

REFERENCE: BR-0002

PROJECT: 67002

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0002	1	18

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

**CONTENTS**

SHEET NO.	DESCRIPTION
1	TITLE SHEET
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2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
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15-18	CORE PHOTOGRAPHS

COUNTY ASHE  
PROJECT DESCRIPTION REPLACE BRIDGE #8 ON NC 194  
OVER NORTH FORK NEW RIVER

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 1919 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT 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 THE 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.

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

PERSONNEL

C.D. JOHNSON

D.O. CHEEK

C.J. COFFEY

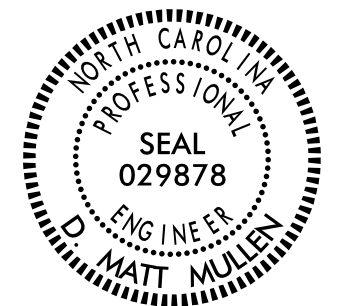
INVESTIGATED BY D.M. MULLEN

DRAWN BY DMM

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SUBMITTED BY JCK

DATE 8/1/2019



DocuSigned by:  
D Matt Mullen 8/2/2019  
18909BD3CD5740C SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
**SUBSURFACE INVESTIGATION**  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																													
<p>SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p>										<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, 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>ALLUVIUM (ALLUV.)</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, SUCH 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 (ROD)</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 (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 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 (SROD)</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>																													
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>ANGULARITY OF GRAINS</b>										<b>WEATHERED ROCK (WR)</b>										<b>CRYSTALLINE ROCK (CR)</b>																													
<p>GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (&gt; 35% PASSING #200) ORGANIC MATERIALS</p>										<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</b></p>										<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>										<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>																													
<b>MINERALOGICAL COMPOSITION</b>										<b>COMPRESSION</b>										<b>NON-CRYSTALLINE ROCK (NCR)</b>										<b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b>																													
<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL &lt; 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL &gt; 50</p>										<p>FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>										<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>																													
<b>PERCENTAGE OF MATERIAL</b>										<b>GROUND WATER</b>										<b>WEATHERING</b>										<b>MISCELLANEOUS SYMBOLS</b>																													
<p>ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL</p> <p>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 &gt; 10% &gt; 20% HIGHLY 35% AND ABOVE</p>										<p>▽ 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 SEEP</p>										<p>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, WOULD YIELD SPT N VALUES &gt; 100 BPF</i> VERY SEVERE (V SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD 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. SAPROLITE IS ALSO AN EXAMPLE.</p>										<p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY</p> <p>DIP &amp; DIP DIRECTION OF ROCK STRUCTURES SPT DMT VST PMT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION</p> <p>SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE</p>																													
<b>TEXTURE OR GRAIN SIZE</b>										<b>RECOMMENDATION SYMBOLS</b>										<b>ROCK HARDNESS</b>										<b>ABBREVIATIONS</b>																													
<p>U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053</p>										<p>UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK</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. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.</p>										<p>AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS HI. - HIGHLY</p> <p>MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY</p> <p>VST - VANE SHEAR TEST WEA. - WEATHERED γ<sub>s</sub> - UNIT WEIGHT γ<sub>d</sub> - DRY UNIT WEIGHT</p> <p>SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO</p>																													
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>										<b>EQUIPMENT USED ON SUBJECT PROJECT</b>										<b>FRACTURE SPACING</b>										<b>BEDDING</b>																													
<p>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION</p> <p>LL - LIQUID LIMIT PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SHRINKAGE LIMIT</p> <p>- SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</p>										<p>DRILL UNITS: <input checked="" type="checkbox"/> CME-45C <input type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST</p> <p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT</p> <p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input checked="" type="checkbox"/> -N XWL</p> <p>HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>										<p>TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FOOT VERY CLOSE LESS THAN 0.16 FEET</p>										<p>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 &lt; 0.008 FEET</p>																													
<b>PLASTICITY</b>										<b>INDURATION</b>										<b>NOTES:</b>										<b>BENCH MARK: BL-7</b>																													
<p>NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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.</p>										<p>ELEVATION: 2686.06 FEET</p>										<p>PLASTICITY INDEX (PI) DRY STRENGTH</p>																													
<b>COLOR</b>										<b>FRACTURE SPACING</b>										<b>BEDDING</b>										<b>INDURATION</b>																													
<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>										<p>DRILL UNITS: <input type="checkbox"/> CME-45C <input type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST</p>										<p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT</p>										<p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p>										<p>CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input checked="" type="checkbox"/> -N XWL</p>										<p>HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>									

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

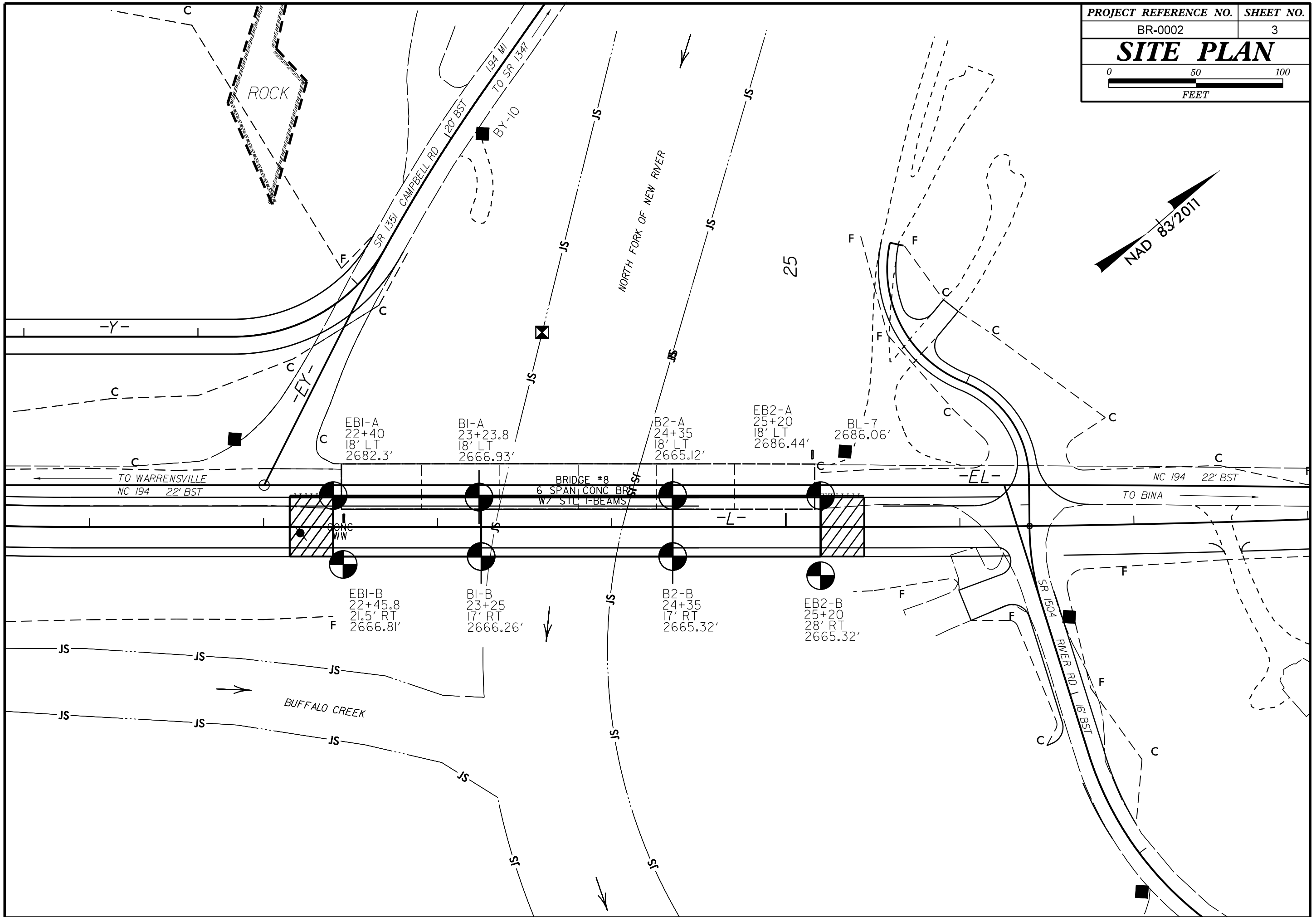
# SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

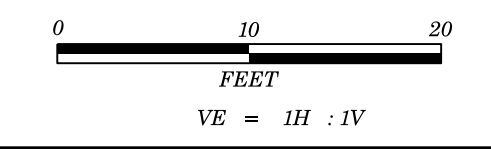
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

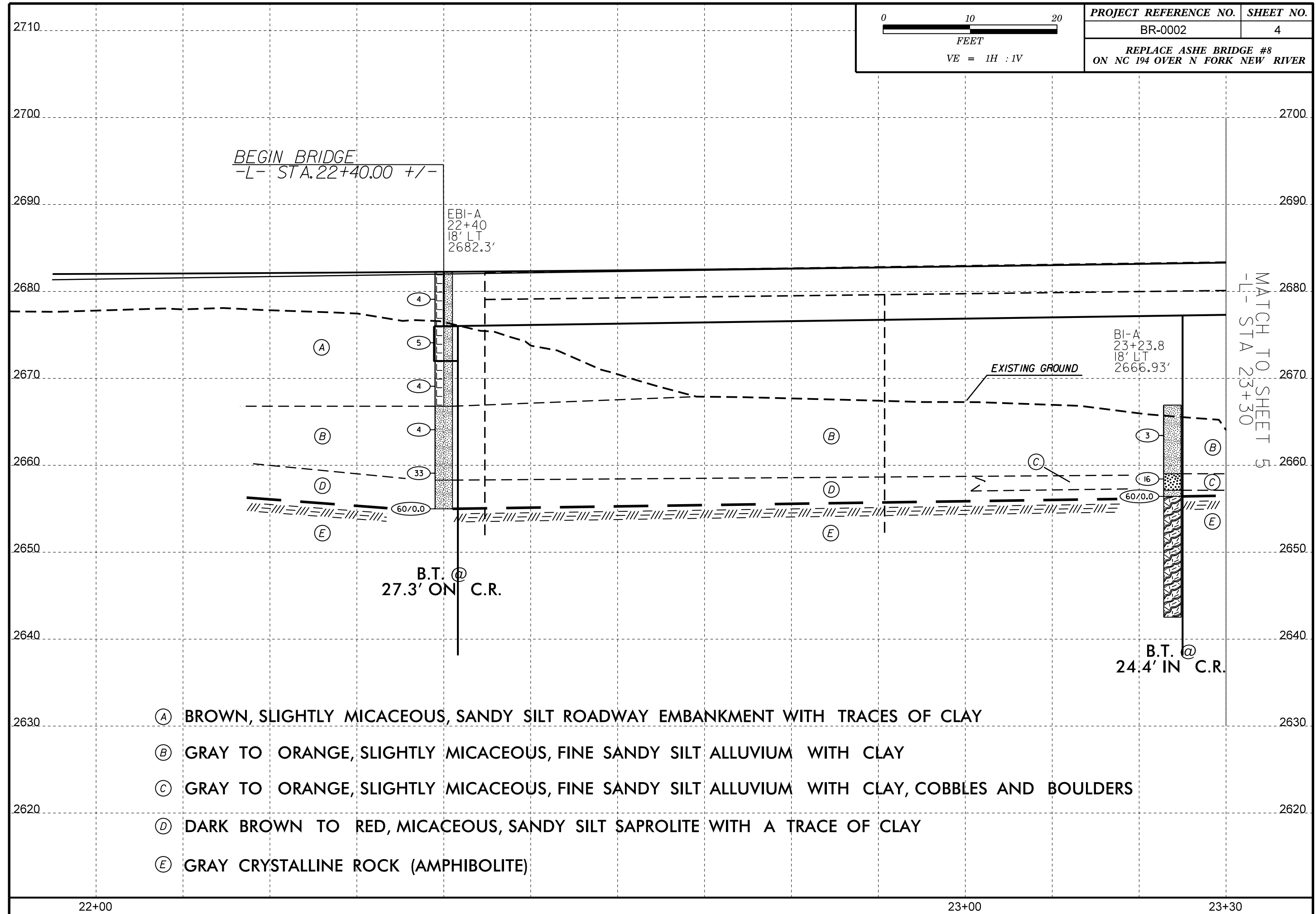
<p><b>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</b></p> <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.</p> <p><b>STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS</b></p>	<p><b>VERY GOOD</b> Very rough, fresh unweathered surfaces</p>	<p><b>GOOD</b> Rough, slightly weathered, iron stained surfaces</p>	<p><b>FAIR</b> Smooth, moderately weathered and altered surfaces</p>	<p><b>POOR</b> Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p>	<p><b>VERY POOR</b> Slickensided, highly weathered surfaces with soft clay coatings or fillings</p>
<p><b>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</b></p> <p>From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.</p> <p><b>COMPOSITION AND STRUCTURE</b></p>	<p><b>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</b></p>	<p><b>VERY GOOD</b> - Very Rough, fresh unweathered surfaces</p>	<p><b>GOOD</b> - Rough, slightly weathered surfaces</p>	<p><b>FAIR</b> - Smooth, moderately weathered and altered surfaces</p>	<p><b>POOR</b> - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p>	<p><b>VERY POOR</b> - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>
<p><b>INTACT OR MASSIVE</b> - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p><b>BLOCKY</b> - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p><b>VERY BLOCKY</b> - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p><b>BLOCKY/DISTURBED/SEAMY</b> - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p><b>DISINTEGRATED</b> - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p><b>LAMINATED/SHEARED</b> - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	<p>DECREASING INTERLOCKING OF ROCK PIECES</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>
<p><b>A. Thick bedded, very blocky sandstone</b> The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.</p> <p><b>B. Sandstone with thin inter-layers of siltstone</b></p> <p><b>C. Sandstone and siltstone in similar amounts</b></p> <p><b>D. Siltstone or silty shale with sandstone layers</b></p> <p><b>E. Weak siltstone or clayey shale with sandstone layers</b></p> <p><b>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</b></p> <p><b>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</b></p> <p><b>H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.</b></p> <p>→ Means deformation after tectonic disturbance</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>	<p>DECREASING SURFACE QUALITY</p>







<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
BR-0002	4
<b>REPLACE ASHE BRIDGE #8 ON NC 194 OVER N FORK NEW RIVER</b>	

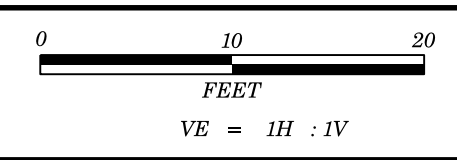


- (A) BROWN, SLIGHTLY MICACEOUS, SANDY SILT ROADWAY EMBANKMENT WITH TRACES OF CLAY
- (B) GRAY TO ORANGE, SLIGHTLY MICACEOUS, FINE SANDY SILT ALLUVIUM WITH CLAY
- (C) GRAY TO ORANGE, SLIGHTLY MICACEOUS, FINE SANDY SILT ALLUVIUM WITH CLAY, COBBLES AND BOULDERS
- (D) DARK BROWN TO RED, MICACEOUS, SANDY SILT SAPROLITE WITH A TRACE OF CLAY
- (E) GRAY CRYSTALLINE ROCK (AMPHIBOLITE)

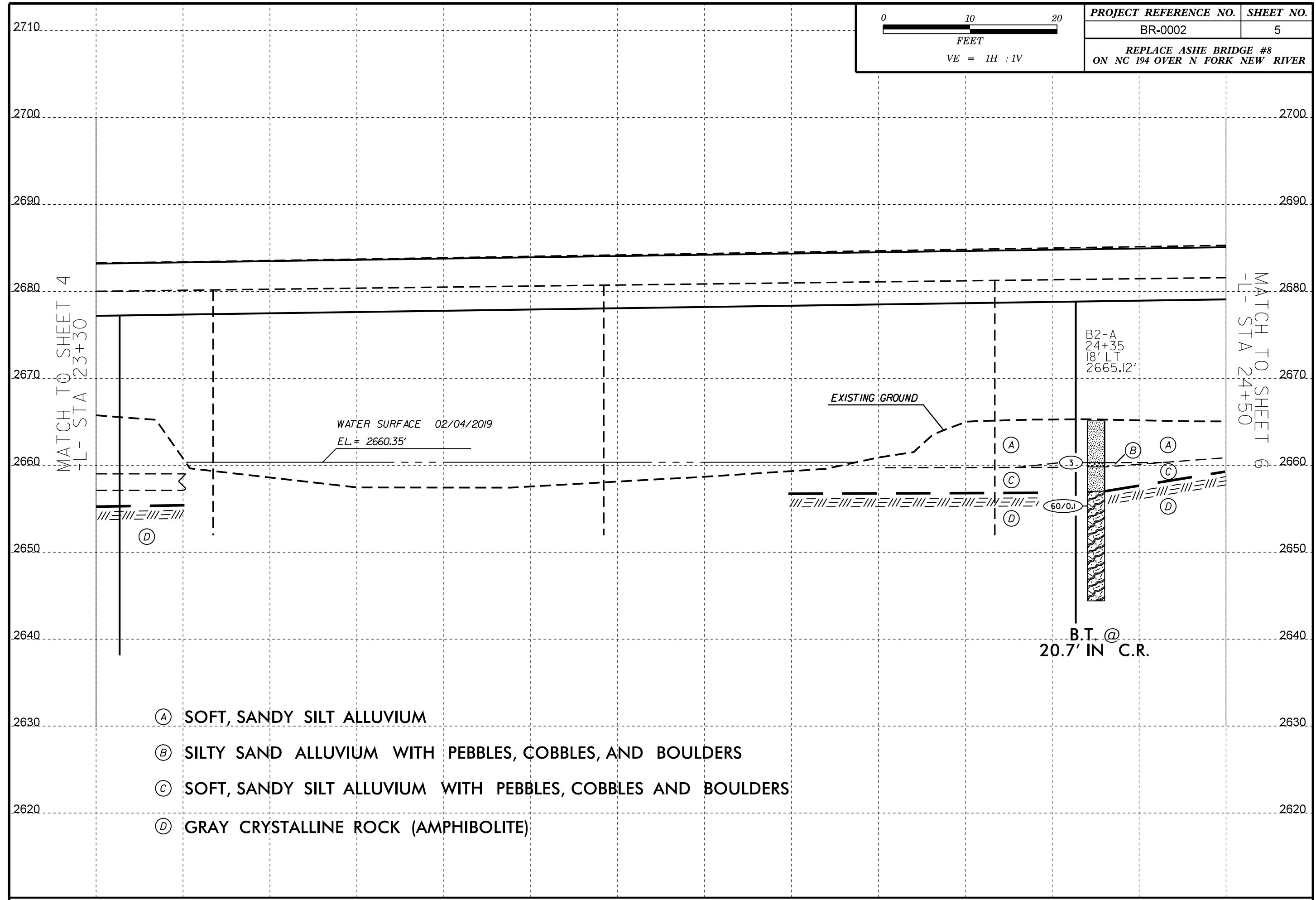
22+00

23+00

23+30



<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
BR-0002	5
<b>REPLACE ASHE BRIDGE #8 ON NC 194 OVER N FORK NEW RIVER</b>	

