

REFERENCE: HB-0023

PROJECT: 50345

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY HAYWOOD
PROJECT DESCRIPTION REPLACE BRIDGE NO. 430169
ON SR 1876 (SONOMA RD) OVER WEST FORK
PIGEON RIVER

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HB-0023	1	22

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PERSONNEL

CG2 EXPLORATION

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SUBMITTED BY **CG2, PLLC**DATE *MARCH 2024*

Prepared in the Office of:

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— DocuSigned by:

D. Matthew Brewer 03/22/2024

386129C0A4	SIGNATURE	DATE
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**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 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, *VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6*

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS		
GROUP CLASS.	A-1	A-3	A-2		A-2-7		A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	
SYMBOL															
% PASSING	50 MX	30 MX	50 MX	51 MN	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	36 MN	
*10	15 MX	25 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	
*200	15 MX	25 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MX	
MATERIAL PASSING #40															
LL															
PI															
GROUP INDEX															
USUAL TYPES OF MAJOR MATERIALS															
GEN. RATING AS SUBGRADE															

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
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY

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
 AUGER BORING
 CORE BORING
 MONITORING WELL
 PIEZOMETER
 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
HL - 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 - TRI-CONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
UNIT WEIGHT
UNIT WEIGHT
SAMPLE ABBREVIATIONS
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
☒ MOBILE B-29
☒ DIEDRICH D-50
ADVANCING TOOLS:
☐ CLAY BITS
☐ 6" CONTINUOUS FLIGHT AUGER
☒ 8" HOLLOW AUGERS
☐ HARD FACED FINGER BITS
☐ TUNG-CARBIDE INSERTS
☒ CASING
☒ W/ ADVANCER
☐ TRICONE
☐ TRICONE
☒ CORE BIT
☐ HAMMER TYPE:
☒ AUTOMATIC
☐ MANUAL
CORE SIZE:
☐ B
☐ H
☒ N
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)
 CRYSTALLINE ROCK (CR)
 NON-CRYSTALLINE ROCK (NCR)
 COASTAL PLAIN SEDIMENTARY ROCK (CP)

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

WEATHERING

FRESH
VERY SLIGHT (V SL.)
SLIGHT (SL.)
MODERATE (MOD.)
MODERATELY SEVERE (MOD. SEV.)
SEVERE (SEV.)
VERY SEVERE (V SEV.)
COMPLETE

ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
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.
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.
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.
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*
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*
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*
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
HARD
MODERATELY HARD
MEDIUM HARD
SOFT
VERY SOFT

CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
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.
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.
CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM
VERY WIDE
WIDE
MODERATELY CLOSE
CLOSE
VERY CLOSE

SPACING
MORE THAN 10 FEET
3 TO 10 FEET
1 TO 3 FEET
0.16 TO 1 FOOT
LESS THAN 0.16 FEET

BEDDING

TERM
VERY THICKLY BEDDED
THICKLY BEDDED
THINLY BEDDED
VERY THINLY BEDDED
THICKLY LAMINATED
THINLY LAMINATED

THICKNESS
4 FEET
1.5 - 4 FEET
0.16 - 1.5 FEET
0.03 - 0.16 FEET
0.008 - 0.03 FEET
< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE
MODERATELY INDURATED
INDURATED
EXTREMELY INDURATED

RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
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 DISLOOED FROM PARENT MATERIAL.
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
ROCK QUALITY DESIGNATION (ROD) - 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: (BL-3) N: 650957.391 E: 844232.469, -BL- STA. II+53.17, ELEVATION: 2653.63

ELEVATION: 2653.63 FEET

NOTES:
F.I.A.D. = FILLED IMMEDIATELY AFTER DRILLING
ROADWAY DESIGN AND SURVEY INFORMATION DATED 12/15/2022
PROVIDED BY TGS ENGINEERS.
C.T. = CORING TERMINATED
NM = NOT MEASURED
REF = ROD SOUNDING REFUSAL
RS-
I = ROD SOUNDING WITH NAME DESIGNATION

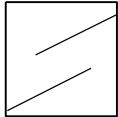
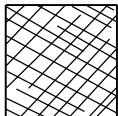
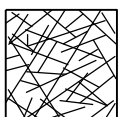

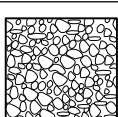
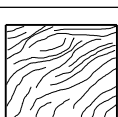
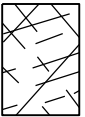
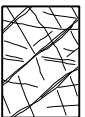
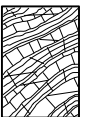
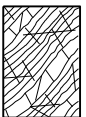
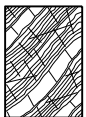



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

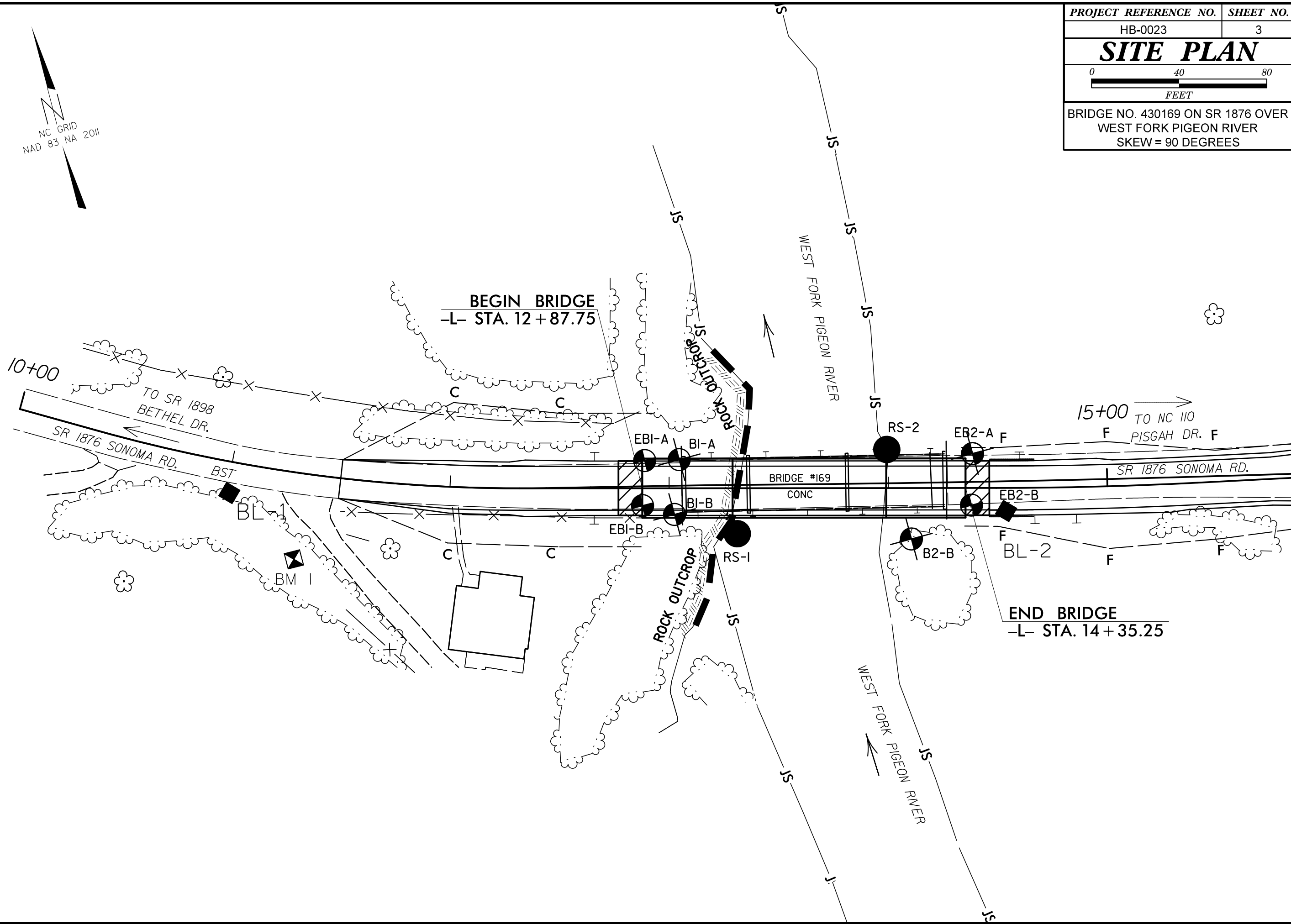
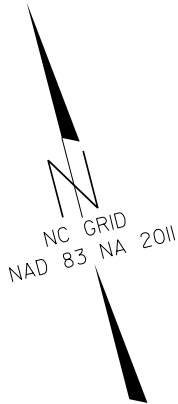
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

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)

<div><div>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</div><div>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.</div></div>	<div>SURFACE CONDITIONS</div> <div>VERY GOOD Very rough, fresh unweathered surfaces</div> <div>GOOD Rough, slightly weathered, iron stained surfaces</div> <div>FAIR Smooth, moderately weathered and altered surfaces</div> <div>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</div> <div>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</div>	<div>STRUCTURE</div> <div><div>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</div><div>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</div><div>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</div><div>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</div><div>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</div><div>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</div></div>	<div>DECREASING SURFACE QUALITY ➡</div> <div>90</div> <div>80</div> <div>70</div> <div>60</div> <div>50</div> <div>40</div> <div>30</div> <div>20</div> <div>10</div> <div>N/A</div> <div>N/A</div>	<div>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</div> <div>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.</div>	<div>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</div> <div>VERY GOOD - Very Rough, fresh unweathered surfaces</div> <div>GOOD - Rough, slightly weathered surfaces</div> <div>FAIR - Smooth, moderately weathered and altered surfaces</div> <div>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</div> <div>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</div>	<div>COMPOSITION AND STRUCTURE</div> <div><div>A. Thick bedded, very blocky sandstone 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.</div><div>B. Sandstone with thin inter-layers of siltstone</div><div>C. Sandstone and siltstone in similar amounts</div><div>D. Siltstone or silty shale with sandstone layers</div><div>E. Weak siltstone or clayey shale with sandstone layers</div><div>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</div><div>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</div><div>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.</div></div> <div><div>C, D, E, and G - 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 F and H.</div><div>➡ Means deformation after tectonic disturbance</div></div>	<div>70</div> <div>60</div> <div>50</div> <div>40</div> <div>30</div> <div>20</div> <div>10</div>
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PROJECT REFERENCE NO.	SHEET NO.
HB-0023	3
SITE PLAN	
0 40 80 FEET	
BRIDGE NO. 430169 ON SR 1876 OVER WEST FORK PIGEON RIVER SKEW = 90 DEGREES	



