

REFERENCE: BR-0044

PROJECT: 67044

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY ROCKINGHAM  
PROJECT DESCRIPTION BRIDGE NO. 780168 OVER SMITH  
RIVER ON NC14 /NC87

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0044	1	34

CAUTION NOTICE

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  - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

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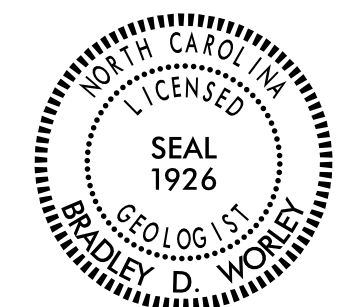
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SIGNATURE DATE

NOTE:  
DUE TO ACCESS ISSUES, AND PER NCDOT GEU GUIDANCE, BORINGS B2-A AND B3-A WILL BE DRILLED DURING THE TIME OF CONSTRUCTION.

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

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)							ORGANIC MATERIALS		
	A-1	A-1-b	A-1-c	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	
GROUP CLASS.	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7					A-1, A-2	A-3	A-4, A-5	A-6, A-7		
SYMBOL																	
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX		40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN		
MATERIAL PASSING #40 LL PI	-	-		40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN		
GROUP INDEX	0	0		0	4 MX	8 MX	12 MX	16 MX	NO MX								
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND	FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	CLAYEY SOILS											
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD				FAIR TO POOR				FAIR TO POOR	POOR	UNSATURABLE						

PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

NON PLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
SLIGHTLY PLASTIC	0-5	VERY LOW
MODERATELY PLASTIC	6-15	SLIGHT
HIGHLY PLASTIC	16-25	MEDIUM
	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LL < 31  
MODERATELY COMPRESSIBLE LL = 31 - 50  
HIGHLY COMPRESSIBLE LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE 1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE 10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME 20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY 35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

- 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
- 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
- VST - VANE SHEAR TEST
- WEA. - WEATHERED
- W - UNIT WEIGHT
- W<sub>d</sub> - DRY UNIT WEIGHT
- S - BULK
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RS - ROCK
- RT - RECOMPACTED TRIAXIAL
- CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

- DRILL UNITS:
  - CME-45C
  - CME-55
  - CME-550X
  - VANE SHEAR TEST
  - PORTABLE HOIST
- ADVANCING TOOLS:
  - CLAY BITS
  - 6" CONTINUOUS FLIGHT AUGER
  - 8" HOLLOW AUGERS
  - HARD FACED FINGER BITS
  - TUNG-CARBIDE INSERTS
  - CASING  W/ ADVANCER
  - TRICONE \* STEEL TEETH
  - TRICONE \* TUNG-CARB.
  - CORE BIT
- HAMMER TYPE:
  - AUTOMATIC  MANUAL
- CORE SIZE:
  - B  -H
  - N Q
- HAND TOOLS:
  - POST HOLE DIGGER
  - HAND AUGER
  - SOUNDING ROD
  - VANE SHEAR TEST

ROCK DESCRIPTION

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:

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

WEATHERING

- FRESH** - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
- VERY SLIGHT (V 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. *IF TESTED, WOULD YIELD SPT REFUSAL*
- SEVERE (SEV.)** - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
- 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. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
- COMPLETE** - ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

- VERY HARD** - CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE 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 GROUDED 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 GROUDED 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.

FRACTURE SPACING

TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

INDURATION

- FRIABLE** - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
- MODERATELY INDURATED** - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
- INDURATED** - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
- EXTREMELY INDURATED** - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

- ALLUVIUM (ALLUV.)** - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
- AQUIFER** - A WATER BEARING FORMATION OR STRATA.
- ARENACEOUS** - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
- ARGILLACEOUS** - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
- ARTESIAN** - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
- CALCAREOUS (CALC.)** - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
- COLLUVIUM** - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
- CORE RECOVERY (REC.)** - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
- DIKE** - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
- DIP** - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
- DIP DIRECTION (DIP AZIMUTH)** - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
- FAULT** - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
- FISSILE** - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
- FLOAT** - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL.
- FLOOD PLAIN (FP)** - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
- FORMATION (FM.)** - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
- JOINT** - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
- LEDGE** - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
- LENS** - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
- MOTTLED (MOT.)** - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
- PERCHED WATER** - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
- RESIDUAL (RES.) SOIL** - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
- ROCK QUALITY DESIGNATION (RQD)** - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
- SAPROLITE (SAP.)** - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
- SILL** - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
- SLICKENSIDE** - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
- STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)** - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
- STRATA CORE RECOVERY (SREC.)** - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
- STRATA ROCK QUALITY DESIGNATION (SROD)** - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
- TOPSOIL (TS.)** - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: \*SEE NOTES - TWO BENCH MARKS USED DURING SURVEY

ELEVATION: FEET

NOTES:

- BM-1 N 1012090 E 1773748 ELEV = 630.72'
- BI-10 N 1011885 E 17734598 ELEV = 574.99'
- FIAD = FILLED IN AFTER DRILLING

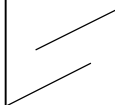
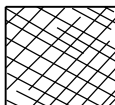


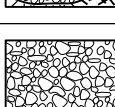
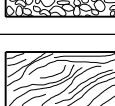
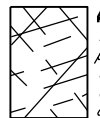


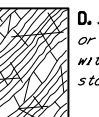




NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

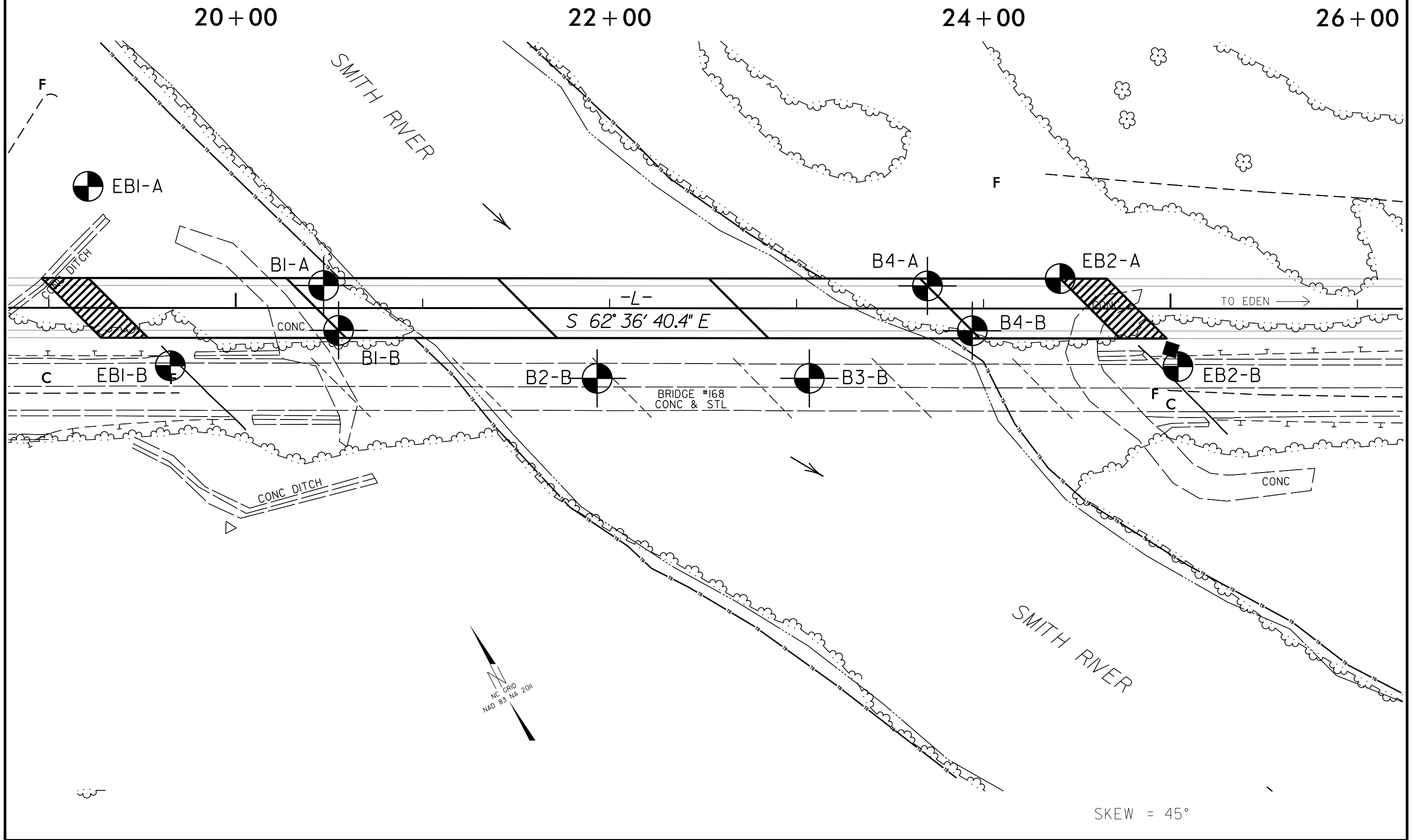
**SUBSURFACE INVESTIGATION**

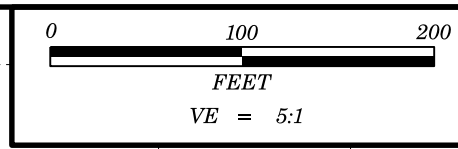
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

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

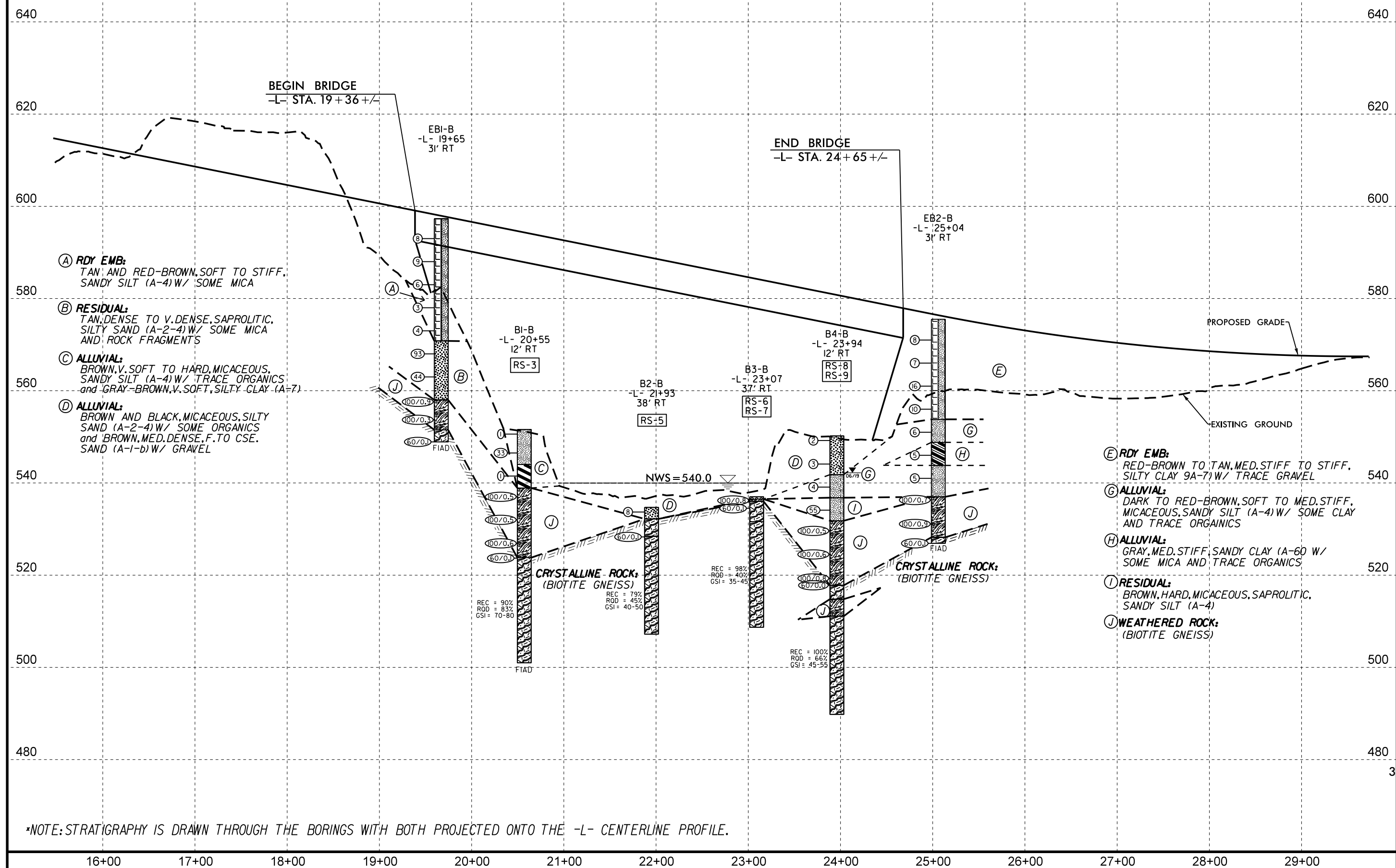
AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

<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>VERY GOOD Very rough, fresh unweathered surfaces</p> <p>GOOD Rough, slightly weathered, iron stained surfaces</p> <p>FAIR Smooth, moderately weathered and altered surfaces</p> <p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> <p>DECREASING SURFACE QUALITY →</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>VERY GOOD - Very Rough, fresh unweathered surfaces</p> <p>GOOD - Rough, slightly weathered surfaces</p> <p>FAIR - Smooth, moderately weathered and altered surfaces</p> <p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p>				
<p><b>INTERLOCKING OF ROCK PIECES</b></p> <p>DECREASING INTERLOCKING OF ROCK PIECES ↓</p> <p> INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p> BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p> VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p> BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p> DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p> LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	<p>90</p> <p>80</p> <p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</p>	<p>N/A</p> <p>N/A</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>C, D, E, and G</b> - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to <b>F</b> and <b>H</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>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>