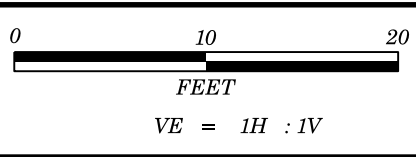


- Ⓐ SOFT, SANDY SILT ALLUVIUM
- Ⓑ SILTY SAND ALLUVIUM WITH PEBBLES, COBBLES, AND BOULDERS
- Ⓒ SOFT, SANDY SILT ALLUVIUM WITH PEBBLES, COBBLES AND BOULDERS
- Ⓓ GRAY CRYSTALLINE ROCK (AMPHIBOLITE)

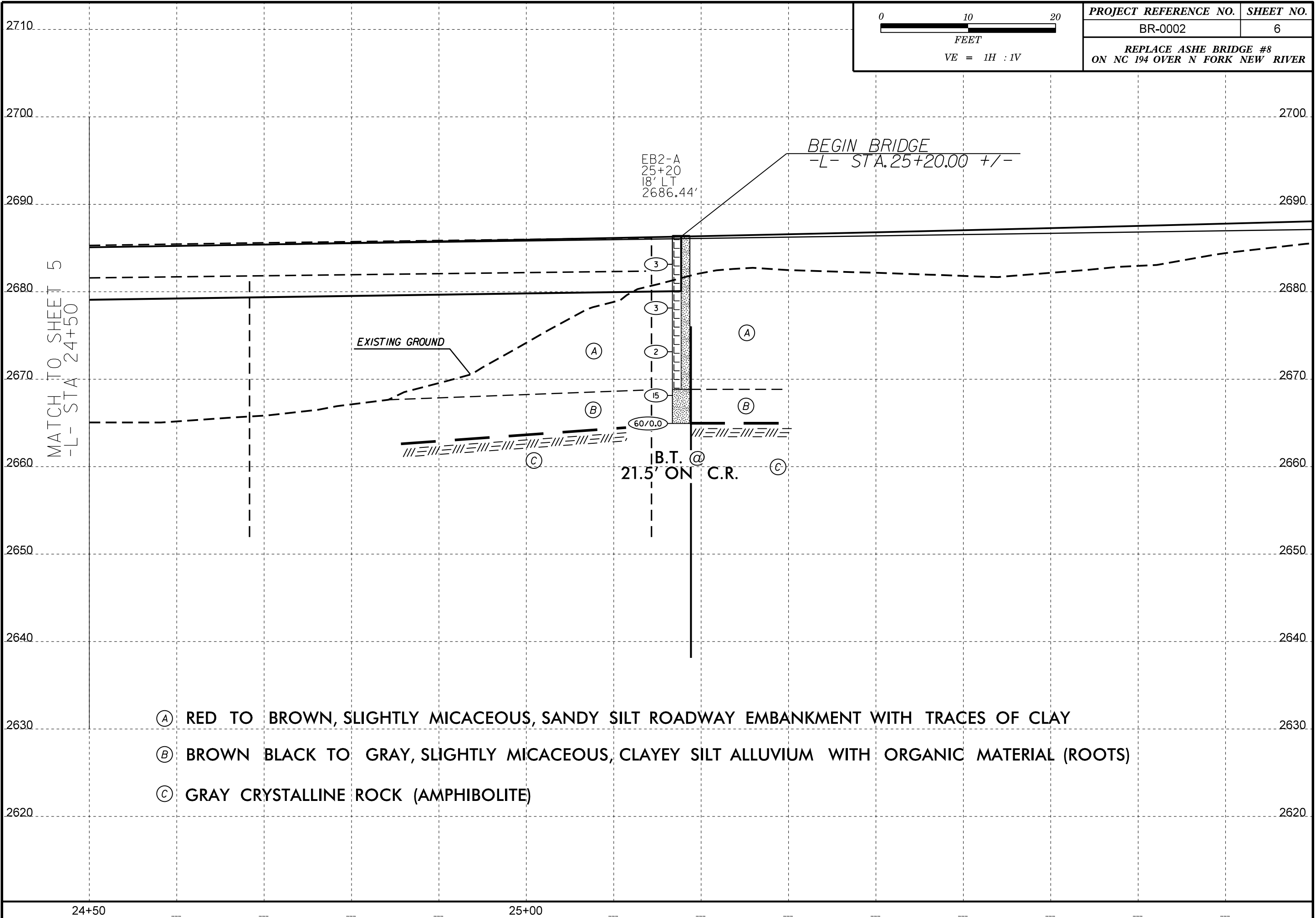
23+30

24+00

24+50



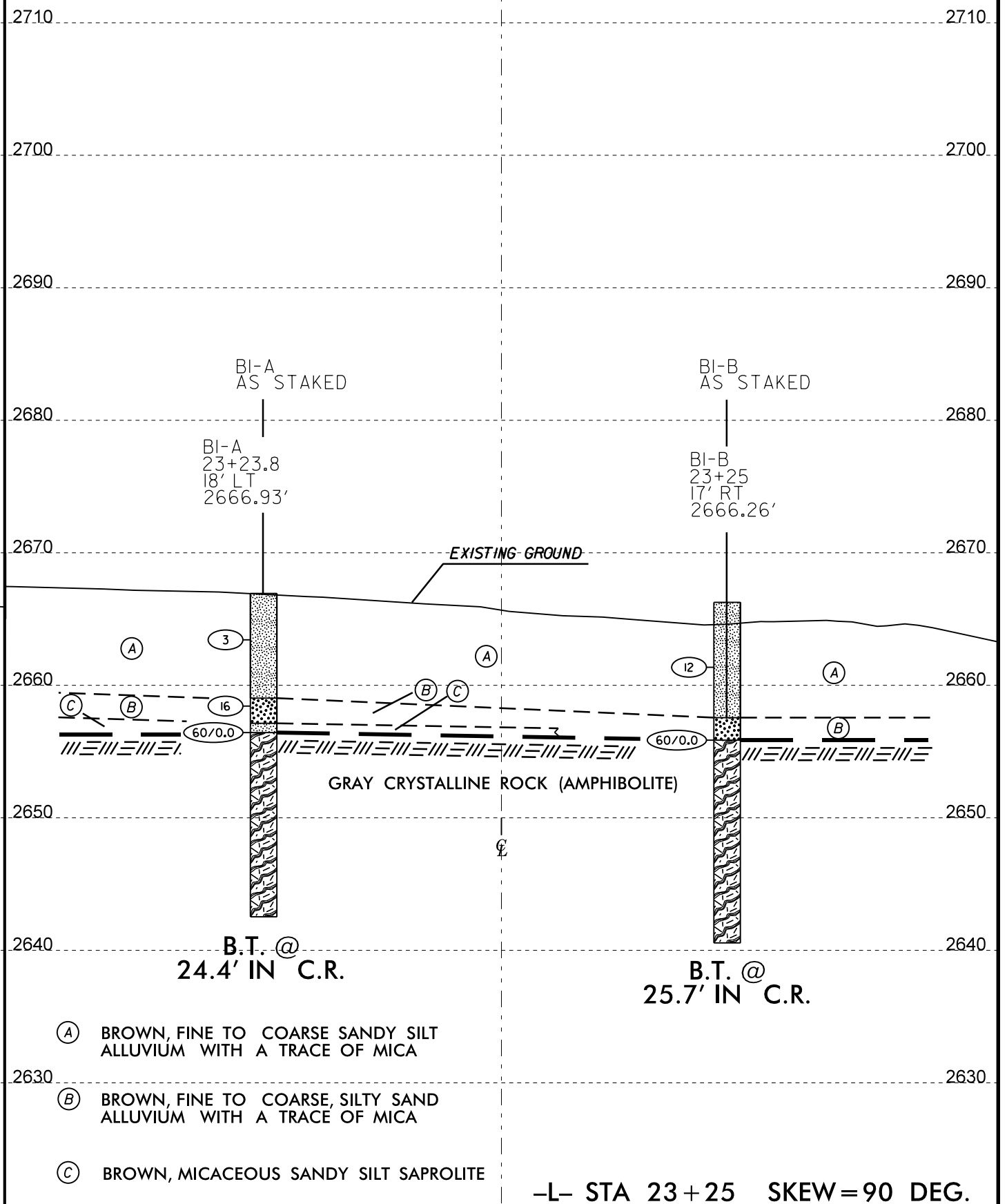
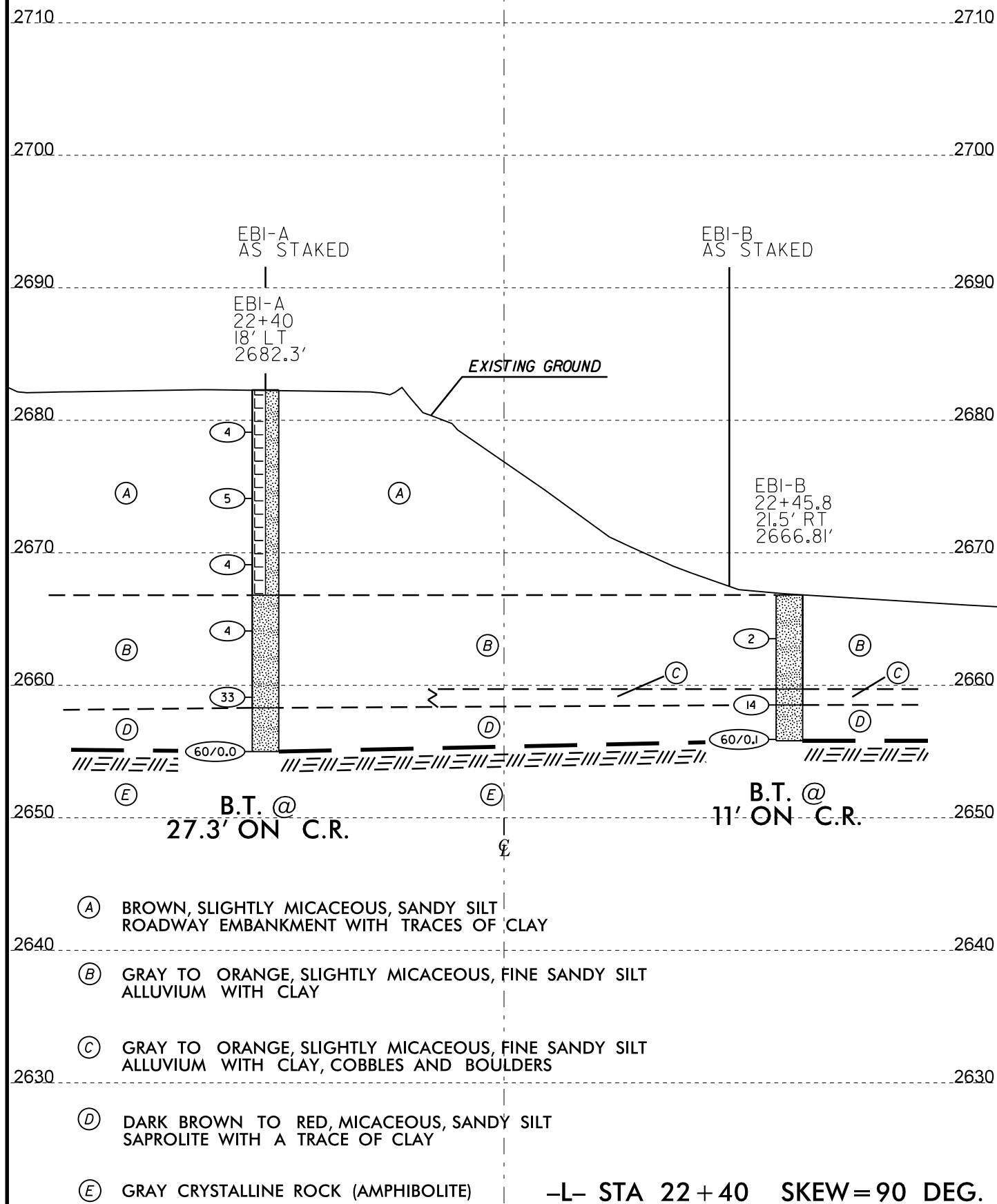
PROJECT REFERENCE NO.	SHEET NO.
BR-0002	6
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N FORK NEW RIVER	



- Ⓐ RED TO BROWN, SLIGHTLY MICACEOUS, SANDY SILT ROADWAY EMBANKMENT WITH TRACES OF CLAY
- Ⓑ BROWN BLACK TO GRAY, SLIGHTLY MICACEOUS, CLAYEY SILT ALLUVIUM WITH ORGANIC MATERIAL (ROOTS)
- Ⓒ GRAY CRYSTALLINE ROCK (AMPHIBOLITE)

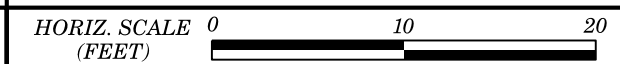
24+50

25+00



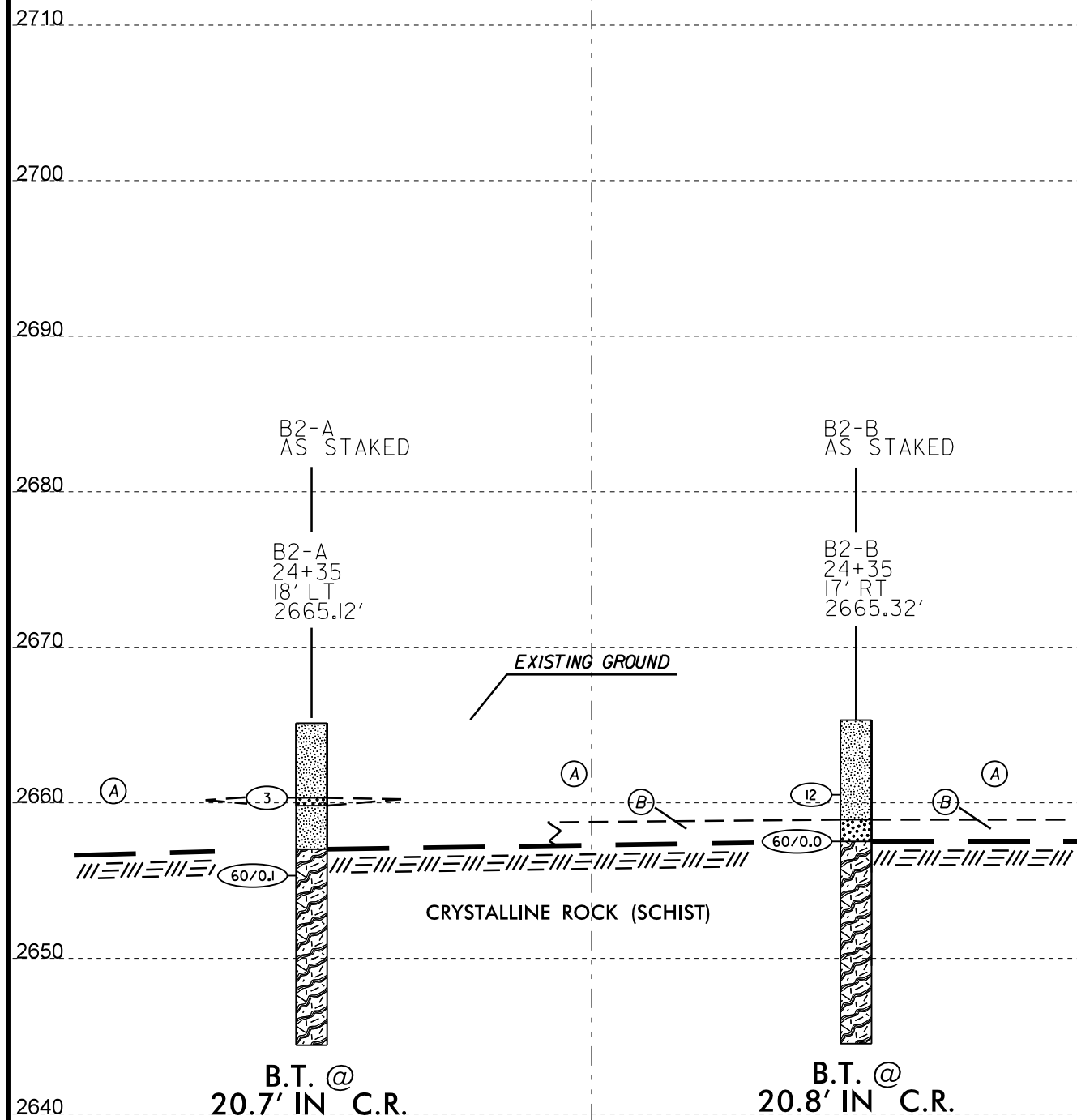
VE = 1H:1V

SECTION ALONG EBI



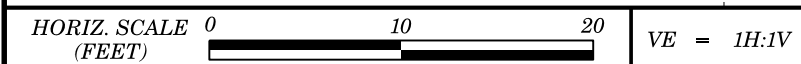
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SECTION ALONG BI

