

**PROJECT: ID: R 5207B**

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R 5207B	1	19

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**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. R 5207B F.A. PROJ. \_\_\_\_\_  
COUNTY HENDERSON  
PROJECT DESCRIPTION BRIDGE NO. 22 OVER BYERS CREEK  
ON SR 1006 (HOWARD GAP ROAD) AND APPROXIMATELY  
450 FEET OF NEW ROADWAY ALIGNMENTS  
SITE DESCRIPTION \_\_\_\_\_

**CAUTION NOTICE**

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

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

PERSONNEL

- M. ROBERTSON
- M. BAHIRADHAN
- J. HAMM
- T. EVANS
- P. ZHANG
- C. BRUINSMA

INVESTIGATED BY P. Z., C. B.  
CHECKED BY M. BAHIRADHAN  
SUBMITTED BY FALCON ENG.  
DATE APRIL 20, 2011

DRAWN BY: P. ZHANG / T. EVANS / J. HAMM

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 DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

PROJECT REFERENCE NO. R 5207B SHEET NO. 2

SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS																																												
<p>SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:</p> <p>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAKERS, HIGH PLASTIC. A-7-6</p>		<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)</p> <p>GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>		<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.</p> <p>ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.</p> <p>ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.</p> <p>CALCARIOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p>SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 60 BLOWS.</p> <p>STRATA CORE RECOVERY (SCRC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p>STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p>TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																												
<p><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1"> <tr> <th>GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="4">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th colspan="2">A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th colspan="2"></th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)				SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS				GROUP CLASS.	A-1	A-3	A-2		A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7			SYMBOL															<p><b>MINERALOGICAL COMPOSITION</b></p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p>		<p><b>WEATHERING</b></p> <p>FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>VERY SLIGHT (V SL.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p>SLIGHT (SL.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH, OPEN JOINTS MAY CONTAIN CLAY, IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>MODERATE (MOD.) - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS, IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY, ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p>MODERATELY SEVERE (MOD. SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION, ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL.</p> <p>SEVERE (SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL, IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</p> <p>VERY SEVERE (V SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING, SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF.</p> <p>COMPLETE - ROCK REDUCED TO SOIL, ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS, QUARTZ MAY BE PRESENT AS DIXES OR STRINGERS, SAPROLITE IS ALSO AN EXAMPLE.</p>		<p><b>COMPRESSION</b></p> <p>SLIGHTLY COMPRESSIBLE</p> <p>MODERATELY COMPRESSIBLE</p> <p>HIGHLY COMPRESSIBLE</p> <p>LIQUID LIMIT LESS THAN 31</p> <p>LIQUID LIMIT EQUAL TO 31-50</p> <p>LIQUID LIMIT GREATER THAN 50</p>	
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<p><b>SOIL MOISTURE - CORRELATION OF TERMS</b></p> <table border="1"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL - LIQUID LIMIT</td> <td>- SATURATED - (SAT.)</td> <td>USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PL - PLASTIC LIMIT</td> <td>- WET - (W)</td> <td>SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td>OM - OPTIMUM MOISTURE</td> <td>- MOIST - (M)</td> <td>SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td>SL - SHRINKAGE LIMIT</td> <td>- DRY - (D)</td> <td>REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> </table>		SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION	LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE	PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE	OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE	SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE	<p><b>EQUIPMENT USED ON SUBJECT PROJECT</b></p> <p>DRILL UNITS:</p> <p>MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST CME-55</p> <p>ADVANCING TOOLS:</p> <p>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</p> <p>HAMMER TYPE:</p> <p>AUTOMATIC MANUAL</p> <p>CORE SIZE:</p> <p>B- N-Q H-</p> <p>HAND TOOLS:</p> <p>POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST</p>		<p><b>ROCK HARDNESS</b></p> <p>VERY HARD - CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD - CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>MODERATELY HARD - CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK, HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p> <p>MEDIUM HARD - CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT, CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p>SOFT - CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT, SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p>VERY SOFT - CAN BE CARVED WITH KNIFE, CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE, CAN BE SCRATCHED READILY BY FINGER NAIL.</p>																															
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April 20, 2011

Mr. Ray Elliot, P.E.  
TGS Engineers  
804-C North Lafayette Street, Suite 141  
Shelby, NC 28150

**Re: Geotechnical Subsurface Exploration Report**

*Project No.:* R 5207B  
*County:* Henderson County  
*Description:* Bridge # 22 over Byers Creek on SR 1006 (Howard Gap Road)  
And approximately 450 feet of new roadway alignments  
*Falcon Proj. No.:* G11005.00

Dear Mr. Elliot:

As authorized, Falcon Engineering, Inc. (Falcon) has revised the draft geotechnical subsurface exploration report completed by Tierra, Inc. (Tierra), dated December 18, 2006 in accordance with the current NCDOT geotechnical report guidelines for Bridge # 22 over Byers Creek on SR 1006 (Howard Gap Road) in Henderson County, North Carolina. The purpose of this report is to present subsurface conditions and foundation design recommendations for the planned structure. Field and laboratory test results, site and boring location plans, and profiles depicting subsurface conditions may be found in this report.

**PROJECT DESCRIPTION**

The road in the vicinity of Byers Creek will be realigned southwards with a new bridge located approximately 40 feet south of the existing bridge over Byers Creek. The new alignments on each side of the proposed bridge structure are to be merged to the existing roadway (SR 1006) at a distance of an approximately 200 feet each from its end bents.

The proposed replacement structure is to be located approximately 40 feet downstream of the existing bridge, consisting of a single span, two bent bridge with the proposed bridge length of an approximately 57 feet. The structure is planned to be located between Station 243+57.4 and Station 244+14.6, and have a skew angle of 75°. The bridge width is 39 feet. The bottom of the end bent caps at both end bents will be at elevation near 2,086 feet, based on North American Vertical Datum, 1988 (NAVD), and the finished grade of the structure will be at or near the exiting grade. Hydraulic scour information was not provided at the time of preparing this report.

Based on the standard loads provided by NCDOT for 60 feet long, 39 feet wide, single span low impact bridge, the factored design load for end piles is 81 Tons/pile. Each end bent will consist of a single row of 7 vertical piles spaced at 7 feet at center-to-center. End bent piles will not carry any lateral load.

If any of the above information is incorrect or has changed, please inform Falcon so that we may amend the recommendations presented in this report if appropriate.

**SITE DESCRIPTION/GEOLOGY**

The proposed project site is located along SR 1006 (Howard Gap Road), approximately two (2) miles south of Fletcher in Henderson County, North Carolina. Existing crossing is a single span bridge supported by vertical abutment walls and wingwalls. The area has a generally rolling terrain with a relatively well developed flood plain and some channel alteration. In general, the surrounding area is residential in use. It is estimated that the floodplain is approximately 70 feet wide at the bridge site. The site area, surrounding the existing bridge structure, consists of standing water and areas covered with grass, bushes and trees. Byers Creek are part of the French Broad River Basin. The French Broad River is approximately 5 miles west of Howard Gap Road.

According to *The Geologic Map of North Carolina* (1985), the project site is located within the Inner Piedmont Physiographic Province, just east of the Brevard Fault Zone. Fletcher and Swainville lie within the Chauga Belt. Specifically, the rock consists of the Swain Gneiss Formation (**Chg**). Rocks of this group are typically granodioritic and inequigranular gneisses. Materials encountered at these sites were classified as mica gneisses.

**FIELD INVESTIGATION**

The subsurface exploration consisted of performing four (4) soil test borings at each side of the proposed end bents and two (2) soil test borings along the proposed new roadway alignment at approximately 100 feet each from end bents of the proposed bridge. Borings were performed with a CME 550 drill rig with an auto hammer using hollow stem augers. Standard Penetration Tests (SPT) and soil sampling were performed in general accordance with American Association of State Highway Transportation Officials (AASHTO T-206-87). The borings for the proposed structure were advanced to depths ranging from 19.8 to 44.5 feet below existing grade and for the proposed detour to depths ranging from 10 to 20 feet below existing grade.

Groundwater measurement readings were taken within each borehole with a weighted 100-foot measuring tape from a reference location at the top of each boring. Readings were recorded immediately after boring termination and after a 24-hour waiting period. Ground surface elevations for the test borings were approximated from the surveyed topographic information provided.

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Byers Creek and is included in this report.

**SUBSURFACE AND GROUNDWATER CONDITIONS - BRIDGE**

Subsurface soils encountered along the proposed replacement bridge alignment typically consist of roadway embankment, alluvial deposits, residual, weathered rock and crystalline rock.

Soils beneath End Bent 1 typically consist of alluvial deposits underlain by residual soils, followed by weathered rock. A thin layer of rootmat approximately 2 inch thick was encountered at EB1B.

Alluvial deposits were encountered at elevations of 2,089.8 feet, NAVD, to 2,089 feet, NAVD, extending to elevations ranging from 2,083.5 feet, NAVD, to 2,082.8 feet, NAVD, and consist of very loose to medium dense silty sand and sand with gravel (A-2-4 and A-1-b), and soft sandy silt (A-4). Residual soils were encountered below the alluvial deposits, extending to elevations ranging from 2,079.5 to 2,077 feet, NAVD, and consist of medium dense silty sand (A-2-4). Weathered rock was encountered below the residual soils, extending to the boring termination depths. A thin layer of residual soil (4 feet thick) consisting of medium stiff sandy silt (A-4) was imbedded within weathered rock at EB1B at elevations between 2,068 feet, NAVD, and 2,064 feet, NAVD.

Soils beneath End Bent 2 typically consist of roadway embankment, alluvial deposits and residual soils underlain by weathered rock. A thin layer of rootmat approximately two (2) inch thick was encountered at BE2A and approximately two (2) inch thick pavement at EB2B. Roadway embankment soils were encountered at an elevation of 2,089.9 feet, NAVD, extending to elevations ranging from 2,087 feet, NAVD, to 2,084.5 feet, NAVD, and consist of medium stiff sandy/clayey silt and sandy clay with gravel (A-4 and A-6). Alluvial deposits one (1) foot thick were encountered below the roadway embankment and consist of loose to medium dense silty sand and sand with gravel (A-2-4 and A-1-b). Residual soils were encountered below the alluvial deposits at elevations of 2,086 feet, NAVD, to 2,083.5 feet, NAVD, extending to elevations ranging from 2,066 to 2,062 feet, NAVD, and consist of medium dense to very dense silty sand and sand (A-2-4, A-1-b), and stiff sandy silt (A-4). Weathered rock was encountered below the residual soils, extending to the boring termination depths. A thin layer of residual soil (5 feet thick) consisting of dense silty sand (A-2-4) was imbedded within weathered rock at EB2B at elevations between 2,051 feet, NAVD, and 2,046 feet, NAVD.

Groundwater elevations measured after 24 hours ranged from 2084.4 to 2,083.5 feet, NAVD.

#### **SUBSURFACE AND GROUNDWATER CONDITIONS - ROADWAY**

Subsurface soils encountered along the proposed detour alignment typically consist of fill materials, alluvial deposits and residual soils.