PROJECT REFERENCE NO.	SHEET
BR-0044	4
-L- CENTERLINE PROFILE	

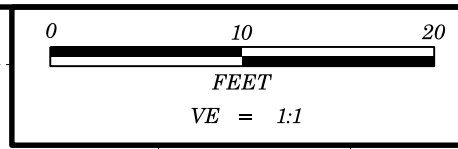


- (A) **RDY EMB:**  
TAN AND RED-BROWN, SOFT TO STIFF, SANDY SILT (A-4) W/ SOME MICA
- (B) **RESIDUAL:**  
TAN, DENSE TO V. DENSE, SAPROLITIC, SILTY SAND (A-2-4) W/ SOME MICA AND ROCK FRAGMENTS
- (C) **ALLUVIAL:**  
BROWN, V. SOFT TO HARD, MICACEOUS, SANDY SILT (A-4) W/ TRACE ORGANICS and GRAY-BROWN, V. SOFT, SILTY CLAY (A-7)
- (D) **ALLUVIAL:**  
BROWN AND BLACK, MICACEOUS, SILTY SAND (A-2-4) W/ SOME ORGANICS and BROWN, MED. DENSE, F. TO CSE. SAND (A-1-b) W/ GRAVEL

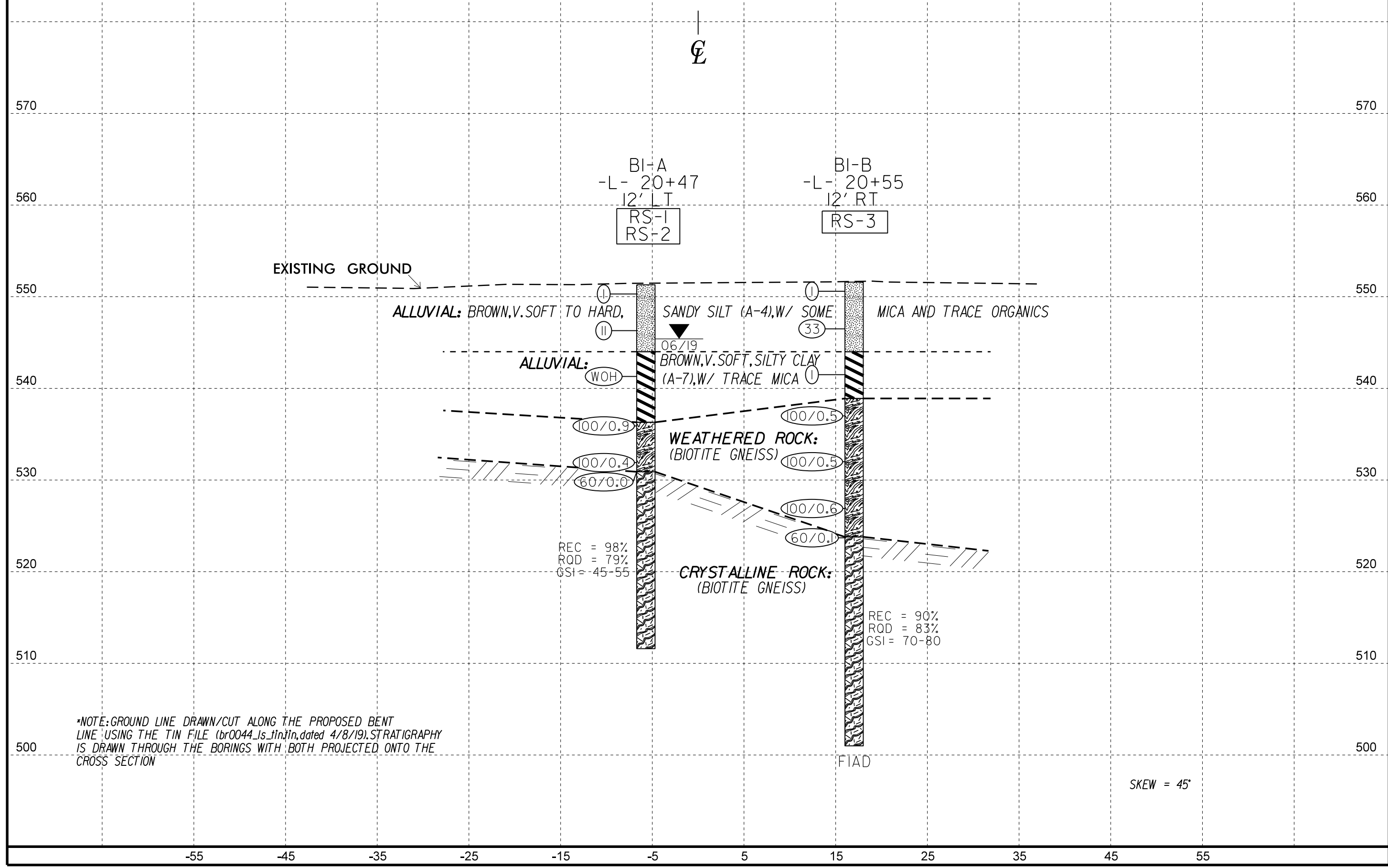
- (E) **RDY EMB:**  
RED-BROWN TO TAN, MED. STIFF TO STIFF, SILTY CLAY 9A-7) W/ TRACE GRAVEL
- (G) **ALLUVIAL:**  
DARK TO RED-BROWN, SOFT TO MED. STIFF, MICACEOUS, SANDY SILT (A-4) W/ SOME CLAY AND TRACE ORGANICS
- (H) **ALLUVIAL:**  
GRAY, MED. STIFF, SANDY CLAY (A-60 W/ SOME MICA AND TRACE ORGANICS
- (I) **RESIDUAL:**  
BROWN, HARD, MICACEOUS, SAPROLITIC, SANDY SILT (A-4)
- (J) **WEATHERED ROCK:**  
(BIOTITE GNEISS)

\*NOTE: STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- CENTERLINE PROFILE.





PROJECT REFERENCE NO.	SHEET
BR-0044	6
<b>BI CROSS SECTION</b>	



BI-A  
-L- 20+47  
12' LT  
RS-1  
RS-2

BI-B  
-L- 20+55  
12' RT  
RS-3

EXISTING GROUND

ALLUVIAL: BROWN, V. SOFT TO HARD, SANDY SILT (A-4), W/ SOME MICA AND TRACE ORGANICS

ALLUVIAL: BROWN, V. SOFT, SILTY CLAY (A-7), W/ TRACE MICA

WEATHERED ROCK:  
(BIOTITE GNEISS)

CRYSTALLINE ROCK:  
(BIOTITE GNEISS)

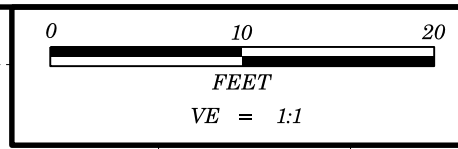
REC = 98%  
RQD = 79%  
GSI = 45-55

REC = 90%  
RQD = 83%  
GSI = 70-80

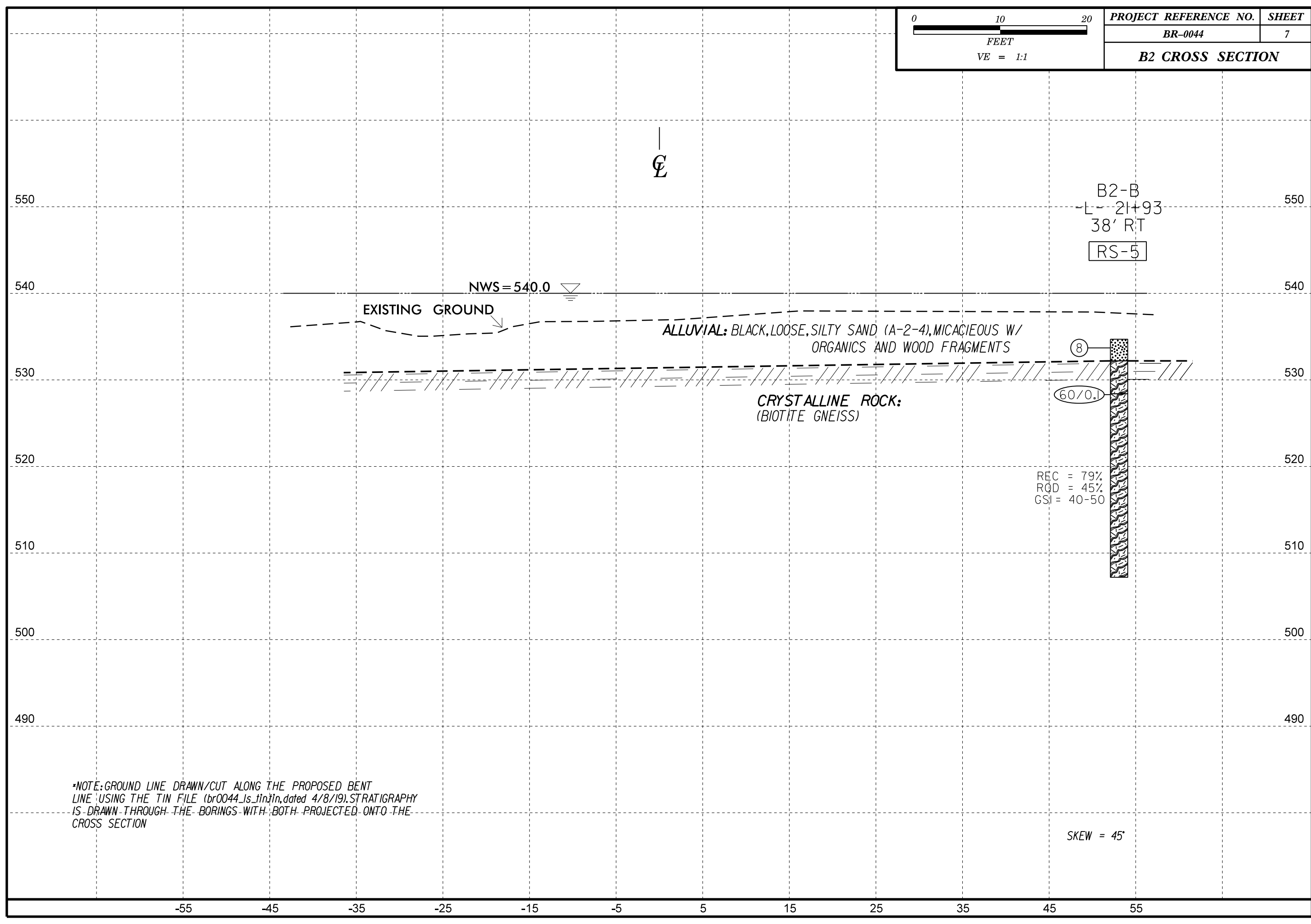
\*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044\_Is\_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SKEW = 45°

FIAD



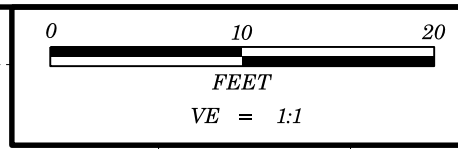
<b>PROJECT REFERENCE NO.</b>	<b>SHEET</b>
BR-0044	7
<b>B2 CROSS SECTION</b>	



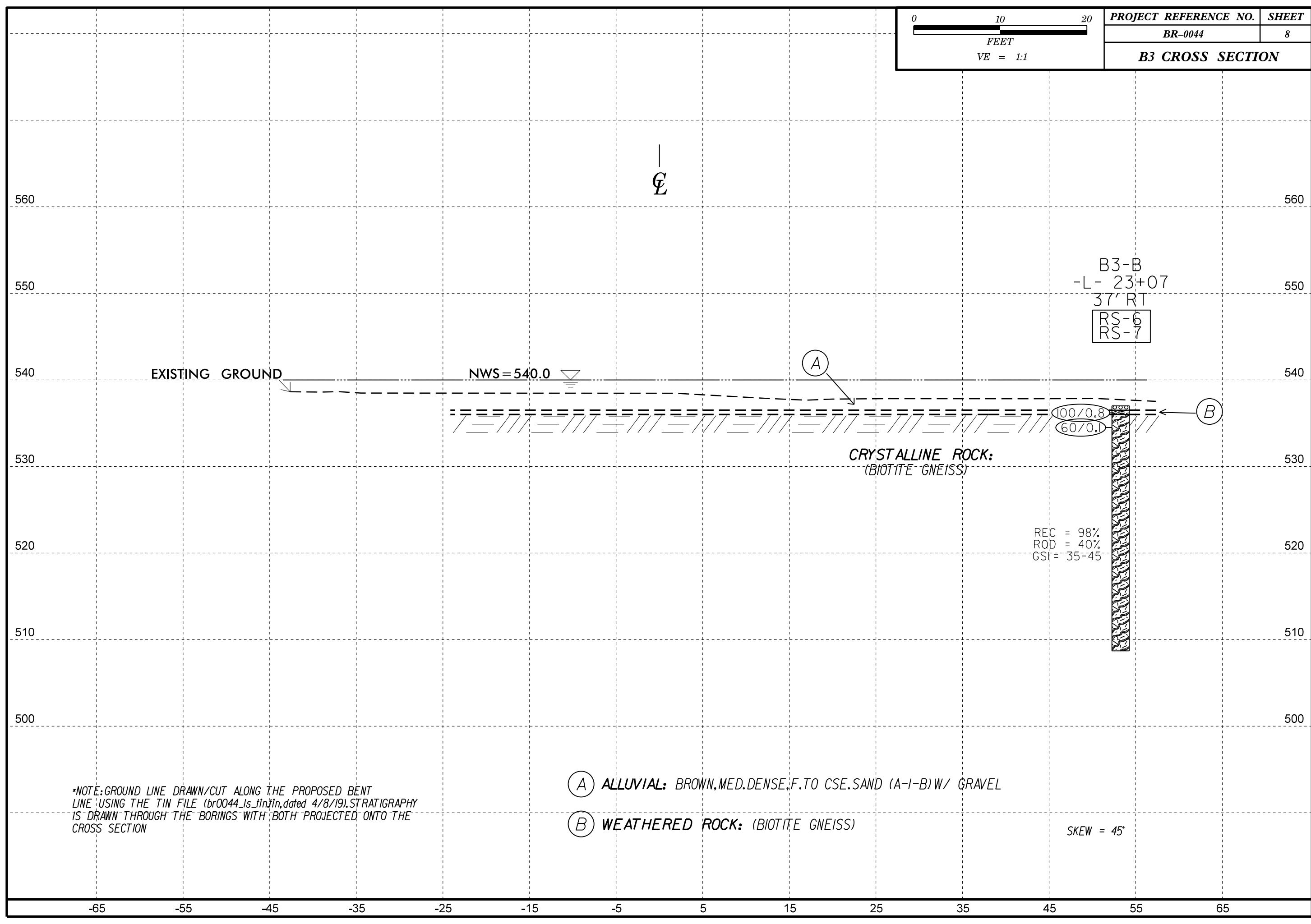
\*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044\_ls.tin) dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SKEW = 45'