6/23/16

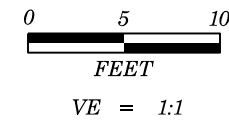
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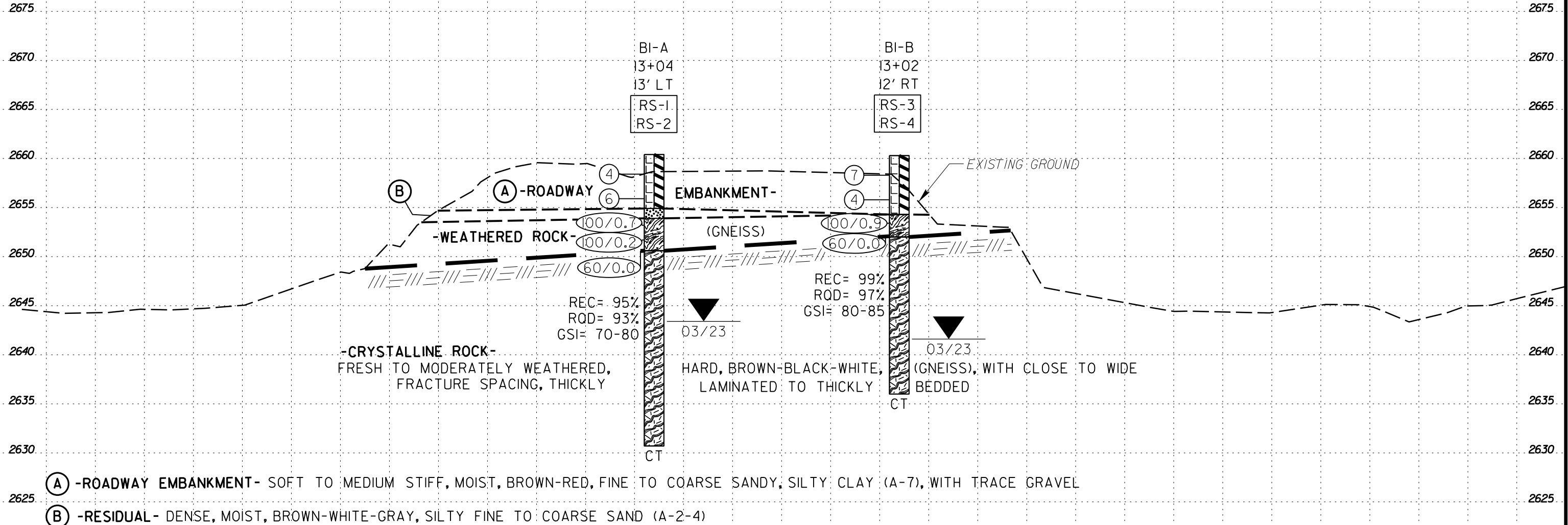


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GROUP

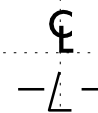


PROJECT REFERENCE NO.	SHEET NO.
HB-0023	6
CROSS SECTION AT BENT 1 BENT 1 SKEW = 90 DEGREES	

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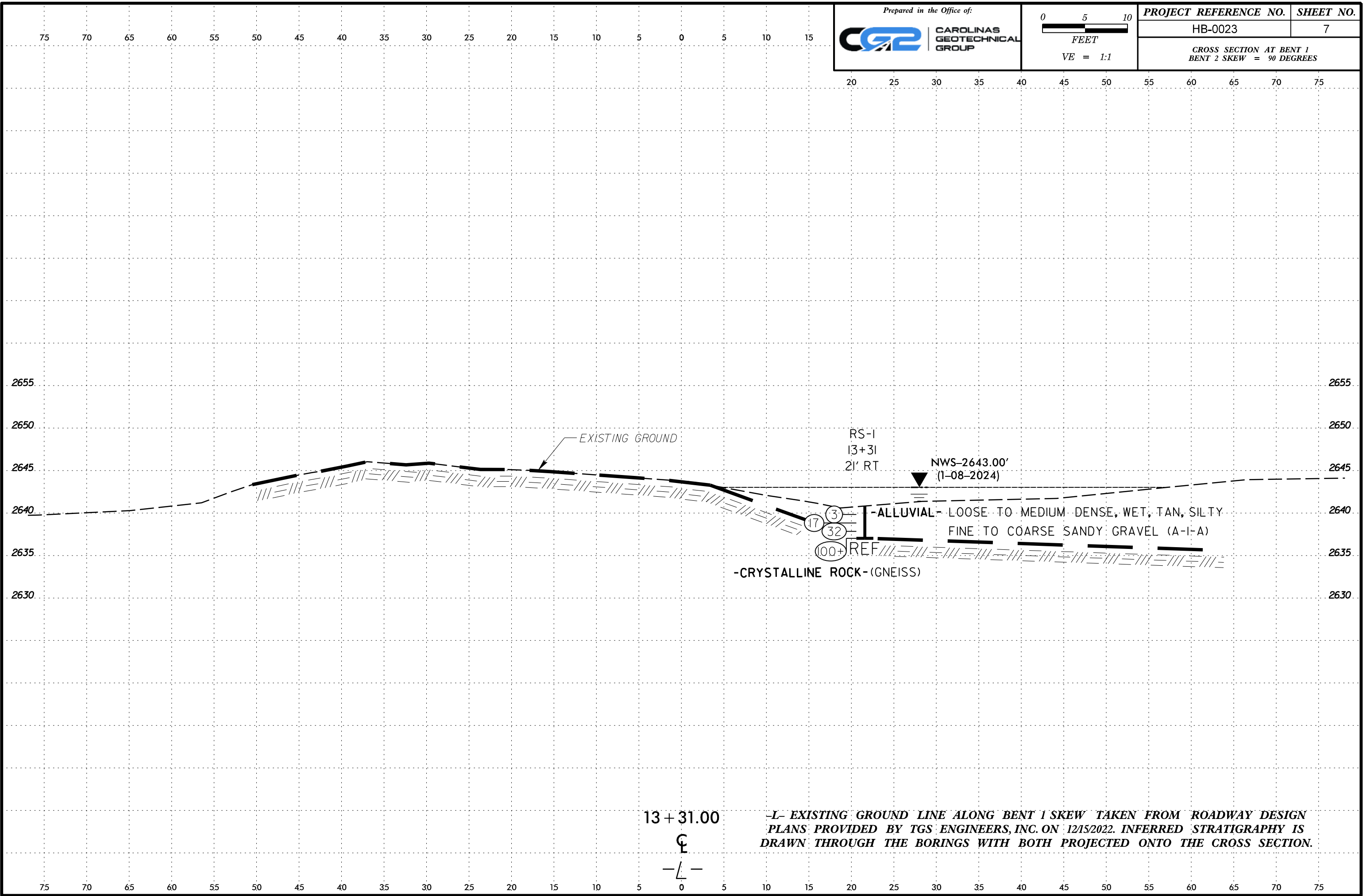


13+10.12



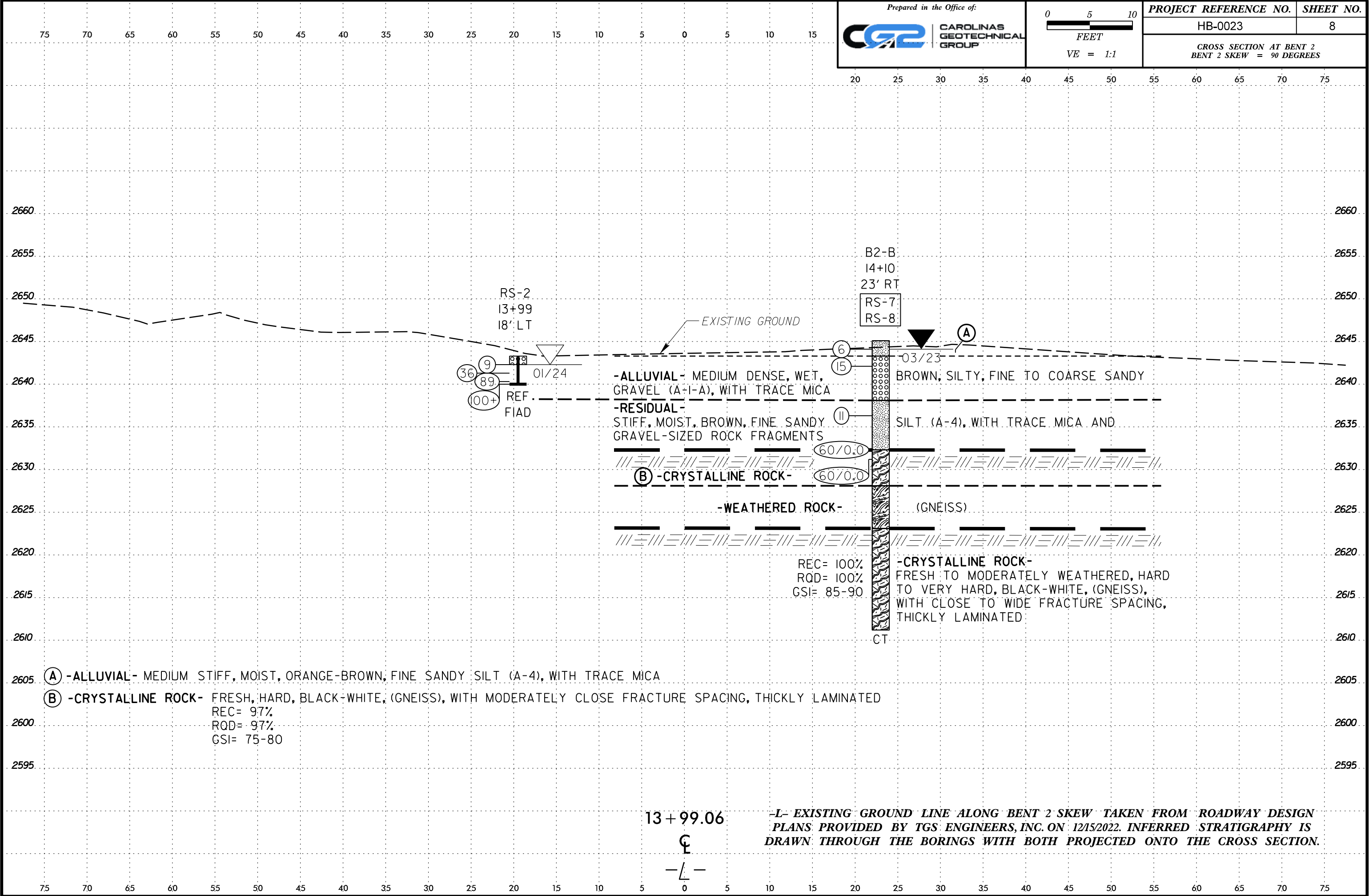
-L- EXISTING GROUND LINE ALONG BENT 1 SKEW TAKEN FROM ROADWAY DESIGN PLANS PROVIDED BY TGS ENGINEERS, INC. ON 12/15/2022. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