Soils encountered at boring S3-B1 consist of alluvial deposit underlain by residual soils. The alluvial deposit consists of approximately 6.5 feet of medium stiff sandy silt (A-4). Below this alluvial deposit, the residual soils was encountered at an elevation of approximately 2,083.5 feet, NAVD, extending to a boring termination elevation of 2080 feet, NAVD, and consist of medium dense silty sand and sand (A-1-b and A-2-4).

Soils encountered at boring S3-B2 consist of fill and alluvial deposits underlain by residual soils. The fill material consists of approximately 7.0 feet of soft to medium stiff silty clay (A-6). The alluvial deposits were encountered below the fill at an elevation of approximately 2088 feet and consist of loose gravelly sand (A-1-a) and soft sandy silty (A-4). Below the alluvial deposits, the residual soils were encountered at an elevation of approximately 2,084 feet, NAVD, extending to a boring termination elevation of 2097 feet, NAVD, and consist of very loose silty sand (A-2-4) and stiff silt (A-4).

Groundwater elevation in boring S3-B2 was 2,089 feet, NAVD. Groundwater was not encountered in boring S3-B1 after 24 hours.

#### **LABORATORY TESTING**

Representative split-spoon samples were selected from soil test borings to verify visual field classification and determine soil index properties. A total of thirteen (13) split-spoon samples were analyzed in our laboratory for natural moisture determination, Atterberg limits, and grain size analysis; nine (9) samples for replacement bridge and four (4) samples for new roadway alignments. Representative channel and bank samples were analyzed for grain size distribution.

- 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"

The results of the laboratory testing are presented in AASHTO Soil Classification and Gradation Sheet attached.

#### **CONCLUSIONS**

Based on our subsurface investigation, the subsurface conditions at the bridge site consist of very loose to very dense sandy soils (A-1-b, and A-2-4) and very soft to stiff sandy clay and sandy silt (A-6 and A-4), underlain by weathered rock. Specifically End Bent 1 encountered weathered rock at shallow depths (9.5 feet to 13 feet deep). Considering the bottom of cap elevations provided and depths to weathered rock, deep foundation are anticipated for the bridge structure. Due to the presence of shallow weathered rock, pile excavation is anticipated for End Bent 1.

#### **FOUNDATION RECOMMENDATIONS**

HP12X53 piles are proposed at the end bents. The foundation recommendations presented below are based on the strength limit state.

The end bent piles will be driven to weathered rock where they are likely to refuse. The end bent piles will develop a factored resistance of 81 Tons per pile, bearing on bedrock. A resistance factor of 0.6 may be applied to evaluate the driving resistance of the piles, assuming they are driven to rock. The piles will be spaced at 7 feet inches on center. Therefore, the group axial capacity of the piles will be the sum of the individual capacities of the piles in a row. For more information, refer to the attached "Summary of Foundation Recommendations".

Temporary excavation or shoring system may be necessary during construction of end bent caps. The design and implementation of temporary slopes or shoring system is the responsibility of the contractor. Backfill behind the end bent caps shall be replaced in accordance with NCDOT Specifications.

From the information provided, we understand the proposed final grade is to be at or near existing grade with minimal fill. Therefore long term settlement is not anticipated to occur. Provided that the embankments are constructed in accordance with NCDOT Specifications and suitable slope protection measures are incorporated, the slopes may be reconstructed at 1.5H:1V as planned.

**CLOSURE**

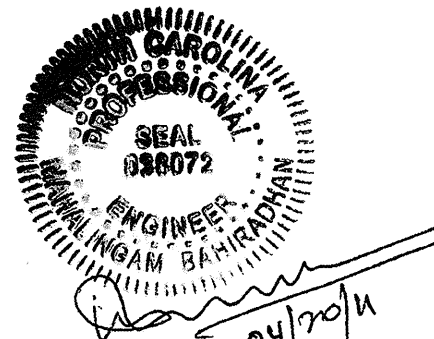
Recommendations and evaluations provided by Falcon are based on the draft report prepared by Tierra, Inc. dated December 18, 2006. Modifications of our recommendations and evaluations may be required if there are changes to the design or location of the structure. Recommendations in this report are based 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. Falcon 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,  
**FALCON ENGINEERING, INC.**



Jeremy R. Hamm  
*Staff Professional*



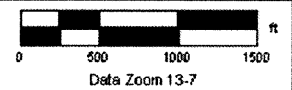
Mahalingam Bahiradhan (Bahi), P.E.  
*Senior Geotechnical Project Manager*





DeLORME

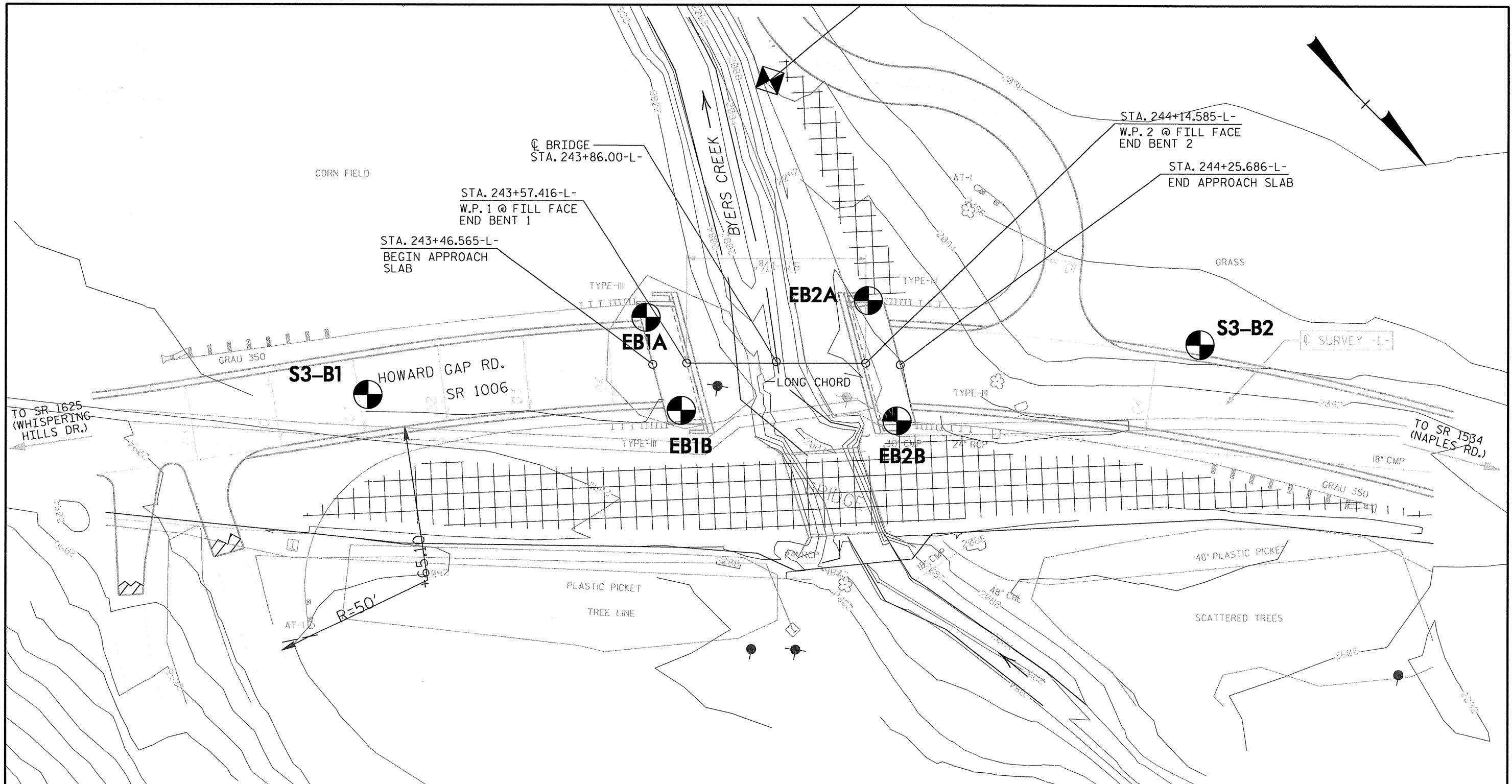
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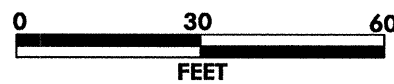
**FALCON**  
ENGINEERING

FALCON ENGINEERING, INC.  
 1210 TRINITY ROAD, SUITE 110  
 RALEIGH, NC 27607  
 PHONE: 919.871.0800  
 FAX: 919.871.0803

SITE VICINITY MAP		
BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC		
MARCH 2, 2011	PROJECT NO.: G11005.00	SHEET 7



**NOTES:**  
 BENCH MARK: BM #12, STA. 11+32.78,  
 12.62' RT. -Y6-, ELEVATION 2095.67'  
 PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM  
 TGS ENGINEERS, DATED JUNE 2006.  
 PROPOSED BRIDGE SKEW: 75 DEGREES  
 APPROXIMATE SPT BORING LOCATION.

