

STATE	STATE PROJECT REFERENCE NO.	
N.C.	B-4015	1
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
33383.1.1	BRZ-1362(I)	P.E. CONST.

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

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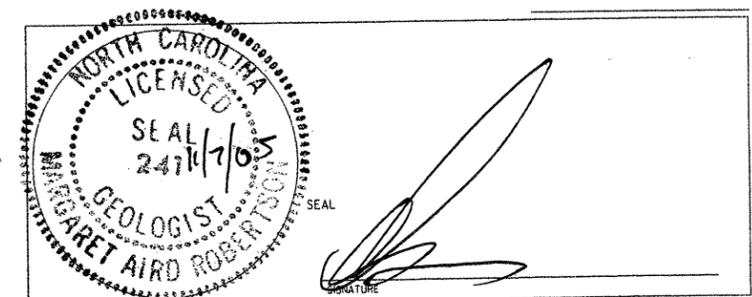
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For Letting

STATE PROJECT 33383.1.1 I.D. NO. B-4015
 F.A. PROJECT BRZ-1362(I)
 COUNTY ASHE
 PROJECT DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)
 SITE DESCRIPTION _____

INVESTIGATED BY J. HOWARD PERSONNEL M. KORN
 CHECKED BY M. ROBERTSON, L.G. C. BRUINSMA
 SUBMITTED BY TIERRA, INC. F. COX
 DATE NOVEMBER, 2005 E. RIVERA



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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.

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DRAWN BY: E. WAGNER

PROJECT: 33383.1.1 ID: B-4015

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4015	33383.1.1	2	47

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																							
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 T206, 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: <i>VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										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. THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.										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. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT. FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LESTERITE, SANDSTONE, CEMENTED SHELL BEGS, ETC.										ALLUVIUM (ALLUV.) - SOILS WHICH 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 IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 (MOTJ) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. 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. SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N 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. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (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. TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.																																							
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION										WEATHERING										GROUND WATER																																							
GENERAL CLASS. GRANULAR MATERIALS (< 5% PASSING #200) SILT-CLAY MATERIALS (> 85% PASSING #200) ORGANIC MATERIALS										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.										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 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> 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.										SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50										WEATHERING										WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. STATIC WATER LEVEL AFTER 24 HOURS. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA SPRING OR SEEPAGE																			
COMPRESSION										PERCENTAGE OF MATERIAL										MISCELLANEOUS SYMBOLS										ABBREVIATIONS																																							
GROUP CLASS. A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-7-7, A-7-8										ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC >10% >20% HIGHLY 35% AND ABOVE										ROADWAY EMBANKMENT WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS INFERRED SOIL BOUNDARIES INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP/DIP DIRECTION OF ROCK STRUCTURES SOUNDING ROD										SPT OPT VST TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION SPT N-VALUE SPT REFUSAL FRAGS. - FRAGMENTS MED. - MEDIUM PMT - PRESSUREMETER TEST SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL UNIT WEIGHT DRY UNIT WEIGHT W - MOISTURE CONTENT V. - VERY VST - VANE SHEAR TEST										AR - AUGER REFUSAL BT - BORING TERMINATED C.I. - CAVE IN CL. - CLAY CPT - CONE PENETRATION TEST CSE. - COARSE C.T. - CORING TERMINATED DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F. - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED																													
CONSISTENCY OR DENSENESS										EQUIPMENT USED ON SUBJECT PROJECT										FRACTURE SPACING										BEDDING																																							
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										DRILL UNITS: MOBILE B- BK-51 CME-45 CME-550 PORTABLE HOIST OTHER DIEDRICH D-50 OTHER										ADVANCING TOOLS: CLAY BITS 6" CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE 3" STEEL TEETH TRICONE TUNG-CARB. CORE BIT OTHER										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: B N +0 HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST OTHER										VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.										TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FEET VERY CLOSE LESS THAN 0.16 FEET										TERM THICKNESS VERY THICKLY BEDDED > 4 FEET THICKLY BEDDED 1.5 - 4 FEET THINLY BEDDED 0.16 - 1.5 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET									
TEXTURE OR GRAIN SIZE										INDURATION										PLASTICITY										COLOR																																							
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.75 2.0 0.42 0.25 0.075 0.053										FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.										VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD										PLASTICITY INDEX (PI) DRY STRENGTH NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH										DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																													
SOIL MOISTURE - CORRELATION OF TERMS										ELEVATION										NOTES																																																	
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										ELEVATION: 2726.45'										BENCH MARK: SPIKE IN 8" MAPLE TREE, BM1, -L- STA. 12+48, 89' L.T.																																																	
LL - LIQUID LIMIT PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SL - SHRINKAGE LIMIT										- SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										NOTES:																																																	



November 7, 2005

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.: 33383.1.1
TIP No.: B-4015
County: Ashe County
Description: Bridge # 165 over Big Horse Creek on SR 1362
(Big Horse Creek Road)
Tierra, Inc. Project No.: 6211-05-037

Dear Mr. Wainaina,

As authorized, Tierra, Inc. has completed the geotechnical subsurface investigation for the proposed replacement structure along SR 1362 over Big Horse Creek located in Ashe County, North Carolina. Additionally, a subsurface investigation was performed at the proposed detour structure located approximately 55 to 65 feet upstream. The purpose of this report is to present subsurface conditions and general notes to the designer for consideration during design of the planned structures. 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.

Matthew A. Korn, EI
Staff Professional

Margaret A. Robertson, L.G.
Contract Manager

1.0 PROJECT DESCRIPTION

Based on information obtained from the North Carolina Department of Transportation (NCDOT) Bridge Survey & Hydraulic Design Report dated March 21, 2005, a 2-span, 3-bent structure is proposed to replace the existing 2-span, 3-bent, timber deck bridge on steel I-beams. The proposed structure will be a 85 feet long by 30 feet wide, cored slab bridge. The new structure will replace the existing structure over Big Horse Creek, along the same alignment. The proposed skew angle for all bents is 45 degrees.

To facilitate the construction of the new bridge, a detour bridge will be constructed approximately 55 to 65 feet upstream of the proposed bridge. The detour structure will be a 115 feet long by 16 feet wide bridge. The proposed skew angle for each bent is 45 degrees.

2.0 SITE DESCRIPTION AND GEOLOGY

The project site is located along SR 1362 (Big Horse Creek Road) in a rural area 3.0 miles outside the town limits of Lansing, North Carolina in Ashe County. Big Horse Creek flows generally southeast into the North Fork New River, approximately 4 miles downstream.

Topographically, the site is mountainous with very steep slopes ascending in elevation away from the bridge. Big Horse Creek was approximately 50 feet wide and 2 feet deep during our investigation. The existing floodplain is approximately 75 feet wide. Floodplain cover consists of brush, grasses, and moderately aged trees.

The project site is located in the Blue Ridge Physiographic Province of North Carolina, outside Lansing, North Carolina. According to **The Geologic Map of North Carolina** (1985), the site is located within a general unit of Middle to Late Proterozoic gneisses (Ybgg). These rocks contain well foliated to massive gneiss interlayered with amphibolite, schist, calc-silicate rocks and marble. This site is also located near the metagraywackes of the Mount Rodgers Formation (Zml). Metagraywackes of the Mount Rodgers Formation consist of metagraywacke interlayered with metaconglomerates, finely laminated siltstones (i.e. phyllite), slates, greenstones and metarhyolites. These rocks are Late Proterozoic in age, and are part of an isolated volcanogenic sequence of rocks that extend from the far northwest portion of North Carolina into southwest Virginia. Rocks encountered at the site consist of a combination of massive to slightly layered amphibolites, amphibolite gneiss, and metagraywackes interlayered with thin phyllite and greenstone layers.

Dip direction and angles were obtained from two outcrops. Each outcrop is right of the centerline. The first outcrop is located between Stations 14+25 and 14+75 and appears to be a result of a road cut associated with Big Horse Creek Road. The second outcrop is located along the creek bank, approximately 80 feet south of the existing bridge abutment and appears to be a natural outcrop. Both outcrops exhibit similar joint patterns. Approximately 11 representative joint planes were measured for dip direction and angle, in which two distinct joint patterns were evident. Rocks in both outcrops exhibit strong foliation in association with a possible remnant bedding plane. These dip directions range from 145 to 176 degrees (SE) with dip angles ranging from 28 to 55 degrees. The second distinct joint pattern has dip directions ranging from 217 to

266 degrees (SW) with dip angles ranging from 55 to 85 degrees. Both outcrop sites consist of relatively massive metagraywackes with some of the joints bearing water seeps. Where multiple dip and dip angles were measured, an average was taken and placed on the boring location plan to represent the general joint pattern at that location.

3.0 FIELD EVALUATION PROCEDURE

Subsurface conditions were evaluated for the proposed structure by advancing eight soil test borings. Two borings per bent were drilled near proposed bent centerlines in October 2005. Additionally, two borings along the centerline of the detour structure were performed. Borings DET-1 and DET-2 were offset due to existing slopes and boulders at the proposed locations. Soil test borings were drilled utilizing a track-mounted Diedrich D-50 drill rig with an automatic hammer. Borings were drilled using a 3-inch tricone wash rotary method and a continuous sampling 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 all bent locations and was performed in accordance with (AASHTO T-225-83 (2000)) procedure utilizing a 2.5-inch diameter HQ size core barrel.

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Big Horse Creek to determine scour impact for foundation design purposes. The field scour report was electronically submitted October 25, 2005.

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. Nine split-barrel sampler samples and 2 grab samples were analyzed in our laboratory for Atterberg limits, and grain size with hydrometer analysis. Six samples were tested to determine natural moisture. Five alluvial samples were analyzed for grain size determination to assist the NCDOT in theoretical scour elevations. Three rock core samples were analyzed in our laboratory for unconfined compression strength and Young's Modulus. 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"

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 2.4 to 7.8 feet of stiff to soft sandy silt (A-4) with gravel and boulders. Alluvium deposits consist of very soft to medium stiff silty clay and sandy silt (A-7-5, A-4) and loose to dense silty sand and sandy gravel (A-2-4, A-1-b) with cobbles and boulders. Alluvium deposits directly overlie metagraywacke and amphibolite gneiss rock.

A layer of boulders was penetrated in borings EB1B and EB2A. This layer exists at approximately 7.8 to 8.5 feet beneath existing ground surfaces and is approximately 0.5 to 3 feet thick. The boulders range in size from approximately 0.5 to 1 foot in diameter.

Crystalline rock (CR) was encountered at varying elevations between 2711 and 2709 feet Mean Sea Level (MSL), consisting of metagraywacke, phyllite, amphibolite gneiss, and greenstone. Strata recoveries (REC) range from 61 to 100 percent. A majority of the rock is slightly weathered to fresh, moderately hard to very hard, and very close to widely fractured. Strata rock quality designation (RQD) is between 38 and 100 percent and typically increases with depth.

The following table summarizes approximate (MSL) rock elevations across the end bents:

Location	Boring Elevation (ft)	CR Elevation (ft)
EB1A	2718.9	2709.8
EB1B	2719.9	2709.2
EB2A	2720.5	2711.4
EB2B	2720.9	2708.9

5.2 Interior Bents

Soils beneath Bent 1 consist of alluvium deposits and residual material. Alluvium deposits consist of approximately 1.5 feet of medium dense sand with gravel (A-1-b). An approximate 1 to 1.5-foot residual layer of very dense silty sand (A-2-4) underlies alluvium deposits. Residual material directly overlies crystalline rock.

Crystalline rock exists at an approximate elevation of 2708 feet (MSL) consisting of metagraywacke, amphibolite gneiss and phyllites with recoveries at approximately 100 percent. A majority of the rock is moderately severely weathered to fresh, moderately hard to very hard, and close to widely fractured. Rock quality is between 88 and 94 percent and typically increases with depth.

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

Location	Boring Elevation (ft)	CR Elevation (ft)
B1A	2710.7	2708.1
B1B	2710.8	2707.5

5.3 Detour Bents

Soil beneath End Bent 1 consists of a roadway embankment of stiff to medium stiff sandy silt. Roadway embankment directly overlies a 1.5-foot layer of weathered metagraywacke rock.

Due to the offset of DET-2 boring, soil strata have been projected. The projected soils consist of an approximate seven-foot layer of alluvial cobbles and boulders with a soil matrix of silty sand. The cobbles and boulders range in size from approximately 0.6 to 3 feet in diameter.

Crystalline rock was encountered at varying elevations between 2718 and 2709 feet (MSL) consisting of amphibolite and metagraywacke. Rock recovery in both core holes is 100 percent. A majority of the rock is very slightly weathered to fresh, hard, and moderately close to widely fractured. Rock quality ranges from 86 to 99 percent and increases with depth.

The following table summarizes approximate (MSL) rock elevations across the detour end bents:

Location	Boring Elevation (ft)	WR Elevation (ft)	CR Elevation (ft)
DET-1	2724.3	2719.8	2718.3
DET-2	2720.8	N/A	2709.5

5.4 Groundwater

Groundwater across the site ranges in elevation between 2720 and 2711 feet (MSL). At the time of the investigation, surface water elevation within Big Horse Creek was approximately 2712 feet (MSL).

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 EB1B cobbles and boulders, ranging in diameter from 0.5 to 1 foot, were penetrated between elevations 2713.8 and 2709.2 (MSL).
- Crystalline rock was encountered approximately 3 feet beneath the existing ground surface across the interior bent, at an approximate elevation of 2708 feet (MSL).
- Within the end bent borings, crystalline rock was penetrated at approximately 10 feet beneath the existing ground surface, elevations of approximately 2709 and 2711 feet (MSL).

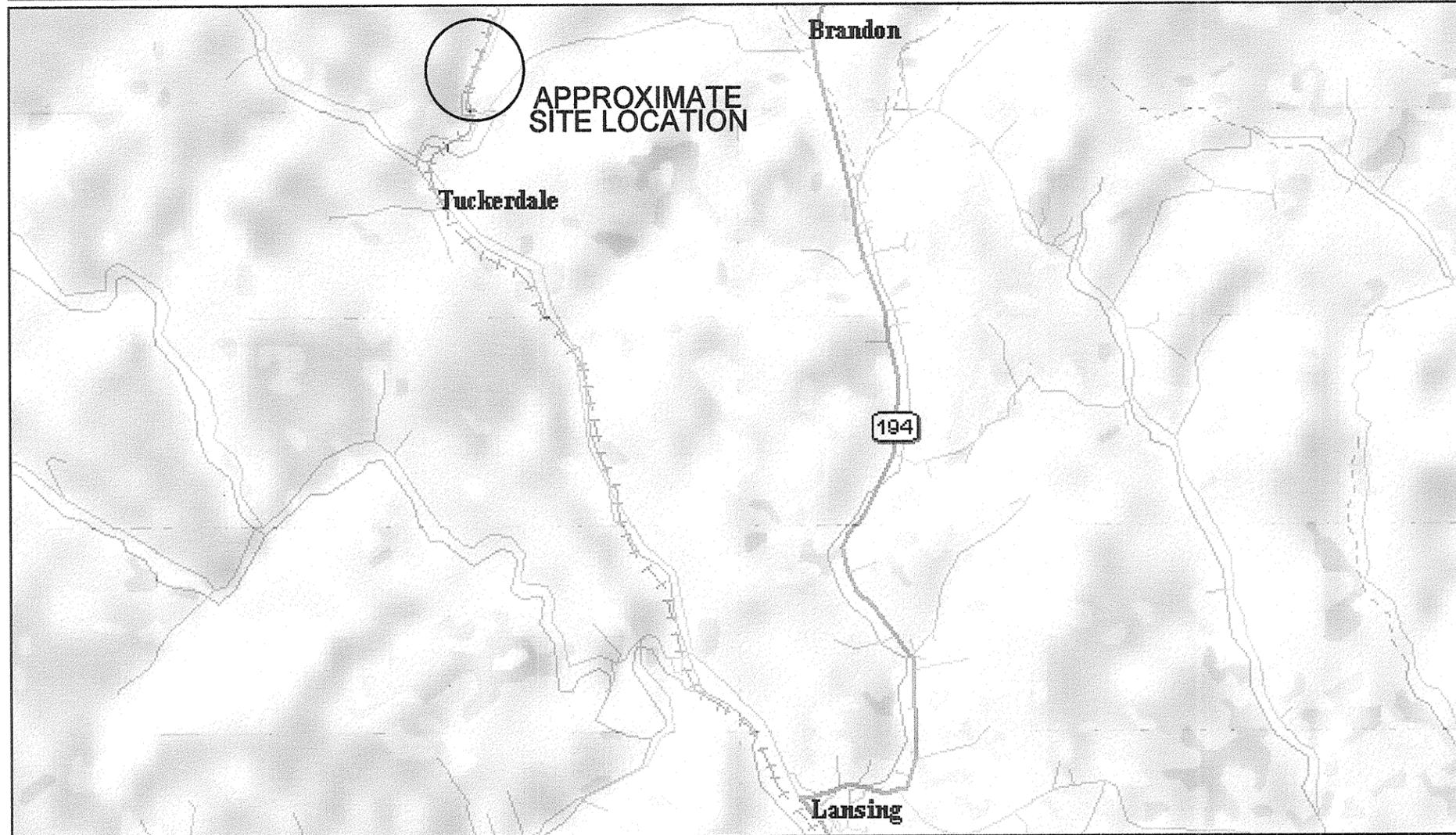
- Weathered rock was penetrated within 5 feet of the existing ground surface, at elevation 2719.8 feet (MSL), in boring DET-1.
- Cobbles and boulders ranging in diameter from about 1 to 3 feet, were observed at the proposed detour end bent 2 ground surface.
- Static groundwater was measured approximately 4 feet below existing ground surface in DET-1, at elevation 2719.8 feet (MSL).

7.0 CLOSURE

Notes to the designer and evaluations provided by Tierra, Inc. are based on the Hydraulic Design Report dated March 21, 2005, provided by NCDOT. Modifications to our report may be required if there are changes to the design or location of the proposed structures. 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.

DeLORME

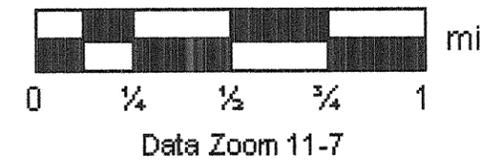
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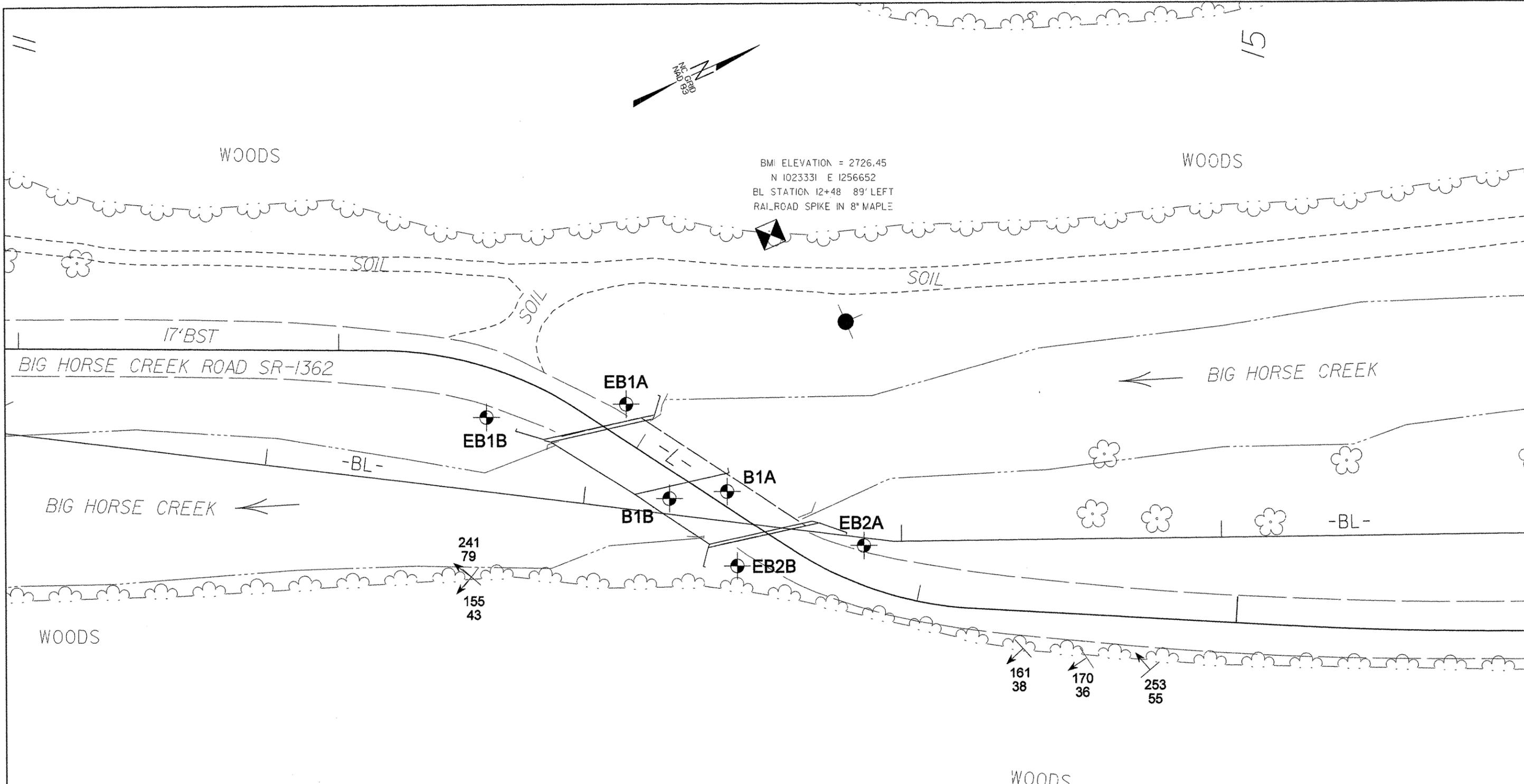


