

PROJECT: 33658.1.1 ID: B-4321

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33658.1.1 I.D. NO. B-4321
 F.A. PROJECT BRSTP-1918 (2)
 COUNTY WAYNE
 PROJECT DESCRIPTION BRIDGE #17 OVER
CARRAWAY CREEK ON SR 1918
(PECAN ROAD)
 SITE DESCRIPTION _____

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4321	1	30
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
33658.1.1	BRSTP-1918 (2)	P.E. CONST.	

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CAUTION NOTICE

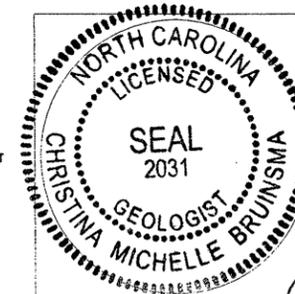
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS 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.

For Letting

INVESTIGATED BY C. BRUINSMA PERSONNEL P. ZHANG
 CHECKED BY G. LANG, P.E.
 SUBMITTED BY TIERRA, INC.
 DATE APRIL, 2006



[Signature]

5-25-06

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

NOTE - 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.

DRAWN BY: P. ZHANG

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4321	33658.1.1	2	30

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 WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T298, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:</p> <p style="text-align: center;"><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</p> <p>UNIFORM: INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)</p> <p>GAP-GRADED: INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p style="text-align: center;">ANGULARITY OF GRAINS</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>	<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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.</p> <p>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>	<p>ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>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.</p> <p>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.</p> <p>CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>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.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FML) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>ROCK QUALITY DESIGNATION (R.Q.D.) - 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>SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR B.P.F. 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 LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.</p> <p>STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p>STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - 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.</p> <p>TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																																																												
<p style="text-align: center;">SOIL LEGEND AND AASHTO CLASSIFICATION</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 (75% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>A-1</th> <th>A-2</th> <th>A-3</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> <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>A-1, A-2</td> <td>A-3</td> <td>A-4, A-5</td> <td>A-6, A-7</td> <td></td> <td></td> </tr> <tr> <td>SYMBOL</td> <td colspan="4">[Pattern]</td> <td colspan="4">[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> <td>[Pattern]</td> </tr> <tr> <td>% PASSING</td> <td colspan="4">50 MX</td> <td colspan="4">40 MX</td> <td colspan="3">30 MX</td> <td colspan="3">20 MX</td> <td colspan="3">10 MX</td> </tr> <tr> <td>LIQUID LIMIT</td> <td colspan="4">6 MX</td> <td colspan="4">N.P.</td> <td colspan="3">40 MX</td> <td colspan="3">30 MX</td> <td colspan="3">20 MX</td> </tr> <tr> <td>PLASTIC INDEX</td> <td colspan="4">0</td> <td colspan="4">0</td> <td colspan="3">4 MX</td> <td colspan="3">3 MX</td> <td colspan="3">2 MX</td> </tr> <tr> <td>GROUP INDEX</td> <td colspan="4">0</td> <td colspan="4">0</td> <td colspan="3">4 MX</td> <td colspan="3">3 MX</td> <td colspan="3">2 MX</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td colspan="4">FINE SAND</td> <td colspan="4">SILTY OR CLAYEY GRAVEL AND SAND</td> <td colspan="3">SILTY SOILS</td> <td colspan="3">CLAYEY SOILS</td> <td colspan="3">HIGHLY ORGANIC SOILS</td> </tr> <tr> <td>GENERAL RATING AS A SUBGRADE</td> <td colspan="4">EXCELLENT TO GOOD</td> <td colspan="4">FAIR TO POOR</td> <td colspan="3">FAIR TO POOR</td> <td colspan="3">POOR</td> <td colspan="3">UNSATISFACTORY</td> </tr> </table> <p style="text-align: center;">P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30</p>	GENERAL CLASS.	GRANULAR MATERIALS (35% PASSING #200)				SILT-CLAY MATERIALS (75% PASSING #200)				ORGANIC MATERIALS			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7			GROUP CLASS.	A-1-a	A-1-b	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	[Pattern]				[Pattern]				[Pattern]	[Pattern]	[Pattern]	[Pattern]	[Pattern]	[Pattern]	[Pattern]	[Pattern]	% PASSING	50 MX				40 MX				30 MX			20 MX			10 MX			LIQUID LIMIT	6 MX				N.P.				40 MX			30 MX			20 MX			PLASTIC INDEX	0				0				4 MX			3 MX			2 MX			GROUP INDEX	0				0				4 MX			3 MX			2 MX			USUAL TYPES OF MAJOR MATERIALS	FINE SAND				SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS			CLAYEY SOILS			HIGHLY ORGANIC SOILS			GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD				FAIR TO POOR				FAIR TO POOR			POOR			UNSATISFACTORY			<p style="text-align: center;">MINERALOGICAL COMPOSITION</p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p style="text-align: center;">COMPRESSIBILITY</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>SLIGHTLY COMPRESSIBLE</td> <td>LIQUID LIMIT LESS THAN 30</td> </tr> <tr> <td>MODERATELY COMPRESSIBLE</td> <td>LIQUID LIMIT 31-50</td> </tr> <tr> <td>HIGHLY COMPRESSIBLE</td> <td>LIQUID LIMIT GREATER THAN 50</td> </tr> </table> <p style="text-align: center;">PERCENTAGE OF MATERIAL</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <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</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>>10%</td> <td>>20%</td> <td>HIGHLY</td> </tr> <tr> <td></td> <td></td> <td></td> <td>35% AND ABOVE</td> </tr> </table> <p style="text-align: center;">GROUND WATER</p> <p>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.</p> <p>▽ STATIC WATER LEVEL AFTER 24 HOURS.</p> <p>▽ PW PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA</p> <p>○ SPRING OR SEEPAGE</p>	SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30	MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50	HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50	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	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	HIGHLY ORGANIC	>10%	>20%	HIGHLY				35% AND ABOVE	<p style="text-align: center;">WEATHERED ROCK (WR)</p> <p>NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.</p> <p style="text-align: center;">CRYSTALLINE ROCK (CR)</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> <p style="text-align: center;">NON-CRYSTALLINE ROCK (NCR)</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 style="text-align: center;">COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> <p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p> <p style="text-align: center;">WEATHERING</p> <p>FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>VERY SLIGHT (V. SL.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p>SLIGHT (SL.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>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.</p> <p>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></p> <p>SEVERE (SEV.) - ALL ROCKS 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></p> <p>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></p> <p>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> <p style="text-align: center;">ROCK HARDNESS</p> <p>VERY HARD - CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD - CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>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.</p> <p>MEDIUM HARD - CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p>SOFT - CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p>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>	<p style="text-align: center;">CONSISTENCY OR DENSENESS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <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 (M, H, L, H, S, L, E)</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 (L, H, S, L, E)</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 0.5 0.5 TO 1 1 TO 2 2 TO 4 > 4</td> </tr> </table> <p style="text-align: center;">TEXTURE OR GRAIN SIZE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>U.S. STD. 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<p style="text-align: center;">FRAC. SPACING</p> <p>VERY WIDE MORE THAN 10 FEET</p> <p>WIDE 3 TO 10 FEET</p> <p>MODERATELY CLOSE 1 TO 3 FEET</p> <p>CLOSE 0.16 TO 1 FEET</p> <p>VERY CLOSE LESS THAN 0.16 FEET</p>	<p style="text-align: center;">BEDDING</p> <p>VERY THICKLY BEDDED > 4 FEET</p> <p>THICKLY BEDDED 1.5 - 4 FEET</p> <p>THINLY BEDDED 0.16 - 1.5 FEET</p> <p>VERY THINLY BEDDED 0.03 - 0.16 FEET</p> <p>THICKLY LAMINATED 0.008 - 0.03 FEET</p> <p>THINLY LAMINATED < 0.008 FEET</p>	<p style="text-align: center;">INDURATION</p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>	<p>BENCH MARK: TBM #2, -L-, STA. 18+30.91, 26.83' RT.,</p> <p style="text-align: right;">ELEVATION: 76.12'</p> <p>NOTES: PP - DENOTES POCKET PENETROMETER TEST PERFORMED SG - DENOTES BULK SPECIFIC GRAVITY/POROSITY TEST PERFORMED</p>																																																																																																																																																																																																																																																												



May 25, 2006

N.C. Department of Transportation
Geotechnical Engineering Unit
1589 Mail Service Center
Raleigh, North Carolina 27699-1589

Attn: Mr. Njoroge W. Wainaina, P.E.

Ref: Geotechnical Structure Subsurface Investigation Report

State Project No.: 33658.1.1
TIP No.: B-4321
County: Wayne County
Description: Bridge # 17 over Carraway Creek on SR 1918 (Pecan Road)
Tierra, Inc. Project No.: 6211-06-011

Dear Mr. Wainaina,

As authorized, Tierra, Inc. has completed the geotechnical subsurface investigation for the proposed replacement structure along SR 1918 over Carraway Creek located in Wayne County, North Carolina. The purpose of this report is to present subsurface conditions and general notes to the designer for consideration during design of the planned structure. Field and laboratory test results, site and boring location plans, and profile/cross sections depicting subsurface conditions may be found in the appendix of this report.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty expressed or implied is made. Tierra, Inc. appreciates this opportunity to provide you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely,
TIERRA, INC.

Christina M. Bruinsma, L.G.
Project Geologist

Gabriel W. Lang, P.E.
Sr. Geotechnical Engineer/Manager

1.0 PROJECT DESCRIPTION

Based on information obtained from the North Carolina Department of Transportation (NCDOT) Bridge Survey & Hydraulic Design Report dated August 18, 2005, a 2-span, 3-bent structure is proposed to replace the existing 3-span, 4-bent, concrete deck bridge on timber beams. The proposed structure will be a 130 feet long by 30 feet wide bridge. The new structure will replace the existing structure over Carraway Creek, at a slightly skewed alignment from the existing. The proposed skew angle for all bents is 90 degrees.

2.0 SITE DESCRIPTION AND GEOLOGY

The project site is located along SR 1918 (Pecan Road) in a rural area 2.0 miles south of Seymour Johnson Air Force Base and the city of Goldsboro, North Carolina in Wayne County. Carraway Creek flows generally north into the Neuse River, approximately 1 mile downstream.

Topographically, the site is gently rolling in association with Carraway Creek. Carraway Creek was approximately 9 feet wide and 0.4 to 0.8 feet deep during our investigation. The existing floodplain is approximately 500 feet wide. Floodplain cover consists of brush, grasses, and young to moderately aged trees.

The project site is located in the Coastal Plain Physiographic Province of North Carolina, outside Goldsboro, North Carolina. According to *The Geology of the Carolinas* (1991), the site is located within the Black Creek Group (Kb), which is Cretaceous in age. Calcareous sand and clay containing fossils is described within the upper 100 to 200 feet of the Black Creek Group and is referred to as the Tar Heel Formation. Interbedded limestone and calcareous mudstone, and shelly sandy limestone can be associated with this formation. Facies containing dirty limestones can be indicative of transitional zones between deltaic depositions and shelf/shallow sea water interfaces.

In addition, correspondence with Dr. W. Harris of University of North Carolina at Wilmington indicates that lignite within the limestone matrix is indicative of Tar Heel Formation material. Fossil assemblage also correlates with typical Cretaceous fossil records.

