PROJECT: MA12018R ID:

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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT MA12018R I.D. NO. _____

F.A. PROJECT _____

COUNTY GASTON

PROJECT DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

SITE DESCRIPTION _____

STATE	STATE PROJECT REFERENCE NO.		SHEET NO.	TOTAL SHEETS
N.C.	MA12018R		1	30
STATE PROJ. NO.		F.A. PROJ. NO.	DESCRIPTION	
MA12018R			P.E.	
			CONST.	

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.

INVESTIGATED BY J. HOWARD PERSONNEL P. ZHANG

CHECKED BY G. LANG, P.E.

SUBMITTED BY TIERRA, INC.

DATE JANUARY, 2006

DRAWN BY: E. WAGNER

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.

NORTH CAROLINA PROFESSIONAL SEAL 31421 ENGINEER GABRIEL W. LANG

SEAL

1-19-06

SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
	MA12018R	2	30

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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:

VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤35% PASSING #200)							SILT-CLAY MATERIALS (>35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN				
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX				
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS					
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE	

P.I. OF A-7-5 ≤ L.L. - 30 : P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.25	0.005
	IN.	12"	3"				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	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

COLOR

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.

GRADATION

WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE
UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS; ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.
- STATIC WATER LEVEL AFTER 24 HOURS.
- PW — PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA
- SPRING OR SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- ● - SOUNDING ROD
- SPT CPT OPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

SAMPLE DESIGNATIONS
S- BULK SAMPLE
SS- SPLIT SPOON SAMPLE
ST- SHELBY TUBE SAMPLE
RS- ROCK SAMPLE
RT- RECOMPACTED TRIAXIAL SAMPLE
CBR - CBR SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
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
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
REF. - REFUSAL
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45
- ☐ CME-550
- ☐ PORTABLE HOIST
- ☒ OTHER 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___
- ☒ -H Q

HAND TOOLS:
- ☐ POST HOLE DIGGER
- ☐ HAND AUGER
- ☐ SOUNDING ROD
- ☐ VANE SHEAR TEST
- ☐ OTHER ___

ROCK DESCRIPTION

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 FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V. 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
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. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS 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 GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.25 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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

BEDDING

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

INDURATION

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.

TERMS AND DEFINITIONS

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 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 (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL 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.

BENCH MARK: TBM #3, TRAVERSE DISK AT -L- STA. 20+51.50, 22.4' LT.

ELEVATION: 636.12'

NOTES:

January 18, 2006

Charles L. Flowe, P.E.
TGS Engineers
975 Walnut Street, Suite 141
Cary, NC 27511

Re: Geotechnical Subsurface Exploration Report
Project No.: MA-12018R
County: Gaston County
Description: Bridge No. 28 on SR 2416 (Robinson Road) over Miles Creek
Tierra Inc. Proj. No.: 6211-05-028

Dear Mr. Flowe:

As authorized, Tierra, Inc. has completed the geotechnical subsurface exploration for Bridge No. 28 on SR 2416 (Robinson Road) over Miles Creek. Our investigation was performed in general accordance with our proposal number TR-04-071, dated August 2, 2004. The purpose of this report is to present subsurface conditions at the locations tested and foundation design recommendations for the planned structure. Field and laboratory test results, site and boring location plans, and profile/cross-sections depicting subsurface conditions may be found in this report.

PROJECT DESCRIPTION

According to the Bridge Survey and Hydraulic Design Report dated July 2005, the referenced project will replace the existing three span bridge, currently spanning Miles Creek. The proposed replacement structure will be a three span, four bent bridge, located at essentially the same alignment as the existing structure. The proposed bridge will be approximately 122 feet long, located between Station 19+01 and Station 20+23, and have a skew angle of 105°. In addition, the bridge embankments will be reconstructed to match the current pavement elevations and are not anticipated to require new fills. The slopes in front of the abutment will be constructed with 4:1 (horizontal: vertical) slopes and Class II Rip Rap. Design scour elevations and structural loads were provided by TGS Engineers on September 26 and October 20, 2005, respectively, and are presented on the attached Summary of Foundation Recommendations.

SITE DESCRIPTION/GEOLOGY

The proposed project site is located along SR 2416 in a rural area of Gaston County, approximately 5 miles south of Gastonia, NC. The area has a generally rolling terrain with a relatively well developed flood plain. It is estimated that the floodplain is approximately 190 feet wide at the bridge site. The site appears to be wooded and undeveloped. The depth of water in the creek at the time of drilling was approximately ½ foot along the upstream side.

2736 Rowland Road ▪ Raleigh, North Carolina 27615
Phone (919) 871-0800 ▪ Fax (919) 871-0803

According to ***The Geologic Map of North Carolina*** (1985), the project site is part of the Piedmont Physiographic Providence and is located within the Kings Mountain Belt. The map shows that the site is within the Battleground formation (**Zbt**). Rocks include quartz-sericite schist with metavolcanic rock, quartz-pebble metaconglomerate, kyanite-sillimanite quartzite and garnet-quartz rock.

FIELD EVALUATION PROCEDURE

The subsurface exploration consisted of performing six (6) soil test borings near the proposed end bents and interior bents. Some borings were offset due to utility and accessibility issues. Borings were performed with a track-mounted Diedrich D-50 drill rig with an automatic hammer. Standard Penetration Tests (SPT) and soil sampling were performed in general accordance with American Association of State Highway Transportation Officials (AASHTO T-206-87), and North Carolina Department of Transportation (NCDOT) latest Geotechnical Guidelines and Procedures Manual. Rock coring was performed in general conformance with (ASTM) procedure D2113 utilizing HQ size barrels.

Groundwater measurement readings were taken within each borehole with a weighted 100-foot measuring 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. Surveyed borehole elevations are based on a temporary benchmark TBM #3, located at Station 20+51.50, 22.4 feet left of –L-. The elevation at this benchmark is 636.12 feet.

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Miles Creek to determine scour impact for foundation design purposes. The scour report is included in the Appendix of this report.

SUBSURFACE AND GROUNDWATER CONDITIONS

Subsurface soils penetrated beneath the site consist of roadway embankment, alluvial deposits and residual materials underlain by weathered rock and crystalline rock.

End Bents

Soils beneath End Bent 1 consist of roadway embankment, alluvial deposits and residual materials, underlain by weathered rock and crystalline rock. Roadway embankment soils were encountered at or near ground surface and consist of approximately 9 feet of loose silty sand and medium stiff sandy clay (A-2-4, A-7-5). Alluvial deposits were encountered below the roadway embankment soils and consist of approximately 13 to 15 feet of loose to very loose silty sand and soft sandy silt (A-2-4, A-4). Residual soils were encountered below the alluvial deposits and consist of approximately 7 to 12 feet of loose to dense silty sand (A-2-4). Weathered schist was encountered below the residual soils at elevations of approximately 607 and 601 feet. Crystalline rock was encountered below the weathered rock at elevations of approximately 606 and 595 feet.

Soils beneath End Bent 2 consist of roadway embankment, alluvial deposits and residual materials underlain by weathered rock and/or crystalline rock. Roadway embankment soils were encountered at or near ground surface and consist of approximately 4 feet of medium stiff sandy

clay (A-6). Alluvial deposits were encountered either at the ground surface or below the roadway embankment soils and consist of approximately 8 feet of loose to medium dense silty sand and soft to stiff sandy silt (A-2-4, A-4). Residual soils were encountered below the alluvial deposits and consist of approximately 10 to 24 feet of stiff to very stiff sandy silt and loose to dense silty sand (A-4, A-2-4). Weathered rock was encountered below the residual soils at an elevation of approximately 616 feet at EB2B. Crystalline rock was encountered below the weathered rock at EB2B at an elevation of approximately 615 feet, and below the residual soils at EB2A at an elevation of approximately 599 feet.

Interior Bents

Soils beneath Interior Bent 1 consist of alluvial deposits and residual materials underlain by weathered rock and crystalline rock. Alluvial deposits were encountered at or near ground surface and consist of approximately 19 feet of very loose to loose silty sand (A-2-4). Residual soils were encountered below alluvial deposits and consist of approximately 8 feet of loose to medium dense silty sand (A-2-4). Weathered schist was encountered below the residual soils at an elevation of approximately 600 feet. Crystalline rock was encountered approximately 6 feet below the top of weathered rock at an elevation of approximately 594 feet.

Soils beneath Interior Bent 2 consist of alluvial deposits and residual materials underlain by weathered rock and crystalline rock. Alluvial deposits were encountered at or near ground surface and consist of approximately 8 feet of loose silty sand and stiff sandy clay (A-2-4, A-6). Residual soils were encountered below alluvial deposits and consist of approximately 5 feet of medium stiff sandy clay (A-6). Weathered schist was encountered below the residual soils at an elevation of approximately 614 feet. Crystalline rock was encountered approximately 4 feet below the top of weathered rock at an elevation of approximately 611 feet.

Groundwater across the site ranges in elevation between approximately 627 and 619 feet. Water level within the creek at the time of our investigation was approximately elevation 619 feet.

LABORATORY TESTING

Representative split-spoon samples were selected from soil test borings to verify visual field classifications and determine soil index properties. A total of seven split-spoon samples were analyzed in our laboratory for natural moisture determination, Atterberg limits, and grain size analysis. In addition, representative channel and bank samples were analyzed for grain size distribution. Two rock core samples were also tested for compressive strength. 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 "Laboratory Determination of Moisture Content of Soils"
- ASTM 2938-95 "Unconfined Compressive Strength of Intact Rock Core"
- ASTM 3148-02 "Elastic Moduli of Intact Rock Core in Uniaxial Compression"

CONCLUSIONS

Based on our subsurface investigation, the subsurface conditions consist of loose/medium stiff roadway embankment soils, very loose to medium dense/soft to stiff alluvial soils, and loose to dense/medium stiff to very stiff residual soils, underlain by weathered rock and crystalline rock. The thickness of the alluvial soils ranges from approximately 8 to 19 feet. Weathered rock was encountered at depths ranging from approximately 13 to 35 feet (elevations of 616 to 600 feet). Due to the loose/soft nature of the alluvial soils and deeper depths to weathered rock and crystalline rock, a combination of driven piles and drilled piers bearing on weathered and/or crystalline rock are anticipated for the bridge structure.

FOUNDATION RECOMMENDATIONS

Based on the depth to competent bearing material, the end bents for the proposed bridge should be supported by driven HP 12x53 piles. The piles may be designed using an allowable capacity of 45 tons and a safety factor of 2. The interior bents of the bridge should be supported by 42-inch concrete drilled piers. The piers may be designed to bear on crystalline rock with an allowable capacity of 330 tons, based on a safety factor of 2.5. For more information, refer to the attached "Summary of Foundation Recommendations".

Based upon the information provided, we understand the existing grades at new end bents will not be changed. Construction for the end bents will only require excavation for the abutments and new slopes. Therefore, additional settlement is not anticipated for the bridge approaches. The end bent slopes are proposed to be 4 Horizontal to 1 Vertical (4H:1V). Provided that the embankments are constructed in accordance with NCDOT specifications and suitable slope protection measures are incorporated, the slopes may be constructed at 4H:1V.

CLOSURE

Recommendations and evaluations provided by Tierra, Inc. are based on the Bridge Survey & Hydraulic Design Report dated July 2005. Modifications of our recommendations and evaluations may be required if there are changes to the design or location of the structure. Recommendations 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.

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 have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely,
TIERRA, INC.

