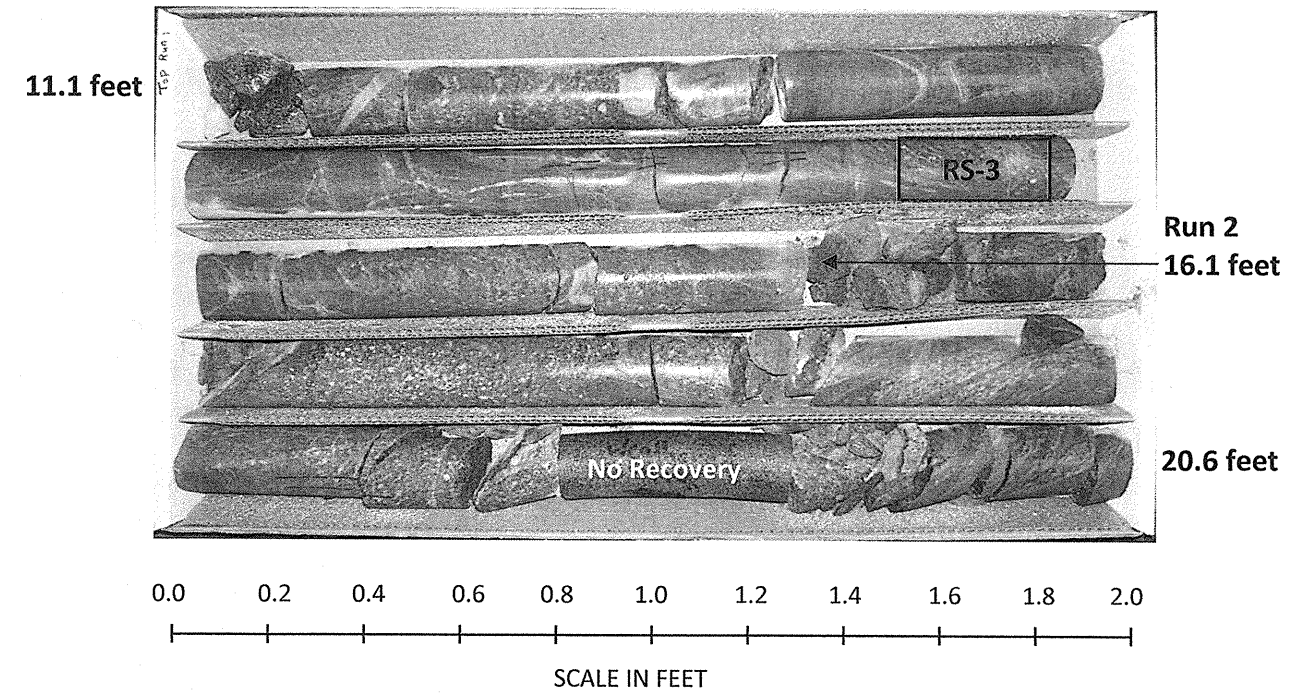


CORE PHOTOGRAPHS: Bridge No. 159 on SR 2824 over North Buffalo Creek, B2-A: Station 16+96, 9' LT





CORE PHOTOGRAPHS: Bridge No. 159 on SR 2824 over North Buffalo Creek, B2-B: Station 16+96, 9' RT