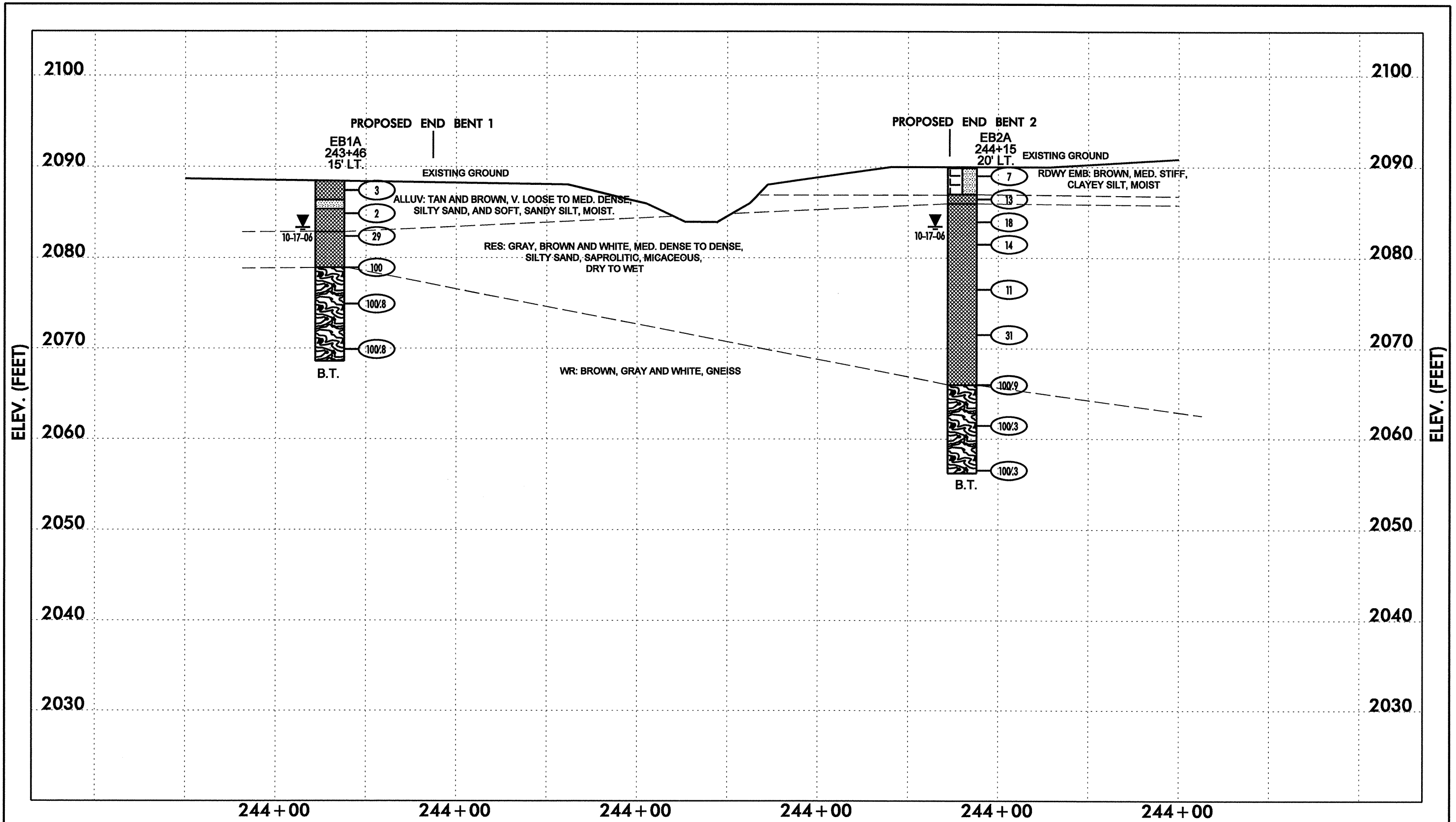


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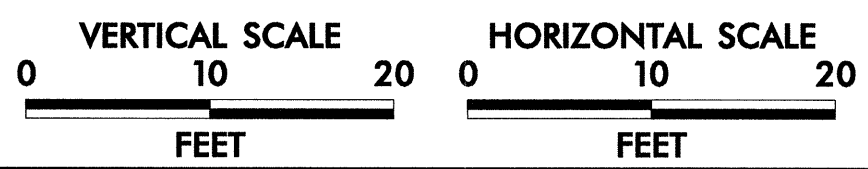
<b>BORING LOCATION PLAN</b>		
BRIDGE NO. 22 BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC		
MARCH 2, 2011	PROJECT NO.: G11005.00	SHEET 8





**NOTES:**

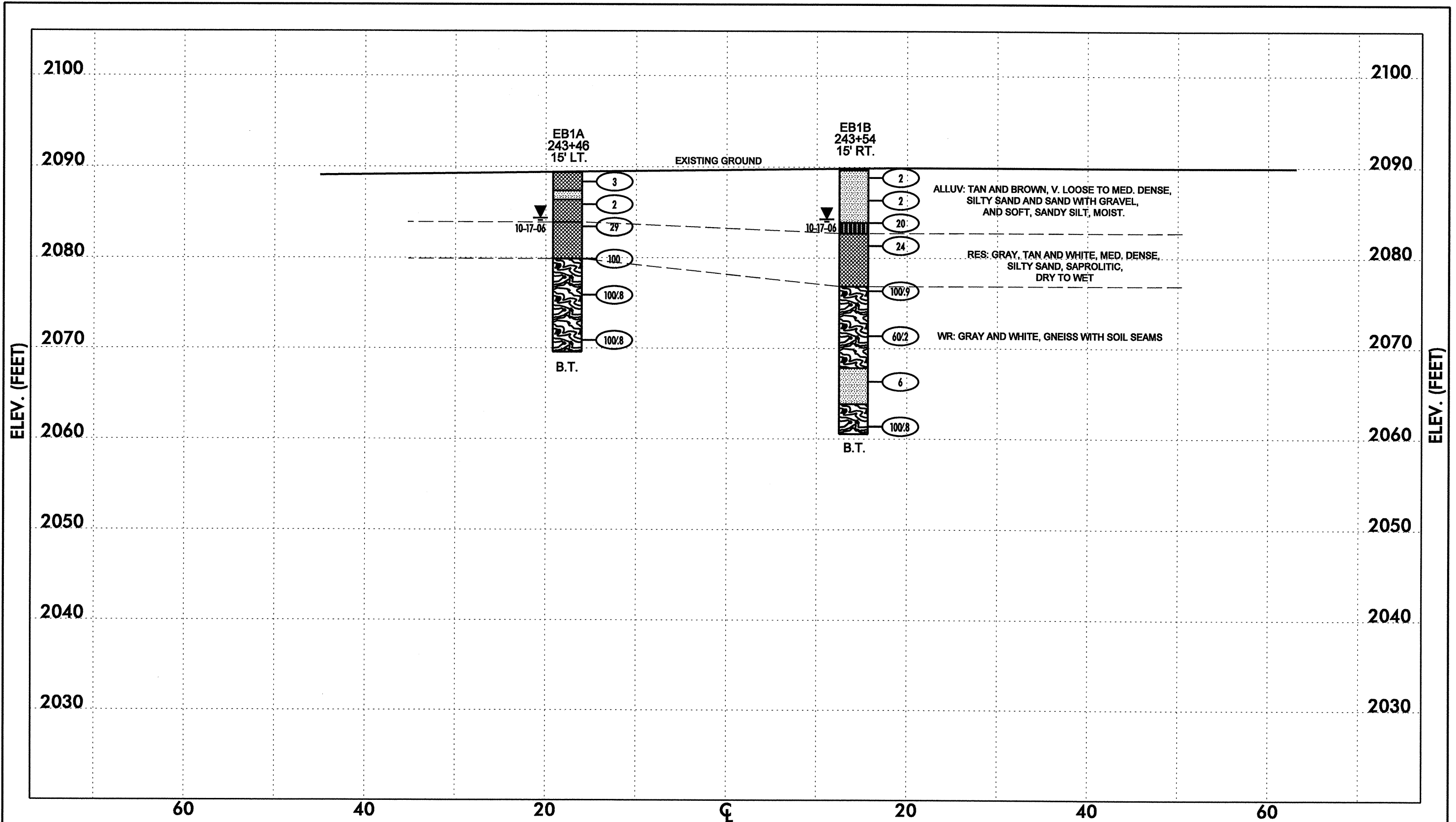
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- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.
- BRIDGE SKEW: 75 DEGREES



**FALCON ENGINEERING**

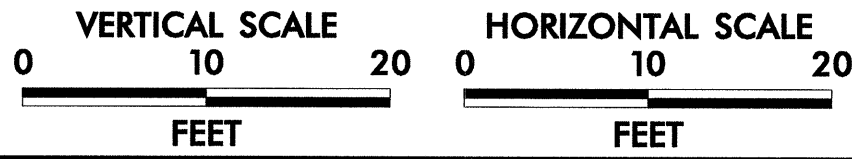
FALCON ENGINEERING, INC.  
 1210 TRINITY ROAD, SUITE 110  
 RALEIGH, NC 27607  
 PHONE: 919.871.0800  
 FAX: 919.871.0803

<b>SUBSURFACE PROFILE ALONG -L-</b>		
BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC		
MARCH 2, 2011	PROJECT NO.: G11005.00	SHEET 9



**NOTES:**

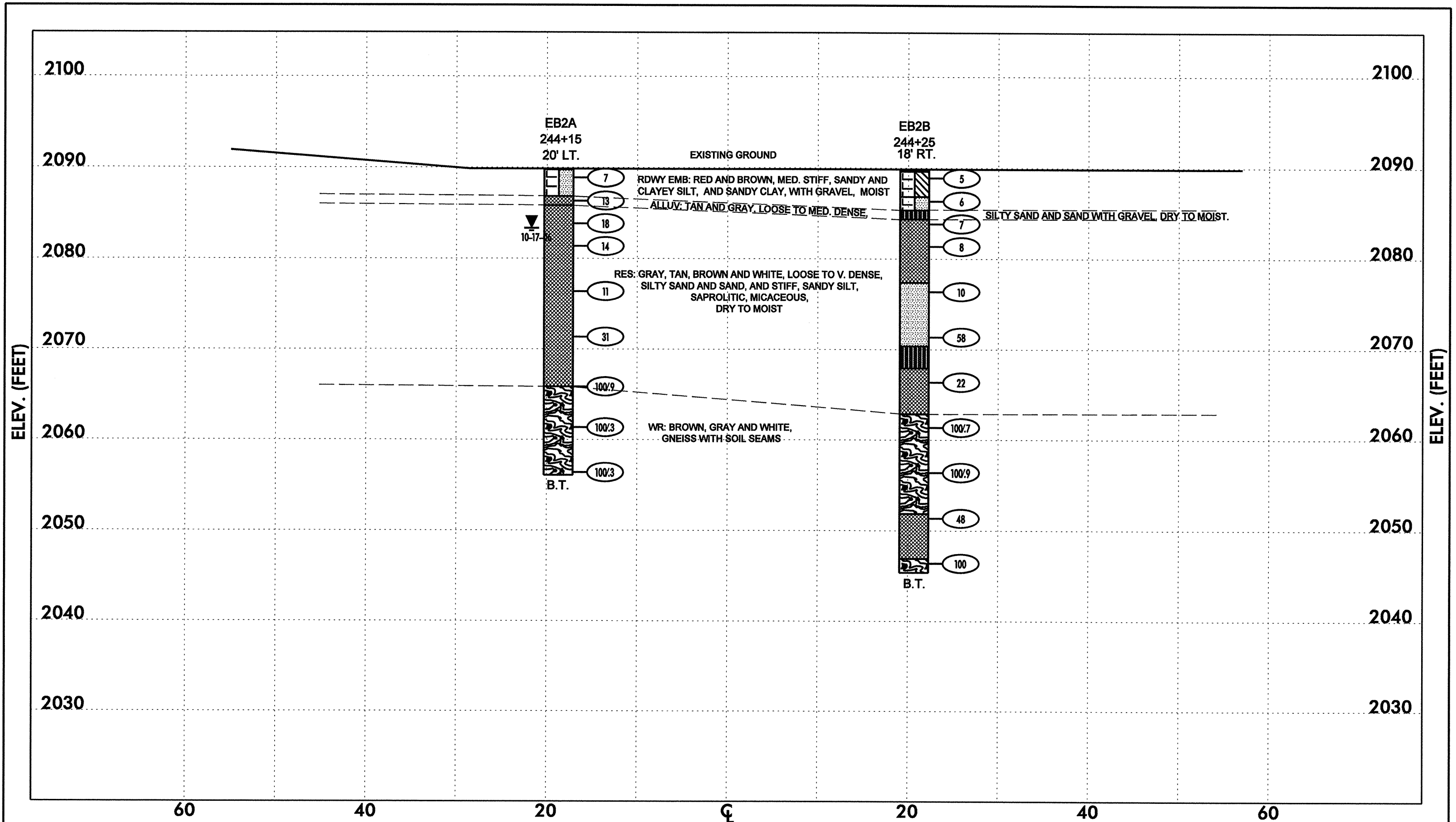
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- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.
- BRIDGE SKEW: 75 DEGREES