SITE VICINITY MAP

NCDOT PROJECT #: 33383.1.1 (B-4015)
 ASHE CO., NC
 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)



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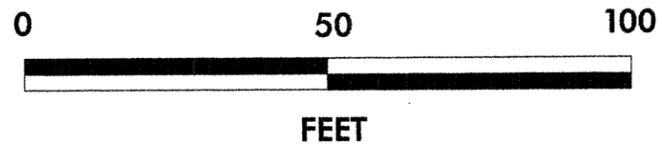


NOTES:

BENCH MARK: SPIKE IN 8" MAPLE TREE, BMI,
-L- STA. 12+48, 89' LT., ELEVATION 2726.45'

PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED
FROM NCDOT, DATED AUGUST, 2005

PROPOSED BRIDGE SKEW: 45°



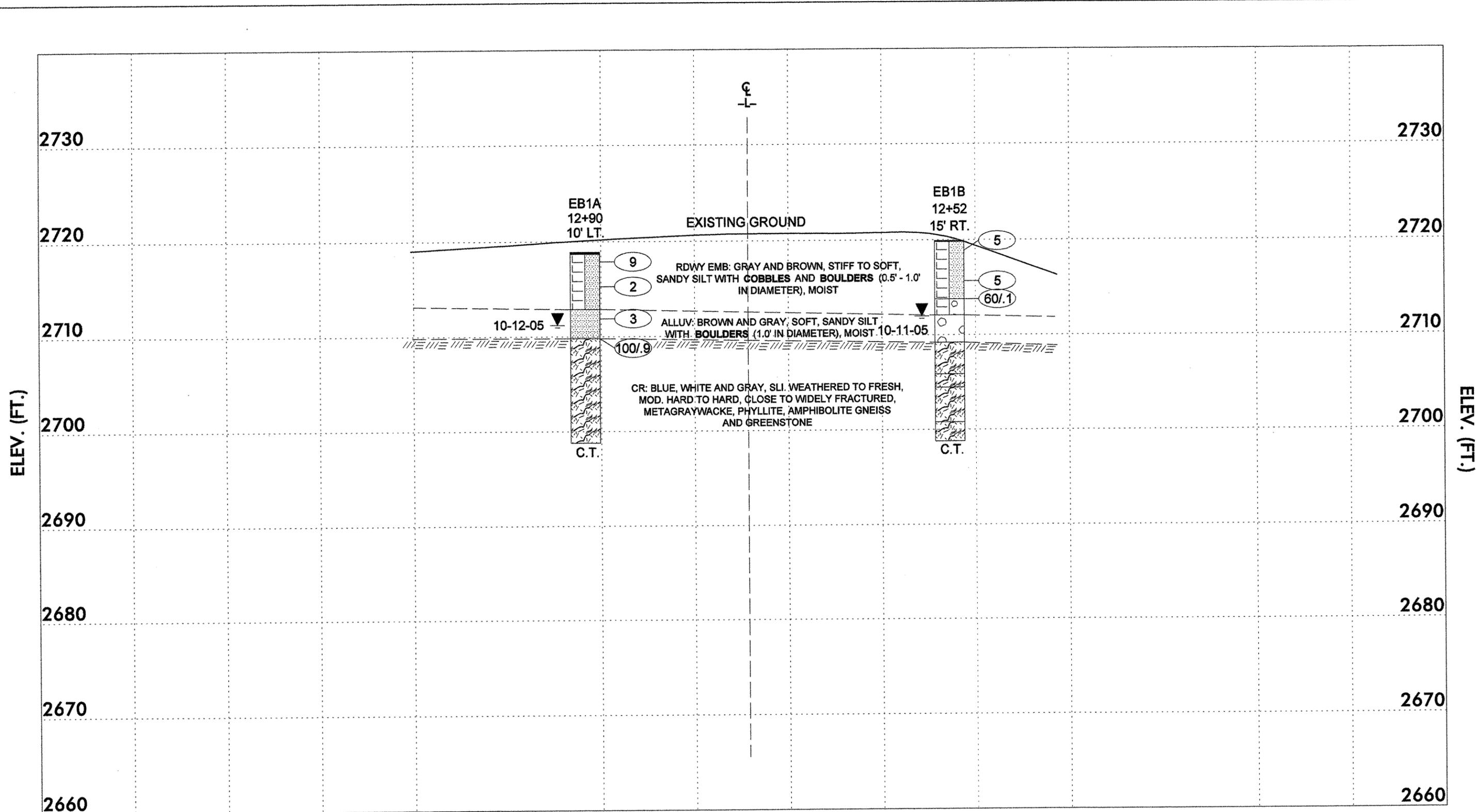
BORING LOCATION PLAN

NCDOT PROJECT #: 33383.1.1 (B-4015)
ASHE CO., NC
BRIDGE #165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)



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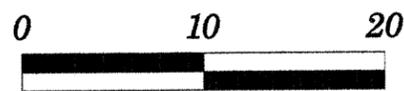
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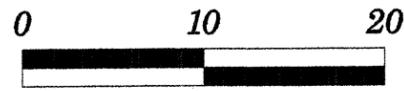
ELEV. (FT.)

ELEV. (FT.)

VERTICAL SCALE



HORIZONTAL SCALE

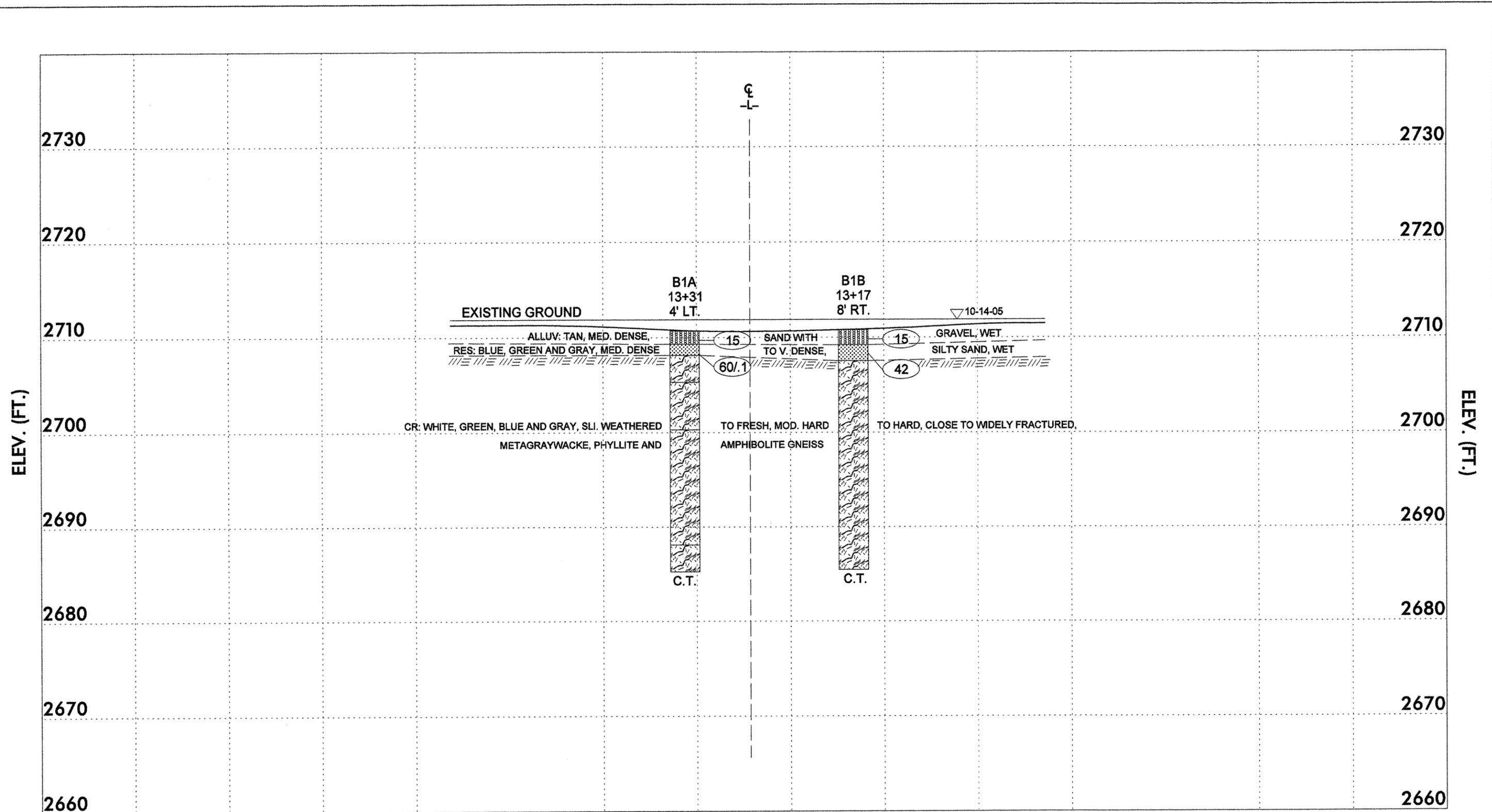


Cross Section End Bent 1

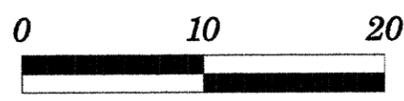
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 ASHE CO., NC
 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)



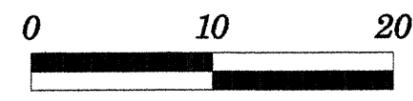
TIERRA, NC.
 2136 RDW, AND RD.
 RALEIGH, NC 27615
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 FAX 919 871-0803



VERTICAL SCALE



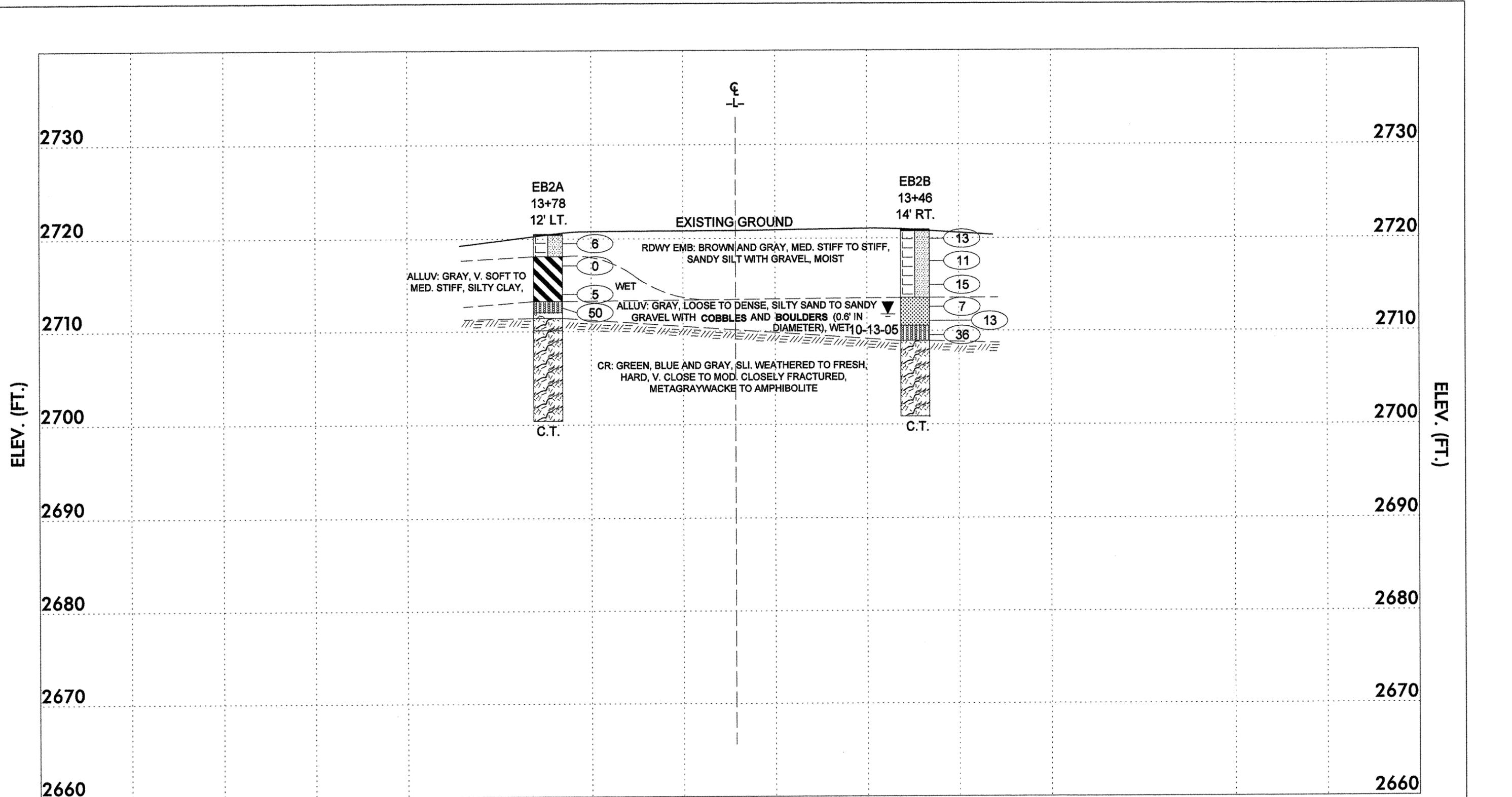
HORIZONTAL SCALE



Cross Section Bent 1

NCDOT PROJECT NO. : 33383.1.1 (B-4015)
 ASHE CO., NC
 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)

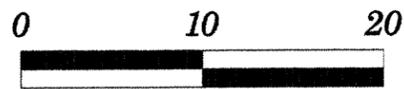




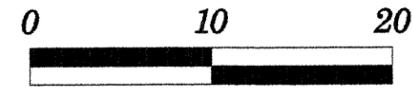
ELEV. (FT.)

ELEV. (FT.)

VERTICAL SCALE



HORIZONTAL SCALE



Cross Section End Bent 2

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 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)





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

SHEET 1 OF 1

PROJECT NO. 33383.1.1		ID. B-4015		COUNTY ASHE		GEOLOGIST J. HOWARD						
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)						GROUND WATER (ft)						
BORING NO. EB1A		BORING LOCATION 12+90		OFFSET 10' LT.		ALIGNMENT -L-						
COLLAR ELEV. 2718.9 ft		NORTHING 1,023,268.8		EASTING 1,256,681.8		0 HR. 8.9						
TOTAL DEPTH 20.1 ft		DRILL MACHINE DIEDRICH 50		DRILL METHOD WASH		HAMMER TYPE AUTO						
DATE STARTED 10-11-05		COMPLETED 10-11-05		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			
2718.9	0.0	4	4	5	EXISTING GROUND							
	2.6	1	1	1						SS-1	32.2%	2718.7 ROOTMAT RDWY EMB: GRAY AND BROWN, STIFF TO SOFT, SANDY SILT (A-4)
2715	6.0	6	2	1						SS-2	27.5%	2712.9 ALLUV: BROWN AND GRAY, SOFT, SANDY SILT (A-4)
	8.2	11	89/4									2709.8 CR: BLUE AND GRAY, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO WIDELY FRACTURED, METAGRAYWACKE WEATHERED ZONE AT 18.3'
2710												
2705												
2700												
												2698.8 CORING TERMINATED AT ELEV. 2698.8' IN CR: BLUE AND GRAY, METAGRAYWACKE

CORE BORING REPORT

DATE: 10/11/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: EB1A GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2718.9 FT TOTAL DEPTH: 20.1 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2709.8	9.1	3:30	1.0	0.5/1.0	0.0/1.0		9.1-20.1 CR: BLUE AND GRAY, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO WIDELY FRACTURED, METAGRAYWACKE WEATHERED ZONE AT 18.3'
				50%	0%		
2708.8	10.1						
2708.8	10.1	4:15	5.0	4.7/5.0	4.7/5.0		
		5:00		94%	94%		
		4:00					
2703.8	15.1	2:30	5.0	5.0/5.0	4.8/5.0		
		3:15		100%	96%		
		3:30					
2698.8	20.1	2:45					STRATA REC = 92.7% STRATA RQD = 86.4%

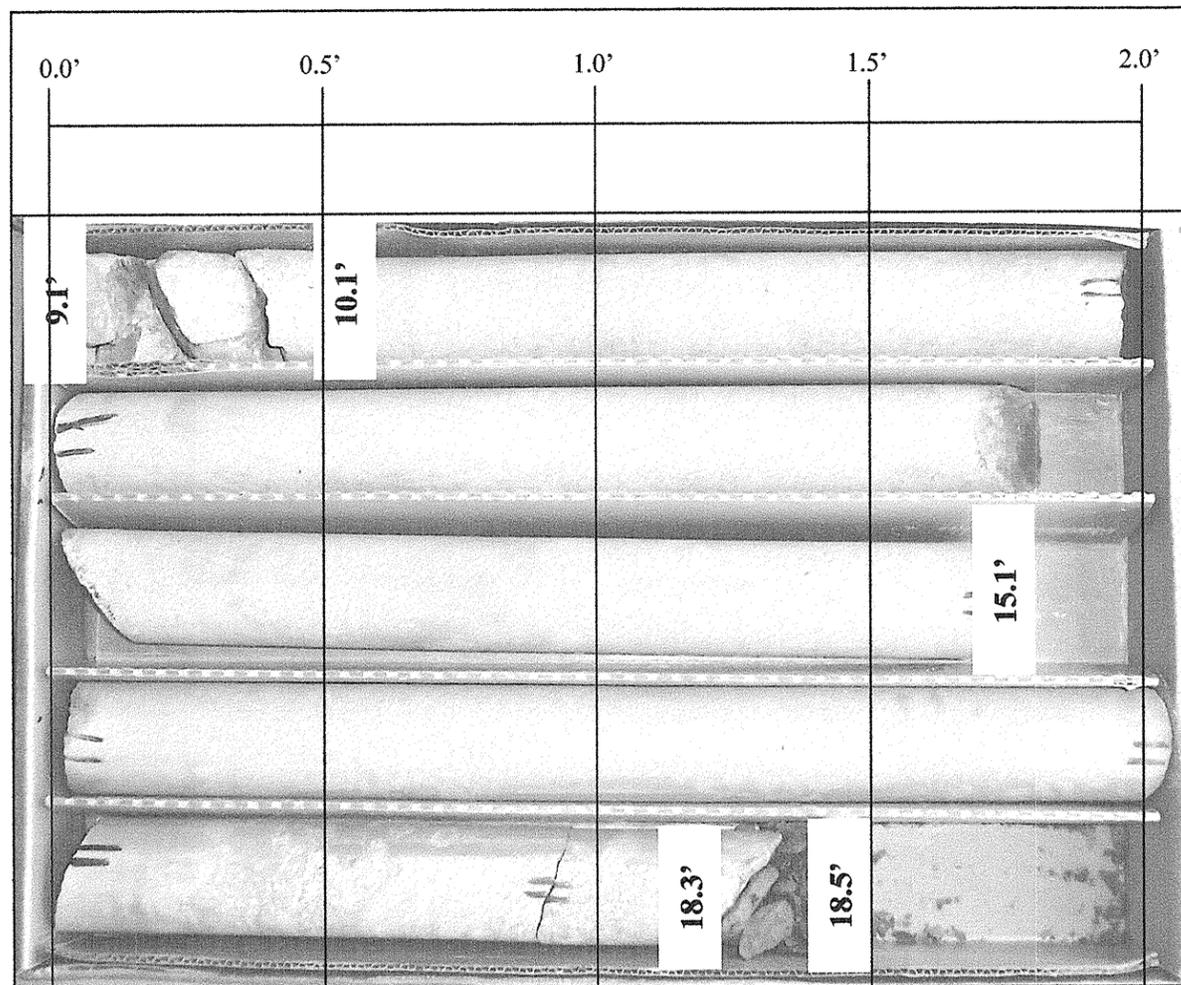
CORING TERMINATED AT 20.1 FT
 ELEVATION: 2698.8 FT

