



Mr. Barry Hobbs, PE
Project Manager
Johnson, Mirmiran & Thompson, Inc.

March 17, 2026

TIP NUMBER: 100-01-00205
COUNTY: Yancey
DESCRIPTION: Bridge on Sweetbirch Rd. over East of US 19W Over Cane River
SUBJECT: Foundation Design Recommendations

Dear Mr. Hobbs,

HDR Engineering, Inc. of the Carolinas has completed the foundation recommendations for the proposed Structure on Sweetbirch Rd over Cane River. Boring performed from nearby proposed bridge end bent was utilized for the foundation design calculations. Also attached are the foundation recommendations with notes to be placed on the structure plans and supporting calculations.

Please contact me if you have any questions.

Sincerely,
HDR ENGINEERING, INC. OF THE CAROLINAS

Saket Kabra 3/17/2026

Saket Kabra, PE
Geotechnical Engineer

Anil Kumar Varri 3/17/2026

Anil Varri, PE
Senior Geotechnical Engineer

Attachments
Foundation Recommendations
Boring Location Plan View and Boring logs
Geometry and Loading Information
Supporting Calculations



FOUNDATION RECOMMENDATIONS



FOUNDATION RECOMMENDATIONS

WBS #	100-01-00205	DESCRIPTION	BRIDGE ON -L6- (SWEETBIRCH RD.)
T.I.P. NO.	100-01-00205	EAST OF US 19W OVER CANE RIVER	
COUNTY	YANCEY		
STATION	11+20.4 -L6-		
BRIDGE NO.	205		



	INITIALS	DATE
DESIGN	AKV	12/15/2025
CHECK	SMV	12/19/2025
APPROVAL		

	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	10+69.00 -L6-	36" Dia Drilled Piers	395 kips/pier	Top of Drilled Piers El. = 2403 ft Piers Minimum Tip El. = 2389.5 ft Pt of Fixity El. = 2395 ft Number of Piers = 4
BENT 1	11+20.40 -L6-	36" Dia Drilled Piers	615 kips/pier	Top of Drilled Piers El. = 2406 ft Piers Minimum Tip El. = 2389.5 ft Pt of Fixity El. = 2395 ft Number of Piers = 2
END BENT 2	11+71.79 -L6-	36" Dia Drilled Piers	400 kips/pier	Top of Drilled Piers El. = 2403 ft Piers Minimum Tip El. = 2389.5 ft Pt of Fixity El. = 2395 ft Number of Piers = 4

NOTES ON PLANS & COMMENTS

(See following page)



SUMMARY OF DRILLED PIER INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent / Bent No, Pier(s) #(-#) (e.g., "Bent 1, Piers 1-3")	Number of Piers per Line	Factored Resistance per Pier KIPS	Required Drilled Pier Tip Elevation FT	Required Tip Resistance per Pier KSF	Scour Critical Elevation FT	Minimum Drilled Pier Penetration Into Rock per Pier LIN FT	Drilled Pier Length* per Pier LIN FT	Drilled Pier Length Not In Soil* per Pier LIN FT	Drilled Pier Length In Soil* per Pier LIN FT	Permanent Steel Casing Required? YES	Permanent Steel Casing Tip Elevation (Elevation Not To Extend Casing Below) FT	Permanent Steel Casing Length** per Pier LIN FT
End Bent 1, Piers 1-4	4	395	2389.50	130		8.6	13.5***	8.6	4.9			
Bent 1, Piers 1-2	2	615	2389.50	200	2398.10	8.5	16.5***	8.6	4.9	YES	2398.10	7.9
End Bent 2, Piers 1-4	4	400	2389.50	130		8.5	13.5***	8.6	4.9			
TOTAL QUANTITY:								86	49			15.8

* Drilled Pier Length, Drilled Pier Length Not in Soil and Drilled Pier Length in Soil represent estimated drilled pier quantities and are measured and paid for as either "36" Dia. Drilled Piers" or "36" Dia. Drilled Piers Not in Soil" and "36" Dia. Drilled Piers in Soil" in accordance with Article 411-7 of the NCDOT Standard Specifications. For bents with a not in soil pay item, drilled piers through air or water will be paid at the contract unit price for "36" Dia. Drilled Piers in Soil."

** Permanent Steel Casing Length equals the difference between the ground line or top of drilled pier elevation, whichever is higher, and the permanent casing tip elevation and is measured and paid for as "Permanent Steel Casing for 36" Dia. Drilled Pier" in accordance with Article 411-7 of the NCDOT Standard Specifications.