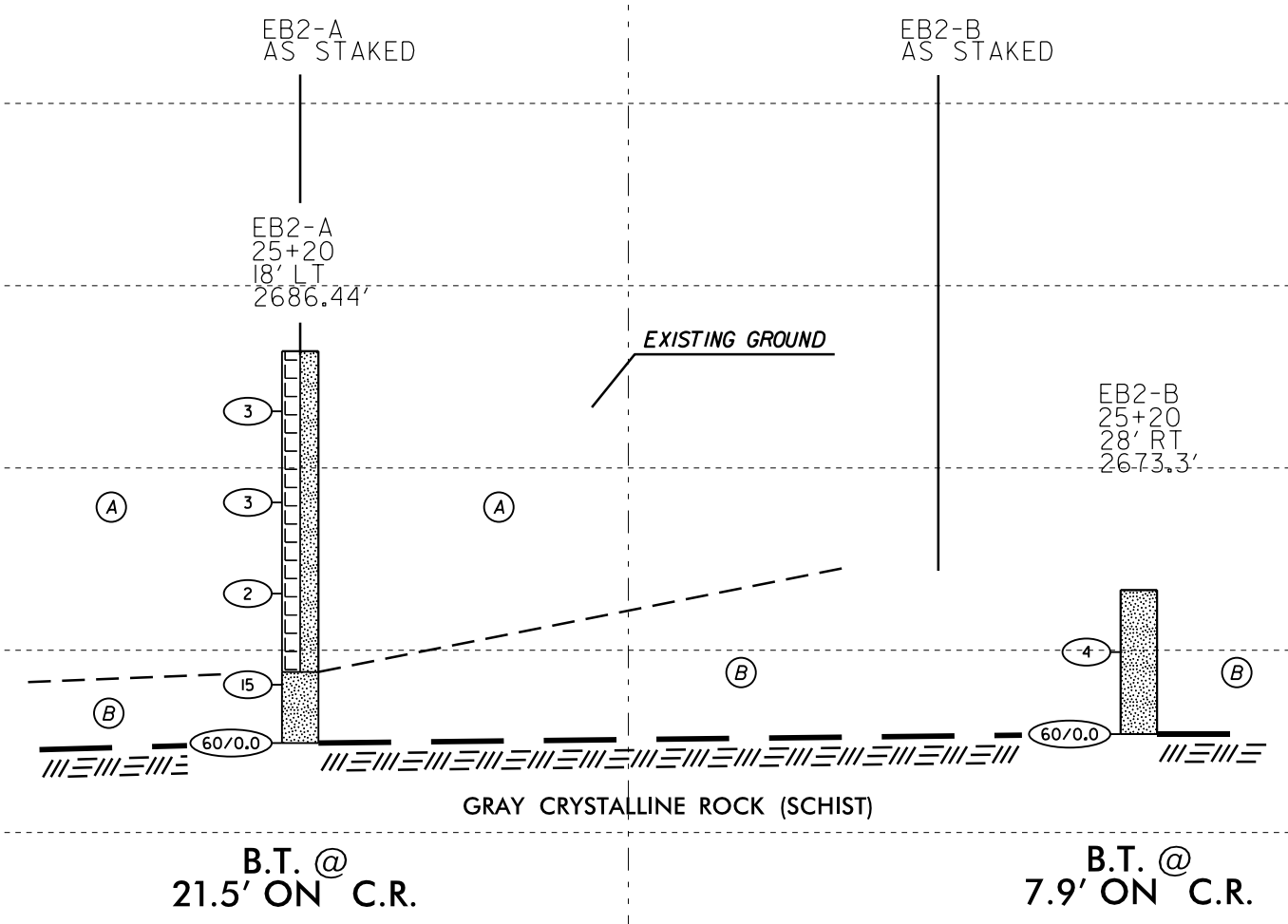


- (A) SOFT, BROWN, SANDY SILT ALLUVIUM
- (B) BROWN, SLIGHTLY MICACEOUS, SILTY SAND ALLUVIUM WITH PEBBLES, COBBLES, AND BOULDERS

-L- STA 24+35 SKEW=90 DEG.

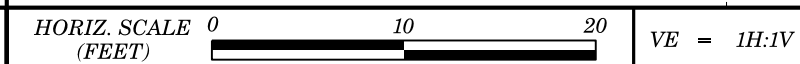


**SECTION ALONG B2**



- (A) RED TO BROWN, SLIGHTLY MICACEOUS, SANDY SILT ROADWAY EMBANKMENT WITH A TRACE OF CLAY
- (B) BROWN BLACK TO GRAY, SLIGHTLY MICACEOUS, CLAYEY SILT ALLUVIUM WITH ORGANIC MATERIAL (ROOTS)

-L- STA 25+20 SKEW=90 DEG.



**SECTION ALONG EB2**

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 22+40		OFFSET 18 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,682.3 ft		TOTAL DEPTH 27.3 ft		NORTHING 997,900		EASTING 1,261,495										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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						
2685																
														2,682.3	GROUND SURFACE	0.0
2680	2,679.1	3.2													ROADWAY EMBANKMENT BROWN, SL MIC, SND-SLT w/TR CL, PIECES OF ASPHALT, GRVLS	
			2	2	2											
2675	2,674.1	8.2														
			1	2	3											
2670	2,669.1	13.2														
			1	2	2											
2665	2,664.1	18.2													ALLUVIAL GREY TO ORANGE, SL MIC, FN SND-SLT w/CL	15.5
			2	2	2											
2660	2,659.1	23.2														
			4	13	20											
2655	2,655.0	27.3													SAPROLITE DK BROWN-RED, MIC, SND-SLT w/TR CL, SAPROLITIC TEXTURE	27.3
		60/0.0													CRYSTALLINE ROCK GREY CRYSTALLINE ROCK (AMPHIBOLITE) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,655.0 ft ON CRYSTALLINE ROCK (AMPHIBOLITE)	

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 22+46		OFFSET 22 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,673.3 ft		TOTAL DEPTH 11.0 ft		NORTHING 997,879		EASTING 1,261,529										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		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						
2675																
														2,673.3	GROUND SURFACE	0.0
2670	2,670.0	3.3													ALLUVIAL BLACK, SL MIC, CL-SND-SLT	
			1	1	1											
2665	2,665.0	8.3													COBBLES/BLDRS @7.1'	7.1
			12	7	7											8.3
	2,662.4	10.9													SAPROLITE BLACK TO BRN-RED, MIC, SND-SLT w/FEW RK FRAGS	11.0
															CRYSTALLINE ROCK BROWN CRYSTALLINE ROCK (SCHIST) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,662.3 ft ON CRYSTALLINE ROCK (SCHIST)	
		60/0.1														

NCDOT BORE DOUBLE BR0002\_BRD0008\_ASH\_BOREHOLES.GPJ NC\_DOT\_GDT 7/19/19



# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)									
BORING NO. B1-A		STATION 23+24		OFFSET 18 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,666.9 ft		TOTAL DEPTH 24.4 ft		NORTHING 997,963		EASTING 1,261,551										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
2670																
2665	2,663.4	3.5	2	2	1											
2660	2,658.4	8.5	8	9	7											
2655	2,656.4	10.5	60/0.0													
2650																
2645																

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)					
BORING NO. B1-A		STATION 23+24		OFFSET 18 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,666.9 ft		TOTAL DEPTH 24.4 ft		NORTHING 997,963		EASTING 1,261,551						
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic						
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A						
CORE SIZE nxwl			TOTAL RUN 13.9 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
2656.43												
2655	2,656.4	10.5	3.9	N=60/0.0	(3.6) 92%	(3.0) 77%					Begin Coring @ 10.5 ft CRYSTALLINE ROCK	10.5
	2,652.5	14.4										
2650			5.0		(5.0) 100%	(4.7) 94%					GSI 80 - 90	
	2,647.5	19.4										
2645			5.0		(5.0) 100%	(4.7) 94%						
	2,642.5	24.4									Boring Terminated at Elevation 2,642.5 ft IN CRYSTALLINE ROCK (SCHIST)	

NCDOT BORE DOUBLE BR0002\_BRDG0008\_ASHE\_BOREHOLES.GPJ\_NC\_DOT.GDT 7/19/19

NCDOT BORE DOUBLE BR0002\_BRDG0008\_ASHE\_BOREHOLES.GPJ\_NC\_DOT.GDT 7/19/19



# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)								
BORING NO. B2-A		STATION 24+35		OFFSET 18 ft LT		ALIGNMENT L									
COLLAR ELEV. 2,665.1 ft		TOTAL DEPTH 20.7 ft		NORTHING 998,048		EASTING 1,261,623									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		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					
2670															
2665														2,665.1	0.0
2660	2,660.3	4.8												2,660.3	4.8
2655	2,655.3	9.8	50	2	1								2,657.0	8.1	
2650															
2645															
Boring Terminated at Elevation 2,644.4 ft IN CRYSTALLINE ROCK (SCHIST)															

NCDOT BORE DOUBLE BR0002\_BRDG0008\_ASHE\_BOREHOLES.GPJ NC\_DOT.GDT 7/19/19

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.						
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)					
BORING NO. B2-A		STATION 24+35		OFFSET 18 ft LT		ALIGNMENT L						
COLLAR ELEV. 2,665.1 ft		TOTAL DEPTH 20.7 ft		NORTHING 998,048		EASTING 1,261,623						
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD NW Casing WSPT & Core		HAMMER TYPE Automatic						
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
2655.82												
2655	2,655.8	9.3	1.4	N=60/0.1	(1.2) 86%	(1.2) 86%						
	2,654.4	10.7	5.0		(5.0) 100%	(4.5) 90%						
2650	2,649.4	15.7	5.0		(4.9) 98%	(4.9) 98%						
2645	2,644.4	20.7									GSI 80 - 90	
Continued from previous page												

NCDOT BORE DOUBLE BR0002\_BRDG0008\_ASHE\_BOREHOLES.GPJ NC\_DOT.GDT 7/19/19

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)							
BORING NO. B2-B		STATION 24+35		OFFSET 17 ft RT		ALIGNMENT L								
COLLAR ELEV. 2,665.3 ft		TOTAL DEPTH 20.8 ft		NORTHING 998,025		EASTING 1,261,649								
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
2670														
2665														2,665.3 GROUND SURFACE 0.0
2660	2,660.5	4.8	4	6	9									ALLUVIAL Brown, sandy silt with mica and a trace of clay
2655	2,657.5	7.8	60/0.0											2,658.9 6.4 2,657.5 7.8 ALLUVIAL Brown, silty sand with cobbles and boulders
2650														CRYSTALLINE ROCK
2645														Boring Terminated at Elevation 2,644.5 ft IN CRYSTALLINE ROCK (SCHIST)

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.					
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)				
BORING NO. B2-B		STATION 24+35		OFFSET 17 ft RT		ALIGNMENT L					
COLLAR ELEV. 2,665.3 ft		TOTAL DEPTH 20.8 ft		NORTHING 998,025		EASTING 1,261,649					
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017		DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic							
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A					
CORE SIZE n x w l			TOTAL RUN 13.0 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
2657.52	2,657.5	7.8	3.0		(2.9) 97%	(2.9) 97%					Continued from previous page
2655	2,654.5	10.8	5.0		(4.9) 98%	(4.7) 94%					CRYSTALLINE ROCK
2650	2,649.5	15.8	5.0		(4.5) 90%	(4.1) 82%					GSI 80 - 90
2645	2,644.5	20.8									Boring Terminated at Elevation 2,644.5 ft IN CRYSTALLINE ROCK (SCHIST)

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 25+20		OFFSET 18 ft LT		ALIGNMENT L									
COLLAR ELEV. 2,686.4 ft		TOTAL DEPTH 21.5 ft		NORTHING 998,112		EASTING 1,261,678									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2690															
2685	2,683.1	3.3	1	1	2										2,686.4
GROUND SURFACE 0.0															
ROADWAY EMBANKMENT RED-BROWN, SL MIC, CL-SND-SLT															
2680	2,678.1	8.3	1	1	2										
2675	2,673.1	13.3	1	1	1										
2670	2,668.1	18.3	4	7	8										2,668.8
2665	2,664.9	21.5													2,664.9
ALLUVIAL BRN-BLACK TO GREY, SL MIC, CL-SLT w/ORGX (ROOTS) 17.6															
CRYSTALLINE ROCK BROWN CRYSTALLINE ROCK (SCHIST) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,664.9 ft ON CRYSTALLINE ROCK (SCHIST) 21.5															

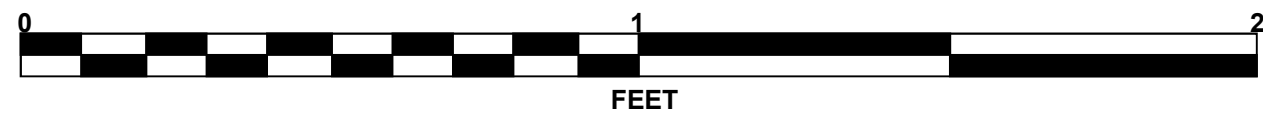
WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BRIDGE #8 ON NC194 OVER NORTH FORK NEW RIVER							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 25+20		OFFSET 28 ft RT		ALIGNMENT L									
COLLAR ELEV. 2,673.3 ft		TOTAL DEPTH 7.9 ft		NORTHING 998,082		EASTING 1,261,713									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers			HAMMER TYPE Automatic									
DRILLER Cheek, D. O.		START DATE 05/30/19		COMP. DATE 05/30/19		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2675															
GROUND SURFACE 0.0															
ALLUVIAL LT BROWN, SL MIC, CL-SND-SLT HARDER BEGIN 6.6'-7.7'															
2670	2,669.9	3.4	3	1	3										2,673.3
CRYSTALLINE ROCK BROWN CRYSTALLINE ROCK (SCHIST) Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 2,665.4 ft ON CRYSTALLINE ROCK (SCHIST) 7.9															



# CORE PHOTOGRAPHS

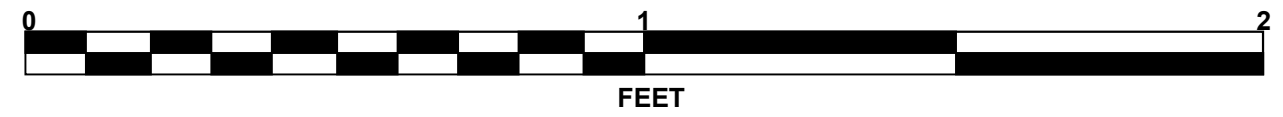
## B1-A

BOX 1 OF 2: 10.5 - 19.4 FEET  
GSI 80 - 90



## B1-A

BOX 2 OF 2: 19.4 - 24.4 FEET  
GSI 80 - 90





# CORE PHOTOGRAPHS

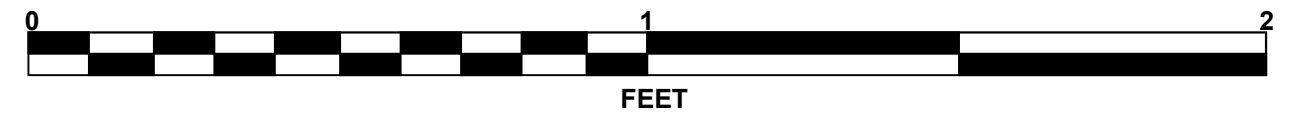
## B1-B

BOX 1 OF 2: 10.4 - 20.2 FEET  
GSI 80 - 90



## B1-B

BOX 2 OF 2: 20.2 - 25.7 FEET  
GSI 80 - 90





# CORE PHOTOGRAPHS

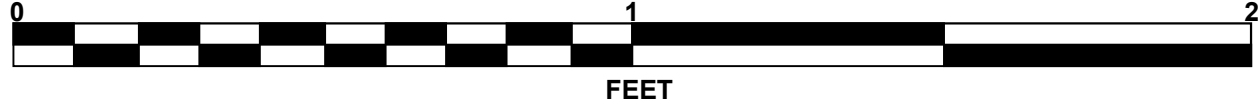
## B2-A

BOX 1 OF 2: 9.3 - 17.5 FEET  
GSI 80 - 90



## B2-A

BOX 2 OF 2: 17.5 - 20.7 FEET  
GSI 80 - 90

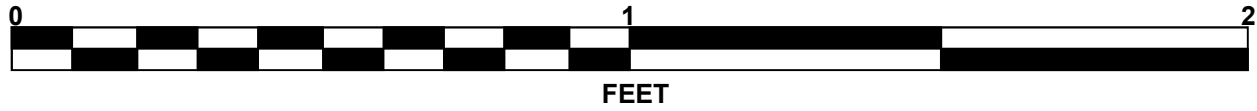




# CORE PHOTOGRAPHS

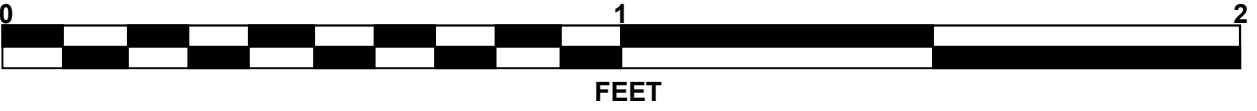
## B2-B

BOX 1 OF 2: 7.8 - 15.8 FEET  
GSI 80 - 90



## B2-B

BOX 2 OF 2: 15.8 - 20.8 FEET  
GSI 80 - 90



REFERENCE: BR-0002

PROJECT: 67002.1.1

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	67002.1.1	1	15

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

**CONTENTS**

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-7	PROFILES
8-12	CROSS SECTIONS
13-15	BORE LOGS

COUNTY ASHE  
PROJECT DESCRIPTION REPLACE ASHE BRIDGE #8  
ON NC 194 OVER NORTH FORK OF NEW RIVER

SITE DESCRIPTION RETAINING WALL #1  
-L- STA 15+00 - 20+00 OFFSET 26.5' RT

**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 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT 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 THE 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.

- NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
  2. 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.