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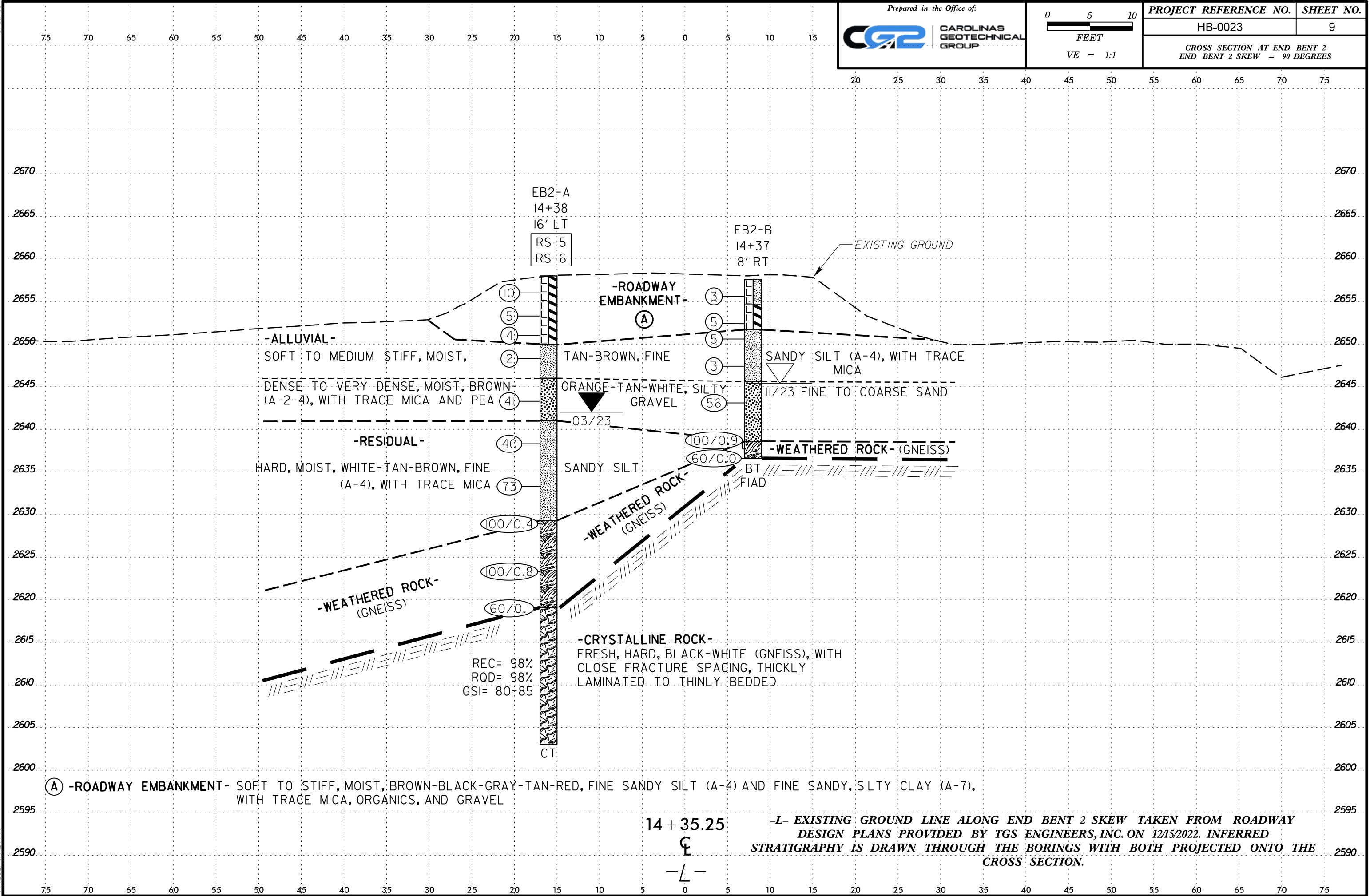


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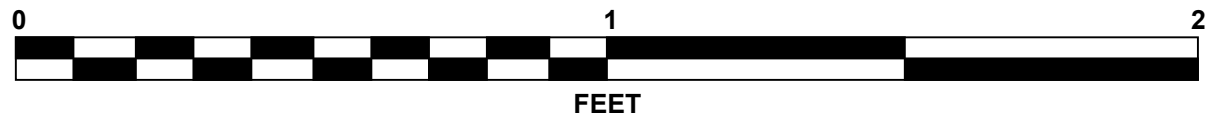


WBS 50345.1.1						TIP HB-0023				COUNTY HAYWOOD				GEOLOGIST S. Patterson, P.G.					
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)														GROUND WTR (ft)					
BORING NO. B1-A						STATION 13+04				OFFSET 13 ft LT				ALIGNMENT -L-				0 HR. NM	
COLLAR ELEV. 2,660.3 ft						TOTAL DEPTH 29.7 ft				NORTHING 651,026				EASTING 843,796				24 HR. 17.0	
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022										DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic					
DRILLER C. Odom						START DATE 03/29/23				COMP. DATE 03/29/23				SURFACE WATER DEPTH N/A					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION					
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)				
2665																			
2660														2,660.3	GROUND SURFACE 0.0				
	2,659.3	1.0	3	1	3							M			ROADWAY EMBANKMENT				
	2,656.8	3.5										M			Soft to Medium Stiff, Brown-Red, Fine to Coarse Sandy, Silty CLAY (A-7), with trace gravel				
2655	2,654.3	6.0	2	3	3									2,654.8	5.5				
	2,651.8	8.5												2,653.8	RESIDUAL 6.5				
	2,650.5	9.8	36	60	40/0.2										Dense, Brown-White-Gray, Silty Fine to Coarse SAND (A-2-4)				
2650			100/0.2											2,650.5	WEATHERED ROCK 9.8				
			60/0.0												White-Black-Gray, (GNEISS)				
															CRYSTALLINE ROCK				
2645															Black-White, (GNEISS)				
															REC=95%				
															RQD=93%				
2640															GSI=70-80				
2635																			
														2,630.6	29.7				
															Boring Terminated at Elevation 2,630.6 ft In Crystalline Rock (GNEISS)				

WBS 50345.1.1				TIP HB-0023				COUNTY HAYWOOD				GEOLOGIST S. Patterson, P.G.					
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)												GROUND WTR (ft)					
BORING NO. B1-A				STATION 13+04				OFFSET 13 ft LT				ALIGNMENT -L-				0 HR. NM	
COLLAR ELEV. 2,660.3 ft				TOTAL DEPTH 29.7 ft				NORTHING 651,026				EASTING 843,796				24 HR. 17.0	
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic					
DRILLER C. Odom				START DATE 03/29/23				COMP. DATE 03/29/23				SURFACE WATER DEPTH N/A					
CORE SIZE NQ				TOTAL RUN 19.9 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) %	L O G	DESCRIPTION AND REMARKS			DEPTH (ft)	
2650.5													Begin Coring @ 9.8 ft				
2650	2,650.5	9.8	4.9	N=60/0.0 5:25/0.9 5:27/1.0 5:03/1.0 2:37/1.0 2:56/1.0	(4.9) 100%	(4.5) 92%			(18.9) 95%	(18.5) 93%			2,650.5 CRYSTALLINE ROCK Fresh to Slightly Weathered, Hard, Black-White, (GNEISS), with Close to Wide Fracture Spacing, Thickly Laminated to Thinly Bedded			9.8	
2645	2,645.6	14.7											RS-1: 21.9-22.5' Unit Weight: 191.9 pcf Unconfined Compressive Strength: 12,630 psi (1,819 ksf)				
2640	2,640.6	19.7	5.0	3:09/1.0 2:19/1.0 3:10/1.0 2:27/1.0 2:59/1.0	(4.7) 94%	(4.7) 94%							RS-2: 26.0-26.5' Unit Weight: 174.3 pcf Unconfined Compressive Strength: 12,900 psi (1,858 ksf)				
2635	2,635.6	24.7	5.0	2:40/1.0 3:08/1.0 2:59/1.0 3:08/1.0 4:00/1.0	(4.3) 86%	(4.3) 86%	RS-1						GSI=70-80				
	2,630.6	29.7		2:02/1.0 2:12/1.0 1:54/1.0 2:43/1.0 2:34/1.0	(5.0) 100%	(5.0) 100%	RS-2						2,630.6 Boring Terminated at Elevation 2,630.6 ft In Crystalline Rock (GNEISS)			29.7	

Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road), Haywood County, NC
Rock Core Photographs
B1-A

9.8 to 29.7 Feet




GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50345.1.1			TIP HB-0023			COUNTY HAYWOOD			GEOLOGIST S. Patterson, P.G.					
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)									GROUND WTR (ft)					
BORING NO. B1-B			STATION 13+02			OFFSET 12 ft RT			ALIGNMENT -L-			0 HR. NM		
COLLAR ELEV. 2,660.4 ft			TOTAL DEPTH 24.3 ft			NORTHING 651,002			EASTING 843,787			24 HR. 18.7		
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic					
DRILLER C. Odom			START DATE 03/29/23			COMP. DATE 03/29/23			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)
2665														
2660	2,659.4	1.0	2	3	4								2,660.4	0.0
2655	2,656.9	3.5	2	1	3						M		ROADWAY EMBANKMENT Soft to Medium Stiff, Red-Brown, Fine Sandy, Silty CLAY (A-7), with trace gravel	
	2,654.4	6.0	6	94/0.4							M		2,654.4	6.0
2650	2,652.1	8.3	60/0.0										2,652.1	8.3
													WEATHERED ROCK Brown, (GNEISS)	
2645													CRYSTALLINE ROCK Brown-Black-White, (GNEISS)	
2640													REC=99% RQD=97% GSI=80-85	
											RS-3			
											RS-4		2,636.1	24.3
													Boring Terminated at Elevation 2,636.1 ft In Crystalline Rock (GNEISS)	

GEOTECHNICAL BORING REPORT
CORE LOG

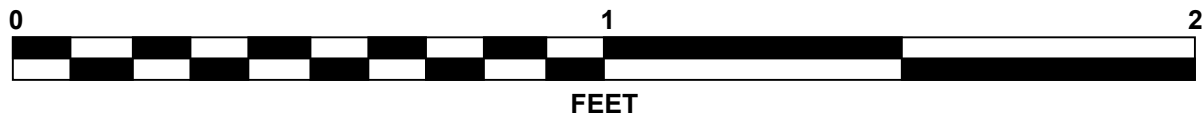
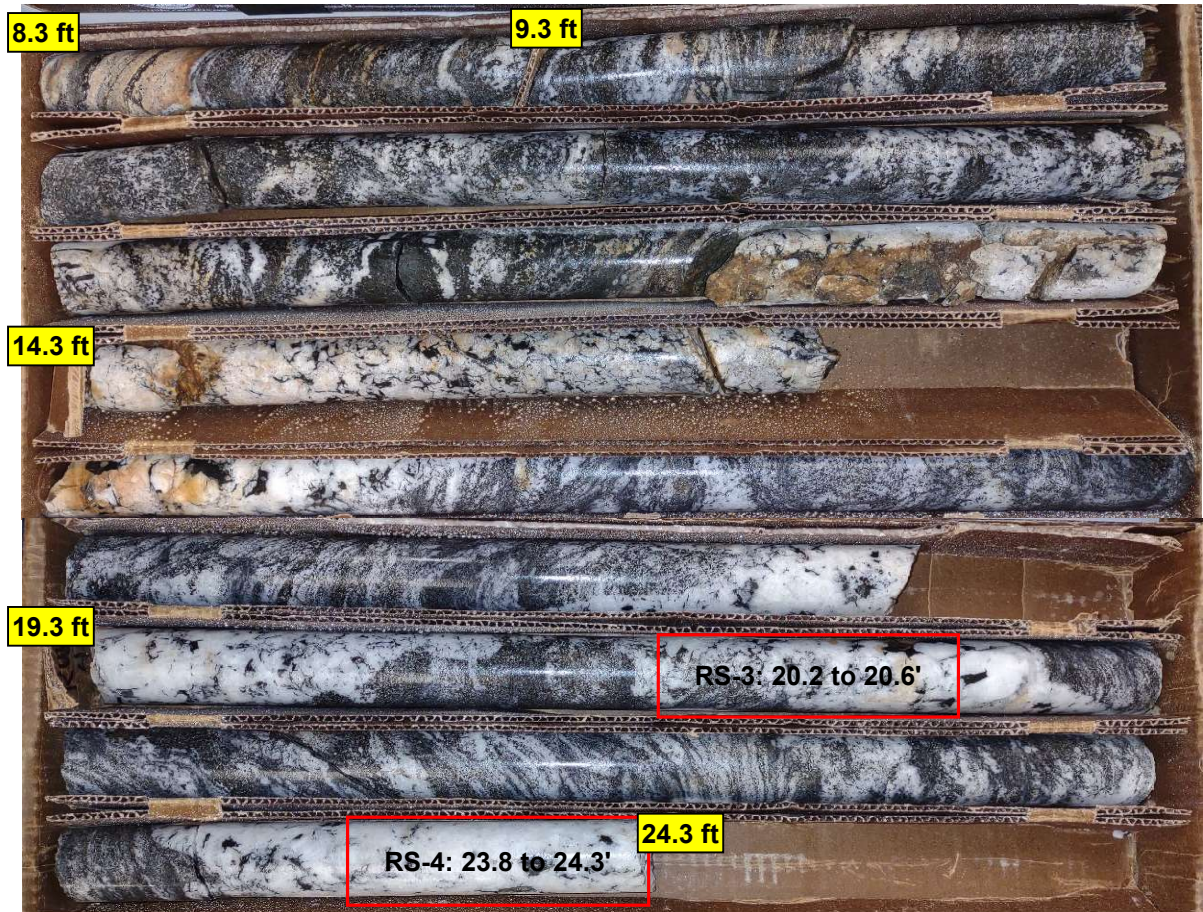
SHEET 13