Pu (Paul) Zhang, Ph.D., P.E.
Geotechnical Engineer

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

NORTH CAROLINA PROFESSIONAL SEAL 31421 ENGINEER GABRIEL W. LANG

1-19-06

SUMMARY OF FOUNDATION RECOMMENDATIONS

NCDOT PROJ. NO.: MA-12018R **PROJECT DESCRIPTION:** Bridge No. 28 on SR 2416

T.I.P. NO.: over Miles Creek

COUNTY: Gaston

STATION: 19+62 -L-

PREPARED BY: PZ **DATE:** 01/18/06

CHECKER: GL **DATE:** 01/18/06

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 31421 ENGINEER GABRIEL W. LANG
1-19-06
SIGNATURE

	STATION	FOUNDATION TYPE	ALLOWABLE LOAD	FOUNDATION DETAILS
END BENT 1	19+01 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Abutment = 631 ft ± Recommended Length of Pile = 35 ft
BENT 1	19+37 -L-	42 inch Drilled Pier	330 tons/Pier	Assumed Bottom of Cap =632 ft ± Assumed Top of Pier = 625 ft ± Recommended Length of Pier = 37 ft Tip Elevation No Higher Than = 588 ft
BENT 2	19+87 -L-	42 inch Drilled Pier	330 tons/Pier	Assumed Bottom of Cap =632 ft ± Assumed Top of Pier = 625 ft ± Recommended Length of Pier = 37 ft LT Recommended Length of Pier = 29 ft RT Tip Elevation No Higher Than = 588 ft LT Tip Elevation No Higher Than = 596 ft RT
END BENT 2	20+23 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Abutment = 632 ft ± Recommended Length of Pile = 35 ft

COMMENTS & NOTES (Attached)

Note on Plans:

1. Piles for End Bents No. 1 and 2 shall be driven to a minimum bearing capacity of 45 tons each.
2. When driving piles, the maximum blow counts shall not be exceeded.
3. The drilled piers at Bents No. 1 and 2 have been designed for both skin friction and tip bearing. The required tip bearing capacity is 25 tsf.
4. The required tip bearing capacity at Bents No. 1 and 2 shall be verified.
5. Drilled piers for Bents No. 1 and 2 have been designed for an applied load of 330 tons each at the top o the column.
6. Drilled piers at Bent No. 1 shall extend to an elevation no higher than 588 feet and satisfy the required tip bearing capacity.
7. Drilled piers at Bent No. 2 shall extend to an elevation no higher than 588 feet LT and 596 feet RT and satisfy the required tip bearing capacity.
8. Permanent steel casing may be required for drilled piers at Bent No. 1. If required, the casing shall no extend below elevation 600 feet without the engineer's permission. The need for permanent steel casing will be determined by the engineer.
9. Permanent steel casing may be required for drilled piers at Bent No. 2. If required, the casing shall no extend below elevation 600 feet LT, and 607 feet RT without the engineer's permission. The need for permanent steel casing will be determined by the engineer.
10. For permanent steel casing, see special provision for drilled piers.
11. SPT testing is not required to determine the tip bearing capacity of the drilled piers at Bents No. 1 and 2.
12. Slurry construction shall not be used for this project.
13. SID inspections are not required to determine the bottom cleanliness of the drilled piers at Bents No. 1 and 2.
14. For drilled piers, see special provisions.
15. The scour critical elevations for Bents No. 1 and 2 are 606 feet. The scour critical elevations are for use by maintenance forces to monitor possible scour problems during the life of the structure.

Comments:

1. The elevation of the point of fixity for Bent No. 1 is 592 ft.
2. The elevations of the point of fixity for Bent No. 2 are 592 ft LT and 600 ft RT.
3. Design scour elevation for Bents No. 1 and 2 is 607 ft.
4. The actual boring location for Bent No. 2 was approximately 18 feet offset from the edge of the road due to accessibility issues. Our recommendation for Bent No. 2 is based on assumed rockline elevations a proposed location through interpolation. It is subjected to change if the revealed subsurface conditions vary from our assumptions during construction.
5. 4:1 (H:V) embankment slope at end bents maybe constructed with suitable slope face protection.
6. A longitudinal shear load of 1.1 kips with a free head condition was assumed for Bents No. 1 and 2.
7. A transverse shear load of 0.1 kips with a fixed head condition was assumed for Bents No. 1 and 2.

DRILLED PIER PAY ITEM QUANTITIES

PROJECT NO. MA-12018R

TIP NO.

COUNTY GASTON

STATION 19+62 -L-

DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK

DATE 1/18/2006

DESIGNED BY PZ

CHECKED BY GL

NUMBER OF BENTS WITH DRILLED PIERS 2

NUMBER OF PIERS PER BENT 3

BENT #	DRILLED PIER PAY ITEMS					
	PERMANENT STEEL CASING FOR 42 INCH DIA. DRILLED PIER (yes/no/maybe)	42 INCH DIA. DRILLED PIERS NOT IN SOIL (feet)	SPT TESTING (each)	SID INSPECTION (each)	CROSSHOLE SONIC LOGGING* (each)	CSL TUBES* (yes/no)
1	Maybe	27	0	0	0	No
2	Maybe	27	0	0	0	No
3						
4						
5						
6						
7						
8						
9						
10						
TOTALS		54	0	0	0	

* Pay items, "Crosshole Sonic Logging" and "CSL Tubes" are not required unless CSL testing is required with a Note on Plans.

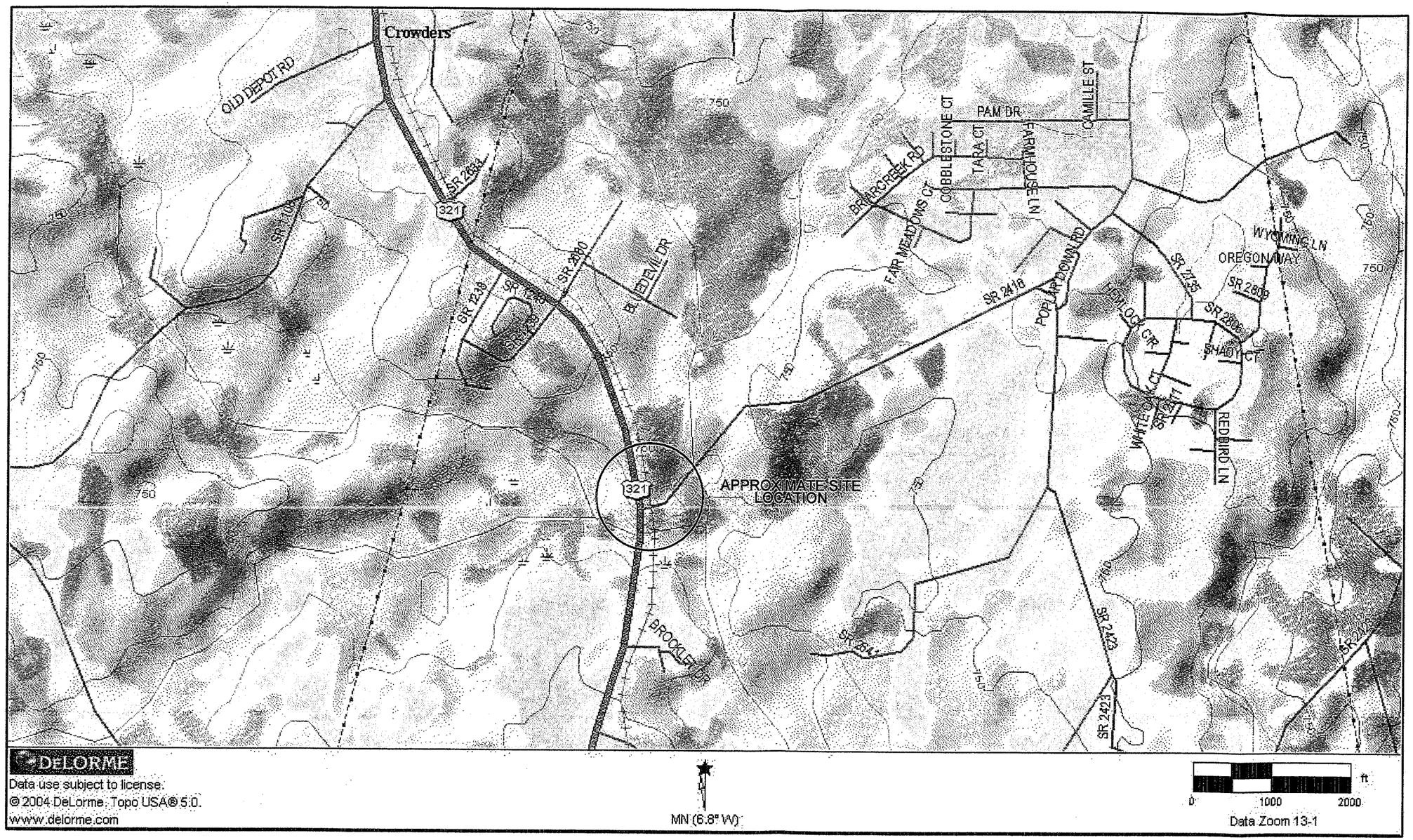
Notes:

Blanks or no represent quantity of zero.

If permanent steel casing is required or may be required, Structure Design should calculate the pay item quantity, "Permanent Steel Casing for ___ Dia. Drilled Pier", as the difference between the top of drilled pier elevation or the top of permanent steel casing elevation (whichever is lower) and the elevation the permanent steel casing can not extend below as shown with a Note on Plans.

Structure Design should determine the pay item quantity, "___ Dia. Drilled Piers in Soil", based upon the total drilled pier length per bent minus the "___ Dia. Drilled Piers not in Soil" per bent shown in the table above.

If CSL tubes are required, Structure design should calculate the pay item quantity, "CSL Tubes", as follows:
"CSL Tubes" per bent = (drilled pier length + 2.5 feet) x number of CSL tubes per pier
The number of CSL tubes per pier is dependent upon the drilled pier diameter. For drilled piers with a diameter of 5 feet or less, use 4 tubes. For drilled piers with a diameter greater than 5 feet, use 6 tubes.



SITE VICINITY MAP

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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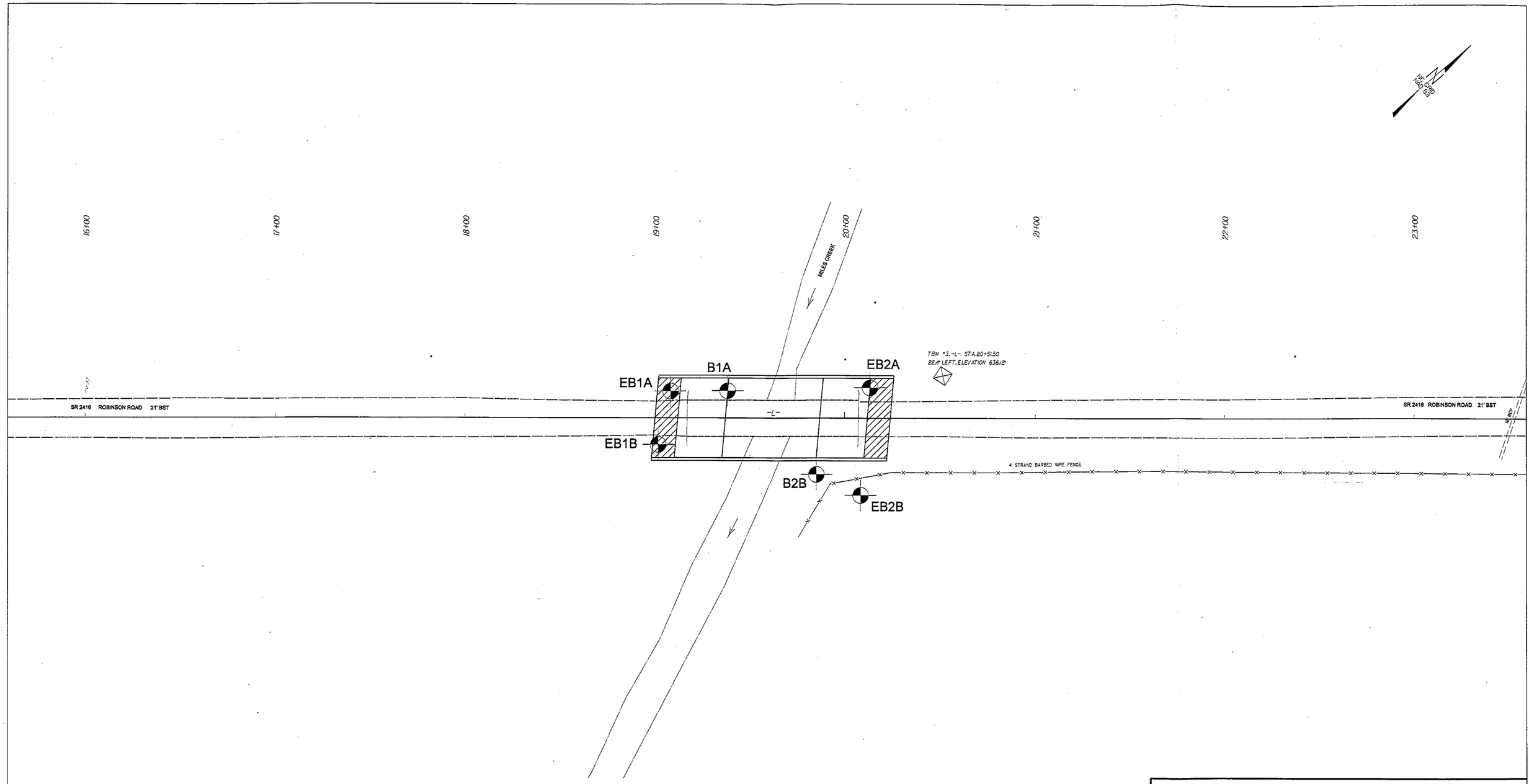

NOTES:

BENCH MARK: TBM #3, TRAVERSE DISK AT -L-
STA. 20+51.50, 22.4' LT., ELEVATION 636.12'

PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM TGS ENGINEERS, DATED JULY, 2005

