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**September 29, 2025**

**Reference Number:** 005-01-34397  
**County:** ASHE  
**Description:** Replace Bridge on Rustic Road over South Fork New River  
**SUBJECT:** Geotechnical Screening Report - Structure Subsurface Inventory

**Project Description**

The proposed 0.062-mile-long project is located approximately 6 miles southeast of West Jefferson in Ashe County, North Carolina. The project consists of the replacement of the existing single lane bridge on Rustic Road over the South Fork New River. In general, the proposed earthwork is minor throughout the project corridor, with slight change in grade of the roadway/bridge approaches. The proposed new bridge will be approximately 144 feet long and will be located where the existing damaged bridge is located.

The geotechnical investigation for this project was conducted during mid to late September of 2025. Two (2) borings were advanced using 3.25-inch hollow stem auger drilling methods and NQ wireline coring methods to depths of between 30.9 and 40.7 feet below ground surface. The two borings were advanced using a CME-550X ATV drill rig equipped with an automatic hammer. Standard Penetration Tests (SPT) were performed at 5.0-foot intervals at these locations to provide subsurface information for bridge foundation design/construction. These two (2) borings were drilled at the proposed end bents of the new bridge to depths that meet the requirements for driven pile foundations. One of these borings was advanced with NQ-sized rock coring methods after shallow SPT refusal on Crystalline Rock and drilled per RQD termination requirements for drilled pier foundations. Borings were left open for a minimum of twenty-four (24) hours to collect groundwater data. Interior bents for the proposed bridge were investigated using rod sounding methods. Four rod soundings were performed for the three interior bents and advanced to depths of between 1.5 and 10.3 feet. Representative soil samples were collected for visual classification in the field. Final bore logs and core logs with core photographs are included with this report.

All borings were advanced by a North Carolina Licensed Driller (Certified Well Contractors - CWC). All borings were logged by a North Carolina Licensed Geologist (LG/PG), Geologist in Training (GIT), Engineer Intern (EI), or other professional geotechnical field staff deemed qualified by NCDOT. All investigations and reporting were performed in accordance with the NCDOT Geotechnical Engineering Unit's 2021 "Geotechnical Investigation and Recommendations Manual."

The following alignment, totaling approximately 0.062 miles, was explored.

<u>Alignment</u>	<u>Station (±)</u>
-L-	10+40.00 - 13+65.00

**Physiography, Geography, and Geology**

The project area is situated within the Blue Ridge Physiographic Province, a mountainous region characterized by steep ridges and valleys that intersect at all angles with elevation differences of a several hundred feet between peaks and valleys. Within the project corridor, the topography is best described as flat to moderately rolling with well-developed drainages. A relative topographic low of approximately 2759 feet above sea level occurs within the channel of South Fork New River in the middle of the project area. From this area, the project ascends on either side of the South Fork New River to a relative topographic high of approximately 2781 feet above sea level at the start of the project, and approximately 2776 feet above sea level at the end of the project corridor.

The project area lies within the New River Basin. Surface drainage within the project corridor follows the existing topography, flowing into South Fork New River, meanders to the north eventually joining the North Fork New River to become the New River near the North Carolina and Virginia state line.

The project area is located within the Blue Ridge Belt. A geological belt is a typically fault-bounded fragment of Earth's crust that shares a common geologic history distinguishing it from surrounding belts or areas. The Blue Ridge Belt is characterized by mostly Precambrian aged, highly metamorphosed, and deformed rocks including gneisses, schists, phyllites, and amphibolites, which have been strongly folded, faulted and thrust-faulted during various orogenies. According to the Geologic Map of North Carolina, the project site is underlain by muscovite-biotite gneiss, and locally includes mica schist, amphibolite, and hornblende gneiss. This rock unit has been mapped by the North Carolina Geological Survey (NCGS) as "Ashe Metamorphic Suite and Tallulah Falls Formation; Muscovite-biotite gneiss (Map Symbol: Zatm)."

**Soil Properties**

Soils encountered during this geotechnical investigation have been divided into two categories based on origin, including Alluvial and Residual soils.

Alluvial soil is present along the project corridor, underlying and adjacent to the existing Rustic Road. Where encountered, these soils consist of granular soils characterized as brown, moist to saturated, very loose to very dense silty sand, (A-2-4), with trace gravel and boulders.