WBS 50345.1.1				TIP HB-0023				COUNTY HAYWOOD				GEOLOGIST S. Patterson, P.G.							
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)												GROUND WTR (ft)							
BORING NO. B1-B				STATION 13+02				OFFSET 12 ft RT				ALIGNMENT -L-				0 HR. NM			
COLLAR ELEV. 2,660.4 ft				TOTAL DEPTH 24.3 ft				NORTHING 651,002				EASTING 843,787				24 HR. 18.7			
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic							
DRILLER C. Odom				START DATE 03/29/23				COMP. DATE 03/29/23				SURFACE WATER DEPTH N/A							
CORE SIZE NQ				TOTAL RUN 16.0 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) %	L O G	DESCRIPTION AND REMARKS						
													ELEV. (ft)	DEPTH (ft)					
2652.1	2,652.1	8.3	1.0	N=60/0.0	(0.9)	(0.9)			(15.8)	(15.5)			2,652.1	8.3					
2650	2,651.1	9.3	5.0	6:09/1.0	90%	90%			99%	97%			Begin Coring @ 8.3 ft						
				4:46/1.0	(5.0)	(4.9)							CRYSTALLINE ROCK						
				3:21/1.0	100%	98%							Fresh to Moderately Weathered, Hard, Brown-Black-White, (GNEISS), with						
				3:26/1.0									Close to Moderatley Close Fracture Spacing, Thinly to Thickly Bedded						
				3:16/1.0															
				3:10/1.0															
2645	2,646.1	14.3	5.0	2:41/1.0	(4.9)	(4.7)							RS-3: 20.2-20.6'						
				3:01/1.0	98%	94%							Unit Weight: 173.8 pcf						
				3:36/1.0									Unconfined Compressive Strength: 11,220 psi (1,616 ksf)						
				2:42/1.0															
				5:04/1.0															
2640	2,641.1	19.3	5.0	6:17/1.0	(5.0)	(5.0)		RS-3											
				8:09/1.0	100%	100%													
				4:39/1.0															
				6:27/1.0															
	2,636.1	24.3		11:07/1.0				RS-4					2,636.1	24.3					
													Boring Terminated at Elevation 2,636.1 ft In Crystalline Rock (GNEISS)						

NCDOT BORE DOUBLE HAYWOOD 169 GEO_BRDG.GPJ NC_DOT.GDT 3/21/24

NCDOT CORE DOUBLE HAYWOOD 169 GEO_BRDG.GPJ NC_DOT.GDT 3/21/24

Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road), Haywood County, NC
Rock Core Photographs
B1-B
8.3 to 24.3 Feet



NCDOT BORE DOUBLE HAYWOOD 169 GEO BRDG.GPJ NC DOT.GDT 1/30/24

WBS		50345.1.1		TIP		HB-0023		COUNTY		HAYWOOD		GEOLOGIST		T. Wenner											
SITE DESCRIPTION													Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)			GROUND WTR (ft)									
BORING NO.		RS-2		STATION		13+99		OFFSET		18 ft LT		ALIGNMENT		-L-		0 HR.	1.0								
COLLAR ELEV.		2,643.3 ft		TOTAL DEPTH		3.3 ft		NORTHING		651,007		EASTING		843,883		24 HR.	FIAD								
DRILL RIG/HAMMER EFF./DATE								N/A				DRILL METHOD				Rod Sounding		HAMMER TYPE		N/A					
DRILLER				N/A				START DATE				01/08/24		COMP. DATE				01/08/24		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	100															
2645																									
														2,643.3	GROUND SURFACE			0.0							
														2,642.3	ALLUVIAL			1.0							
2640														2,640.0	Medium Dense, Tan, Silty Fine to Coarse SAND (A-2-4), with trace gravel			3.3							
														Boring Terminated at Elevation 2,640.0 ft In Alluvial Silty SAND (A-2-4)											
														Notes: Hand Auger Refusal at 1.0 feet Rod Sounding Refusal at 3.3 feet											

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50345.1.1		TIP HB-0023		COUNTY HAYWOOD		GEOLOGIST S. Patterson, P.G.										
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)							GROUND WTR (ft)									
BORING NO. B2-B		STATION 14+10		OFFSET 23 ft RT		ALIGNMENT -L-		0 HR. NM								
COLLAR ELEV. 2,645.1 ft		TOTAL DEPTH 33.9 ft		NORTHING 650,964		EASTING 843,889		24 HR. 1.0								
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022				DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic									
DRILLER C. Odom		START DATE 03/30/23		COMP. DATE 03/30/23		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2650																
2645	2,645.1	0.0												2,645.1	GROUND SURFACE	0.0
2640	2,643.1	2.0	1	1	5	6							M	2,643.3	ALLUVIAL Medium Stiff, Orange-Brown, Fine Sandy SILT (A-4), with trace mica	1.8
			19	8	7	15							W		Medium Dense, Brown, Silty, Fine to Coarse Sandy GRAVEL (A-1-a), with trace mica	
2635	2,637.3	7.8	3	5	6	11							M	2,638.1	RESIDUAL Stiff, Brown, Fine Sandy SILT (A-4), with trace mica and gravel-sized rock fragments	7.0
	2,632.3	12.8												2,632.3		12.8
2630	2,631.2	13.9	60/0.0								60/0.0				CRYSTALLINE ROCK Black-White, (GNEISS)	
			60/0.0													
2625												RS-7		2,628.1	REC=75% RQD=75% GSI=55-60	17.0
														2,623.1	WEATHERED ROCK Brown, (GNEISS)	22.0
2620												RS-8			REC=0% RQD=0%	
															CRYSTALLINE ROCK Black-White, (GNEISS)	
2615															REC=75% RQD=75% GSI=55-60	
														2,611.2	Boring Terminated at Elevation 2,611.2 ft In Crystalline Rock (GNEISS)	33.9

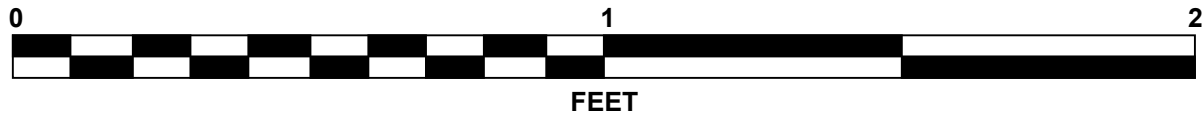
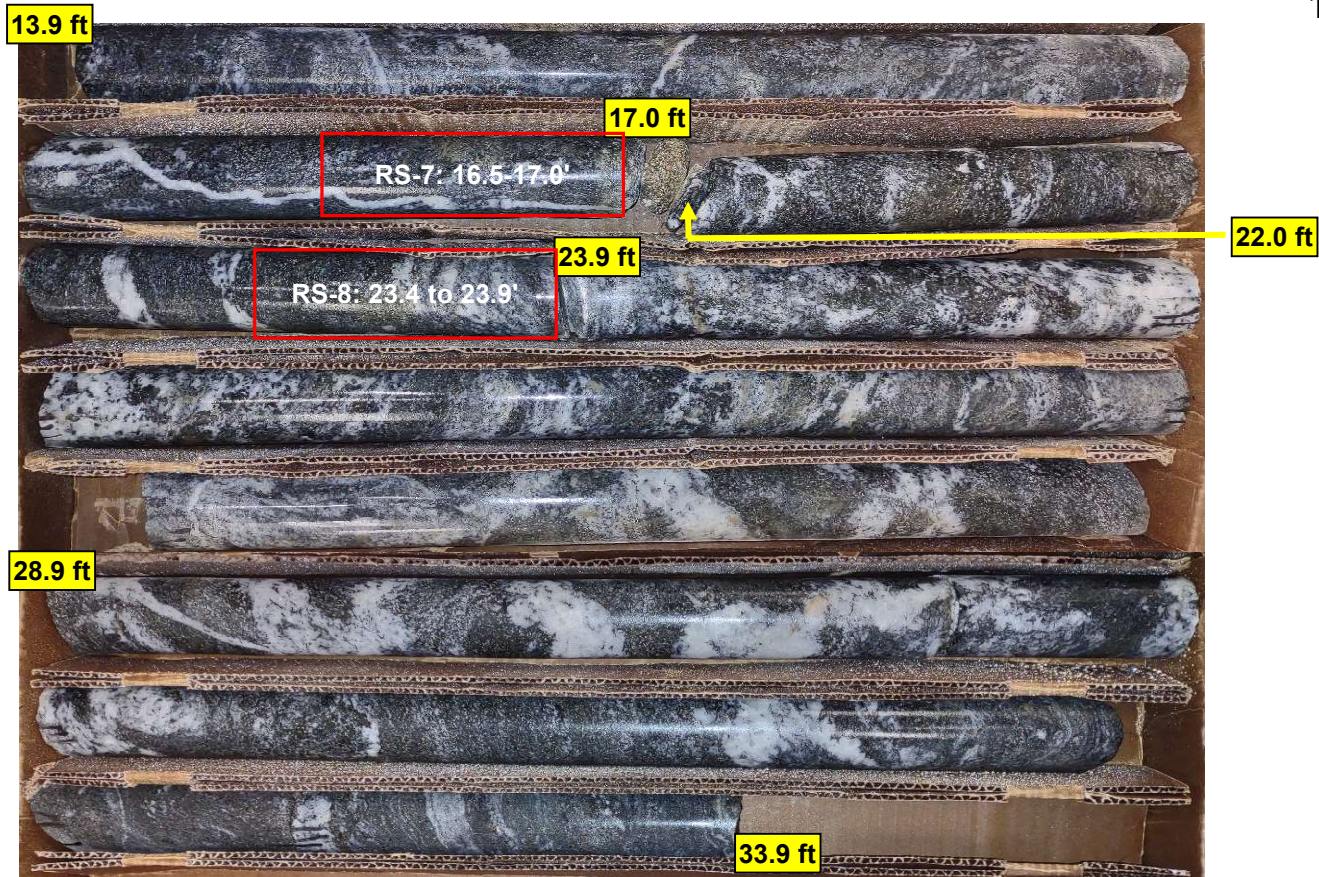
NCDOT BORE DOUBLE HAYWOOD 169_GEO_BRDG.GPJ NC_DOT.GDT 1/30/24