Material encountered in core holes within the upper portions of the material are fine grained gray green limestone with little to no visible fossils, containing occasional wood/organic fragments 1-3 mm in size. This material is frequently interbedded with the finely laminated darker green calcareous mudstones. At approximately 40 feet below the ground surface (40-30' MSL) materials coarsen downward into fossiliferous, porous limestone with occasional wood/organic fragments, some phosphate pebbles (1 to 15 mm in diameter), as well as isolated coarse, subangular to rounded quartz grains in matrix. Shells become more frequent with depth, and increase in size. No other known coastal plain material was encountered during our investigation. No outcrops were observed within the vicinity of the bridge.

3.0 FIELD EVALUATION PROCEDURE

Subsurface conditions were evaluated for the proposed structure by advancing four soil test borings. One boring per end bent and two borings for the interior bent were drilled near proposed bent centerlines in April 2006. Soil test borings were drilled utilizing a truck-mounted CME 55 drill rig with a manual hammer. Borings were drilled using a 3-inch tricone mud rotary method and 2 3/4-inch hollow stem auger method. Standard penetration tests were performed at regular intervals, in accordance with American Association of State Highway Transportation Officials (AASHTO T-206-03), and North Carolina Department of Transportation (NCDOT) latest Geotechnical Guidelines and Procedures Manual. Rock coring was conducted beneath the interior bent location and was performed in accordance with (AASHTO T-225-83 (2000)) procedure utilizing a 2.0-inch diameter NQ size core barrel.

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Carraway Creek to determine scour impact for foundation design purposes. The field scour report was electronically submitted April 28, 2006.

Groundwater measurements were recorded within each borehole utilizing a weighted 100-foot tape from a survey reference location at the top of each boring. Readings were recorded immediately after boring termination and after a 24-hour waiting period.

4.0 LABORATORY TESTING

Representative split-barrel sampler samples were selected from soil test borings to verify visual field classification and determine soil index properties. Ten split-barrel sampler samples and two grab samples were analyzed in our laboratory for Atterberg limits, and grain size with hydrometer analysis. Two samples were tested to determine natural moisture. Five alluvial samples were analyzed for grain size determination to assist the NCDOT in theoretical scour elevations. Four rock core samples were analyzed in our laboratory for unconfined compression strength and Young's Modulus. Two rock core samples, consisting of limestone, were tested for bulk specific gravity, absorption and porosity. Three rock core samples, consisting of mudstone, were tested with a pocket penetrometer prior to and after a 24 hour soaking period. All testing was performed in accordance with the following American Society for Testing and Materials (ASTM), NCDOT Modified and/or AASHTO procedures:

- AASHTO T-88-00 (As Modified) "Particle Size Analysis of Soil"
- AASHTO T-89-02 (As Modified) "Determining the Liquid Limits of Soil"
- AASHTO T-90-00 "Determining the Plastic Limit and Plasticity of Soils"
- AASHTO T-265-93 (2000) "Laboratory Determination of Moisture Content of Soils"
- ASTM D 1140-97 "Amount of Material in Soils Finer than the #200 Sieve"
- ASTM D 2938-95 "Unconfined Compressive Strength of Intact Rock Core"
- ASTM D 3148-02 "Elastic Moduli of Intact Rock Core in Uniaxial Compression"
- ASTM D 6473-99 "Specific Gravity and Absorption of Rock For Erosion Control"

5.0 SUBSURFACE AND GROUNDWATER CONDITIONS

5.1 End Bents

Soils beneath End Bent 1 and 2 consist of roadway embankment and alluvium deposits. Roadway embankment consists of approximately 12 to 13 feet of very loose to loose sand and silty to clayey sand (A-3, A-2-4, A-2-6). Alluvium deposits consist of approximately 4.2 to 4.5 feet of very loose to loose silty sand and medium to fine grained sand (A-2-4, A-3), as well as medium stiff sandy clay (A-6). Alluvium deposits directly overlie coastal plain rock.

Coastal plain sedimentary rock (CP) was encountered at elevations between 64.3 and 64.1 feet Mean Sea Level (MSL), consisting of fine grained sandy limestone and calcareous mudstone.

5.2 Interior Bent

Soils beneath Bent 1 consist of roadway embankment and alluvium deposits. Roadway embankment consists of approximately 12 to 13 feet of very loose to loose clayey silty sand (A-2-4) with occasional cobbles and boulders (1 ft diameter) within the A side embankment. Alluvium deposits consist of approximately 3.9 to 5.0 feet of very loose silty sand. Alluvium deposits directly overlie coastal plain rock.

Coastal plain sedimentary rock (CP) was encountered at elevations between 64.2 and 63.6 feet Mean Sea Level (MSL), consisting of fine grained sandy limestone, calcareous mudstone, and porous shelly sandy limestone. Strata recoveries (REC) range from approximately 78 to 100 percent. Rock types consist of two general classifications across the site. The upper rock type is limestone interbedded with calcareous mudstone, is very thinly to thickly bedded, and friable to indurated. Mudstone accounts for the friable nature and thin bedding. The second rock type is generally deeper within the rock profile, and consists of thickly to very thickly bedded, friable to moderately indurated porous sandy limestone. The rock generally has good recovery, but has blow counts that do not necessarily yield SPT refusal.

Two limestone samples were tested for specific gravity, absorption and porosity. Representative samples were chosen from the upper fine grained limestone and the lower porous limestone to determine the porosity of each. Upper material was found to have approximately 4% porosity, compared to 23% percent porosity in the lower coarse grained limestone.

Three representative calcareous mudstone samples were chosen to perform penetrometer tests along the x-axis. All samples had penetrometer values in excess of 4.5 tons per square foot (tsf) prior to soaking in water. After soaking for 24 hours, the samples broke along the bedding planes at values ranging from 1.5 to 3.5 tsf.

The following table summarizes approximate (MSL) rock elevations across the Interior Bent:

Location	Boring Elevation (ft)	CP Elevation (ft)
B1A	81.1	63.6
B1B	81.4	64.2

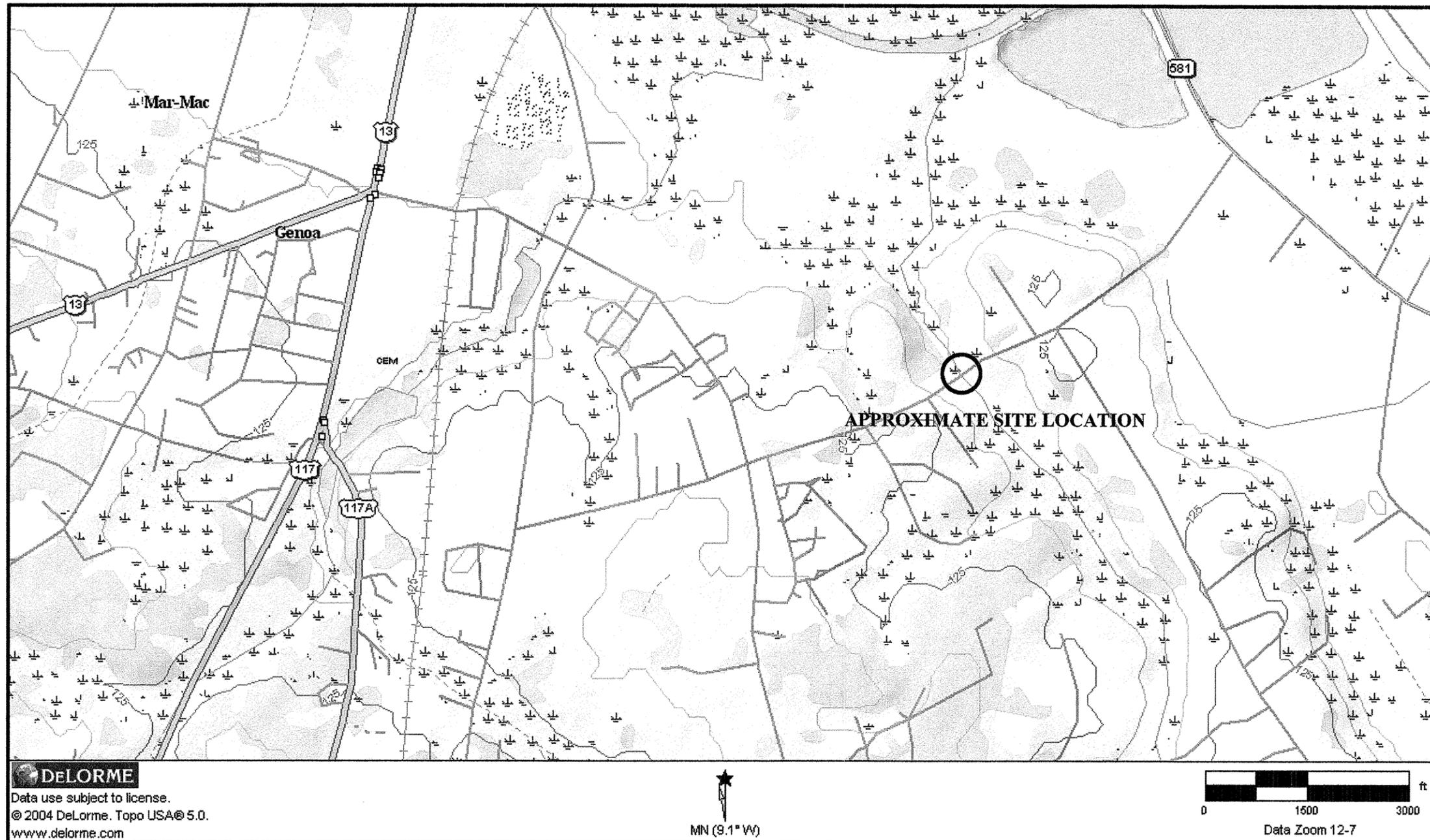
6.0 NOTES TO DESIGNER

Based on our field exploration the following conditions may impact design and construction of the proposed structure. Therefore the designer should be aware of the following subsurface conditions:

- In B1A cobbles and boulders up to 1 foot in diameter, were penetrated within embankment fill between elevations 81.1 and 68.6 feet (MSL).
- Coastal Plain rock was encountered across the site at depths ranging from 16.2 to 17.5 feet below existing ground surface (approximate elevations of 64.6 to 63.2 feet [MSL]). Standard penetration tests performed within the rock range from SPT refusal to 93 blows per foot.
- Static groundwater was measured approximately 12 to 13 feet below existing ground surface across the site, at elevations ranging from approximately 68.9 to 68.5 feet (MSL).

7.0 CLOSURE

Notes to the designer and evaluations provided by Tierra, Inc. are based on the Hydraulic Design Report dated August 18, 2005, provided by NCDOT. Modifications to our report may be required if there are changes to the design or location of the proposed structure. Notes to the designer in this report are based on data obtained from soil borings. The nature and extent of variations between borings may not become evident until construction.