BORING LOCATION PLAN

NCDOT PROJECT #: MA 12018R
GASTON CO., NC
BRIDGE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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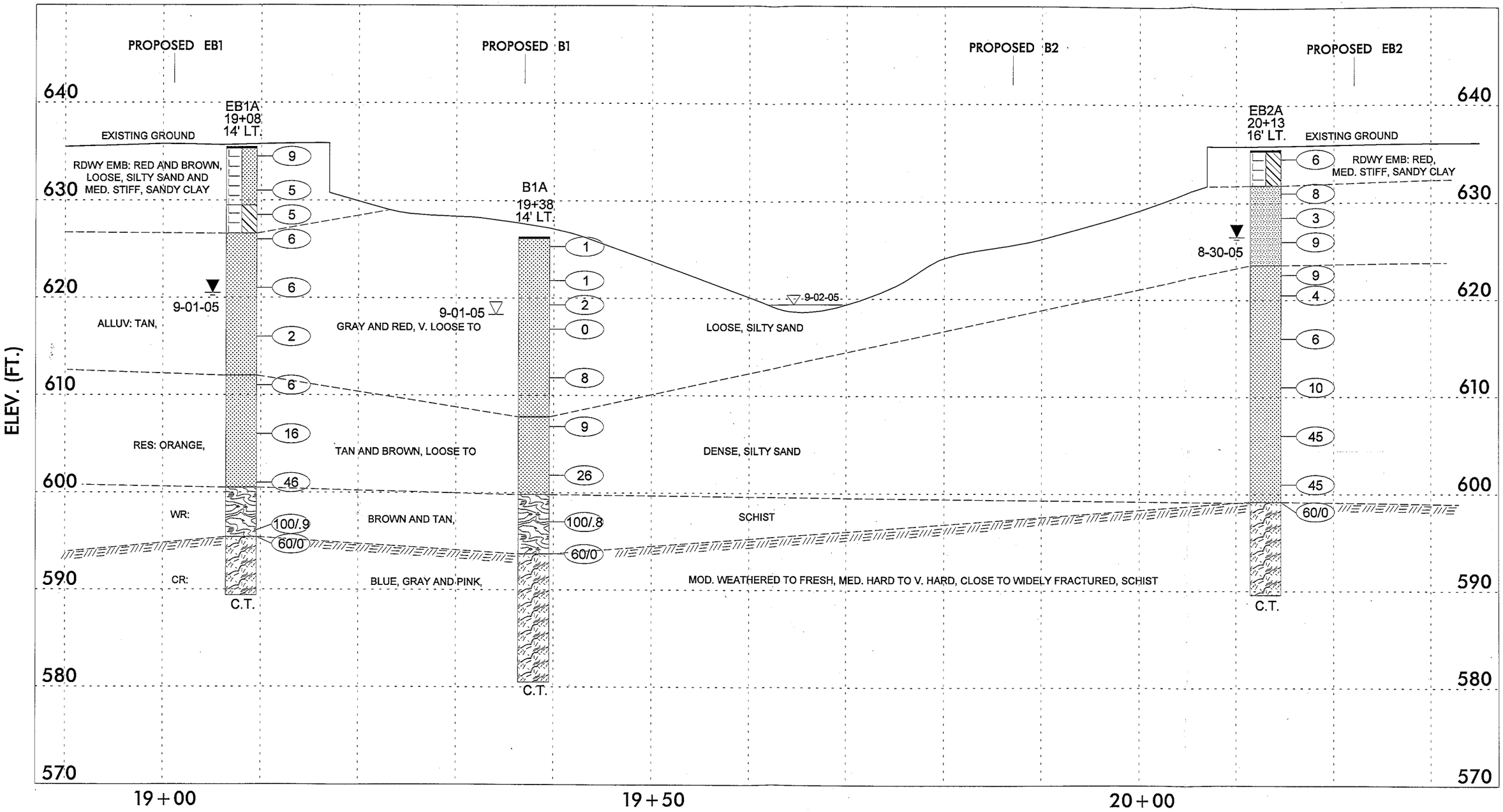

BENCH MARK: TBM #3, TRAVERSE DISK AT -L-
STA. 20+51.50, 22.4' LT., ELEVATION 636.12'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

PROFILE 12' LEFT OF -L-

NCDOT PROJECT #: MA12013R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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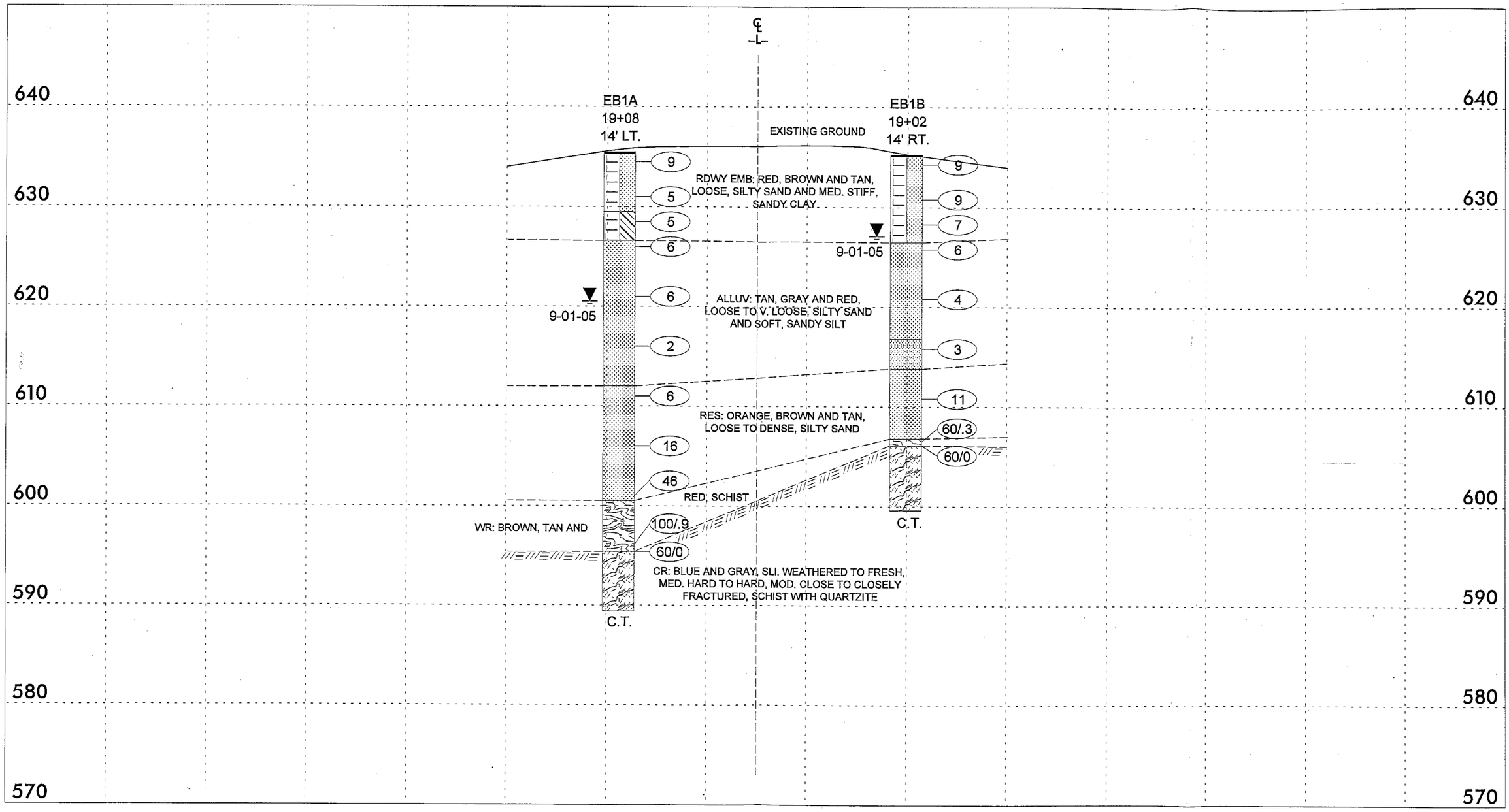

BENCH MARK: TBM #3, TRAVERSE DISK AT -L-
STA. 20+51.50, 22.4' LT., ELEVATION 636.12'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

CROSS SECTION END BENT 1

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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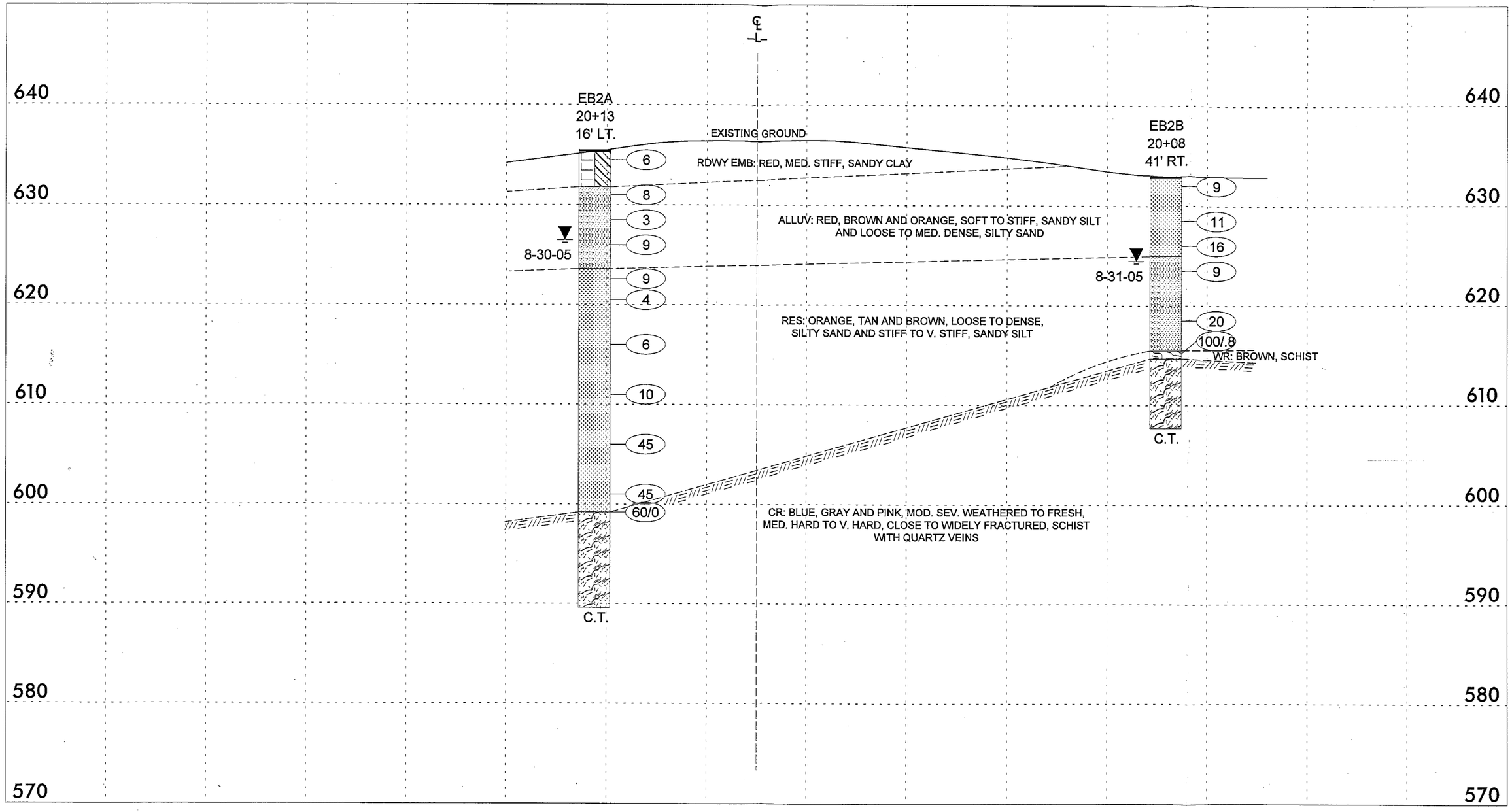

BENCH MARK: TBM #3, TRAVERSE DISK AT -L-
STA. 20+51.50, 22.4' LT., ELEVATION 636.12'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

