

PROJECT: BP14.R032 REFERENCE: SF-430041

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-7	BORE LOGS
8	SITE PHOTOS

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY HAYWOOD  
 PROJECT DESCRIPTION REPLACE BRIDGE 41 IN  
HAYWOOD COUNTY OVER CRABTREE CREEK ON  
SR 1357 (CRABTREE CHURCH RD)  
 SITE DESCRIPTION BRIDGE NO. 430041 OVER CRABTREE  
CREEK ON CRABTREE CHURCH ROAD (SR 1357)  
IN HAYWOOD COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-430041	1	

CAUTION NOTICE

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

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

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

- NOTES:
- THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
  - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

M. SCHUBERT

CG2 PERSONNEL

INVESTIGATED BY RK&K

DRAWN BY J. MIZE

CHECKED BY A. ASOUDEH

SUBMITTED BY RK&K

DATE JANUARY 2025

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SIGNATURE DATE

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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	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7
SYMBOL															
% PASSING	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MN	35 MX 10 MX	35 MX 10 MX	35 MX 10 MN	36 MN 10 MX	36 MN 10 MX	36 MN 10 MN	36 MN 10 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT	
MATERIAL PASSING #40	LL PI		NP	40 MX 10 MX	41 MN 10 MN	40 MX 11 MN	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	0	0	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															

GRADATION			
WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.			
ANGULARITY OF GRAINS			
THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.			
MINERALOGICAL COMPOSITION			
MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.			
COMPRESSIBILITY			
SLIGHTLY COMPRESSIBLE	LL < 31		
MODERATELY COMPRESSIBLE	LL = 31 - 50		
HIGHLY COMPRESSIBLE	LL > 50		
PERCENTAGE OF MATERIAL			
ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE 1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE 10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME 20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY 35% AND ABOVE
GROUND WATER			
	WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING		
	STATIC WATER LEVEL AFTER 24 HOURS		
	PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA		
	SPRING OR SEEP		

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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i>
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

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 DISLODGED FROM PARENT MATERIAL.	
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	
FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.	
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	
LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.	
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	
MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.	
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	
RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.	
ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.	
SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.	
SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.	
SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.	
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.	
STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.	
STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.	
TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.	

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

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
	SOUNDING ROD
	TEST BORING WITH CORE
	SPT N-VALUE

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

ROCK HARDNESS	
VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.

TEXTURE OR GRAIN SIZE						
U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	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					

ABBREVIATIONS		
AR - AUGER REFUSAL	MED. - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	W <sub>d</sub> - DRY UNIT WEIGHT
CSE - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
Ø - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, 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
HL. - HIGHLY	V - VERY	

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

EQUIPMENT USED ON SUBJECT PROJECT	
DRILL UNITS:	ADVANCING TOOLS:
<input type="checkbox"/> CME-45C	<input type="checkbox"/> CLAY BITS
<input type="checkbox"/> CME-55	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER
<input type="checkbox"/> CME-950	<input checked="" type="checkbox"/> 2 1/4" HOLLOW AUGERS
<input type="checkbox"/> VANE SHEAR TEST	<input type="checkbox"/> HARD FACED FINGER BITS
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS
<input checked="" type="checkbox"/> MOBILE B-29	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER
	<input type="checkbox"/> TRICONE <input type="checkbox"/> STEEL TEETH
	<input type="checkbox"/> TRICONE <input type="checkbox"/> TUNG-CARB.
	<input type="checkbox"/> 4" CORE BIT

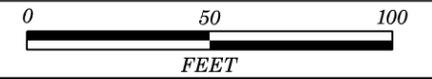
SOIL MOISTURE - CORRELATION OF TERMS		
SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL PLASTIC RANGE (PI) PL	LIQUID LIMIT	- SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
	PLASTIC LIMIT	- WET - (W) SEMISOLID;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

HAMMER TYPE:	
<input checked="" type="checkbox"/> AUTOMATIC	<input type="checkbox"/> MANUAL
CORE SIZE:	
<input type="checkbox"/> B	<input type="checkbox"/> H
<input type="checkbox"/> N	
HAND TOOLS:	
<input type="checkbox"/> POST HOLE DIGGER	
<input type="checkbox"/> HAND AUGER	
<input type="checkbox"/> SOUNDING ROD	
<input type="checkbox"/> VANE SHEAR TEST	