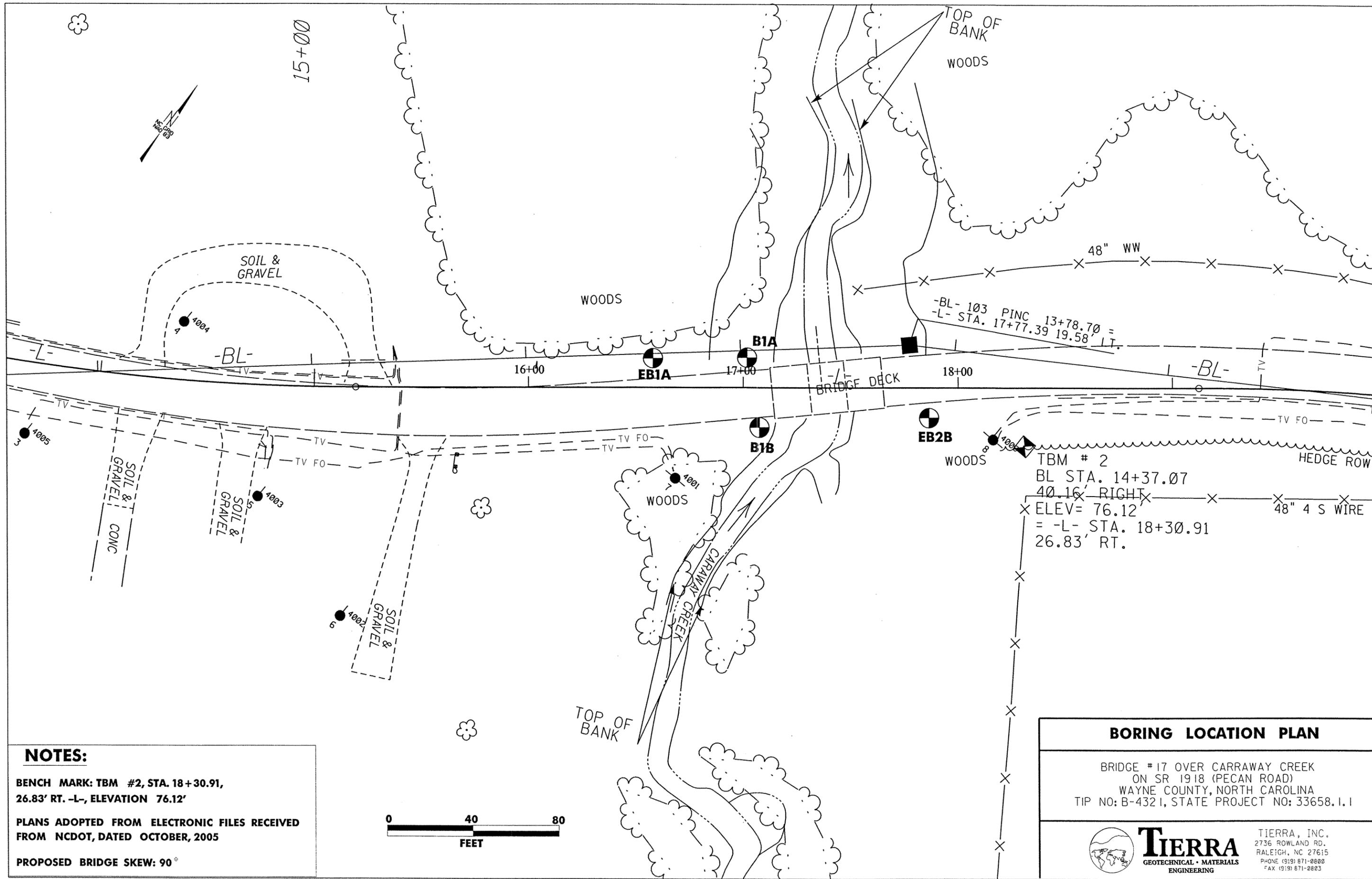


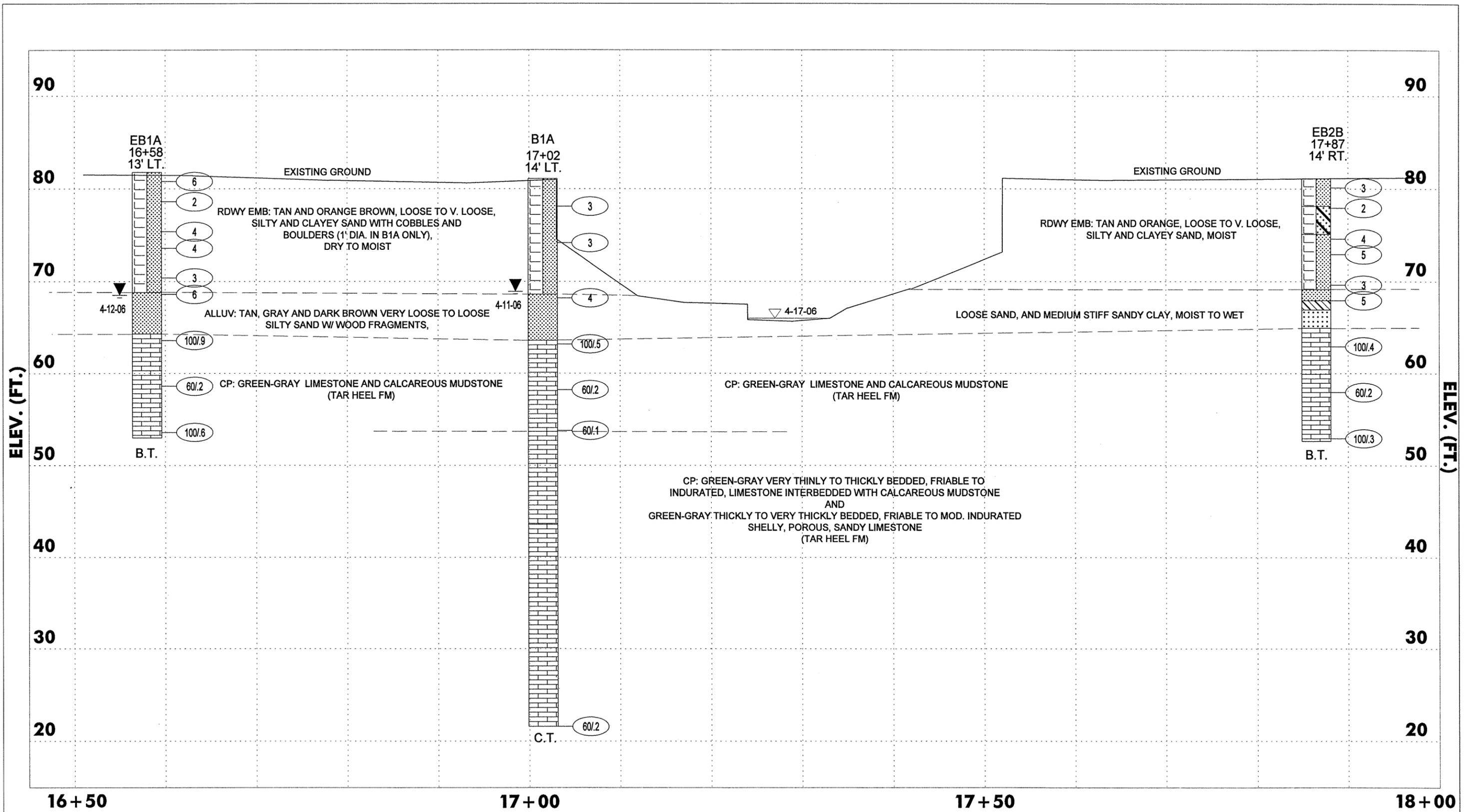
SITE VICINITY MAP

**BRIDGE #17 OVER CARRAWAY CREEK
ON SR 1918 (PECAN ROAD)
WAYNE COUNTY, NORTH CAROLINA
TIP NO: B-4321, STATE PROJECT NO: 33658.1.1**



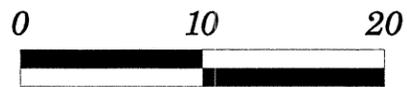
TIERRA, INC.
2736 ROWLAND RD.
RALEIGH, NC 27615
PHONE (919) 871-0800
FAX (919) 871-0803



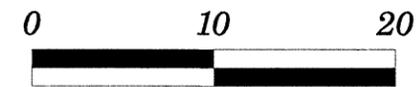


BENCH MARK: TBM #2, STA. 18+30.91,
26.83' RT. -L-, ELEVATION 76.12'

VERTICAL SCALE



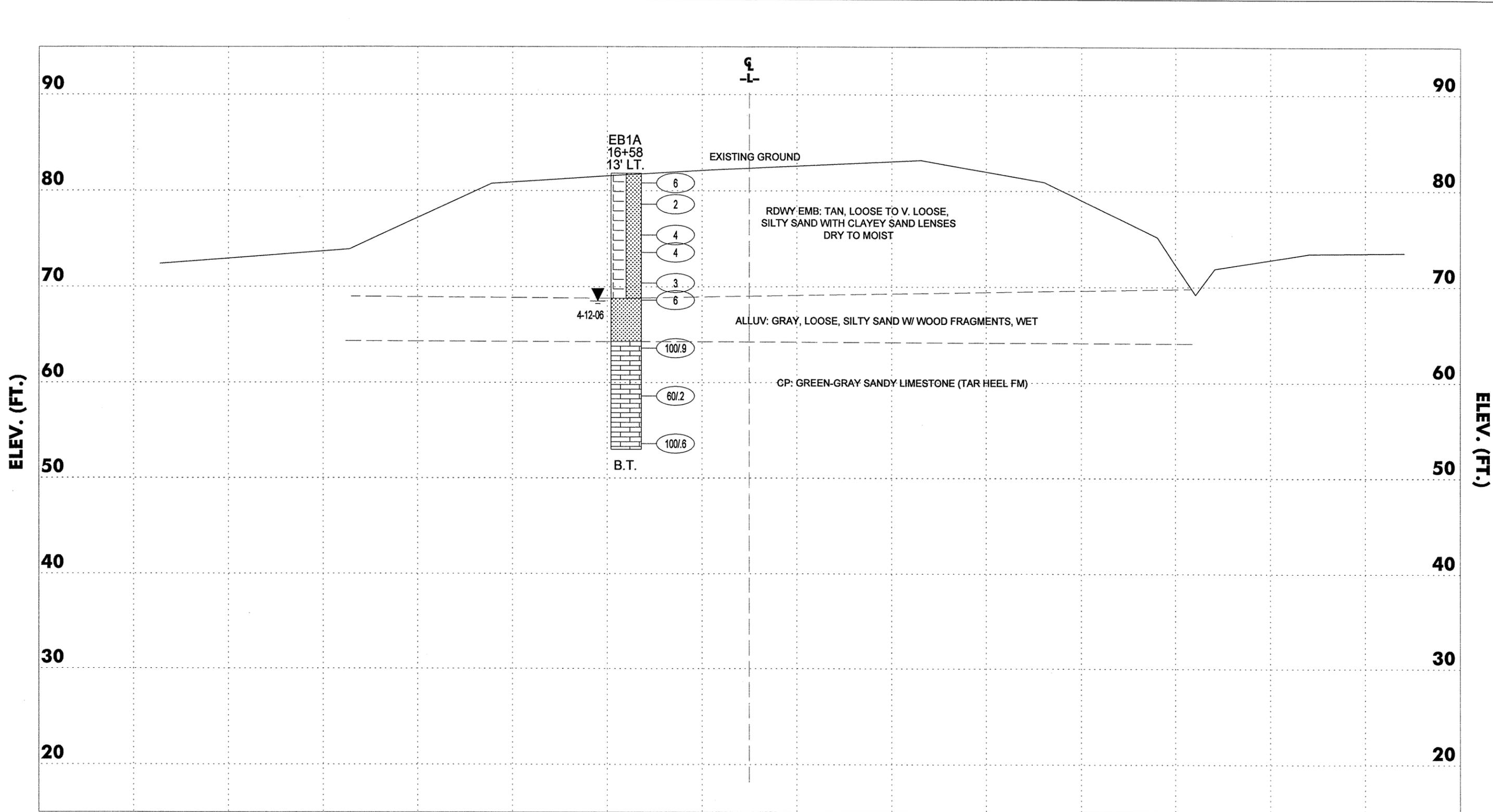
HORIZONTAL SCALE



PROFILE 18' LEFT OF -L-

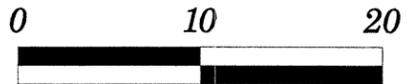
BRIDGE #17 OVER CARRAWAY CREEK
ON SR 1918 (PECAN ROAD)
WAYNE COUNTY, NORTH CAROLINA
TIP NO: B-432 I, STATE PROJECT NO: 33658. I. I