Residual soils were encountered underlying the Alluvial soils on the north end of the project site. The Residual soils consisted of granular soils characterized as brown and red, moist to saturated, loose to very dense silty sand (A-2-4) with mica. Residual soils at the project site are derived from the in-situ weathering of the underlying bedrock materials. Consistency or denseness typically increases with depth, as well as the amount of relic rock fragments present within the soil profile, until Weathered Rock and/or Crystalline Rock materials are encountered.

**Rock Properties**

Weathered Rock and Crystalline Rock consisting of gneiss was encountered within the subsurface beneath the Alluvial and/or Residual soils at depths ranging from ±1 to ±27 feet below existing ground surface in all the borings performed for the proposed bridge replacement at the project site. Crystalline Rock: Gneiss was cored at End Bent 1 of the proposed bridge to confirm the presence of continuous bedrock and is characterized as white and gray, moderately to slightly weathered, very closely to moderately closely fractured, medium hard to hard gneiss. In the cored boring, Crystalline Rock transitioned back to Weathered Rock for approximately 11 feet



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before transitioning back to competent bedrock. Trace iron staining was observed on some fracture surfaces of the recovered core. Rod soundings were performed at the interior bent locations and encountered Weathered Rock at depths between 1.0 and 5.5 feet and encountered Crystalline Rock and depths of between 1.5 and 10.3 feet. No outcropping was observed at the surface at or near the project site.

### **Groundwater Properties**

The geotechnical investigation was conducted during a period of average rainfall. Groundwater was encountered in two (2) of the borings. Where encountered, groundwater depths ranged from 1.9 feet to 6.2 feet below existing ground surface and elevations ranged from 2767.5 feet to 2770.5 feet above sea level. The water surface elevation of the South Fork New River was observed to be at approximately 2768 feet above sea level at the time of our investigation.

### **Areas of Special Geotechnical Interest**

Shallow Weathered Rock and Crystalline Rock was encountered in the rod soundings performed at the interior bent locations. Weathered Rock was encountered at depths between 1.0 and 5.5 feet and Crystalline Rock was encountered at depths between 1.5 and 10.3 feet below the existing ground surface at the interior bent locations. Shallow Weathered Rock and Crystalline Rock may prevent driven piles from achieving the required embedment for bearing or stability. Therefore, other foundation types such as drilled shafts may need to be considered during foundation design for this bridge.

Respectfully Submitted,

A handwritten signature in blue ink that reads "Aaron B. Gross".

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

SOIL DESCRIPTION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>									
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									
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX 10 MX	51 MN 35 MX 35 MX 35 MX	36 MN 36 MN 36 MN	41 MN 41 MN 41 MN	40 MX 40 MX 40 MX	36 MN 36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS
MATERIAL PASSING #40 LL PI	-		40 MX 41 MN 40 MX 41 MN 40 MX 41 MN	40 MX 41 MN 40 MX 41 MN	40 MX 41 MN 40 MX 41 MN	40 MX 41 MN 40 MX 41 MN	40 MX 41 MN 40 MX 41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC SOILS
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			
	4.75	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	MM 305	75	2.0	0.25	0.05	0.005			
	IN. 12	3							
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							
	- 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-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	
TRACE OF ORGANIC MATTER	2 - 3%	
LITTLE ORGANIC MATTER	3 - 5%	
MODERATELY ORGANIC	5 - 10%	
HIGHLY ORGANIC	> 10%	
SILT - CLAY SOILS	3 - 5%	
	5 - 12%	
	12 - 20%	
	> 20%	
OTHER MATERIAL	1 - 10%	
LITTLE	10 - 20%	
SOME	20 - 35%	
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 DEGRADED ROCK	
	UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL	
ABBREVIATIONS		
AR - AUGER REFUSAL	MED. - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL. - CLAY	MOD. - MODERATELY	U - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	U <sub>g</sub> - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
e - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILTY, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	V - VERY	

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 SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL
SEVERE (SEV.)	ALL 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. FABRIC 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 GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.
FRACTURE SPACING	
TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET
BEDDING	
TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET
INDURATION	
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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 (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: SEE NOTES	
ELEVATION: N/A FEET	
NOTES:	
FIAD = FILLED IMMEDIATELY AFTER DRILLING	
LOCATIONS AND ELEVATIONS DETERMINED WITH SURVEY GRADE GPS - EMLID REACH RS3 RECEIVER PERFORMING GNSS RTK VRS SURVEYS REFERENCED TO THE NC CORS RTN	

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


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**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)

**GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)**

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.