DRILLER: F. COX

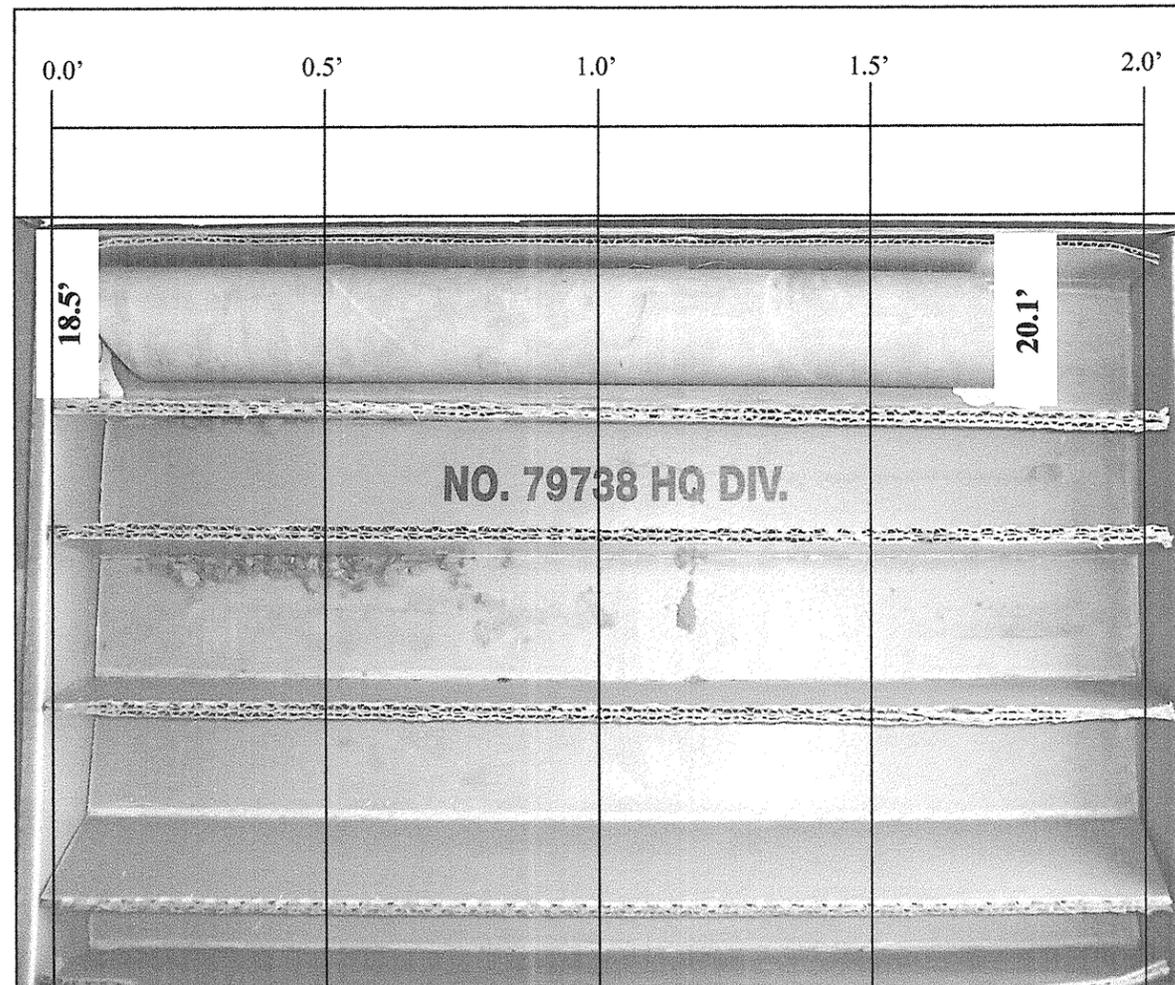
CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50

NCDOT_BORE 05-037 BR 165 - ASHE CO.GPJ NCDOT.GDT 10/25/05



Boring EB1A, Box 1 of 2, 9.1 feet to 18.5 feet.



Boring EB1A, Box 2 of 2, 18.5 feet to 20.1 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)
ASHE COUNTY, NORTH CAROLINA
TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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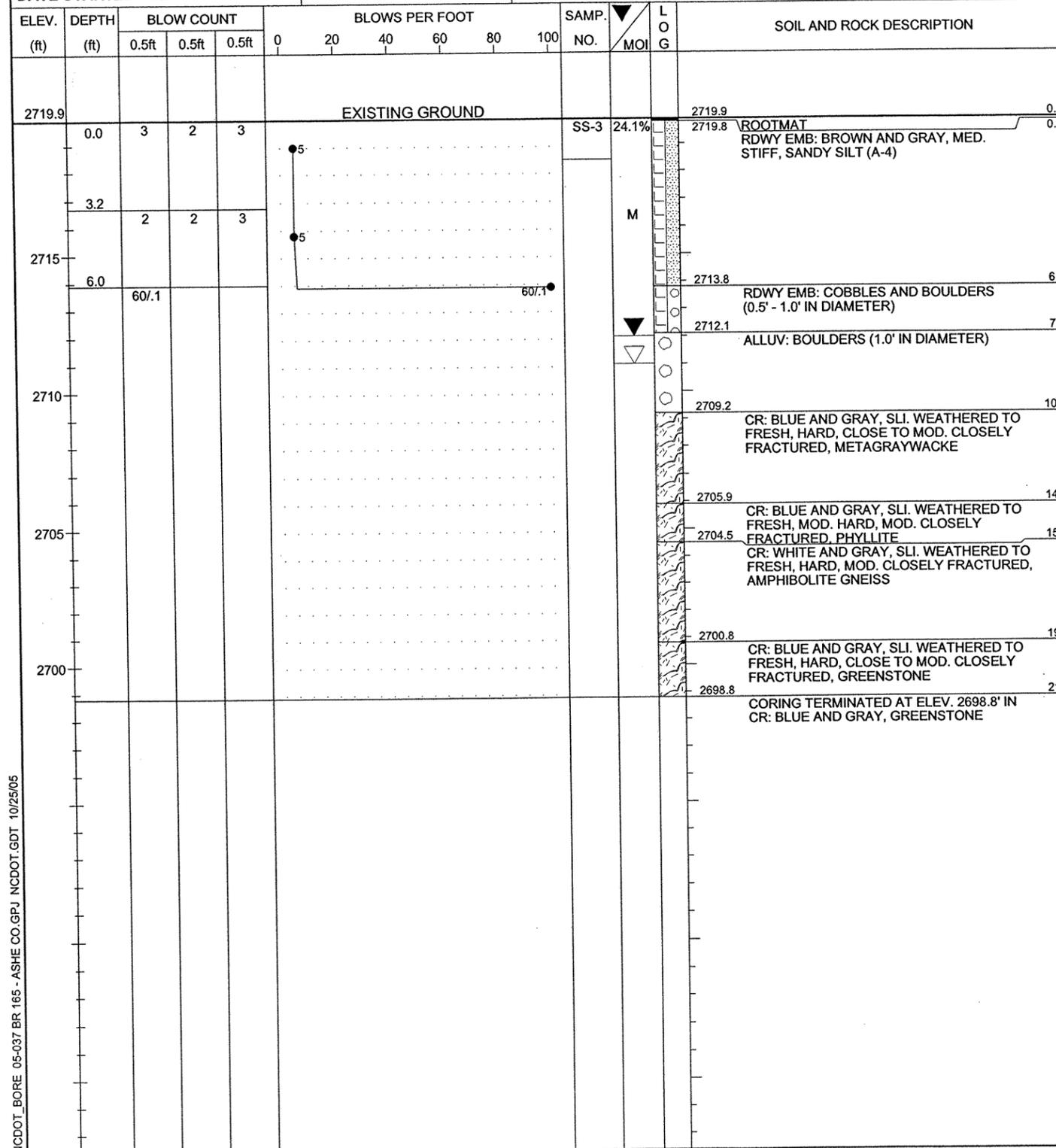


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 Phone (919) 871-0800 Fax (919) 871-0803

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

SHEET 1 OF 1

PROJECT NO. 33383.1.1	ID. B-4015	COUNTY ASHE	GEOLOGIST J. HOWARD
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)			GROUND WATER (ft)
BORING NO. EB1B	BORING LOCATION 12+52	OFFSET 15' RT.	ALIGNMENT -L-
COLLAR ELEV. 2719.9 ft	NORTHING 1,023,227.3	EASTING 1,256,668.0	0 HR. 8.9 24 HR. 7.9
TOTAL DEPTH 21.1 ft	DRILL MACHINE DIEDRICH 50	DRILL METHOD WASH	HAMMER TYPE AUTO
DATE STARTED 10-10-05	COMPLETED 10-10-05	SURFACE WATER DEPTH N/A	



CORE BORING REPORT

DATE: 10/10/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: EB1B GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2719.9 FT TOTAL DEPTH: 21.1 FT

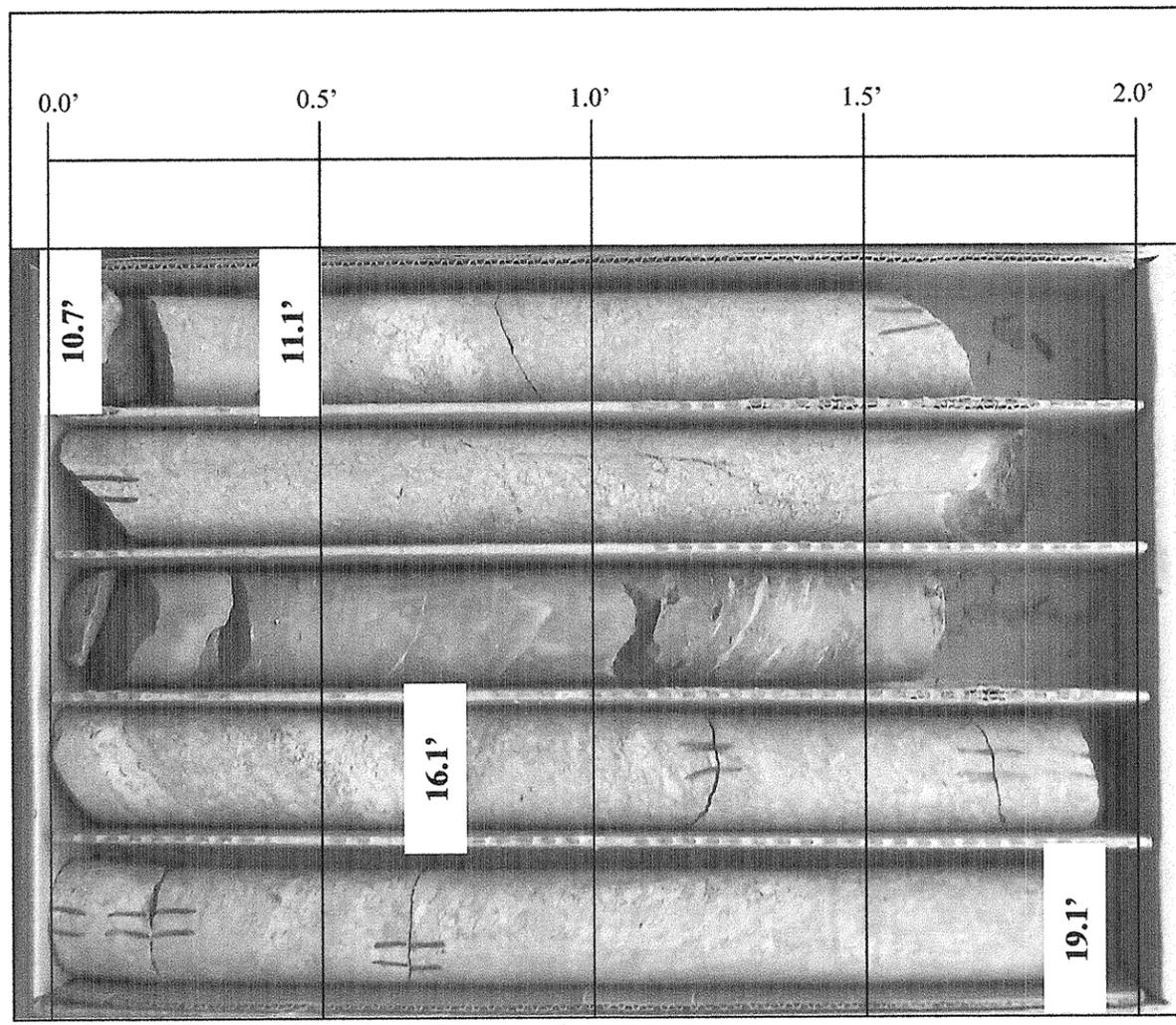
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2719.9	0.0						EXISTING GROUND
2719.8	0.1						ROOTMAT
2719.8	0.1						RDWY EMB: BROWN AND GRAY, MED. STIFF, SANDY SILT (A-4)
2715.0	3.2						
2713.8	6.1						RDWY EMB: COBBLES AND BOULDERS (0.5' - 1.0' IN DIAMETER)
2712.1	7.8						ALLUV: BOULDERS (1.0' IN DIAMETER)
2709.2	10.7	1:00	0.4	0.4/0.4	0.0/0.4		CR: BLUE AND GRAY, SLI. WEATHERED TO FRESH, HARD, CLOSE TO MOD. CLOSELY FRACTURED, METAGRAYWACKE
2708.8	11.1			100%	0%		
2708.8	11.1	10:30		5.0/5.0	4.7/5.0		STRATA REC = 100% STRATA RQD = 87.9%
2708.8	11.1	5:00		100%	94%		14.0-15.4 CR: BLUE AND GRAY, SLI. WEATHERED TO FRESH, MOD. HARD, MOD. CLOSELY FRACTURED, PHYLLITE
2708.8	11.1	4:30	5.0	100%	94%		
2708.8	11.1	4:45					
2703.8	16.1	3:45					STRATA REC = 100% STRATA RQD = 78.6%
2703.8	16.1	3:45		5.0/5.0	4.5/5.0		15.4-19.1 CR: WHITE AND GRAY, SLI. WEATHERED TO FRESH, HARD, MOD. CLOSELY FRACTURED, AMPHIBOLITE GNEISS
2703.8	16.1	3:00		100%	95%		
2703.8	16.1	3:30					
2703.8	16.1	3:15					
2698.8	21.1	3:15					STRATA REC = 100% STRATA RQD = 100%
							19.1-21.1 CR: BLUE AND GRAY, SLI. WEATHERED TO FRESH, HARD, CLOSE TO MOD. CLOSELY FRACTURED, GREENSTONE
							STRATA REC = 100% STRATA RQD = 75%

CORING TERMINATED AT 21.1 FT
 ELEVATION 2698.8 FT

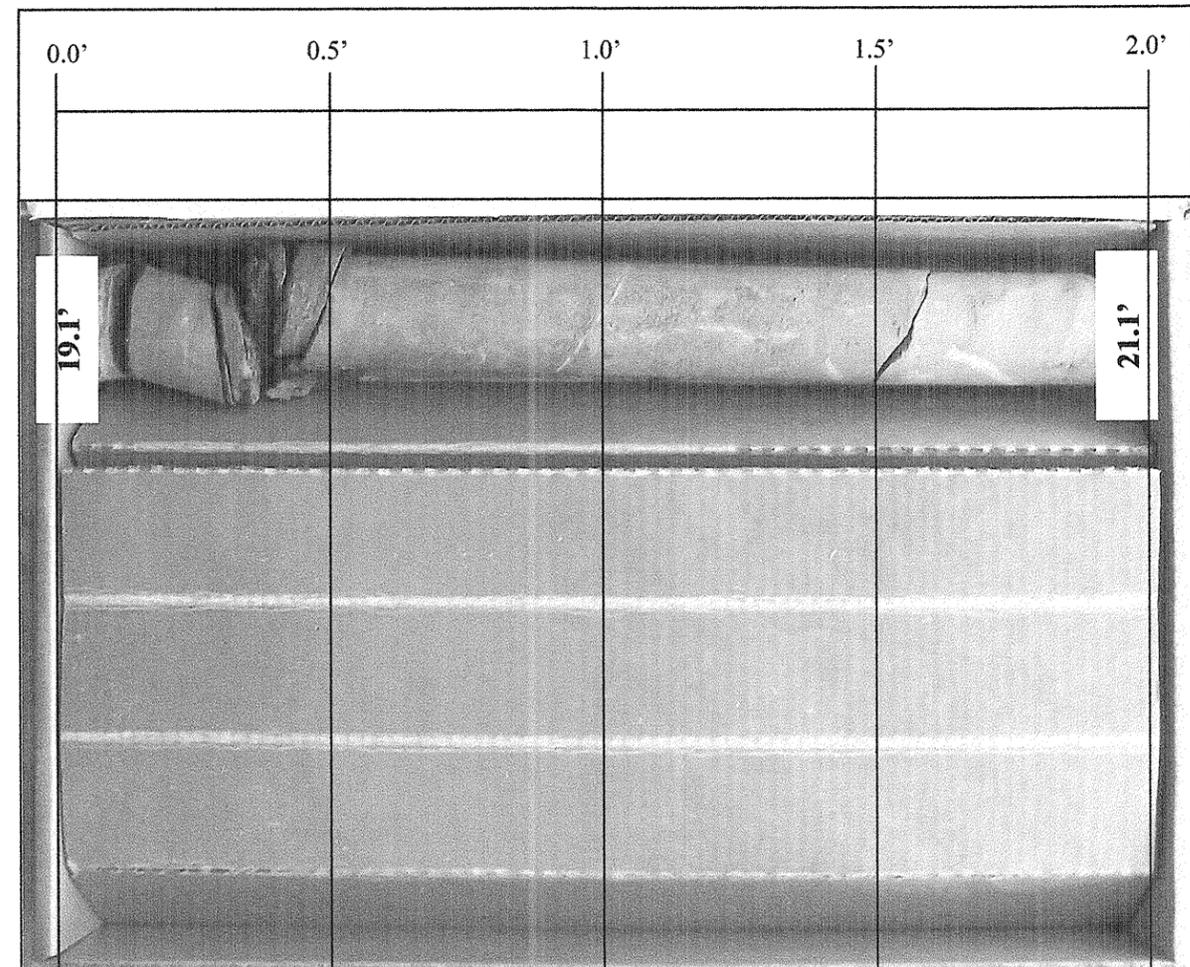
DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50



Boring EB1B, Box 1 of 2, 10.7 feet to 19.1 feet.