CROSS SECTION END BENT 2

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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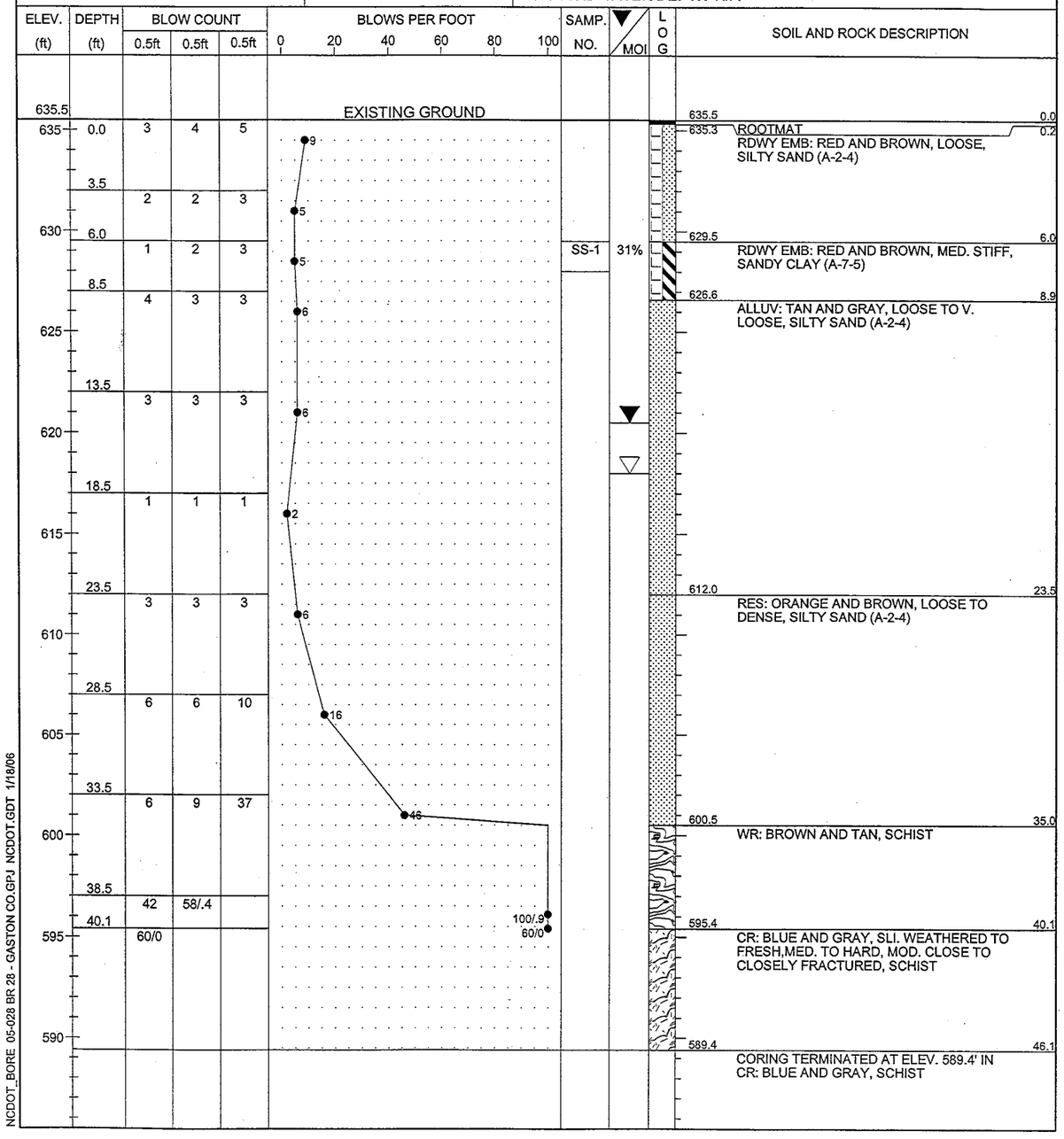
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. EB1A	**BORING LOCATION** 19+08	**OFFSET** 14' LT.	**ALIGNMENT** -L-	**0 HR.** 17.5
COLLAR ELEV. 635.5 ft	**NORTHING**	**EASTING**	**24 HR.** 15.0
TOTAL DEPTH 46.1 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-31-05	**COMPLETED** 8-31-05	**SURFACE WATER DEPTH** N/A	



NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 9/01/05

PROJECT: MA12018R I.D. NO.: BORING NO: EB1A GEOLOGIST: J. HOWARD

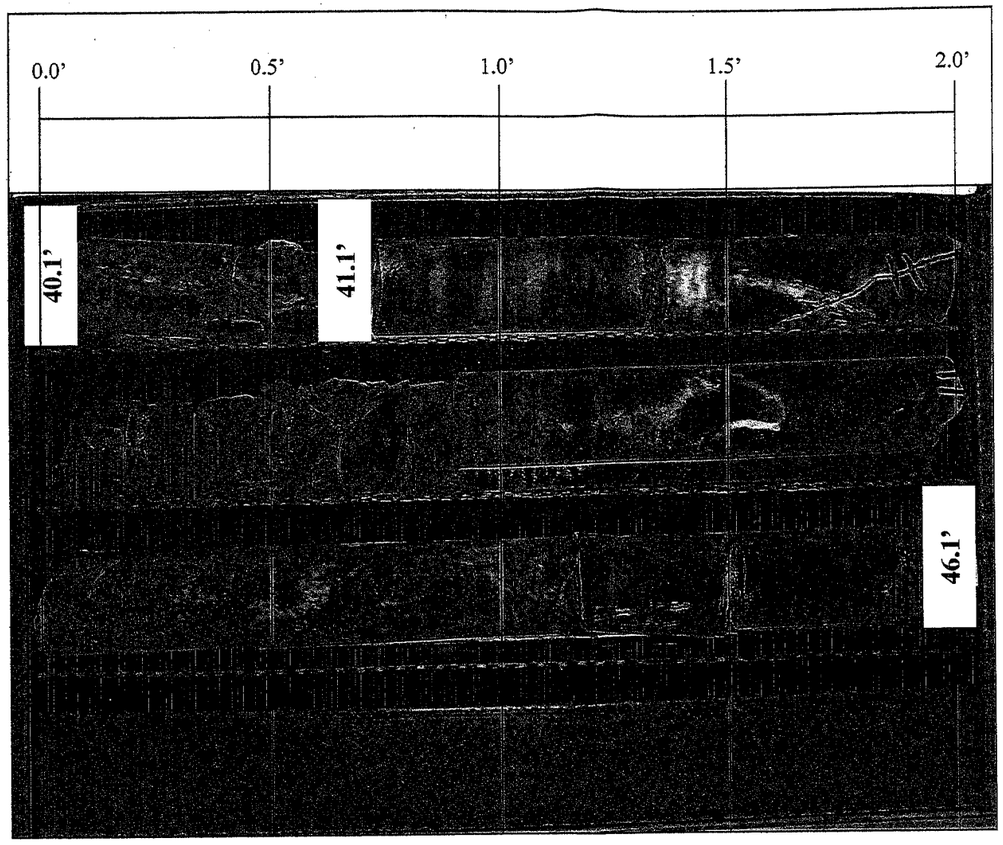
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 635.5 FT TOTAL DEPTH: 46.1 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
595.4	40.1	6:00	1.0	0.8/1.0 80%	0.0/1.0 0%		40.1-46.1 CR: BLUE AND GRAY, SLI. WEATHERED TO FRESH, MED. HARD TO HARD, MOD. CLOSE TO CLOSELY FRACTURED, SCHIST
594.4	41.1						
594.4	41.1	3:30	5.0	5.0/5.0 100%	4.5/5.0 90%		
		4:30					
		5:00					
		6:30					
589.4	46.1	6:00					STRATA REC = 97% STRATA RQD = 75%

CORING TERMINATED AT 46.1 FT
ELEVATION 589.4 FT

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



Boring EB1A, Box 1 of 1, 40.1 feet to 46.1 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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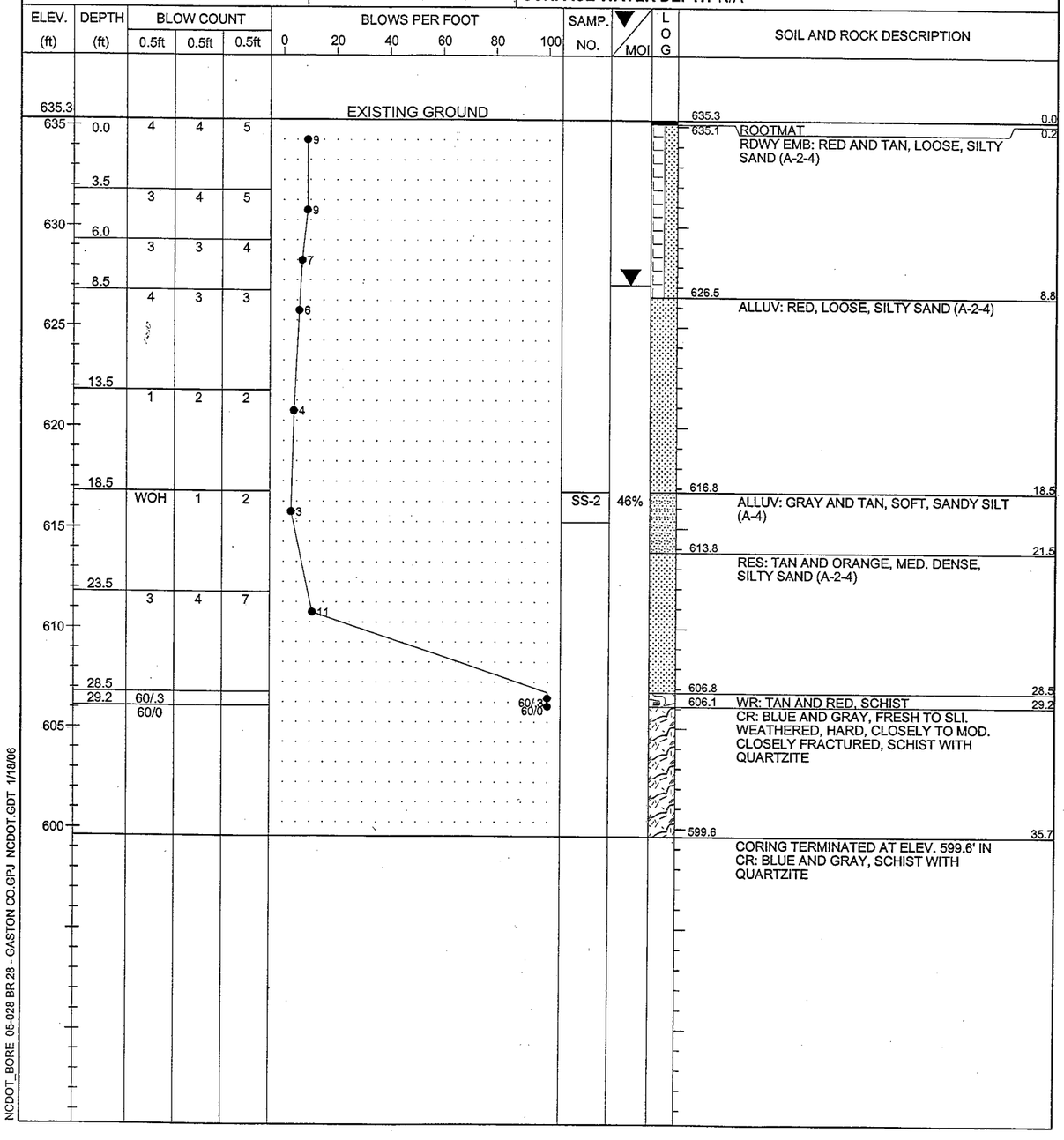
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. EB1B	**BORING LOCATION** 19+02	**OFFSET** 14' RT.	**ALIGNMENT** -L-	**0 HR.** 8.2
COLLAR ELEV. 635.3 ft	**NORTHING**	**EASTING**	**24 HR.** 8.2
TOTAL DEPTH 35.7 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-31-05	**COMPLETED** 8-31-05	**SURFACE WATER DEPTH** N/A	



NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 8-31-05

PROJECT: MA12018R I.D. NO.: BORING NO: EB1B GEOLOGIST: J. HOWARD

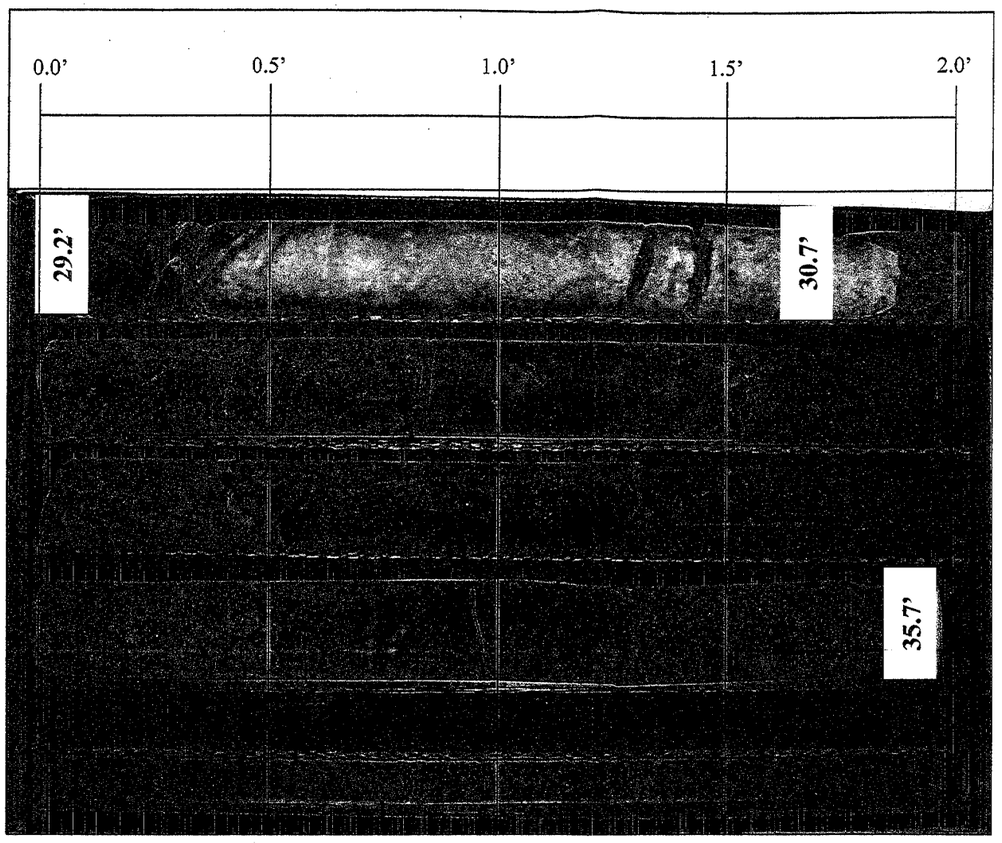
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 635.3 FT TOTAL DEPTH: 35.7 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
606.1	29.2	5:00	1.5	1.5/1.5 100%	0.9/1.5 60%		29.2-35.7 CR: BLUE AND GRAY, FRESH TO SLI. WEATHERED, HARD, CLOSELY TO MOD. CLOSELY FRACTURED, SCHIST WITH QUARTZITE
		2:45					
604.6	30.7						
604.6	30.7	4:30	5.0	5.0/5.0 100%	4.5/5.0 90%		
		4:15					
		4:00					
		4:00					
599.6	35.7	4:00					STRATA REC = 100% STRATA RQD = 83%