PERSONNEL

C.D. JOHNSON  
D.O. CHEEK  
C.J. COFFEY

INVESTIGATED BY D.M. MULLEN  
DRAWN BY D.M.M.  
CHECKED BY J.C. KUHNE  
SUBMITTED BY J.C. KUHNE  
DATE 6/13/2019



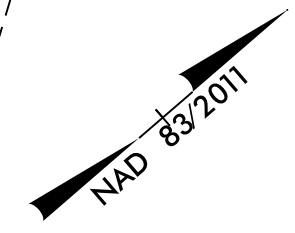
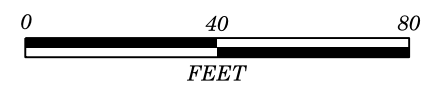
DocuSigned by:  
D Matt Mullen 6/14/2019  
18909BD38840RE DATE

**DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED**



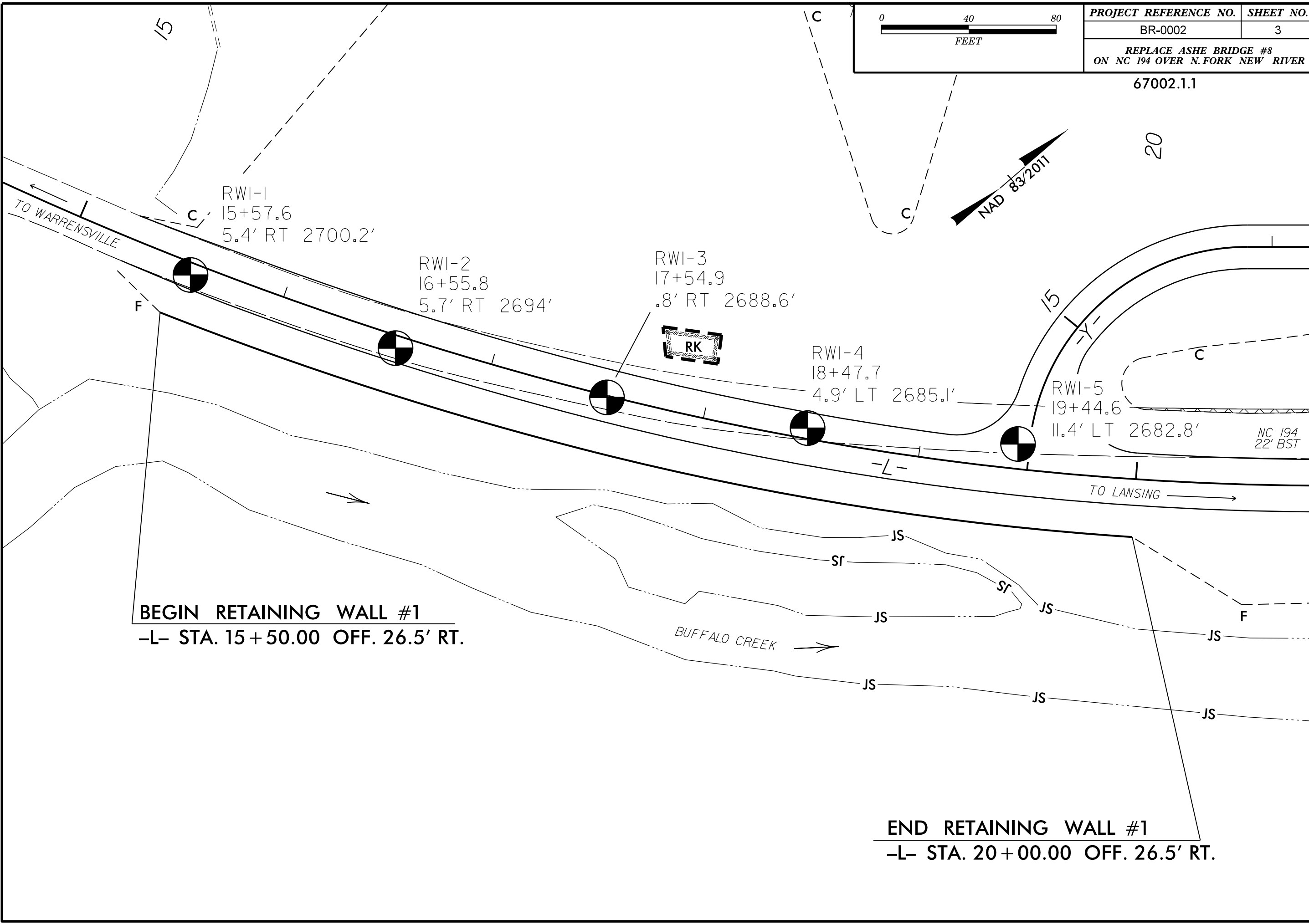
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

Table with multiple sections: SOIL DESCRIPTION, SOIL LEGEND AND AASHTO CLASSIFICATION, GRADATION, MINERALOGICAL COMPOSITION, ROCK DESCRIPTION, TERMS AND DEFINITIONS, CONSISTENCY OR DENSENESS, TEXTURE OR GRAIN SIZE, SOIL MOISTURE - CORRELATION OF TERMS, PLASTICITY, COLOR, MISCELLANEOUS SYMBOLS, RECOMMENDATION SYMBOLS, ABBREVIATIONS, EQUIPMENT USED ON SUBJECT PROJECT, ROCK HARDNESS, FRACTURE SPACING, BEDDING, INDURATION. Includes various symbols, diagrams, and descriptive text for geotechnical engineering.



67002.1.1

20



RWI-1  
15+57.6  
5.4' RT 2700.2'

RWI-2  
16+55.8  
5.7' RT 2694'

RWI-3  
17+54.9  
.8' RT 2688.6'

RWI-4  
18+47.7  
4.9' LT 2685.1'

RWI-5  
19+44.6  
11.4' LT 2682.8'

**BEGIN RETAINING WALL #1**  
-L- STA. 15+50.00 OFF. 26.5' RT.

**END RETAINING WALL #1**  
-L- STA. 20+00.00 OFF. 26.5' RT.

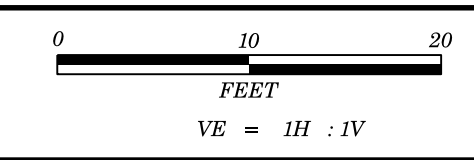
BUFFALO CREEK →

TO WARRENSVILLE ←

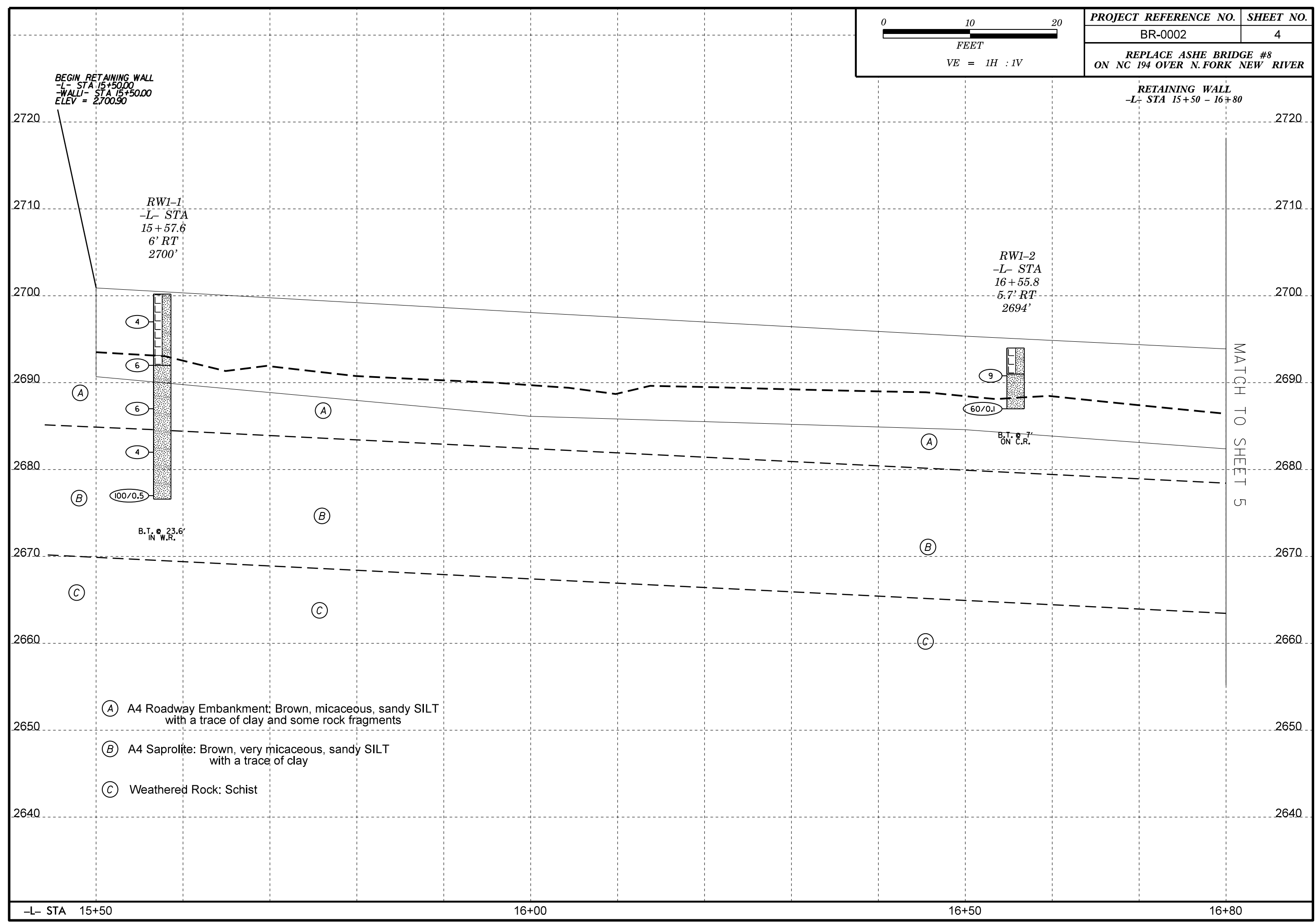
TO LANSING →

NC 194  
22' BST





PROJECT REFERENCE NO.	SHEET NO.
BR-0002	4
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	



BEGIN RETAINING WALL  
-L- STA 15+50.00  
-WALL- STA 15+50.00  
ELEV = 2700.90

RW1-1  
-L- STA 15+57.6  
6' RT  
2700'

RW1-2  
-L- STA 16+55.8  
5.7' RT  
2694'

RETAINING WALL  
-L+ STA 15+50 - 16+80

MATCH TO SHEET 5

(A)

(B)

(C)

(A)

(B)

(C)

(A)

(B)

(C)

(A) A4 Roadway Embankment; Brown, micaceous, sandy SILT with a trace of clay and some rock fragments

(B) A4 Saprolite; Brown, very micaceous, sandy SILT with a trace of clay

(C) Weathered Rock: Schist

B.T. @ 23.6'  
IN W.R.

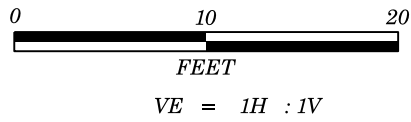
B.T. @ 7'  
ON C.R.

-L- STA 15+50

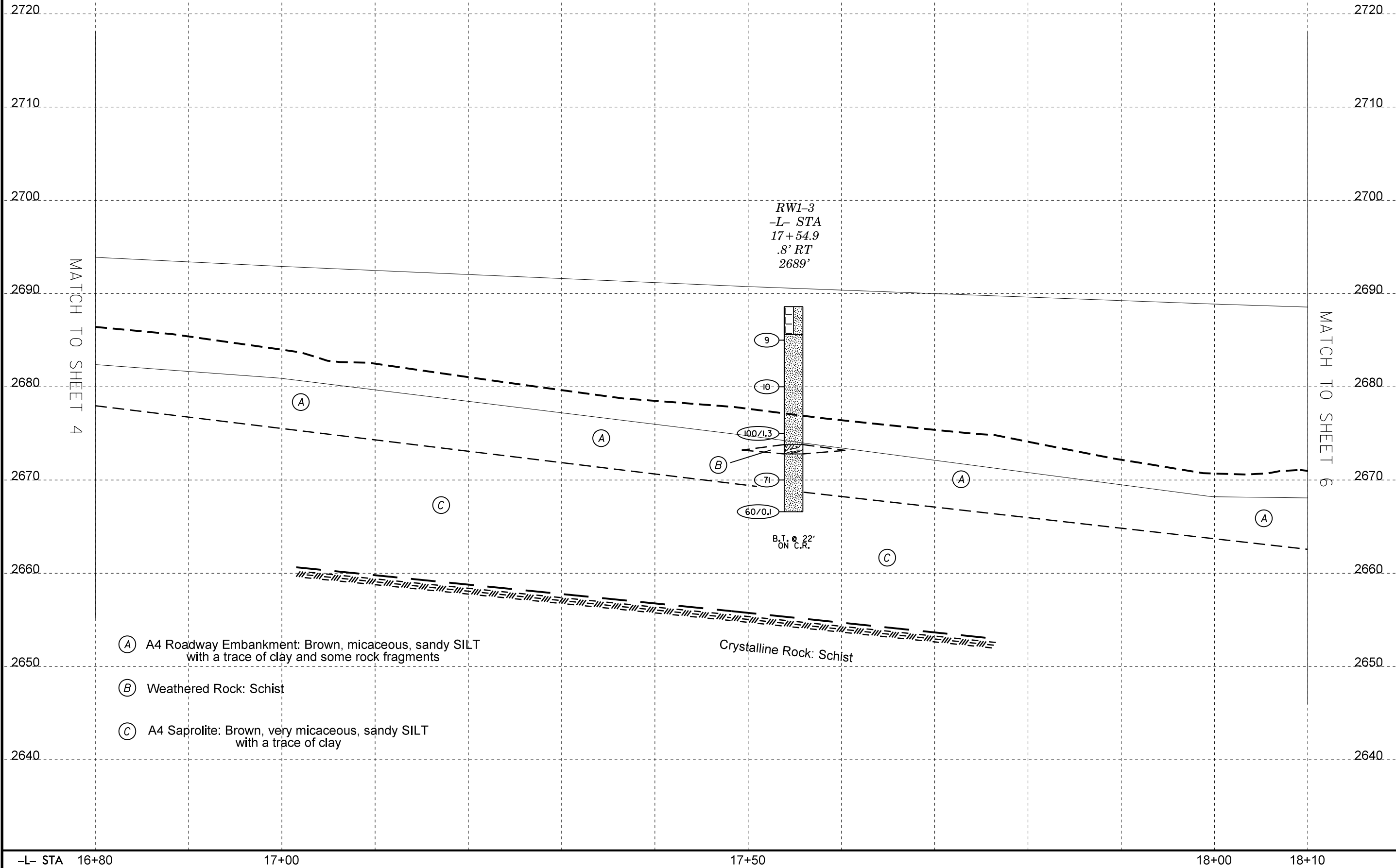
16+00

16+50

16+80



RETAINING WALL  
-L+ STA 15+50 - 16+80



2720

2720

2710

2710

2700

2700

2690

2690

2680

2680

2670

2670

2660

2660

2650

2650

2640

2640

MATCH TO SHEET 4

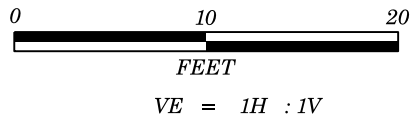
MATCH TO SHEET 6

RW1-3  
-L- STA  
17+54.9  
.8' RT  
2689'

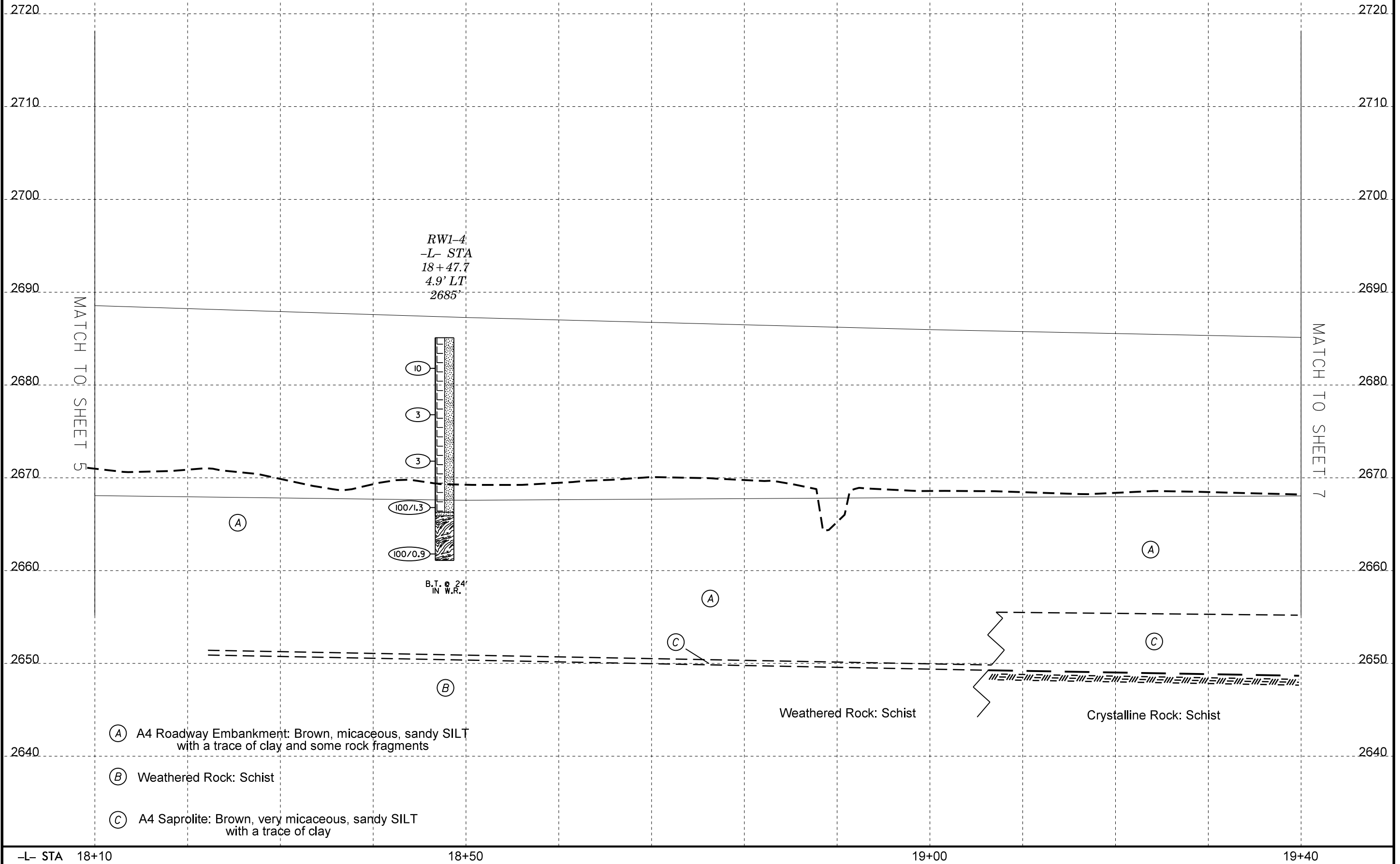
B.T. @ 22'  
ON C.R.

- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) Weathered Rock: Schist
- (C) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay

Crystalline Rock: Schist



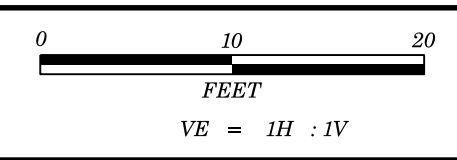
**RETAINING WALL  
-L+ STA 15+50 - 16+80**



- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) Weathered Rock: Schist
- (C) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay

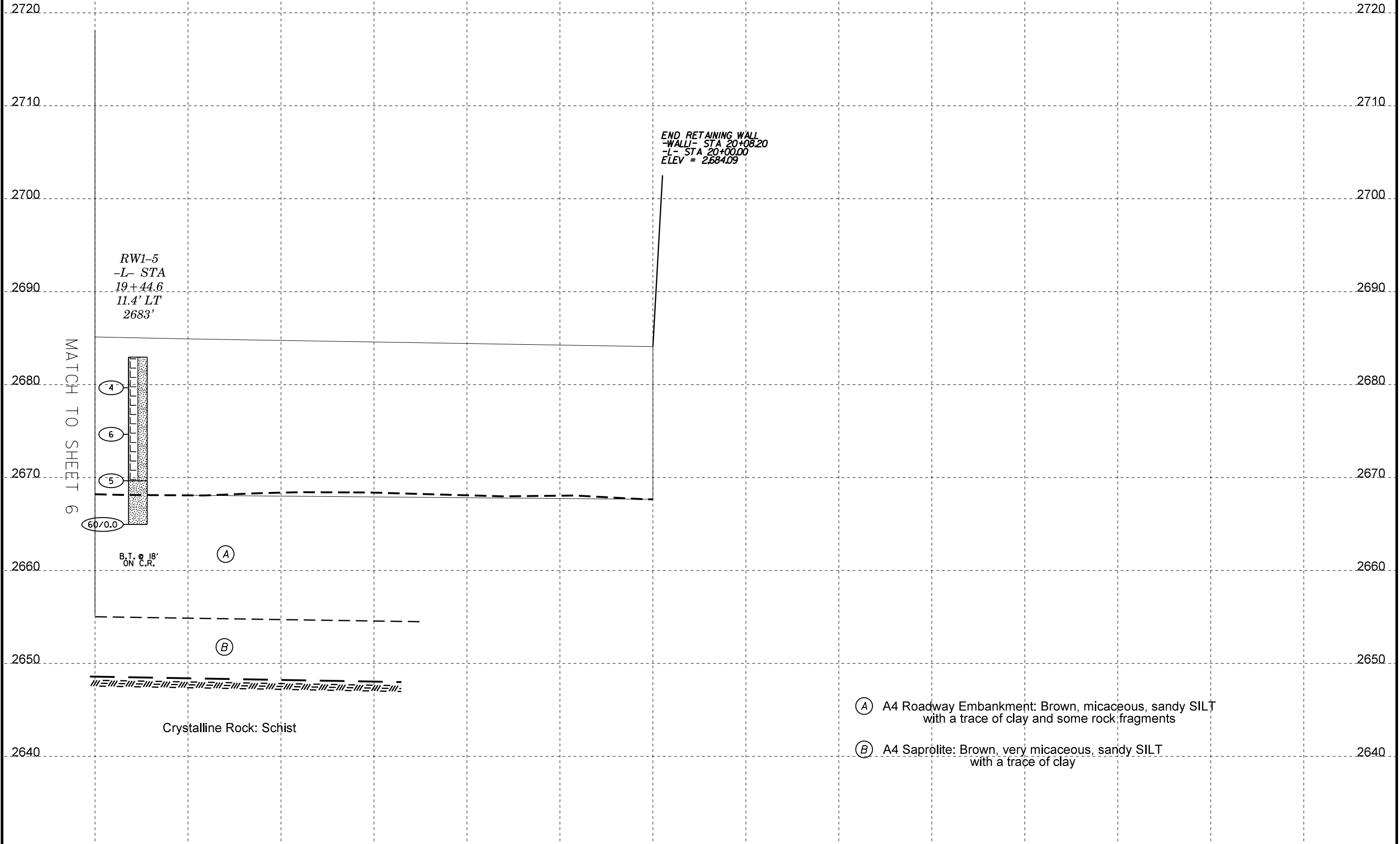
Weathered Rock: Schist

Crystalline Rock: Schist



PROJECT REFERENCE NO.	SHEET NO.
BR-0002	7
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

RETAINING WALL  
-L+ STA 15+50 - 16+80



END RETAINING WALL  
- WALL - STA 20+08.20  
- L - STA 20+00.00  
ELEV = 2684.09

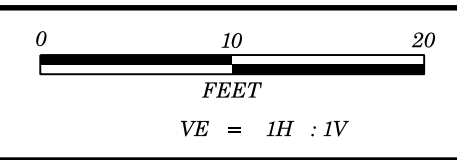
RW1-5  
-L- STA  
19+44.6  
11.4' LT  
2683'

MATCH TO SHEET 6

B.T. @ 18'  
ON C.R.

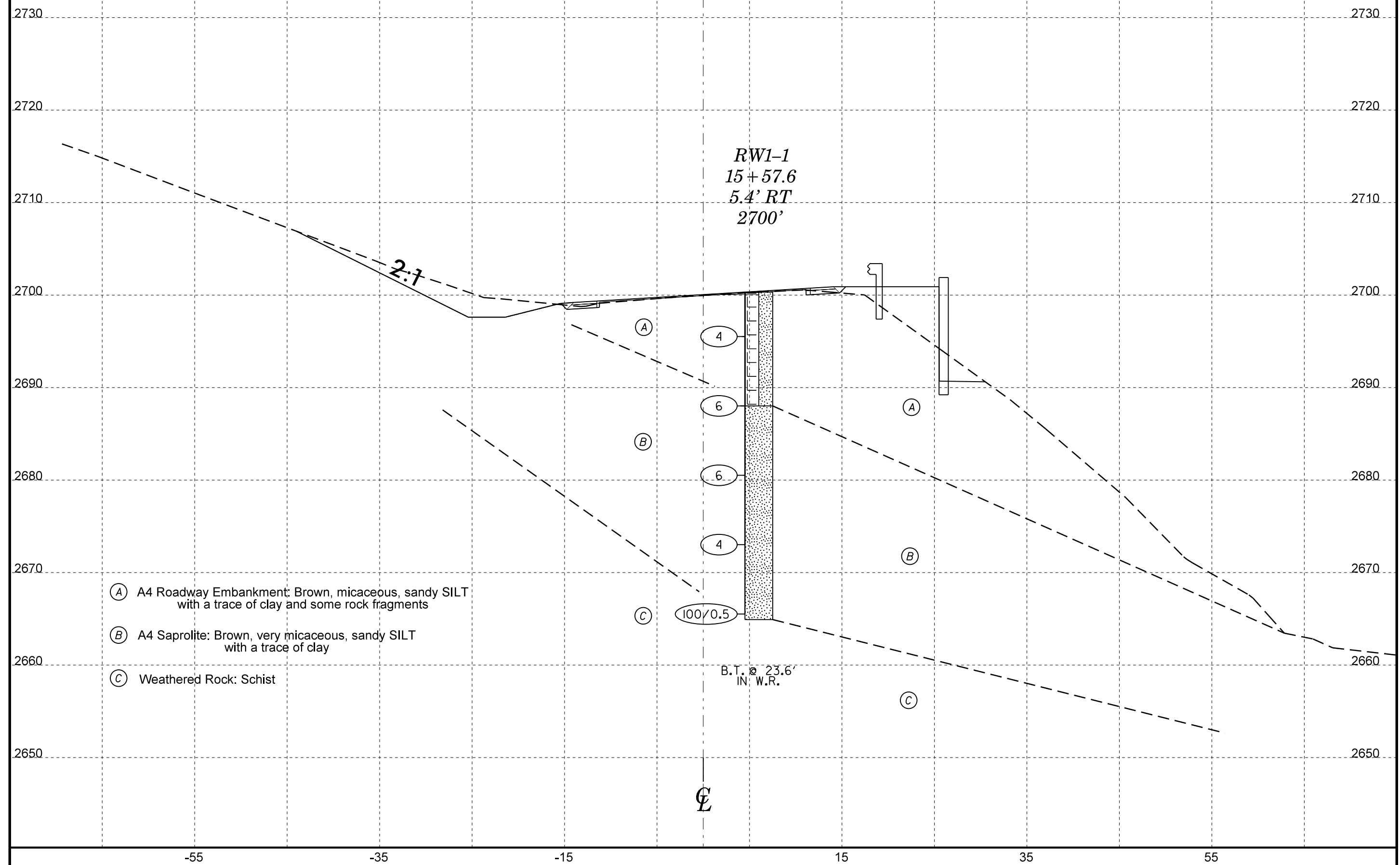
Crystalline Rock: Schist

- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay



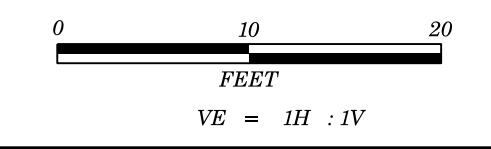
PROJECT REFERENCE NO.	SHEET NO.
BR-0002	8
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

CROSS SECTION: -L- STA 15+50



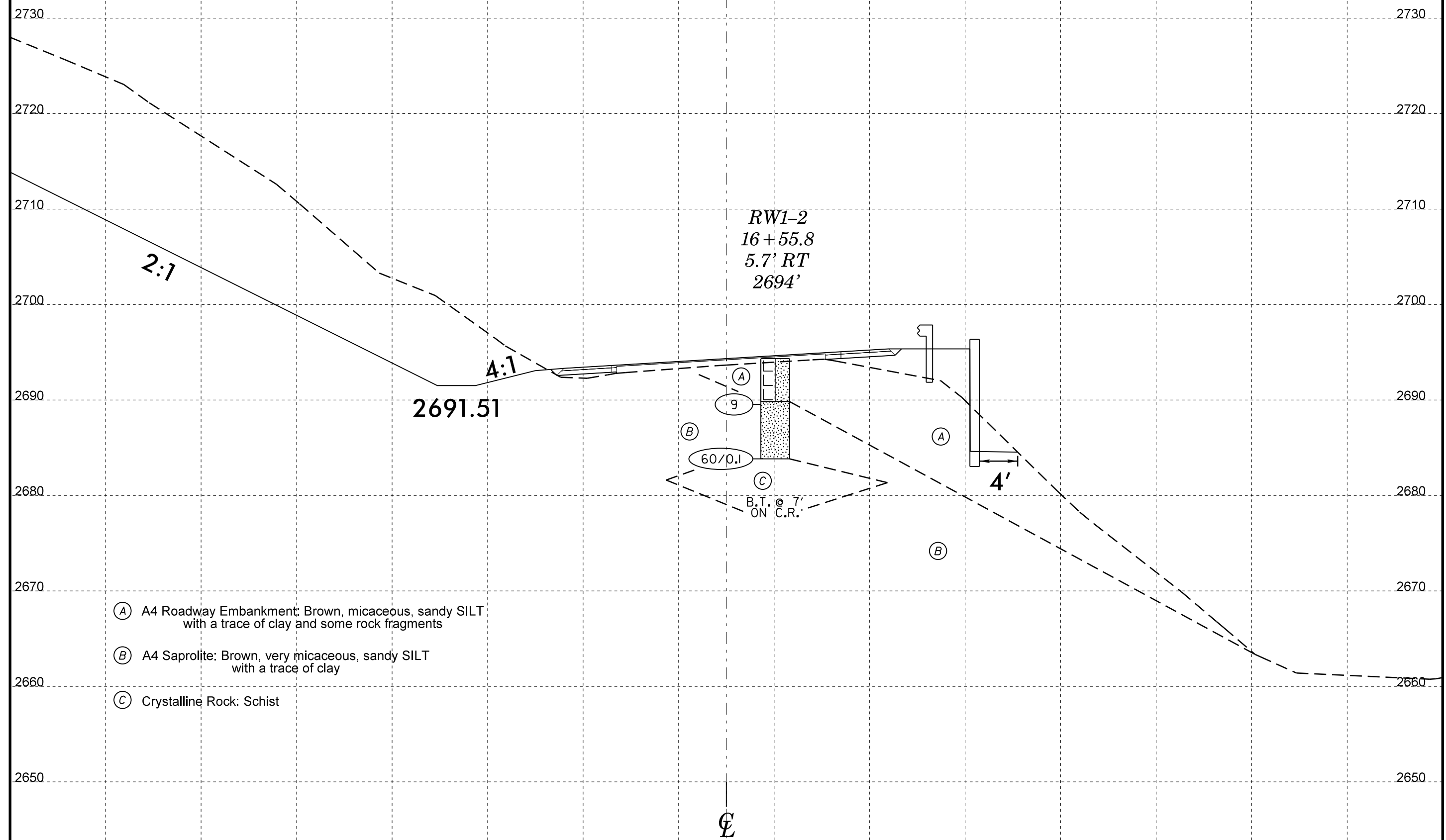
- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay
- (C) Weathered Rock: Schist

4  
6  
6  
4  
100/0.5



PROJECT REFERENCE NO.	SHEET NO.
BR-0002	9
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

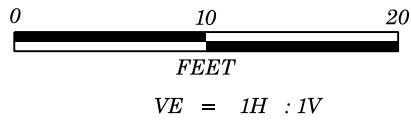
CROSS SECTION: -L- STA 16+50



- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay
- (C) Crystalline Rock: Schist

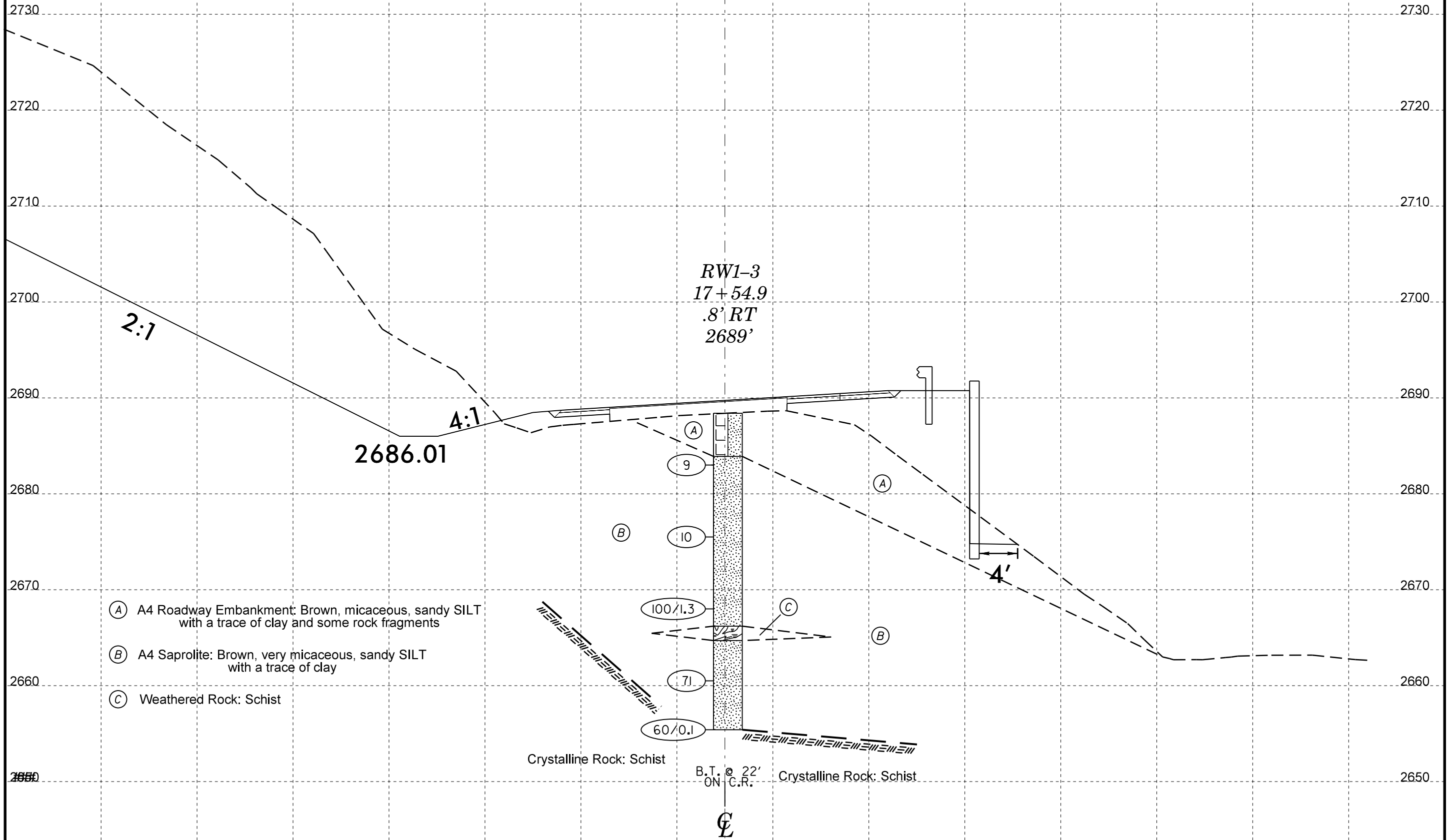
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PROJECT REFERENCE NO.	SHEET NO.
BR-0002	10
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