<b>SURFACE CONDITIONS</b>	<b>VERY GOOD</b> Very rough, fresh unweathered surfaces	<b>GOOD</b> Rough, slightly weathered, iron stained surfaces	<b>FAIR</b> Smooth, moderately weathered and altered surfaces	<b>POOR</b> Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	<b>VERY POOR</b> Slickensided, highly weathered surfaces with soft clay coatings or fillings
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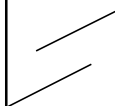
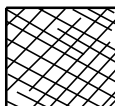


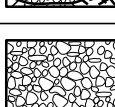

DECREASING SURFACE QUALITY →

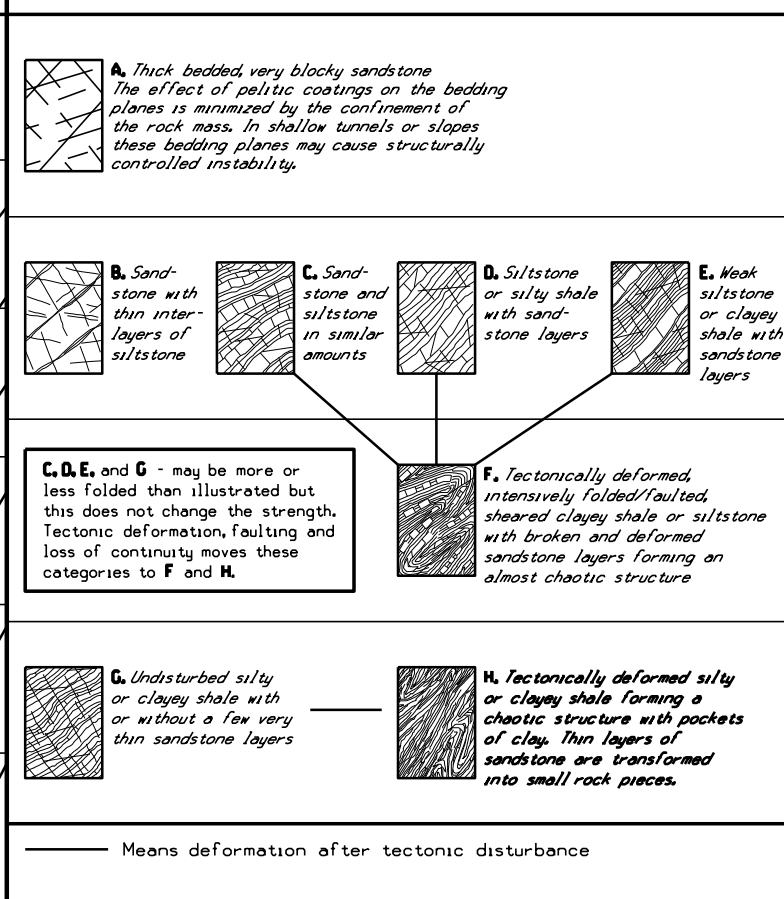
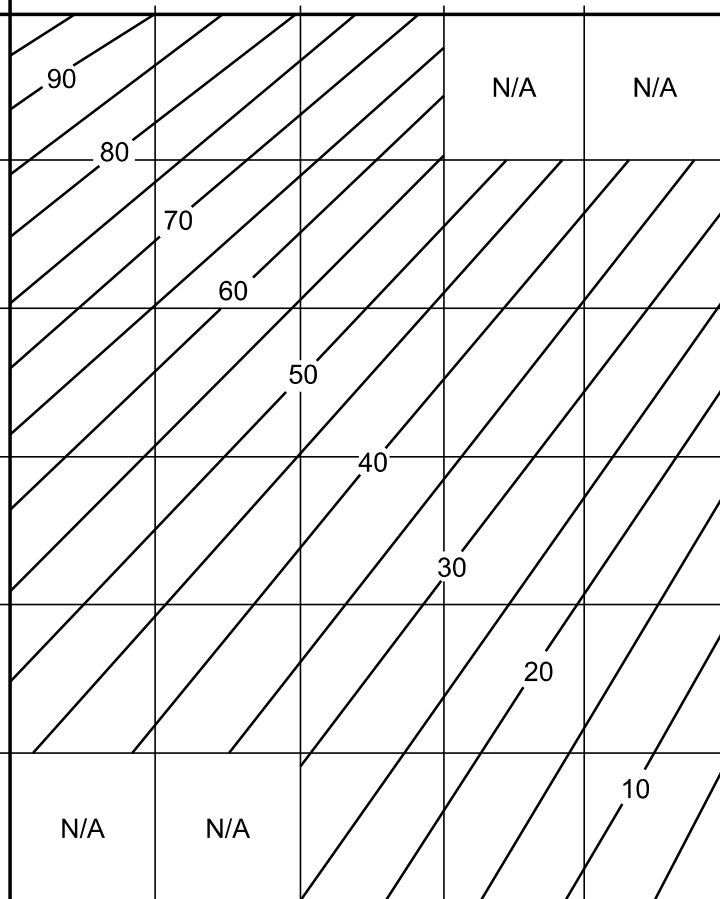
**GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)**

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.