CORING TERMINATED AT 35.7 FT
ELEVATION 599.6 FT

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



Boring EB1B, Box 1 of 1, 29.2 feet to 35.7 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. B1A	**BORING LOCATION** 19+38	**OFFSET** 14' LT.	**ALIGNMENT** -L-	**0 HR.** 8.0
COLLAR ELEV. 626.3 ft	**NORTHING**	**EASTING**	**24 HR.** BACKFILL
TOTAL DEPTH 45.8 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 9-01-05	**COMPLETED** 9-02-05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
626.3					EXISTING GROUND				626.3 0.0
625	0.0	1	WOH	1	1				626.1 ROOTMAT 0.2 ALLUV: TAN TO GRAY, V. LOOSE TO LOOSE, SILTY SAND (A-2-4)
	3.5								
		1	WOH	1	1				
620	6.0								
		1	1	1	2				
	8.5								
		WOH	WOH	WOH	0	SS-3			
615									
	13.5								
		9	4	4	8				
610									
	18.5								
		6	5	4	9				607.8 18.5 RES: TAN AND BROWN, LOOSE TO MED. DENSE, SILTY SAND (A-2-4)
605									
	23.5								
		6	8	18	26				
600									
	28.5								
		31	69/.3		100/.8				599.8 26.5 WR: BROWN AND TAN, SCHIST
595									
	32.6								
		60/0			60/0				593.7 32.6 CR: BLUE, GRAY AND PINK, SLI. WEATHERED TO FRESH, HARD TO V. HARD, CLOSE TO MOD. CLOSELY FRACTURED, SCHIST WITH QUARTZITE
590									
						RS-1			
585									
	45.8								580.5 45.8 CORING TERMINATED AT ELEV. 580.5' IN CR: BLUE, GRAY AND PINK, SCHIST WITH QUARTZITE

NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 9-02-05

PROJECT: MA12018R I.D. NO.: BORING NO: B1A GEOLOGIST: J. HOWARD

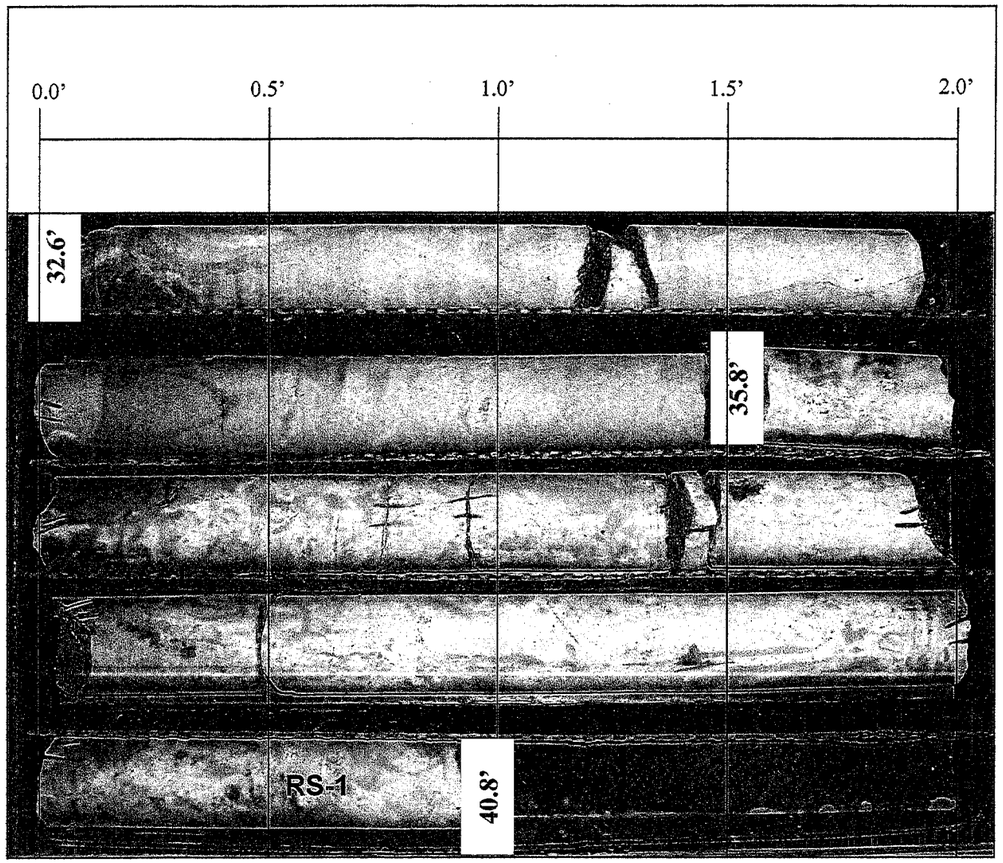
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 626.3 FT TOTAL DEPTH: 45.8 FT

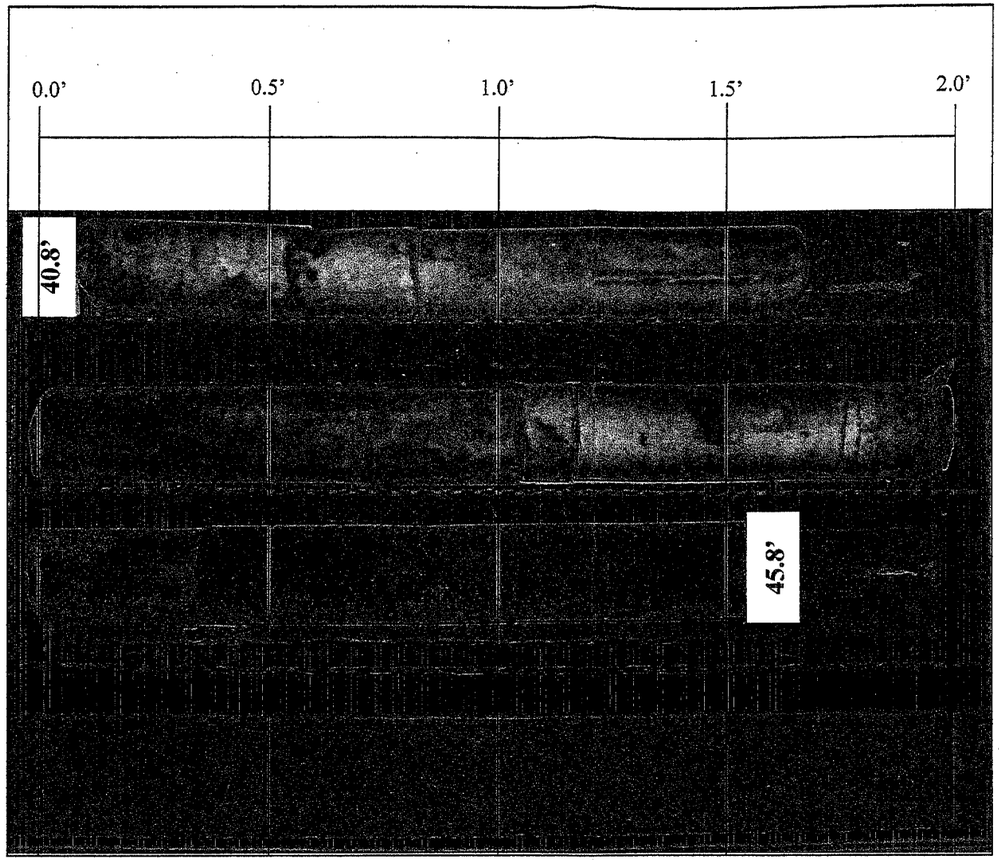
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
593.7	32.6	6:00					32.6/45.8 CR: BLUE, GRAY AND PINK, SLI. WEATHERED TO FRESH, HARD TO V. HARD, CLOSE TO MOD. CLOSELY FRACTURED, SCHIST WITH QUARTZITE
		6:30		3.2/3.2	3.0/3.2		
		7:00/1.2	3.20				
				100%	94%		
590.5	35.8						
590.5	35.8	7:00					
		7:30		5.0/5.0	4.9/5.0		
		6:45	5.0				
		7:15		100%	98%		
585.5	40.8	8:00				RS-1	
585.5	40.8	10:30					
		10:15		5.0/5.0	4.5/5.0		
		12:15	5.0				
		13:45		100%	90%		
580.5	45.8	12:45					STRATA REC = 100% STRATA RQD = 94%

CORING TERMINATED AT 45.8 FT
ELEVATION 580.5 FT

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



Boring B1A, Box 1 of 2, 32.6 feet to 40.8 feet.



Boring B1A, Box 2 of 2, 40.8 feet to 45.8 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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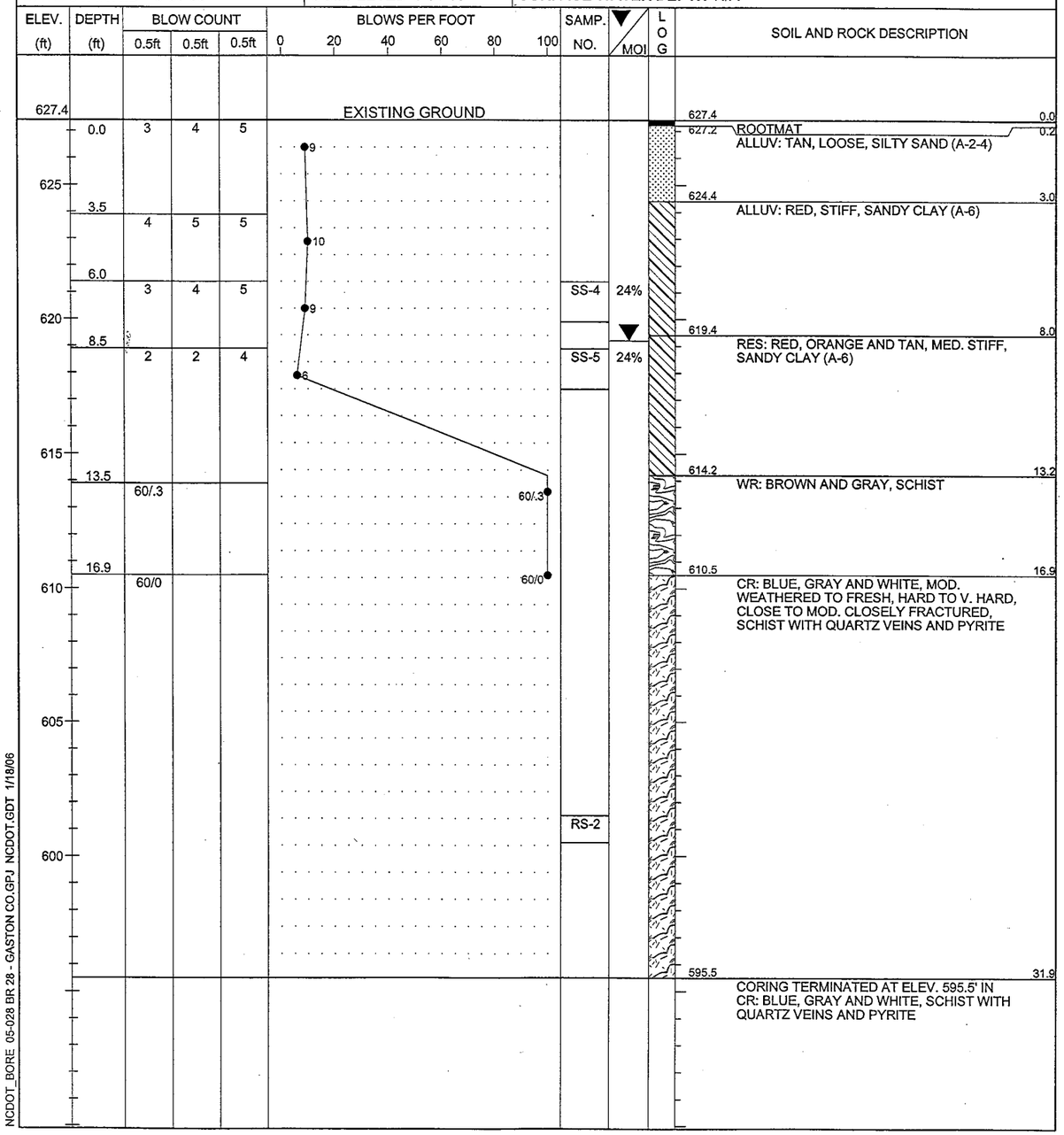
BORING LOG