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 50345.1.1					TIP HB-0023			COUNTY HAYWOOD			GEOLOGIST S. Patterson, P.G.			
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)										GROUND WTR (ft)				
BORING NO. B2-B					STATION 14+10			OFFSET 23 ft RT			ALIGNMENT -L-		0 HR. NM	
COLLAR ELEV. 2,645.1 ft					TOTAL DEPTH 33.9 ft			NORTHING 650,964			EASTING 843,889		24 HR. 1.0	
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022								DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic			
DRILLER C. Odom					START DATE 03/30/23			COMP. DATE 03/30/23			SURFACE WATER DEPTH N/A			
CORE SIZE NQ					TOTAL RUN 20.0 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 ELEV. (ft)	DESCRIPTION AND REMARKS	DEPTH (ft)
2631.2													Begin Coring @ 13.9 ft	
2630	2,631.2	13.9	5.0	N=60/0.0 4:14/1.0 3:37/1.0 2:43/1.0 0:37/1.0 1:09/1.0	(3.0) 60%	(3.0) 60%							CRYSTALLINE ROCK Fresh, Hard, Black-White, (GNEISS), with Moderately Close Fracture Spacing, Thickly Laminated	17.0
	2,626.2	18.9		2:49/1.0 2:19/1.0 1:45/1.0 2:39/1.0 4:29/1.0	(2.0) 40%	(1.9) 38%	RS-7			(0.0) 0%		2,628.1	RS-7: 16.5-17.0' Unit Weight: 182.3 pcf Unconfined Compressive Strength: 10,650 psi (1,534 ksf)	
2625			5.0									2,623.1	GSI=55-60 (continued)	22.0
	2,621.2	23.9		5:06/1.0 4:40/1.0 3:40/1.0 3:38/1.0 4:16/1.0	(5.0) 100%	(5.0) 100%	RS-8		(11.9) 100%	(11.9) 100%			WEATHERED ROCK Brown, (GNEISS)	
2620			5.0										CRYSTALLINE ROCK Fresh to Moderately Weathered, Hard to Very Hard, Black-White, (GNEISS), with Close to Wide Fracture Spacing, Thickly Laminated	
	2,616.2	28.9	5.0	4:06/1.0 4:15/1.0 3:36/1.0 4:15/1.0 4:00/1.0	(5.0) 100%	(5.0) 100%						2,611.2	RS-8: 23.4-23.9' Unit Weight: 181.4 pcf Unconfined Compressive Strength: 9,270 psi (1,335 ksf)	33.9
2615	2,611.2	33.9											GSI=55-60 Boring Terminated at Elevation 2,611.2 ft In Crystalline Rock (GNEISS)	

Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road), Haywood County, NC
Rock Core Photographs
B2-B

13.9 to 33.9 Feet



GEOTECHNICAL BORING REPORT

BORE LOG

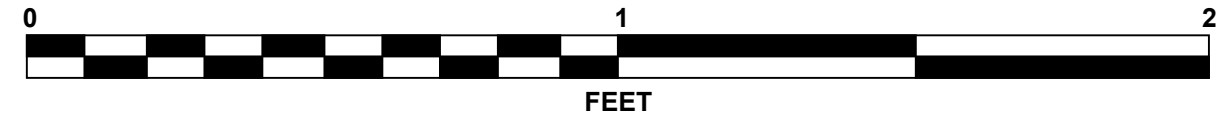
WBS 50345.1.1				TIP HB-0023				COUNTY HAYWOOD				GEOLOGIST S. Patterson, P.G.					
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)												GROUND WTR (ft)					
BORING NO. EB2-A				STATION 14+38				OFFSET 16 ft LT				ALIGNMENT -L-				0 HR. 22.8	
COLLAR ELEV. 2,658.0 ft				TOTAL DEPTH 55.0 ft				NORTHING 650,995				EASTING 843,926				24 HR. 16.0	
DRILL RIG/HAMMER EFF./DATE CG320446 Diedrich D60 87% 05/10/2022								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic					
DRILLER C. Odom				START DATE 11/14/22				COMP. DATE 03/30/23				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	100				ELEV. (ft)	DEPTH (ft)		
2660																	
	2,657.0	1.0	4	7	3	10								2,658.0	0.0		
2655	2,654.3	3.7	1	2	3	5								ROADWAY EMBANKMENT			
	2,652.0	6.0	2	1	3	4								Soft to Stiff, Red-Brown, Fine Sandy, Silty, CLAY (A-7), with trace mica, gravel, and organics			
2650	2,649.3	8.7	WOH	1	1	2								2,650.0	8.0		
														ALLUVIAL			
2645	2,644.3	13.7	14	18	23									2,646.0	12.0		
														Soft, Tan-Brown, Fine Sandy SILT (A-4), with trace mica			
2640	2,639.3	18.7	10	16	24									2,641.0	17.0		
														Dense, White-Orange-Tan, Silty Fine SAND (A-2-4), with trace mica			
2635	2,634.3	23.7	29	35	38									2,641.0	17.0		
														RESIDUAL			
2630	2,629.3	28.7	100/0.4											2,629.3	28.7		
														Hard, White-Tan-Brown, Fine Sandy SILT (A-4), with trace mica			
2625	2,624.1	33.9	53	47/0.3													
														CRYSTALLINE ROCK			
2620	2,619.1	38.9	60/0.1											2,619.1	38.9		
														Black-White, (GNEISS)			
2615																	
2610																	
2605														2,603.0	55.0		
														Boring Terminated at Elevation 2,603.0 ft In Crystalline Rock (GNEISS)			

GEOTECHNICAL BORING REPORT CORE LOG

[illegible]

NC DOT BORE DOUBLE HAYWOOD 169 GEO BRDG.GPJ NC DOT.GDT 1/30/24

Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road), Haywood County, NC
Rock Core Photographs
EB2-A
39.0 to 55.0 Feet



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50345.1.1			TIP HB-0023			COUNTY HAYWOOD			GEOLOGIST P. Tomasic					
SITE DESCRIPTION Bridge No. 430169 over West Fork Pigeon River on SR 1876 (Sonoma Road)									GROUND WTR (ft)					
BORING NO. EB2-B			STATION 14+37			OFFSET 8 ft RT			ALIGNMENT -L-			0 HR. 12.2		
COLLAR ELEV. 2,657.6 ft			TOTAL DEPTH 21.0 ft			NORTHING 4,650,972			EASTING 843,919			24 HR. Dry		
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 86% 04/08/2022						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic					
DRILLER M. Brewer			START DATE 11/14/22			COMP. DATE 11/14/22			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)
2660														
	2,656.6	1.0	3	2	1								2,657.6	GROUND SURFACE 0.0
2655	2,653.4	4.2	5	3	2								2,654.6	ROADWAY EMBANKMENT Soft, Brown-Black, Fine Sandy SILT (A-4), with trace mica and organics 3.0
	2,651.6	6.0	12	3	2								2,651.7	Medium Stiff, Gray-Tan-Red, Fine Sandy, Silty CLAY (A-7), with trace mica, organics, and gravel 5.9
2650	2,648.4	9.2	3	2	1									ALLUVIAL Soft to Medium Stiff, Tan-Brown, Fine Sandy SILT (A-4), with trace mica
2645	2,644.1	13.5	25	31	25								2,645.6	12.0 Very Dense, Brown-Orange-Tan, Silty Fine to Coarse SAND (A-2-4), with trace mica and pea gravel
2640	2,639.1	18.5	4	14	86/0.4								2,638.6	19.0
	2,636.6	21.0											2,636.6	WEATHERED ROCK Brown-Black, (GNEISS) 21.0
														Boring Terminated with Standard Penetration Test Refusal at Elevation 2,636.6 ft On Crystalline Rock (GNEISS)

NCDOT BORE SINGLE HAYWOOD 169_GEO_BRDG.GPJ NC_DOT.GDT 2/16/24

ROCK TEST RESULTS							
SAMPLE NO.	BORING	STATION	OFFSET	DEPTH INTERVAL	ROCK TYPE	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH
RS-1	B1-A	13+04 -L-	13' LT	21.9 - 22.5'	GNEISS	191.9	12,630 psi /1,819 ksf
RS-2	B1-A	13+04 -L-	13' LT	26.0 - 26.5'	GNEISS	174.3	12,900 psi /1,858 ksf
RS-3	B1-B	13+02 -L-	12' RT	20.2 - 20.6'	GNEISS	173.8	11,220 psi /1,616 ksf
RS-4	B1-B	13+02 -L-	12' RT	23.8 - 24.3'	GNEISS	166.4	16,770 psi /2,415 ksf
RS-7	B2-B	14+10 -L-	23' RT	16.5 - 17.0'	GNEISS	182.3	10,650 psi /1,534 ksf
RS-8	B2-B	14+10 -L-	23' RT	23.4 - 23.9'	GNEISS	181.4	9,270 psi /1,335 ksf
RS-5	EB2-A	14+38 -L-	16' LT	42.1 - 42.5'	GNEISS	174.3	8,350 psi /1,202 ksf
RS-6	EB2-A	14+38 -L-	16' LT	47.2 - 47.6'	GNEISS	178.0	8,580 psi /1,236 ksf

Alex M. Alsmulky

AUTHORIZED SIGNATURE
NCDOT CERT NO. 130-0212



PHOTO #1: ROCK OUTCROP AT END BENT 1 OF BRIDGE NO. 430169 LOOKING WEST (DOWN STATION)



PHOTO #2: END BENT 1 OF BRIDGE NO. 430169 LOOKING EAST (UP STATION)



PHOTO #3: BRIDGE NO. 430169 LOOKING NORTH AND DOWNSTREAM

PROJECT: 50345

REFERENCE: HB-0023

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5-8	CROSS SECTIONS
9-14	BORE LOGS, CORE LOGS, AND ROCK CORE PHOTOS
15	LAB RESULTS
16	SITE PHOTOGRAPHS

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE

SUBSURFACE INVESTIGATION

COUNTY HAYWOOD

PROJECT DESCRIPTION REPLACE BRIDGE NO. 430170

ON SR 1105 (MAX THOMPSON RD) OVER EAST

PIGEON RIVER

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HB-0023	1	15

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT, AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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PERSONNEL

CG2 EXPLORATION

P. TOMASIC, G.I.T

INVESTIGATED BY CG2, PLLC

DRAWN BY K. DE MONTBRUN, P.E.