<b>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</b>	<b>VERY GOOD</b> - Very Rough, fresh unweathered surfaces	<b>GOOD</b> - Rough, slightly weathered surfaces	<b>FAIR</b> - Smooth, moderately weathered and altered surfaces	<b>POOR</b> - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	<b>VERY POOR</b> - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings
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**STRUCTURE**

	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes



# GEOTECHNICAL BORING REPORT BORE LOG

# GEOTECHNICAL BORING REPORT CORE LOG

WBS 005-01-34397		TIP N/A		COUNTY ASHE		GEOLOGIST T. Wedding										
SITE DESCRIPTION ASHE COUNTY - Replace Bridge on Rustic Road over South Fork New River							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 11+10		OFFSET 9 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 2,773.7 ft		TOTAL DEPTH 40.7 ft		NORTHING 948,588		EASTING 1,286,040										
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 86% 11/14/2023		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic												
DRILLER M. G. Moseley		START DATE 09/11/25		COMP. DATE 09/11/25		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2775	2,773.7	0.0	3	9	9										2,773.7	0.0
2770	2,770.3	3.4	WOH 1		2										2,773.7	0.0
2765	2,765.3	8.4	16	27	48										2,760.3	13.4
2760	2,760.3	13.4	60/0.1												2,760.2	13.5
2755															2,755.1	18.6
2750																
2745																
2740																
2735																
															2,733.0	40.7
Boring Terminated at Elevation 2,733.0 ft in Crystalline Rock: GNEISS																

NCDOT BORE DOUBLE ASHE 005-01-3497\_GEO\_BRDG\_SUMMIT GINT.GPJ NC\_DOT.GDT 9/26/25

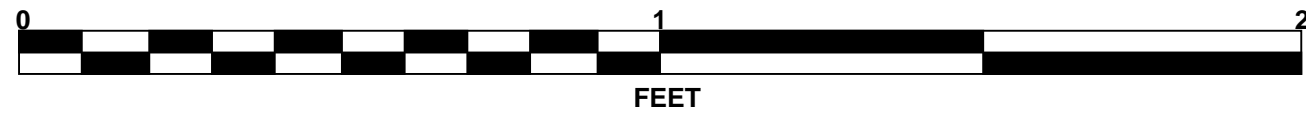
WBS 005-01-34397		TIP N/A		COUNTY ASHE		GEOLOGIST T. Wedding						
SITE DESCRIPTION ASHE COUNTY - Replace Bridge on Rustic Road over South Fork New River							GROUND WTR (ft)					
BORING NO. EB1-B		STATION 11+10		OFFSET 9 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 2,773.7 ft		TOTAL DEPTH 40.7 ft		NORTHING 948,588		EASTING 1,286,040						
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 86% 11/14/2023		DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic								
DRILLER M. G. Moseley		START DATE 09/11/25		COMP. DATE 09/11/25		SURFACE WATER DEPTH N/A						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
2760.2	2,760.2	13.5	2.2	1:30/1.2	(2.0)	(0.9)		(4.9)	(1.2)		Begin Coring @ 13.5 ft	
	2,758.0	15.7	5.0	0:47	91%	41%		96%	24%		<b>CRYSTALLINE ROCK</b> White and Gray, moderately to slightly weathered, very closely to moderately closely fractured, medium hard to hard GNEISS with trace iron staining on fracture surfaces GSI = 30-35	13.5
2755				0:59	(2.9)	(0.3)						
	2,753.0	20.7	5.0	1:01	58%	6%		(1.6)	NA		<b>WEATHERED ROCK</b> Gray and Brown, severely to moderately severely weathered, very closely fractured, soft to medium hard, GNEISS (GSI = N/A)	18.6
2750				1:23								
	2,748.0	25.7	5.0	1:19	(0.3)	(0.0)						
2745				1:33	6%	0%						
	2,743.0	30.7	5.0	1:12								
2740				0:50								
	2,738.0	35.7	5.0	1:17	(4.7)	(3.7)		(10.1)	(8.6)		<b>CRYSTALLINE ROCK</b> White and Gray, very slightly weathered to fresh, closely to moderately closely fractured, hard GNEISS GSI = 55-60	30.0
2735				2:03	94%	74%						
	2,733.0	40.7	5.0	2:17	(4.7)	(4.4)						
				1:46	94%	88%						
				1:36								
				1:54								
				1:59								
				2:06								
Boring Terminated at Elevation 2,733.0 ft in Crystalline Rock: GNEISS												