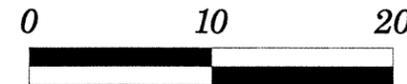


BENCH MARK: TBM #2, STA. 18+30.91,
26.83' RT. -L-, ELEVATION 76.12'

VERTICAL SCALE



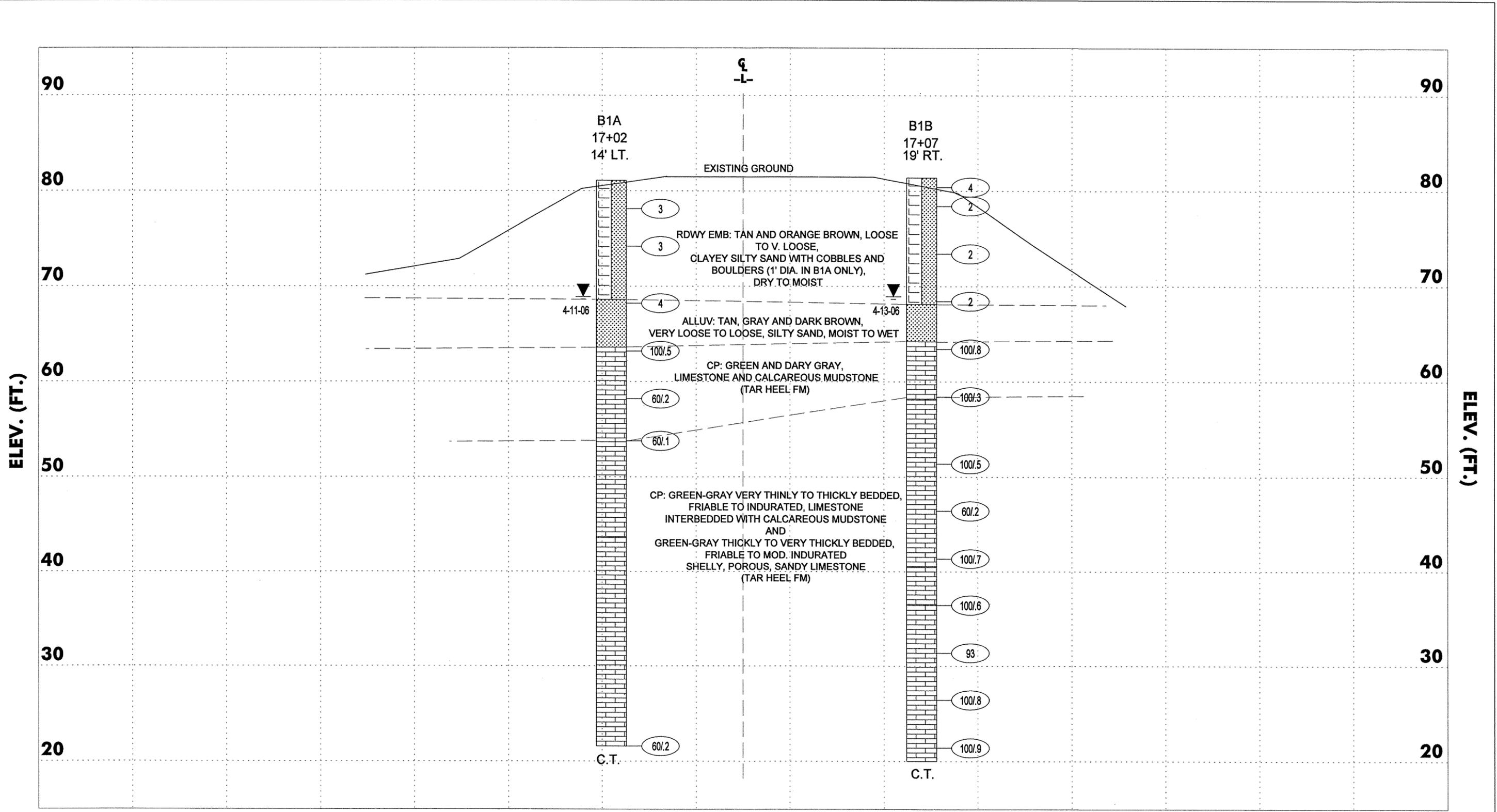
HORIZONTAL SCALE



CROSS SECTION END BENT 1

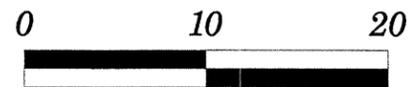
BRIDGE #17 OVER CARRAWAY CREEK
ON SR 1918 (PECAN ROAD)
WAYNE COUNTY, NORTH CAROLINA
TIP NO: B-432 I, STATE PROJECT NO: 33658.1.1



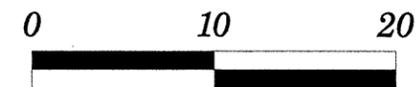


BENCH MARK: TBM #2, STA. 18+30.91,
26.83' RT. -L-, ELEVATION 76.12'

VERTICAL SCALE



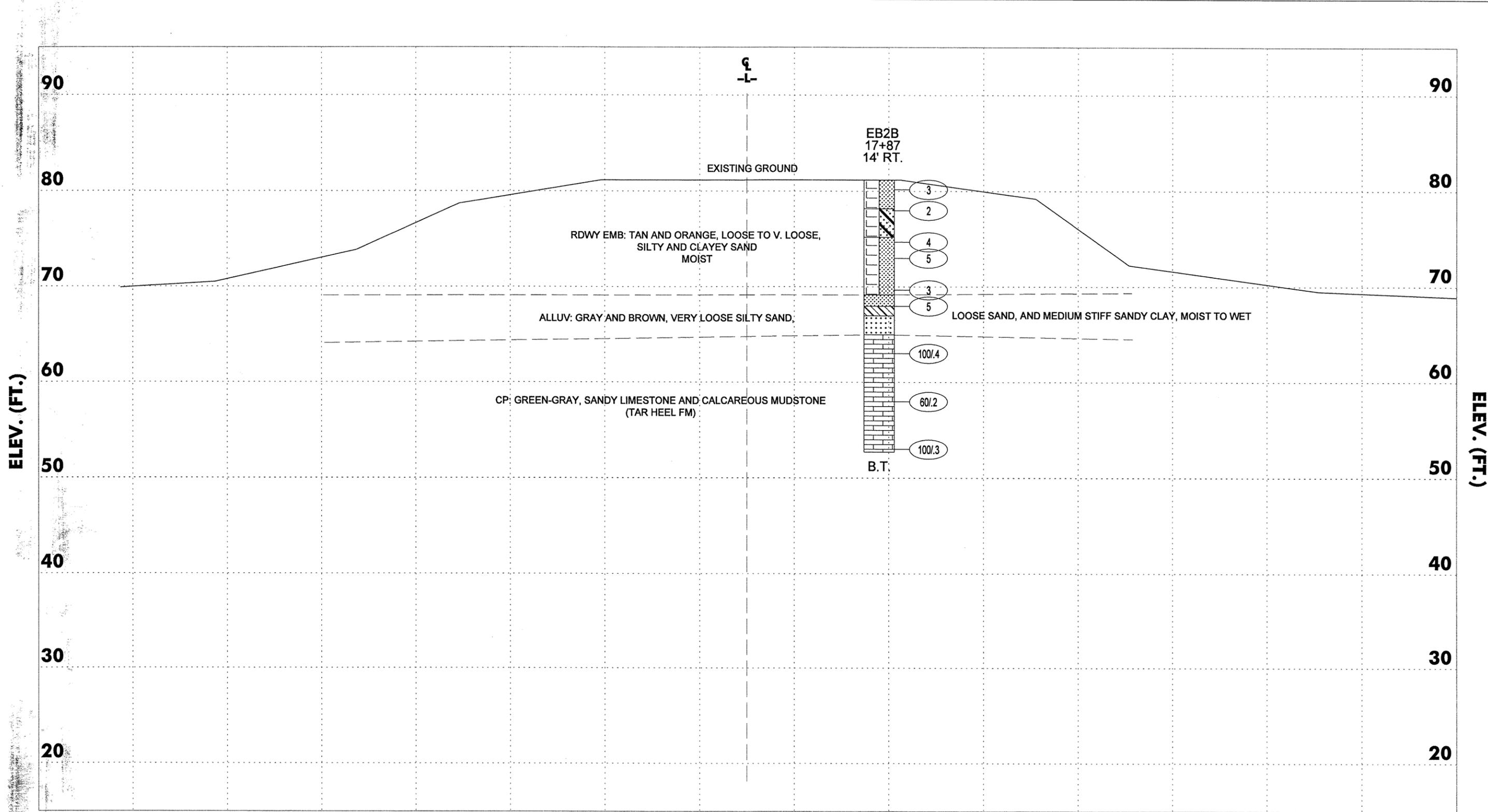
HORIZONTAL SCALE



CROSS SECTION BENT 1

BRIDGE # 17 OVER CARRAWAY CREEK
ON SR. 1918 (PECAN ROAD)
WAYNE COUNTY, NORTH CAROLINA
TIP NO: B-4321, STATE PROJECT NO: 33658.1.1



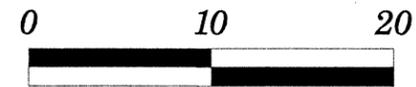


BENCH MARK: TBM #2, STA. 18+30.91,
26.83' RT. -L-, ELEVATION 76.12'

VERTICAL SCALE



HORIZONTAL SCALE



CROSS SECTION END BENT 2

BRIDGE #17 OVER CARRAWAY CREEK
ON SR 1918 (PECAN ROAD)
WAYNE COUNTY, NORTH CAROLINA
TIP NO: B-432 I, STATE PROJECT NO: 33658. I. I