CHECKED BY M. WALKO, P.E.

SUBMITTED BY CG2, PLLC

DATE APRIL 2024


Prepared in the Office of:



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PROFESSIONAL
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045542
KELLY ENGINEER
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DocuSigned by:

F7633FB568FE4D7...

04/11/2024

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

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

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS					
GROUP CLASS.	A-1		A-3		A-2		A-4		A-5		A-6		A-7		A-1, A-2		A-4, A-5	
SYMBOL	A-1-a	A-1-b	A-2-4		A-2-5		A-2-6		A-2-7		A-4		A-5		A-6		A-7	
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT	
MATERIAL PASSING #40 LL PI	— 6 MX		— NP		40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS	
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		UNSUITABLE	
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 ²)
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
	4.75	2.00	0.42	0.25	0.075	0.053
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CSE. SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						
GRAIN SIZE	305 IN.	75 IN.	2.0	0.25	0.05	0.005

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL PLASTIC RANGE (PI) PL	- 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
OM SL SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

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

COLOR

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.

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
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY

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

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
HL - 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 - TRI-CONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
% - UNIT WEIGHT
%g - DRY UNIT WEIGHT
SAMPLE ABBREVIATIONS
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
☒ DIEDRICH D-50
☐

ADVANCING TOOLS:
☐ CLAY BITS
☐ 6" CONTINUOUS FLIGHT AUGER
☒ 8" HOLLOW AUGERS
☐ HARD FACED FINGER BITS
☐ TUNG-CARBIDE INSERTS
☒ CASING
☒ W/ ADVANCER
☐ TRICONE
☐ TRICONE
☒ 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)

CRYSTALLINE ROCK (CR)

NON-CRYSTALLINE ROCK (NCR)

COASTAL PLAIN SEDIMENTARY ROCK (CP)

NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.

FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.

FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES 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 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 GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.

VERY SOFT
CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM
VERY WIDE
WIDE
MODERATELY CLOSE
CLOSE
VERY CLOSE

SPACING
MORE THAN 10 FEET
3 TO 10 FEET
1 TO 3 FEET
0.16 TO 1 FOOT
LESS THAN 0.16 FEET

BEDDING

TERM
VERY THICKLY BEDDED
THICKLY BEDDED
THINLY BEDDED
VERY THINLY BEDDED
THICKLY LAMINATED
THINLY LAMINATED

THICKNESS
4 FEET
1.5 - 4 FEET
0.16 - 1.5 FEET
0.03 - 0.16 FEET
0.008 - 0.03 FEET
< 0.008 FEET

INDURATION

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.

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 DISLOGGED 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: (BM #2) N: 650806.345 E: 844615.809, -L- STA. 21+53.50, ELEVATION: 2,655.89' FEET

NOTES:
F.I.A.D. = FILLED IMMEDIATELY AFTER DRILLING
ROADWAY DESIGN AND SURVEY INFORMATION DATED 10/13/2023
PROVIDED BY TGS ENGINEERS.
C.T. = CORING TERMINATED
NM = NOT MEASURED

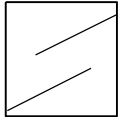
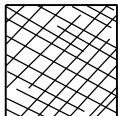
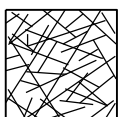

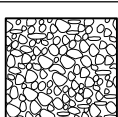
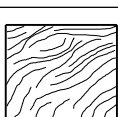
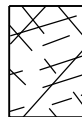
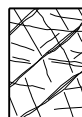
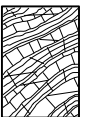



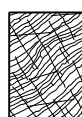

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

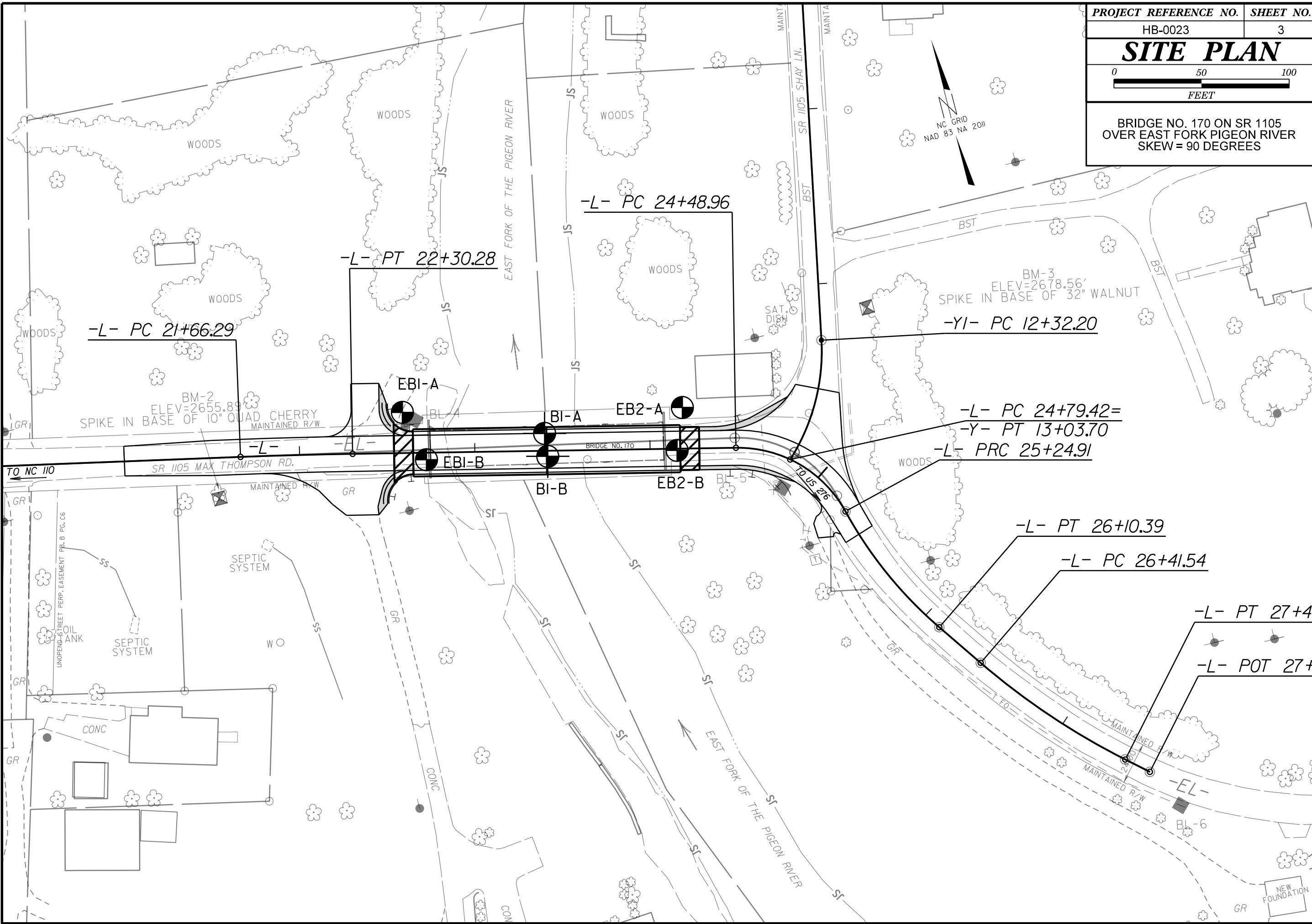
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

<div><div>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</div><div>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.</div></div>	<div>SURFACE CONDITIONS</div> <div>VERY GOOD Very rough, fresh unweathered surfaces</div> <div>GOOD Rough, slightly weathered, iron stained surfaces</div> <div>FAIR Smooth, moderately weathered and altered surfaces</div> <div>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</div> <div>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</div>	<div>STRUCTURE</div> <div><div>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</div><div>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</div><div>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</div><div>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</div><div>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</div><div>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</div></div>	<div>DECREASING SURFACE QUALITY ➡</div> <div>90</div> <div>80</div> <div>70</div> <div>60</div> <div>50</div> <div>40</div> <div>30</div> <div>20</div> <div>10</div> <div>N/A</div> <div>N/A</div>	<div>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</div> <div>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.</div>	<div>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</div> <div>VERY GOOD - Very Rough, fresh unweathered surfaces</div> <div>GOOD - Rough, slightly weathered surfaces</div> <div>FAIR - Smooth, moderately weathered and altered surfaces</div> <div>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</div> <div>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</div>	<div>COMPOSITION AND STRUCTURE</div> <div><div>A. Thick bedded, very blocky sandstone. 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.</div><div>B. Sandstone with thin inter-layers of siltstone</div><div>C. Sandstone and siltstone in similar amounts</div><div>D. Siltstone or silty shale with sandstone layers</div><div>E. Weak siltstone or clayey shale with sandstone layers</div><div>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</div><div>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</div><div>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.</div></div> <div>➡ Means deformation after tectonic disturbance</div>	<div>70</div> <div>60</div> <div>50</div> <div>40</div> <div>30</div> <div>20</div> <div>10</div>
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PROJECT REFERENCE NO.	SHEET NO.
HB-0023	3
SITE PLAN	
0 50 100 FEET	

BRIDGE NO. 170 ON SR 1105
OVER EAST FORK PIGEON RIVER
SKEW = 90 DEGREES





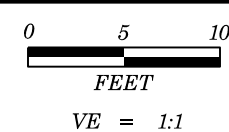
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75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15