**FALCON ENGINEERING**

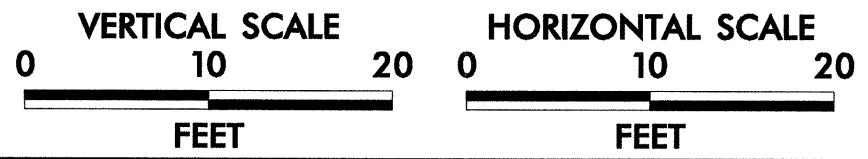
FALCON ENGINEERING, INC.  
1210 TRINITY ROAD, SUITE 110  
RALEIGH, NC 27607  
PHONE: 919.871.0800  
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<b>SUBSURFACE CROSS SECTION EB1</b>		
BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC		
MARCH 2, 2011	PROJECT NO.: G11005.00	SHEET 10



**NOTES:**

- BENCH MARK: BM #12, STA. 11+32 78, 15.62' RT. -Y6-, ELEVATION 2095.67'
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- BRIDGE SKEW: 75 DEGREES



**FALCON ENGINEERING**

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1210 TRINITY ROAD, SUITE 110  
RALEIGH, NC 27607  
PHONE: 919.871.0800  
FAX: 919.871.0803

<b>SUBSURFACE CROSS SECTION EB2</b>		
BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC		
MARCH 2, 2011	PROJECT NO.: G11005.00	SHEET 11



**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA										
SITE DESCRIPTION BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)									
BORING NO. EB1A		STATION 243+46		OFFSET 15 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 2,089.0 ft		TOTAL DEPTH 19.8 ft		NORTHING N/A		EASTING N/A										
DRILL MACHINE CME 550		DRILL METHOD HSA		HAMMER TYPE Automatic												
DRILLER N/A		START DATE 10/16/06		COMP. DATE 10/16/06		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2090														2,089.0	GROUND SURFACE	0.0
	2,088.0	1.0												2,087.0	ALLUVIAL LIGHT BROWN, V. LOOSE, SILTY SAND (A-2-4)	2.0
2085	2,085.5	3.5	2	1	2									2,086.0	ALLUVIAL BROWN, SOFT, SANDY SILT (A-4)	3.0
	2,083.0	6.0	1	1	1									2,083.5	ALLUVIAL BROWN, V. LOOSE, SILTY SAND (A-2-4)	5.5
2080	2,080.5	8.5	8	12	17									2,079.5	RESIDUAL GRAY AND WHITE, MED. DENSE, SILTY SAND (A-2-4), SAPROLITIC	9.5
	2,075.5	13.5	12	22	78									2,075.5	WEATHERED ROCK LIGHT GRAY AND WHITE, GNEISS	
2075	2,070.5	18.5	32	62	38/3									2,069.2	Boring Terminated at Elevation 2,069.2 ft IN WR: GNEISS	19.8
2070			42	53	47/3											
2065																
2060																
2055																
2050																
2045																
2040																
2035																
2030																
2025																
2020																
2015																
2010																

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA										
SITE DESCRIPTION BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)									
BORING NO. EB1B		STATION 243+54		OFFSET 15 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 2,090.0 ft		TOTAL DEPTH 29.3 ft		NORTHING N/A		EASTING N/A										
DRILL MACHINE CME 550		DRILL METHOD HSA		HAMMER TYPE Automatic												
DRILLER N/A		START DATE 10/16/06		COMP. DATE 10/16/06		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2090														2,090.0	GROUND SURFACE	0.0
	2,089.0	1.0	2	1	1									2,089.8	ALLUVIAL ROOTMAT	0.2
2085	2,086.5	3.5	2	1	1									2,084.0	ALLUVIAL BROWN, SOFT, SANDY SILT (A-4)	6.0
	2,084.0	6.0	3	7	13									2,082.8	ALLUVIAL TAN, MED. DENSE, SAND (A-1-b) W/ GRAVEL	7.2
2080	2,081.5	8.5	10	11	13									2,077.0	RESIDUAL GRAY, WHITE AND TAN, MED. DENSE, SILTY SAND (A-2-4) SAPROLITIC	13.0
	2,076.5	13.5	59	41/0.4										2,077.0	WEATHERED ROCK GRAY AND WHITE, GNEISS	
2075	2,071.5	18.5	60/0.2											2,068.0	RESIDUAL BROWN AND WHITE, MED. STIFF, SANDY SILT (A-4) SAPROLITIC, MICACEOUS	22.0
2070	2,066.5	23.5	7	3	3									2,064.0	WEATHERED ROCK GRAY AND WHITE, GNEISS	26.0
	2,061.5	28.5	36	64/0.3										2,060.7	Boring Terminated at Elevation 2,060.7 ft IN WR: GNEISS	29.3
2060																
2055																
2050																
2045																
2040																
2035																
2030																
2025																
2020																
2015																
2010																

NCDOT BORE DOUBLE NCDOT 06-021 BR. #22, BYERS CT. GPJ NC\_DOT\_GDT 4/21/11



**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA							
SITE DESCRIPTION BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)						
BORING NO. EB2A	STATION 244+15	OFFSET 20 ft LT	ALIGNMENT -L-					0 HR. 6.0					
COLLAR ELEV. 2,090.0 ft	TOTAL DEPTH 33.8 ft	NORTHING N/A	EASTING N/A					24 HR. 6.5					
DRILL MACHINE CME 550	DRILL METHOD HSA	HAMMER TYPE Automatic											
DRILLER N/A	START DATE 10/16/06	COMP. DATE 10/16/06	SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			
2090												2,090.0 GROUND SURFACE 0.0	
	2,089.0	1.0	7	4	3							2,089.9 ROOTMAT 0.1	
	2,086.5	3.5	4	6	7							2,087.0 ROADWAY EMBANKMENT 3.0	
2085												2,086.0 BROWN, MED. STIFF, SANDY CLAYEY SILT (A-4) 4.0	
	2,084.0	6.0	9	9	9							ALLUVIAL TAN, MED. DENSE, SILTY SAND (A-2-4) 13	
	2,081.5	8.5	6	7	7							RESIDUAL BROWN AND WHITE, MED. DENSE TO DENSE, SILTY SAND (A-2-4) SAPROLITIC, MICACEOUS 14	
2080													
	2,076.5	13.5	5	5	6								
2075													
	2,071.5	18.5	23	18	13								
2070													
	2,066.5	23.5	16	36	64/0.4								
2065													
	2,061.5	28.5	100/0.3										
2060													
	2,056.5	33.5	100/0.3										
2055													
2050													
2045													
2040													
2035													
2030													
2025													
2020													
2015													
2010													

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA							
SITE DESCRIPTION BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)						
BORING NO. EB2B	STATION 244+25	OFFSET 18 ft RT	ALIGNMENT -L-					0 HR. 3.0					
COLLAR ELEV. 2,089.0 ft	TOTAL DEPTH 44.5 ft	NORTHING N/A	EASTING N/A					24 HR. FIAD					
DRILL MACHINE CME 550	DRILL METHOD HSA	HAMMER TYPE Automatic											
DRILLER N/A	START DATE 10/16/06	COMP. DATE 10/16/06	SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			
2090												2,089.9 GROUND SURFACE 0.0	
	2,088.0	1.0	2	2	3							2,088.8 ROADWAY EMBANKMENT BITUMINOUS CONCRETE 0.3	
	2,085.5	3.5	2	2	4							2,086.0 ROADWAY EMBANKMENT 3.0	
2085												2,084.5 ROADWAY EMBANKMENT AGGREGATE BASE COURSE 4.5	
	2,083.0	6.0	2	3	4							2,083.5 ROADWAY EMBANKMENT 5.5	
	2,080.5	8.5	4	3	5							RED AND BROWN, MED. STIFF, SANDY CLAY (A-6) WITH GRAVEL	
2080												ROADWAY EMBANKMENT 12.5	
	2,075.5	13.5	3	4	6							ALLUVIAL LIGHT GRAY, LOOSE, SAND (A-1-b) W/ GRAVEL	
2075												RESIDUAL GRAY AND WHITE, LOOSE, SILTY SAND (A-2-4) SAPROLITIC	
	2,070.5	18.5	8	24	34							19.5	
2070												2,069.5 RESIDUAL TAN AND WHITE, STIFF, SANDY SILT (A-4) SAPROLITIC, MICACEOUS	
	2,065.5	23.5	5	11	11							2,067.0 RESIDUAL TAN AND WHITE, V. DENSE, SAND (A-1-b) SAPROLITIC	
2065												2,062.0 RESIDUAL BROWN, GRAY AND WHITE, MED. DENSE, SILTY SAND (A-2-4) SAPROLITIC	
	2,060.5	28.5	66	34/2								WEATHERED ROCK GRAY AND WHITE, GNEISS	
2060													
	2,055.5	33.5	32	68/4									
2055													
	2,050.5	38.5	31	29	19								
2050													
	2,045.5	43.5	72	28/5									
2045													
2040													
2035													
2030													
2025													
2020													
2015													
2010													

NCDOT BORE DOUBLE NCDOT 06-021 BR. #22, BYERS CT. GPJ NC\_DOT\_GDT 4/21/11



**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA											
SITE DESCRIPTION APPROACH ROADWAY TO BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)										
BORING NO. S3-B1		STATION 242+55		OFFSET N/A		ALIGNMENT -L-											
COLLAR ELEV. 2,090.0 ft		TOTAL DEPTH 10.0 ft		NORTHING N/A		EASTING N/A											
DRILL MACHINE CME 550		DRILL METHOD HSA		HAMMER TYPE Automatic													
DRILLER N/A		START DATE 10/16/06		COMP. DATE 10/16/06		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
2090															2,090.0	GROUND SURFACE	0.0
	2,089.0	1.0														ALLUVIAL	
			WOH	2	3											TAN, MED. STIFF, SILTY SAND (A-4)	
2085	2,086.5	3.5		2	4	3											
	2,084.0	6.0		4	11	15										RESIDUAL	
2080	2,081.5	8.5		8	5	7										TAN AND BROWN, MED. DENSE, SAND (A-1-b) W/ QUARTZ GRAVEL	8.0
																RESIDUAL	
																BROWN AND TAN, MED. DENSE, SILTY SAND (A-2-4) SAPROLITIC, MICACEOUS	10.0
																Boring Terminated at Elevation 2,080.0 ft IN RES: SILTY SAND	
2075																	
2070																	
2065																	
2060																	
2055																	
2050																	
2045																	
2040																	
2035																	
2030																	
2025																	
2020																	
2015																	
2010																	