*** Drilled pier lengths are based on assumption that rock elevation is approximately at Elevation 2398 ft. If different subsurface conditions are encountered, Engineer shall be contacted for updated pier lengths.

SUMMARY OF DRILLED PIER TESTING

(Blank entries indicate item is not applicable to structure)

End Bent / Bent No, Pier(s) #(-#) (e.g., "Bent 1, Piers 1-3")	Standard Penetration Test (SPT) EACH	Crosshole Sonic Logging (CSL) EACH	Thermal Integrity Profiler (TIP) EACH	Shaft Inspection Device (SID) EACH	Pile Integrity Test (PIT) EACH
End Bent 1, Piers 1-4		1			
Bent 1, Piers 1-2		1			
End Bent 2, Piers 1-4		1			
TOTAL QUANTITY:		3			


PROJECT NO. GROW NC 100-01-00205

YANCEY COUNTY

STATION: 11+20.40 -L6-

NOTES:

- The Drilled Pier Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer (Saket Kabra, #053059) on 03-17-2026.
- The design presented herein is based on subsurface information obtained from borings performed for Site-Q217A. It has been assumed that similar subsurface conditions exist at the current site. Actual rock elevations may vary from those indicated. If significant variations in rock elevation are encountered during construction, the Engineer must be contacted immediately to review and verify the design.
- The Engineer may adjust the quantity for Permanent Steel Casing, SPTs, TIPs, CSL Testing, SID Inspections and PITs when necessary.
- For Drilled Piers, see Section 411 of the Standard Specifications.
- CSL tubes are required and CSL testing may be required for drilled piers. The engineer will determine the need for CSL testing. For CSL testing, see section 411 of the Standard Specifications.
- SID inspections may be required for drilled piers. The engineer will determine the need for SID inspections.
- Permanent steel casings are required for drilled piers at Bent No. 1. Do not extend permanent casings below elevation 2398 ft without prior approval from the Engineer.
- Test Holes are required for drilled piers at End Bent No. 1, End Bent No.2 and Bent No. 1 to confirm continuous rock. For Test holes, see Section 411 of the Standard Specifications.

	STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
	PILE AND DRILLED PIER FOUNDATION TABLES					
SIGNATURE _____	DATE _____	REVISIONS				SHEET NO.
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	NO. <u>1</u>	BY: _____	DATE: _____	NO. <u>3</u>	BY: _____	TOTAL SHEETS
	NO. <u>2</u>	BY: _____	DATE: _____	NO. <u>4</u>	BY: _____	



HDR Engineering, Inc., of the Carolinas
 555 Fayetteville Street, Suite 900
 Raleigh, NC 27601

SUBJECT: BRIDGE ON -L6- (SWEETBIRCH RD.)		WBS Element: 100-01-00205
EAST OF US 19W OVER CANE RIVER		YANCEY County
PREPARED BY:	AKV	100-01-00205
DATE:	12/15/25	
CHECKED BY:	SMV	SHEET:
DATE:	12/19/2025	

END BENTS SUMMARY

END BENT 1

Foundation Type:	36" Drilled Piers	
Bottom of Column/ Top of Drilled Pier Elevation:	2403 +/- ft.	<i>Provided by HDR Structural Engineer</i>
Number of Piers	4	<i>Provided by HDR Structural Engineer</i>
Max Factored Load:	395 kips/pier	<i>Provided by HDR Structural Engineer</i>
Provided Factored Resistance:	395 kips/pier	<i>Required factored Resistance including weight of column and pier</i>
Drilled Pier Minimum Tip Elevat	2389.5 ft.	<i>Determined from NCDOT Drilled Pier Axial Resistance Spreadsheet and LPILE</i>
Drilled Pier Length:	13.5 ft	<i>Top of Pier - Pier Tip Elevation</i>
Point of Fixity EL:	2395.0 ft	<i>From LPILE</i>

END BENT 2

Foundation Type:	36" Drilled Piers	
Bottom of Column/ Top of Drilled Pier Elevation:	2403 +/- ft.	<i>Provided by HDR Structural Engineer</i>
Number of Piers	4	<i>Provided by HDR Structural Engineer</i>
Max Factored Load:	400 kips/pier	<i>Provided by HDR Structural Engineer</i>
Provided Factored Resistance:	400 kips/pier	<i>Required factored Resistance including weight of column and pier</i>
Drilled Pier Minimum Tip Elevat	2389.5 ft.	<i>Determined from NCDOT Drilled Pier Axial Resistance Spreadsheet and LPILE</i>
Drilled Pier Length:	13.5 ft	<i>Top of Pier - Pier Tip Elevation</i>
Point of Fixity EL:	2395.0 ft	<i>From LPILE</i>

Comments:
 Tip elevations are based on good quality rock encountered at elevation 2398 ft based on borings performed at Site 0217-A. It is anticipated that revisions to the tip elevations will be made when actual conditions at each drilled pier location are known. Engineer shall be contacted if rock elevations vary from above assumed elevation.