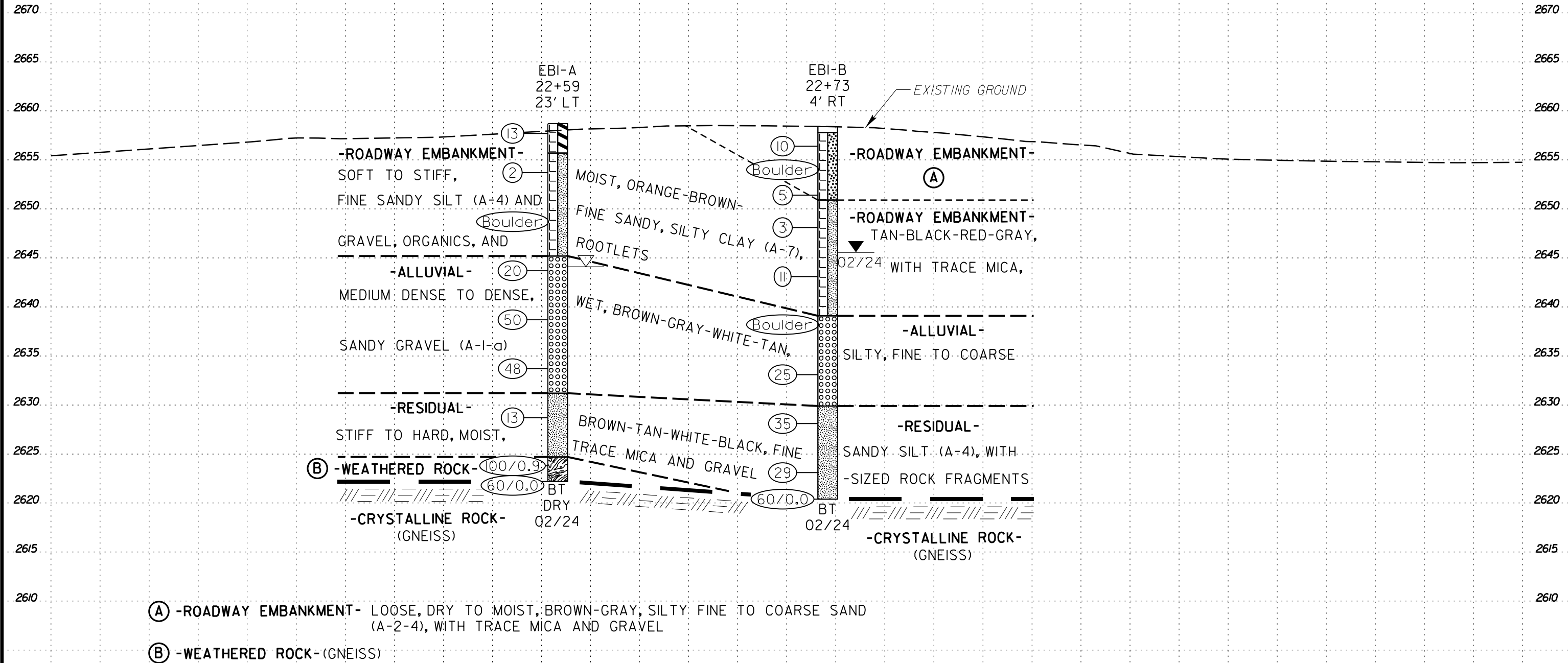
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Prepared in the Office of:
 CAROLINAS
GEOTECHNICAL
GROUP

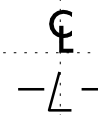


PROJECT REFERENCE NO.	SHEET NO.
HB-0023	5
CROSS SECTION AT END BENT 1 END BENT 1 SKEW = 90 DEGREES	

20 25 30 35 40 45 50 55 60 65 70 75



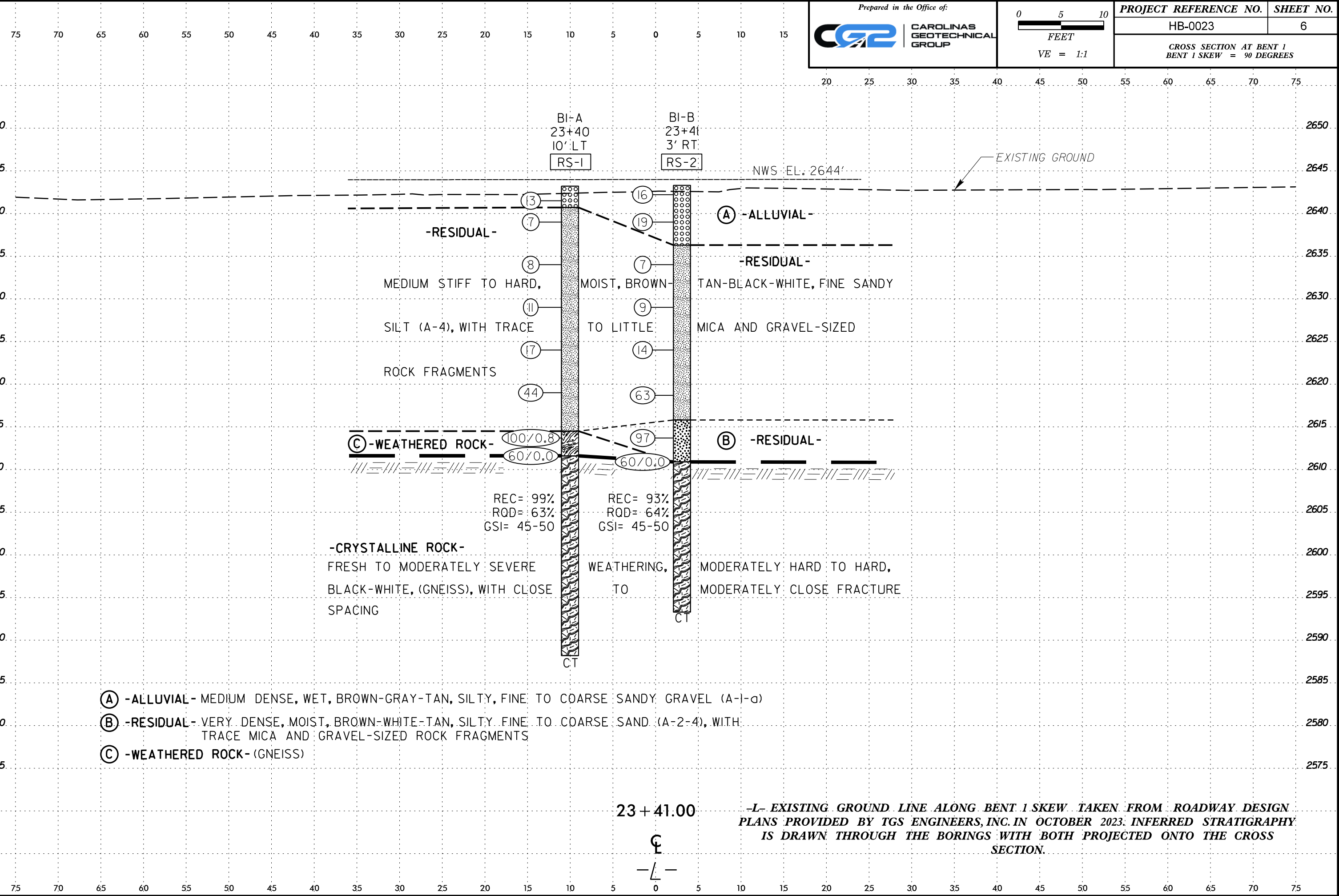
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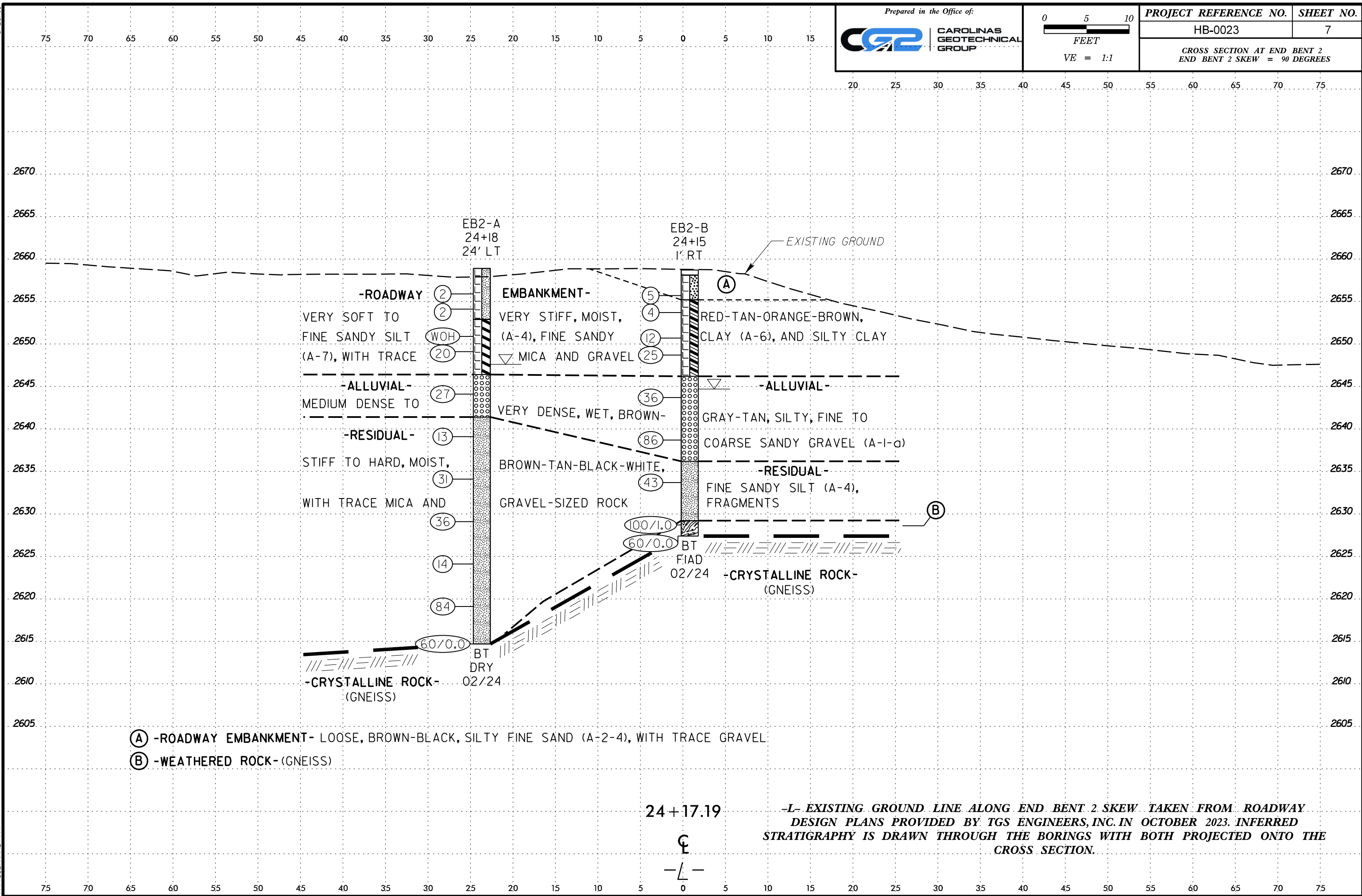


-L- EXISTING GROUND LINE ALONG END BENT 1 SKEW TAKEN FROM ROADWAY
DESIGN PLANS PROVIDED BY TGS ENGINEERS, INC. IN OCTOBER 2023. INFERRED
STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE
CROSS SECTION.