Boring EB1B, Box 2 of 2, 19.1 feet to 21.1 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)
ASHE COUNTY, NORTH CAROLINA
TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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

SHEET 1 OF 1

PROJECT NO. 33383.1.1		ID. B-4015		COUNTY ASHE		GEOLOGIST J. HOWARD							
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)							GROUND WATER (ft)						
BORING NO. B1A		BORING LOCATION 13+31		OFFSET 4' LT.		ALIGNMENT -L-							
COLLAR ELEV. 2710.7 ft		NORTHING 1,023,287.0		EASTING 1,256,718.9		0 HR.							
TOTAL DEPTH 25.4 ft		DRILL MACHINE DIEDRICH 50		DRILL METHOD WASH		HAMMER TYPE AUTO							
DATE STARTED 10-13-05		COMPLETED 10-13-05		SURFACE WATER DEPTH 1.4'									
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
2710.7					EXISTING GROUND								
2710	0.0	5	6	9							W	2710.7	ALLUV: TAN, MED. DENSE, SAND (A-1-a) WITH GRAVEL
	1.5										SS-4	2709.3	RES: BLUE AND GRAY, MED. DENSE TO V. DENSE, SILTY SAND (A-2-4)
		6	27	60/1							W	2708.1	CR: DARK GRAY, SLI. WEATHERED, MOD. HARD, V. CLOSE TO CLOSELY FRACTURED, PHYLLITE
												2705.3	CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO WIDELY FRACTURED, AMPHIBOLITE GNEISS
2705												2700.3	CR: GREEN AND GRAY, SLI. WEATHERED TO FRESH, HARD, WIDELY FRACTURED, METAGRAYWACKE
2700											RS-1		
2695													
2690													
												2688.1	CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD, WIDELY FRACTURED, AMPHIBOLITE GNEISS
												2685.3	CORING TERMINATED AT ELEV. 2685.3' IN CR: GRAY AND WHITE, AMPHIBOLITE GNEISS

CORE BORING REPORT

DATE: 10/13/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: B1A GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2710.7 FT TOTAL DEPTH: 25.4 FT

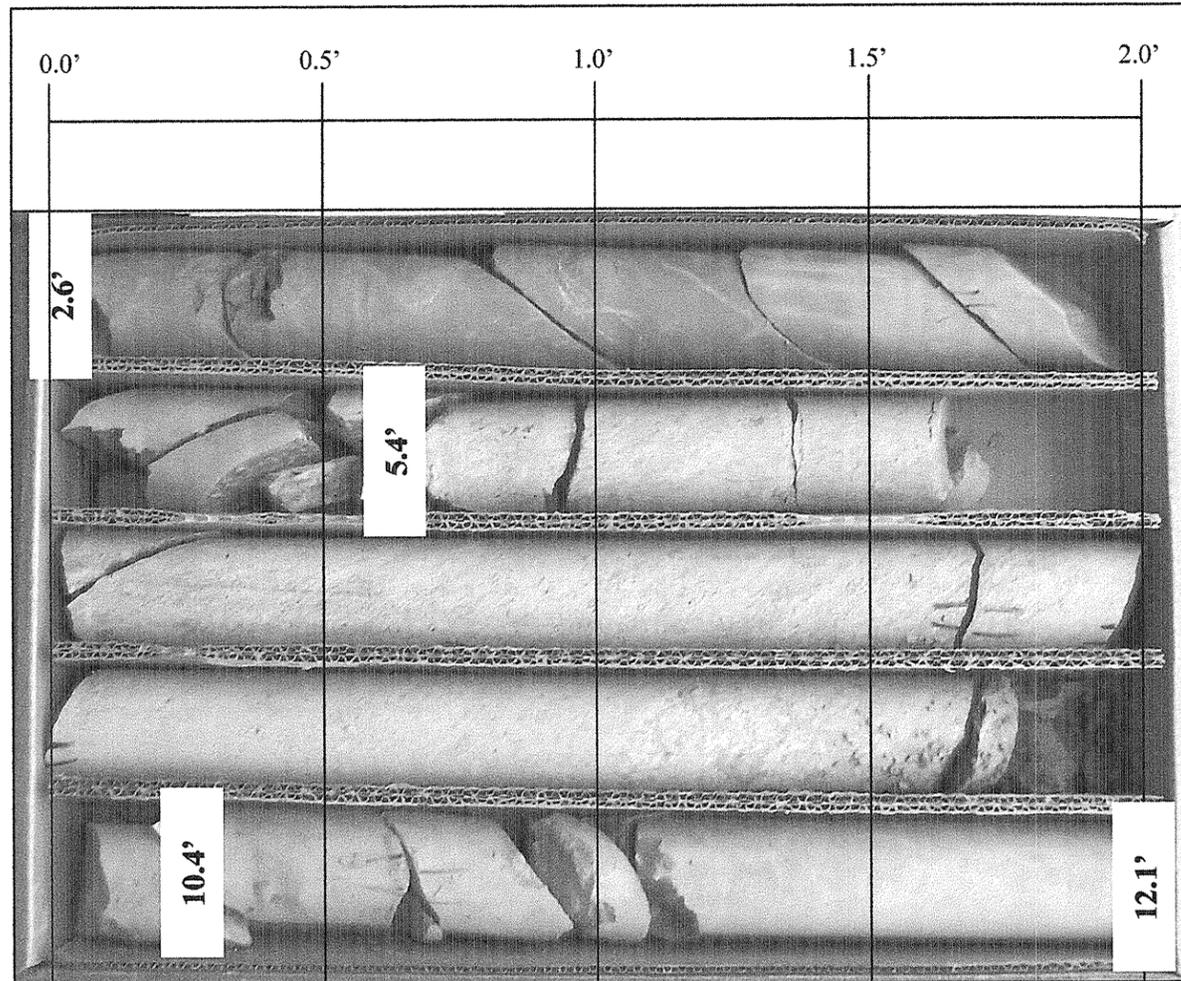
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2708.1	2.6	9:00	2.8	2.8/2.8	1.5/2.8		2.6-5.4 CR: DARK GRAY, SLI. WEATHERED, MOD. HARD, V. CLOSE TO CLOSELY FRACTURED, PHYLLITE
		12:15					
		10:15/0.8					
2705.3	5.4			100%	54%		STRATA REC = 100% STRATA RQD = 54%
2705.3	5.4	5:40	5.0	5.0/5.0	3.8/5.0		5.4-10.4 CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO WIDELY FRACTURED, AMPHIBOLITE GNEISS
		5:15					
		5:30					
		5:15					
2700.3	10.4	4:45		100%	76%		STRATA REC = 100% STRATA RQD = 76%
2700.3	10.4	4:15	5.0	5.0/5.0	4.8/5.0	RS-1	10.4-22.6 CR: GREEN AND GRAY, SLI. WEATHERED TO FRESH, HARD, WIDELY FRACTURED, METAGRAYWACKE
		3:30					
		4:15					
2695.3	15.4	2:00		100%	96%		
2695.3	15.4	4:15	5.0	5.0/5.0	5.0/5.0		
		3:15					
		4:00					
		4:00					
2690.3	20.4	4:30		100%	100%		
2690.3	20.4	4:30	5.0	4.9/5.0	4.9/5.0		22.6-25.4 CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD, WIDELY FRACTURED, AMPHIBOLITE GNEISS
		4:30					
		5:00					
2685.3	25.4	3:30		98%	98%		STRATA REC = 96.4% STRATA RQD = 96.4%

CORING TERMINATED AT 25.4 FT
 ELEVATION 2685.3 FT

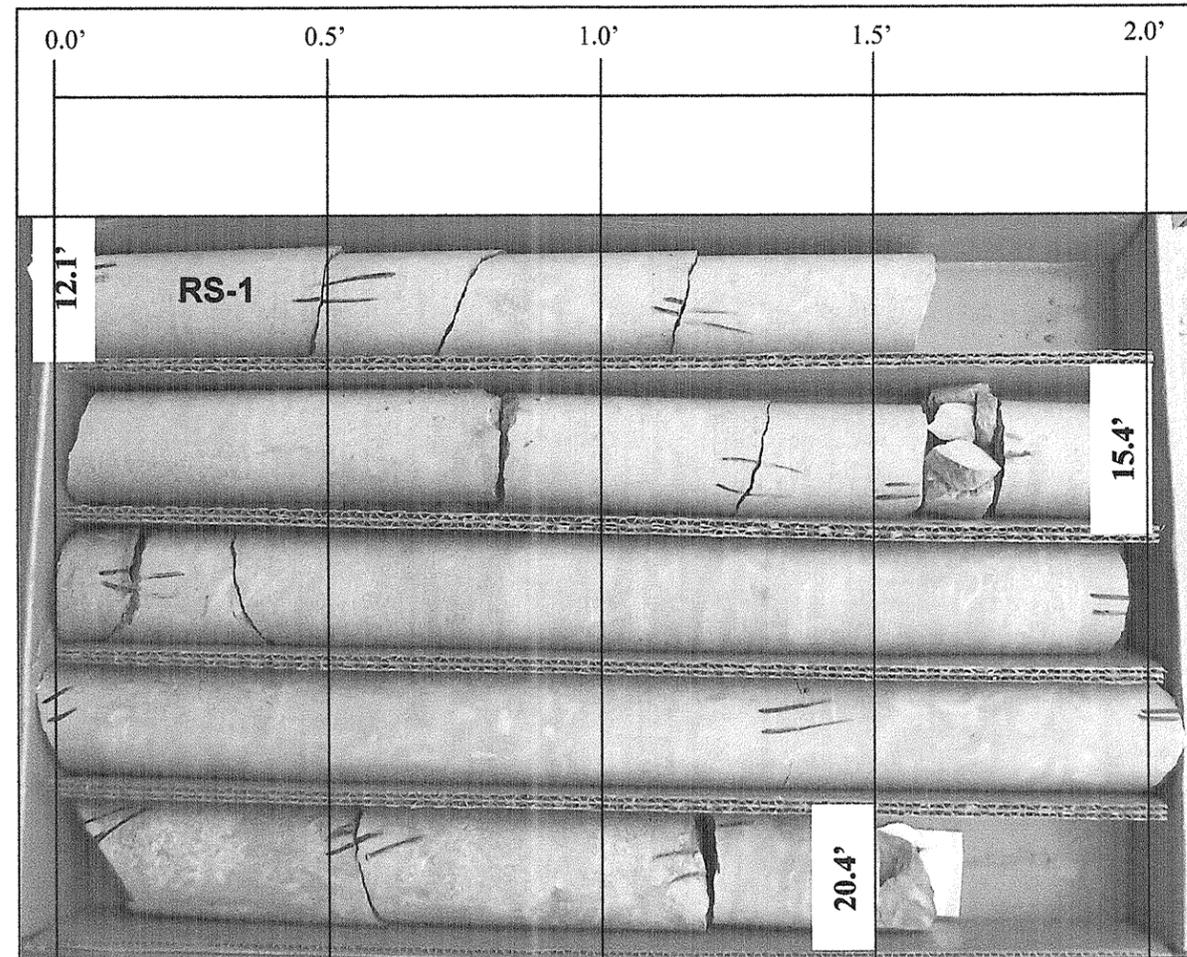
DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50



Boring B1A, Box 1 of 3, 2.6 feet to 12.1 feet.



Boring B1A, Box 2 of 3, 12.1 feet to 20.4 feet.

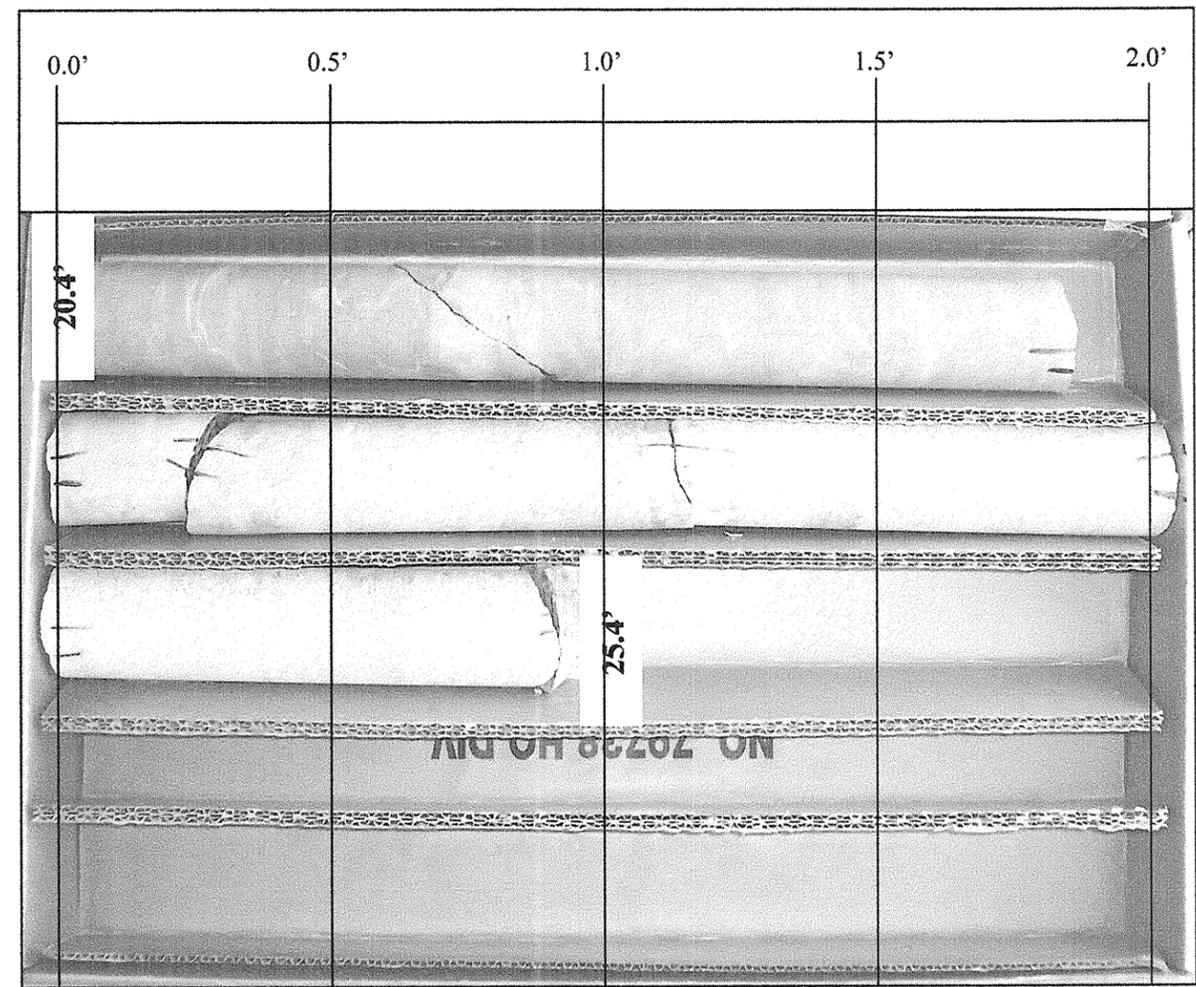
SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)
 ASHE COUNTY, NORTH CAROLINA
 TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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



Boring B1A, Box 3 of 3, 20.4 feet to 25.4 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS	
BRIDGE NO. 165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.) ASHE COUNTY, NORTH CAROLINA TIP NO: B-4015, STATE PROJECT NO: 33383.1.1	
	TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NC 27615 PHONE (919) 871-0800 FAX (919) 871-0803



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. 33383.1.1		ID. B-4015		COUNTY ASHE		GEOLOGIST J. HOWARD							
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)						GROUND WATER (ft)							
BORING NO. B1B		BORING LOCATION 13+17		OFFSET 8' RT.		ALIGNMENT -L-							
COLLAR ELEV. 2710.8 ft		NORTHING 1,023,269.7		EASTING 1,256,713.7		0 HR.							
TOTAL DEPTH 25.3 ft		DRILL MACHINE DIEDRICH 50		DRILL METHOD CONT. SAMPLING		HAMMER TYPE AUTO							
DATE STARTED 10-12-05		COMPLETED 10-12-05		SURFACE WATER DEPTH 1.2'									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
2710.8													EXISTING GROUND
2710	0.0	5	6	9								W	2710.8 ALLUV: TAN AND GRAY, MED. DENSE, SAND (A-1-a) WITH GRAVEL
	1.5											W	2709.2 RES: GREEN AND GRAY, DENSE, SILTY SAND (A-2-4)
		8	15	27									2707.5 CR: BLUE AND GRAY, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO MOD. CLOSELY FRACTURED, METAGRAYWACKE WITH PHYLLITE AND GREENSTONE LAYERS
2705													
2700													
2695													
2690													
												RS-2	
													2685.5 CORING TERMINATED AT ELEV. 2685.5' IN CR: BLUE AND GRAY, GREENSTONE

CORE BORING REPORT

DATE: 10/12/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: B1B GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2710.8 FT TOTAL DEPTH: 25.3 FT

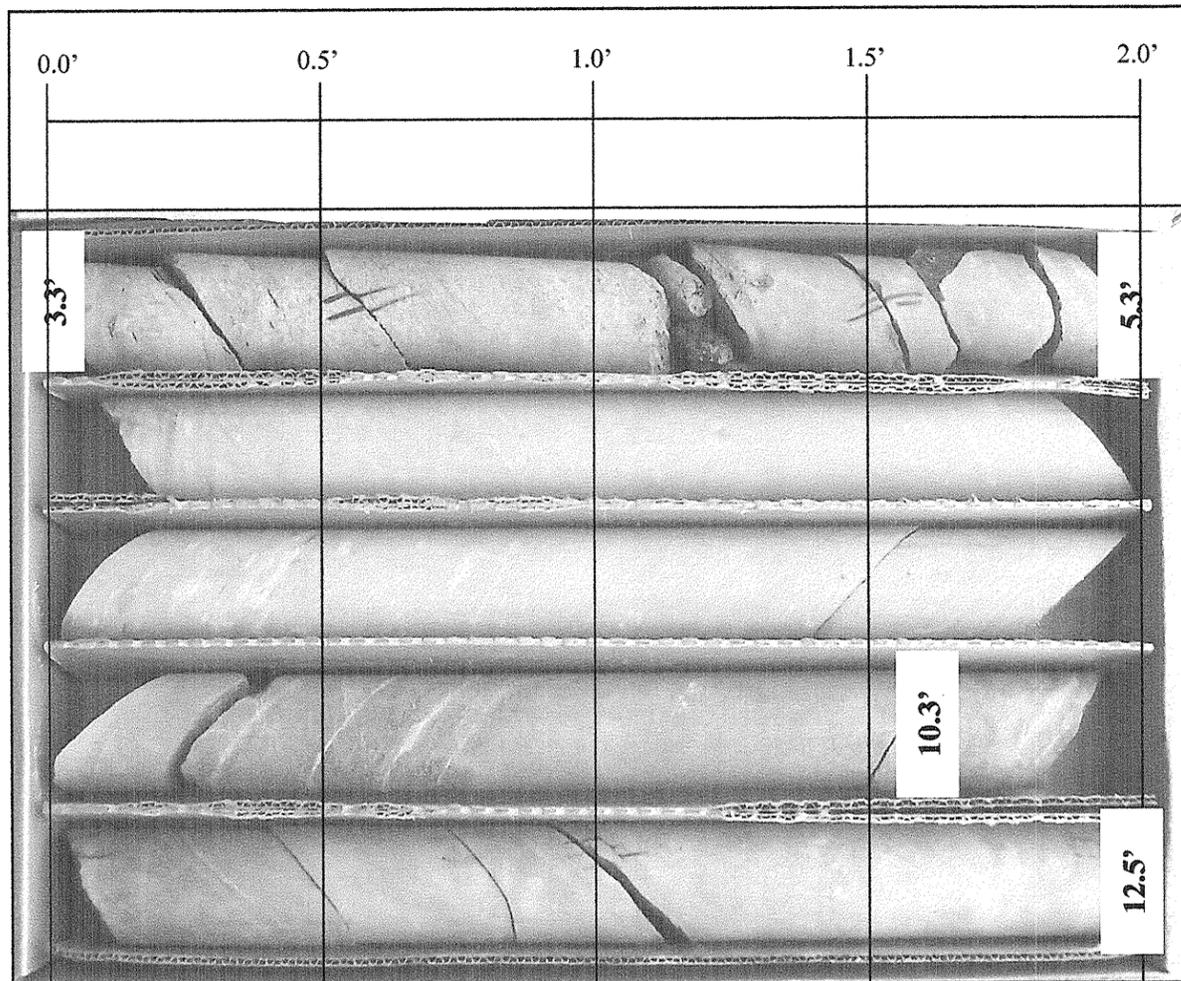
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2707.5	3.3	8:00	2.0	2.0/2.0	1.1/2.0		3.3-25.3 CR: BLUE AND GRAY, V. SLI. WEATHERED TO FRESH, HARD, CLOSE TO MOD. CLOSELY FRACTURED, METAGRAYWACKE WITH PHYLLITE AND GREENSTONE LAYERS
		6:30		100%	55%		
2705.5	5.3		5.0	5.0/5.0	4.7/5.0		
2705.5	5.3	4:30		100%	94%		
		4:00					
		4:45					
2700.5	10.3	3:15	5.0	4.8/5.0	4.8/5.0		
2700.5	10.3	4:30		96%	96%		
		3:45					
		4:00					
2695.5	15.3	3:15	5.0	5.0/5.0	5.0/5.0		
2695.5	15.3	4:00		100%	100%		
		3:30					
		5:30					
2690.5	20.3	3:15	5.0	5.0/5.0	5.0/5.0		
2690.5	20.3	5:30		100%	100%		
		4:45					
		5:00					
2685.5	25.3	3:45				RS-2	
							STRATA REC = 99.1% STRATA RQD = 93.6%

CORING TERMINATED AT 25.3 FT
 ELEVATION 2685.5 FT

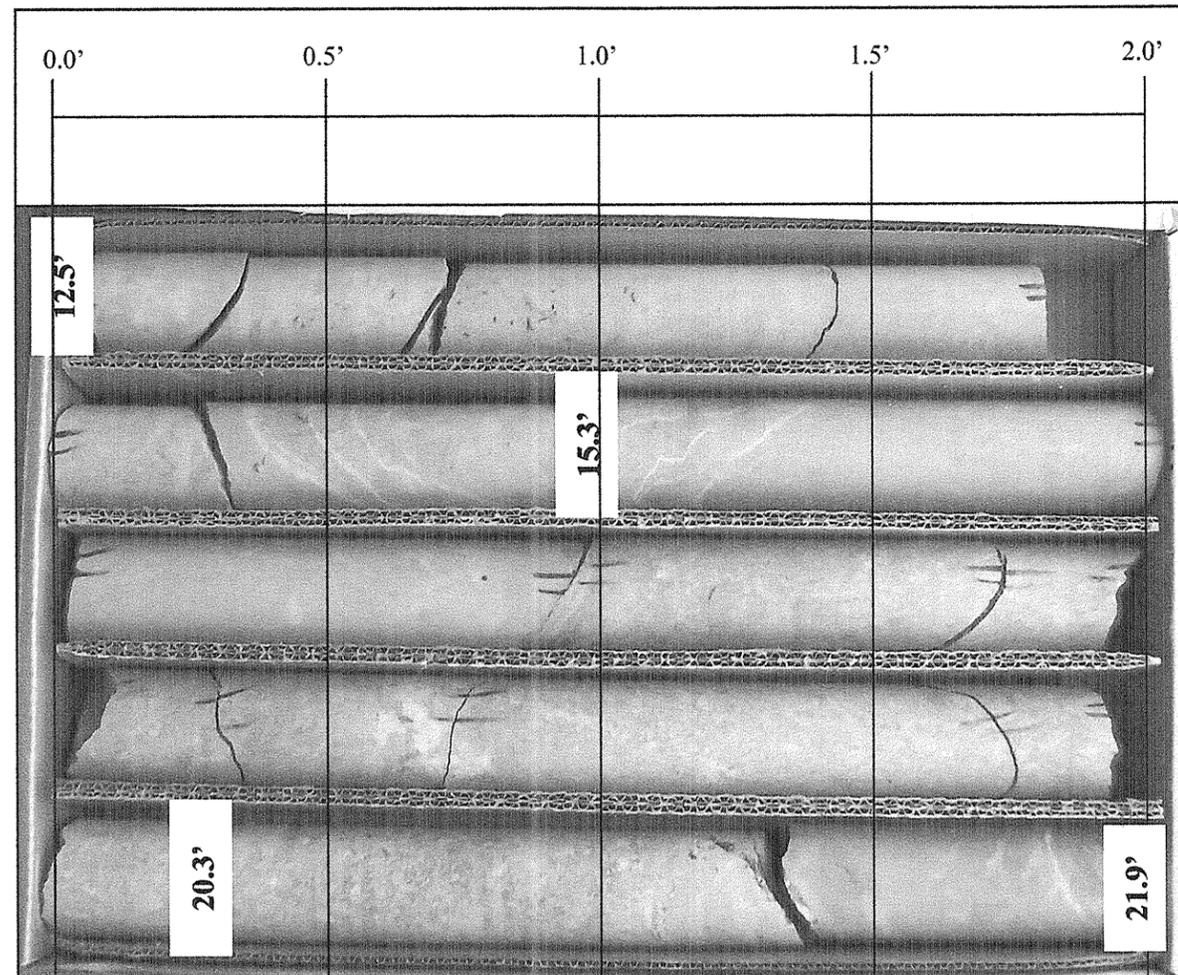
DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50



Boring B1B, Box 1 of 3, 3.3 feet to 12.5 feet.