HDR Engineering, Inc., of the Carolinas
 555 Fayetteville Street, Suite 900
 Raleigh, NC 27601

SUBJECT: BRIDGE ON -L6- (SWEETBIRCH RD. EAST OF US 19W OVER CANE RIVER		WBS Element: 100-01-00205
PREPARED BY:	AKV	YANCEY County
DATE:	12/15/25	100-01-00205
CHECKED BY:	SMV	SHEET:
DATE:	12/19/2025	

INTERIOR BENTS SUMMARY

BENT 1

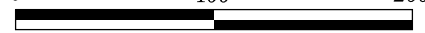
Foundation Type:	36" Drilled Piers	
Bottom of Column/ Top of Drilled Pier Elevation:	2406 +/- ft.	<i>Provided by HDR Structural Engineer</i>
Number of Piers	2	<i>Provided by HDR Structural Engineer</i>
Max Factored Load:	615 kips/pier	<i>Provided by HDR Structural Engineer</i>
Provided Factored Resistance:	622 kipspier	<i>Required factored Resistance including weight of column and pier</i>
Drilled Pier Minimum Tip Elevation:	2389.5 ft.	<i>Determined from NCDOT Drilled Pier Axial Resistance Spreadsheet and LPILE</i>
Drilled Pier Length:	16.5 ft	<i>Top of Pier - Pier Tip Elevation</i>
Point of Fixity EL:	2395.0 ft	<i>From LPILE</i>

Comments:

Tip elevations are based on good quality rock encountered at elevation 2398 ft based on borings performed at Site 0217-A. It is anticipated that revisions to the tip elevations will be made when actual conditions at each drilled pier location are known. Engineer shall be contacted if rock elevations vary from above assumed elevation.

BORING LOCATION PLAN AND BORING LOGS

Note: Borings are not performed at Site 205 location.
Boring performed at nearby structure Site 217 is used for
this design recommendations.

PROJECT REFERENCE NO.	SHEET NO.
100-01-00217A	3
SITE PLAN	
0 100 200	
	
FEET	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 00217A			TIP 100-01-00217a			COUNTY YANCEY			GEOLOGIST WATKINS, A.							
SITE DESCRIPTION Site 100-01-00217A										GROUND WTR (ft)						
BORING NO. B-1			STATION N/A			OFFSET N/A			ALIGNMENT N/A							
COLLAR ELEV. 2,404.2 ft			TOTAL DEPTH 16.1 ft			NORTHING 817,508			EASTING 998,700							
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024						DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic							
DRILLER DAVIS, S.			START DATE 09/02/25			COMP. DATE 09/02/25			SURFACE WATER DEPTH 5.0ft							
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						
2405	2,404.2	0.0												2,404.2	GROUND SURFACE	0.0
2400	2,400.6	3.6	2	7	3						M		2,401.2	ALLUVIAL Brown, loose to medium dense, silty SAND (A-2-4), trace mica, trace gravel	3.0	
	2,398.1	6.1	2	2	12						60/0.0		2,398.1	RESIDUAL Brown, stiff, grey, sandy SILT (A-4), highly micaceous	6.1	
2395															CRYSTALLINE ROCK Light grey, white, black, migmatic biotite-hornblend GNEISS	
2390														2,388.1	Black and brown	16.1
															Boring Terminated at Elevation 2,388.1 ft In Crystalline Rock	