6/23/16

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GEOTECHNICAL BORING REPORT

BORE LOG

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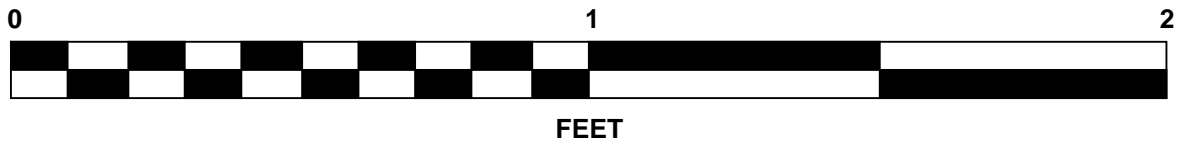
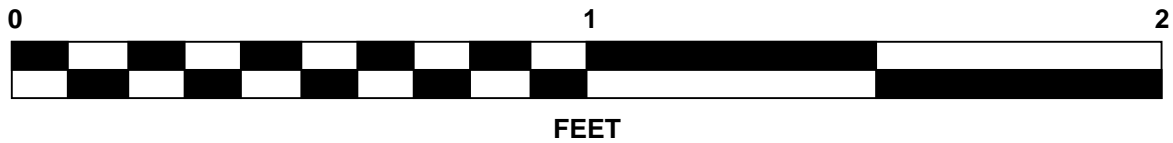
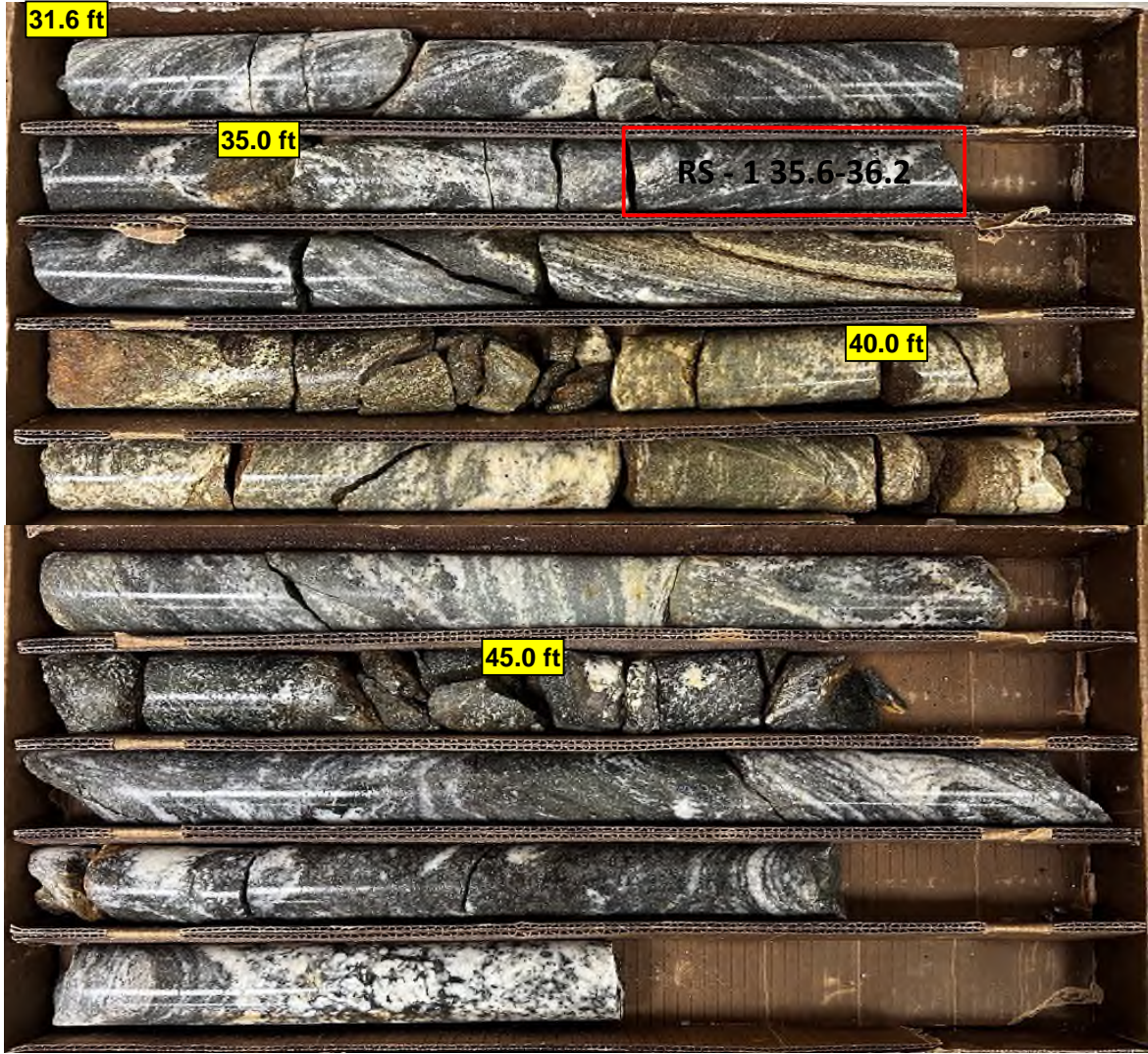
GEOTECHNICAL BORING REPORT CORE LOG

WBS 50345.1.1				TIP HB-0023				COUNTY HAYWOOD				GEOLOGIST P. Tomasic, G.I.T.							
SITE DESCRIPTION Replace Bridge No. 430170 on SR 1105 (Max Thompson Road) over E. Pigeon River												GROUND WTR (ft)							
BORING NO. B1-A				STATION 23+40				OFFSET 10 ft LT				ALIGNMENT -L-				0 HR. N/A			
COLLAR ELEV. 2,643.2 ft				TOTAL DEPTH 55.0 ft				NORTHING 650,796				EASTING 844,805				24 HR. N/A			
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022								DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Automatic							
DRILLER C. Odom				START DATE 02/07/24				COMP. DATE 02/07/24				SURFACE WATER DEPTH 1.3ft							
CORE SIZE NQ				TOTAL RUN 23.4 ft															
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) % ROD (ft) %		SAMP. NO.	STRATA REC. (ft) % ROD (ft) %		L O G	DESCRIPTION AND REMARKS					DEPTH (ft)			
2611.6											Begin Coring @ 31.6 ft								
2610	2,611.6	31.6	3.4	N=60/0.0 5:00/1.0 2:49/1.0 2:54/1.0 1:29/0.4	(2.3) 68%	(1.3) 38%		(22.0) 94%	(14.7) 63%		2,611.6					31.6			
	2,608.2	35.0	5.0	3:23/1.0 3:44/1.0 2:19/1.0 2:47/1.0 3:37/1.0	(4.7) 94%	(1.8) 36%	RS-1	Fresh to Moderately Weathered, Moderately Hard to Hard, Black-White, (GNEISS), with Close to Moderatley Close Fracture Spacing											
2605	2,603.2	40.0		3:14/1.0 2:32/1.0 3:24/1.0 4:18/1.0 3:11/1.0	(5.0) 100%	(2.8) 56%		RS-1: 35.6-36.2' Unit Weight: 177.0 pcf Unconfined Compressive Strength: 18,740 psi (2,699 ksf)											
			5.0	2:42/1.0 3:21/1.0 3:21/1.0 4:27/1.0 5:51/1.0	(5.0) 100%	(3.9) 78%		GSI= 45-50											
2600	2,598.2	45.0																	
			5.0	3:52/1.0 2:38/1.0 2:25/1.0 2:24/1.0 3:08/1.0	(5.0) 100%	(4.9) 98%													
2595	2,593.2	50.0																	
			5.0																
2590	2,588.2	55.0										2,588.2					55.0		
												Boring Terminated at Elevation 2,588.2 ft In Crystalline Rock (Gneiss)							

NCDOT BORE DOUBLE HAYWOOD 170 GEO BRDG.GPJ NC DOT.GDT 2/28/24

NCDOT CORE DOUBLE HAYWOOD 170 GEO BRDG.GPJ NC DOT.GDT 2/28/24

WBS: BP13.R049 - Replace Bridge No. 430170 on SR 1105
(Max Thompson Road) over E. Pigeon River
Rock Core Photographs
Bridge No. 430170 - B1-A
31.6 to 55.0 Feet

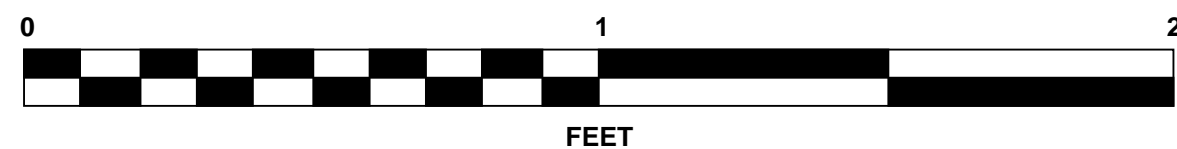


**WBS: BP13.R049 - Replace Bridge No. 430170 on SR 1105
(Max Thompson Road) over E. Pigeon River**

Rock Core Photographs

Bridge No. 430170 - B1-B

32.4 to 50.0 Feet



NC DOT BORE DOUBLE HAYWOOD 170 GEO BRDG.GPJ NC DOT.GDT 2/28/24

WBS 50345.1.1			TIP HB-0023			COUNTY HAYWOOD			GEOLOGIST P. Tomasic, G.I.T.					
SITE DESCRIPTION Replace Bridge No. 430170 on SR 1105 (Max Thompson Road) over E. Pigeon River									GROUND WTR (ft)					
BORING NO. EB2-B			STATION 24+15			OFFSET 1 ft RT			ALIGNMENT -L-			0 HR. 14.0		
COLLAR ELEV. 2,658.7 ft			TOTAL DEPTH 31.3 ft			NORTHING 650,768			EASTING 844,875			24 HR. FIAD		
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic					
DRILLER C. Odom			START DATE 02/08/24			COMP. DATE 02/08/24			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		MOI		
2660														
	2,656.7	2.0	3	2	3	5							M	GROUND SURFACE 0.0 2,658.1 ROADWAY EMBANKMENT 0.6'
2655	2,654.7	4.0	1	2	2	4							M	2,655.2 Loose, Brown-Black, Silty Fine SAND (A-2-4), with trace gravel 3.5
	2,651.7	7.0											M	Soft to Very Stiff, Red-Brown, Fine Sandy, Silty CLAY (A-6), with trace mica and gravel
2650	2,649.7	9.0	3	7	5	12							M	
			9	11	14								M	
2645	2,644.7	14.0				25							W	2,646.2 ALLUVIAL 12.5
			7	13	23								W	Dense to Very Dense, Brown-Tan, Silty, Fine to Coarse Sandy GRAVEL (A-1-a)
2640	2,639.7	19.0	34	31	55	36							W	
													M	2,636.2 RESIDUAL 22.5
2635	2,634.7	24.0	3	4	39	43								Hard, Brown-Tan-Black-White, Fine Sandy SILT (A-4), with trace mica and gravel-sized rock fragments
2630	2,629.7	29.0	19	39	61/0.5									2,629.2 WEATHERED ROCK 29.5
	2,627.4	31.3												2,627.4 Brown-White-Tan, (GNEISS) 31.3
														Boring Terminated with Standard Penetration Test Refusal at Elevation 2,627.4 ft On Crystalline Rock (Gneiss)

ROCK TEST RESULTS							
SAMPLE NO.	BORING	STATION	OFFSET	DEPTH INTERVAL	ROCK TYPE	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH
RS-1	B1-A	23+40 -L-	10' LT	35.6' - 36.2'	GNEISS	177.0	18,740 psi /2,699 ksf
RS-2	B1-B	23+41 -L-	3' RT	41.1' - 41.7'	GNEISS	166.8	11,370 psi /1,637 ksf

Alex M. Atkinson

AUTHORIZED SIGNATURE
NCDOT CERT NO. 130-0212



PHOTO #1: VIEW OF END BENT 2 OF BRIDGE NO. 430170 FACING WEST (DOWN STATION).



PHOTO #2: END BENT 1 OF BRIDGE NO. 430170 LOOKING EAST (UP STATION)



PHOTO #3: VIEW OF BRIDGE NO. 430170 FACING EAST (UP STATION).



PHOTO #4: VIEW OF BRIDGE NO. 430170 FACING WEST (DOWN STATION).