CROSS SECTION: -L- STA 17+50



- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay
- (C) Weathered Rock: Schist

RW1-3  
17+54.9  
.8' RT  
2689'

2686.01

2:1

4:1

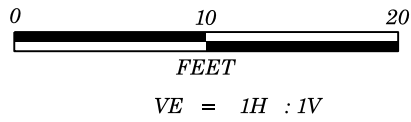
4'

Crystalline Rock: Schist

Crystalline Rock: Schist

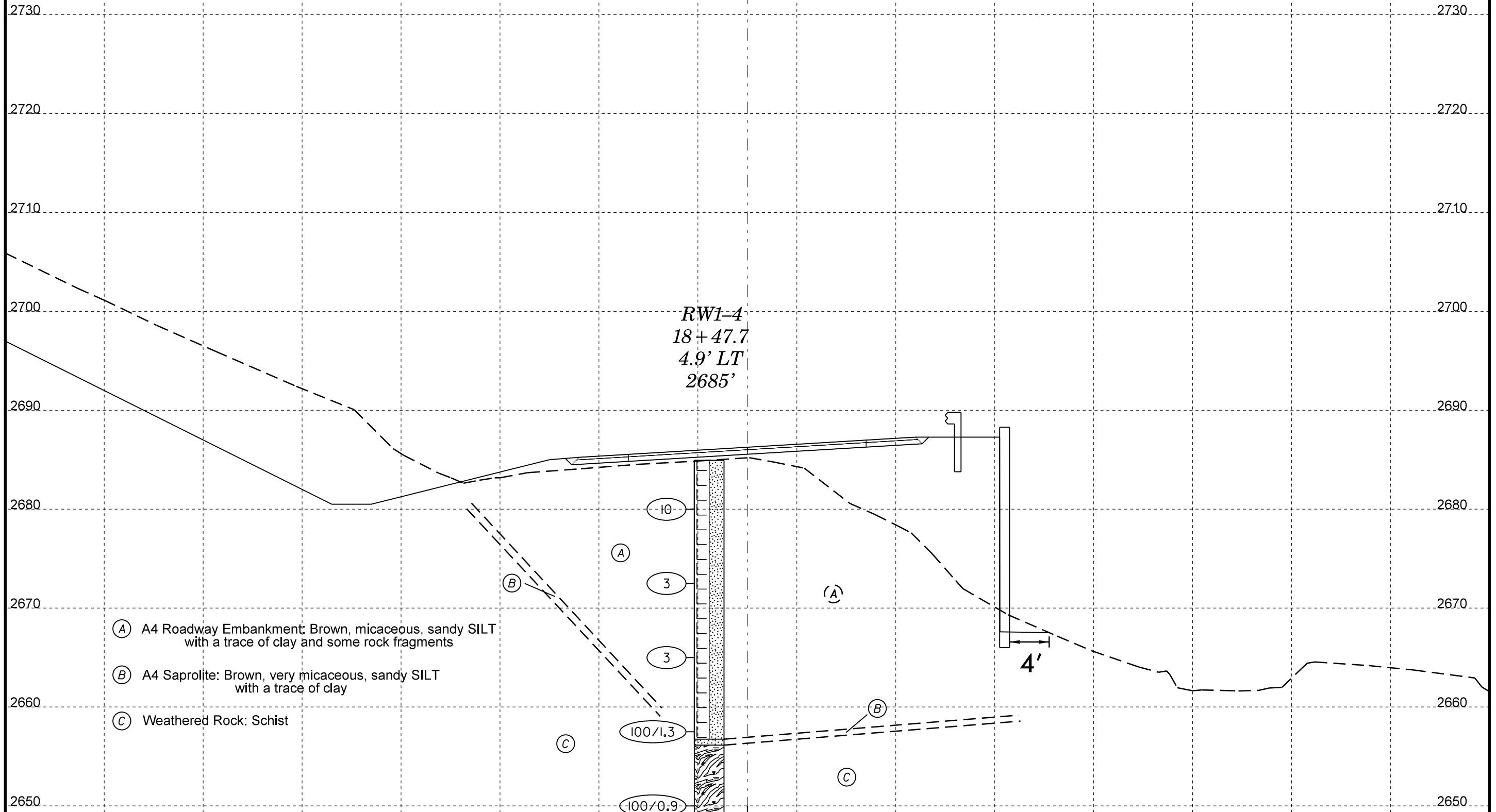
B.T. ON C.R. 22'





PROJECT REFERENCE NO.	SHEET NO.
BR-0002	11
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

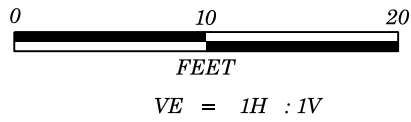
CROSS SECTION: -L- STA 18+50



- (A) A4 Roadway Embankment: Brown, micaceous, sandy SILT with a trace of clay and some rock fragments
- (B) A4 Saprolite: Brown, very micaceous, sandy SILT with a trace of clay
- (C) Weathered Rock: Schist

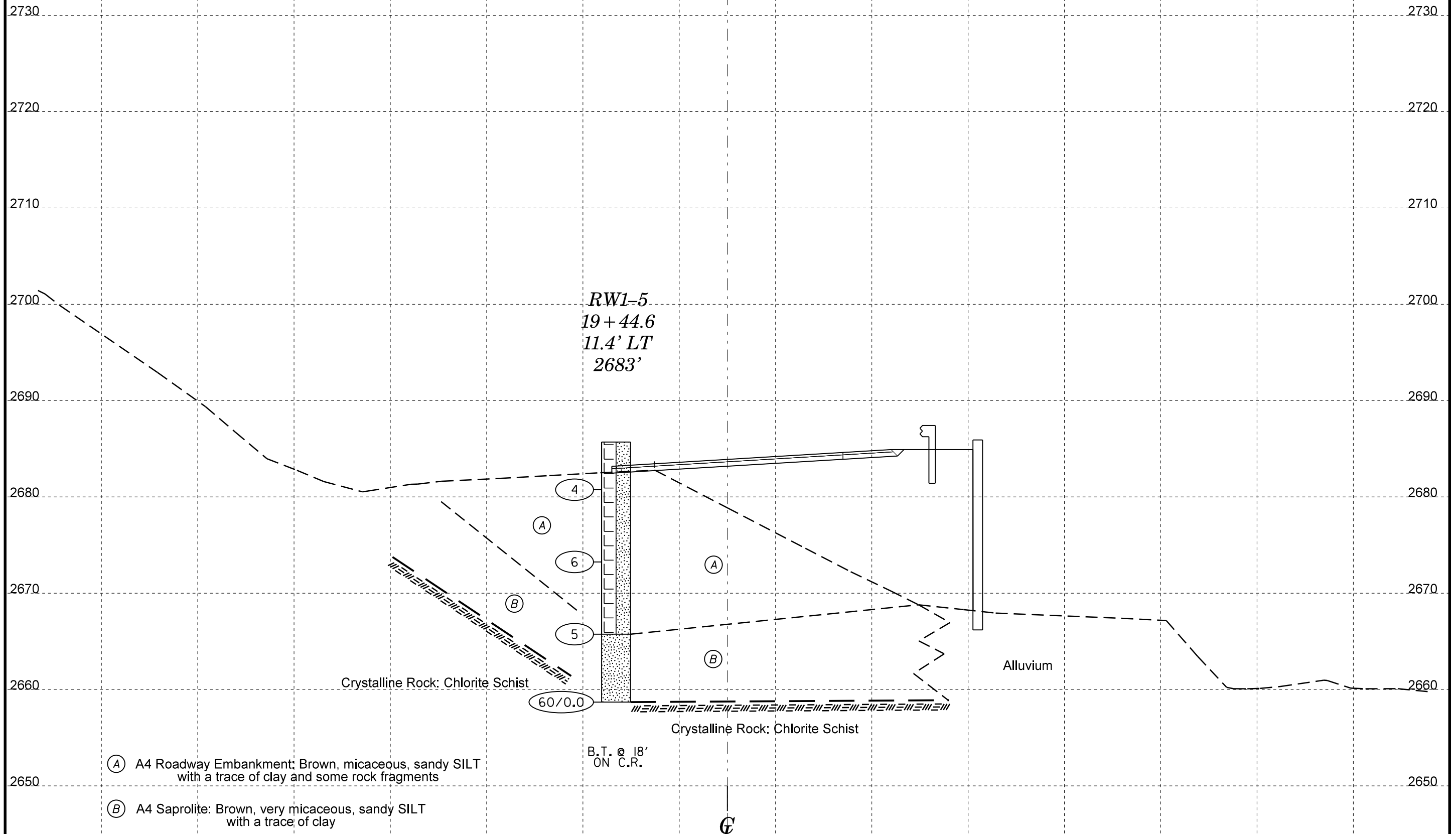
*RW1-4*  
18+47.7  
4.9' LT  
2685'

B.T. © 24  
IN W.R.



PROJECT REFERENCE NO.	SHEET NO.
BR-0002	12
REPLACE ASHE BRIDGE #8 ON NC 194 OVER N. FORK NEW RIVER	

CROSS SECTION: -L- STA 19+50



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)								
BORING NO. RW1-1		STATION 15+52		OFFSET 6 ft RT		ALIGNMENT L									
COLLAR ELEV. 2,700.2 ft		TOTAL DEPTH 23.7 ft		NORTHING 997,440		EASTING 1,260,993									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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					
2705															
2700															
	2,697.0	3.2	3	2	2										2,700.2
2695	2,692.0	8.2	1	2	4										2,692.0
2690															
	2,687.0	13.2	2	3	3										
2685															
	2,682.0	18.2	1	2	2										
2680															
	2,677.0	23.2													2,676.6

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)								
BORING NO. RW1-2		STATION 16+50		OFFSET 5 ft RT		ALIGNMENT L									
COLLAR ELEV. 2,694.0 ft		TOTAL DEPTH 7.1 ft		NORTHING 997,489		EASTING 1,261,077									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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					
2695															
	2,694.0														2,694.0
2690	2,690.8	3.2	2	3	6										2,691.0
	2,687.0	7.0													2,687.0

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)									
BORING NO. RW1-3		STATION 17+47		OFFSET 0 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,688.6 ft		TOTAL DEPTH 22.0 ft		NORTHING 997,545		EASTING 1,261,157										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD N/A		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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						
2690														2,688.6	0.0	GROUND SURFACE
														2,685.6	3.0	ROADWAY EMBANKMENT Roadway embankment
2685	2,685.0	3.6	2	3	6											SAPROLITE Brown-white-gray, micaceous sandy SILT with rock fragments
2680	2,680.0	8.6	3	4	6											
2675	2,675.0	13.6	8	11	89/0.3											
2670	2,670.0	18.6	17	24	47									2,673.8	14.8	WEATHERED ROCK Weathered rock (schist)
														2,672.8	15.8	SAPROLITE Brown-white-gray, micaceous sandy SILT with rock fragments
	2,666.7	21.9												2,666.6	22.0	CRYSTALLINE ROCK Crystalline rock (schist) Boring Terminated at Elevation 2,666.6 ft ON CR

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.											
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)										
BORING NO. RW1-4		STATION 18+44		OFFSET 4 ft LT		ALIGNMENT L											
COLLAR ELEV. 2,685.1 ft		TOTAL DEPTH 24.0 ft		NORTHING 997,608		EASTING 1,261,232											
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD N/A		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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							
2690																2,685.1	0.0
																	ROADWAY EMBANKMENT Red brown clayey slightly micaceous SILT with rock fragments and roots
2685																	
2680	2,681.8	3.3	7	6	4												
2675	2,676.8	8.3	1	1	2												
2670	2,671.8	13.3	1	2	1												
2665	2,666.8	18.3	5	41	59/0.3												
	2,661.8	23.3	39	61/0.4													
														2,666.3	18.8	SAPROLITE Brown micaceous clayey SILT	
														2,665.9	19.2	WEATHERED ROCK Weathered schist with MnO seams	
														2,661.1	24.0	Boring Terminated at Elevation 2,661.1 ft IN WR	

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)									
BORING NO. RW1-5		STATION 19+35		OFFSET 4 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,682.8 ft		TOTAL DEPTH 18.0 ft		NORTHING 997,672		EASTING 1,261,295										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD N/A		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
2685														2,682.8	0.0	GROUND SURFACE
2680	2,679.5	3.3	2	2	2	1	1	1	1	1	1	1	1			ROADWAY EMBANKMENT Brown micaceous sandy SILT with a trace of clay, roots, and a few gravels
2675	2,674.5	8.3	1	2	4	1	1	1	1	1	1	1	1			
2670	2,669.5	13.3	1	2	3	1	1	1	1	1	1	1	1	2,669.5	13.3	SAPROLITE Brown gray, micaceous clayey silt with some rock fragments
2665	2,664.8	18.0	60	0	0	1	1	1	1	1	1	1	1	2,664.8	18.0	CRYSTALLINE ROCK Crystalline chlorite schist Boring Terminated at Elevation 2,664.8 ft ON CR

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19



March 24, 2020

Mr. John Pilipchuk, LG, PE and Ms. Christina Bruinsma, PG  
Geotechnical Engineering Unit  
North Carolina Department of Transportation  
1020 Birch Ridge Drive  
Raleigh, NC 27610

**RE:           REPORT ON GEOPHYSICAL STUDY**  
**Proposed Retaining Wall Location by Buffalo Creek, Warrensville, NC**  
ESP Project No. GR22.323

WBS Number:           67002.1.1  
TIP Number:           BR-0002  
Project ID:             35254  
County:                ASHE  
Description:            Replace Bridge No. 040008 over North Fork New River on NC194  
Site Description:       Retaining Wall, -L- Sta. 15+00 to 20+00

Dear Mr. Pilipchuk and Ms. Bruinsma:

ESP Associates, Inc. (ESP) is pleased to submit this report on our geophysical study of the subject site. This work was performed in accordance with your Request for Proposal dated February 12, 2020 and our cost proposal dated February 21, 2020. The Notice to Proceed (NTP) was received on February 27, 2020.

We appreciate the opportunity to assist you during this phase of the project. If you should have any questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

ESP Associates, Inc.

Edward D. Billington, PG  
Senior Geologist/Geophysicist  
EDB/PMW/JS



4/2/2020

DocuSigned by:

7402544DC92F4E0...

not considered Final unless all signatures are completed

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Figure 1	Site Vicinity Map
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Figure 3	Site Plan with Seismic Line Locations
Figure 4	Seismic Line 1 Velocity Model
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Figure 6	NCDOT GEU Soil and Rock Legend

## ATTACHMENTS

Attachment A	Soil Test Boring Logs Provided by the NCDOT
Attachment B	Final Survey Report



## **1.0 INTRODUCTION**

The North Carolina Department of Transportation (NCDOT) is planning to replace Bridge No. 040008 over the North Fork New River on NC194 (Figure 1). The project will require realignment of the two-lane highway from NW School Road to the bridge, and the construction of a retaining wall next to Buffalo Creek. The retaining wall is planned to be approximately 500 feet long, extending from -L- Sta. 15+00 to 20+00. Since the planned location of the retaining wall was too steep to allow drilling to explore for bedrock depths, the NCDOT requested that ESP perform a geophysical investigation to assess the approximate depth to bedrock. Based on the 1985 Geologic Map of North Carolina, the bedrock at the site is identified as an amphibolite (Zata), described as equigranular, massive to well foliated, interlayered, rarely discordant, metamorphosed intrusive to extrusive mafic rock; may include metasedimentary rock.

## **2.0 SITE OBSERVATIONS**

ESP performed a site visit with NCDOT personnel on February 5, 2020 to assess the feasibility of performing work on the slope. The slope distance from the guard rail to the creek appeared to range from about 40 to 75 feet. In some places, the slope appeared to be approximately 1H:1V. There was a narrow strip of grass between the edge of pavement and the guard rail and occasionally a narrow soil bench on the slope side of the guard rail. The upper part of the slope was fairly open with tall grass and briars while the lower part of the slope was lightly wooded with briars. Boulders and some apparent rock outcrops were visible on the lower slope and at the creek level.

## **3.0 FIELD METHODS**

ESP performed field work at the planned retaining wall location on March 3 through 6, and on March 9, 2020. The work consisted of seismic refraction data collection on March 3 through 5, driving “bridge rods” on March 6, and surveying the location of stakes for the seismic lines and bridge rod locations on March 9. Photographs of the site and of the seismic data collection are shown on Figure 2.

### **3.1 Seismic Refraction**

ESP collected seismic refraction data along 6 lines: Line 1 was located along the approximate planned retaining wall location, and Lines 2 through 6 were oriented down the slope starting at the edge of pavement (Figure 3). The work was performed by Edward Billington, PG, Ryan Pastrana, GIT, and Chase Hallenbeck of ESP.

The seismic data were collected using a 24-channel system consisting of a Geode seismograph, 8Hz geophones spaced 5 feet apart, and a 16-pound sledgehammer striking a steel plate on the ground as the energy source. Four 115-foot long arrays using 24 geophones were employed for Line 1. Due to the length of the slope, 9 to 10 geophones were used for the slope lines with array lengths of 40 to 45 feet. Some lines or portion of lines required hand clearing. Noise from passing

vehicles affected the data although we tried to not collect data when cars and trucks were passing. Due to the steepness of the slope, the personnel working on the slope used a safety rope to help prevent falls. Wooden stakes were placed at 50-foot intervals along Line 1, and at the top, bottom, and significant slope changes on Lines 2, 3, 4, 5, and 6.

### **3.2 Bridge Rods**

ESP drove bridge rods at the intersections of Line 1 with Lines 2, 3, 5, and 6 on March 6 (Figure 3). The slope at Line 4 was too steep for driving rods. The work consisted of driving 5-foot long half-inch steel rods with a 16-pound slide hammer approximately vertically down into the ground until refusal. Couplers were used when more than one rod was needed. Refusal was defined as 100 blows with less than an inch penetration. Notes were recorded as to the relative softness or hardness of the materials that were driven through with the rods. Wooden stakes were placed to mark the location of the rod drives.