PROJECT NO. G11005.00		ID. R 5207B		COUNTY HENDERSON		GEOLOGIST C. BRUINSMA											
SITE DESCRIPTION APPROACH ROADWAY TO BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)							GROUND WTR (ft)										
BORING NO. S3-B2		STATION 245+20		OFFSET 17 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 2,095.0 ft		TOTAL DEPTH 20.0 ft		NORTHING N/A		EASTING N/A											
DRILL MACHINE CME 550		DRILL METHOD HSA		HAMMER TYPE Automatic													
DRILLER N/A		START DATE 10/16/06		COMP. DATE 10/16/06		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
2095															2,095.0	GROUND SURFACE	0.0
	2,094.0	1.0														ARTIFICIAL FILL	
																ROOTMAT	0.2
	2,091.5	3.5		2	1	2										ARTIFICIAL FILL	
2090	2,089.0	6.0		3	3	4										TAN, SOFT TO MED. STIFF, SANDY SILTY CLAY (A-6)	
	2,088.0	6.0		2	4	4											
2085	2,086.5	8.5		2	2	1										ALLUVIAL	
																TAN, LOOSE, GRAVELLY SAND (A-1-a)	7.0
																ALLUVIAL	
																GRAY AND TAN, SOFT, SANDY SILT (A-4)	11.0
																RESIDUAL	
																GRAY AND WHITE, V. LOOSE, SILTY SAND (A-2-4) SAPROLITIC	8.0
2080	2,081.5	13.5		2	1	2											
2075	2,076.5	18.5		4	6	7										RESIDUAL	
																BROWN AND TAN, STIFF, SANDY SILT (A-4) SAPROLITIC	17.0
																Boring Terminated at Elevation 2,075.0 ft IN RES: SILTY SAND	20.0
2070																	
2065																	
2060																	
2055																	
2050																	
2045																	
2040																	
2035																	
2030																	
2025																	
2020																	
2015																	

NCDOT BORE DOUBLE NCDOT 06-021 BR. #22, BYERS CT. GPJ NC\_DOT.GDT 4/21/11



**FIELD  
 SCOUR REPORT**

WBS: \_\_\_\_\_ TIP: R 5207B COUNTY: HENDERSON

DESCRIPTION(1): BRIDGE #22 OVER BYERS CREEK ON SR 1106 (HOWARD GAP ROAD)

**EXISTING BRIDGE**

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) \_\_\_\_\_

Bridge No.: 3 Length: 26 Total Bents: 2 Bents in Channel: 0 Bents in Floodplain: 2  
 Foundation Type: CONCRETE VERT. ABUT. & WINGWALLS

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: NOT VISABLE

Interior Bents: N/A

Channel Bed: SOME DEGRADATION

Channel Bank: SOME UNDERMINING

**EXISTING SCOUR PROTECTION**

Type(3): CONCRETE WINGWALLS, RIP RAP

Extent(4): WING WALL 20' IN ALL DIRECTIONS, RIP RAP AT DOWNSTREAM

Effectiveness(5): EFFECTIVE

Obstructions(6): NONE

**INSTRUCTIONS**

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

**DESIGN INFORMATION**

Channel Bed Material(7): SANDS AND COBBLES

Channel Bank Material(8): \_\_\_\_\_

Channel Bank Cover(9): TREES, BUSHES, AND SHRUBS

Floodplain Width(10): 70+ FEET

Floodplain Cover(11): BUSHES, SHRUBS, AND TREES

Stream is(12): Aggrading \_\_\_\_\_ Degrading  Static \_\_\_\_\_

Channel Migration Tendency(13): TO THE SOUTHEAST

Observations and Other Comments: \_\_\_\_\_

Reported by: \_\_\_\_\_ Date: 3/2/2011  
 FALCON ENGINEERING, INC.

**DESIGN SCOUR ELEVATIONS(14)**

Feet  Meters \_\_\_\_\_

	<b>BENTS</b>										
	B1	B2	B3	B4							
100 yr DSE											

Comparison of DSE to Hydraulics Unit theoretical scour: \_\_\_\_\_

DSE determined by: \_\_\_\_\_ Date: \_\_\_\_\_

**SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL**

Bed or Bank	BED	BANK					
Sample No.	SS-4	SS-2					
Retained #4	35	0.7					
Passed #10	57	99					
Passed #40	43	98					
Passed #200	24	61					
Coarse Sand	14	1					
Fine Sand	19	37					
Silt							
Clay							
LL	18	31					
PI	NP	7					
AASHTO	A-1-b	A-4					
Station	243+54	243+46					
Offset	15'RT	15'LT					
Depth	6.0-7.5	1.0-2.5					

FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110, RALEIGH NC 27607  
 SOIL CLASSIFICATION AND GRADATION SHEET  
 BRIDGE # 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)  
 TIP NO.: R 5207A  
 HENDERSON COUNTY, NORTH CAROLINA  
 FALCON ENGINEERING, INC. PROJECT NO: G11005.00

BORING #		SAMPLE #		NATURAL MOISTURE CONTENT	TOTAL SAMPLE			ATTERBERG LIMIT		
AASHTO Classification					PERCENT PASSING			LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
STATION #	OFFSET (FEET)	DEPTH (FEET)	#10		#40	#200				
EB1A		SS-1		36.1%	99	93	35	26	-	NP
A-2-4										
243+46	15'LT	3.5-5.0								
EB1B		SS-2		28.3%	99	98	61	31	24	7
A-4										
243+54	15'RT	1.0-2.5								
EB1B		SS-3		29.5%	100	99	62	26	23	3
A-4										
243+54	15'RT	3.5-5.0								
EB1B		SS-4		13.3%	57	43	24	18	-	NP
A-1-b										
243+54	15'RT	6.0-7.5								
EB1B		SS-5		33.0%	96	82	48	28	-	NP
A-4										
243+54	15'RT	23.5-25.0								
EB2A		SS-6		12.9%	75	59	25	29	-	NP
A-2-4										
244+15	20'LT	3.5-5.0								
EB2A		SS-7		22.2%	92	78	40	27	-	NP
A-2-4										
244+15	20'LT	13.5-15.0								
EB2B		SS-8		16.8%	96	88	60	31	18	13
A-6										
244+25	18'RT	1.0-2.5								
EB2B		SS-9		17.6%	85	81	47	29	-	NP
A-4										
244+25	18'RT	3.5-5.0								
S3-B1		SS-10		25.6%	100	98	56	27	-	NP
A-4										
242+55	CL	1.0-2.5								
S3-B1		SS-11		9.2%	48	31	11	17	-	NP
A-1-b										
242+55	CL	6.0-7.5								
S3-B2		SS-12		21.5%	100	94	70	38	18	20
A-6										
245+20	17'LT	1.0-2.5								
S3-B2		SS-13		23.1%	78	71	45	29	27	2
A-4										
245+20	17'LT	8.5-10.0								
S3-B2		S-1		21.1%	99	94	72	37	19	18
A-6										
245+20	17'LT	0.0-5.0								



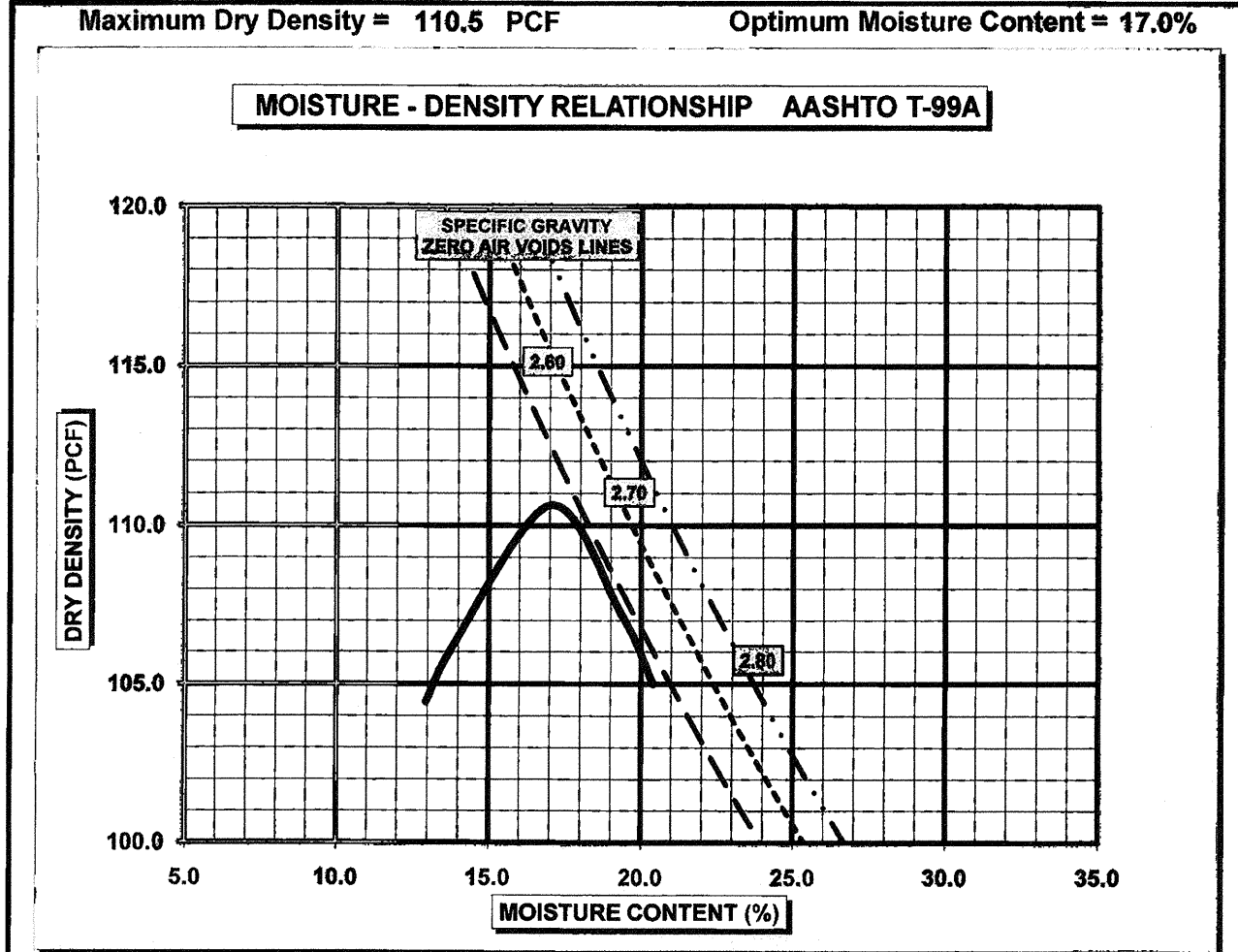
FALCON ENGINEERING, INC.

1210 TRINITY RD, SUITE 110, RALEIGH, NORTH CAROLINA. 27607

BRIDGE # 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)  
HENDERSON COUNTY, NORTH CAROLINA

BORING NO.: S3-B2  
SAMPLE NO.: S-1  
DEPTH: 0.0-5.0

SAMPLE DESCRIPTION: TAN SANDY SILTY CLAY (A-6)



Sample Date : 10/06      Liquid Limit = 37  
Natural Moisture Content = 21.1%      Plastic Limit = 19  
Percent Passing #200 Sieve = 72%      Plastic Index = 18

FALCON. Project # G11005.00

FALCON ENGINEERING, INC.