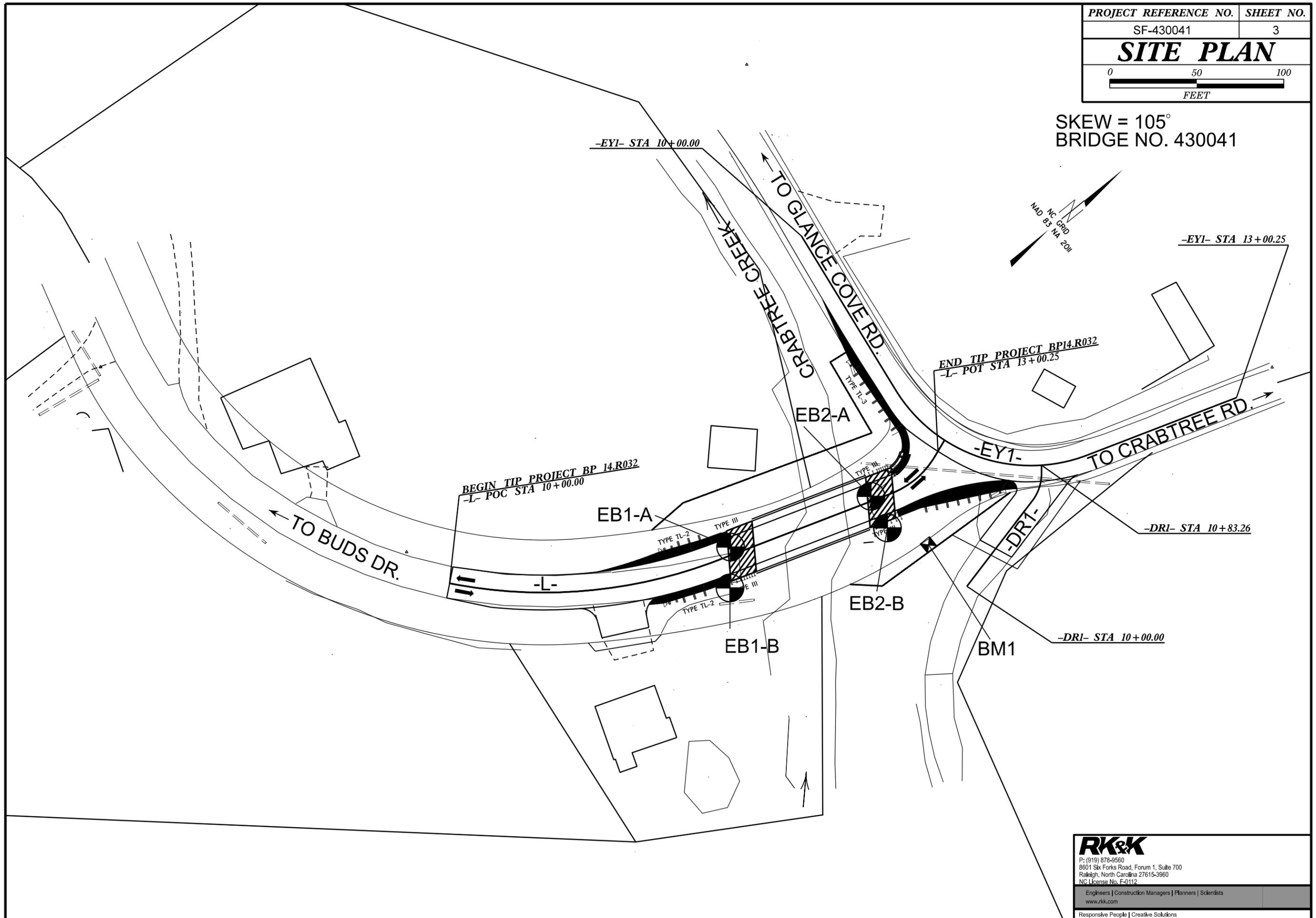
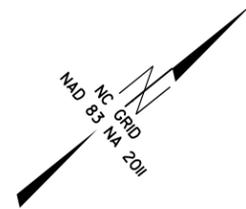
INDURATION	
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT 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.