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. B2B	**BORING LOCATION** 19+85	**OFFSET** 30' RT.	**ALIGNMENT** -L-	**0 HR.** 8.2
COLLAR ELEV. 627.4 ft	**NORTHING**	**EASTING**	**24 HR.** 8.2
TOTAL DEPTH 31.9 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-30-05	**COMPLETED** 8-31-05	**SURFACE WATER DEPTH** N/A	



NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 8-30-05

PROJECT: MA12018R I.D. NO.: BORING NO: B2B GEOLOGIST: J. HOWARD

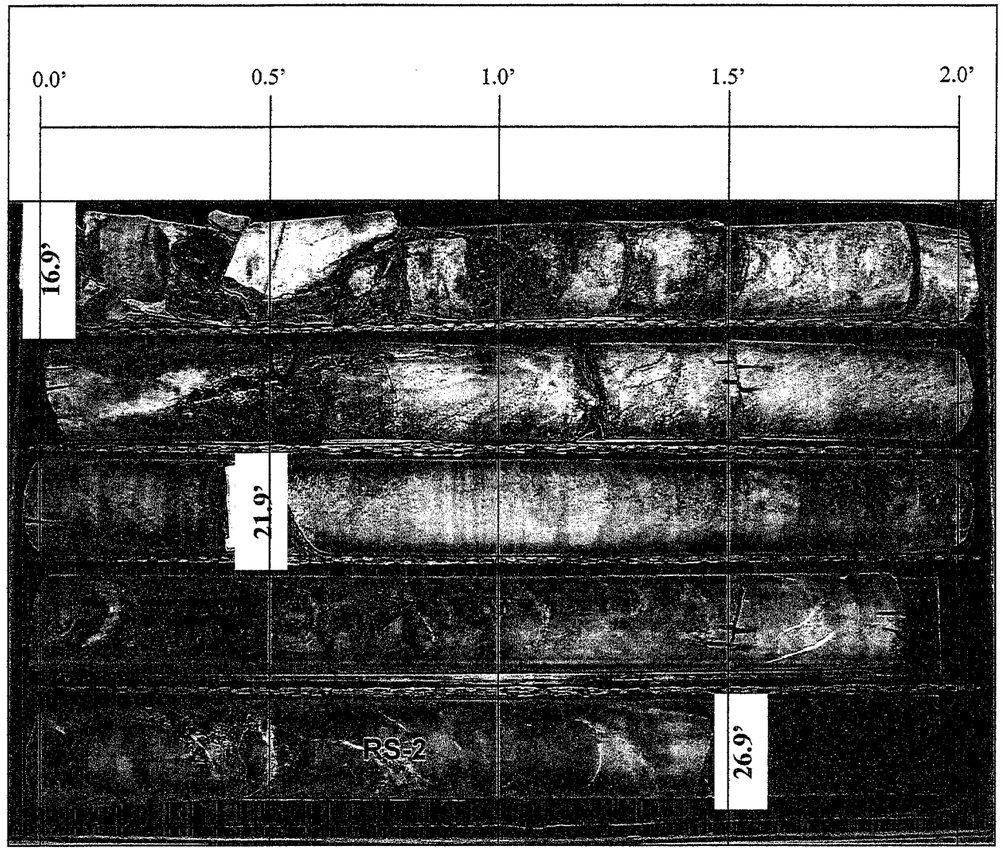
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 627.4 FT TOTAL DEPTH: 31.9 FT

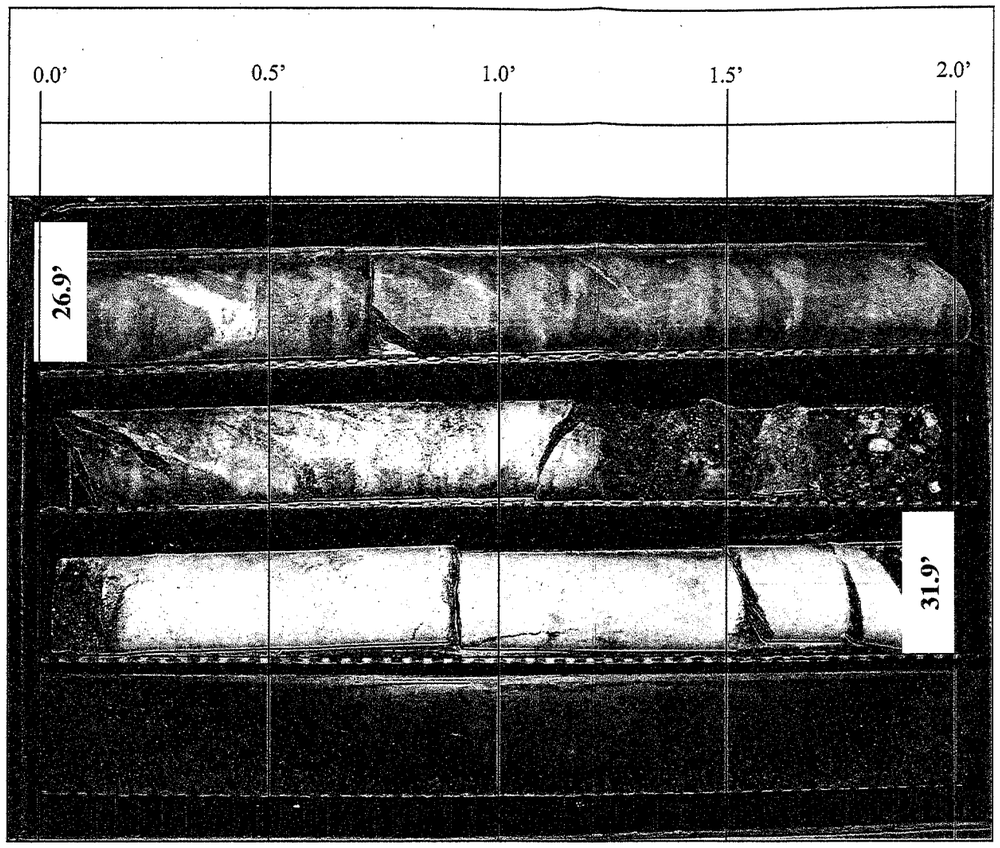
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
610.5	16.9	2:30					16.9-31.9 CR: BLUE, GRAY AND WHITE, MOD. WEATHERED TO FRESH, HARD TO V. HARD, CLOSE TO MOD. CLOSELY FRACTURED, SCHIST WITH QUARTZ VEINS AND PYRITE
		2:45		0.8/1.0	3.0/5.0		
		3:30	5.0				
		3:30		80%	60%		
605.5	21.9	2:00					
605.5	21.9	3:00					
		3:00		5.0/5.0	4.7/5.0		
		3:00	5.0				
		3:00		100%	94%		
600.5	26.9	2:30				RS-2	
600.5	26.9	3:45					
		3:00		5.0/5.0	4.5/5.0		
		3:45	5.0				
		5:30		100%	90%		
595.5	31.9	5:15					STRATA REC = 94% STRATA RQD = 81%

CORING TERMINATED AT 31.9 FT
ELEVATION 595.5 FT

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



Boring B2B, Box 1 of 2, 16.9 feet to 26.9 feet.



Boring B2B, Box 2 of 2, 26.9 feet to 31.9 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. EB2A	**BORING LOCATION** 20+13	**OFFSET** 16' LT.	**ALIGNMENT** -L-	**0 HR.** 12.0
COLLAR ELEV. 635.5 ft	**NORTHING**	**EASTING**	**24 HR.** 9.0
TOTAL DEPTH 45.9 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-29-05	**COMPLETED** 8-29-05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
635.5					EXISTING GROUND				635.5 0.0
635	0.0	3	3	3	6				635.3 ROOTMAT 0.2
	3.5								RDWY EMB: RED, MED. STIFF, SANDY CLAY (A-6)
		3	4	4	8				631.8 3.7
630	6.0								ALLUV: BROWN, RED AND ORANGE, MED. STIFF TO SOFT TO STIFF, SANDY SILT (A-4)
		2	1	2	3	SS-6	22%		
	8.5								
		3	4	5	9				
625	11.9								623.6 11.9
		13	7	2	9				RES: ORANGE, TAN AND BROWN, LOOSE TO DENSE, SILTY SAND (A-2-4)
	14.0								
		1	2	2	4				
620	18.5								
		1	2	4	6				
615	23.5								
		3	4	6	10				
610	28.5								
		14	18	27	45				
605	33.5								
		25	24	21	45				
600	36.3								599.2 36.3
		60/0			60/0				CR: BLUE AND PINK, V. SLI. WEATHERED TO FRESH, V. HARD, CLOSE TO WIDELY FRACTURED, FELDSPATHIC SCHIST WITH QUARTZ VEINS
595									
590									589.6 45.9
									CORING TERMINATED AT ELEV. 589.6' IN CR: BLUE AND PINK, FELDSPATHIC SCHIST WITH QUARTZ VEINS

NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 8-30-05

PROJECT: MA12018R I.D. NO.: BORING NO: EB2A GEOLOGIST: J. HOWARD

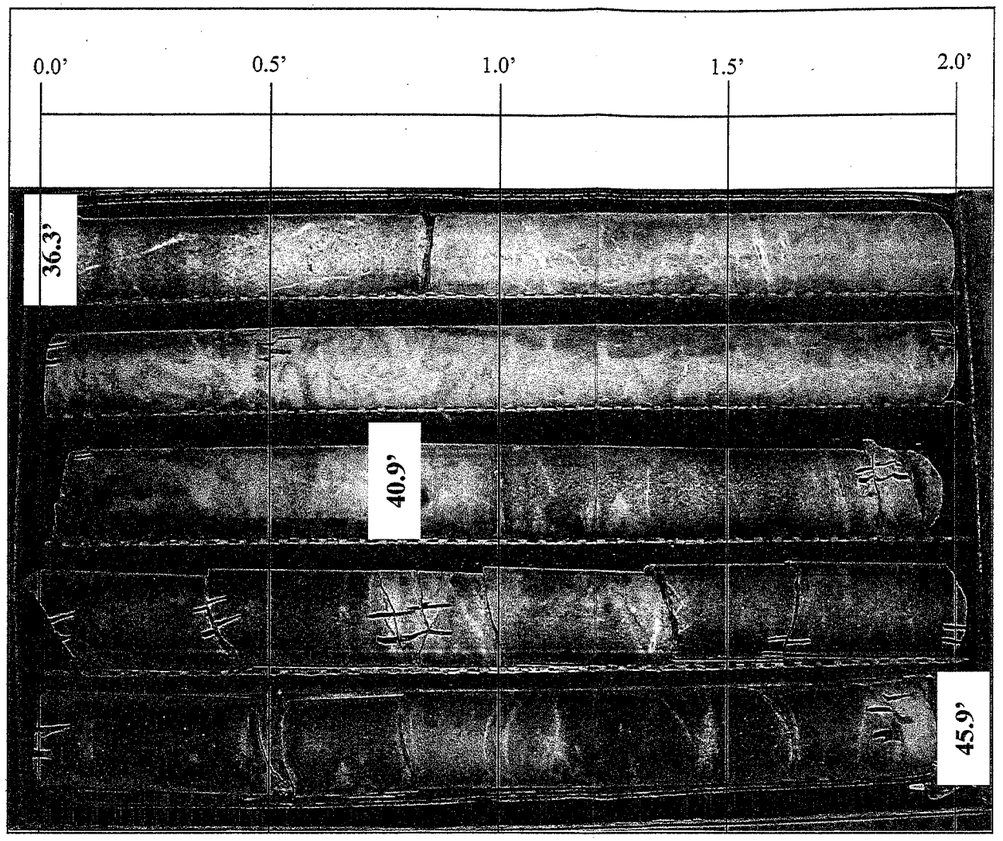
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 635.5 FT TOTAL DEPTH: 45.9 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
599.2	36.3	8:30					36.3-45.9 CR: BLUE AND PINK, V. SLI. WEATHERED TO FRESH, V. HARD, CLOSE TO WIDELY FRACTURED, FELDSPATHIC SCHIST WITH QUARTZ VEINS
		9:00		4.6/4.6	4.6/4.6		
		10:30	4.6				
		9:45		100%	100%		
594.6	40.9	7:15/0.6					
594.6	40.9	7:15					
		6:15		5.0/5.0	4.7/5.0		
		7:00	5.0				
		7:45		100%	94%		
589.6	45.9	5:30					STRATA REC = 100% STRATA RQD = 97%