2736 ROWLAND ROAD
RALEIGH, NORTH CAROLINA 27615
Phone (919) 871-0800 Fax (919) 871-0803

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33658.1.1		ID. B-4321		COUNTY WAYNE		GEOLOGIST C. BRUINSMA							
SITE DESCRIPTION BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD)						GROUND WATER (ft)							
BORING NO. B1A		BORING LOCATION 17+02		OFFSET 14' LT		ALIGNMENT -L-							
COLLAR ELEV. 81.1 ft		NORTHING 899,657.5		EASTING 1,311,858.9		0 HR. 11.6							
TOTAL DEPTH 59.7 ft		DRILL MACHINE CME 55		DRILL METHOD MUD ROTARY		HAMMER TYPE MANUAL							
DATE STARTED 4-10-06		COMPLETED 4-10-06		SURFACE WATER DEPTH N/A									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
81.1													EXISTING GROUND
80	3.0	1	2	1									RDWY EMB: ORANGE BROWN, V. LOOSE, CLAYEY SILTY SAND (A-2-4) WITH COBBLES AND BOULDERS (1' DIA.)
75	6.9	6	2	1									
70	12.9	2	2	2									ALLUV: DARK BROWN-GRAY, LOOSE, SILTY SAND (A-2-4)
65	17.9	100/5											CP: DARK GRAY-GREEN, CALCAREOUS MUDSTONE WITH LIMESTONE LAYERS (1" TO 3") (TAR HEEL FORMATION)
60	22.9	60/2											
55	27.3	60/1											CP: GREEN-GRAY, SANDY LIMESTONE WITH CLAY SEAMS
50													CP: GREEN-GRAY, V. THINLY BEDDED TO THICKLY BEDDED, INDURATED TO FRIABLE, SANDY LIMESTONE WITH CALCAREOUS MUDSTONE LAYERS (1" TO 6" THICK)
45													
40													CP: GREEN-GRAY, THICKLY BEDDED, FRIABLE TO MOD. INDURATED SANDY LIMESTONE (WITH FOSSILS AND PHOSPHATE)
35													
30													CP: GREEN-GRAY, V. THINLY BEDDED TO THINLY BEDDED, INDURATED TO FRIABLE SANDY LIMESTONE WITH CALCAREOUS MUDSTONE LAYERS (1" TO 3" THICK)
25													CP: GREEN-GRAY, THICKLY BEDDED, MOD. INDURATED TO FRIABLE SANDY LIMESTONE (POROUS WITH OCC. PHOSPHATE AND ABUND. SHELL FRAGMENT)
21.6	59.5	60/2											CORING TERMINATED AT ELEVATION 21.6' IN CP: SANDY LIMESTONE
													BORING TERMINATED AT ELEVATION 21.4' IN CP: SANDY LIMESTONE
													MUD DENSITY = 64.36 PCF NOTE: BORING OFFSET DOWNSTATION FROM BENT DUE TO SLOPE

CORE BORING REPORT

DATE: 4/10-4/11/06

PROJECT: 33658.1.1 I.D. NO.: B-4321 BORING NO: B1A GEOLOGIST: C. BRUINSMA

DESCRIPTION: BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN RD)

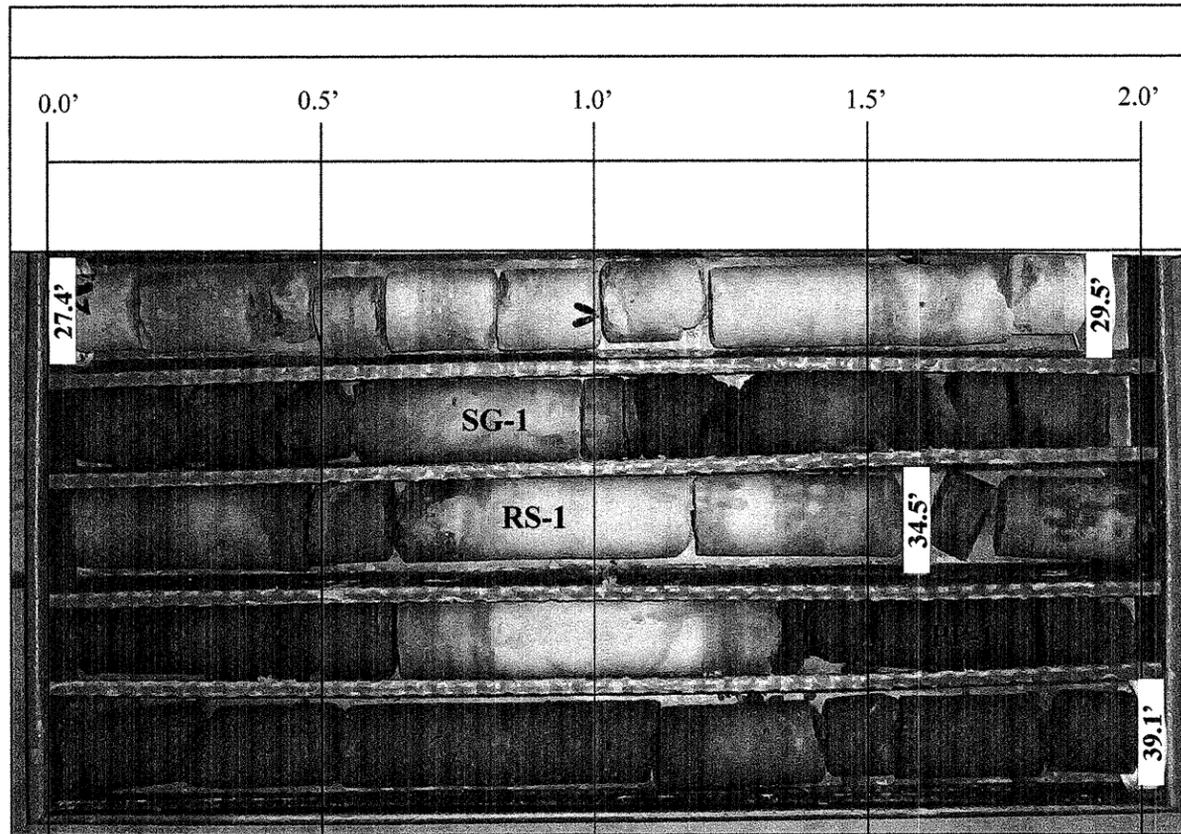
COUNTY: WAYNE COLLAR ELEV.: 81.1 FT TOTAL DEPTH: 59.7 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
53.7	27.4	2:30	2.1	1.8/2.1	N/A		27.4-37.5 CP: GREEN-GRAY, V. THINLY BEDDED TO THICKLY BEDDED, INDURATED TO FRIABLE, SANDY LIMESTONE WITH CALCAREOUS MUDSTONE LAYERS (1-6" THICK)(TAR HEEL FORMATION)
		3:00					
		0:30/ 0.1				85.7%	
51.6	29.5	--					
51.6	29.5	4:30	5.0	3.3/5.0	N/A	SG-1	37.5-49.5 CP: GREEN-GRAY, THICKLY BEDDED, FRIABLE TO MOD. INDURATED SANDY LIMESTONE (WITH FOSSILS AND PHOSPHATE)
		5:00					
		5:30				66.0%	
46.6	34.5	6:00				RS-1	
46.6	34.5	4:00	5.0	4.6/5.0	N/A		STRATA REC = 78.2%
		2:30					
		3:30				92.0%	
41.6	39.5	2:00				PP-1	
41.6	39.5	3:30	5.0	5.0/5.0	N/A		STRATA REC = 94.2%
		3:00					
		3:00				100%	
36.6	44.5	4:00				PP-2	
36.6	44.5	3:00	5.0	5.0/5.0	N/A		STRATA REC = 86.0%
		2:30					
		2:30				100%	
31.6	49.5	3:30				RS-3	
31.6	49.5	2:30	5.0	4.3/5.0	N/A		49.5-54.5 CP: GREEN-GRAY, V. THINLY BEDDED TO THINLY BEDDED, INDURATED TO FRIABLE SANDY LIMESTONE WITH CALCAREOUS MUDSTONE LAYERS (1-3" THICK)
		2:30					
		2:30				86.0%	
26.6	54.5	2:00					STRATA REC = 86.0%
26.6	54.5	3:00					

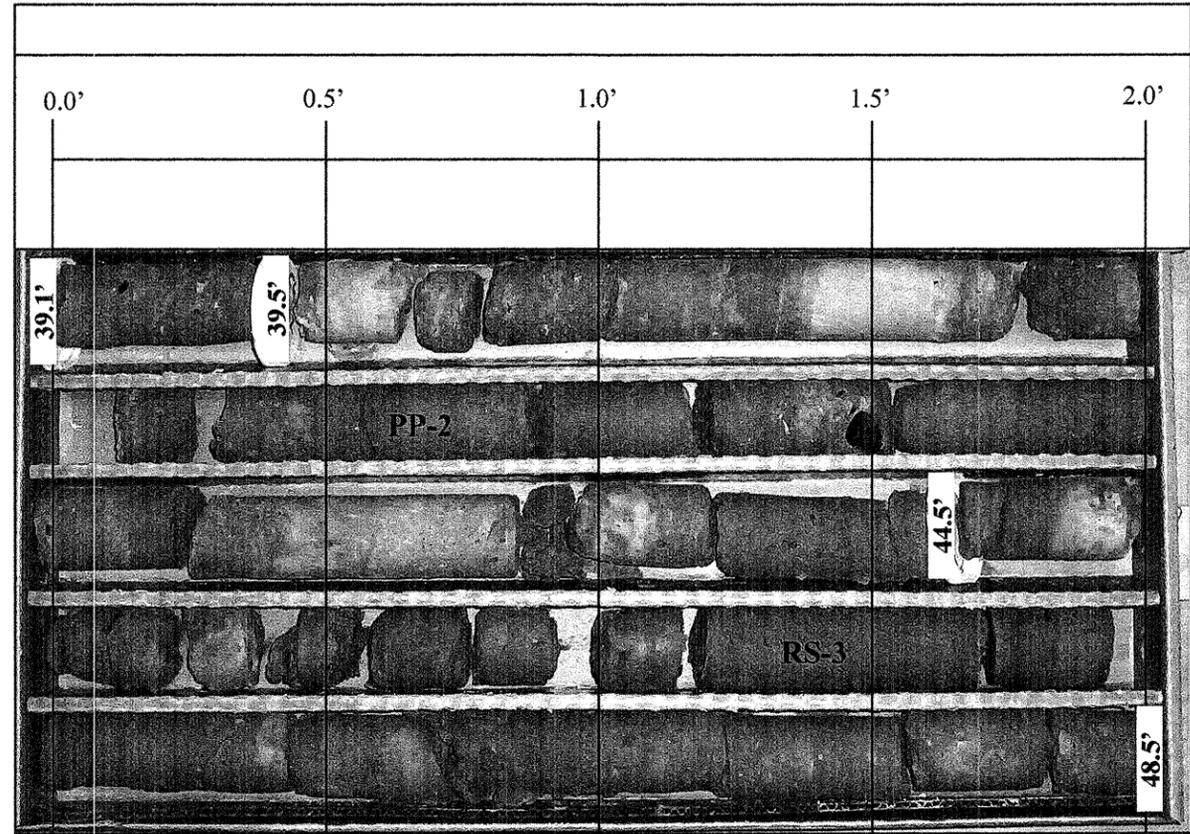
CORING TERMINATED AT 59.5 FT
ELEVATION 21.6 FT

DRILLER: S. GOWER CORE SIZE: NQ EQUIPMENT: CME 55

NCDOT_BORE_06-011.GPJ NCDOT.GDT 5/25/06



Boring B1A, Box 1 of 3, 27.4 feet to 39.1 feet.



Boring B1A, Box 2 of 3, 39.1 feet to 48.5 feet.