BENCH MARK: BMI, AT -L- STATION I2+69, 36' RT, RR SPIKE IN BASE OF 7" WALNUT	
ELEVATION: 2480.3 FEET	
<b>NOTES:</b>	
BOREHOLE ELEVATIONS DETERMINED BY RK&K USING A TRIMBLE GEO 7X AND PROVIDED BLP.dgn FILE.	
CORRECTIONS OBTAINED VIA REAL-TIME CORRECTIONS FROM NORTH CAROLINA GEODETIC SURVEY (RTN.NC.GOV)	
BLP.dgn file: SOI-HAYWOOD41.GEO.RDY.BLP.dgn	
SR = SPT REFUSAL	
FIAD = FILLED IMMEDIATELY AFTER DRILLING	

# SITE PLAN



SKIEW = 105°  
BRIDGE NO. 430041



**RK&K**  
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 Engineers | Construction Managers | Planners | Scientists  
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# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS BP14.R032	TIP SF-430041	COUNTY HAYWOOD	GEOLOGIST M. Schubert
SITE DESCRIPTION Bridge No. 430041 over Crabtree Creek on Crabtree Church Road (SR 1357) in Haywood County			GROUND WTR (ft)
BORING NO. EB1-A	STATION 11+66	OFFSET 4 ft LT	ALIGNMENT -L-
COLLAR ELEV. 2,482.1 ft	TOTAL DEPTH 34.1 ft	NORTHING 697,474	EASTING 829,327
DRILL RIG/HAMMER EFF./DATE CG29022 Mobile B-29 92% 04/09/2024		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic
DRILLER M. Brewer	START DATE 11/21/24	COMP. DATE 11/21/24	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				ELEV. (ft)	DEPTH (ft)	
2485																
	2,482.1	0.0													2,482.1	0.0
			3	4	4										2,481.8	0.3
2480															2,480.1	2.0
	2,478.1	4.0	12	1	1											
2475																
	2,473.1	9.0	6	8	9										2,474.1	8.0
2470																
	2,468.1	14.0	38	39	29										2,469.1	13.0
2465																
	2,463.1	19.0	100/0.5												2,464.1	18.0
2460																
	2,459.1	23.0	100/0.3													
2455																
	2,453.1	29.0	100/1.0													
2450																
	2,448.1	34.0	60/0.1												2,449.1	33.0
															2,448.0	34.1

NCDOT BORE SINGLE BP14\_R032.GPJ NC\_DOT.GDT 1/24/25

Boring Terminated at Elevation 2,448.0 ft in Crystalline Rock: SCHIST

# GEOTECHNICAL BORING REPORT

## BORE LOG

<b>WBS</b> BP14.R032		<b>TIP</b> SF-430041		<b>COUNTY</b> HAYWOOD		<b>GEOLOGIST</b> M. Schubert	
<b>SITE DESCRIPTION</b> Bridge No. 430041 over Crabtree Creek on Crabtree Church Road (SR 1357) in Haywood County							<b>GROUND WTR (ft)</b>
<b>BORING NO.</b> EB1-B		<b>STATION</b> 11+57		<b>OFFSET</b> 16 ft RT		<b>ALIGNMENT</b> -L-	0 HR. 10.7
<b>COLLAR ELEV.</b> 2,482.5 ft		<b>TOTAL DEPTH</b> 43.7 ft		<b>NORTHING</b> 697,459		<b>EASTING</b> 829,345	24 HR. 9.3
<b>DRILL RIG/HAMMER EFF./DATE</b> CG29022 Mobile B-29 92% 04/09/2024				<b>DRILL METHOD</b> H.S. Augers		<b>HAMMER TYPE</b> Automatic	
<b>DRILLER</b> M. Brewer		<b>START DATE</b> 11/21/24		<b>COMP. DATE</b> 11/21/24		<b>SURFACE WATER DEPTH</b> N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2485																
	2,482.5	0.0												2,482.5	GROUND SURFACE	0.0
2480	2,479.0	3.5	6	4	3								M	2,482.2	<b>ROADWAY EMBANKMENT</b> Topsoil	7.3
	2,479.0	3.5	8	7	5								M	2,479.5	Brown to gray, loose, silty SAND (A-2-4), some rock fragments, trace rootlets, trace mica	3.0
2475	2,474.0	8.5	8	9	12									2,474.5	<b>ALLUVIAL</b> Brown to gray, medium dense, silty SAND (A-2-4), little rock fragments, trace of organic matter, little mica	8.0
2470	2,469.0	13.5	1	0	3									2,469.5	Brown to gray, medium dense, gravelly SAND (A-1-a), little mica	13.0
2465	2,464.0	18.5	5	11	15									2,464.5	<b>RESIDUAL</b> Brown to orange, soft, clayey SILT (A-5), some fine to coarse sand, little mica	18.0
2460	2,459.0	23.5	2	4	7										Brown to orange, medium dense, silty coarse to fine SAND (A-2-4), trace rock fragments, some mica, trace clay, saprolitic	
2455	2,454.0	28.5	25	32	55											
2450	2,449.0	33.5	54	46/0.2												
	2,449.0	33.5												2,449.5	<b>WEATHERED ROCK</b> SCHIST	33.0
2445	2,444.0	38.5	100/0.4													
2440	2,439.0	43.5	100/0.2											2,438.8		43.7
															Boring Terminated at Elevation 2,438.8 ft in Weathered Rock: SCHIST	