Boring B1B, Box 2 of 3, 12.5 feet to 21.9 feet.

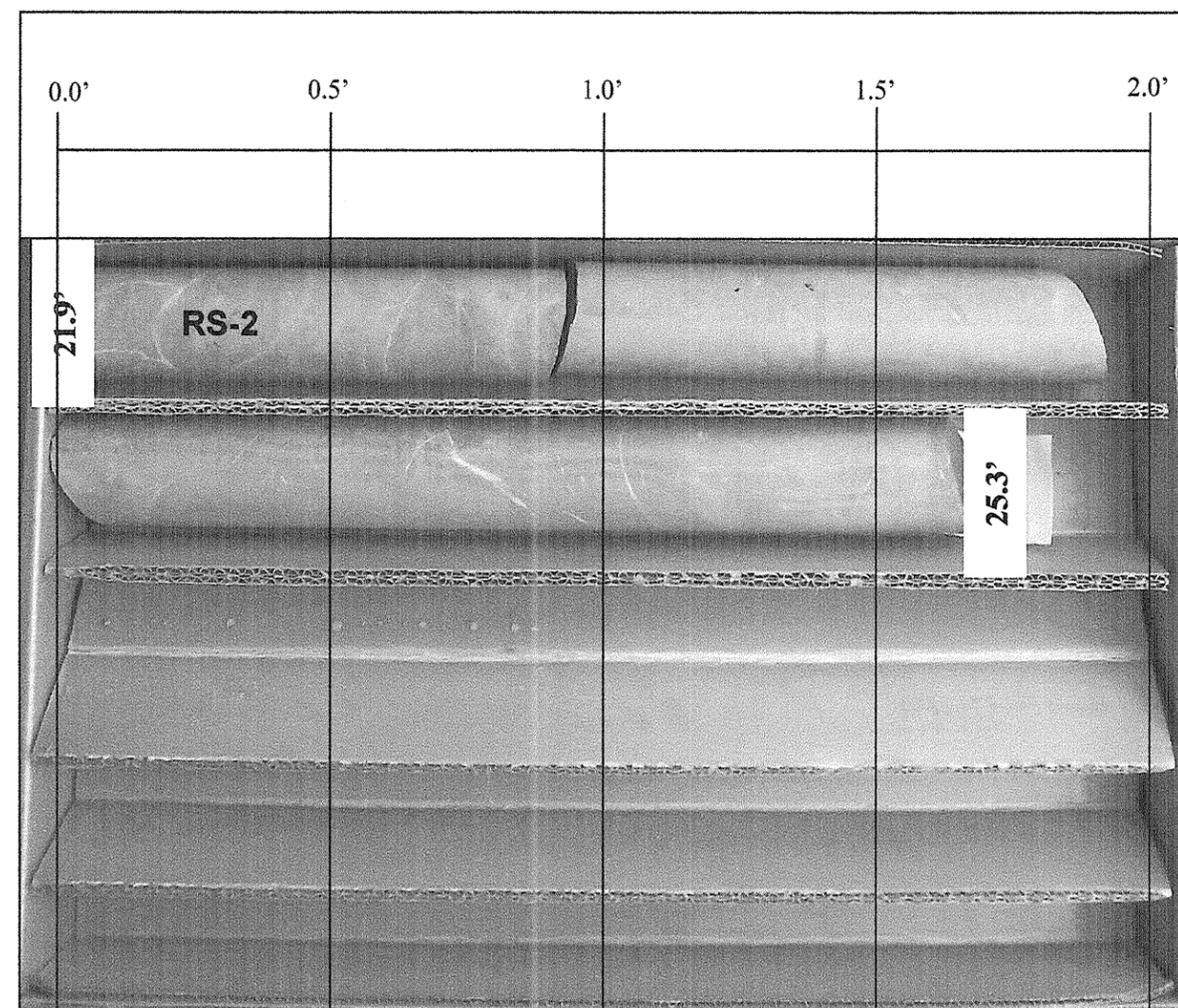
SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)
ASHE COUNTY, NORTH CAROLINA
TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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



Boring B1B, Box 3 of 3, 21.9 feet to 25.3 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)
ASHE COUNTY, NORTH CAROLINA
TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



TIERRA, INC.
2735 ROWLAND RD.
RALEIGH, NC 27615
PHONE (919) 871-0800
FAX (919) 871-0803

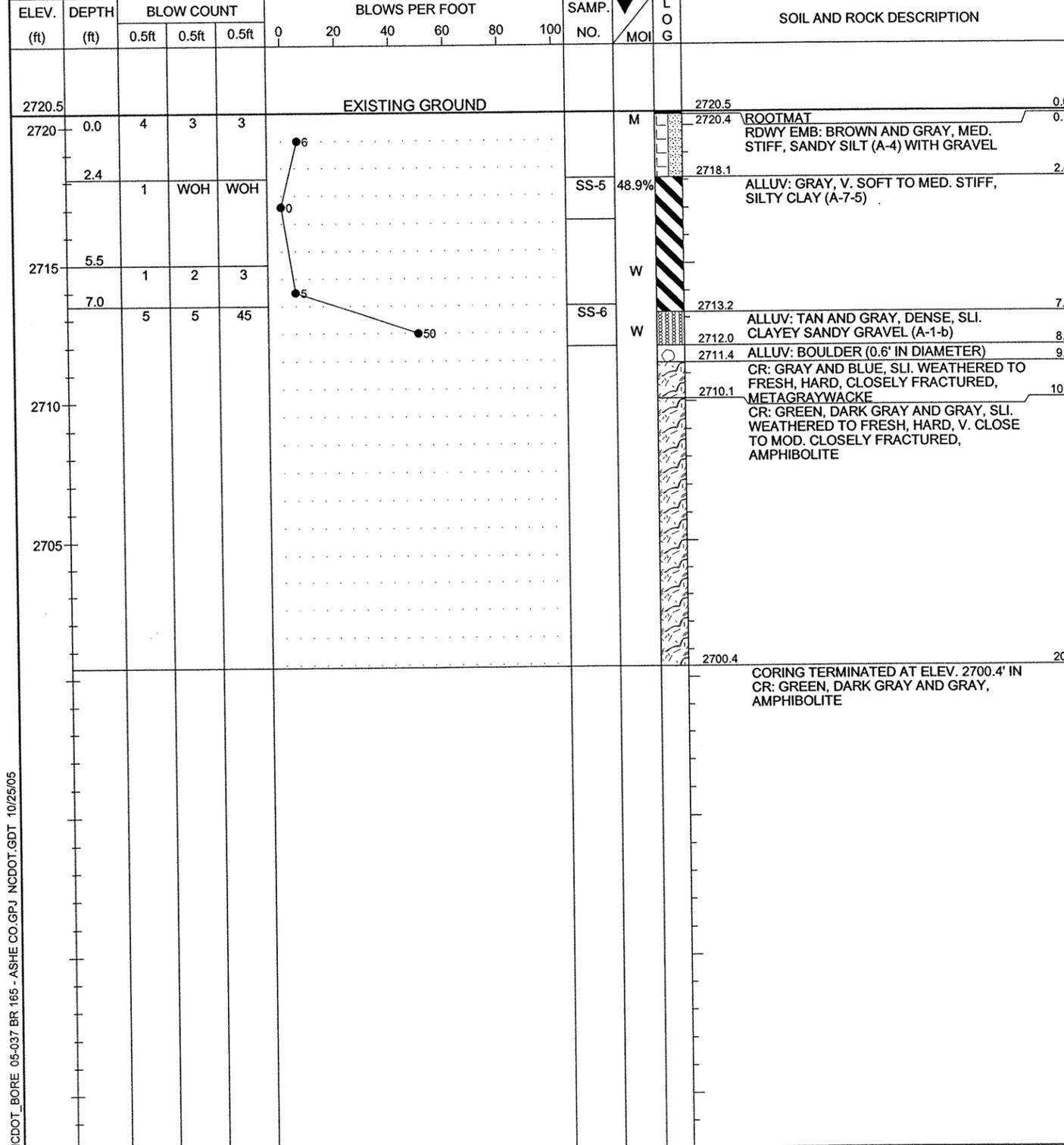


2736 ROWLAND ROAD
 RALEIGH, NORTH CAROLINA 27615
 Phone (919) 871-0800 Fax (919) 871-0803

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

SHEET 1 OF 1

PROJECT NO. 33383.1.1	ID. B-4015	COUNTY ASHE	GEOLOGIST J. HOWARD
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)			GROUND WATER (ft)
BORING NO. EB2A	BORING LOCATION 13+78	OFFSET 12' LT.	ALIGNMENT -L-
COLLAR ELEV. 2720.5 ft	NORTHING 1,023,319.5	EASTING 1,256,751.2	0 HR. C.I. 8.2'
TOTAL DEPTH 20.1 ft	DRILL MACHINE DIEDRICH 50	DRILL METHOD WASH	HAMMER TYPE AUTO
DATE STARTED 10-11-05	COMPLETED 10-11-05	SURFACE WATER DEPTH N/A	



CORE BORING REPORT

DATE: 10/11/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: EB2A GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2720.5 FT TOTAL DEPTH: 20.1 FT

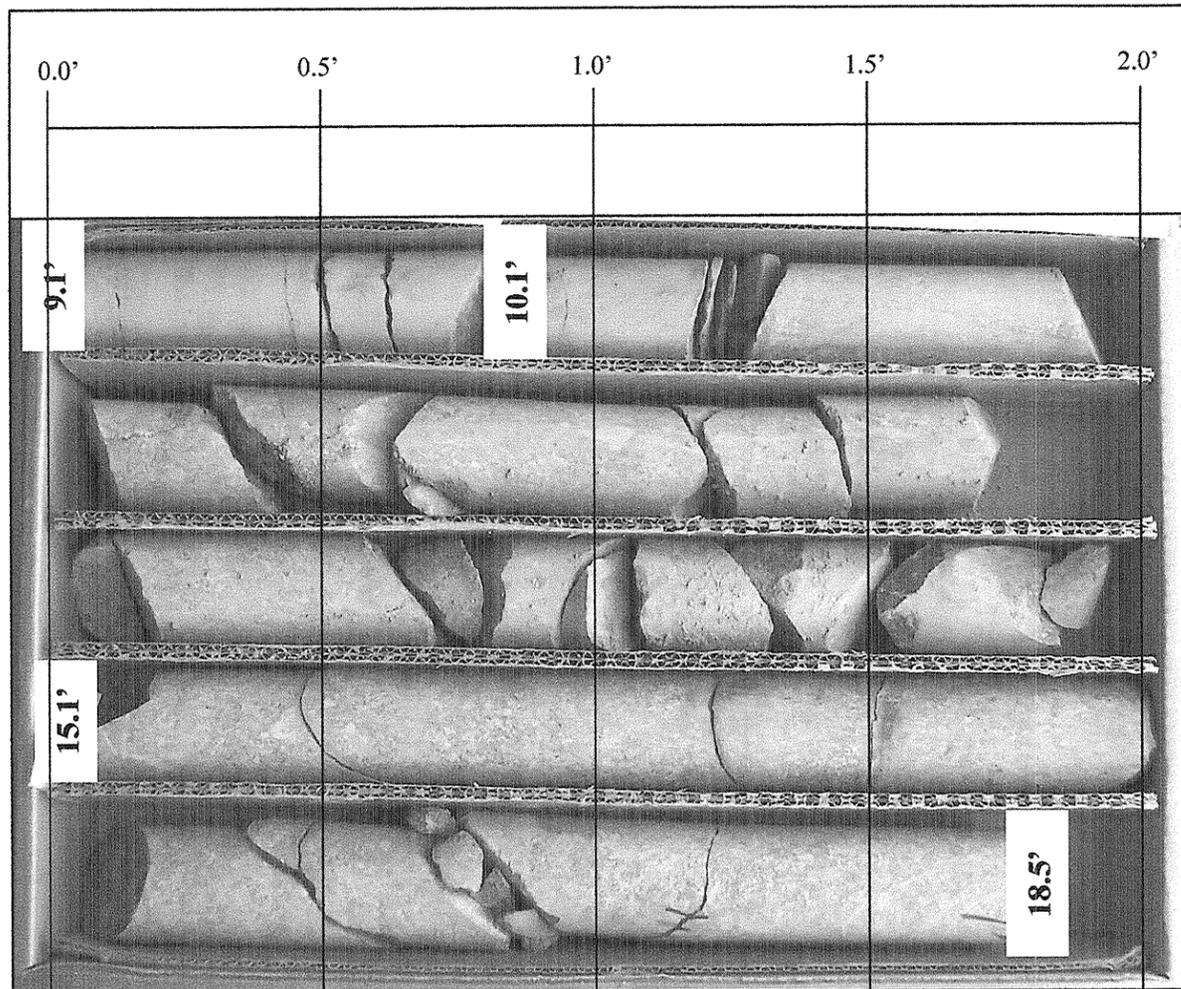
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2711.4	9.1	3:00		0.8/1.0	0.5/1.0		9.1-10.4 CR: GRAY AND BLUE, SLI. WEATHERED TO FRESH, HARD, CLOSELY FRACTURED, METAGRAYWACKE
2710.4	10.1		1.0	80%	50%		STRATA REC = 61.5% STRATA RQD = 38.5%
2710.4	10.1	1:35		4.7/5.0	1.5/5.0		10.4-20.1 CR: GREEN, DARK GRAY AND GRAY, SLI. WEATHERED TO FRESH, HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, AMPHIBOLITE
2705.4	15.1	4:45					
2705.4	15.1	4:30		5.0/5.0	3.6/5.0		
2700.4	20.1	5:30		100%	72%		STRATA REC = 100% STRATA RQD = 52.6%

CORING TERMINATED AT 20.1 FT
 ELEVATION: 2700.4 FT

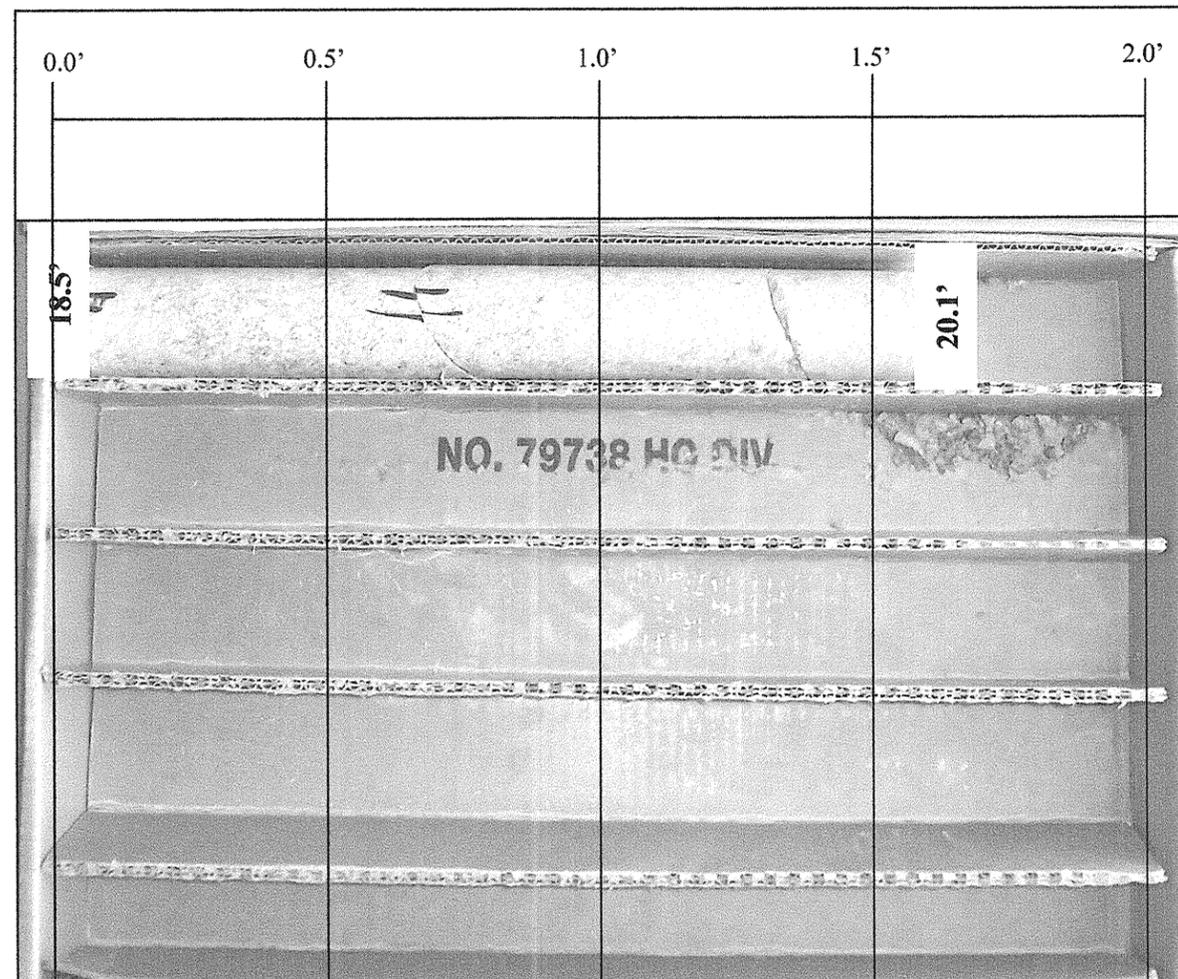
DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50



Boring EB2A, Box 1 of 2, 9.1 feet to 18.5 feet.