NCDOT BORE SINGLE SITE-0217A.GPJ NC DOT.GDT 9/25/25

GEOTECHNICAL BORING REPORT CORE LOG

WBS 00217A			TIP 100-01-00217a			COUNTY YANCEY			GEOLOGIST WATKINS, A.		
SITE DESCRIPTION Site 100-01-00217A										GROUND WTR (ft)	
BORING NO. B-1			STATION N/A			OFFSET N/A			ALIGNMENT N/A		
COLLAR ELEV. 2,404.2 ft			TOTAL DEPTH 16.1 ft			NORTHING 817,508			EASTING 998,700		
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024						DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic		
DRILLER DAVIS, S.			START DATE 09/02/25			COMP. DATE 09/02/25			SURFACE WATER DEPTH 5.0ft		
CORE SIZE N			TOTAL RUN 10.0 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
2398.1											
	2,398.1	6.1	4.0	3:21/1.0 4:56/1.0 7:22/1.0	(3.9) 98%	(3.9) 98%				2,398.1	6.1
2395	2,394.1	10.1		10:20/1.0							
			5.0	3:10/1.0 3:48/1.0 4:00/1.0	(5.0) 100%	(5.0) 100%					
2390	2,389.1	15.1		4:17/1.0 4:43/1.0							
	2,388.1	16.1	1.0	1:56/1.0	(0.5) 50%	(0.0) 0%				2,388.1	16.1
<p>Begin Coring @ 6.1 ft</p> <p>CRYSTALLINE ROCK</p> <p>Light grey, white, black, slight to fresh weathering, moderately hard to hard, close to wide fracture spacing, migmatic biotite-hornblend GNEISS.</p> <p>GSI=75-85</p> <p>Black and brown, very severe to moderately severe weathering</p> <p>GSI=15-25</p> <p>Boring Terminated at Elevation 2,388.1 ft In Crystalline Rock</p>											

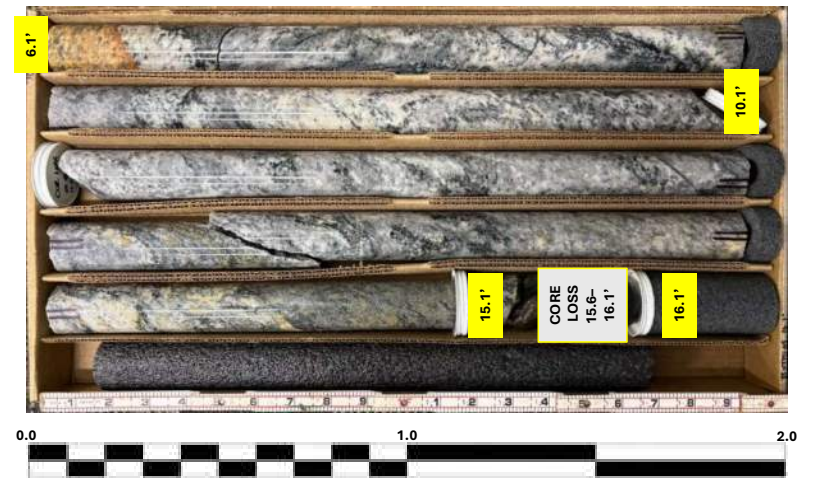
NCDOT CORE SINGLE SITE-0217A.GPJ NC_DOT.GDT 9/25/25

CORE PHOTOGRAPHIC RECORD
Site 100-01-00217A
Grow NC/SCEM-Support for the Private Road and Bridge

B-1 DRY
Box 1 of 2: 6.1 – 16.1 FEET



B-1 DRY
Box 1 of 2: 6.1 – 16.1 FEET



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	100.01.00202	1	

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY YANCEY
PROJECT DESCRIPTION NORTH CAROLINA EMERGENCY
MANAGEMENT-PRIVATE ROADS, BRIDGE REPAIR
AND REPLACEMENT PROGRAM
SITE DESCRIPTION BRIDGE OVER CANE RIVER ON
SOUTH FACE LANE BETWEEN EWART WILSON RD.
(SR 1100) AND NO OUTLET

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-9	BORE LOG(S), CORE REPORT(S) & CORE PHOTOGRAPH(S)
10	SITE PHOTOGRAPH(S)

PERSONNEL

J. BASKIN
C. BRAKE
S. DAVIS
TY. BEARD

INVESTIGATED BY F&R, Inc.
DRAWN BY T.T. WALKER
CHECKED BY P. ALTON, P.E.
SUBMITTED BY C. WANG, P.E.
DATE OCTOBER 2025

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.

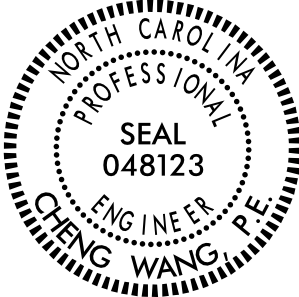
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND 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 GEOTECHNICAL ENGINEER DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE GEOTECHNICAL ENGINEER 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 GEOTECHNICAL ENGINEER 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.