NCDOT BORE SINGLE BP14\_R032.GPJ NC\_DOT\_GDT 1/24/25

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS BP14.R032	TIP SF-430041	COUNTY HAYWOOD	GEOLOGIST M. Schubert
SITE DESCRIPTION Bridge No. 430041 over Crabtree Creek on Crabtree Church Road (SR 1357) in Haywood County			GROUND WTR (ft)
BORING NO. EB2-A	STATION 12+53	OFFSET 2 ft LT	ALIGNMENT -L-
COLLAR ELEV. 2,481.4 ft	TOTAL DEPTH 49.6 ft	NORTHING 697,555	EASTING 829,355
DRILL RIG/HAMMER EFF./DATE GEO0007 Geoprobe 3230DT 96% 02/05/2024		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic
DRILLER S. Harig	START DATE 11/22/24	COMP. DATE 11/22/24	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				ELEV. (ft)
2485														
2480	2,481.4	0.0	9	1	1								M	GROUND SURFACE 0.0 ROADWAY EMBANKMENT 0.1 Topsoil 2.0
2475	2,476.9	4.5	11	7	2								M	Brown to dark gray, very loose, sandy SILT (A-4), low recovery, trace mica ALLUVIAL Brown, stiff, silty CLAY (A-7-5), trace mica
2470	2,471.9	9.5	5	7	12								W	* Boulders between 3' to 7' * * inflated blow count due to boulders * Brown to gray, medium dense, silty fine to coarse SAND (A-2-4), some mica, trace rock fragments
2465	2,466.9	14.5	17	19	11								W	RESIDUAL Brown to orange, loose to dense, silty coarse to fine SAND (A-2-4), some mica, trace rock fragments, saprolitic
2460	2,461.9	19.5	5	2	2								Sat.	
2455	2,456.9	24.5	24	76/0.3						100/0.8				WEATHERED ROCK SCHIST 23.0
2450	2,451.9	29.5	31	35	41								Sat.	RESIDUAL Brown to gray, hard, sandy SILT (A-4), some mica 28.0
2445	2,446.9	34.5	9	5	17								Sat.	Brown to gray, medium dense, silty coarse to fine SAND (A-2-4), some mica, trace rock fragments, saprolitic 34.0
2440	2,441.9	39.5	100/0.3							100/0.3				WEATHERED ROCK SCHIST 38.0
2435	2,436.9	44.5	100/0.2							100/0.2				
	2,431.9	49.5	60/0.1							60/0.1				CRYSTALLINE ROCK SCHIST 48.0 49.6 Boring Terminated at Elevation 2,431.8 ft in Crystalline Rock: SCHIST

NCDOT BORE SINGLE BP14\_R032.GPJ NC\_DOT.GDT 1/24/25





Former Bridge Location, Facing Down STA from EB2

Former Bridge Location, Facing LT from EB2



Bridge Replacement #430041  
 Crabtree, NC  
 Haywood County

DATE: 11/19/2024  
 SHEET 8