Boring EB2A, Box 2 of 2, 18.5 feet to 20.1 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)
 ASHE COUNTY, NORTH CAROLINA
 TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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 RALEIGH, NORTH CAROLINA 27615
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N.C.D.O.T. GEOTECHNICAL UNIT
 BORING LOG

SHEET 1 OF 1

PROJECT NO. 33383.1.1		ID. B-4015		COUNTY ASHE		GEOLOGIST J. HOWARD								
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)						GROUND WATER (ft)								
BORING NO. EB2B		BORING LOCATION 13+46		OFFSET 14' RT.		ALIGNMENT -L-								
COLLAR ELEV. 2720.9 ft		NORTHING 1,023,280.8		EASTING 1,256,741.1		0 HR. 8.8								
TOTAL DEPTH 20.1 ft		DRILL MACHINE DIEDRICH 50		DRILL METHOD WASH		24 HR. 9.2								
DATE STARTED 10-11-05		COMPLETED 10-12-05		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	
2720.9	0.0	5	5	8	EXISTING GROUND							2720.9	0.0	
2720	2.4	3	6	5	RDWY EMB: BROWN AND GRAY, STIFF, SANDY SILT (A-4) WITH GRAVEL							2720.7	0.2	
	5.0	16	9	6	ALLUV: GRAY, LOOSE TO MED. DENSE, SILTY SAND (A-2-4)							2713.5	7.4	
2715	7.4	1	1	6	ALLUV: GRAY, DENSE, SLI. SILTY SANDY GRAVEL (A-1-b) WITH COBBLES							2710.5	10.4	
	8.9	8	8	5	CR: BLUE AND GRAY, FRESH, HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, AMPHIBOLITE							2708.9	12.0	
2710	10.4	16	9	27	CORING TERMINATED AT ELEV. 2700.8' IN CR: BLUE AND GRAY, AMPHIBOLITE							2700.8	20.1	

CORE BORING REPORT

DATE: 10/11/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: EB2B GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2720.9 FT TOTAL DEPTH: 20.1 FT

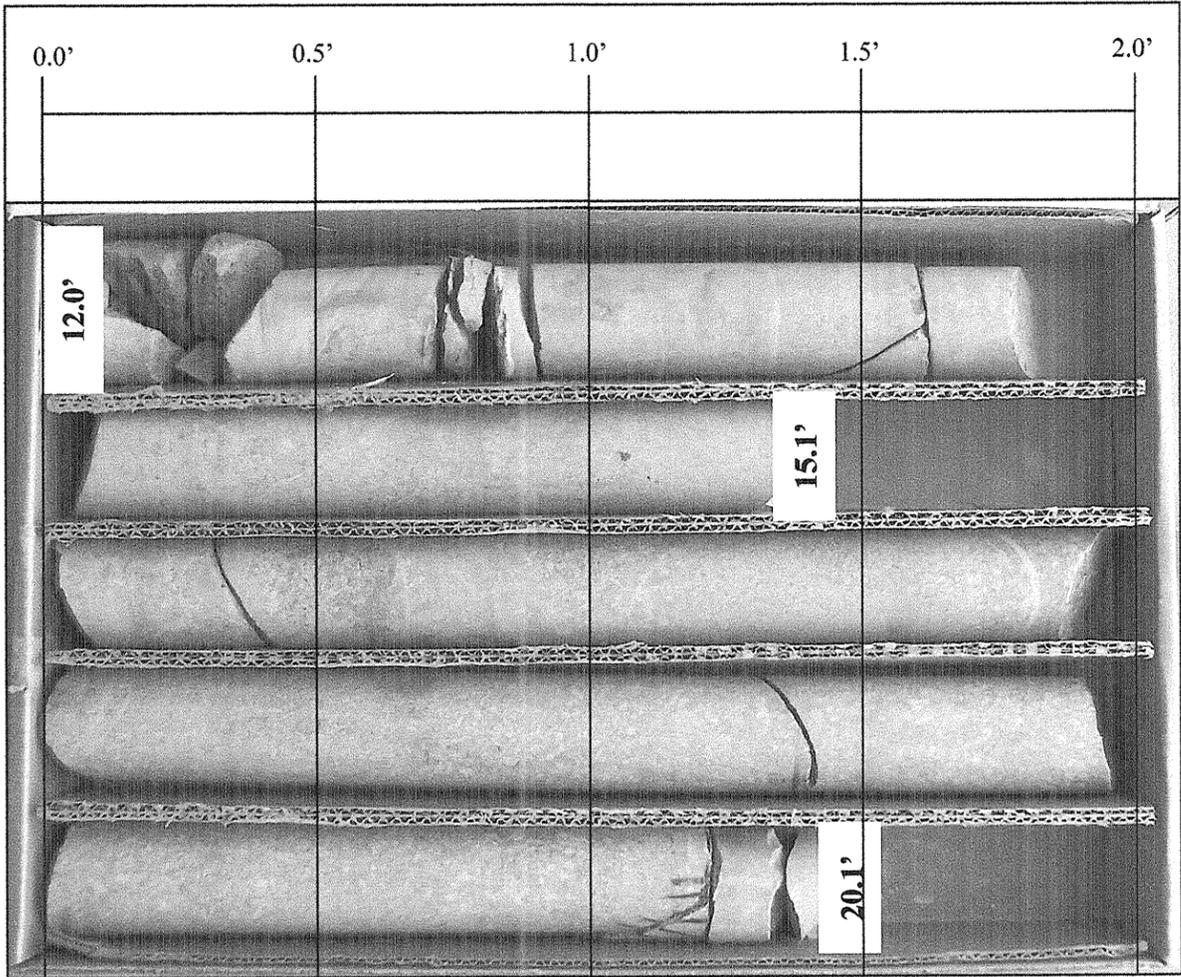
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2708.9	12.0	6:00	3.1	3.1/3.1	2.5/3.1		12.0-20.1 CR: BLUE AND GRAY, FRESH, HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, AMPHIBOLITE
		11:30					
		6:00					
2705.8	15.1			100%	81%		
2705.8	15.1	5:30	5.0	5.0/5.0	5.0/5.0		STRATA REC = 100% STRATA RQD = 92.3%
		5:30					
		6:15					
				100%	100%		
2700.8	20.1	6:30					

CORING TERMINATED AT 20.1 FT
 ELEVATION 2700.8 FT

DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50



Boring EB2B, Box 1 of 1, 12.0 feet to 20.1 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS	
BRIDGE NO. 165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.) ASHE COUNTY, NORTH CAROLINA TIP NO: B-4015, STATE PROJECT NO: 33383.1.1	
	<small>TIERRA, INC. 2756 ROWLAND RD. RALEIGH, NC 27615 PHONE (919) 871-0800 FAX (919) 871-0803</small>

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 33383.1.1 (B-4015)

F.A. NO.: BRZ-1362(1)

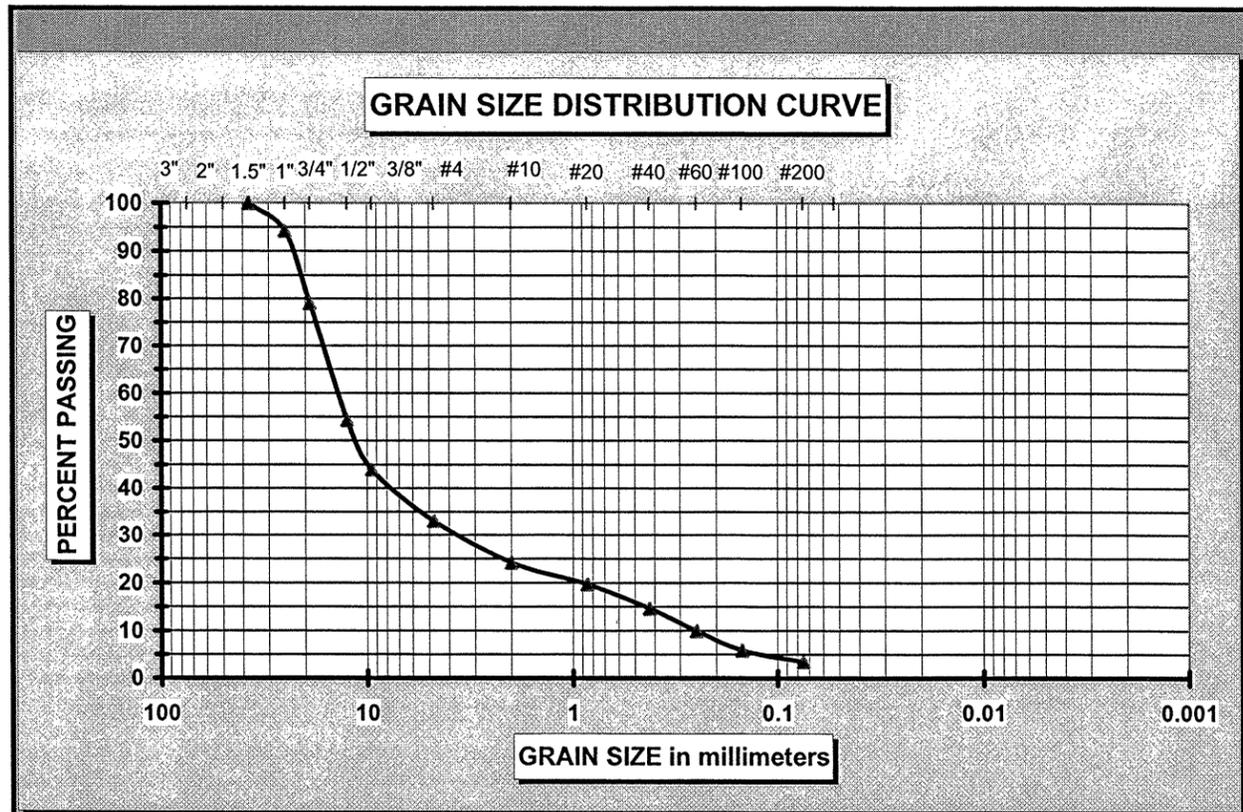
COUNTY: ASHE

BRIDGE NO. 165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-1	B1A	12.1-12.6	Metagraywacke	Zml	96.0%	0.41	0.21	185.5	11,044.9	492,804		
RS-2	B1B	21.9-22.8	Greenstone	Zml	100.0%	0.42	0.21	191.4	13,316.2	841,581		

BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)
ASHE COUNTY

NCDOT Project No: 33383.1.1 - T.I.P. No: B-4015



AASHTO M-145 Classification of Soil for Engineering Purposes				
Gravel	< 3" and > #10	Coarse Sand	< #10 and > #60	$Cu = D_{60} / D_{10}$
		Fine Sand	< #60 and > #200	$Cc = (D_{30})^2 / (D_{10} \times D_{60})$

BORING #: CHANNEL SAMPLE #: S-1 DEPTH: 0.0-1.0

BROWN SANDY GRAVEL (A-1-a)

% PASSING #200 SIEVE: 4%

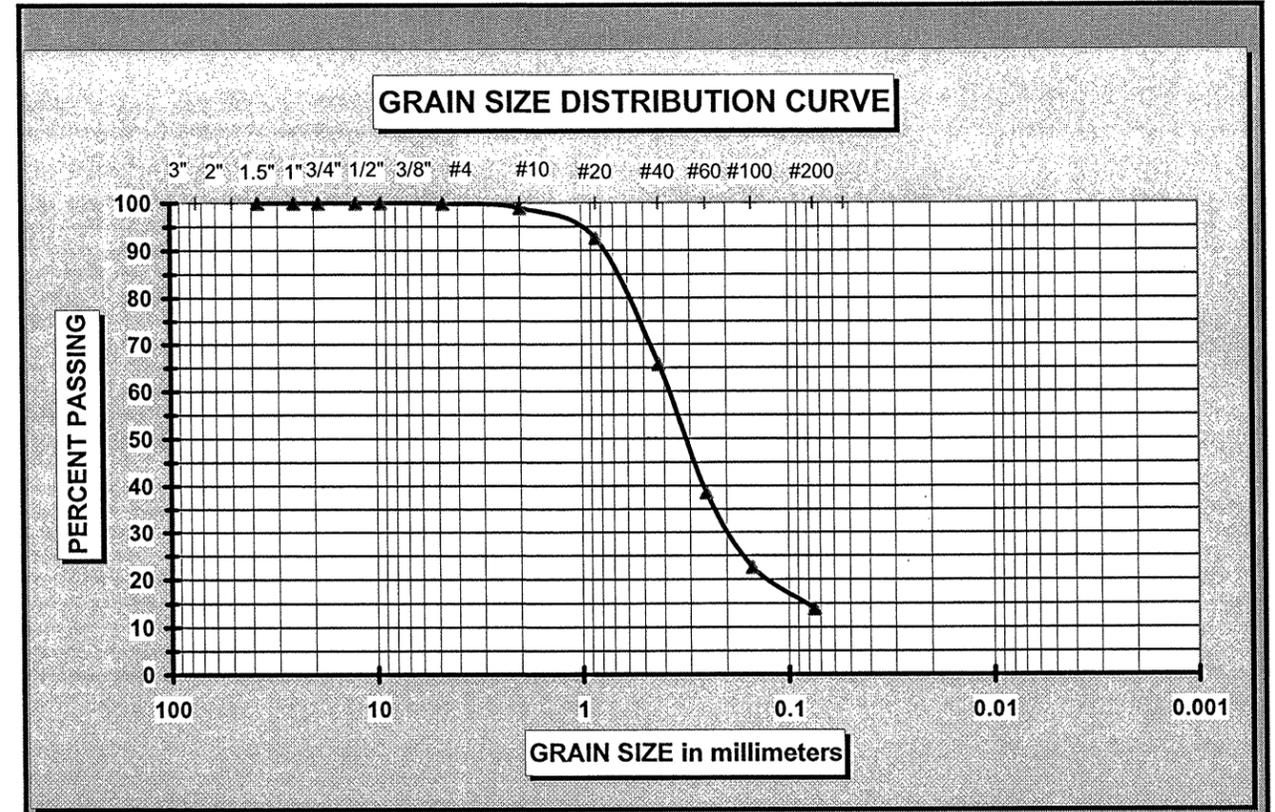
NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTIC INDEX	NA

TIERRA, INC. PROJECT #: 6211-05-037

BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)
ASHE COUNTY

NCDOT Project No: 33383.1.1 - T.I.P. No: B-4015



AASHTO M-145 Classification of Soil for Engineering Purposes				
Gravel	< 3" and > #10	Coarse Sand	< #10 and > #60	$Cu = D_{60} / D_{10}$
		Fine Sand	< #60 and > #200	$Cc = (D_{30})^2 / (D_{10} \times D_{60})$

BORING #: BANK SAMPLE #: S-2 DEPTH: 0.0-1.0

BROWN SILTY SAND (A-2-4)

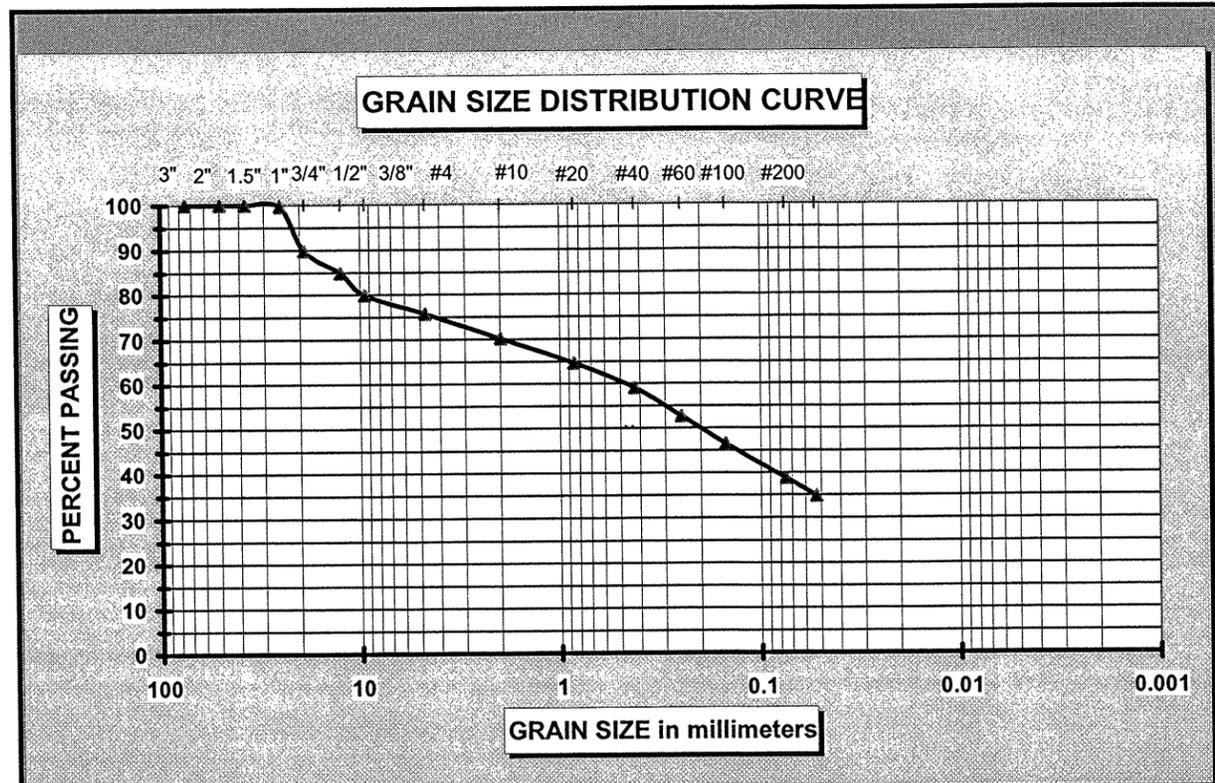
% PASSING #200 SIEVE: 14%

NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	29
PLASTIC LIMIT	-
PLASTIC INDEX	NP

TIERRA, INC. PROJECT #: 6211-05-037

BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)
 ASHE COUNTY
 NCDOT Project No: 33383.1.1 - T.I.P. No: B-4015



AASHTO M-145 Classification of Soil for Engineering Purposes				
Gravel	< 3" and > #10	Coarse Sand	< #10 and > #60	$Cu = D_{60} / D_{10}$
		Fine Sand	< #60 and > #200	$Cc = (D_{30})^2 / (D_{10} \times D_{60})$

BORING #: EB1A SAMPLE #: SS-2 DEPTH: 6.0-7.5

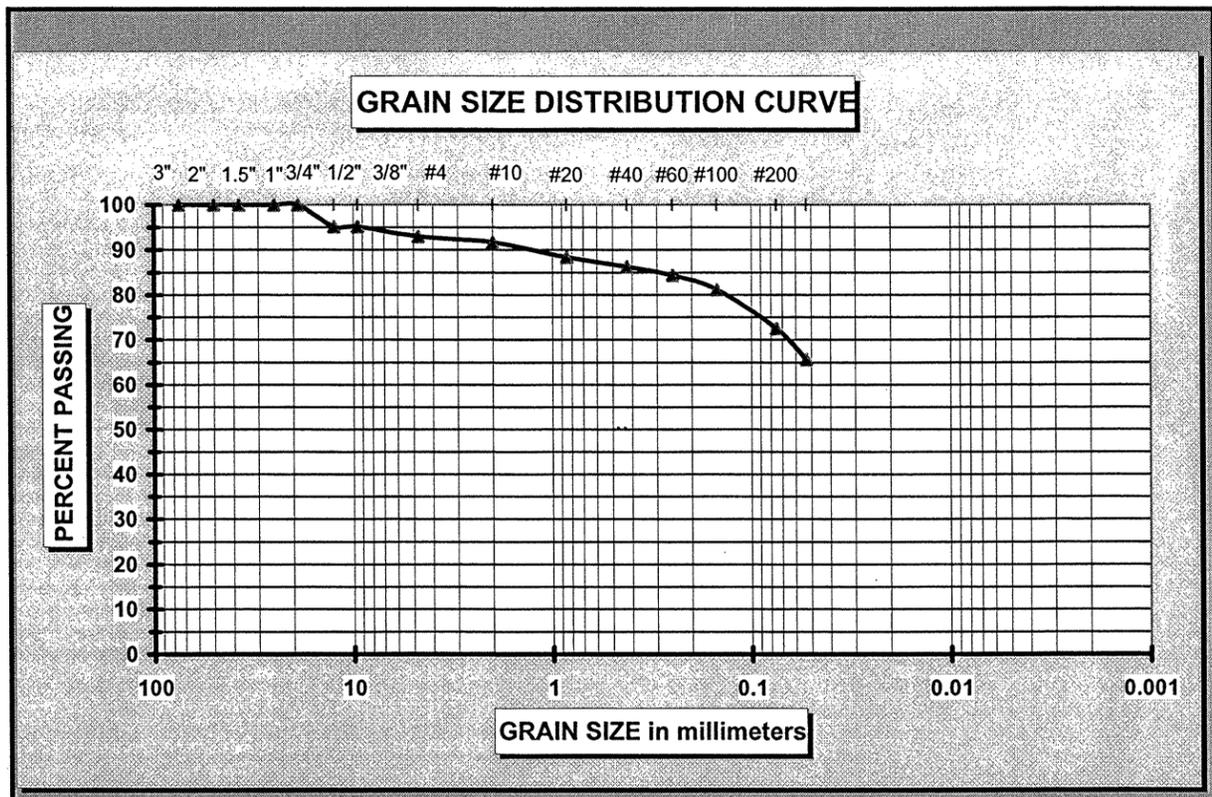
BROWN AND GRAY SANDY SILT (A-4)

% PASSING #200 SIEVE: 39%

NATURAL MOISTURE CONTENT = 27.5%

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	34
PLASTIC LIMIT	24
PLASTIC INDEX	10

BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)
 ASHE COUNTY
 NCDOT Project No: 33383.1.1 - T.I.P. No: B-4015



AASHTO M-145 Classification of Soil for Engineering Purposes				
Gravel	< 3" and > #10	Coarse Sand	< #10 and > #60	$Cu = D_{60} / D_{10}$
		Fine Sand	< #60 and > #200	$Cc = (D_{30})^2 / (D_{10} \times D_{60})$

BORING #: EB2A SAMPLE #: SS-5 DEPTH: 2.4-3.9

GRAY SILTY CLAY (A-7-5)

% PASSING #200 SIEVE: 73%

NATURAL MOISTURE CONTENT = 48.9%

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	52
PLASTIC LIMIT	35
PLASTIC INDEX	17

GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 33383.1.1 ID: B-4015 COUNTY: ASHE

DESCRIPTION(1): BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK ROAD)

INFORMATION ON EXISTING BRIDGES Information obtained from: [x] field inspection [] microfilm(Reel: Pos:) [x] other hydro report

COUNTY BRIDGE NO. 165 BRIDGE LENGTH 60 NO. BENTS IN: CHANNEL 1 FLOOD PLAIN 2

FOUNDATION TYPE: TIMBER DECK ON STEEL I-BEAMS, CONCRETE BENT AND ABUTMENTS

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: EVIDENT ON END BENT 1, UPSTREAM CORNER

INTERIOR BENTS: ON UPSTREAM SIDE

CHANNEL BED: MINIMAL

CHANNEL BANKS: NONE

EXISTING SCOUR PROTECTION:

TYPE(3): RIP RAP ON END BENT 1 BANK

EXTENT(4): ALONG SOUTH BANK RUNNING 100 FT. UPSTREAM AND 15 FT. DOWNSTREAM

EFFECTIVENESS(5): VERY EFFECTIVE

OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): LARGE LOG, RECENTLY CUT (10-10-05) STILL IN CHANNEL

DESIGN INFORMATION

CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED): COBBLES, BOULDERS (1' TO 4') SAND AND GRAVEL

CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED): SILTY SAND AND SAND WITH 1/2" SILT LAYER ON TOP

CHANNEL BANK COVER(9): BRUSH, GRASS AND OCCASIONAL MODERATELY AGED TREES

FLOOD PLAIN WIDTH(10): APPROXIMATELY 75 FEET

FLOOD PLAIN COVER(11): BRUSH, GRASS AND OCCASIONAL MODERATELY AGED TREES

DESIGN INFORMATION CONT.