SINCE *Prepared in the Office of:*

FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881
310 Hubert Street
Raleigh, North Carolina 27603-2302
License No. F-0266
Bus: 919.828.3441 Fax: 919.828.5751
1881



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

REFERENCE: N/A

PROJECT: N/A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
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										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.									
GROUP CLASS. A-1 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										MINERALOGICAL COMPOSITION									
SYMBOL										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
% PASSING #10 #40 #200										COMPRESSIBILITY									
MATERIAL PASSING #40 LL PI										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
GROUP INDEX										PERCENTAGE OF MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
GEN. RATING AS SUBGRADE										GROUND WATER									
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30										<input type="checkbox"/> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING <input checked="" type="checkbox"/> STATIC WATER LEVEL AFTER 24 HOURS <input checked="" type="checkbox"/> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA <input checked="" type="checkbox"/> SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
U.S. STD. SIEVE SIZE OPENING (MM)										25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SPT DMT VST PMT AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION									
BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE. SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)										SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE									
GRAIN SIZE MM IN.										RECOMMENDATION SYMBOLS									
SOIL MOISTURE - CORRELATION OF TERMS										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									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										ABBREVIATIONS									
LL LIQUID LIMIT PLASTIC RANGE (PI) PL PLASTIC LIMIT OM OPTIMUM MOISTURE SL SHRINKAGE LIMIT										AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE. - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS HI. - HIGHLY MED. - MEDIUM MICA. - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VEGETY VST - VANE SHEAR TEST WEA. - WEATHERED γ - UNIT WEIGHT γ _d - DRY UNIT WEIGHT									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
NON PLASTIC SLIGHTLY PLASTIC MODERATELY PLASTIC HIGHLY PLASTIC										DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE HOIST CME-750X									
COLOR										ADVANCING TOOLS: CLAY BITS 6' CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG.-CARBIDE INSERTS CASING W/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG.-CARB. CORE BIT									
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.										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: -B -H -N Q3 HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST									





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2A

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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p>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 IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. 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.</p>	
WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.	
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.	
WEATHERING			
FRESH		ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.	
VERY SLIGHT (V SL.)		ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	
SLIGHT (SL.)		ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	
MODERATE (MOD.)		SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.	
MODERATELY SEVERE (MOD. SEV.)		ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <u>IF TESTED, WOULD YIELD SPT REFUSAL.</u>	
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. <u>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</u>	
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. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>	
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		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
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: GPS-2(50002)= N: 769,806J5, E: 1,017,652.26	
		ELEVATION: 2,973.8 FEET	
NOTES:			
FIAD= FILLED IMMEDIATELY AFTER DRILLING			
NM= NOT MEASURED			
DATE: 8-15-14			

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (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.

SURFACE CONDITIONS

VERY GOOD
Very rough, fresh unweathered surfaces

GOOD
Rough, slightly weathered, iron stained surfaces

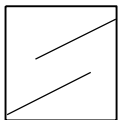
FAIR
Smooth, moderately weathered and altered surfaces

POOR
Slackensided, highly weathered surfaces with compact coatings or fillings or angular fragments

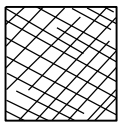
VERY POOR
Slackensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY →

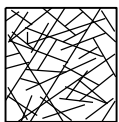
STRUCTURE



INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



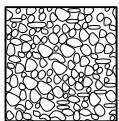
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets



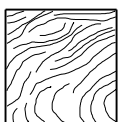
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets



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

DECREASING INTERLOCKING OF ROCK PIECES ↓

	90			N/A	N/A
	80				
		70			
			60		
				50	
					40
					30
					20
					10
	N/A	N/A			

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**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
 FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)**

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

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.

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD - Very Rough, fresh unweathered surfaces

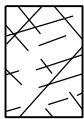
GOOD - Rough, slightly weathered surfaces

FAIR - Smooth, moderately weathered and altered surfaces

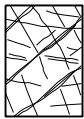
POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments

VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

COMPOSITION AND STRUCTURE



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.



B. Sandstone with thin inter-layers of siltstone



C. Sandstone and siltstone in similar amounts



D. Siltstone or silty shale with sandstone layers



E. Weak siltstone or clayey shale with sandstone layers

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**.