### **3.3 Location Surveys**

On March 9, ESP surveyed the locations and elevations of the wooden stakes placed to mark the seismic line locations and rod drives. The work was performed by a 3-person survey crew utilizing conventional survey equipment. The surveyed points were added to the MicroStation site plan and used to draw the approximate location of the seismic lines and rod drives (Figure 3). More information regarding the survey task is provided in the final survey report (Attachment B).

## **4.0 DATA ANALYSIS**

### **4.1 Seismic Refraction Velocity Models**

The processing steps for the seismic refraction data analysis consisted of assigning geometry, picking the arrival times of refracted energy at each geophone (first breaks), creating an elevation model from the survey point data, then performing a tomographic inversion of the arrival time data to develop a compressional wave velocity model for each line (Figures 4 and 5). The velocities are presented in feet per second (ft/s).

### **4.2 Bridge Rods and Soil Test Borings Data**

The bridge rod and soil test boring data are listed in Table 1 and are superimposed on the velocity models on Figures 4 and 5. The soil test borings were performed by the NCDOT prior to ESP's work on this project (Attachment A).

### **4.3 Location Survey Data**

The results of the location surveys were added to the MicroStation site plan on Figure 3.

## 5.0 DISCUSSION OF RESULTS

The velocity models were correlated with the rod drives to assess the approximate depth to weathered rock and to crystalline rock. Based on this evaluation, we made the following generalized definitions.

Compressional Wave Velocity (ft/s)	Corresponding Material Type <sup>1</sup>
Less than 3500	Fill and Residual Soil
3500 to 7500	Weathered Rock, WR
7500 or more <sup>2</sup>	Crystalline Rock, CR

<sup>1</sup>Material type as categorized by the NCDOT GEU; see Figure 6.

<sup>2</sup>7500 ft/s is the approximate limit of rippability for metamorphic rock (Handbook of Ripping, February 2000, 12th Edition, Caterpillar Inc., Peoria, IL).

The velocity model for Line 1 indicates that the depth to weathered rock is approximately 20 feet from STA 15+00 to 17+00. After STA 17+00, the depth to weathered rock decreases to 10 feet or less. At rod drive BR-01 on the alluvial bench, the material was soft until almost refusal at 4.7 feet below ground surface (bgs). Based on the seismic velocities, it appears that BR-01 refused on crystalline rock, so there appears to be little to no weathered rock in the vicinity of BR-01; this would be expected for an alluvial stream bank where the stream had previously scoured down to bedrock.

Due to the slope distance from the guard rail to the creek, the length of the arrays for Lines 2 through 6 were too short to obtain sufficient refracted arrivals from crystalline rock, resulting in velocity models that probably do not represent the true velocity structure of the subsurface. Although there is not a satisfactory match between the velocity model for Line 1 and the models for Lines 2 through 6 where they intersect, the models for Lines 2 through 6 do indicate that the depth to weathered rock decreases from STA 15+00 to STA 20+00, supporting the interpretation of Line 1, and they show a reasonable correlation with the adjacent RW1 soil test borings.

## 6.0 LIMITATIONS

These services have been provided to the NCDOT in accordance with generally accepted guidelines for performing geophysical surveys. It is recognized that the results of geophysical surveys are non-unique and subject to interpretation. Further, the seismic refraction method is an averaging technique; it is likely that there are bedrock highs and lows that are not imaged by this method.

## **TABLES**

**TABLE 1  
BRIDGE ROD AND BORING INFORMATION**

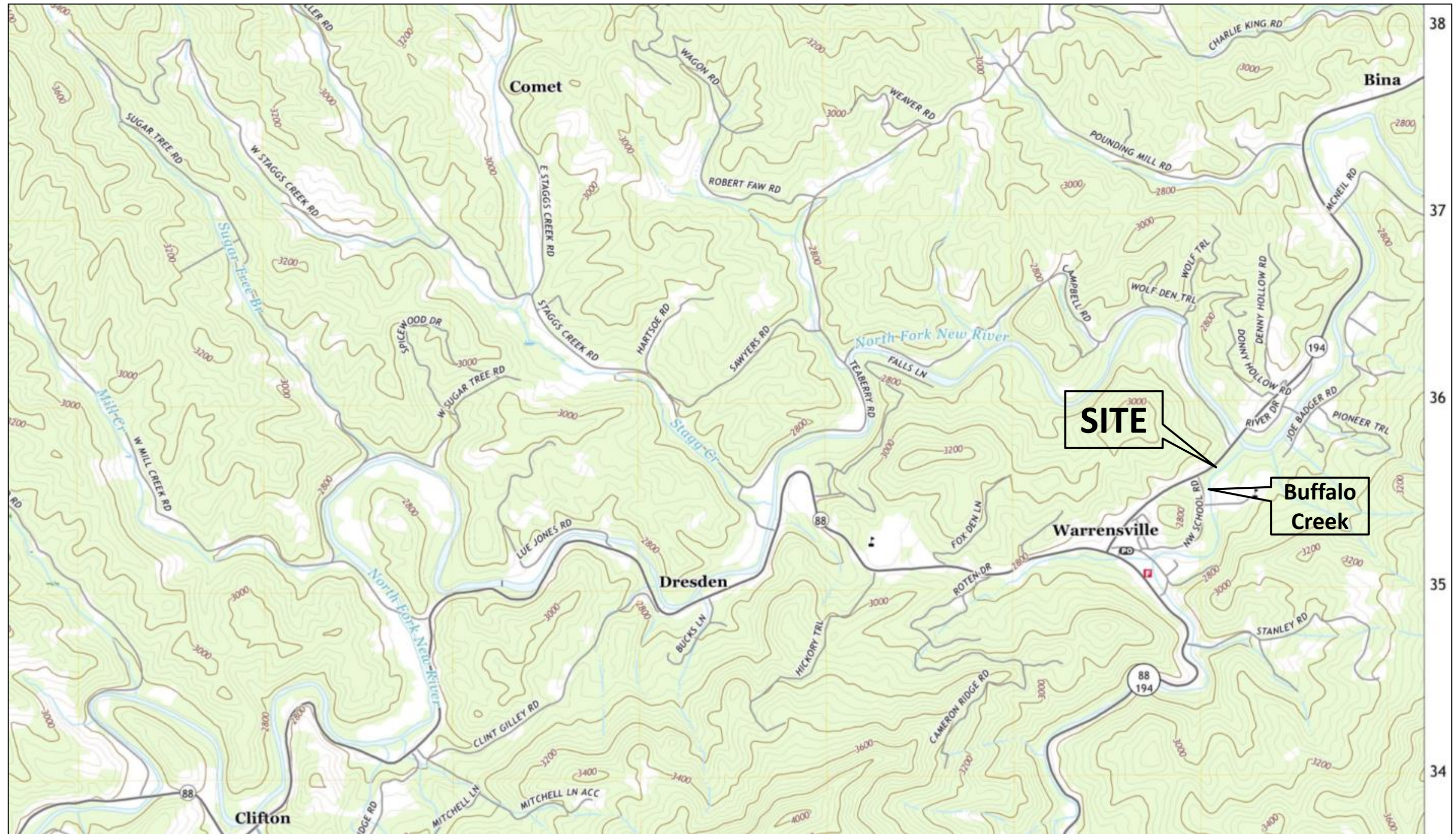
<b>Bridge Rod or Boring*</b>	<b>Station &amp; Offset (-WALL1-)</b>	<b>Location on Seismic Line (Line, Station)</b>	<b>Refusal Depth (feet bgs)</b>	<b>Comments</b>
BR-01	19+55 1' LT	Intersection of Line 1 and Line 2; Line 1 458'	4.7	0.0' – 4.5' - Soft 4.5' – 4.7' - Firm
BR-02	18+51 1' RT	Intersection of Line 1 and Line 3; Line 1, 353'	8.3	0.0' – 6.1' - Soft 6.1' – 8.3' - Firm
BR-03	18+50 8' RT	Line 3, 40'	6.7	0.0' – 5.5' - Soft 5.5' – 6.7' - Firm
BR-04	16+59 3' LT	Line 5, 15'	16.7	0.0' – 13.2' - Soft 13.2' – 16.7' - Firm
BR-05	15+51 7' LT	Line 6, 10'	21.8	0.0' – 11.9' - Soft 11.9' – 16.3' - Firm 16.3' – 21.8' - Hard
RW1-1*	15+56 21' LT	Near start of Line 6	-	Weathered Rock from 23.2' - 23.7' Boring Terminated in Weathered Rock
RW1-2*	16+58 21' LT	Near start of Line 5	7.1	Boring Terminated on Crystalline Rock (probable boulder, not bedrock)
RW1-3*	17+58 26' LT	Near start of Line 4	22.0	Weathered Rock and Hard Silt (N=71) from 14.8' - 22.0' Boring Terminated on Crystalline Rock
RW1-4*	18+53 31' LT	Near start of Line 3	-	Weathered Rock from 19.2' - 24.0' Boring Terminated in Weathered Rock
RW1-5*	19+52 38' LT	Near start of Line 2	18.0	Boring Terminated on Crystalline Rock

\*Borings completed prior to ESP's work. Boring data provided by NCDOT.



## **FIGURES**





From: USGS US Topo 7.5 - minute map for WARRENSVILLE, NC, Date: 2019, Original Scale: 1:24,000

PROJECT NO.	GR22.323
SCALE	AS SHOWN
DATE	3/17/20
BY	EDB

**FIGURE 1**  
**SITE VICINITY MAP**

**BR-0002, REPLACE BRIDGE NO. 040008 OVER NORTH FORK NEW RIVER ON NC194, RETAINING WALL -L- STA. 15+00 TO 20+00**



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7011 Albert Pick Rd.,  
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336.334.7724  
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A. Photograph of site, looking downstream (northeast).



B. Photograph of site, looking upstream (southwest).



C. Photograph of seismic line being set up on slope.



D. Photograph of seismic refraction data collection with sledgehammer source.

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SCALE	N/A
DATE	3/17/20
BY	EDB

**FIGURE 2**  
**DATA COLLECTION PHOTOGRAPHS**

**BR-0002, REPLACE BRIDGE NO. 040008 OVER NORTH FORK NEW RIVER ON NC194, RETAINING WALL -L- STA. 15+00 TO 20+00**

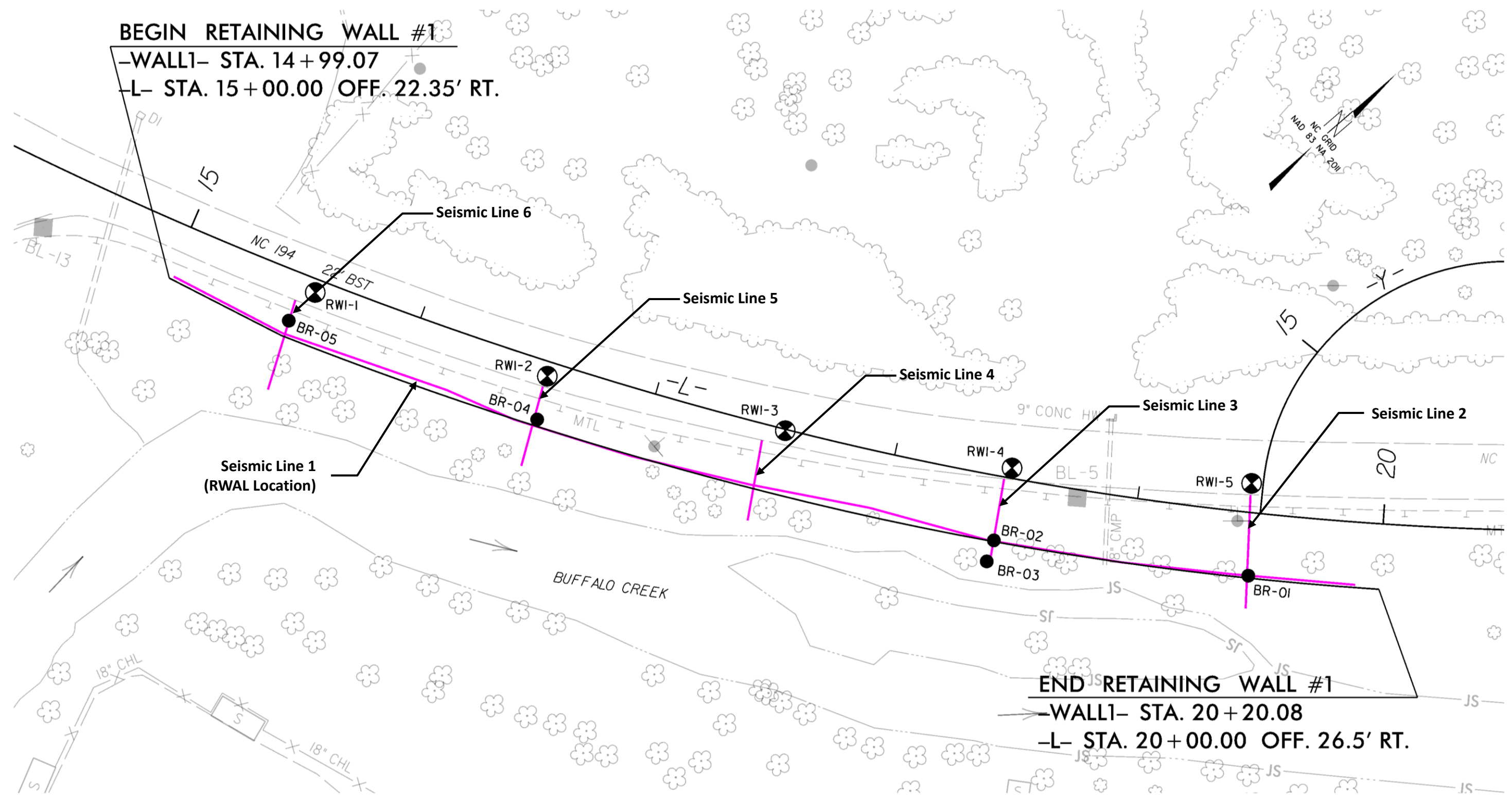


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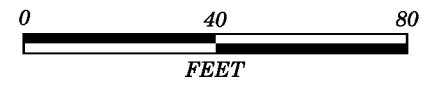


**BEGIN RETAINING WALL #1**  
 -WALL1- STA. 14+99.07  
 -L- STA. 15+00.00 OFF. 22.35' RT.

**END RETAINING WALL #1**  
 -WALL1- STA. 20+20.08  
 -L- STA. 20+00.00 OFF. 26.5' RT.



Explanation	
	Seismic refraction line
	BR-01 Bridge rod location and number



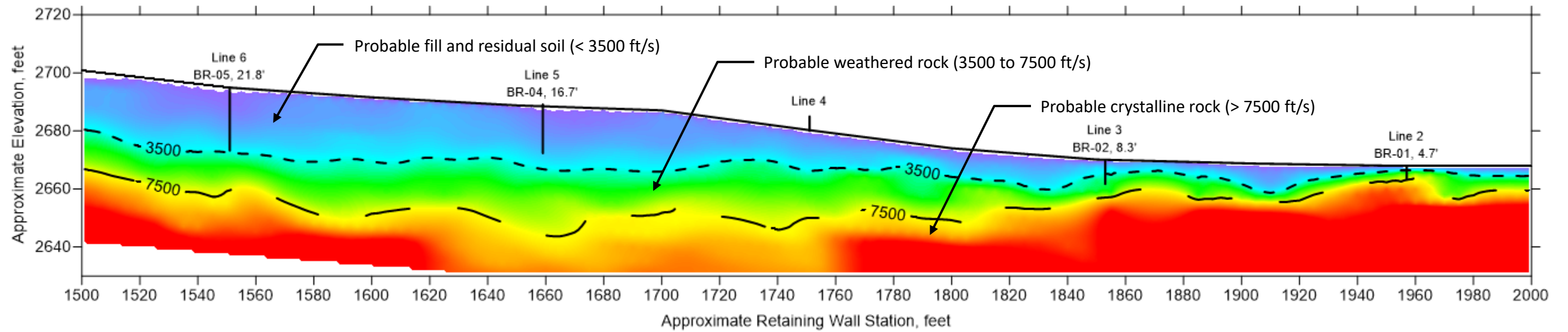
PROJECT NO.	GR22.323
SCALE	AS SHOWN
DATE	3/17/20
BY	EDB

**FIGURE 3**  
**SITE PLAN WITH SEISMIC LINE LOCATIONS**  
 BR-0002, REPLACE BRIDGE NO. 040008 OVER NORTH FORK NEW RIVER ON NC194, RETAINING WALL -L- STA. 15+00 TO 20+00

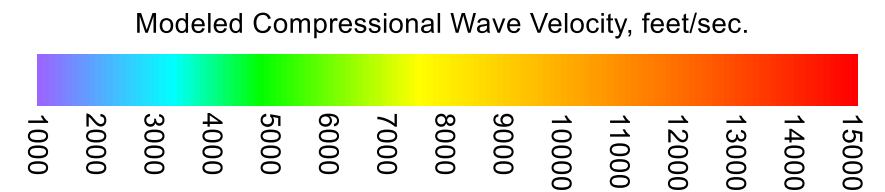


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### SEISMIC LINE 1 VELOCITY MODEL



Explanation	
Line 2	Intersecting seismic line number and location
+	
BR01, 4.7'	Bridge rod number, refusal depth, and location