<b>PROJECT REFERENCE NO.</b>	<b>SHEET</b>
BR-0044	8
<b>B3 CROSS SECTION</b>	

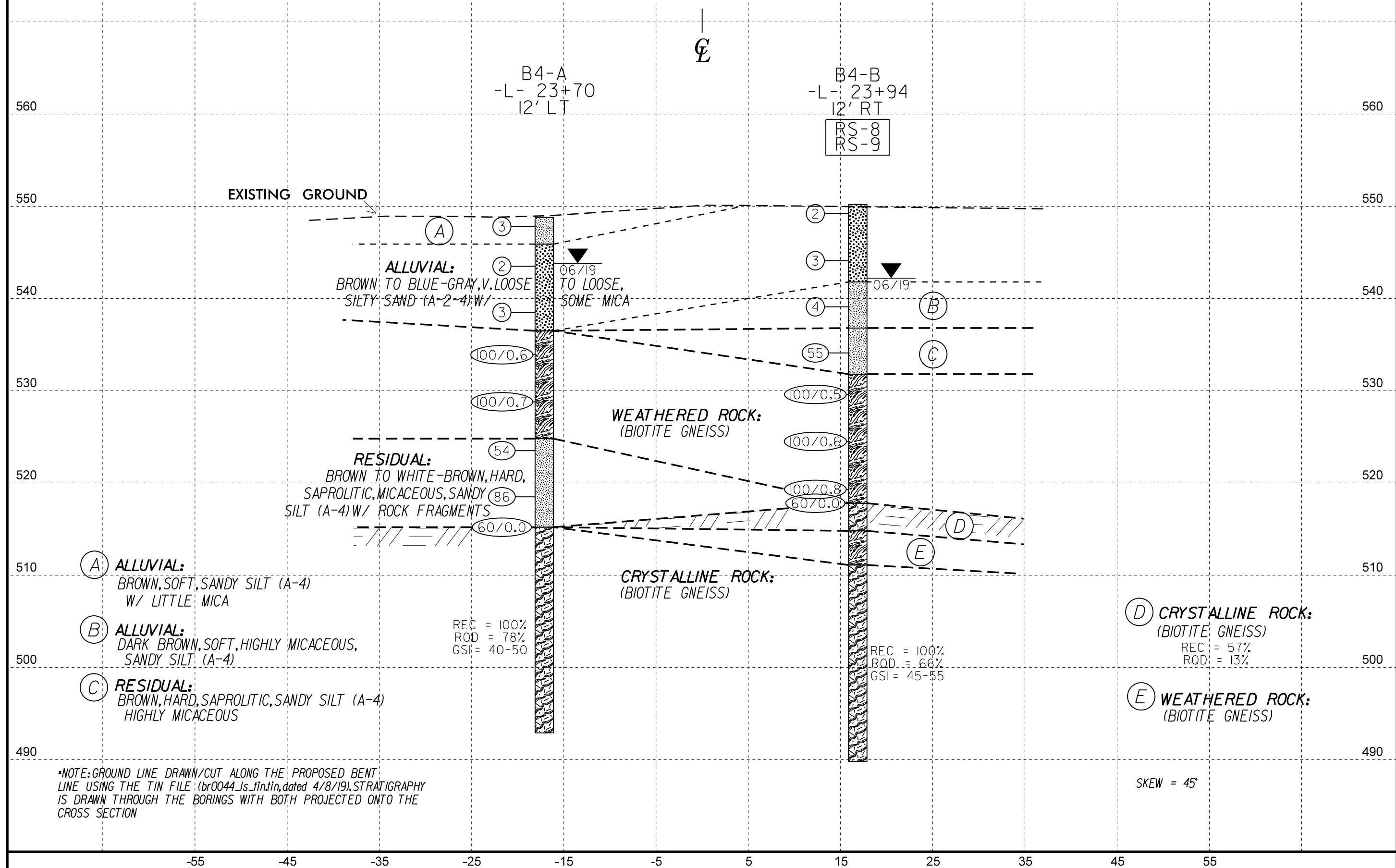
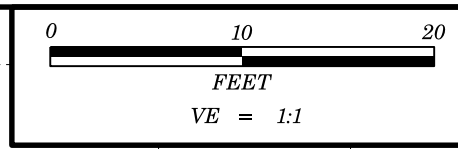


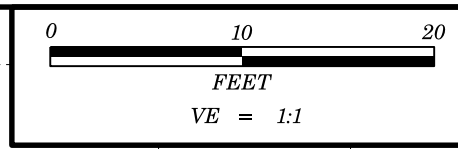
\*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044\_ls\_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

(A) ALLUVIAL: BROWN, MED. DENSE, F. TO CSE. SAND (A-I-B) W/ GRAVEL

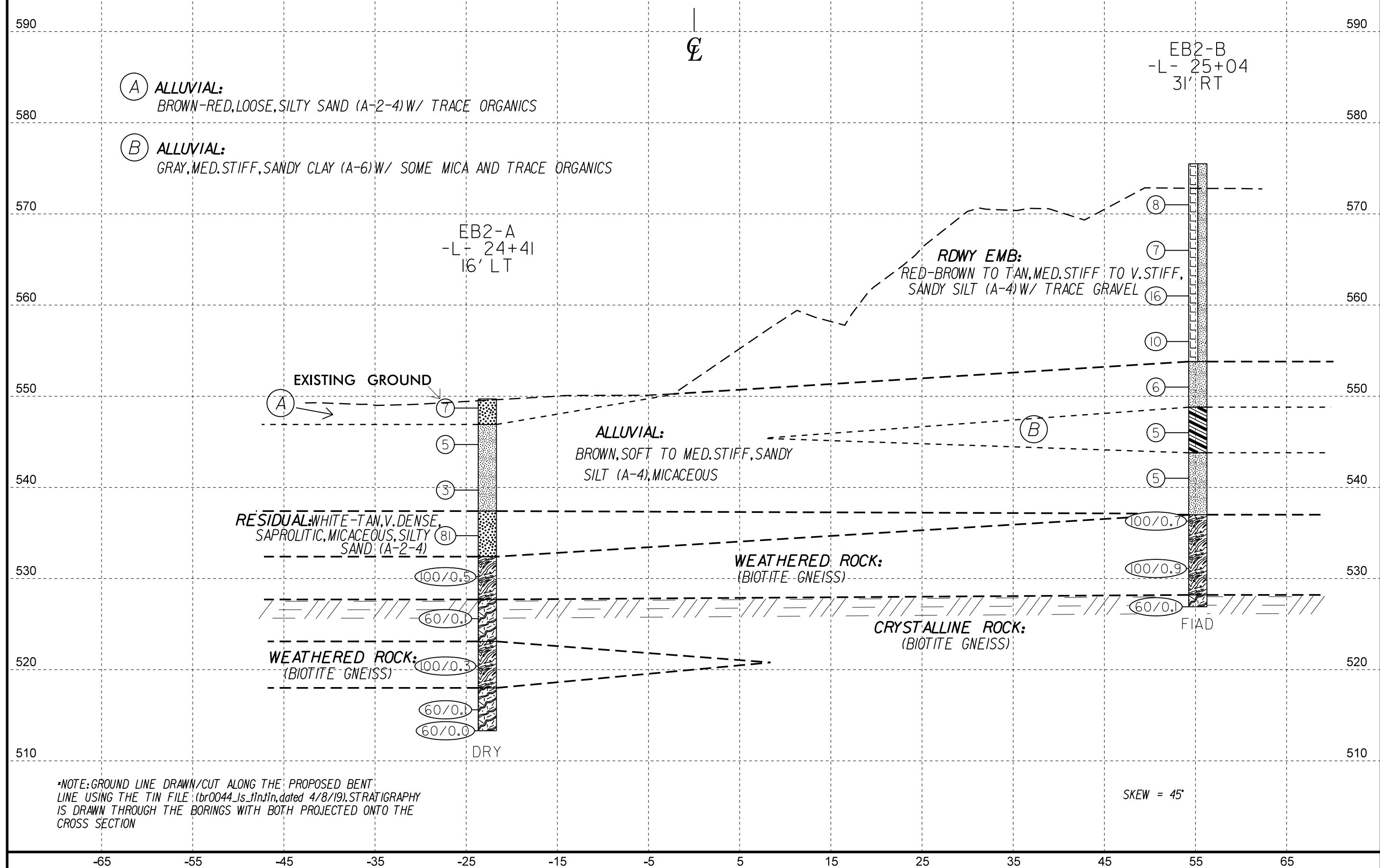
(B) WEATHERED ROCK: (BIOTITE GNEISS)

SKREW = 45'





PROJECT REFERENCE NO.	SHEET
BR-0044	10
<b>EB2 CROSS SECTION</b>	



\*NOTE: GROUND LINE DRAWN/CUT ALONG THE PROPOSED BENT LINE USING THE TIN FILE (br0044\_Is\_tin.tin, dated 4/8/19). STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley									
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)								
BORING NO. EB1-A		STATION 19+21		OFFSET 65 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 556.0 ft		TOTAL DEPTH 14.0 ft		NORTHING 1,012,228		EASTING 1,774,124									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER L. Gonzalez		START DATE 06/11/19		COMP. DATE 06/11/19		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					
560															
555	556.0	0.0	1	1	0										
550	551.8	4.2	2	2	3										
545	546.8	9.2	3	7	5										
	542.0	14.0													60/0.0
<p style="text-align: center;"><b>GROUND SURFACE</b> 556.0 0.0</p> <p style="text-align: center;"><b>ALLUVIAL</b> Brown, v. soft to med. stiff, Sandy SILT (A-4), trace mica to micaceous, no rock fragments to trace gravel-sized rock fragments</p> <p style="text-align: center;"><b>RESIDUAL</b> Brown, stiff, Sandy SILT (A-4), little mica, saprolitic, trace gravel-sized rock fragments</p> <p style="text-align: center;"><b>CRYSTALLINE ROCK</b> (biotite gneiss) (Hard grinding at 13.7 feet) (Auger and SPT refusal at 14.0 feet) Boring Terminated with Standard Penetration Test Refusal at Elevation 542.0 ft In Crystalline Rock (biotite gneiss)</p>															

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST M. Shipman									
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 19+65		OFFSET 31 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 597.3 ft		TOTAL DEPTH 48.4 ft		NORTHING 1,012,122		EASTING 1,774,118									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER L. Gonzalez		START DATE 06/13/19		COMP. DATE 06/13/19		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					
600															
595	594.0	3.3	3	3	5										
590	589.0	8.3	2	4	5										
585	584.0	13.3	2	3	3										
580	579.0	18.3	1	2	1										
575	574.0	23.3	1	2	2										
570	569.0	28.3	15	37	56										
565	564.0	33.3	16	19	25										
560	559.0	38.3	9	20	80/0.4										
555	554.0	43.3													100/0.3
550	549.0	48.3													60/0.1
<p style="text-align: center;"><b>GROUND SURFACE</b> 597.3 0.0</p> <p style="text-align: center;"><b>ROADWAY EMBANKMENT</b> Tan and red-brown or gray, soft to stiff, Sandy SILT (A-4), little to some mica</p> <p style="text-align: center;"><b>RESIDUAL</b> Tan, dense to v. dense, Silty SAND (A-2-4), little to some mica, saprolitic, no rock fragments to trace gravel-sized rock fragments</p> <p style="text-align: center;"><b>WEATHERED ROCK</b> (biotite gneiss) (Harder blows at 39.3 feet) (Spoon wet inside and out on 43.3 ft sample drive)</p> <p style="text-align: center;"><b>CRYSTALLINE ROCK</b> (biotite gneiss) (SPT refusal at 48.4 feet) (Driller states harder at 45.8 feet) (Spoon wet inside and out on 48.3 ft sample drive) Boring Terminated with Standard Penetration Test Refusal at Elevation 548.9 ft In Crystalline Rock (biotite gneiss)</p>															

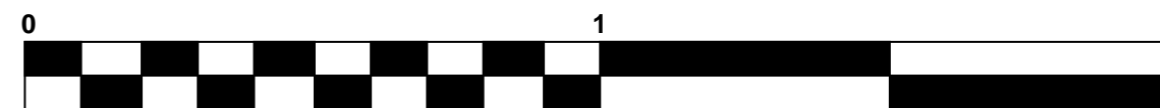
NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19



# CORE PHOTOGRAPHS

## B1-A

BOXES 1 & 2 : 20.4 - 39.7 FEET



FEET

# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley								
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87						GROUND WTR (ft)								
BORING NO. B1-B		STATION 20+55		OFFSET 12 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 551.6 ft		TOTAL DEPTH 50.6 ft		NORTHING 1,012,098		EASTING 1,774,207								
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER L. Gonzalez		START DATE 06/17/19		COMP. DATE 06/17/19		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
555														
	551.6	0.0												551.6 GROUND SURFACE 0.0
550			1	0	1								M	550 ALLUVIAL Brown, v. soft to hard, Sandy SILT (A-4), trace rootlets, some mica to micaceous
	547.5	4.1											M	
545			2	6	27								M	545 Gray-brown, v. soft, Silty CLAY (A-7), trace mica
	542.5	9.1											M	544.0 7.6
540			WOH	WOH	1								M	540 WEATHERED ROCK (biotite gneiss) (Driller states harder at 12.7 feet)
	537.5	14.1												538.9 12.7
535			100/0.5											535 CRISTALLINE ROCK (biotite gneiss) (Auger and SPT refusal at 27.8 feet) (Switched to coring at 27.8 feet)  GSI: 70-80
	532.5	19.1												532.8 27.8
530			100/0.5											530 Boring Terminated at Elevation 501.0 ft In Crystalline Rock (biotite gneiss)
	527.5	24.1												
525			55	45/0.1										
	523.8	27.8												
520			60/0.1											
515														
510														
505														