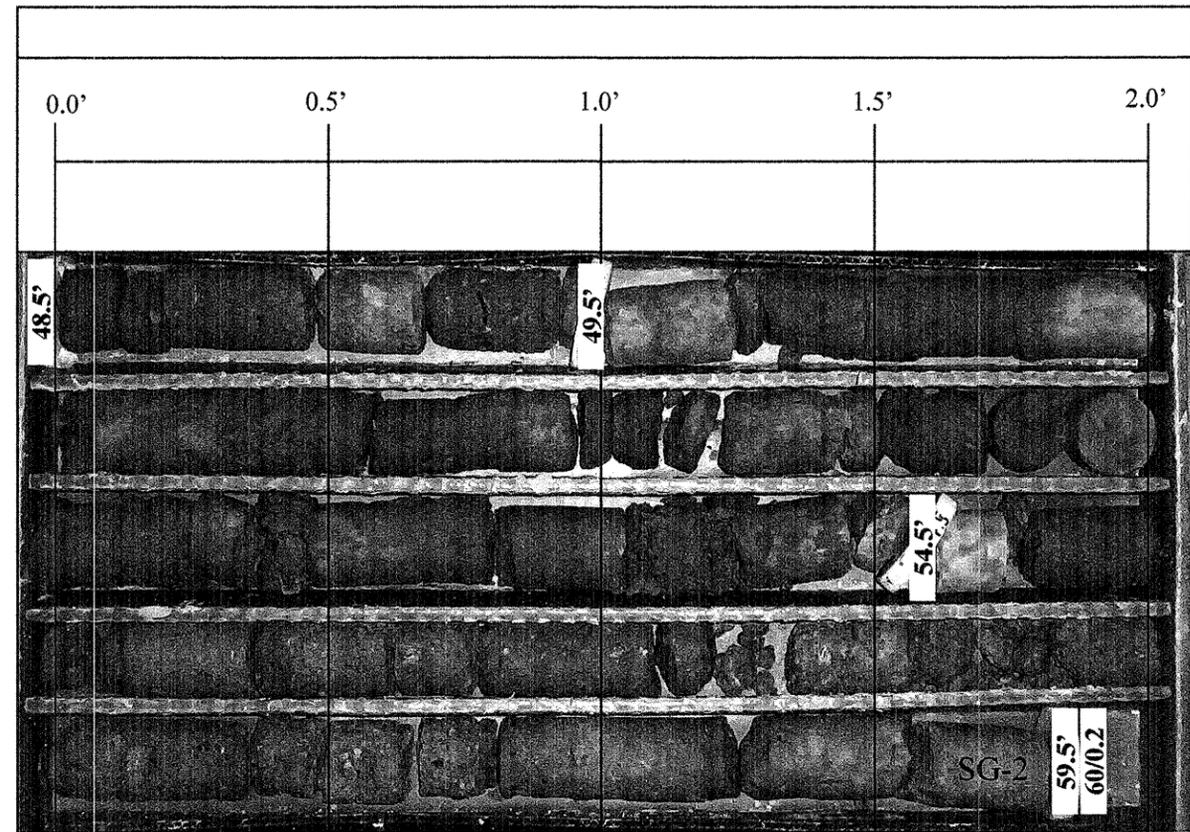
SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE #17 OVER CARRAWAY CREEK
 ON SR 1918 (PECAN ROAD)
 WAYNE COUNTY, NORTH CAROLINA
 TIP NO: B-4321, STATE PROJECT NO: 33658.1.1**



TIERRA, INC.
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 PHONE (919) 871-0800
 FAX (919) 871-6803



Boring B1A, Box 3 of 3, 48.5 feet to 59.5 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE #17 OVER CARRAWAY CREEK
 ON SR 1918 (PECAN ROAD)
 WAYNE COUNTY, NORTH CAROLINA
 TIP NO: B-4321, STATE PROJECT NO: 33658.1.1**



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33658.1.1		ID. B-4321		COUNTY WAYNE		GEOLOGIST C. BRUINSMA							
SITE DESCRIPTION BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD)						GROUND WATER (ft)							
BORING NO. B1B		BORING LOCATION 17+07		OFFSET 19' RT		ALIGNMENT -L-							
COLLAR ELEV. 81.4 ft		NORTHING 899,659.2		EASTING 1,311,891.7		0 HR. 11.3							
TOTAL DEPTH 61.4 ft		DRILL MACHINE CME 55		DRILL METHOD HSA		HAMMER TYPE MANUAL							
DATE STARTED 4-12-06		COMPLETED 4-12-06		SURFACE WATER DEPTH N/A									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
81.4													EXISTING GROUND
80	1.0												RDWY EMB. TAN. LOOSE TO V. LOOSE, CLAYEY SILTY SAND (A-2-4)
	3.0	2	3	1									
		2	1	1									
75	8.0												
		2	1	1									
70	13.0												
		1	1	1									
65	18.0												
		35	65/3										
60	23.0												
		100/3											
55	30.0												
		100/5											
50	35.0												
		60/2											
45	40.0												
		15	85/2										
40	45.0												
		60	40/1										
35	50.0												
		39	42	51									
30	55.0												
		35	37	63/3									
25	60.0												
		16	33	67/4									

CORE BORING REPORT

DATE: 4/12/06

PROJECT: 33658.1.1 I.D. NO.: B-4321 BORING NO: B1B GEOLOGIST: C. BRUINSMA

DESCRIPTION: BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN RD)

COUNTY: WAYNE

COLLAR ELEV.: 81.4 FT

TOTAL DEPTH: 61.4 FT

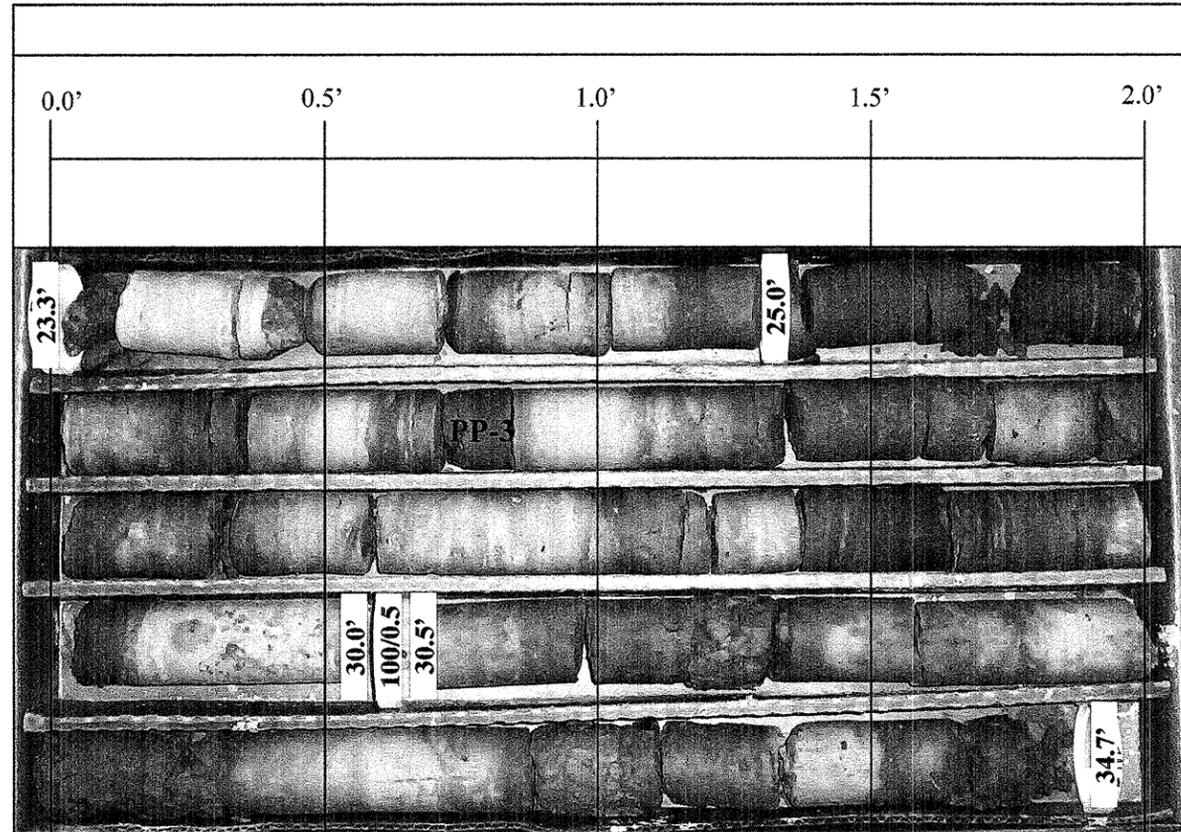
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
58.1	23.3	4:30	1.7	1.2/1.7	N/A		23.3-40.9 CP: GREEN-GRAY, THINLY TO THICKLY BEDDED INDURATED TO FRIABLE LIMESTONE WITH CALCAREOUS MUDSTONE LAYERS (1"-3" THICK) (TAR HEEL FORMATION)
		2:30/0.7		70.6%			
		-					
56.4	25.0	-	5.0	5.0/5.0	N/A	PP-3	
56.4	25.0	3:00		100%			
		4:00					
		3:00					
51.4	30.0	3:30					
51.4	30.0	4:00					
51.4	30.0	30.0 - 30.5 (SPT 100/0.5)					
50.9	30.5	2:00/0.5	4.5	3.4/4.5	N/A		
		4:00		75.5%			
		4:00					
		4:00					
46.4	35.0	4:45					
46.4	35.0	35.0 - 35.2 (SPT 60/0.2)					
46.2	35.2	2:30/0.8	4.8	4.8/4.8	N/A		
		2:30		100%			
		2:00					
		4:00					
41.4	40.0	4:00					
41.4	40.0	40.0 - 40.7 (SPT 100/0.7)					
40.7	40.7	1:00/0.3	4.3	4.2/4.3	N/A	RS-4	
		2:30		97.7%			
		4:00					
		3:00					
36.4	45.0	3:30					
36.4	45.0	45.0 - 45.6 (SPT 100/0.6)					
35.8	45.6	1:45/0.4	4.4	4.0/4.4	N/A		
		2:30		90.9%			
		1:45					
		2:00					
31.4	50.0	2:00					
31.4	50.0	50.0 - 51.5 (SPT N=93)					