1210 TRINITY RD. SUITE 110, RALEIGH, NORTH CAROLINA 27607

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

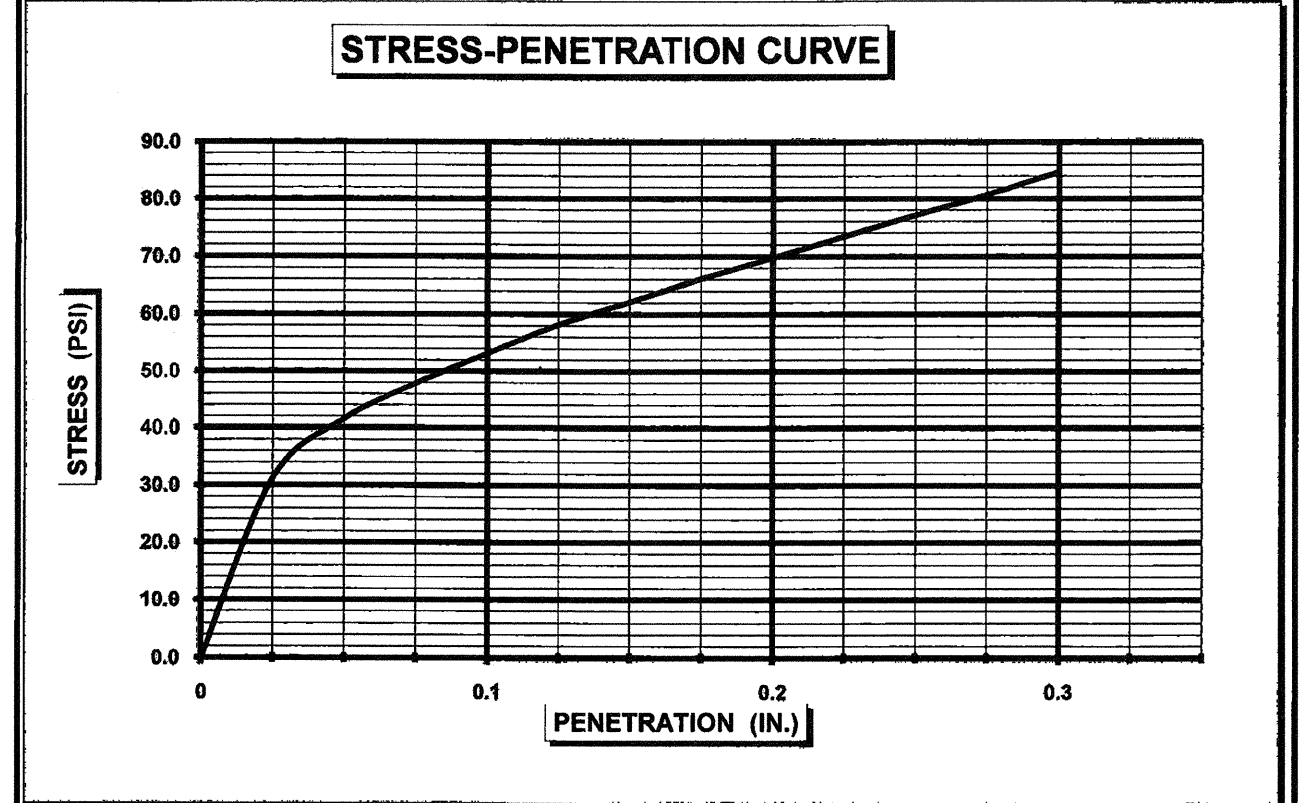
AASHTO T-99 \ ASTM D-1883

PROJECT #: G11005.00      DATE: 3/2/2011  
PROJECT NAME: BRIDGE # 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD)  
BORING: S3-B2      SAMPLE: S-1      DEPTH: 0-5

SOIL DESCRIPTION: TAN SANDY SILTY CLAY (A-6)

COMPACTION:	AASHTO T99A	SOAK	96 HRS.
MAXIMUM DRY DENSITY	110.5 PCF	STRAIN RATE	.05 IN / MIN.
OPTIMUM MOISTURE CONTENT	17.0%	PROVING RING	1500 LB.
TEST DATA		SURCHARGE WEIGHT	10 lb.
DRY DENSITY	105.2 PCF	SURCHARGE PER SQUARE FOOT	100 lbs/sq.ft.
MOISTURE CONTENT	18.3%	FINAL MOISTURE CONTENT	N/A
PERCENT COMPACTION	95.2%	SWELL	0.09%

	ACTUAL	CORRECTED
CBR VALUE AT .1"	5.3	
CBR VALUE AT .2"	4.7	



LIQUID LIMIT	37	PLASTIC LIMIT	19	PLASTIC INDEX	18
Percent Passing #200 Sieve = 71.5%			Natural Moisture Content = 21.1%		



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



PHOTO 2: BYERS CREEK, LOOKING UPSTREAM.



 <p>FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 RALEIGH, NC 27607 PHONE: 919.871.0800 FAX: 919.871.0803</p>	<b>SITE PHOTOS</b>	
	BRIDGE NO. 22 OVER BYERS CREEK ON SR 1006 (HOWARD GAP ROAD) HENDERSON COUNTY, NC	
	MARCH 2, 2011	PROJECT NO.: G11005.00



PHOTO 3: END BENT 1, LOOKING FROM LEFT TO RIGHT.



PHOTO 4: END BENT 2, LOOKING FROM LEFT TO RIGHT.

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

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**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 45393.1.2 (R-5207B) F.A. PROJ. \_\_\_\_\_

COUNTY HENDERSON

PROJECT DESCRIPTION SR-1006 (HOWARD GAP ROAD) FROM  
BRIDGE No. 20 TO SR-1539

SITE DESCRIPTION RETAINING WALL No. 2

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1919 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

**PROJECT: 45393.1.2 ID: R-5207B**

PERSONNEL

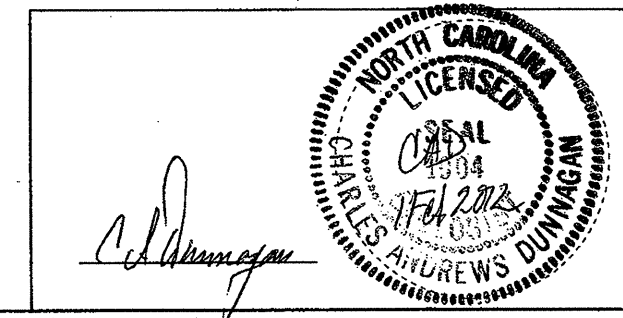
- M M HAGER
- D O CHEEK
- C J COFFEY
- J T WILLIAMS

INVESTIGATED BY C A DUNNAGAN  
 CHECKED BY W D FRYE, Jr  
 SUBMITTED BY W D FRYE, Jr  
 DATE FEBRUARY 2012

DRAWN BY: C A DUNNAGAN

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 DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

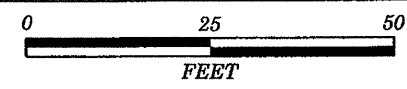
PROJECT REFERENCE NO. 45393.1.2 (R-5207B)  
SHEET NO. 2/16