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley		
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87						GROUND WTR (ft)		
BORING NO. B1-B		STATION 20+55		OFFSET 12 ft RT		ALIGNMENT -L-		
COLLAR ELEV. 551.6 ft		TOTAL DEPTH 50.6 ft		NORTHING 1,012,098		EASTING 1,774,207		
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic				
DRILLER L. Gonzalez		START DATE 06/17/19		COMP. DATE 06/17/19		SURFACE WATER DEPTH N/A		
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	TOTAL RUN 22.8 ft		L O G	DESCRIPTION AND REMARKS
					REC. (ft) %	RQD (ft) %		
523.8								523.8 Begin Coring @ 27.8 ft
	523.8	27.8	2.8	1:12/0.8 N=60/0.1	(2.0) 71%	(1.6) 57%		523.8 CRISTALLINE ROCK Gray to dark gray, mod. weathered to fresh, v. soft to v. hard, close to wide fracture spacing, biotite schist and biotite gneiss  GSI: 70-80
520			5.0	1:12/0.8 1:09/1.0 1:06/1.0	(3.9) 78%	(3.3) 66%		
	521.0	30.6		1:48/1.0 1:57/1.0 1:57/1.0 1:24/1.0				
515			5.0	2:12/1.0 1:52/1.0 1:07/1.0	(5.0) 100%	(4.5) 90%		
	516.0	35.6		2:34/1.0 2:54/1.0 3:15/1.0				
510			5.0	2:29/1.0 2:58/1.0 2:59/1.0 5:48/1.0 9:39/1.0	(4.7) 94%	(4.5) 90%		
	511.0	40.6						
505			5.0	4:34/1.0 4:23/1.0 4:27/1.0 4:17/1.0 4:57/1.0	(5.0) 100%	(5.0) 100%		
	506.0	45.6						
	501.0	50.6						501.0 Boring Terminated at Elevation 501.0 ft In Crystalline Rock (biotite gneiss)

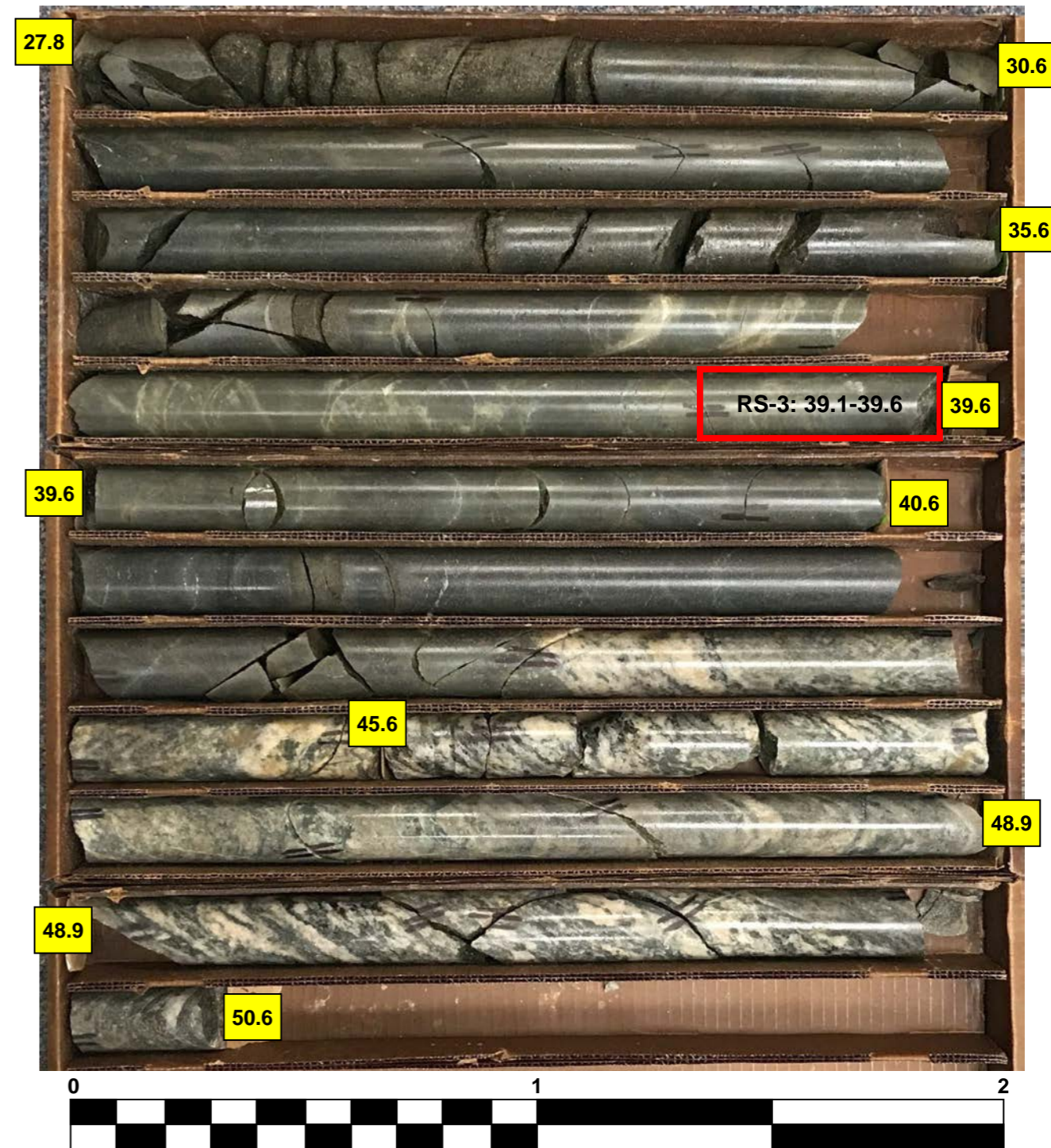
NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ NC\_DOT.GDT 10/1/19

NCDOT CORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ NC\_DOT.GDT 10/1/19

# CORE PHOTOGRAPHS

## B1-B

BOXES 1, 2 & 3 : 27.8 - 50.6 FEET



27.8

30.6

35.6

RS-3: 39.1-39.6

39.6

39.6

40.6

45.6

48.9

48.9

50.6



FEET



# GEOTECHNICAL BORING REPORT

## BORE LOG

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Gross									
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)								
BORING NO. B2-B		STATION 21+93		OFFSET 38 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 534.7 ft		TOTAL DEPTH 27.5 ft		NORTHING 1,012,012		EASTING 1,774,318									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic											
DRILLER L. Gonzalez		START DATE 09/19/19		COMP. DATE 09/20/19		SURFACE WATER DEPTH 3.2ft									
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)	
535	534.7	0.0	1	2	6							Sat.	534.7	GROUND SURFACE	0.0
													532.2	ALLUVIAL Black, loose, Silty SAND (A-2-4), micaceous, with organics and wood chunks	2.5
530													528.4	CRYSTALLINE ROCK (biotite gneiss)	6.3
	528.4	6.3	60/0.1											CRYSTALLINE ROCK (biotite gneiss)	
525												RS-4		GSI = 40-50	
520															
515												RS-5			
510															
													507.2	Boring Terminated at Elevation 507.2 ft In Crystalline Rock (biotite gneiss)	27.5
														*Deck to datum: 52.5 feet	

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Gross					
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)				
BORING NO. B2-B		STATION 21+93		OFFSET 38 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 534.7 ft		TOTAL DEPTH 27.5 ft		NORTHING 1,012,012		EASTING 1,774,318					
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic							
DRILLER L. Gonzalez		START DATE 09/19/19		COMP. DATE 09/20/19		SURFACE WATER DEPTH 3.2ft					
CORE SIZE NQ-2		TOTAL RUN 21.2 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	
					REC (ft) %	RQD (ft) %	REC (ft) %	RQD (ft) %		ELEV. (ft)	DEPTH (ft)
528.4	528.4	0.3	1.2	3:11/1.0	(0.4)	(0.0)	(16.8)	(9.6)		Continued from previous page	
	527.2	7.5	5.0	N=60/0.1 3:11/1.0 0:31/0.2	33%	0%	79%	45%		CRYSTALLINE ROCK Gray and white, soft to v. hard, mod. weathered to fresh, close to moderately close fractured, biotite gneiss	
525				2:09/1.0 2:11/1.0 2:35/1.0	(4.5)	(3.0)				GSI = 40-50	
	522.2	12.5	5.0	2:12/1.0 2:55/1.0	(2.0)	(0.4)				*Note: 12.5'-17.5' is interpreted as CR. Poor recovery due to equipment malfunction (inner core barrel not locking in) during third core run, per conversation w/ field geologist and driller.	
520				2:08/1.0 4:07/1.0 7:40/1.0 2:33/1.0 3:42/1.0	40%	8%				RS-4	
	517.2	17.5	5.0	2:06/1.0 2:13/1.0 2:30/1.0 2:34/1.0 3:01/1.0	(5.0)	(3.3)				RS-5	
515					100%	66%					
	512.2	22.5	5.0	3:34/1.0 3:25/1.0 2:29/1.0 4:35/1.0 3:25/1.0	(4.9)	(2.9)					
510					98%	58%					
	507.2	27.5								Boring Terminated at Elevation 507.2 ft In Crystalline Rock (biotite gneiss)	
										*Deck to datum: 52.5 feet	

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

# CORE PHOTOGRAPHS

## B2-B

BOXES 1 & 2 : 6.3 - 27.5 FEET



FEET

## GEOTECHNICAL BORING REPORT BORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Gross									
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)								
BORING NO. B3-B		STATION 23+07		OFFSET 37 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 537.0 ft		TOTAL DEPTH 28.3 ft		NORTHING 1,011,960		EASTING 1,774,419									
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic											
DRILLER L. Gonzalez		START DATE 09/20/19		COMP. DATE 09/23/19		SURFACE WATER DEPTH 4.5ft									
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)
540															
	537.0	0.0	12	88	0.3										
535	534.6	2.4	60	0.1											
530															
525															
520															
515															
510															
GROUND SURFACE ALLUVIAL Brown, med. dense, Fine to Coarse SAND (A-1-b) with gravel WEATHERED ROCK (granitic schist) CRYSTALLINE ROCK (biotite gneiss) (casing advancer refusal at 5.1') GSI = 35-45															
Boring Terminated at Elevation 508.7 ft In Crystalline Rock (biotite gneiss) *Deck to datum: 46.7 feet															

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

## GEOTECHNICAL BORING REPORT CORE LOG

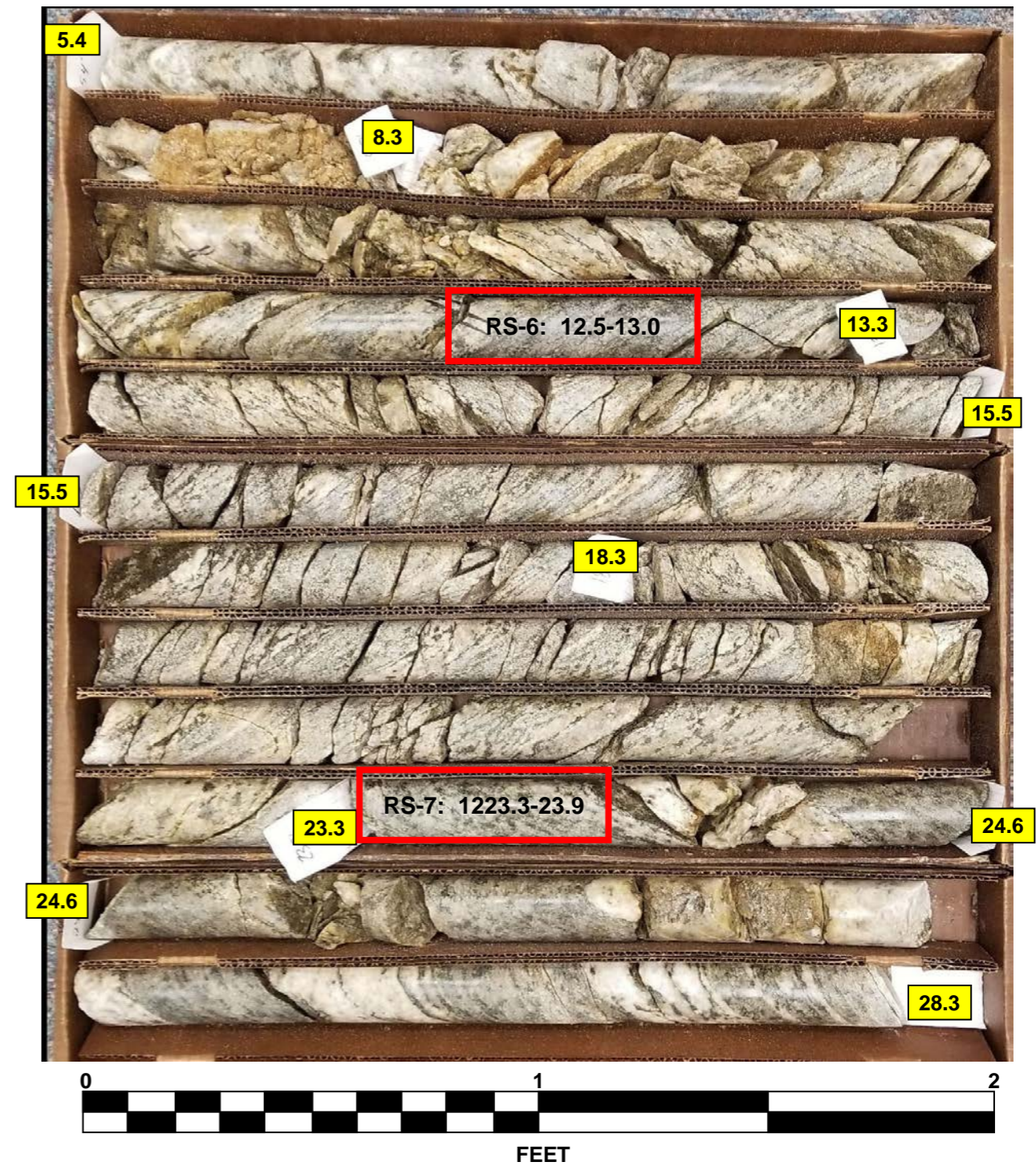
WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Gross				
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)			
BORING NO. B3-B		STATION 23+07		OFFSET 37 ft RT		ALIGNMENT -L-				
COLLAR ELEV. 537.0 ft		TOTAL DEPTH 28.3 ft		NORTHING 1,011,960		EASTING 1,774,419				
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic						
DRILLER L. Gonzalez		START DATE 09/20/19		COMP. DATE 09/23/19		SURFACE WATER DEPTH 4.5ft				
CORE SIZE NQ-2		TOTAL RUN 22.9 ft		DESCRIPTION AND REMARKS						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (%)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	LOG
531.6	531.6	5.4	2.9	2:11/1.0 2:03/1.0 2:29/0.9	(2.6) 90%	(1.6) 55%		(22.4) 98%	(9.1) 40%	
530	528.7	8.3	5.0	2:08/1.0 2:18/1.0 2:51/1.0 2:17/1.0 2:23/1.0	(4.8) 96%	(1.6) 32%				
525	523.7	13.3	5.0	1:59/1.0 2:24/1.0 2:26/1.0 2:11/1.0 2:18/1.0	(5.0) 100%	(1.6) 32%	RS-6			
520	518.7	18.3	5.0	2:00/1.0 1:36/1.0 2:21/1.0 2:20/1.0 1:21/1.0	(5.0) 100%	(1.2) 24%				
515	513.7	23.3	5.0	3:00/1.0 1:53/1.0 2:50/1.0 3:10/1.0 3:21/1.0	(5.0) 100%	(3.1) 62%	RS-7			
510	508.7	28.3								
Continued from previous page CRYSTALLINE ROCK Gray and white, mod. weathered to fresh, soft to v. hard, v. close to close fractured, biotite gneiss GSI = 35-45										
Boring Terminated at Elevation 508.7 ft In Crystalline Rock (biotite gneiss) *Deck to datum: 46.7 feet										