CORING TERMINATED AT 45.9 FT
ELEVATION: 589.6 FT

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



Boring EB2A, Box 1 of 1, 36.3 feet to 45.9 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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

SHEET 1 OF 1

PROJECT NO. 6211-05-028	**ID.** MA12018R	**COUNTY** GASTON	**GEOLOGIST** J. HOWARD
SITE DESCRIPTION BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK			**GROUND WATER (ft)**
BORING NO. EB2B	**BORING LOCATION** 20+08	**OFFSET** 41' RT.	**ALIGNMENT** -L-	**0 HR.** 9.0
COLLAR ELEV. 633.0 ft	**NORTHING**	**EASTING**	**24 HR.** 8.5
TOTAL DEPTH 25.3 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-30-05	**COMPLETED** 8-30-05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
633.0					EXISTING GROUND				
	0.0	2	5	4	9				633.0 0.0 ROOTMAT 632.8 0.2 ALLUV: RED, LOOSE TO MED. DENSE, SILTY SAND (A-2-4)
630	3.5	4	5	6	11				
	6.0	3	7	9	16				
625	8.5	4	4	5	9	SS-7	46%		625.0 8.0 RES: ORANGE AND BROWN, STIFF TO V. STIFF, SANDY SILT (A-4)
620	13.5	12	12	8	20				
	17.0	45	55/.3		100/.8				615.5 17.5 614.7 WR: BROWN, SCHIST 18.3 CR: BLUE AND GRAY, MOD. SEV. WEATHERED TO FRESH, MED. HARD TO HARD, CLOSE TO WIDELY FRACTURED, SCHIST
615									
610									607.7 25.3 CORING TERMINATED AT ELEV. 607.7' IN CR: BLUE AND GRAY, SCHIST

NCDOT_BORE 05-028 BR 28 - GASTON CO.GPJ NCDOT.GDT 1/18/06

CORE BORING REPORT

DATE: 8-30-05

PROJECT: MA12018R I.D. NO.: BORING NO: EB2B GEOLOGIST: J. HOWARD

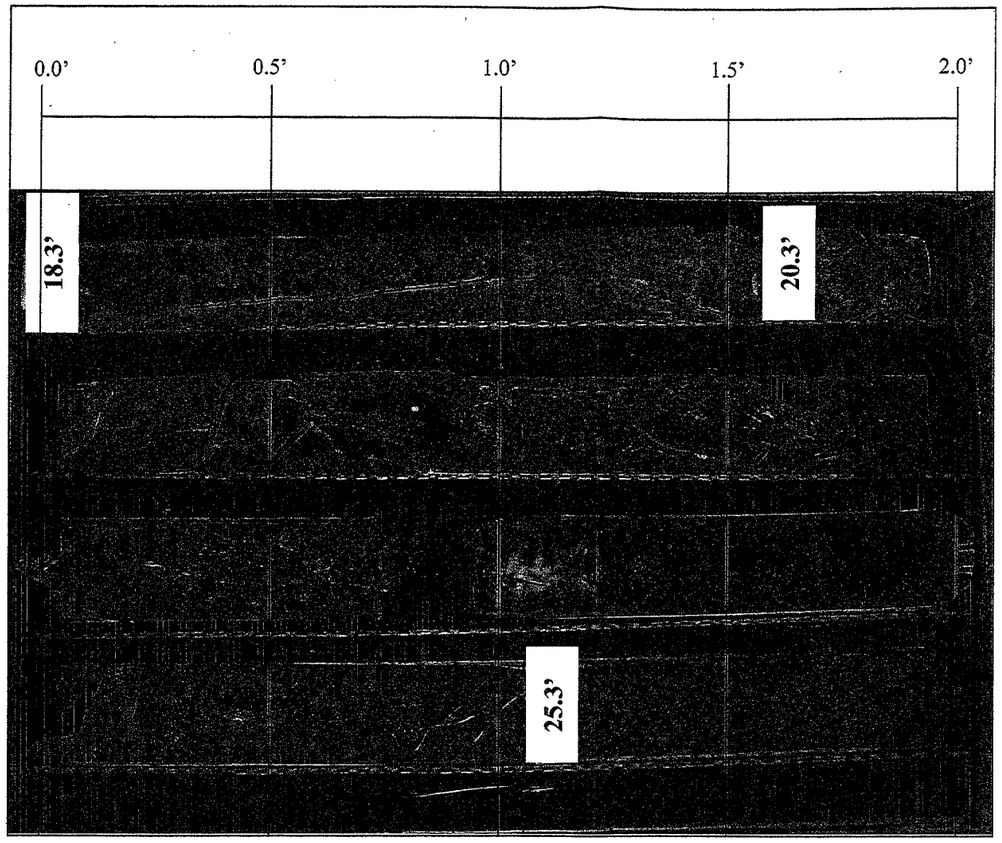
DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON RD.) OVER MILES CREEK

COUNTY: GASTON COLLAR ELEV.: 633.0 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
614.7	18.3	3:15					18.3-25.3 CR: BLUE AND GRAY, MOD. SEV. WEATHERED TO FRESH, MED. HARD TO HARD, CLOSE TO WIDELY FRACTURED, SCHIST
		6:00		1.5/2.0	1.4/2.0		
			2.0				
				75%	70%		
612.7	20.3						
612.7	20.3	7:00					
		5:30		4.8/5.0	4.5/5.0		
		5:00	5.0				
		4:30		96%	90%		
607.7	25.3	3:30					STRATA REC = 90% STRATA RQD = 84%

CORING TERMINATED AT 25.3 FT
ELEVATION 607.7 FT

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



Boring EB2B, Box 1 of 1, 18.3 feet to 25.3 feet.

SCALE 1:40 (1"=4")

ROCK CORE PHOTOGRAPHS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

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SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK
NCMA PROJECT NO: MA12018R

GASTON COUNTY

TIERRA, INC. PROJECT NO: 6211-05-028

BORING #		SAMPLE #	NATURAL MOISTURE CONTENT	TOTAL SAMPLE PERCENT PASSING			ATTERBERG LIMIT		
AASHTO Classification									
STATION #	OFFSET (FEET)	DEPTH (FEET)		#10	#40	#200	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
EB1A		SS-1	30.5%	99	95	81	48	33	15
A-7-5									
19+08	14' LT	6.0-7.5							
EB1B		SS-2	45.6%	96	84	48	26	21	5
A-4									
19+02	14' RT	18.5-20.0							
B1A		SS-3	N/A	100	96	23	NP	NP	NP
A-2-4									
19+38	14' LT	8.5-10.0							
B2B		SS-4	23.9%	88	70	40	38	26	12
A-6									
19+85	30' RT	6.0-7.5							
B2B		SS-5	23.6%	100	94	70	39	28	11
A-6									
19+85	30' RT	8.5-10.0							
EB2A		SS-6	22.4%	99	95	72	35	25	10
A-4									
20+13	16' LT	6.0-7.5							
EB2B		SS-7	45.9%	99	95	52	NP	NP	NP
A-4									
20+08	41' RT	8.5-10.0							

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES
Bridge No. 28 on SR 2416 Over Miles Creek
Gaston County, North Carolina
MA 12018 R
TIERRA No: 6211-05-028

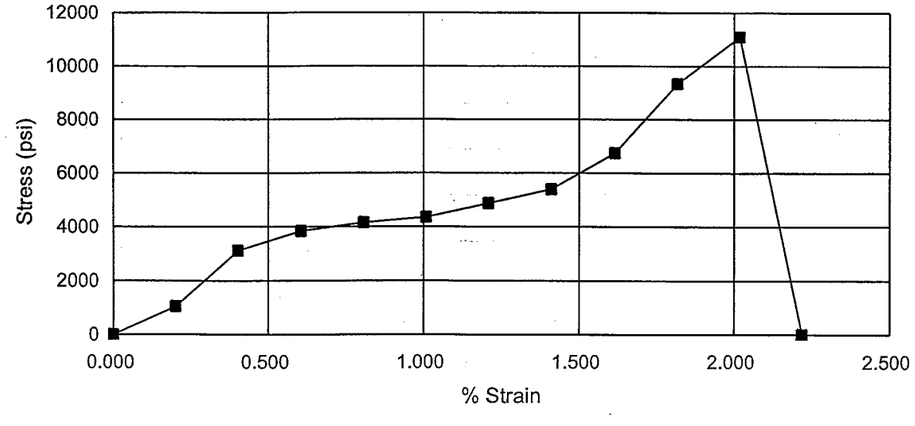
Boring #	Sample #	Depth (ft)	Average Diameter (in)	Average Length (in)	L/D	Total Volume (ft)3	Total Core Weight (lb)	Core Moisture Content (%)	Core Dry Weight (lb)	Unit Weight (pcf)	Rate of Stress Increase (lbs/min)	Max Unconfined Compression (psi)	Remarks
B1A	RS - 1	40.0 - 40.8	2.478	4.955	2.00	0.0138	2.3180	0.21	2.3131	167.4	5000	11093	
B2B	RS - 2	25.9 - 26.9	2.476	4.813	1.94	0.0134	2.3300	0.33	2.3223	173.3	5000	5895	

ROCK CORE UNIAXIAL COMPRESSIVE STRENGTH TEST

Job No.: 6211-05-028 Job Name: Bridge 28 on SR 2416 Over Miles Creek Gaston County, North Carolina
Project No. MA 12018 R
Date: 9/9/2005 Sample No.: RS - 1
Boring No.: B1A Depth (ft): 40.0 - 40.8
Description: Blue, gray and pink slightly weathered to fresh, hard to very hard, close to moderately closely fractured schist with quartzite
Length (in.): 4.955
Diameter (in.): 2.478
Area (sq. in.): 4.823

Compressive Strength (psi): 11093

Deflection (in.)	Strain (%)	Corrected Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0.0	
0.010	0.202	5000	1036.8	513,714
0.020	0.404	15000	3110.3	770,571
0.030	0.605	18500	3836.0	633,580
0.040	0.807	20000	4147.0	513,714
0.050	1.009	21000	4354.4	431,520
0.060	1.211	23500	4872.8	402,409
0.070	1.413	26000	5391.1	381,616
0.080	1.615	32500	6738.9	417,392
0.090	1.816	45000	9330.8	513,714
0.100	2.018	53500	11093.3	549,674
0.110	2.220	0	0.0	0

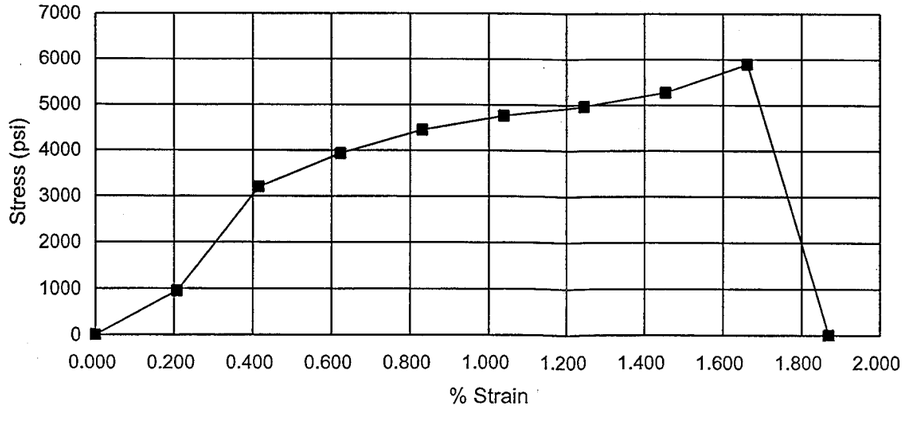


ROCK CORE UNIAXIAL COMPRESSIVE STRENGTH TEST

Job No.: 6211-05-028 Job Name: Bridge 28 on SR 2416 Over Miles Creek Gaston County, North Carolina
Project No. MA 12018 R
Date: 9/9/2005 Sample No.: RS - 2
Boring No.: B2B Depth (ft): 25.9 - 26.9
Description: Blue, gray and white moderately weathered to fresh, hard to very hard, close to moderately closely fractured schist with quartz veins and pyrite
Length (in.): 4.813
Diameter (in.): 2.476
Area (sq. in.): 4.815

Compressive Strength (psi): 5895

Deflection (in.)	Strain (%)	Corrected Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0.0	
0.010	0.208	4580	951.2	457,815
0.020	0.416	15396	3197.5	769,489
0.030	0.623	18924	3930.3	630,545
0.040	0.831	21414	4447.4	535,134
0.050	1.039	22908	4757.7	457,975
0.060	1.247	23904	4964.5	398,239
0.070	1.454	25398	5274.8	362,682
0.080	1.662	28386	5895.4	354,682
0.090	1.870	0	0.0	0



GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 6211-05-028 ID: MA12018R COUNTY: GASTON

DESCRIPTION(1): BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK

INFORMATION ON EXISTING BRIDGES Information obtained from: _x_ field inspection
___ microfilm(Reel: ____ Pos: ___)
_x_ other hydro report

COUNTY BRIDGE NO. 28 BRIDGE LENGTH 90 NO. BENTS IN: CHANNEL 0 FLOOD PLAIN 4

FOUNDATION TYPE: TIMBER DECKING AND TIMBER ABUTMENTS

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: NONE

INTERIOR BENTS: BOTH BENTS SHOW MODERATE SIGNS OF SCOUR

CHANNEL BED: NONE VISIBLE

CHANNEL BANKS: DOWNSTREAM HAS LITTLE VEGETATION ON CHANNEL WALLS

EXISTING SCOUR PROTECTION:

TYPE(3): RIPRAP AT UPSTREAM, WING WALLS

EXTENT(4): WING WALLS EXTEND 10 FEET IN ALL DIRECTIONS

EFFECTIVENESS(5): FAIR, MANY PIECES OF RIPRAP ARE NOW IN THE STREAM BEAD

OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): NONE

DESIGN INFORMATION

CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED): BROWN SAND (A-1-b)

CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED): BROWN SILTY SAND (A-2-4)

CHANNEL BANK COVER(9): GRASS

FLOOD PLAIN WIDTH(10): 90 FEET ON EAST SIDE; 100 FEET ON WEST SIDE

FLOOD PLAIN COVER(11): GRASS, SHRUBS AND TREES

DESIGN INFORMATION CONT.