**SUBSURFACE INVESTIGATION**

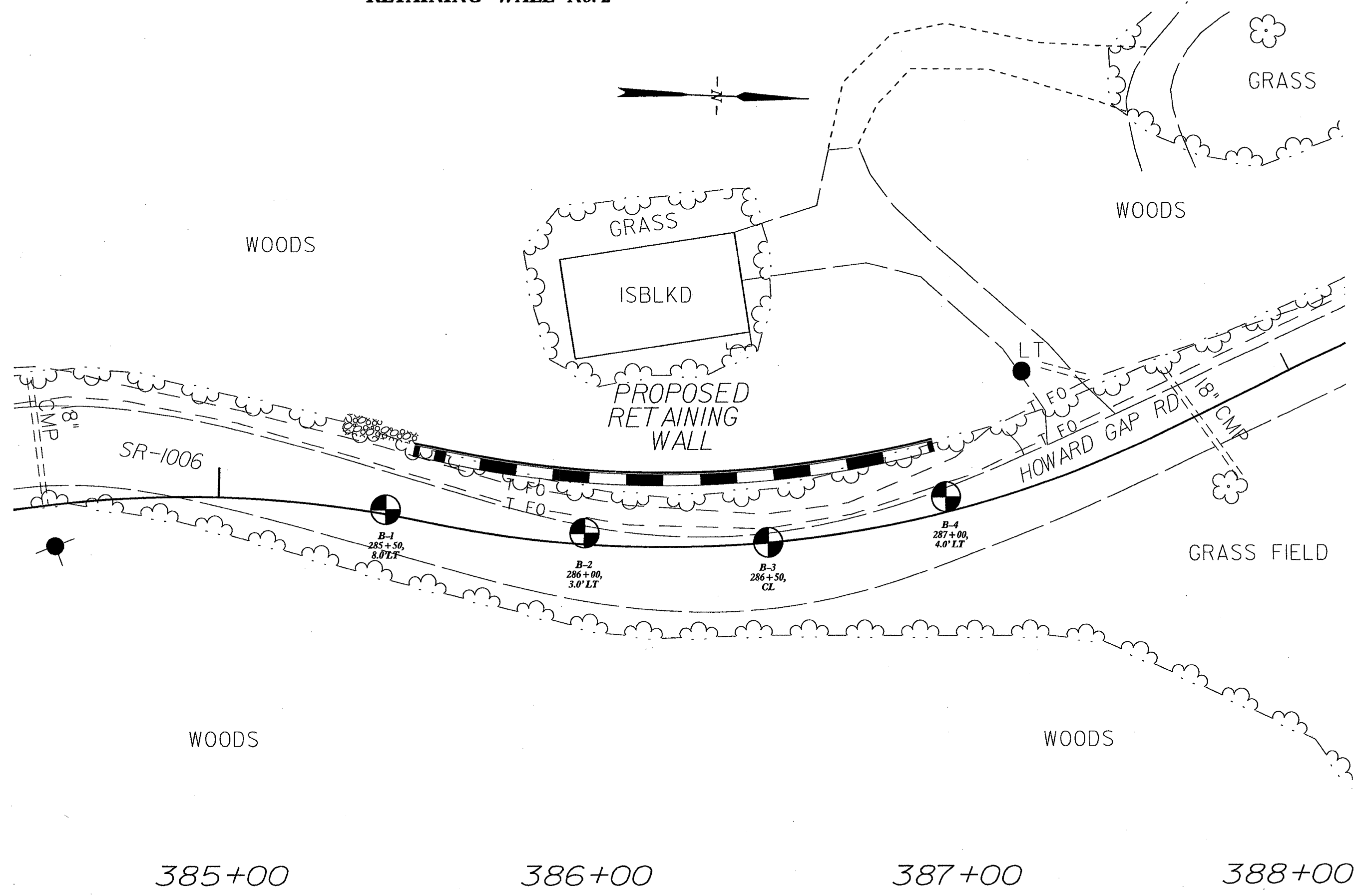
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS																																																																																																																																																																																																																																																																																		
<p>SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (ASHTO T208, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE ASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:</p> <p style="text-align: center;"><i>VERY STIFF, ORG. SILTY CLAY, W/ST WITH INTERBEDDED FINE SAND LENS, HIGH PLASTIC, A-7-6</i></p>		<p><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORM</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO <b>POORLY GRADED</b>) <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p style="text-align: center;"><b>ANGULARITY OF GRAINS</b></p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR</b>, <b>SUBANGULAR</b>, <b>SUBROUNDED</b>, OR <b>ROUNDED</b>.</p>		<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p><b>ALLOVIUM (ALLOV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA. <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. <b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL. <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. <b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. <b>ROCK QUALITY DESIGNATION (RQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. <b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. <b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. <b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. <b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																																																																																		
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">GENERAL CLASS.</th> <th colspan="7">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th> <th colspan="7">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>SYMBOL</th> <th>A-1</th> <th>A-1-b</th> <th>A-3</th> <th>A-2</th> <th>A-2-4</th> <th>A-2-5</th> <th>A-2-6</th> <th>A-2-7</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th>A-7-5</th> <th>A-7-6</th> <th>A-7-7</th> <th>A-7-8</th> <th>A-7-9</th> <th>A-7-10</th> <th>A-7-11</th> <th>A-7-12</th> <th>A-7-13</th> <th>A-7-14</th> <th>A-7-15</th> <th>A-7-16</th> <th>A-7-17</th> <th>A-7-18</th> <th>A-7-19</th> <th>A-7-20</th> </tr> <tr> <td>% PASSING</td> <td></td> <td>50</td> <td>30</td> <td>15</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>LIQUID LIMIT</td> <td></td> <td>50</td> <td>40</td> <td>30</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> <td>25</td> </tr> <tr> <td>PLASTIC INDEX</td> <td></td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>GROUP INDEX</td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td></td> <td>STONE FRAGS. GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILT OR CLAYEY GRAVEL AND SAND</td> <td>SILT SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> <td>CLAYEY SOILS</td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td></td> <td colspan="4">EXCELLENT TO GOOD</td> <td colspan="4">FAIR TO POOR</td> <td colspan="4">FAIR TO POOR</td> <td colspan="4">POOR</td> <td colspan="4">UNSATISFACTORY</td> </tr> <tr> <td colspan="28">PI OF A-7-5 SUBGROUP IS &lt;= LL - 30 ; PI OF A-7-6 SUBGROUP IS &gt; LL - 30</td> </tr> </table>		GENERAL CLASS.		GRANULAR MATERIALS (<= 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)							ORGANIC MATERIALS			GROUP CLASS.	SYMBOL	A-1	A-1-b	A-3	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	A-7-5	A-7-6	A-7-7	A-7-8	A-7-9	A-7-10	A-7-11	A-7-12	A-7-13	A-7-14	A-7-15	A-7-16	A-7-17	A-7-18	A-7-19	A-7-20	% PASSING		50	30	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	LIQUID LIMIT		50	40	30	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	PLASTIC INDEX		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	GROUP INDEX		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	USUAL TYPES OF MAJOR MATERIALS		STONE FRAGS. 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ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p>		<p><b>WEATHERED ROCK (WR)</b> - NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p> <p><b>CRYSTALLINE ROCK (CR)</b> - FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p> <p><b>NON-CRYSTALLINE ROCK (NCR)</b> - FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p> <p><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b> - COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		<p><b>FRESH</b> - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p><b>VERY SLIGHT (V SL.)</b> - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p><b>SLIGHT (SL.)</b> - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p><b>MODERATE (MOD.)</b> - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p><b>MODERATELY SEVERE (MOD. SEV.)</b> - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i></p> <p><b>SEVERE (SEV.)</b> - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</i></p> <p><b>VERY SEVERE (V SEV.)</b> - 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 &lt; 100 BPF.</i></p> <p><b>COMPLETE</b> - ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p>	
GENERAL CLASS.		GRANULAR MATERIALS (<= 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)							ORGANIC MATERIALS																																																																																																																																																																																																																																																																								
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		<p>DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p>																																																																																																																																																																																																																																																																																						
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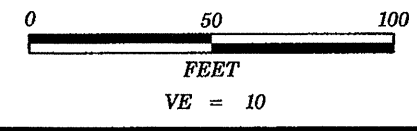
SR-1006 FROM BRIDGE No. 20 TO SR-1539  
RETAINING WALL No. 2



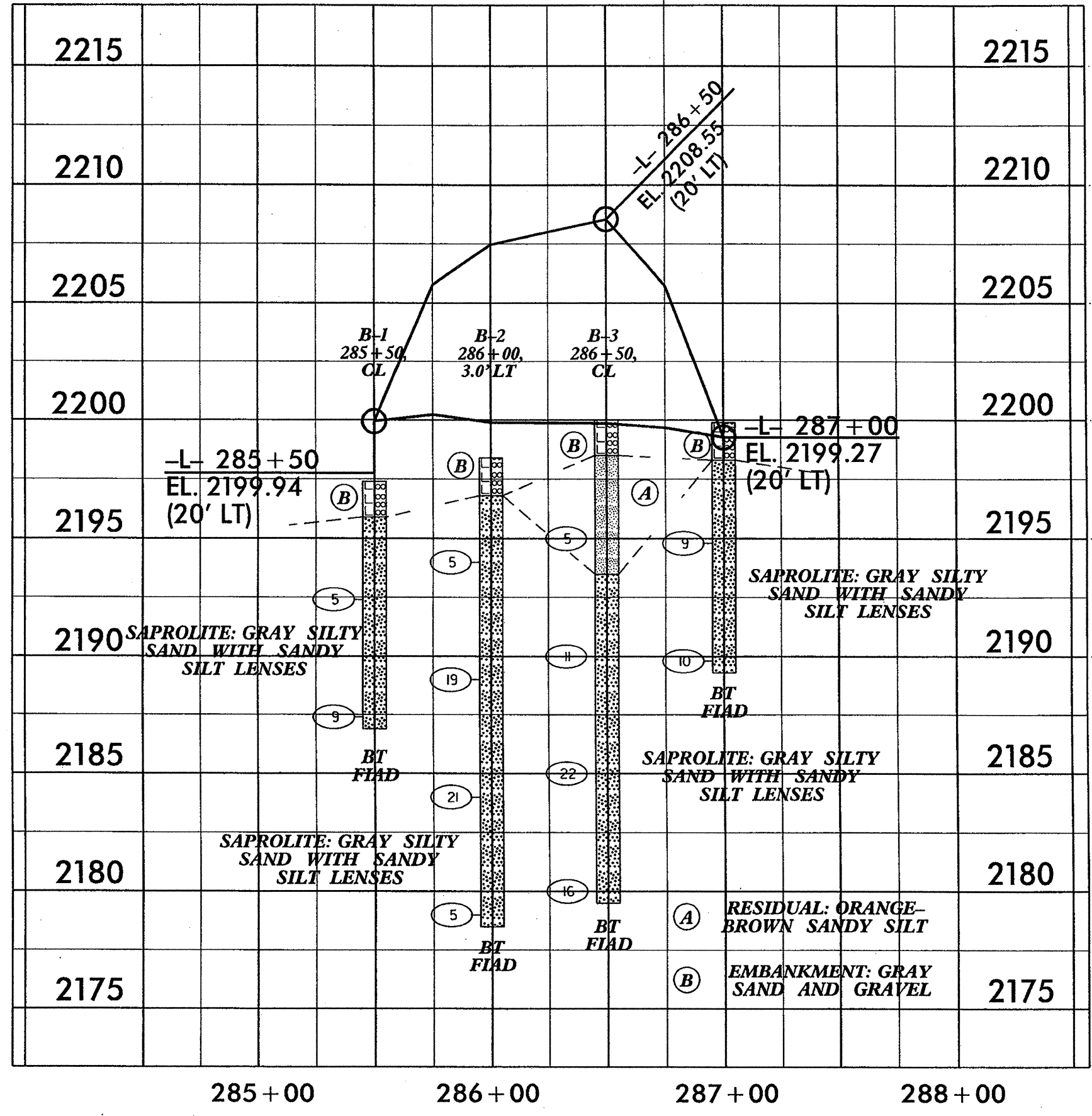
PROJECT REFERENCE NO.	SHEET
45393.1.2 (R-5207B)	3 / 6
PLAN VIEW	



**SR-1006 FROM BRIDGE No. 20 TO SR-1539  
RETAINING WALL No. 2**



<b>PROJECT REFERENCE NO.</b>	<b>SHEET</b>
45393.1.2 (R-5207B)	4/6
<b>PROFILE 20' LEFT -L-</b>	







WBS 45393.1.2		TIP B-5207B		COUNTY HENDERSON		GEOLOGIST Hager, M. M.										
SITE DESCRIPTION SR-1006 from Bridge No. 20 to SR-1539: Retaining Wall No. 2							GROUND WTR (ft)									
BORING NO. B-3		STATION 286+50		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 2,200.0 ft		TOTAL DEPTH 20.5 ft		NORTHING 618,507		EASTING 960,328										
DRILL RIG/HAMMER EFF./DATE AFO0070 CME-550X 81% 09/03/2009		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
DRILLER Coffey, Jr., C.		START DATE 01/31/12		COMP. DATE 01/31/12		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2200														2,200.0	0.0	GROUND SURFACE
														2,198.5	1.5	ROADWAY EMBANKMENT Gray sand and gravel.
2195	2,196.0	4.0	2	1	4								M	2,193.5	6.5	RESIDUAL Orange-brown sandy silt.
2190	2,191.0	9.0	3	5	6								D			SAPROLITE Gray silty sand.
2185	2,186.0	14.0	10	10	12								D			
2180	2,181.0	19.0	4	7	9								D	2,179.5	20.5	Boring Terminated at Elevation 2,179.5 ft in medium dense saprolite.

NCDOT BORE SINGLE BORELOGS.GPJ NC\_DOT.GDT 2/1/12

6/6

WBS 45393.1.2		TIP B-5207B		COUNTY HENDERSON		GEOLOGIST Hager, M. M.										
SITE DESCRIPTION SR-1006 from Bridge No. 20 to SR-1539: Retaining Wall No. 2							GROUND WTR (ft)									
BORING NO. B-4		STATION 287+00		OFFSET 4 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 2,199.9 ft		TOTAL DEPTH 10.6 ft		NORTHING 618,555		EASTING 960,314										
DRILL RIG/HAMMER EFF./DATE AFO0070 CME-550X 81% 09/03/2009		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic												
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			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2200														2,199.9	0.0	GROUND SURFACE
														2,198.3	1.6	ROADWAY EMBANKMENT Gray sand and gravel.
2195	2,195.8	4.1	6	4	5								D			SAPROLITE Gray silty sand with sandy silt lenses.
2190	2,190.8	9.1	3	4	6								D			
														2,189.3	10.6	Boring Terminated at Elevation 2,189.3 ft in medium dense saprolite.