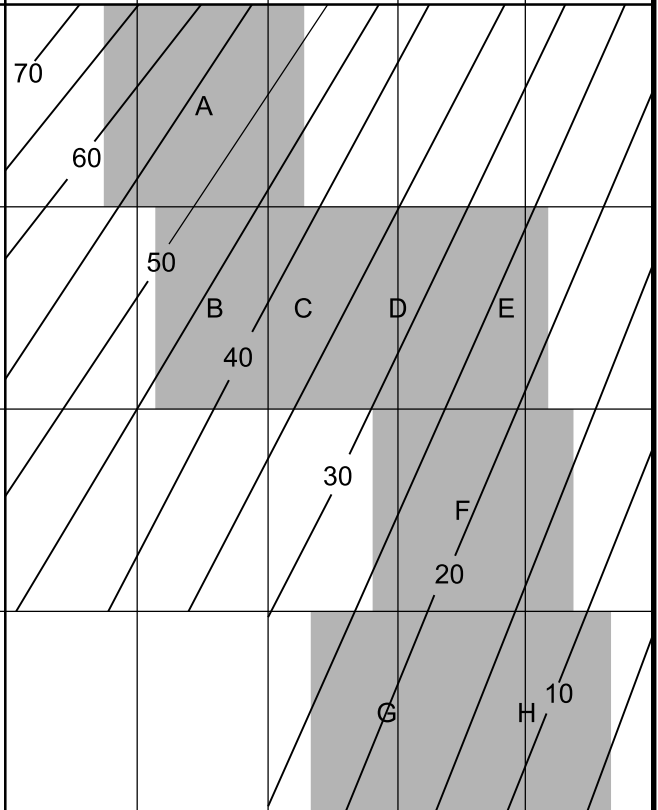
F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure



G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers

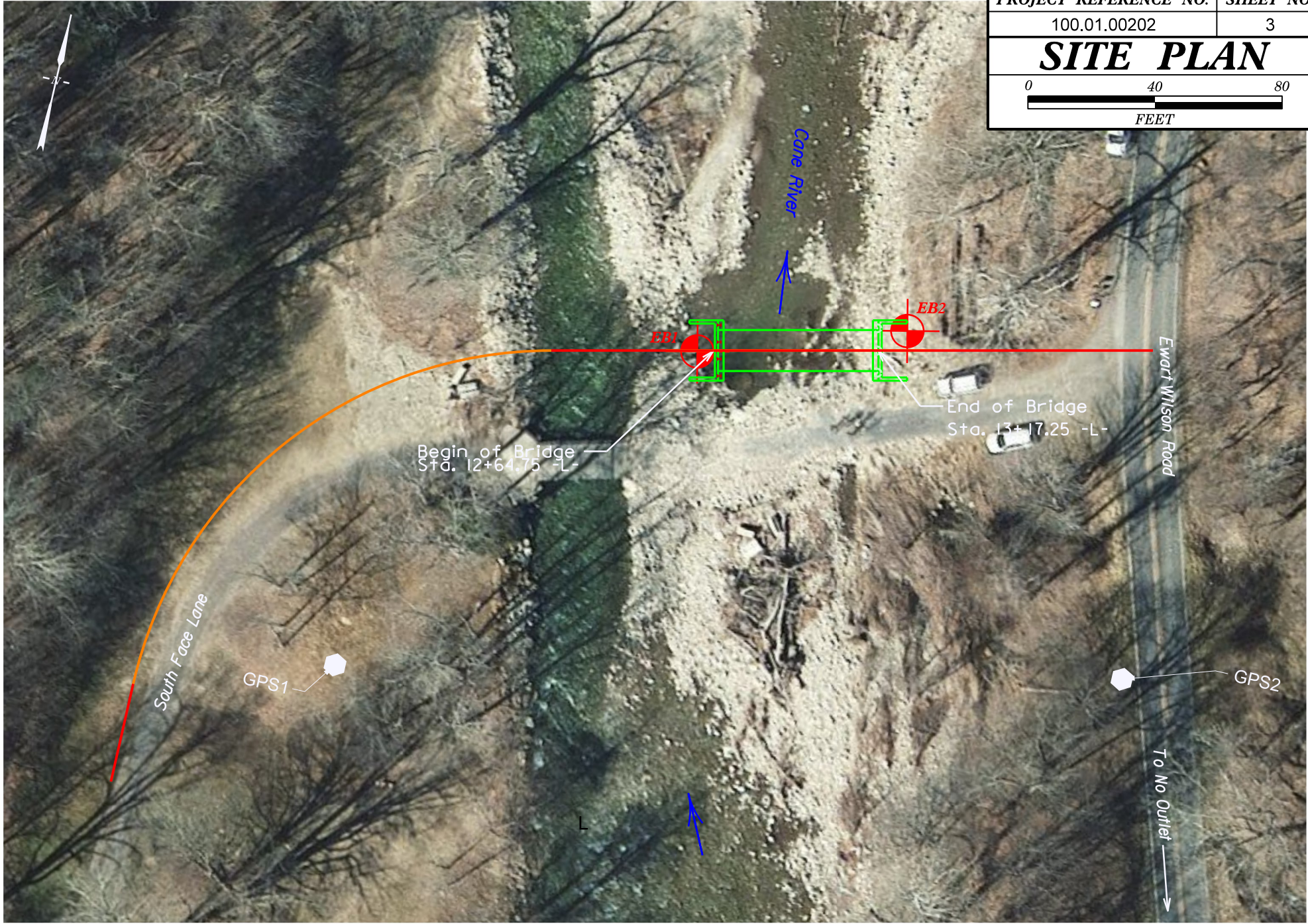


H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.