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 38530.1.1		TIP B-4758		COUNTY GUILFORD		GEOLOGIST C. Manning										
SITE DESCRIPTION Bridge #159 on SR 2824 over North Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 17+29		OFFSET 14 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 679.7 ft		TOTAL DEPTH 19.4 ft		NORTHING 865,551		EASTING 1,799,557										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011			DRILL METHOD 2.25" ID HSA			HAMMER TYPE Automatic										
DRILLER J. Gilchrist		START DATE 01/26/12		COMP. DATE 01/26/12		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
680	679.7	0.0	3	4	3										679.7	GROUND SURFACE
																ROADWAY EMBANKMENT
																Tan to red-brown, silty CLAY (A-7-5), with trace fine sand & gravel.
675	676.2	3.5	1	1	2											
670	671.2	8.5	2	9	6										672.7	Brown, gray & white, fine to coarse sandy GRAVEL (A-1-a).
665	666.2	13.5	2	3	3										667.7	ALLUVIAL
																Brown, highly fine sandy SILT (A-4).
	661.2	18.5	9	91/0.3											661.2	WEATHERED ROCK
	660.3	19.4													660.3	Gray, (METAMORPHOSED GRANITIC ROCK).
																Boring Terminated with Standard Penetration Test Refusal at Elevation 660.3 ft on CRYSTALLINE ROCK (METAMORPHOSED GRANITIC ROCK)

NOTES:
 1) 0.0-0.1' = Surficial Organic Soils
 2) Driller indicates harder drilling at a depth of 10.0'-10.2'.
 3) Auger refusal at a depth of 19.4'.

WBS 38530.1.1		TIP B-4758		COUNTY GUILFORD		GEOLOGIST C. Manning										
SITE DESCRIPTION Bridge #159 on SR 2824 over North Buffalo Creek							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 17+30		OFFSET 16 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 679.6 ft		TOTAL DEPTH 15.5 ft		NORTHING 865,523		EASTING 1,799,551										
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011			DRILL METHOD 2.25" ID HSA			HAMMER TYPE Automatic										
DRILLER J. Gilchrist		START DATE 01/25/12		COMP. DATE 01/25/12		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
680	679.6	0.0	3	3	3										679.6	GROUND SURFACE
																ROADWAY EMBANKMENT
																Red-brown, silty CLAY (A-7-5), with trace fine sand & gravel.
675	676.1	3.5	1	1	2											
670	671.1	8.5	2	2	1										672.6	ALLUVIAL
																Brown, highly fine sandy SILT (A-4).
665	666.1	13.5	10	52	48/0.4										667.1	WEATHERED ROCK
																Gray & brown, (METAMORPHOSED GRANITIC ROCK).
	664.5	15.1													664.5	CRYSTALLINE ROCK
	664.1	15.5													664.1	Gray, (METAMORPHOSED GRANITIC ROCK).
																Boring Terminated with Standard Penetration Test Refusal at Elevation 664.1 ft in CRYSTALLINE ROCK (METAMORPHOSED GRANITIC ROCK)

NOTES:
 1) 0.0-0.1' = Surficial Organic Soils
 2) Driller indicates harder drilling at depths of 12.5' & 15.1'.
 3) Auger refusal at a depth of 15.5'.

NCDOT BORE DOUBLE B4758 GEO_BORELOGS_BRD00159.GPJ NC_DOT.GDT 3/30/12

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 38530.1.1
TIP NO.: B-4758
COUNTY: Guilford
DESCRIPTION: Bridge No. 159 on SR 2824 over North Buffalo Creek

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	Young's Modulus, E (ksi)	RMR
RS-1	B1-A	17.1 - 17.4	Metamorphosed Granitic Rock	CZg	100%	4.16	1.77	183.4	28,449	8300	84
RS-2	B1-A	21.0 - 21.3	Metamorphosed Granitic Rock	CZg	100%	4.14	1.77	183.2	16,285	7000	84
RS-3	B2-B	14.4 - 14.7	Metamorphosed Granitic Rock	CZg	82%	4.04	1.77	169.2	27,448	4700	66
RS-4	B2-B	22.0 - 22.3	Metamorphosed Granitic Rock	CZg	96%	3.98	1.77	166.4	27,328	8500	79



Bridge No. 159 on SR 2824 over North Buffalo Creek
SITE PHOTOGRAPHS



Photograph No. 1: General view of the bridge site looking west



Photograph No. 3: View looking north along proposed Bent 2



Photograph No. 2: View looking north along proposed Bent 1



Photograph No. 4: View looking southeast at east end of bridge