NCDOT CORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

# CORE PHOTOGRAPHS

## B3-B

BOXES 1 thru 3 : 5.4 - 28.3 FEET



# GEOTECHNICAL BORING REPORT

## BORE LOG

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley								
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)							
BORING NO. B4-A		STATION 23+70		OFFSET 12 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 548.8 ft		TOTAL DEPTH 55.9 ft		NORTHING 1,011,975		EASTING 1,774,498								
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic								
DRILLER L. Gonzalez		START DATE 06/06/19		COMP. DATE 06/07/19		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				
550	548.8	0.0	1	2	1							M	GROUND SURFACE	0.0
545	544.5	4.3	2	1	1							M	<b>ALLUVIAL</b> Brown, soft, Sandy SILT (A-4), little mica	2.9
540	539.5	9.3	1	1	2							W	Brown to blue-gray, v. loose, Silty SAND (A-2-4), little to some mica (Inside of spoon wet at 9.3 ft sample drive)	
535	534.5	14.3	59	41/0.1						100/0.6		W	<b>WEATHERED ROCK</b> (biotite gneiss) (Driller states harder at 12.3 feet) (Boulders at 11.3 feet) (Inside and outside of spoon wet at 14.3 ft sample drive)	12.3
530	529.5	19.3	43	57/0.2						100/0.7		W		
525	524.5	24.3	9	23	31							M	<b>RESIDUAL</b> Brown to white-brown, hard, Sandy SILT (A-4), saprolitic, micaceous, trace cobble-sized rock fragments (Harder drilling from 24.5 feet to 29.0 feet)	24.0
520	519.5	29.3	13	47	39							M		
515	515.2	33.6	60/0.0							60/0.0		M	<b>CRYSTALLINE ROCK</b> (biotite gneiss) (Driller states harder at 33.6 feet) (Auger and SPT refusal at 33.6 feet) (Switch to coring at 33.6 feet)  GSI = 40-50	33.6
510														
505														
500														
495														
														492.9
														55.9
Boring Terminated at Elevation 492.9 ft In Crystalline Rock (biotite gneiss)														

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

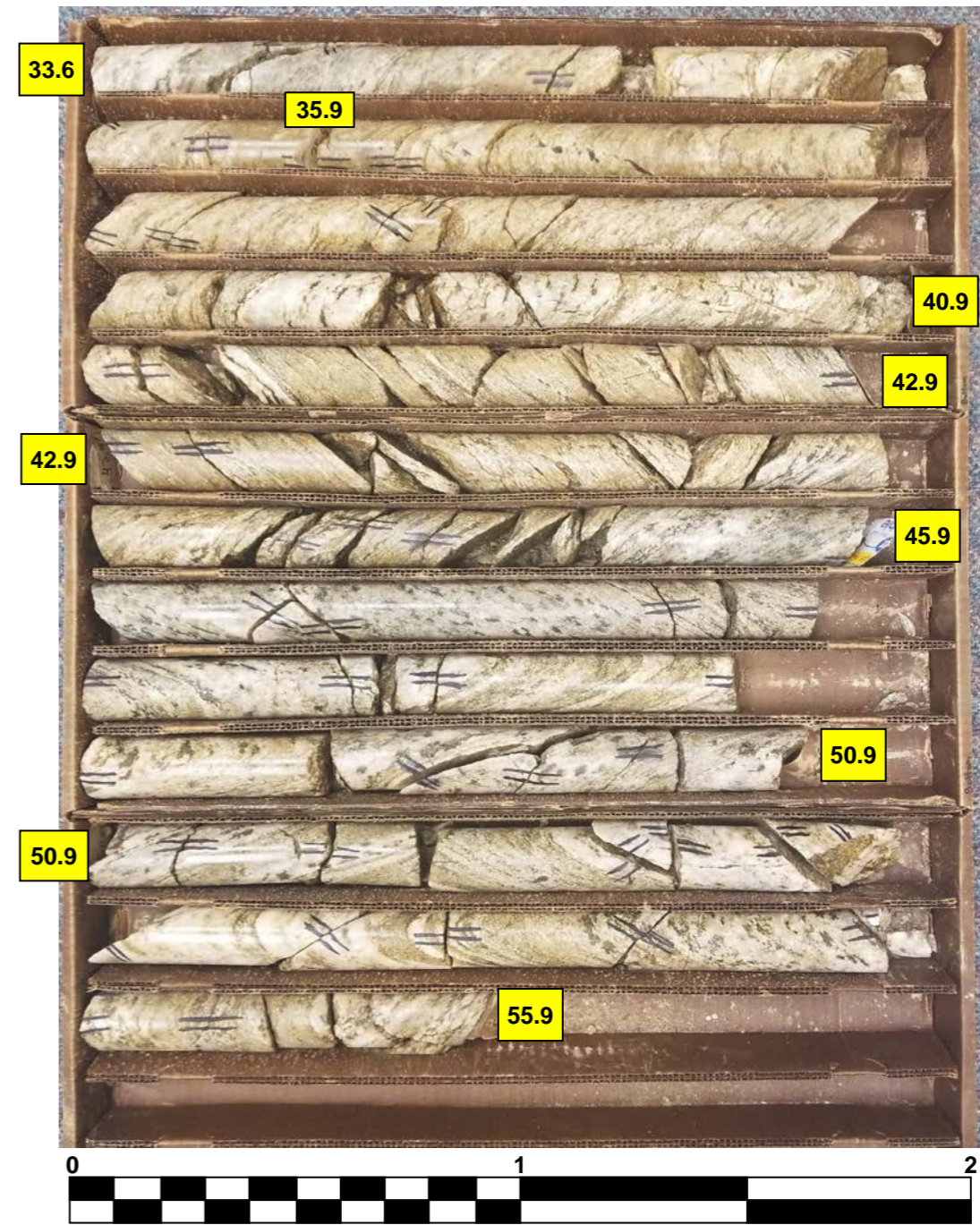
WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley						
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ N87							GROUND WTR (ft)					
BORING NO. B4-A		STATION 23+70		OFFSET 12 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 548.8 ft		TOTAL DEPTH 55.9 ft		NORTHING 1,011,975		EASTING 1,774,498						
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic						
DRILLER L. Gonzalez		START DATE 06/06/19		COMP. DATE 06/07/19		SURFACE WATER DEPTH N/A						
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)			
515.2	515.2	33.6	2.3	N=60/0.0 2:42/1.0 2:50/1.0 1:08/0.3	(2.3)	(1.9)		(22.3)	(17.4)		Continued from previous page	
512.9	512.9	35.9	5.0	1:39/1.0 1:49/1.0 2:00/1.0 1:47/1.0 2:16/1.0	100%	83%		100%	78%		<b>CRYSTALLINE ROCK</b> Brown and gray, mod. weathered to fresh, mod. hard to hard, closely fractured, biotite gneiss	33.6
510											GSI = 40-50	
507.9	507.9	40.9	5.0	2:16/1.0 2:03/1.0 2:13/1.0 2:02/1.0 2:52/1.0	(5.0)	(2.3)		100%	46%			
505												
502.9	502.9	45.9	5.0	2:26/1.0 2:27/1.0 2:30/1.0 2:13/1.0 2:29/1.0	(5.0)	(4.6)		100%	92%			
500												
497.9	497.9	50.9	5.0	2:08/1.0 3:02/1.0 2:19/1.0 2:13/1.0 2:08/1.0	(5.0)	(4.5)		100%	90%			
495												
492.9	492.9	55.9									Boring Terminated at Elevation 492.9 ft In Crystalline Rock (biotite gneiss)	55.9

NCDOT CORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

# CORE PHOTOGRAPHS

## B4-A

BOXES 1, 2, & 3 : 33.6 - 55.9 FEET



FEET

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley							
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ N87							GROUND WTR (ft)						
BORING NO. B4-B		STATION 23+94		OFFSET 12 ft RT		ALIGNMENT -L-							
COLLAR ELEV. 550.2 ft		TOTAL DEPTH 60.4 ft		NORTHING 1,011,942		EASTING 1,774,508							
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic							
DRILLER L. Gonzalez		START DATE 06/04/19		COMP. DATE 06/05/19		SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75				
555													
550	550.2	0.0	1	1	1								550.2 GROUND SURFACE 0.0
545	545.1	5.1	2	1	2								<b>ALLUVIAL</b> Brown, loose, Silty SAND (A-2-4), little to some mica, trace rootlets
540	540.1	10.1	WOH	1	3								541.8 Dark-brown, soft, Sandy SILT (A-4), highly micaceous 8.4
535	535.1	15.1	4	10	45								536.8 <b>RESIDUAL</b> Brown, hard, Sandy SILT (A-4), highly micaceous, saprolitic (Spoon wet on outside and inside at 15.1 ft drive) 13.4
530	530.1	20.1	100/0.5										531.8 <b>WEATHERED ROCK</b> (biotite gneiss) (Driller states harder at 18.4 feet) 18.4
525	525.1	25.1	72	28/0.1									
520	520.1	30.1	20	80/0.3									
515	517.8	32.4	60/0.0										517.8 <b>CRYSTALLINE ROCK</b> (biotite gneiss) 32.4
510													514.8 (Auger and SPT refusal at 32.4 feet) (Driller states harder at 32.4 feet) (Switch to coring at 32.4 feet) 35.4
505													511.1 <b>WEATHERED ROCK</b> (biotite gneiss) (Driller states softer at 35.4 feet) 39.1
500													<b>CRYSTALLINE ROCK</b> (biotite gneiss) (Driller states harder at 39.1)  GSI = 45-55
495													
490													489.8 Boring Terminated at Elevation 489.8 ft In Crystalline Rock (biotite gneiss) 60.4