Means deformation after tectonic disturbance

PROJECT REFERENCE NO.	SHEET NO.
100.01.00202	3
SITE PLAN	
FEET	



GEOTECHNICAL BORING REPORT

CORE LOG

WBS 100.01.00202		TIP N/A		COUNTY YANCEY		GEOLOGIST J. Baskin					
SITE DESCRIPTION Replace Bridge over Cane River on S. Face Lane							GROUND WTR (ft)				
BORING NO. EB1		STATION N/A		OFFSET N/A		ALIGNMENT N/A	0 HR. Dry				
COLLAR ELEV. 2,964.3 ft		TOTAL DEPTH 64.5 ft		NORTHING 769,877		EASTING 1,017,499	24 HR. FIAD				
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024				DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic					
DRILLER S. Davis		START DATE 09/30/25		COMP. DATE 09/30/25		SURFACE WATER DEPTH N/A					
CORE SIZE NQ3		TOTAL RUN 6.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
2962.8										Begin Coring @ 1.5 ft	
2960	2,962.8	1.5	2.5	0:07/0.5	(1.3)	(0.0)	(2.6)	(0.0)	PO	2,962.8	1.5
	2,960.3	4.0		0:53/1.0	52%	0%	43%	0%	PO	ROADWAY EMBANKMENT Tan-Brown, Silty Fine to Coarse Sandy BOULDERS and GRAVEL (A-1-b)	
	2,958.8	5.5		1:08/1.0					PO		
				N=66					PO		
2955	2,955.3	9.0	3.5	1:12/1.0	(1.3)	(0.0)	(0.0)	(0.0)	PO	2,956.8	7.5
				0:56/1.0	37%	0%	0%	0%	PO	2,955.3	9.0
				1:02/1.0					PO	ALLUVIAL	
				0:38/0.5					PO	Brown-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel and Mica	
				N=28					PO		
2950				N=25					PO		
2945				N=15					PO	2,944.8	19.5
2940				N=13					PO	RESIDUAL Orange-Brown, Fine to Coarse Sandy SILT (A-4) with Trace Rock Fragments and Mica	
2935				N=3					PO		
2930				N=14					PO		
2925				N=14					PO	2,926.8	37.5
				N=45					PO	Brown-Black, Silty Fine to Coarse SAND (A-2-4) with Trace Mica	
2920				N=79					PO		
2915				N=100/0.7					PO	2,911.8	52.5
2910				N=69					PO	WEATHERED ROCK Tan MICA GNEISS	
2905				N=45					PO	2,906.8	57.5
				N=69					PO	RESIDUAL Tan-White, Fine to Coarse Sandy SILT (A-4) with Trace Mica	
2900				N=100/0.5					PO	2,900.3	64.0
				N=60/0.0					PO	2,899.8	64.5
									PO	WEATHERED ROCK MICA GNEISS	
									PO	Boring Terminated with Standard Penetration Test Refusal at Elevation 2,899.8 ft on CRYSTALLINE ROCK (MICA GNEISS)	
									PO	Notes: 1. Started Coring at 1.5' and Stopped at 9.0' and Continued with Casing Advancer to Termination 2. Dry, Caved at 6.3'	

NCDOT CORE SINGLE PRB_100.01.00202_GEO_BH.GPJ_NC_DOT.GDT 10/8/25



Project # 100.01.00202
Bridge over Cane River on South Face Lane
CORE PHOTOGRAPHS (EB1)