NCDOT CORE DOUBLE ASHE 005-01-3497\_GEO\_BRDG\_SUMMIT GINT.GPJ NC\_DOT.GDT 9/26/25

# CORE PHOTOGRAPHS

## EB1-B

BOXES 1 and 2 of 2: 13.5 - 40.7 FEET





# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 005-01-34397		TIP N/A		COUNTY ASHE		GEOLOGIST A. Gross								
SITE DESCRIPTION ASHE COUNTY - Replace Bridge on Rustic Road over South Fork New River							GROUND WTR (ft)							
BORING NO. B2-B BR		STATION 11+84		OFFSET 5 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 2,764.4 ft		TOTAL DEPTH 10.3 ft		NORTHING 948,662		EASTING 1,286,029								
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE Manual								
DRILLER T. Wedding		START DATE 09/25/25		COMP. DATE 09/25/25		SURFACE WATER DEPTH 3.3ft								
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)
2770														
														▼
														▼
2765	2,764.4	0.0	NA	8	5									2,764.4
	2,763.4	1.0	NA	9	19									
	2,762.4	2.0	NA	4	3									
	2,761.4	3.0	NA	14	9									
2760	2,760.4	4.0	NA	18	12									
	2,759.4	5.0	NA	40	97									
	2,758.4	6.0	NA	110	98									
	2,757.4	7.0	NA	78	60									
	2,756.4	8.0	NA	50	90									
2755	2,755.4	9.0	NA	84	103									
	2,754.4	10.0	NA	200/0.3										

WBS 005-01-34397		TIP N/A		COUNTY ASHE		GEOLOGIST A. Gross								
SITE DESCRIPTION ASHE COUNTY - Replace Bridge on Rustic Road over South Fork New River							GROUND WTR (ft)							
BORING NO. B3-A BR		STATION 12+36		OFFSET 7 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 2,762.6 ft		TOTAL DEPTH 6.1 ft		NORTHING 948,712		EASTING 1,286,013								
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE Manual								
DRILLER T. Wedding		START DATE 09/25/25		COMP. DATE 09/25/25		SURFACE WATER DEPTH 4.9ft								
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)
2770														
														▼
														▼
2765	2,762.6	0.0	NA	15	23									2,762.6
	2,761.6	1.0	NA	21	43									
	2,760.6	2.0	NA	33	44									
2760	2,759.6	3.0	NA	33	59									
	2,758.6	4.0	NA	50	48									
	2,757.6	5.0	NA	60	67									
	2,756.6	6.0	NA	100/0.1										

NCDOT BORE DOUBLE ASHE 005-01-3497\_GEO\_BRDG\_SUMMIT GINT.GPJ NC\_DOT.GDT 9/26/25

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 005-01-34397		TIP N/A		COUNTY ASHE		GEOLOGIST T. Wedding									
SITE DESCRIPTION ASHE COUNTY - Replace Bridge on Rustic Road over South Fork New River							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 12+74		OFFSET 19 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 2,772.4 ft		TOTAL DEPTH 30.9 ft		NORTHING 948,749		EASTING 1,285,998									
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 86% 11/14/2023				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER M. G. Moseley		START DATE 09/10/25		COMP. DATE 09/10/25		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					
2775															
	2,772.4	0.0													2,772.4 GROUND SURFACE 0.0
2770	2,769.0	3.4	WOH	WOH	1										ALLUVIAL Brown, moist, very loose to loose Silty SAND (A-2-4)
2765	2,764.0	8.4													
2760	2,759.0	13.4													RESIDUAL Red and Brown, moist to saturated, loose to very dense, micaceous Silty SAND (A-2-4)
2755	2,754.0	18.4													
2750	2,749.0	23.4													
2745	2,744.0	28.4													WEATHERED ROCK GNEISS
	2,741.6	30.8	100/0.4												CRYSTALLINE ROCK GNEISS
			60/0.1												Boring Terminated with Standard Penetration Test Refusal at Elevation 2,741.5 ft in Crystalline Rock: GNEISS