STREAM IS _X_ DEGRADING ____ AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS:

CHANNEL MIGRATION TENDENCY (13): TOWARD EAST

REPORTED BY: for Jim Howard DATE: 9/2/2005
TIERRA, INC

GEOTECHNICALLY ADJUSTED SCOUR ELEVATION (14):

REPORTED BY: _____ DATE: _____
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 ELEVEVATION 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.

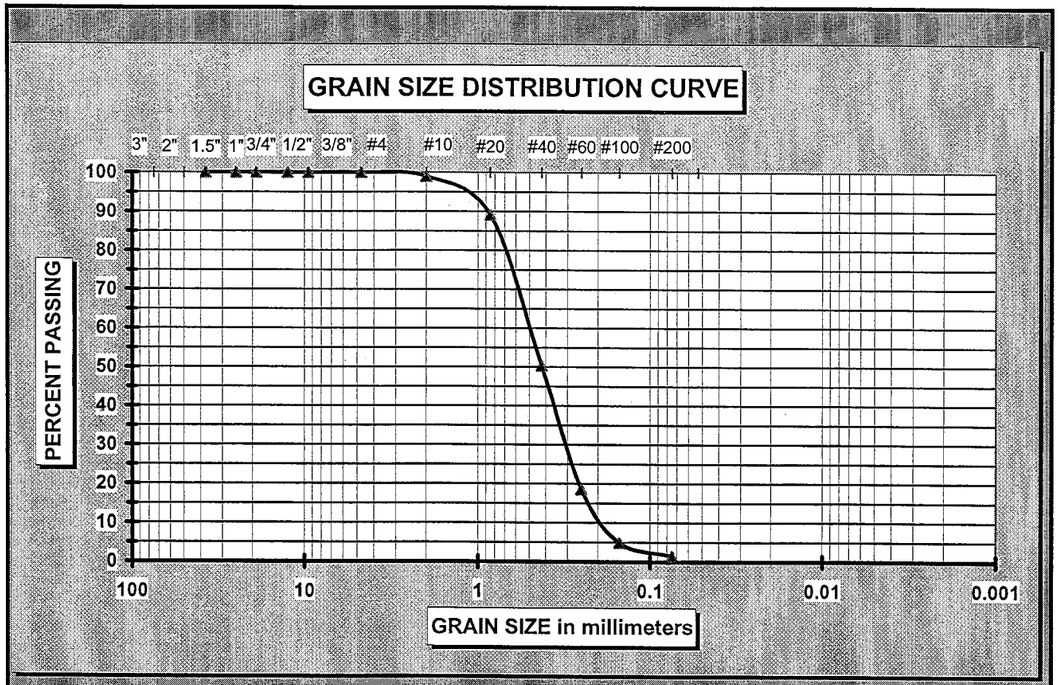
PROJECT #: 6211-05-028

COUNTY: GASTON

DESCRIPTION: BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK

	CHANNEL BED MATERIAL			CHANNEL BANK MATERIAL			
SAMPLE #	SS-8			SS-9			
RETAINED #4	0			0			
PASSING #10	99			100			
PASSING #40	50			95			
PASSING #200	1			20			
SAND	99			80			
SILT/CLAY	1			20			
LL	NP			NP			
PL	NP			NP			
AASHTO	A-1-b			A-2-4			
STATION	19+70			19+68			
OFFSET	CL			CL			
DEPTH	0-1.0			0-1.0			

BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK
GASTON COUNTY
NCMA PROJECT NO: MA12018R



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #40	Cu = D60 / D10
			Fine Sand	< #40 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: CHANNEL **SAMPLE #:** SS-8 **DEPTH:** 0-1.0

BROWN SAND (A-1-b)

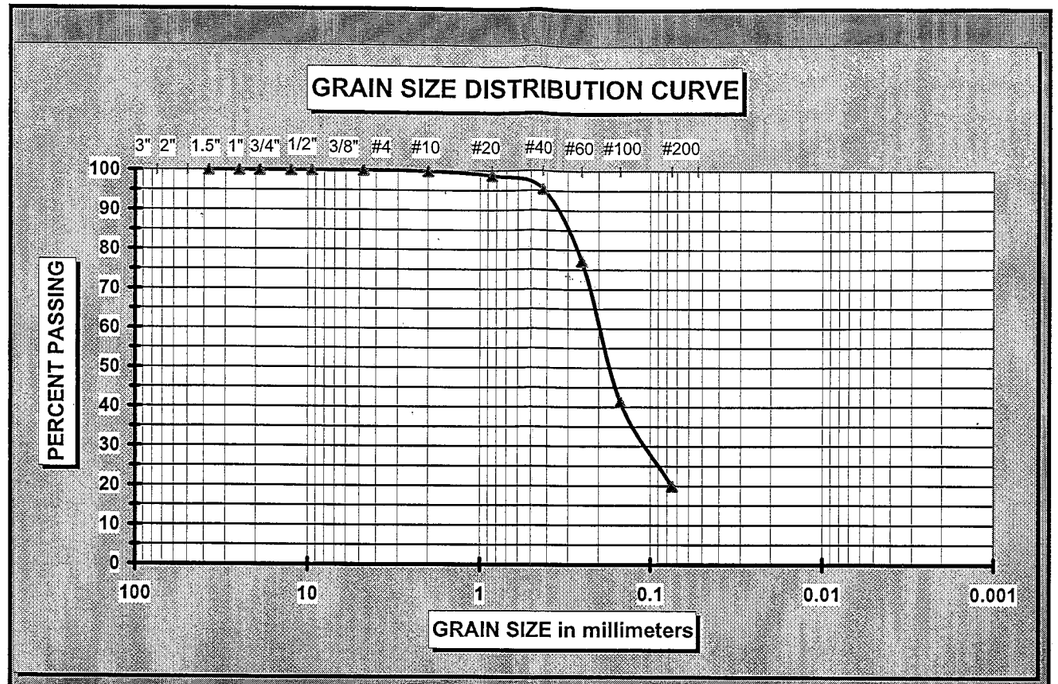
% PASSING #200 SIEVE: 1%

NATURAL MOISTURE CONTENT = N/A

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

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

BRIDGE #28 ON SR 2416 (ROBINSON ROAD) OVER MILES CREEK
GASTON COUNTY
NCMA PROJECT NO: MA12018R



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #40	Cu = D60 / D10
			Fine Sand	< #40 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: BANK **SAMPLE #:** SS-9 **DEPTH:** 0-1.0

BROWN SILTY SAND (A-2-4)

% PASSING #200 SIEVE: 20%

NATURAL MOISTURE CONTENT = N/A

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

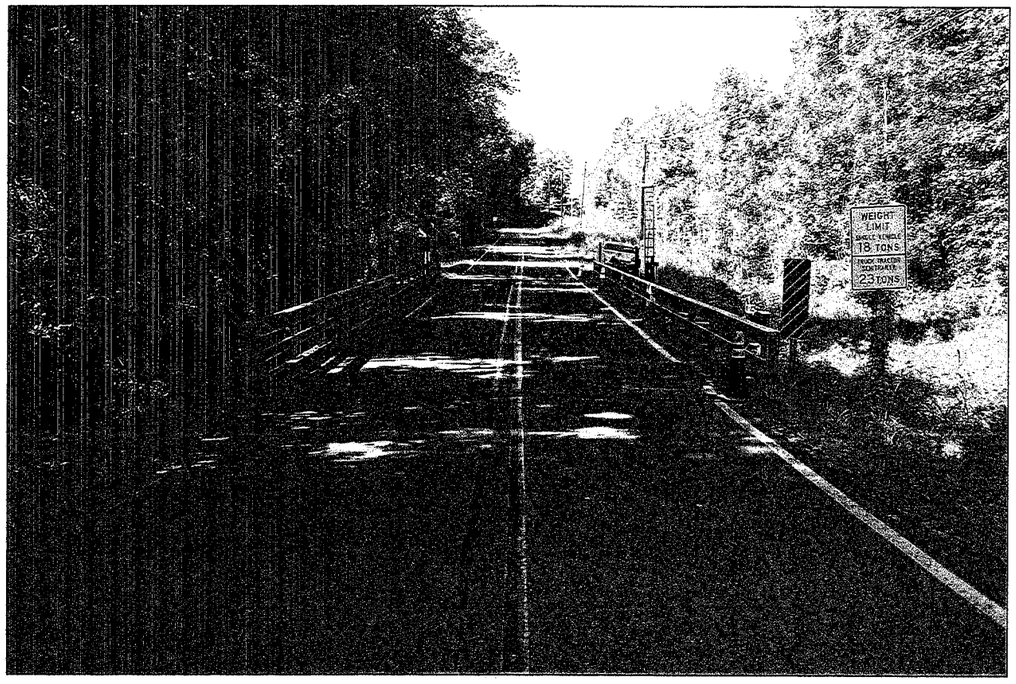


PHOTO 1: CENTERLINE PROFILE (-L-), LOOKING DOWNSTATION

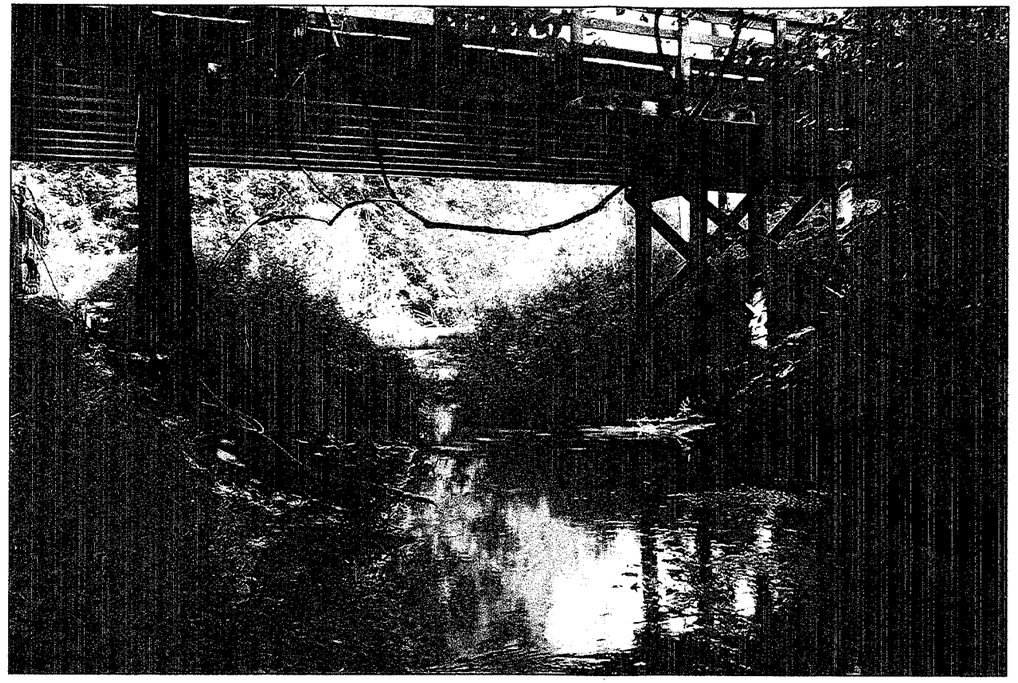


PHOTO 2: MILES CREEK, LOOKING UPSTREAM

SITE PHOTOS

NCDOT PROJECT #: MA12018R
GASTON CO., NC
STRUCTURE #28 ON SR 2416
(ROBINSON RD.) OVER MILES CREEK

TIERRA
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ENGINEERING

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FAX (919) 871-0803

PHOTO 3: END BENT 1, LOOKING FROM EB1B TO EB1A

PHOTO 4: END BENT 2, LOOKING FROM EB2A TO EB2B

SITE PHOTOS

NCDOT PROJECT #: MA12018R
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