CORING TERMINATED AT 60.0 FT
ELEVATION 21.4 FT

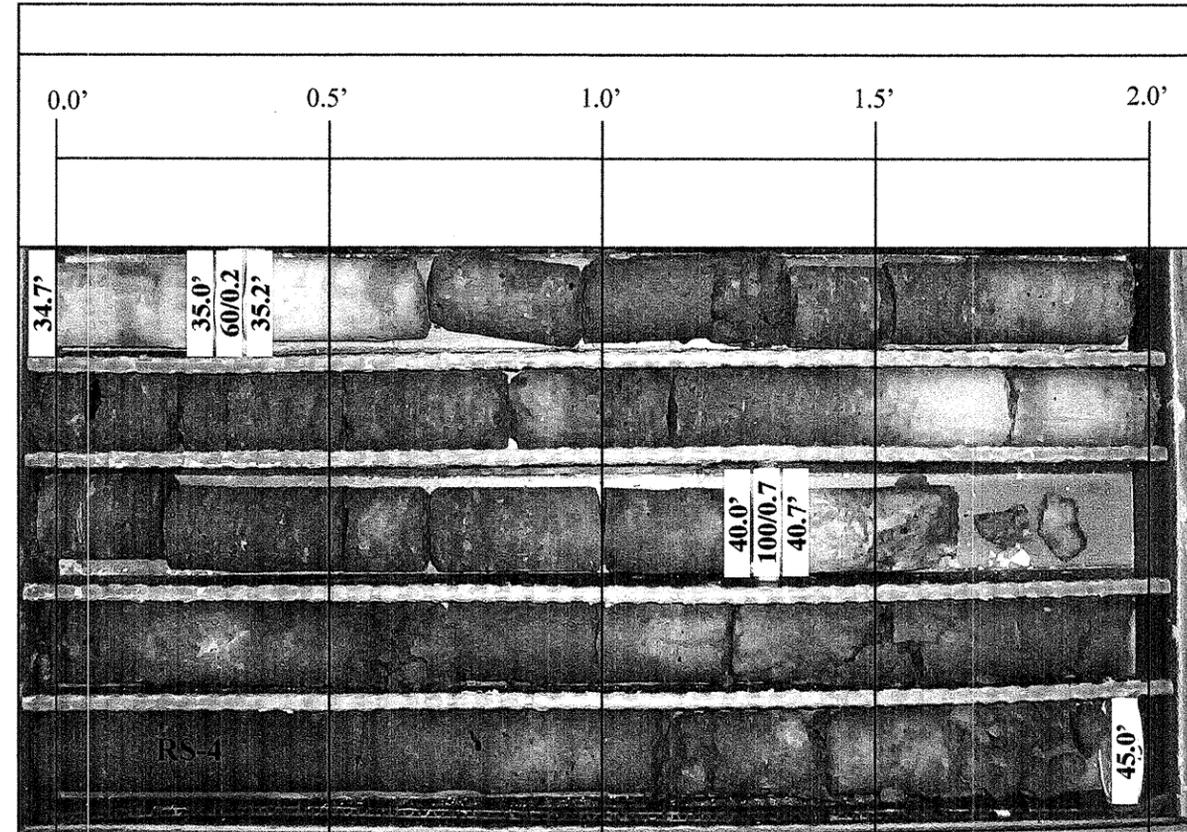
DRILLER: S. GOWER

CORE SIZE: NQ

EQUIPMENT: CME 55



Boring B1B, Box 1 of 4, 23.3 feet to 34.7 feet.



Boring B1B, Box 2 of 4, 34.7 feet to 45.0 feet.

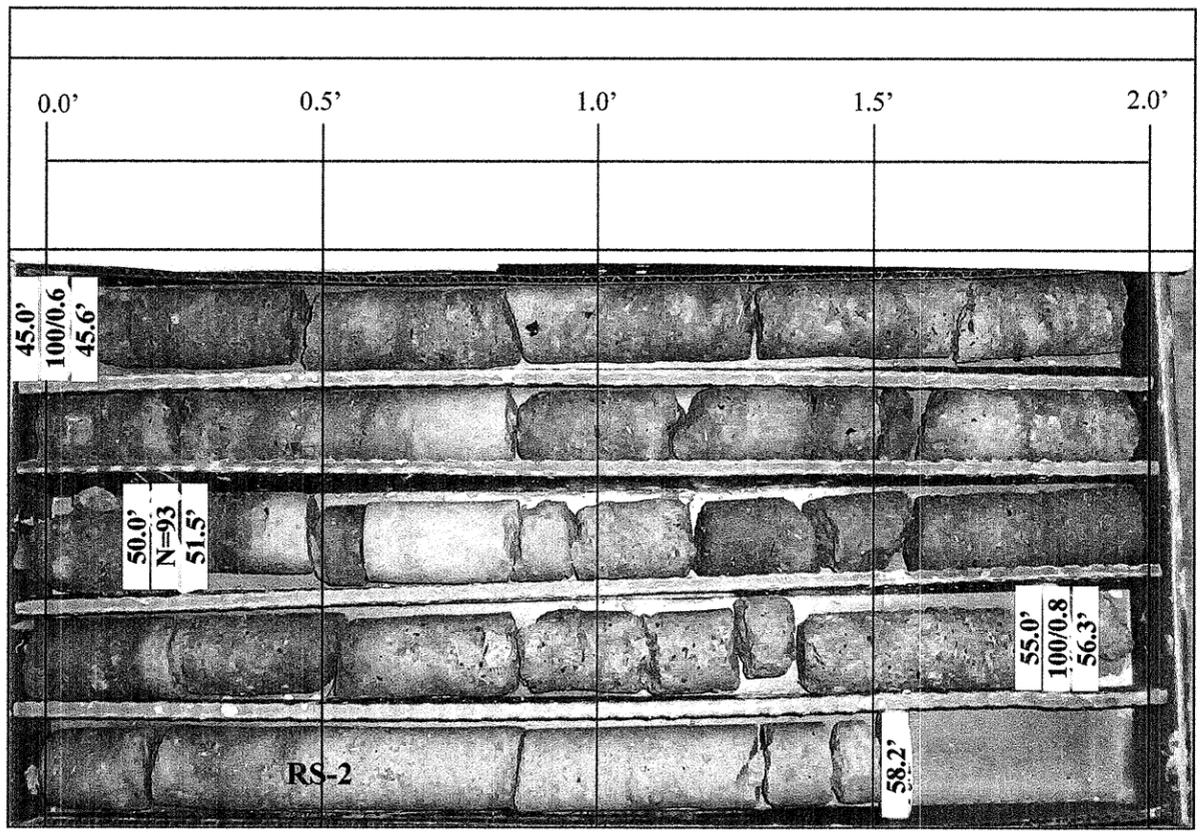
SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

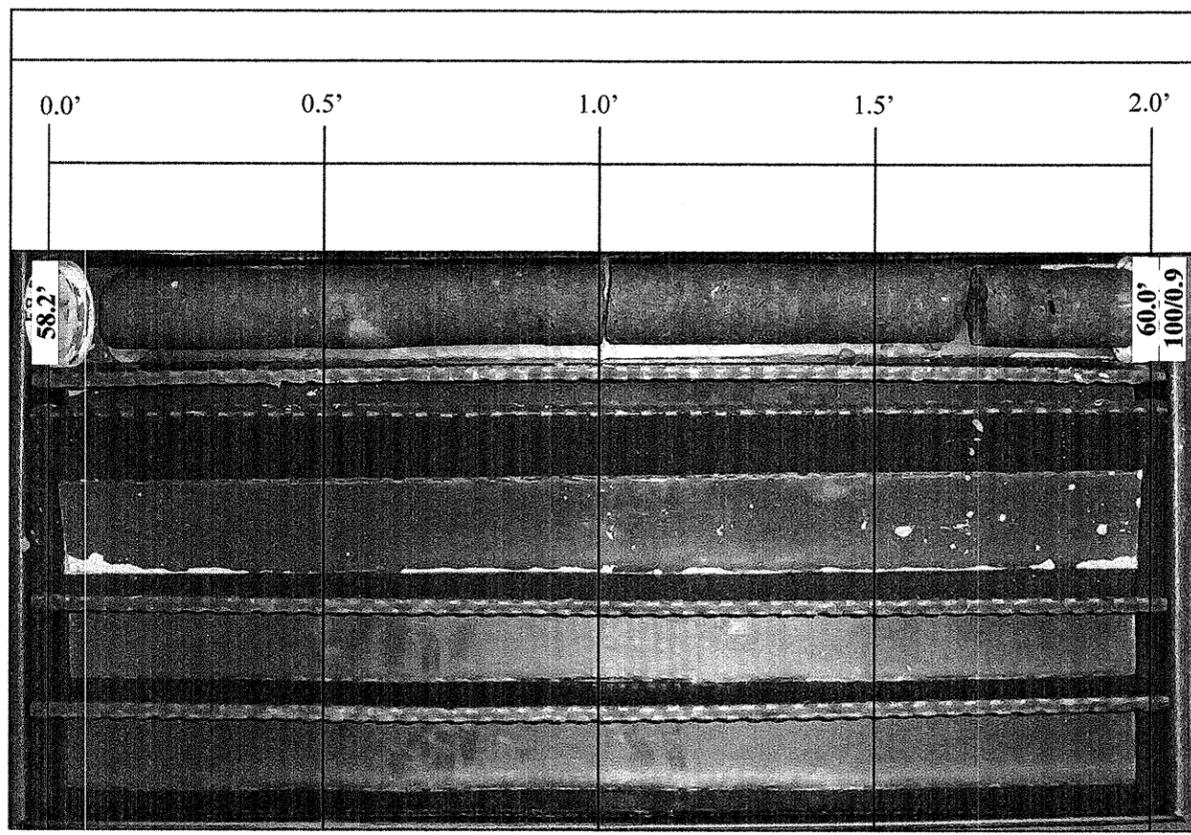
**BRIDGE #17 OVER CARRAWAY CREEK
 ON SR 1918 (PECAN ROAD)
 WAYNE COUNTY, NORTH CAROLINA
 TIP NO: B-4321, STATE PROJECT NO: 33658.1.1**



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Boring B1B, Box 3 of 4, 45.0 feet to 58.2 feet.



Boring B1B, Box 4 of 4, 58.2 feet to 60.0 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS
BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD) WAYNE COUNTY, NORTH CAROLINA TIP NO: B-4321, STATE PROJECT NO: 33658.1.1
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PROJECT NO.: 33658.1.1 (B-4321)

F.A. NO.: BRSTP-1918(2)

COUNTY: WAYNE

BRIDGE NO. 17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD)

**ADDITIONAL LABORATORY TEST RESULTS FOR ROCK CORE SAMPLES
PENETROMETER AND POROSITY TESTS**

Sample #	Boring #	Depth (ft)	Rock Type	PENETRATION PRIOR TO SOAK (tsf)	PENETRATION AFTER 24 HOUR SOAK (tsf)
PP-1	B1A	36.3	CALCAREOUS MUDSTONE	>4.5	3.5*
PP-2	B1A	41.7	CALCAREOUS MUDSTONE	>4.5	2.0*
PP-3	B1B	26.3	CALCAREOUS MUDSTONE	>4.5	1.5*

* SAMPLE BROKE DURING TESTING ALONG BEDDING PLANES BEFORE FULL PENETRATION WAS REACHED

NOTE: ALL SAMPLES PENETRATED LESS THAN 2 mm DURING THE TEST

Sample #	Boring #	Depth (ft)	Rock Type	BULK SPECIFIC GRAVITY	ABSORPTION	POROSITY
SG-1	B1A	30.7-31.0	LIMESTONE	2.184	1.8%	4%
SG-2	B1A	59.3-59.5	COARSE LIMESTONE	1.893	12.00%	23%

PROJECT NO.: 33658.1.1 (B-4321)

F.A. NO.: BRSTP-1918(2)

COUNTY: WAYNE

BRIDGE NO. 17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD)

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Young's Modulus (PSI)	Unconfined Compressive Strength (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-1	B1A	33.7-34.2	LIMESTONE	Kb	N/A	3.56	1.77	128.8	402,327.0	3,388	-	
RS-2	B1B	57.0-57.6	LIMESTONE	Kb	N/A	3.54	1.74	124.9	514,180.0	2,182	-	
RS-3	B1A	45.9-46.4	CALCAREOUS MUDSTONE	Kb	N/A	3.03	1.77	86.5	3,033.0	100	-	
RS-4	B1B	42.3-42.9	CALCAREOUS MUDSTONE	Kb	N/A	3.49	1.74	88.9	7,313.0	147	-	



**FIELD
 SCOUR REPORT**

WBS: 33658.1.1 TIP: B-4321 COUNTY: WAYNE

DESCRIPTION(1): BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN ROAD)

EXISTING BRIDGE

Information from: Field Inspection Microfilm _____ (reel _____ pos: _____)
 Other (explain) HYDRO REPORT