STREAM IS [X] DEGRADING [] AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS: POOL AND RIFFLE STREAM, APPROXIMATELY 75' TO 100' BETWEEN POOLS

CHANNEL MIGRATION TENDENCY (13): TO THE SOUTHWEST

REPORTED BY: [Signature] DATE: 10/10/2005 TIERRA, INC

GEOTECHNICALLY ADJUSTED SCOUR ELEVATION (14):

Table with 2 columns: Location, Elevation. Rows include EB1-A (2709.8 FT), EB1-B (2710.6 FT), B1-A (2707.5 FT), B1-B (2707.0 FT), EB2-A (2710.6 FT), EB2-B (2708.3 FT).

REPORTED BY: [Signature] DATE: 11/4/2005 NCDOT GEOTECHNICAL UNIT INSTRUCTIONS

- (1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED. (2) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS, DEGRADATIONS, ETC.) (3) NOTE ANY EXISTING SCOUR PROTECTION (RIP RAP, ETC.) (4) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION. (5) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING. (6) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC. (7) DESCRIBE THE CHANNEL BED MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS. (8) DESCRIBE THE CHANNEL BANK MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS. (9) DESCRIBE THE BANK COVERING (GRASS, TREES, RIP RAP, NONE, ETC.) (10) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE). (11) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.) (12) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING (13) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). (14) GIVE THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE; PERCENTAGE RQD; DIFFERENTIAL WEATHERING, SHEAR STRENGTH; OBSERVATIONS AT EXISTING STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

PROJECT #: 33383.1.1 (B-4015)

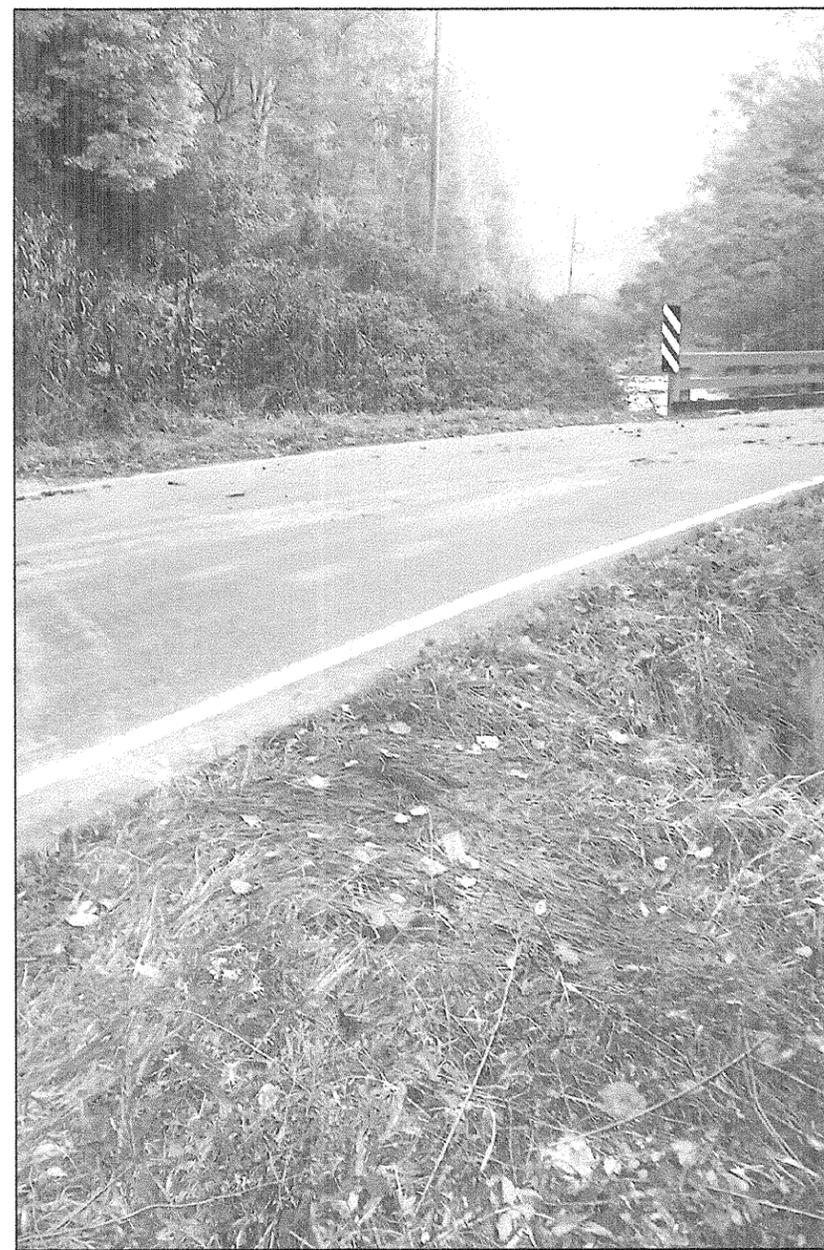
COUNTY: ASHE

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

SAMPLE #	CHANNEL BED MATERIAL		CHANNEL BANK MATERIAL			
	S-1		S-2	SS-2	SS-5	SS-6
RETAINED #4	66.9		0.1	24.3	7.1	27.9
PASSING #10	24.2		98.9	70.2	91.7	53.9
PASSING #40	14.7		65.8	59.0	86.4	26.1
PASSING #200	3.5		14.0	38.8	72.5	14.5
COARSE SAND	9.5		33.1	17.5	7.2	32.6
FINE SAND	11.2		51.8	17.9	18.8	8.3
SILT	-		-	13.9	28.3	3.1
CLAY	-		-	20.9	37.4	9.9
LL	-		29	34	52	21
PL	-		NP	24	35	17
AASHTO CLASSIFICATION	A-1-a		A-2-4	A-4	A-7-5	A-1-b
STATION	13+16		13+53	12+90	13+78	13+78
OFFSET	15 RT		6 LT	10 LT	12 LT	12 LT
DEPTH	0.0-1.0		0.0-1.0	6.0-7.5	2.4-3.9	7.0-8.5



CENTERLINE PROFILE (-L-), LOOKING UPSTATION FROM STATION 12+40 (-L-)



END BENT 1, LOOKING FROM EB1B TO EB1A

SITE PHOTOS

NCDOT Project: 33383.1.1 (B-4015)
 Ashe County, North Carolina
 Bridge No. 165 Over Big Horse Creek
 on SR 1362 (Big Horse Creek Road)



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



BENT 1, LOOKING FROM B1B TO B1A



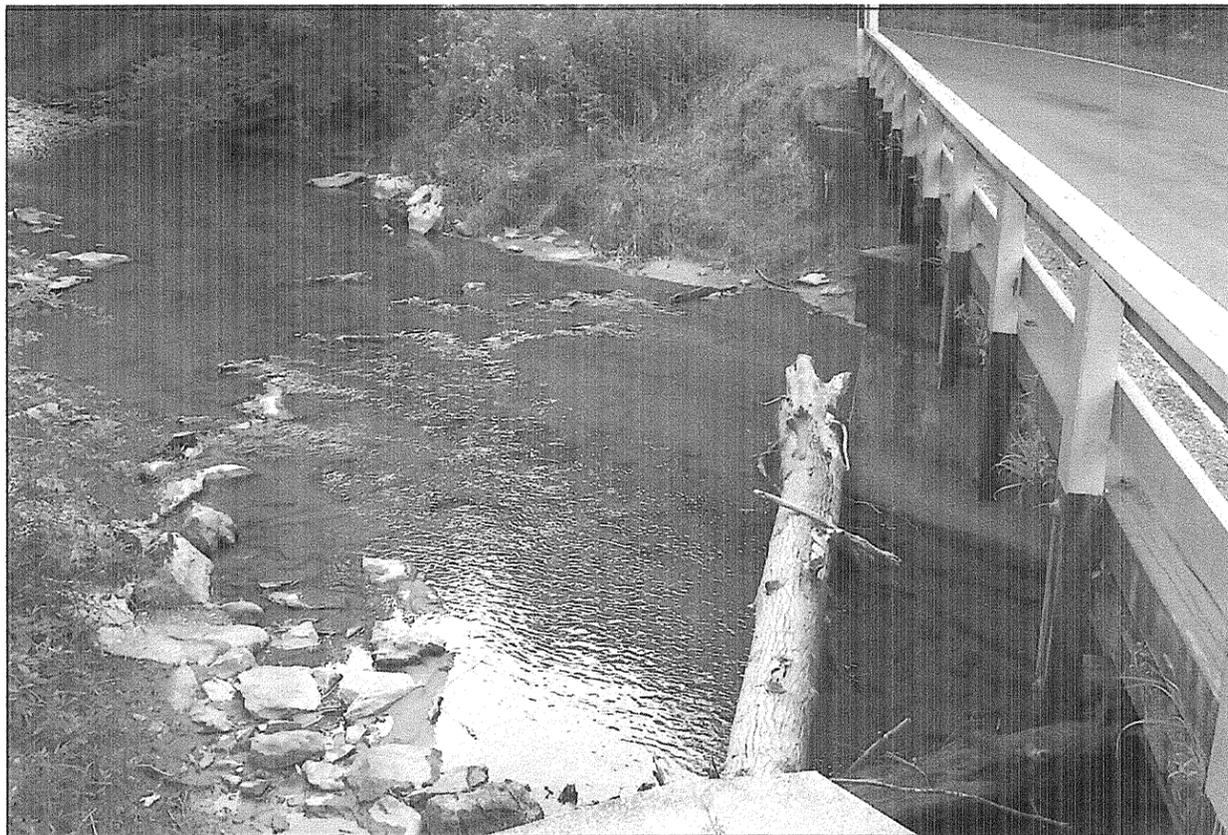
END BENT 2, LOOKING FROM EB2B TO EB2A

SITE PHOTOS

NCDOT Project: 33383.1.1 (B-4015)
Ashe County, North Carolina
Bridge No. 165 Over Big Horse Creek
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BIG HORSE CREEK, LOOKING UPSTREAM



BIG HORSE CREEK, LOOKING DOWNSTREAM

SITE PHOTOS

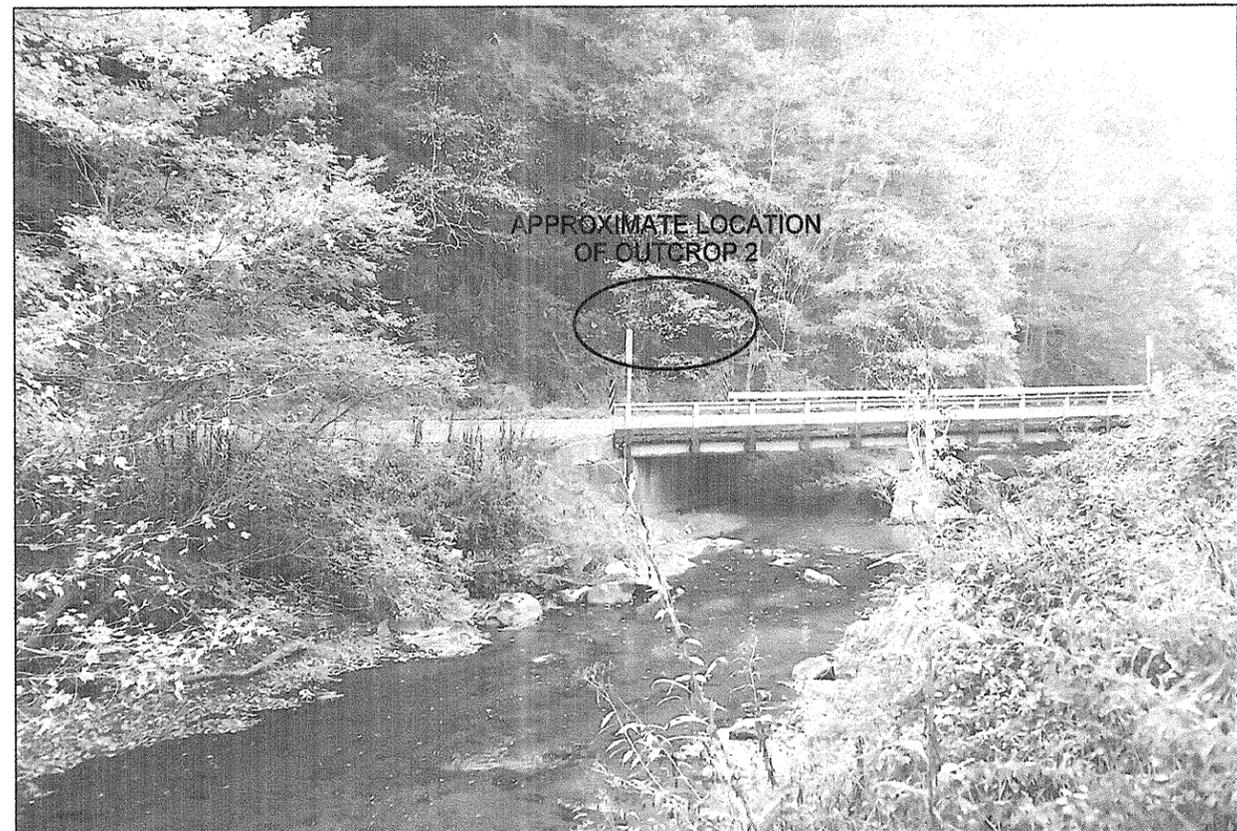
NCDOT Project: 33383.1.1 (B-4015)
Ashe County, North Carolina
Bridge No. 165 Over Big Horse Creek
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OUTCROP LOCATED AT STATION 14+34, 12' RIGHT OF -L-



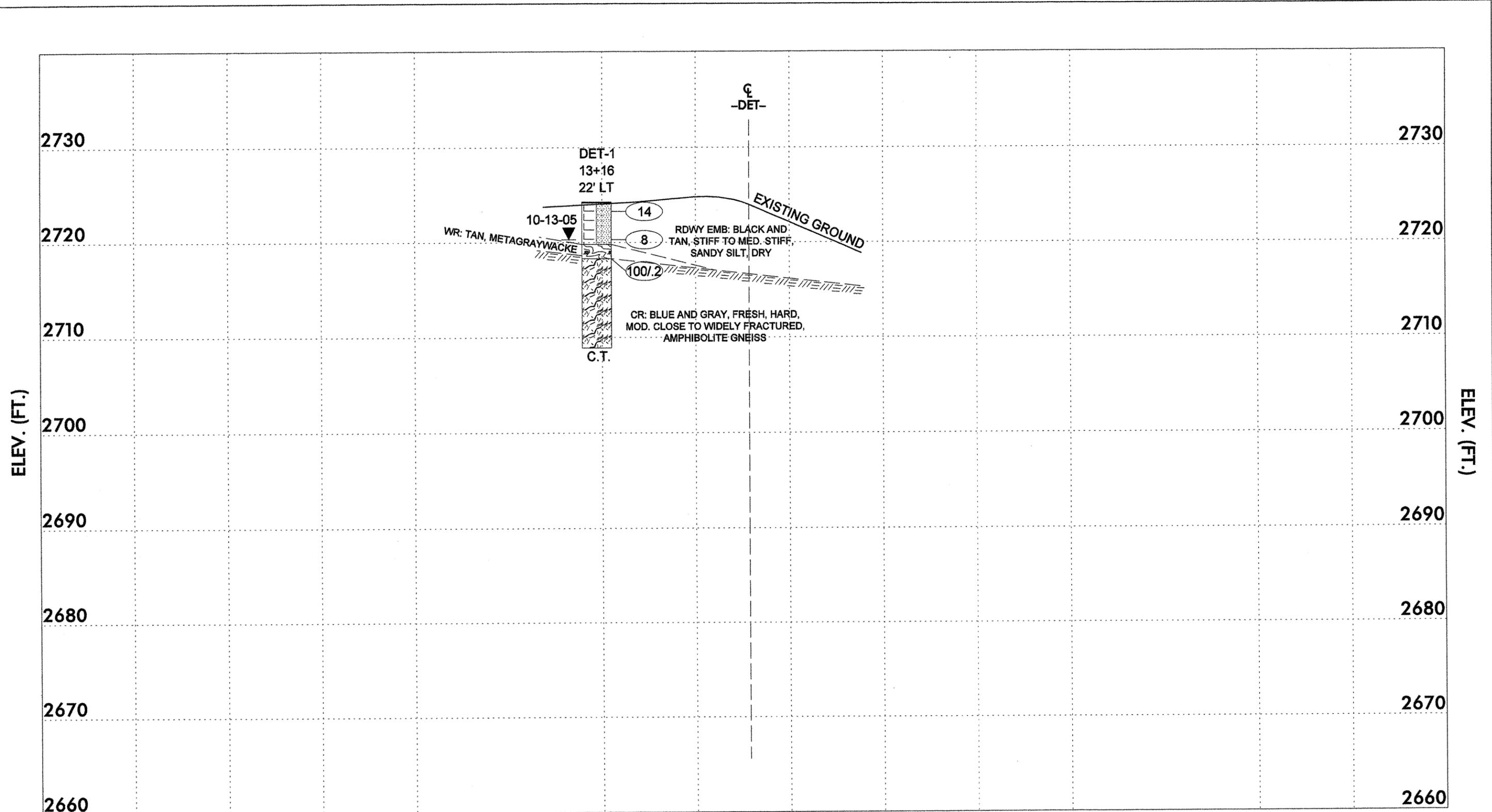
OUTCROP LOCATED AT STATION, 12+78, 61' RIGHT OF -L-

SITE PHOTOS

NCDOT Project: 33383.1.1 (B-4015)
Ashe County, North Carolina
Bridge No. 165 Over Big Horse Creek
on SR 1362 (Big Horse Creek Road)



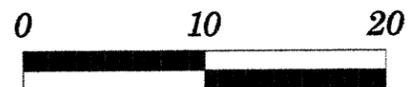
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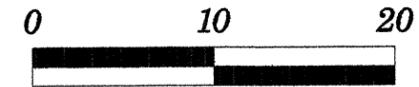
ELEV. (FT.)

ELEV. (FT.)

VERTICAL SCALE



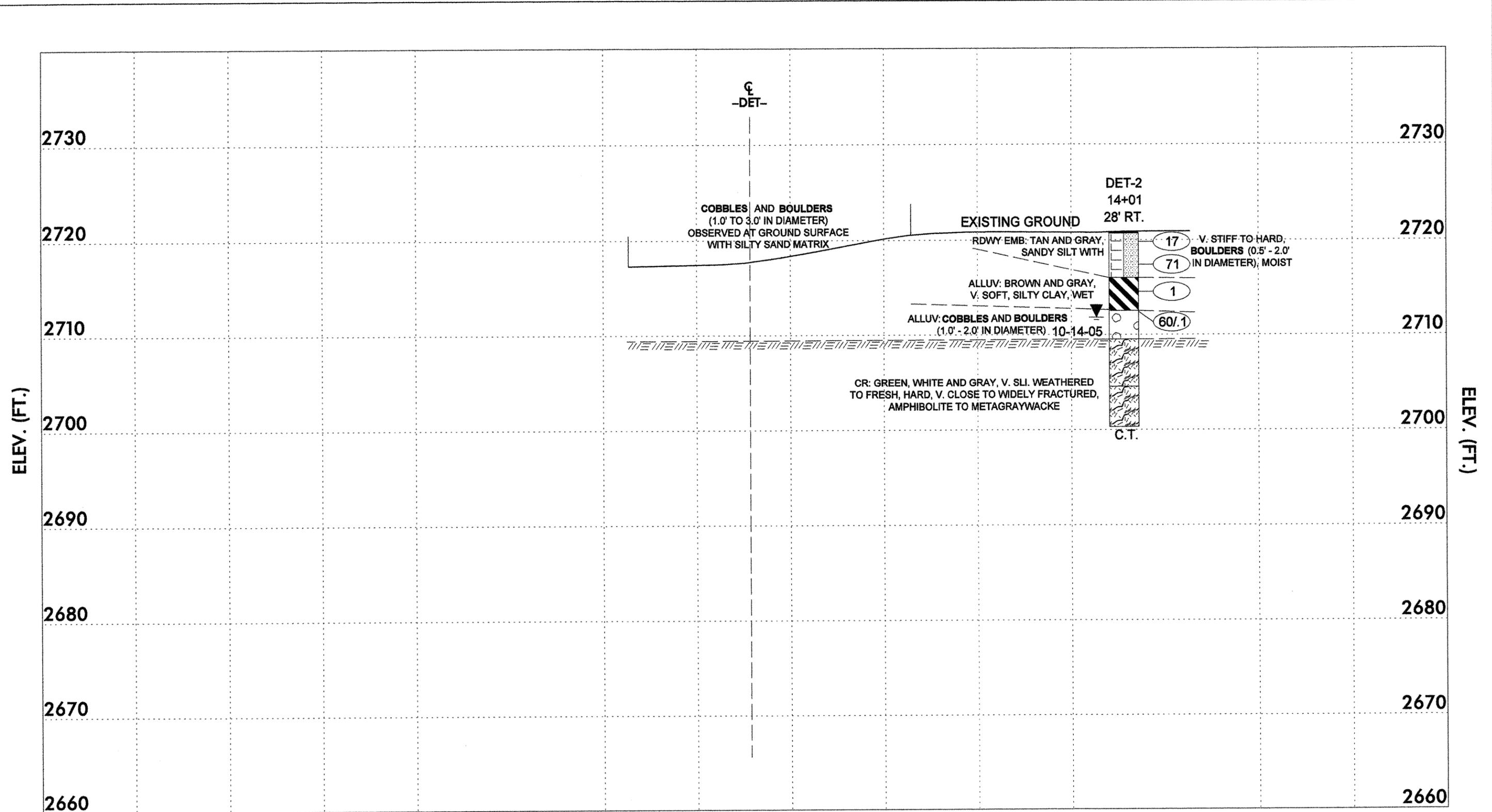
HORIZONTAL SCALE



Cross Section Detour End Bent 1

NCDOT PROJECT NO. : 33383.1.1 (B-4015)
 ASHE CO., NC
 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)

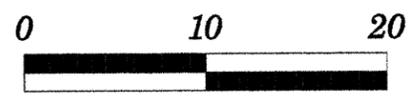




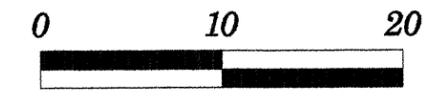
ELEV. (FT.)