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ NC\_DOT.GDT 10/1/19

# GEOTECHNICAL BORING REPORT

## CORE LOG

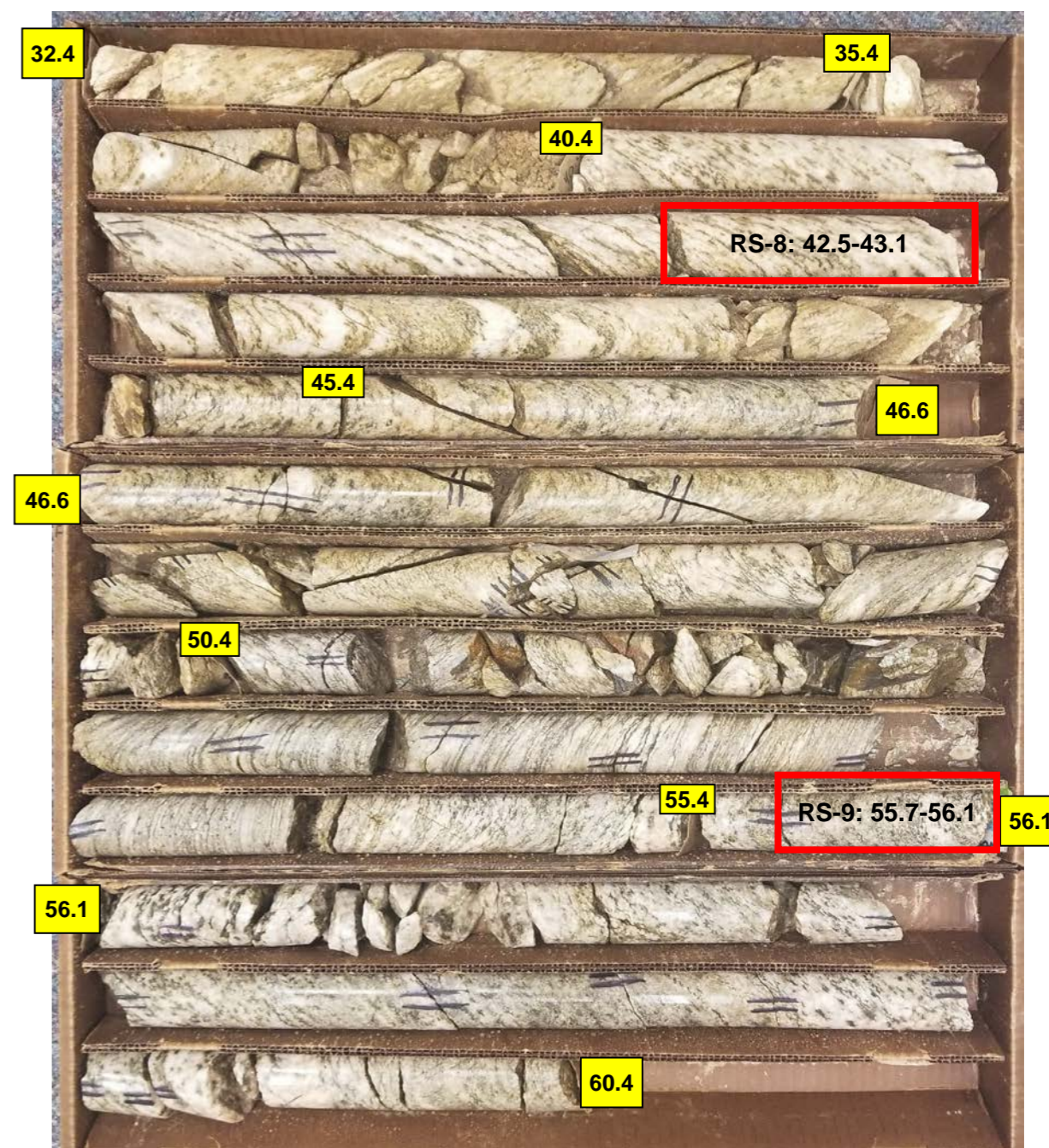
WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)
BORING NO. B4-B		STATION 23+94		OFFSET 12 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 550.2 ft		TOTAL DEPTH 60.4 ft		NORTHING 1,011,942		EASTING 1,774,508	
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
DRILLER L. Gonzalez		START DATE 06/04/19		COMP. DATE 06/05/19		SURFACE WATER DEPTH N/A	
CORE SIZE NQ-2			TOTAL RUN 28.0 ft				
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (%)	RQD (%)	SAMP. NO.
517.8	517.8	32.4	3.0	N=60/0.0 2:32/1.0 3:02/1.0 4:24/1.0	(1.7) 57%	(0.4) 13%	
515	514.8	35.4	5.0	1:52/1.0 2:03/1.0 2:47/1.0 2:13/1.0 2:33/1.0	(1.3) 26%	(0.0) 0%	
510	509.8	40.4	5.0	2:01/1.0 1:57/1.0 2:08/1.0 1:58/1.0 2:17/1.0	(5.0) 100%	(4.0) 80%	RS-8
505	504.8	45.4	5.0	2:31/1.0 2:26/1.0 2:05/1.0 2:05/1.0 4:56/1.0	(5.0) 100%	(3.7) 74%	
500	499.8	50.4	5.0	1:52/1.0 1:49/1.0 2:04/1.0 1:25/1.0 3:06/1.0	(5.0) 100%	(2.6) 52%	
495	494.8	55.4	5.0	1:43/1.0 2:51/1.0 2:17/1.0 2:15/1.0 3:04/1.0	(5.0) 100%	(3.7) 74%	RS-9
490	489.8	60.4					
Boring Terminated at Elevation 489.8 ft In Crystalline Rock (biotite gneiss) 60.4							

NCDOT CORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ NC\_DOT.GDT 10/1/19

# CORE PHOTOGRAPHS

## B4-B

BOXES 1, 2, & 3 : 32.4 - 60.4 FEET





# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST A. Ruley	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)
BORING NO. EB2-A		STATION 24+41		OFFSET 16 ft LT		ALIGNMENT -L-	
COLLAR ELEV. 549.7 ft		TOTAL DEPTH 36.4 ft		NORTHING 1,011,946		EASTING 1,774,563	
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic		
DRILLER L. Gonzalez		START DATE 06/04/19		COMP. DATE 06/04/19		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				
550	549.7	0.0	2	2	5							M	GROUND SURFACE	0.0
545	545.7	4.0	3	2	3							M	<b>ALLUVIAL</b> Brown-red, loose, Silty SAND (A-2-4), trace rootlets and other organic matter	2.8
540	540.7	9.0	2	2	1							W	Brown, soft to med. stiff, Sandy SILT (A-4), little mica to micaceous (Inside of spoon wet in 9.0 ft sample drive)	
535	535.7	14.0	41	45	36							M	<b>RESIDUAL</b> White-tan, v. dense, Silty SAND (A-2-4), saprolitic, micaceous (Inside and outside of spoon wet in 14.0 ft sample drive)	12.3
530	530.7	19.0	100/0.5										<b>WEATHERED ROCK</b> (biotite gneiss)	17.3
525	525.7	24.0	60/0.1										<b>CRYSTALLINE ROCK</b> (biotite gneiss)	22.0
520	520.7	29.0	100/0.3										<b>WEATHERED ROCK</b> (biotite gneiss)	26.8
515	515.7	34.0	60/0.1										<b>CRYSTALLINE ROCK</b> (biotite gneiss) (Auger and SPT refusal at 36.4 feet)	31.7
	513.3	36.4	60/0.0										Boring Terminated with Standard Penetration Test Refusal at Elevation 513.3 ft in Crystalline Rock (biotite gneiss)	36.4

WBS 67044.1.1		TIP BR-0044		COUNTY ROCKINGHAM		GEOLOGIST M. Shipman	
SITE DESCRIPTION Bridge No. 780168 over Smith River on NC14/ NC87							GROUND WTR (ft)
BORING NO. EB2-B		STATION 25+04		OFFSET 31 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 575.5 ft		TOTAL DEPTH 48.6 ft		NORTHING 1,011,874		EASTING 1,774,596	
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 90% 11/19/2018			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic		
DRILLER L. Gonzalez		START DATE 06/14/19		COMP. DATE 06/14/19		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				
580													GROUND SURFACE	0.0
575													<b>ROADWAY EMBANKMENT</b> Red-brown to tan, med. stiff to v. stiff, Silty CLAY (A-7), no rock fragments to trace gravel-sized rock fragments	
570	572.0	3.5	2	4	4							M		
565	567.0	8.5	3	3	4							W		
560	562.0	13.5	3	5	11							M		
555	557.0	18.5	5	5	5							M	<b>RESIDUAL</b> Red-brown to brown, med. dense, Silty SAND (A-2-4), some mica, saprolitic	16.4
550	552.0	23.5	2	3	3							W	Red-brown and brown, med. stiff, Sandy SILT (A-4), some mica, saprolitic	21.7
545	547.0	28.5	2	2	3							W	Gray, med. stiff, Sandy CLAY (A-6), some mica	26.7
540	542.0	33.5	2	2	3							W	Gray and red-brown, med. stiff, Clayey SILT (A-5), little mica, saprolitic	31.7
535	537.0	38.5	63	37/0.2									<b>WEATHERED ROCK</b> (biotite gneiss) (Driller states harder at 38.5 feet)	38.5
530	532.0	43.5	53	47/0.4										
	527.0	48.5	60/0.1										<b>CRYSTALLINE ROCK</b> (biotite gneiss) (Driller states harder at 47.3 feet) (SPT refusal at 48.6 feet) Boring Terminated with Standard Penetration Test Refusal at Elevation 526.9 ft in Crystalline Rock (biotite gneiss)	47.3 48.6

NCDOT BORE DOUBLE BR0044\_GEO\_BRDG\_SUMMIT\_GINT.GPJ\_NC\_DOT.GDT\_10/1/19

**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-1

Location: B1-A

Depth (ft): 28.5 - 28.8

Length (in.): 3.52

Diameter (in.): 1.99

Area (in<sup>2</sup>): 3.110

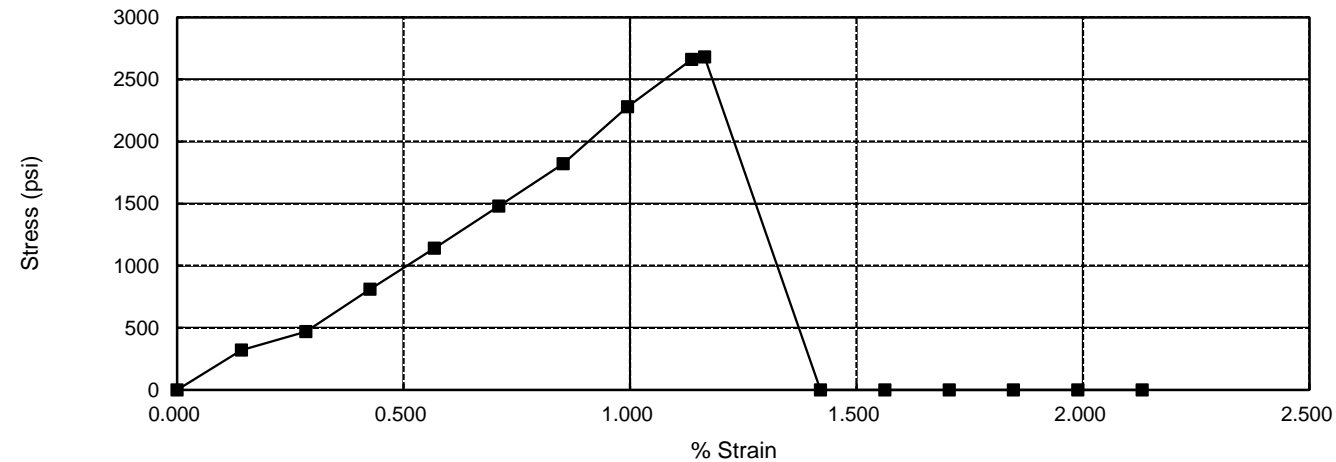
L/D 1.8

Unit Weight (pcf): 159.5

**Compressive Strength (psi): 2680**

Time to Failure, mins:sec: 0:56

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.142	980	320	225,280
0.010	0.284	1460	470	165,440
0.015	0.426	2520	810	190,080
0.020	0.568	3560	1140	200,640
0.025	0.710	4590	1480	208,384
0.030	0.852	5660	1820	213,547
0.035	0.994	7100	2280	229,303
0.040	1.136	8270	2660	234,080
0.041	1.165	8350	2680	230,088
0.050	1.420		0	0
0.055	1.563		0	0
0.060	1.705		0	0
0.065	1.847		0	0
0.070	1.989		0	0
0.075	2.131		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
 Performed in General Accordance with ASTM D7012



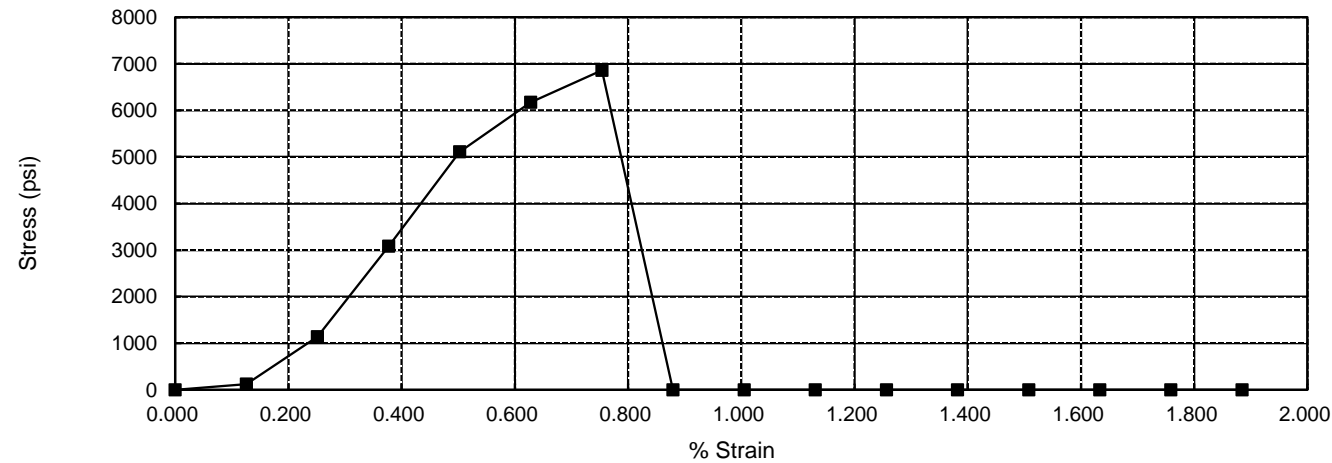
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78  
 Project Number: 67044.1.1  
 Sample ID: RS-2  
 Location: B1-A  
 Depth (ft): 36.0 - 36.3

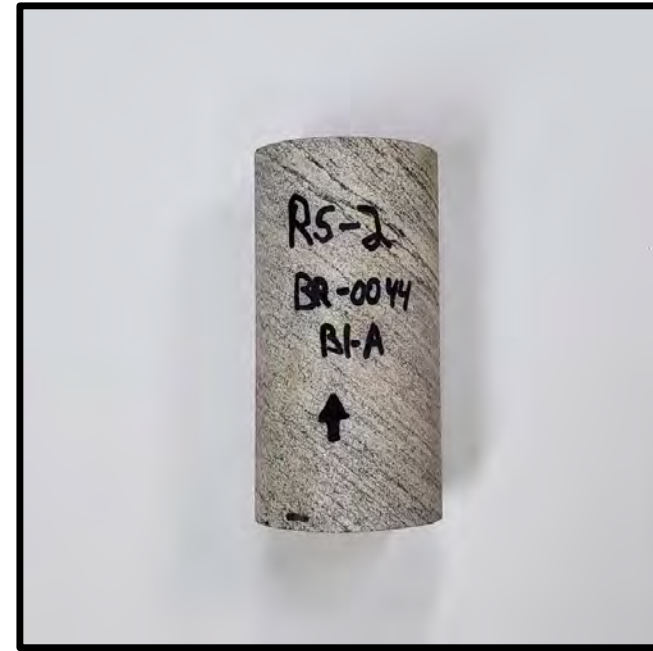
Length (in.): 3.98  
 Diameter (in.): 1.99  
 Area (in<sup>2</sup>): 3.110  
 L/D 2.0  
 Unit Weight (pcf): 163.6