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DATE	3/17/20
BY	EDB

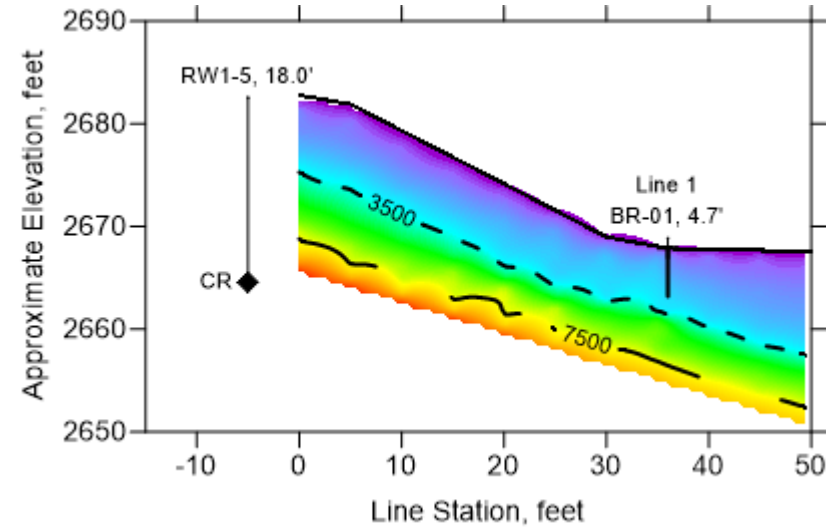
<b>FIGURE 4</b> <b>SEISMIC LINE 1 VELOCITY MODEL</b>
<b>BR-0002, REPLACE BRIDGE NO. 040008 OVER NORTH FORK NEW RIVER ON NC194, RETAINING WALL -L- STA. 15+00 TO 20+00</b>



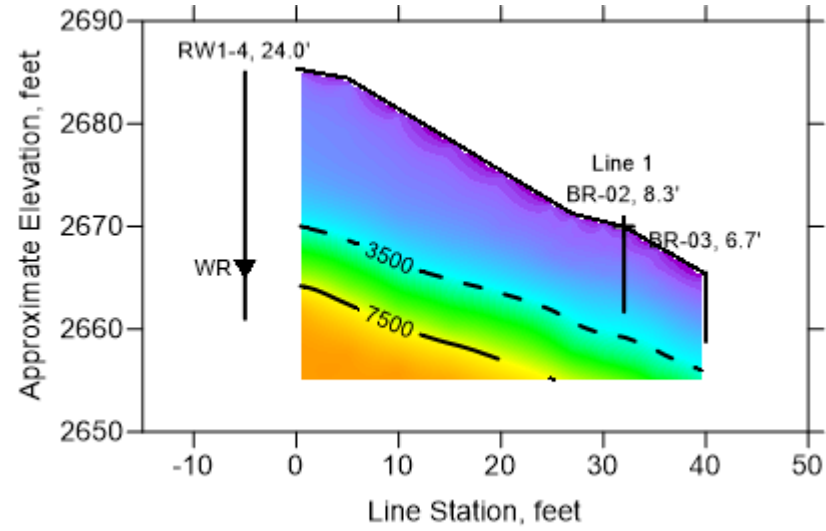
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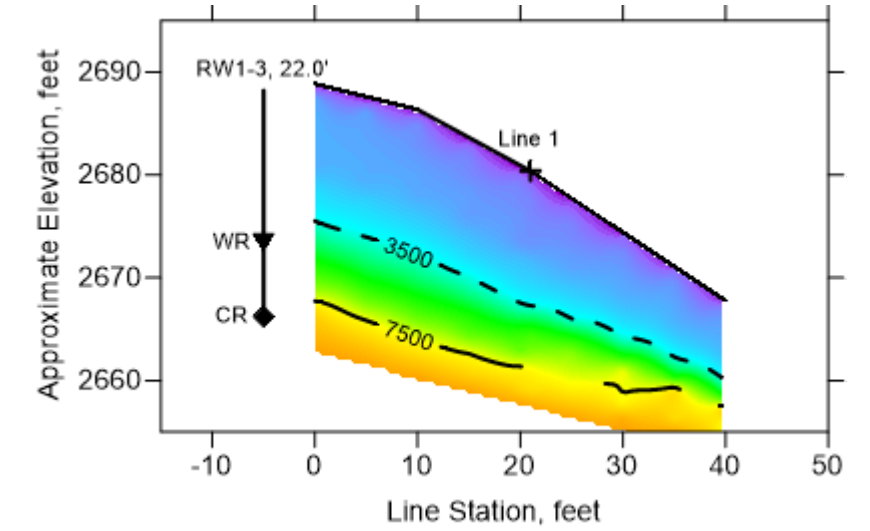
**SEISMIC LINE 2 VELOCITY MODEL**



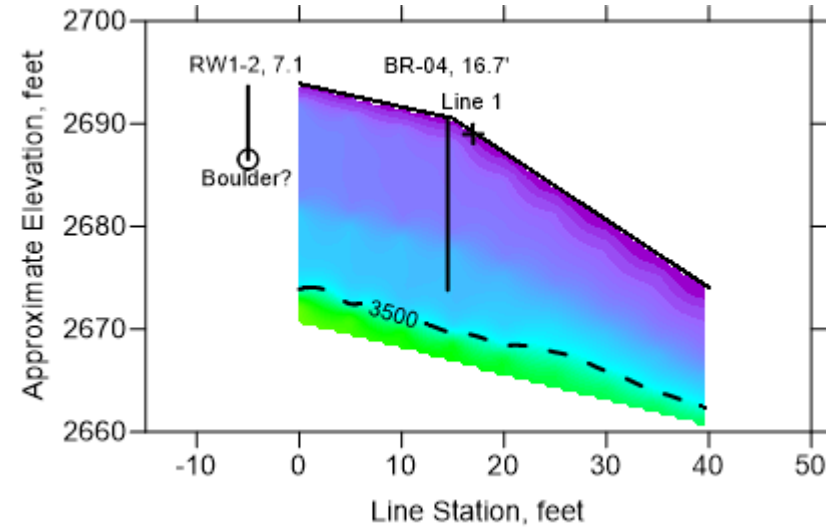
**SEISMIC LINE 3 VELOCITY MODEL**



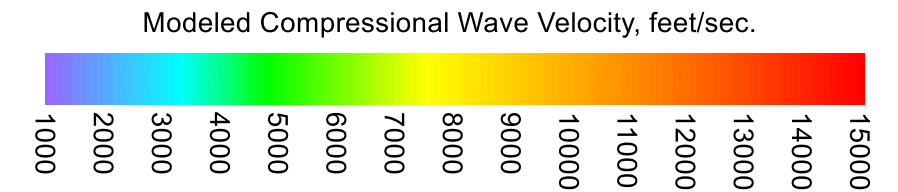
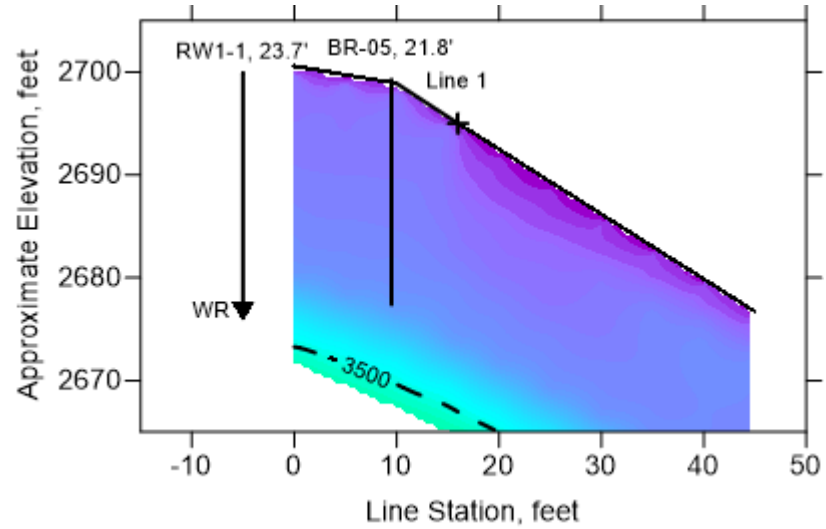
**SEISMIC LINE 4 VELOCITY MODEL**



**SEISMIC LINE 5 VELOCITY MODEL**



**SEISMIC LINE 6 VELOCITY MODEL**



**Explanation**

- Line 2  
+ Intersecting seismic line number and location
- BR01, 4.7'  
| Bridge rod number, refusal depth, and location
- RW1-1, 23.7'  
| Boring designation, termination depth, location, and top of weathered rock or crystalline rock
- WR ▼ WR = weathered rock, CR = crystalline rock
- CR ◆

PROJECT NO.	GR22.323
SCALE	AS SHOWN
DATE	3/17/20
BY	EDB

<b>FIGURE 5</b>
<b>SEISMIC LINES 2 THROUGH 6 VELOCITY MODELS</b>
<b>BR-0002, REPLACE BRIDGE NO. 040008 OVER NORTH FORK NEW RIVER ON NC194, RETAINING WALL -L- STA. 15+00 TO 20+00</b>



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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
**SUBSURFACE INVESTIGATION**  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																																																																																																															
<p>SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. <b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p>										<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, 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>ALLUVIUM (ALLUV.)</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, SUCH 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 (SROD)</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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IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>MODERATE (MOD.): SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED. SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p>MODERATELY SEVERE (MOD. SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p> <p>SEVERE (SEV.): ALL 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, WOULD YIELD SPT N VALUES &gt; 100 BPF</i></p> <p>VERY SEVERE (IV SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i></p> <p>COMPLETE: ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. 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<p style="text-align: center;"><b>COLOR</b></p> <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>										<p style="text-align: center;"><b>BEDDING</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY THICKLY BEDDED</td> <td>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>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>&lt; 0.008 FEET</td> </tr> </table>										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																																																																																																																																																																																												
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<p style="text-align: center;"><b>INDURATION</b></p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE: RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED: GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED: GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED: SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>										<p style="text-align: center;"><b>NOTES:</b></p> <p style="text-align: right;">ELEVATION: FEET</p>																																																																																																																																																																																																																			

**ATTACHMENT A**  
**SOIL TEST BORING LOGS PROVIDED BY THE NCDOT**

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)								
BORING NO. RW1-1		STATION 15+52		OFFSET 6 ft RT		ALIGNMENT L									
COLLAR ELEV. 2,700.2 ft		TOTAL DEPTH 23.7 ft		NORTHING 997,440		EASTING 1,260,993									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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					
2705															
2700															
	2,697.0	3.2													
2695															
	2,692.0	8.2													
2690															
	2,687.0	13.2													
2685															
	2,682.0	18.2													
2680															
	2,677.0	23.2													

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.									
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)								
BORING NO. RW1-2		STATION 16+50		OFFSET 5 ft RT		ALIGNMENT L									
COLLAR ELEV. 2,694.0 ft		TOTAL DEPTH 7.1 ft		NORTHING 997,489		EASTING 1,261,077									
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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					
2695															
	2,694.0														
	2,691.0	3.0													
2690															
	2,690.8	3.2													
	2,687.0	7.0													

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)									
BORING NO. RW1-3		STATION 17+47		OFFSET 0 ft RT		ALIGNMENT L										
COLLAR ELEV. 2,688.6 ft		TOTAL DEPTH 22.0 ft		NORTHING 997,545		EASTING 1,261,157										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD N/A		HAMMER TYPE Automatic											
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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						
2690														2,688.6	0.0	GROUND SURFACE
														2,685.6	3.0	ROADWAY EMBANKMENT Roadway embankment
2685	2,685.0	3.6	2	3	6											SAPROLITE Brown-white-gray, micaceous sandy SILT with rock fragments
2680	2,680.0	8.6	3	4	6											
2675	2,675.0	13.6	8	11	89/0.3											
2670	2,670.0	18.6	17	24	47									2,673.8	14.8	WEATHERED ROCK Weathered rock (schist)
														2,672.8	15.8	SAPROLITE Brown-white-gray, micaceous sandy SILT with rock fragments
	2,666.7	21.9												2,666.6	22.0	CRYSTALLINE ROCK Crystalline rock (schist) Boring Terminated at Elevation 2,666.6 ft ON CR

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.											
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)										
BORING NO. RW1-4		STATION 18+44		OFFSET 4 ft LT		ALIGNMENT L											
COLLAR ELEV. 2,685.1 ft		TOTAL DEPTH 24.0 ft		NORTHING 997,608		EASTING 1,261,232											
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017			DRILL METHOD N/A		HAMMER TYPE Automatic												
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		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							
2690																2,685.1	0.0
																	ROADWAY EMBANKMENT Red brown clayey slightly micaceous SILT with rock fragments and roots
2685																	
2680	2,681.8	3.3	7	6	4												
2675	2,676.8	8.3	1	1	2												
2670	2,671.8	13.3	1	2	1												
2665	2,666.8	18.3	5	41	59/0.3									2,666.3	18.8	SAPROLITE Brown micaceous clayey SILT	
														2,665.9	19.2	WEATHERED ROCK Weathered schist with MnO seams	
	2,661.8	23.3	39	61/0.4										2,661.1	24.0	Boring Terminated at Elevation 2,661.1 ft IN WR	

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67002.1.1		TIP BR-0002		COUNTY ASHE		GEOLOGIST Johnson, C. D.										
SITE DESCRIPTION BORING IN EXISTING PAVEMENT NC194 FOR PROPOSED RWAL							GROUND WTR (ft)									
BORING NO. RW1-5		STATION 19+35		OFFSET 4 ft LT		ALIGNMENT L										
COLLAR ELEV. 2,682.8 ft		TOTAL DEPTH 18.0 ft		NORTHING 997,672		EASTING 1,261,295										
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD N/A		HAMMER TYPE Automatic										
DRILLER Cheek, D. O.		START DATE 05/29/19		COMP. DATE 05/29/19		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
2685														2,682.8	0.0	GROUND SURFACE
2680	2,679.5	3.3	2	2	2	.....	.....	.....	.....							ROADWAY EMBANKMENT Brown micaceous sandy SILT with a trace of clay, roots, and a few gravels
2675	2,674.5	8.3	1	2	4	.....	.....	.....	.....							
2670	2,669.5	13.3	1	2	3	.....	.....	.....	.....					2,669.5	13.3	SAPROLITE Brown gray, micaceous clayey silt with some rock fragments
2665	2,664.8	18.0	60/0.0			.....	.....	.....	.....					2,664.8	18.0	CRYSTALLINE ROCK Crystalline chlorite schist Boring Terminated at Elevation 2,664.8 ft ON CR

NCDOT BORE DOUBLE BR0002\_RW1\_ASHE\_BOREHOLES\_GPJ\_NC\_DOT.GDT 6/6/19



**ATTACHMENT B**  
**FINAL SURVEY REPORT (ESP)**



March 17, 2020

ESP Associates, Inc.  
7011 Albert Pick Road, Suite E  
Greensboro, NC 27409

**FINAL SURVEY REPORT**

March 17<sup>th</sup>, 2020

**TIP#** BR-0002

***PROJECT DESCRIPTION:***

Replace Bridge 040008 over North Fork New River on NC 194  
Retaining Wall -L- Sta. 15+00 to 20+00- Retaining Wall Geophysical Survey

***PROJECT NUMBER:*** 35254

***COUNTY:*** Ashe

***L&S #:*** 67002.1.1

***CONSULTANT:*** ESP Associates, Inc.  
7011 Albert Pick Road Suite E, Greensboro, N.C. 27409  
Contact: John P. Scoville III, PLS, CFS

***DATE OF SURVEY:*** 3-9-2020 through 3-10-2020

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**DATUM DESCRIPTION:**

**The following Datum Description was supplied by the NCDOT as developed by others.**

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE  
NAD 83 NSRS (2011) NORTH CAROLINA STATE PLANE GRID COORDINATES  
ESTABLISHED BY NCDOT FOR MONUMENT "R5832-BL 43" WITH GRID COORDINATES OF:

NORTHING: 996047.666 (s FT)      EASTING: 1259229.395 (s FT)

THE AVERAGE COMBINED FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS:  
0.99997244

ALL LINEAR DISTANCES ARE LOCALIZED HORIZONTAL DISTANCES. THE VERTICAL DATUM  
FOR THIS PROJECT IS NAVD 88

ESP Associates, Inc.  
7011 Albert Pick Road, Suite E  
Greensboro, NC 27409

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**PROJECT LIMITS:**

- The limits for this project were supplied by NCDOT to ESP geophysical group and defined as the extents of the proposed retaining wall from -L- Sta. 15+00 to Sta. 20+00 26.5' right to include the existing roadway and down existing slope to Buffalo creek.

**BASELINE FILE:**

- Project Control for Baselines was supplied by NCDOT in filename BR0002\_ncdot\_fs.dgn.

**SAFETY:**

- ESP survey personnel conducted a PRE JOB Briefing to go over safety concerns at a location outside of traffic concerns adjacent to the project. Signing positions were determined as well as a discussion of proposed procedures and project objectives.
- ESP set signs out at both ends of the work area along highway 194 as well at intersecting New School Road and Cambell Road
- ESP utilized a 3 man crew to accomplish the work along the existing guardrail while one man acted as flagger/lookout for the operation.
- The work plan went well and the work was accomplished accordingly.

**DTM DATA:**

The project was laid out by the ESP Geophysical group as part of their work in collecting geophysical data in the area of the proposed retaining wall.

ESP's survey group identified several baseline monuments in the vicinity of the project and verified the relationship of the baseline monuments with each other both horizontally and vertically to ensure the data being utilized was correct. Utilizing conventional survey equipment, ESP verified the points being utilized, established additional control points along the existing guardrail and located the following items to aid the geophysical survey for the project.

- Existing borings in the pavement RW1-1 through RW 1-5
- Bridge Rods- BR-01 through BR-05
- EP points at assumed zero station of cross section lines 1 through 5 as established by the geophysical layout.
- Downslope locations of slope breaks and other points as established by the geophysical layout.

Baseline monuments and additional control points were surveyed to a horizontal and vertical accuracy of +/- 0.01'. Borings, rod locations, slope breaks and other points were surveyed to a horizontal and vertical accuracy of +/- 0.10'

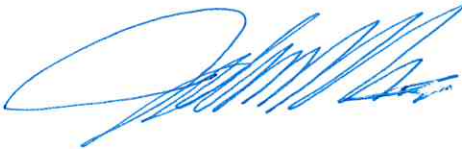
**THE FOLLOWING FILES WERE TRANSMITTED TO ESP GEOPHYSICAL GROUP:**

- GR22.323 TASK 2 ALL.CSV

This csv file contains all of the coordinates established from the survey of the above listed items and including the NCDOT baseline monuments utilized and verified in the survey process.

Completed by: John P. Scoville III, PLS  
March 17<sup>th</sup>, 2020

Sincerely,  
*ESP Associates, Inc.*



John P. Scoville III, PLS, CFS  
Survey Manager