ELEV. (FT.)

VERTICAL SCALE



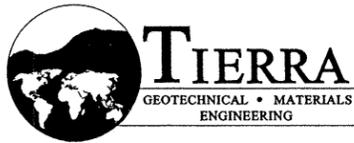
HORIZONTAL SCALE



Cross Section Detour End Bent 2

NCDOT PROJECT NO. : 33383.1.1 (B-4015)
 ASHE CO., NC
 BRIDGE NO. 165 OVER BIG HORSE CREEK
 ON SR 1362 (BIG HORSE CREEK RD.)





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 RALEIGH, NORTH CAROLINA 27615
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N.C.D.O.T. GEOTECHNICAL UNIT
 BORING LOG

SHEET 1 OF 1

PROJECT NO. 33383.1.1		ID. B-4015		COUNTY ASHE		GEOLOGIST J. HOWARD								
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)						GROUND WATER (ft)								
BORING NO. DET-1		BORING LOCATION 13+16		OFFSET 22' LT		ALIGNMENT -DET-								
COLLAR ELEV. 2724.3 ft		NORTHING 1,023,312.8		EASTING 1,256,658.1		0 HR. 3.8								
TOTAL DEPTH 15.4 ft		DRILL MACHINE DIEDRICH 50		DRILL METHOD WASH		24 HR. 4.0								
DATE STARTED 10-12-05		COMPLETED 10-12-05		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100	
2724.3	0.0	13	11	3	EXISTING GROUND							2724.3	0.0	ROOTMAT
	3.0	2	3	5								2724.2	0.1	RDWY EMB: BLACK AND TAN, STIFF TO MED. STIFF, SANDY SILT (A-4)
2720	5.8	100/2										2719.8	4.5	WR: TAN, METAGRAYWACKE
2715												2718.3	6.0	CR: BLUE AND GRAY, FRESH, HARD, MOD. CLOSE TO WIDELY FRACTURED, AMPHIBOLITE GNEISS
2710												2708.9	15.4	CORING TERMINATED AT ELEV. 2708.9' IN CR: BLUE AND GRAY, AMPHIBOLITE GNEISS

CORE BORING REPORT

DATE: 10/12/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: DET-1 GEOLOGIST: J. HOWARD

DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)

COUNTY: ASHE COLLAR ELEV.: 2724.3 FT TOTAL DEPTH: 15.4 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2718.3	6.0	7:15	4.4	4.4/4.4	4.3/4.4	RS-3	6.0-15.4 CR: BLUE AND GRAY, FRESH, HARD, MOD. CLOSE TO WIDELY FRACTURED, AMPHIBOLITE GNEISS
		8:00					
		6:00					
		6:45					
2713.9	10.4	1:45/0.4	5.0	5.0/5.0	5.0/5.0		STRATA REC = 100% STRATA RQD = 98.9%
2713.9	10.4	4:30					
		4:00					
		5:00					
2708.9	15.4	4:00					

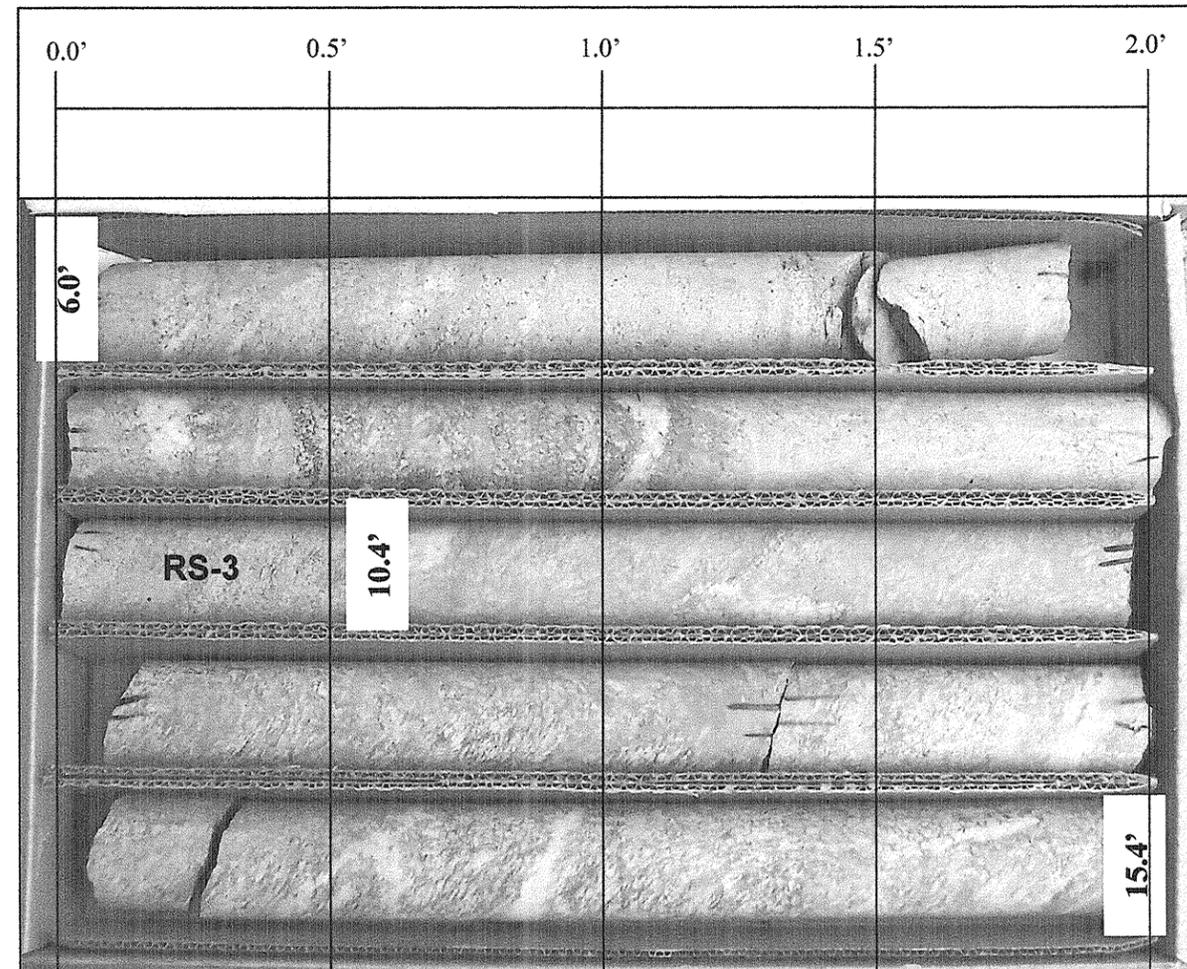
CORING TERMINATED AT 15.4 FT
 ELEVATION 2708.9 FT

DRILLER: F. COX

CORE SIZE: HQ

EQUIPMENT: DIEDRICH D-50

NCDOT_BORE 05-037 BR 165 - ASHE CO.GPJ NCDOT.GDT 10/25/05



Boring DET-1, Box 1 of 1, 6.0 feet to 15.4 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

**BRIDGE NO. 165 OVER BIG HORSE CREEK
ON SR 1362 (BIG HORSE CREEK RD.)
ASHE COUNTY, NORTH CAROLINA
TIP NO: B-4015, STATE PROJECT NO: 33383.1.1**



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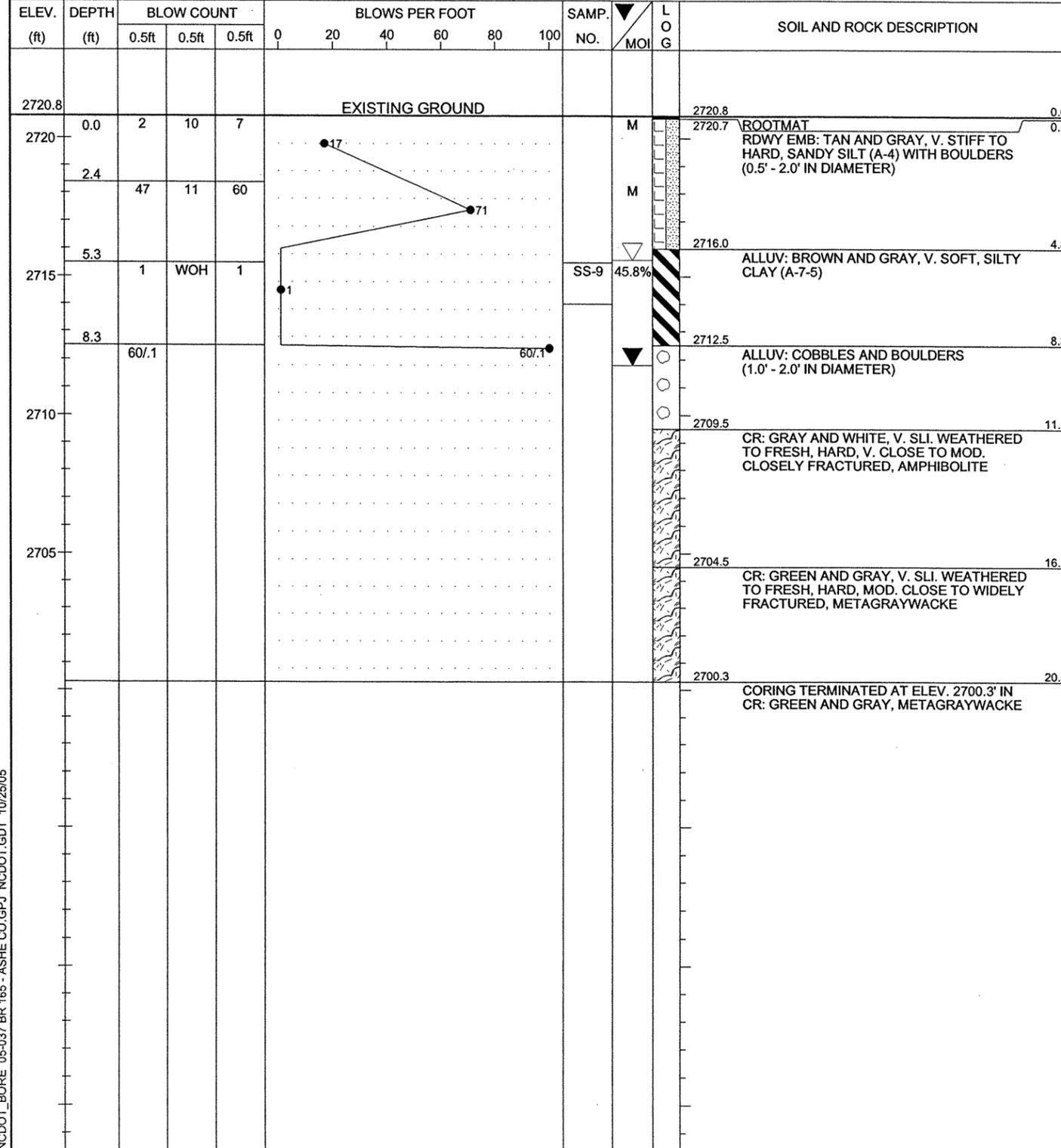


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N.C.D.O.T. GEOTECHNICAL UNIT
 BORING LOG

SHEET 1 OF 1

PROJECT NO. 33383.1.1	ID. B-4015	COUNTY ASHE	GEOLOGIST J. HOWARD
SITE DESCRIPTION BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)			GROUND WATER (ft)
BORING NO. DET-2	BORING LOCATION 14+01	OFFSET 28' RT.	ALIGNMENT -DET-
COLLAR ELEV. 2720.8 ft	NORTHING 1,023,328.8	EASTING 1,256,755.4	0 HR. 5.2
TOTAL DEPTH 20.5 ft	DRILL MACHINE DIEDRICH 50	DRILL METHOD WASH	24 HR. 9.0
DATE STARTED 10-13-05	COMPLETED 10-13-05	SURFACE WATER DEPTH N/A	
HAMMER TYPE AUTO			



CORE BORING REPORT

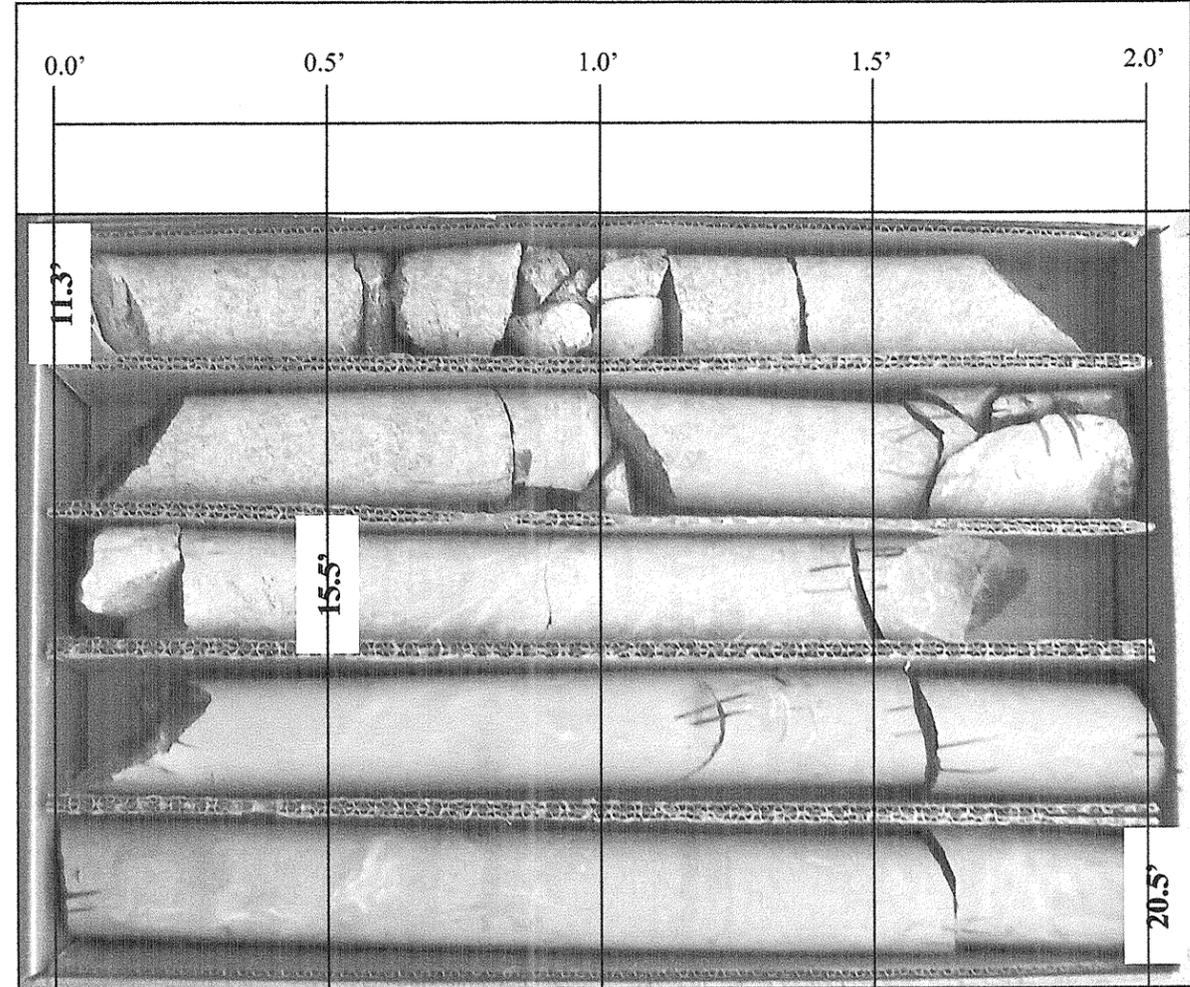
DATE: 10/13/05

PROJECT: 33383.1.1 I.D. NO.: B-4015 BORING NO: DET-2 GEOLOGIST: J. HOWARD
 DESCRIPTION: BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.)
 COUNTY: ASHE COLLAR ELEV.: 2720.8 FT TOTAL DEPTH: 20.5 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
2709.5	11.3	5:30/0.2	4.2	4.2/4.2	2.9/4.2		11.3-16.3 CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, AMPHIBOLITE
		6:15					
		6:00					
2705.3	15.5	4:45	5.0	5.0/5.0	5.0/5.0		16.3-20.5 CR: GREEN AND GRAY, V. SLI. WEATHERED TO FRESH, HARD, MOD. CLOSE TO WIDELY FRACTURED, METAGRAYWACKE
2705.3	15.5	5:45					
		5:15					
2700.3	20.5	4:15					STRATA REC = 100% STRATA RQD = 100%

CORING TERMINATED AT 20.5 FT
 ELEVATION 2700.3 FT

DRILLER: F. COX CORE SIZE: HQ EQUIPMENT: DIEDRICH D-50



Boring DET-2, Box 1 of 1, 11.3 feet to 20.5 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS	
BRIDGE NO. 165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD.) ASHE COUNTY, NORTH CAROLINA TIP NO: B-4015, STATE PROJECT NO: 33383.1.1	
	<small>TIERRA, INC. 2736 KOWLAND RD. RALEIGH, NC 27615 PHONE (919) 871-0800 FAX (919) 871-0803</small>

TIERRA, INC.

2736 ROWLAND ROAD, RALEIGH, NORTH CAROLINA 27615

AASHTO SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE #165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)

NCDOT Project No: 33383.1.1 - T.I.P. No: B-4015

ASHE COUNTY

TIERRA, INC. PROJECT NO: 6211-05-037

BORING #		SAMPLE #	TOTAL SAMPLE			MINUS 2.00 mm FRACTION				Atterberg Limits		MC
AASHTO Classification			PERCENT PASSING			PERCENT RETAINED						
STATION #	OFFSET (FEET)	DEPTH (FEET)	#10	#40	#200	Coarse Sand	Fine Sand	SILT	CLAY	LL	PI	%
DET-1		SS-8	99	78	58	29	20	34	17	29	4	18.1
A-4												
13+16	22 LT	3.0-4.5										
DET-2		SS-9	91	88	76	6	15	32	47	51	21	45.8
A-7-5												
14+01	28 RT	5.3-6.8										

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 33383.1.1 (B-4015)

F.A. NO.: BRZ-1362(1)

COUNTY: ASHE

BRIDGE NO. 165 OVER BIG HORSE CREEK ON SR 1362 (BIG HORSE CREEK RD)

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-3	DET-1	9.8-10.4	Amphibolite Gneiss	Yb9g	98.0%	0.47	0.21	176.0	12,291.8	857,443		



DETOUR CENTERLINE PROFILE (-DET-), LOOKING DOWNSTATION FROM STATION 14+50 (-DET-)

SITE PHOTOS

NCDOT Project: 33383.1.1 (B-4015)
Ashe County, North Carolina
Bridge No. 165 Over Big Horse Creek
on SR 1362 (Big Horse Creek Road)



TIERRA
GEOTECHNICAL • MATERIALS
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DETOUR END BENT 1, LOOKING FROM LEFT TO RIGHT



DETOUR END BENT 2, LOOKING FROM LEFT TO RIGHT

SITE PHOTOS

NCDOT Project: 33383.1.1 (B-4015)
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