**Compressive Strength (psi): 6860**  
 Time to Failure, mins:sec: 2:13

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.126	360	120	95,520
0.010	0.251	3560	1140	453,720
0.015	0.377	9590	3080	817,227
0.020	0.503	15890	5110	1,016,890
0.025	0.628	19200	6170	982,264
0.030	0.754	21350	6860	910,093
0.035	0.879		0	0
0.040	1.005		0	0
0.045	1.131		0	0
0.050	1.256		0	0
0.055	1.382		0	0
0.060	1.508		0	0
0.065	1.633		0	0
0.070	1.759		0	0
0.075	1.884		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-3

Location: B1-B

Depth (ft): 39.2 - 39.5

Length (in.): 3.95

Diameter (in.): 1.99

Area (in<sup>2</sup>): 3.110

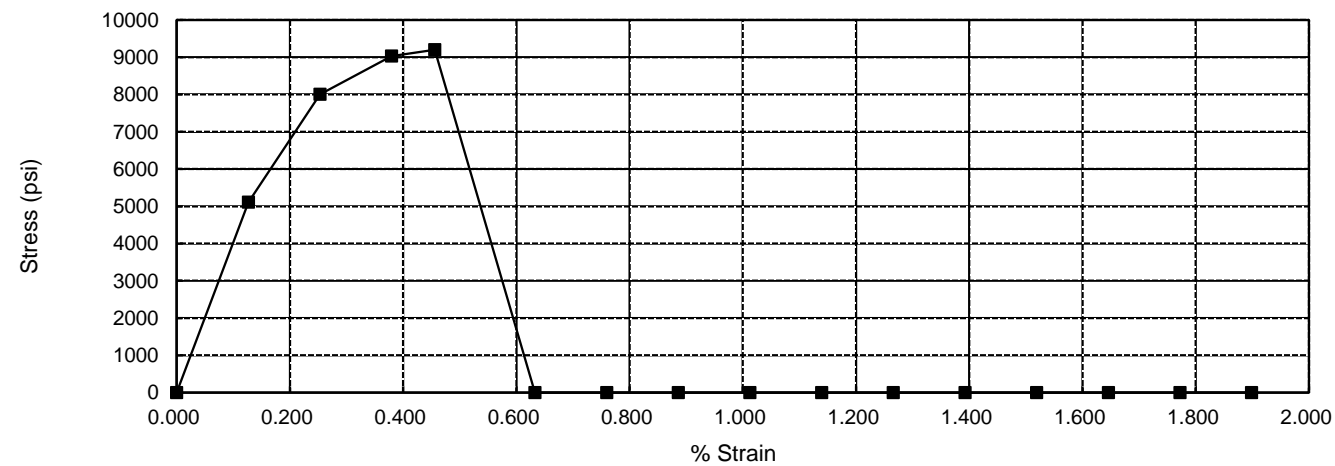
L/D 2.0

Unit Weight (pcf): 165.9

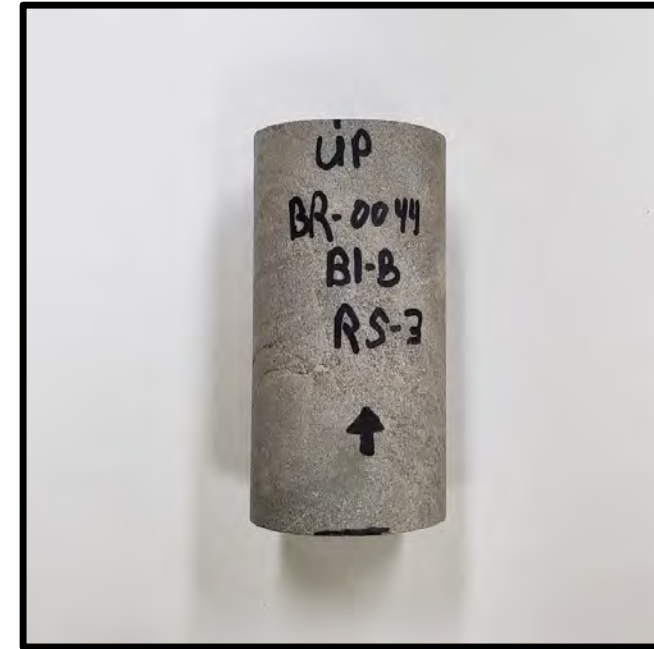
**Compressive Strength (psi): 9200**

Time to Failure, mins:sec: 2:30

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.127	15890	5110	4,036,900
0.010	0.253	24890	8000	3,160,000
0.015	0.380	28090	9030	2,377,900
0.018	0.456	28600	9200	2,018,889
0.025	0.633		0	0
0.030	0.759		0	0
0.035	0.886		0	0
0.040	1.013		0	0
0.045	1.139		0	0
0.050	1.266		0	0
0.055	1.392		0	0
0.060	1.519		0	0
0.065	1.646		0	0
0.070	1.772		0	0
0.075	1.899		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-5

Location: B2-B

Depth (ft): 19.0 - 19.4

Length (in.): 3.95

Diameter (in.): 1.97

Area (in<sup>2</sup>): 3.048

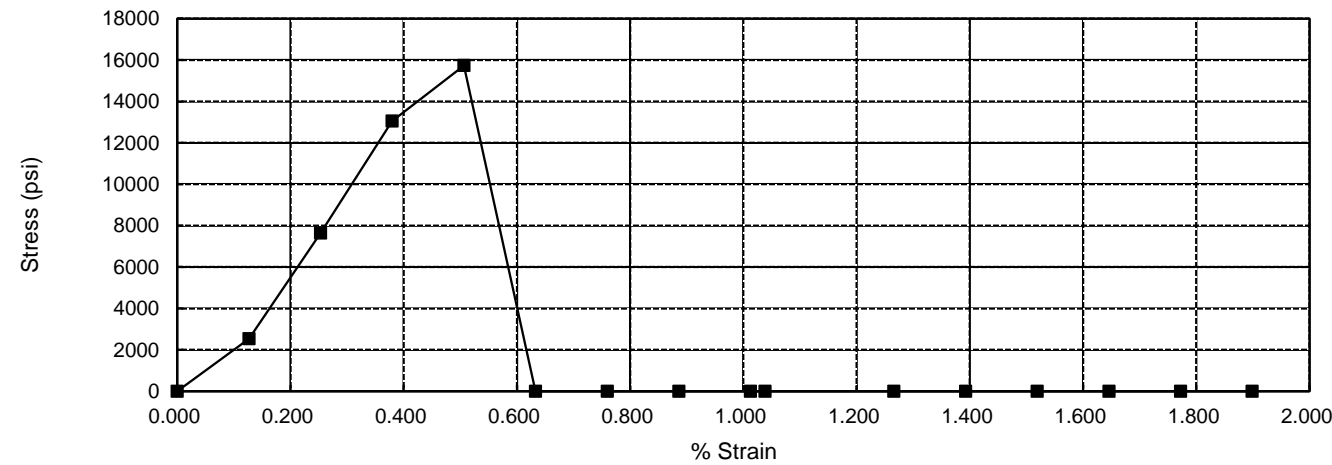
L/D 2.0

Unit Weight (pcf): 161.8

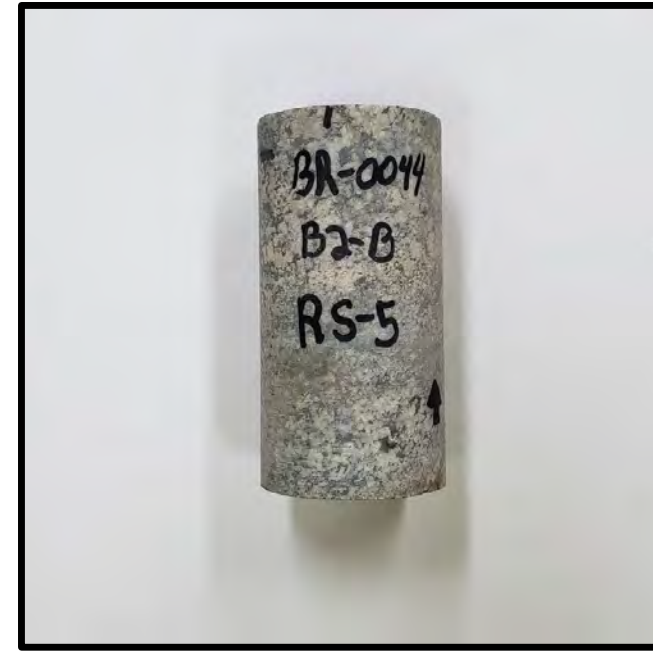
**Compressive Strength (psi): 15730**

Time to Failure, mins:sec: 3:38

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	----
0.005	0.127	7700	2530	1,998,700
0.010	0.253	23290	7640	3,017,800
0.015	0.380	39770	13050	3,436,500
0.020	0.506	47940	15730	3,106,675
0.025	0.633		0	0
0.030	0.759		0	0
0.035	0.886		0	0
0.040	1.013		0	0
0.041	1.038		0	0
0.050	1.266		0	0
0.055	1.392		0	0
0.060	1.519		0	0
0.065	1.646		0	0
0.070	1.772		0	0
0.075	1.899		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
 Performed in General Accordance with ASTM D7012



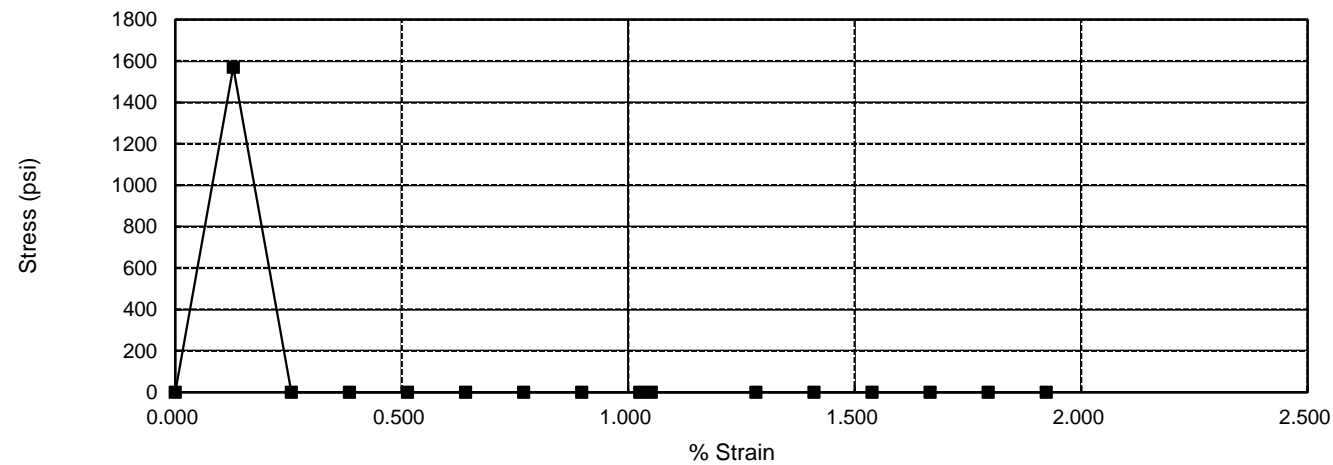
October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78  
 Project Number: 67044.1.1  
 Sample ID: RS-6  
 Location: B3-B  
 Depth (ft): 12.5 to 13.0

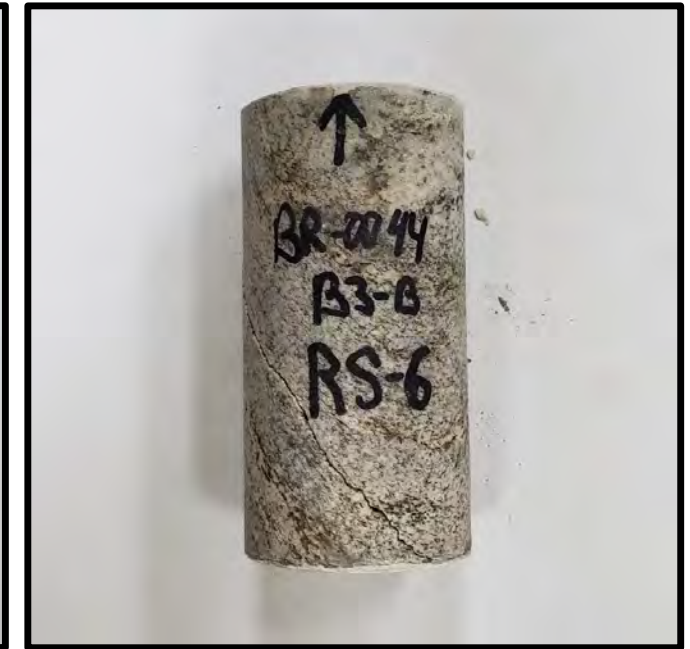
Length (in.): 3.90  
 Diameter (in.): 1.97  
 Area (in<sup>2</sup>): 3.048  
 L/D 2.0  
 Unit Weight (pcf): 164.0

**Compressive Strength (psi): 1570**  
 Time to Failure, mins:sec: 0:17

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	----
0.005	0.128	4790	1570	1,224,600
0.010	0.256		0	0
0.015	0.385		0	0
0.020	0.513		0	0
0.025	0.641		0	0
0.030	0.769		0	0
0.035	0.897		0	0
0.040	1.026		0	0
0.041	1.051		0	0
0.050	1.282		0	0
0.055	1.410		0	0
0.060	1.538		0	0
0.065	1.667		0	0
0.070	1.795		0	0
0.075	1.923		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-7