NCDOT BORE SINGLE BORELOGS.GPJ NC\_DOT.GDT 2/1/12

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

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5	BORE LOG REPORTS

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 45393.1.2 (R-5207B) F.A. PROJ. \_\_\_\_\_  
COUNTY HENDERSON  
PROJECT DESCRIPTION SR-1006 (HOWARD GAP ROAD) FROM  
BRIDGE No. 20 TO SR-1539  
  
SITE DESCRIPTION RETAINING WALL No 1

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1951 250-4008. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE, THE LABORATORY SAMPLE DATA AND THE IN SITU UN-PLACED 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.

**PROJECT: 45393.1.2 ID: R-5207B**

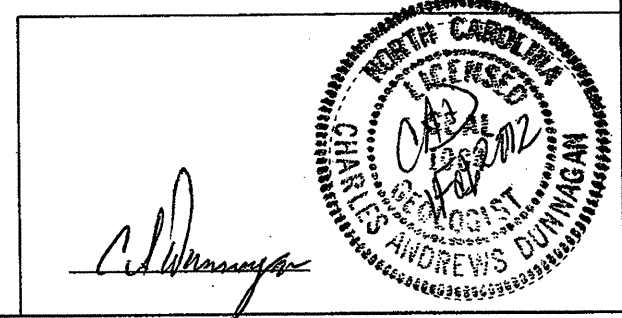
PERSONNEL  
M M HAGER  
D O CHEEK  
C J COFFEY  
J T WILLIAMS

INVESTIGATED BY C A DUNNAGAN  
CHECKED BY W D FRYE, Jr  
SUBMITTED BY W D FRYE, Jr  
DATE FEBRUARY 2012

DRAWN BY: C A DUNNAGAN

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY 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 DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**

PROJECT REFERENCE NO. 45393.1.2 (R-5207B) SHEET NO. 2/5

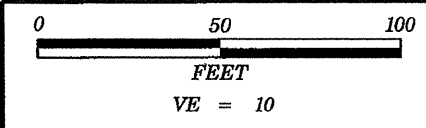
**SUBSURFACE INVESTIGATION**

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

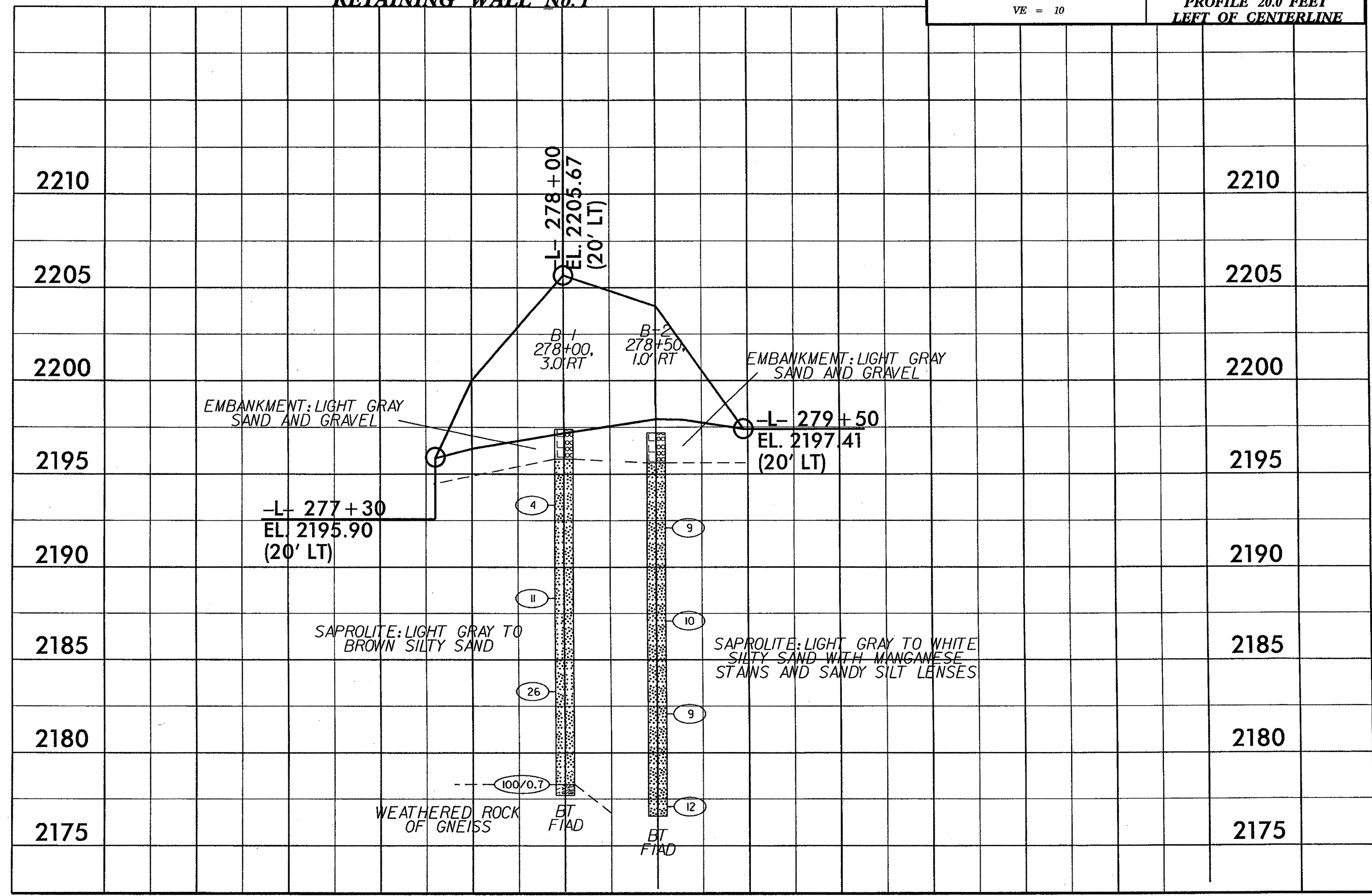
SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																							
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, MOD. PLASTIC, A-7-5</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 IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:  WEATHERED ROCK (WR)  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.  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 YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.  COASTAL PLAIN SEDIMENTARY ROCK (CPI)  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOOED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. 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 (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.																																																							
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>GENERAL CLASS.</th> <th>GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th>SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th>ORGANIC MATERIALS</th> </tr> </thead> <tbody> <tr> <td>GROUP CLASS.</td> <td>A-1, A-1-b, A-3</td> <td>A-2, A-2-4, A-2-5, A-2-6, A-2-7</td> <td>A-4, A-5, A-6, A-7</td> </tr> <tr> <td>SYMBOL</td> <td></td> <td></td> <td></td> </tr> <tr> <td>% PASSING</td> <td>50, 30, 15, 10, 5, 2.5, 1.5, 0.75</td> <td>40, 30, 20, 15, 10, 5, 2.5, 1.5, 0.75</td> <td>40, 30, 20, 15, 10, 5, 2.5, 1.5, 0.75</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>≤ 40</td> <td>40 - 50</td> <td>≤ 50</td> </tr> <tr> <td>PLASTIC INDEX</td> <td>≤ 6</td> <td>6 - 10</td> <td>≤ 10</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0 - 10</td> <td>0 - 10</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS., SAND, SILTY SAND, SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SAND, SILTY SAND, SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILT, CLAYEY SILT, CLAYEY SOILS</td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td>EXCELLENT TO GOOD</td> <td>FAIR TO POOR</td> <td>FAIR TO POOR, POOR, UNSUITABLE</td> </tr> </tbody> </table> <p>PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS &gt; LL - 30</p>	GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)	SILT-CLAY MATERIALS (> 35% PASSING #200)	ORGANIC MATERIALS	GROUP CLASS.	A-1, A-1-b, A-3	A-2, A-2-4, A-2-5, A-2-6, A-2-7	A-4, A-5, A-6, A-7	SYMBOL				% PASSING	50, 30, 15, 10, 5, 2.5, 1.5, 0.75	40, 30, 20, 15, 10, 5, 2.5, 1.5, 0.75	40, 30, 20, 15, 10, 5, 2.5, 1.5, 0.75	LIQUID LIMIT	≤ 40	40 - 50	≤ 50	PLASTIC INDEX	≤ 6	6 - 10	≤ 10	GROUP INDEX	0	0 - 10	0 - 10	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS., SAND, SILTY SAND, SILTY OR CLAYEY GRAVEL AND SAND	SAND, SILTY SAND, SILTY OR CLAYEY GRAVEL AND SAND	SILT, CLAYEY SILT, CLAYEY SOILS	GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD	FAIR TO POOR	FAIR TO POOR, POOR, UNSUITABLE	<b>MINERALOGICAL COMPOSITION</b> MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.  <b>COMPRESSIBILITY</b> SLIGHTLY COMPRESSIBLE MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 LIQUID LIMIT EQUAL TO 31-50 LIQUID LIMIT GREATER THAN 50  <b>PERCENTAGE OF MATERIAL</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT-CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> </thead> <tbody> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>&gt; 10%</td> <td>&gt; 20%</td> <td>HIGHLY</td> </tr> </tbody> </table>	ORGANIC MATERIAL	GRANULAR SOILS	SILT-CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	<b>WEATHERING</b> FRESH - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V SL.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SL.) - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED. SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i> SEVERE (SEV.) - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 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 &lt; 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. 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<b>COLOR</b> DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.	<b>ROCK HARDNESS</b> 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 FINGERNAIL.	<b>FRACATURE SPACING</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>TERM</th> <th>SPACING</th> </tr> </thead> <tbody> <tr> <td>VERY WIDE</td> <td>MORE THAN 10 FEET</td> </tr> <tr> <td>WIDE</td> <td>3 TO 10 FEET</td> </tr> <tr> <td>MODERATELY CLOSE</td> <td>1 TO 3 FEET</td> </tr> <tr> <td>CLOSE</td> <td>0.16 TO 1 FEET</td> </tr> <tr> <td>VERY CLOSE</td> <td>LESS THAN 0.16 FEET</td> </tr> </tbody> </table> <b>BEDDING</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> </thead> <tbody> <tr> <td>VERY THICKLY BEDDED</td> <td>&gt; 4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.003 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>&lt; 0.003 FEET</td> </tr> </tbody> </table>	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	0.003 - 0.03 FEET	THINLY LAMINATED	< 0.003 FEET																														
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	<b>INDURATION</b> 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.	<b>NOTES:</b> BENCH MARK: BM # 14; SPIKE IN TREE 65.28' RT OF -Y18- STA 12+77.17 ELEVATION: 2170.53 FT.																																																								



**SR-1006 FROM BRIDGE No. 20 TO SR-1539  
RETAINING WALL No. 1**



PROJECT REFERENCE NO.	SHEET
45393.1.2 (R-5207B)	4/5
PROFILE 20.0 FEET LEFT OF CENTERLINE	



276+00      277+00      278+00      278+64.86 BK =  
279+17.23 AH