Bridge No.: 17 Length: 53 Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2
 Foundation Type: SPREAD FOOTING/TIMBER PILES, CONCRETE DECK OVER TIMBER BEAMS

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: NONE

Interior Bents: SOUTHERN INT. BENT (EX. B1), SCOUR ON UPSTREAM SIDE OF CONCRETE FOOTING
NORTHERN INT. BENT (EX. B2), SCOURING FROM MIDDLE OF BENT TO DOWNSTREAM

Channel Bed: SOME SCOURING EVIDENT UNDER BRIDGE

Channel Bank: SCOURING ON NORTH SIDE OF BANK EXISTING INT. BENT 2 ON NORTH BANK

EXISTING SCOUR PROTECTION

Type(3): RIP RAP/CONCRETE ON SOUTH END BENT (EX. EB1), TIMBER ABUTMENTS

Extent(4): JUST UNDER BRIDGE AND ALONG DOWNSTREAM TOE OF SLOPE FOR ENDBENTS

Effectiveness(5): INEFFECTIVE

Obstructions(6): LOG APPROX. 150 FEET DOWNSTREAM, IMBEDDED IN STREAM

INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): SAND WITH OCC. GRAVEL, CAOBBLES AND BOULDERS 0.5 TO 1 FOOT IN DIAMETER (RIP RAP ORIGIN)

Channel Bank Material(8): LAYER OF ORGANIC CLAYEY SANDY SILT, OVERLYING SILTY SAND

Channel Bank Cover(9): GRASS AND SHRUBS, OCCASIONAL TREE UPSTREAM SIDE

Floodplain Width(10): 400 TO 500+ FEET

Floodplain Cover(11): GRASS, SHRUBS, AND TREES (YOUNG TO MODERATE IN AGE)

Stream is(12): Aggrading _____ Degrading Static _____

Channel Migration Tendency(13): TO THE NORTH

Observations and Other Comments: ABUNDANT SMALL FISH AND MOLLUSKS OBSERVED. PROBING OF CHANNEL BED DID NOT ENCOUNTER HARD MATERIAL WITHIN UPPER 3 FT.

Reported by: Date: 4/11/2006
 TIERRA, INC.

DESIGN SCOUR ELEVATIONS(14)

Feet Meters _____

	BENTS									
	B1	B2	B3	B4						
100 yr DSE	63.0									

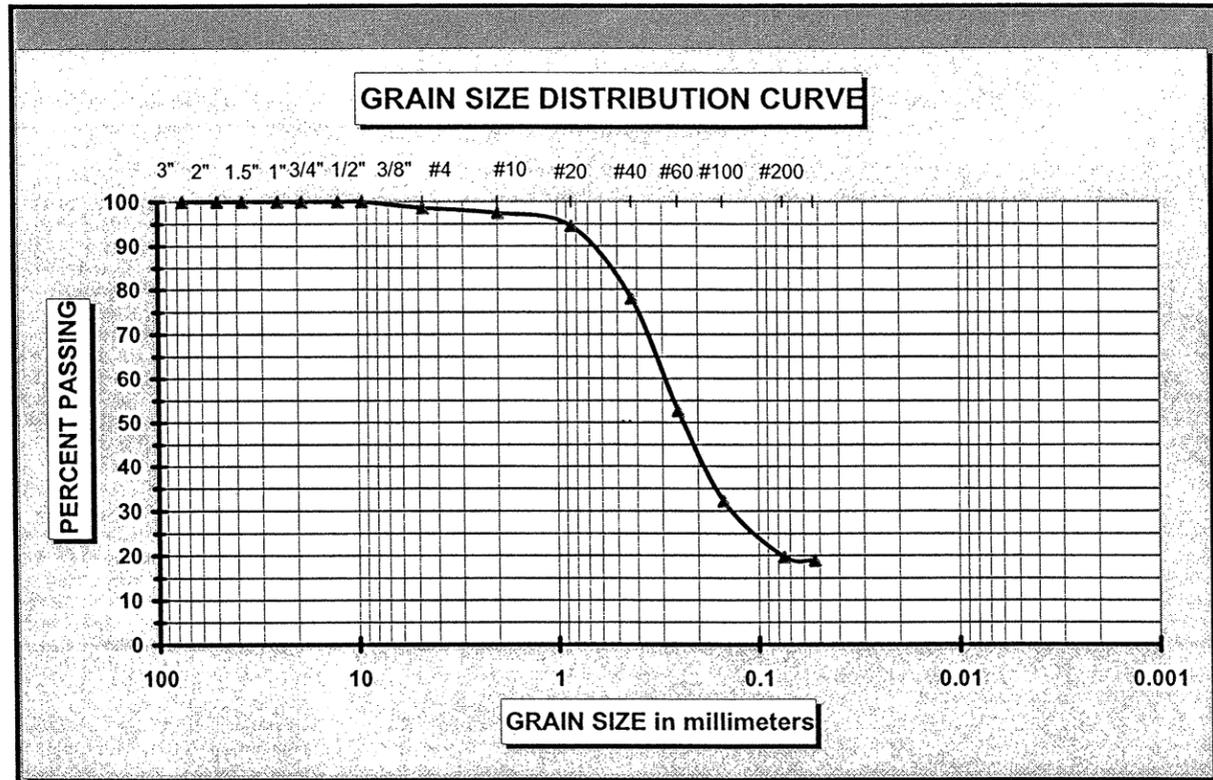
Comparison of DSE to Hydraulics Unit theoretical scour:
 Contraction scour was applied at Bent 1 for the DSE calculations even though the scour report did not. It was felt that Bent 1 was close enough to the edge of the stream bank that contraction should be considered.

DSE determined by: Michael Whalen Date: 5/3/2006

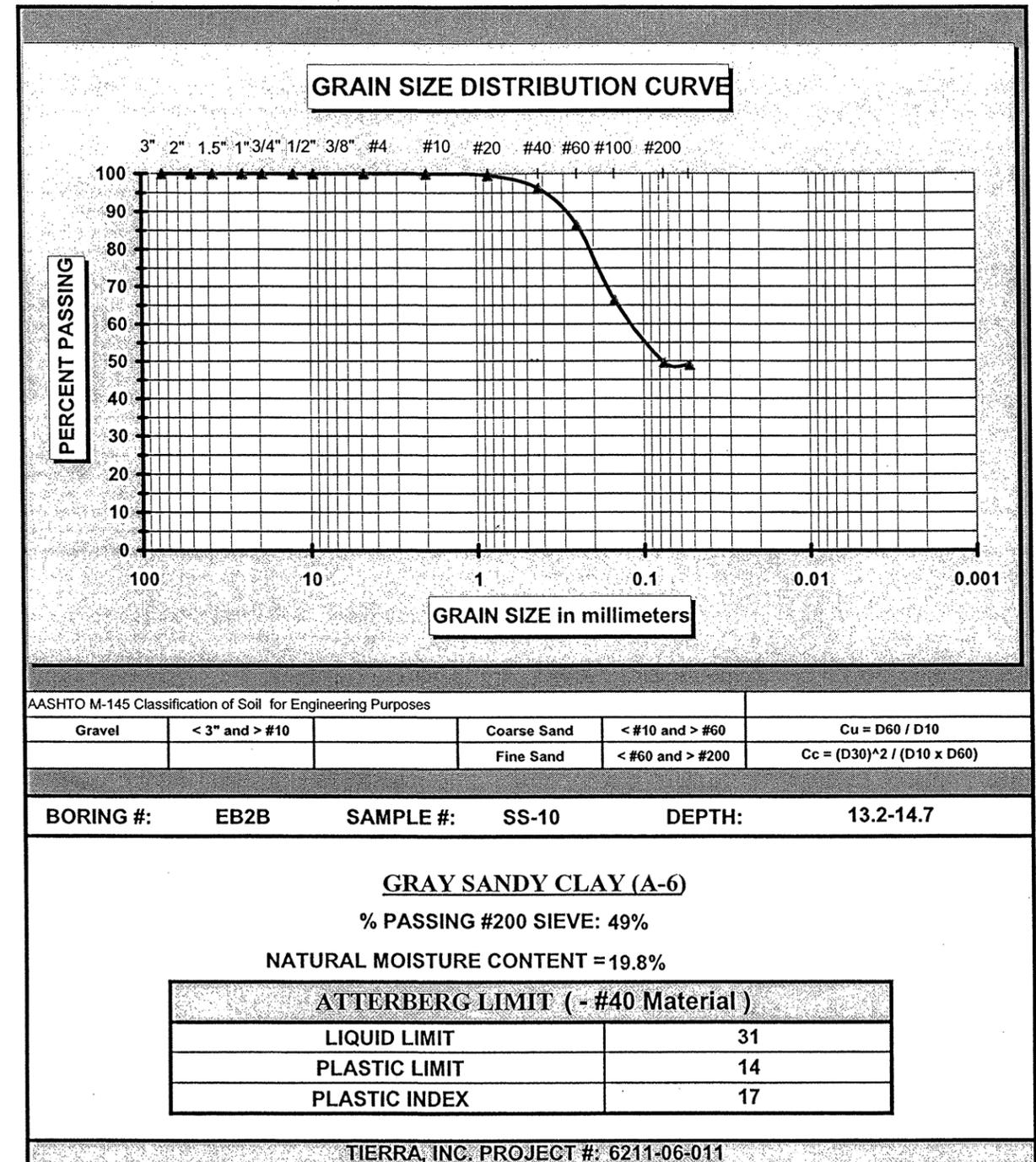
SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	BED	BANK	BANK	BANK	BANK		
Sample No.	S-2	S-1	SS-5	SS-9	SS-10		
Retained #4	0	97	99	100	100		
Passed #10	100	96	98	99	100		
Passed #40	77	76	78	86	96		
Passed #200	0	16	19	26	49		
Coarse Sand	66	46	46	35	13		
Fine Sand	34	38	35	39	38		
Silt	-	6	7	12	15		
Clay	-	10	12	14	34		
LL	17	19	16	16	31		
PI	NP	NP	NP	NP	17		
AASHTO	A-3	A-2-4	A-2-4	A-2-4	A-6		
Station	17+40	16+58	17+07	17+87	17+87		
Offset	10 RT	13 LT	19 RT	14 RT	14 RT		
Depth	0.0-0.5	13.0-13.5	13.0-14.5	11.5-13.0	13.2-14.7		

BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN RD)
 WAYNE COUNTY
 NCDOT Project No: 33658.1.1 - T.I.P. No: B-4321



**BRIDGE #17 OVER CARRAWAY CREEK ON SR 1918 (PECAN RD)
WAYNE COUNTY
NCDOT Project No: 33658.1.1 - T.I.P. No: B-4321**





CENTERLINE PROFILE (-L-), LOOKING DOWNSTATION FROM STATION 18+50 -L-.



INTERIOR BENT 1, LOOKING FROM B1A TO B1B.

SITE PHOTOGRAPHS

**BRIDGE #17 OVER CARRAWAY CREEK
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END BENT 1, LOOKING FROM LEFT TO RIGHT.



END BENT 2, LOOKING FROM LEFT TO RIGHT.

SITE PHOTOGRAPHS

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CARRAWAY CREEK, LOOKING UPSTREAM FROM EXISTING BRIDGE.



CARRAWAY CREEK, LOOKING DOWNSTREAM FROM EXISTING BRIDGE.

SITE PHOTOGRAPHS

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