Location: B3-B

Depth (ft): 23.5 - 23.8

Length (in.): 3.96

Diameter (in.): 1.97

Area (in<sup>2</sup>): 3.048

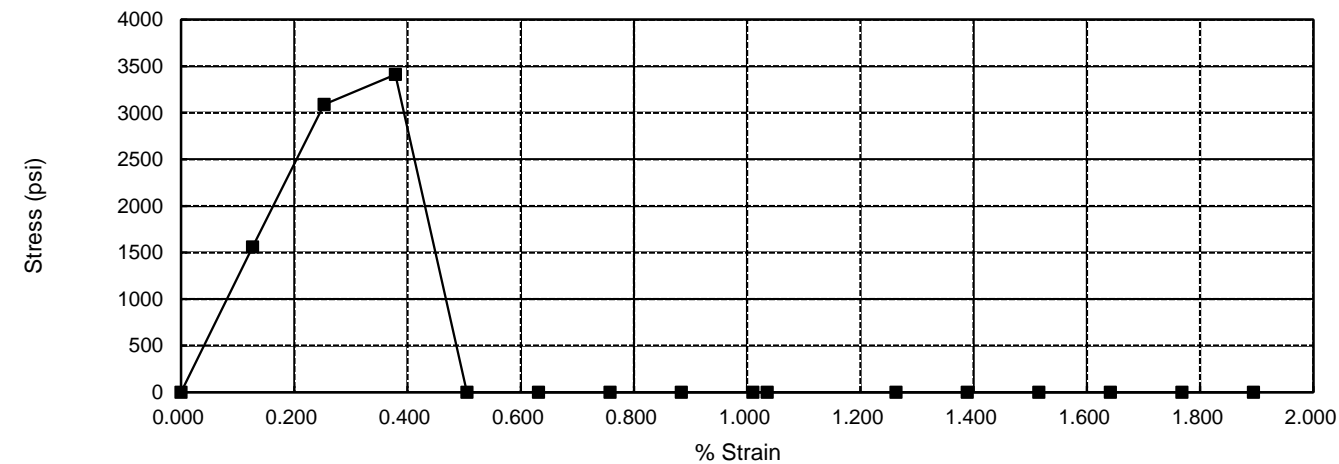
L/D 2.0

Unit Weight (pcf): 164.4

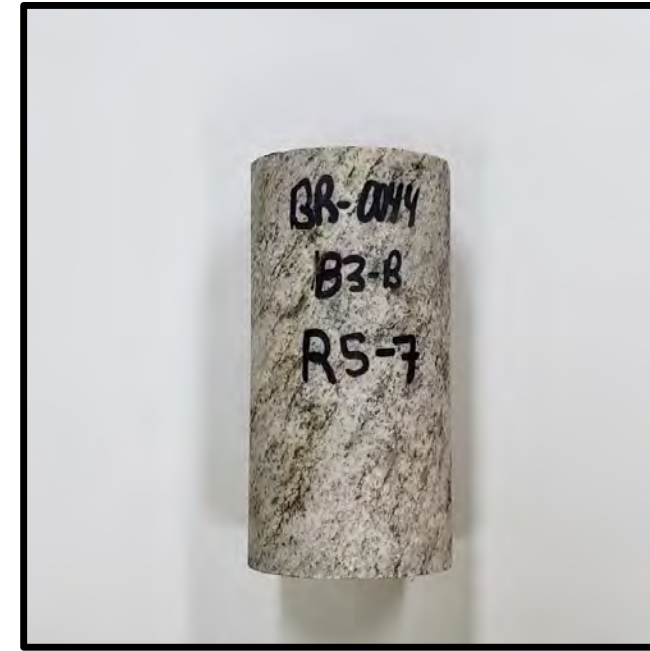
**Compressive Strength (psi): 3410**

Time to Failure, mins:sec: 0:47

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.126	4770	1560	1,235,520
0.010	0.253	9430	3090	1,223,640
0.015	0.379	10400	3410	900,240
0.020	0.505		0	0
0.025	0.631		0	0
0.030	0.758		0	0
0.035	0.884		0	0
0.040	1.010		0	0
0.041	1.035		0	0
0.050	1.263		0	0
0.055	1.389		0	0
0.060	1.515		0	0
0.065	1.641		0	0
0.070	1.768		0	0
0.075	1.894		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-8

Location: B4-B

Depth (ft): 42.7 - 43.0

Length (in.): 3.91

Diameter (in.): 1.99

Area (in<sup>2</sup>): 3.110

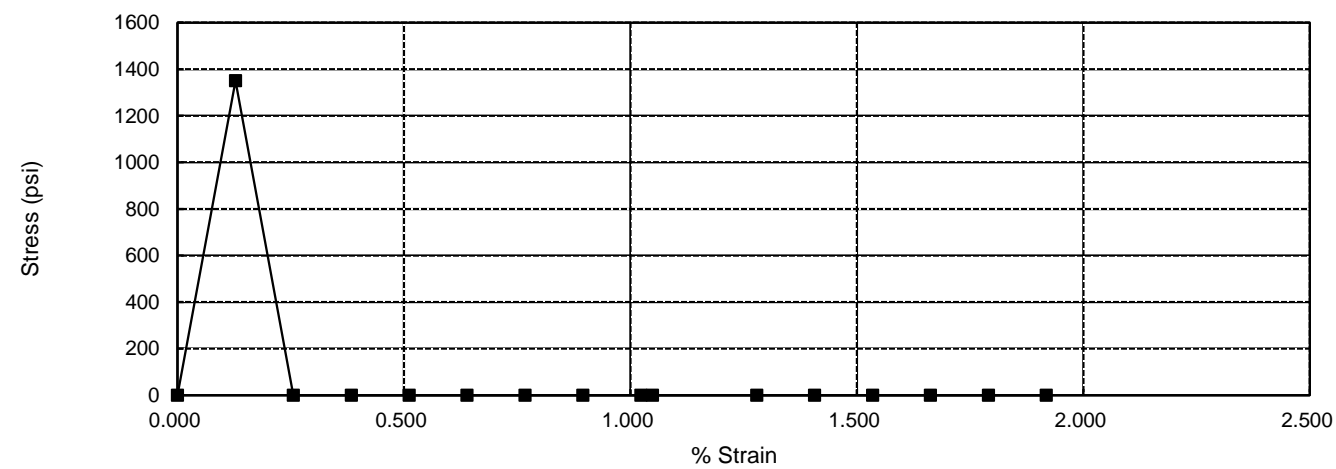
L/D 2.0

Unit Weight (pcf): 160.2

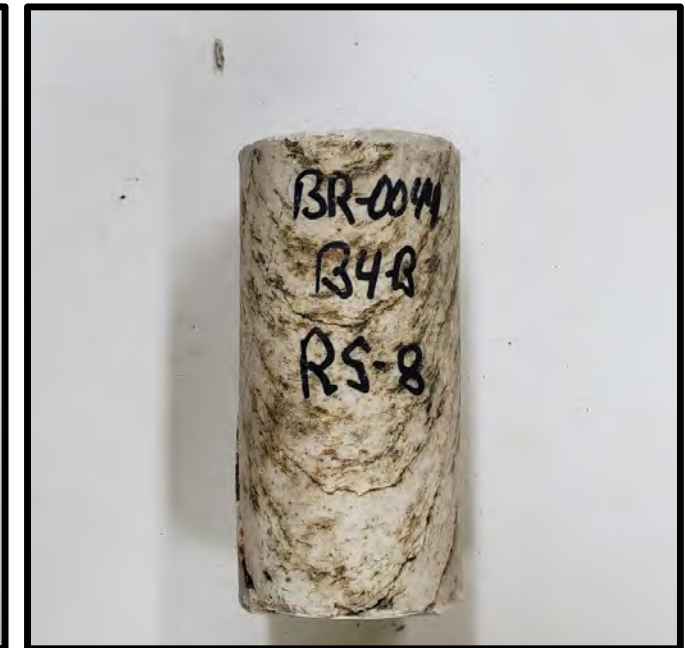
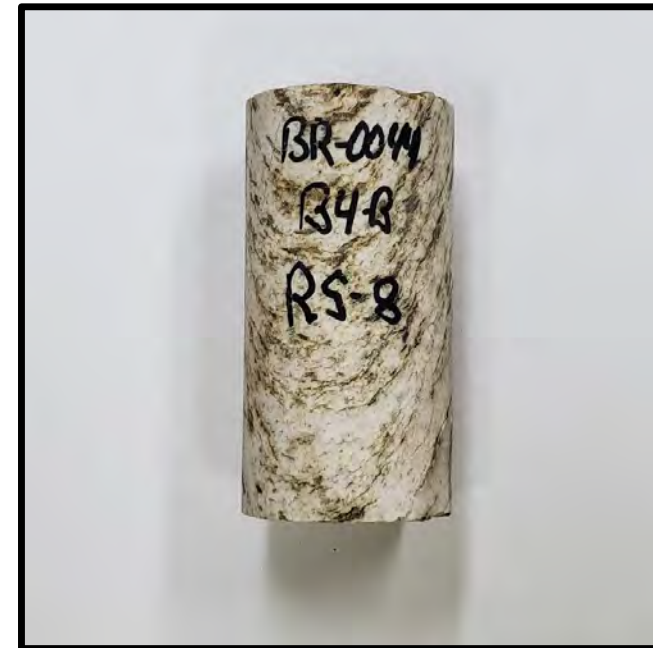
**Compressive Strength (psi): 1350**

Time to Failure, mins:sec: 0:19

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	----
0.005	0.128	4210	1350	1,055,700
0.010	0.256		0	0
0.015	0.384		0	0
0.020	0.512		0	0
0.025	0.639		0	0
0.030	0.767		0	0
0.035	0.895		0	0
0.040	1.023		0	0
0.041	1.049		0	0
0.050	1.279		0	0
0.055	1.407		0	0
0.060	1.535		0	0
0.065	1.662		0	0
0.070	1.790		0	0
0.075	1.918		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."





**UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS**

Performed in General Accordance with ASTM D7012



October 1, 2019

Project Name: Replace Bridge No. 780168 over Smith River on NC-14/NC-78

Project Number: 67044.1.1

Sample ID: RS-9

Location: B4-B

Depth (ft): 55.7 - 56.0

Length (in.): 4.04

Diameter (in.): 1.99

Area (in<sup>2</sup>): 3.110

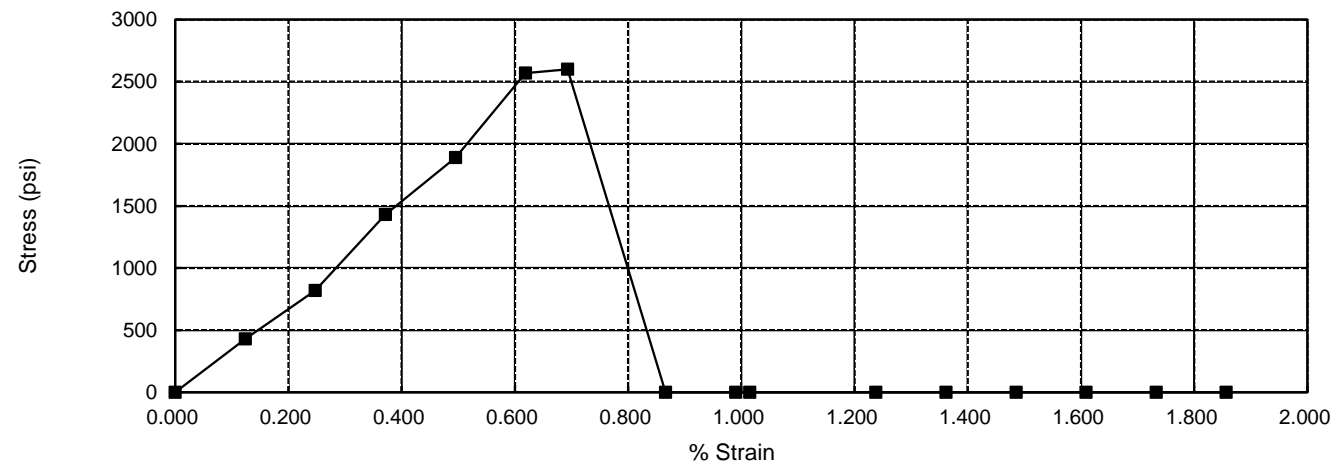
L/D 2.0

Unit Weight (pcf): 160.5

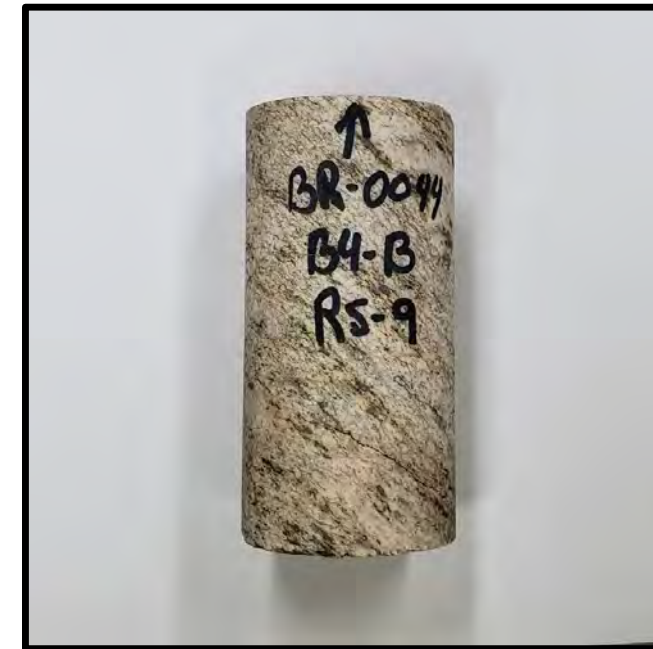
**Compressive Strength (psi): 2600**

Time to Failure, mins:sec: 0:40

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.124	1340	430	347,440
0.010	0.248	2560	820	331,280
0.015	0.371	4460	1430	385,147
0.020	0.495	5890	1890	381,780
0.025	0.619	7980	2570	415,312
0.028	0.693	8080	2600	375,143
0.035	0.866		0	0
0.040	0.990		0	0
0.041	1.015		0	0
0.050	1.238		0	0
0.055	1.361		0	0
0.060	1.485		0	0
0.065	1.609		0	0
0.070	1.733		0	0
0.075	1.856		0	0



**Note:** "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."



# SITE PHOTOGRAPHS

Bridge No. 780168 on -L- (NC14/NC87) over Smith River



View near existing end bent 1, facing upstation (east)



View near existing end bent 2, facing downstation (west)

Note: Images are courtesy Google Maps street view.