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 100.01.00202	TIP N/A	COUNTY YANCEY	GEOLOGIST J. Baskin
SITE DESCRIPTION Replace Bridge over Cane River on S. Face Lane			GROUND WTR (ft)
BORING NO. EB2	STATION N/A	OFFSET N/A	0 HR. NM
COLLAR ELEV. 2,963.7 ft	TOTAL DEPTH 54.8 ft	NORTHING 769,898	24 HR. FIAD
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic
DRILLER S. Davis	START DATE 09/24/25	COMP. DATE 09/25/25	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)	
2965	2,963.7	0.0	3	14	22									2,963.7	0.0	GROUND SURFACE
2960	2,960.2	3.5	31	23	37									2,961.7	2.0	ROADWAY EMBANKMENT Tan, Silty Fine to Coarse SAND (A-1-b) with Gravel
2955	2,957.9	5.8	100/0.3	60/0.0												ALLUVIAL Tan-Brown BOULDERS & COBBLES (A-1-b)
2950	2,952.9	10.8	7	5	100/0.4											
2945	2,947.7	16.0	31	18	13									2,949.7	14.0	RESIDUAL Tan-Gray and Orange-Tan, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica
2940	2,944.0	19.7	24	28	49											
2935	2,939.0	24.7	2	4	5											
2930	2,934.0	29.7	1	1	3											
2925	2,929.0	34.7	1	4	6											
2920	2,924.0	39.7	3	6	7											
2915	2,919.0	44.7	3	6	9											
2910	2,914.0	49.7	3	5	9											
2910	2,909.0	54.7	60/0.1											2,909.0	54.7	CRYSTALLINE ROCK Black-Tan SCHIST
														2,908.9	54.8	Boring Terminated with Standard Penetration Test Refusal at Elevation 2,908.9 ft in CRYSTALLINE ROCK (SCHIST)

NCDOT BORE SINGLE PRB_100.01.00202_GEO_BH.GPJ NC_DOT.GDT 10/8/25

Note:
Started Coring at 1.5' and Ended at 3.5'.
Casing Advancer to 5.8' then Cored to 16.0'
and then Casing Advancer to termination

GEOTECHNICAL BORING REPORT CORE LOG

WBS 100.01.00202				TIP N/A		COUNTY YANCEY			GEOLOGIST J. Baskin		
SITE DESCRIPTION Replace Bridge over Cane River on S. Face Lane										GROUND WTR (ft)	
BORING NO. EB2				STATION N/A			OFFSET N/A		ALIGNMENT N/A		
COLLAR ELEV. 2,963.7 ft				TOTAL DEPTH 54.8 ft			NORTHING 769,898		EASTING 1,017,562		
DRILL RIG/HAMMER EFF./DATE F&R7348 CME-750X 87% 12/20/2024						DRILL METHOD NW Casing w/ Advancer			HAMMER TYPE Automatic		
DRILLER S. Davis				START DATE 09/24/25			COMP. DATE 09/25/25		SURFACE WATER DEPTH N/A		
CORE SIZE NQ3				TOTAL RUN 10.8 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
2962.2										Begin Coring @ 1.5 ft	
2960	2,962.2 2,960.2	1.5 3.5	2.0	0:58/1.0 1:19/1.0 N=60	(0.7) 35%	(0.0) 0%	(3.7) 31%	(0.0) 0%	2961.7	ROADWAY EMBANKMENT Tan, Silty Fine to Coarse SAND (A-1-b) with Gravel (continued)	2.0
2955	2,957.9	5.8	5.0	N=100/0.3 N=60/0.0 4:29/1.0 1:29/1.0 0:27/1.0 0:59/1.0 0:35/1.0 N=100/0.4	(1.2) 24%	(0.0) 0%				ALLUVIAL Tan-Brown BOULDERS & COBBLES (A-1-b)	
2950	2,952.9 2,951.5	10.8 12.2	3.8	1:59/0.8 1:14/1.0 1:07/1.0 N=31	(1.8) 47%	(0.0) 0%	(0.0) 0%	(0.0) 0%	2949.7	RESIDUAL Tan-Gray and Orange-Tan, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica	14.0
2945	2,947.7	16.0		N=77							
2940				N=9							
2935				N=4							
2930				N=10							
2925				N=13							
2920				N=15							
2915				N=14							
2910				N=60/0.1							
									2,909.0 2,908.9	CRYSTALLINE ROCK Black-Tan SCHIST Boring Terminated with Standard Penetration Test Refusal at Elevation 2,908.9 ft in CRYSTALLINE ROCK (SCHIST)	54.7 54.8
Note: Started Coring at 1.5' and Ended at 3.5'. Casing Advancer to 5.8' then Cored to 16.0' and then Casing Advancer to Termination											

NCDOT CORE SINGLE PRB_100.01.00202_GEO_BH.GPJ NC_DOT.GDT 10/8/25



Project # 100.01.00202
Bridge over Cane River on South Face Lane
CORE PHOTOGRAPHS (EB2)

End Run 1 @ 3.5 feet
& SPT 3.5-5.0 feet: N=60

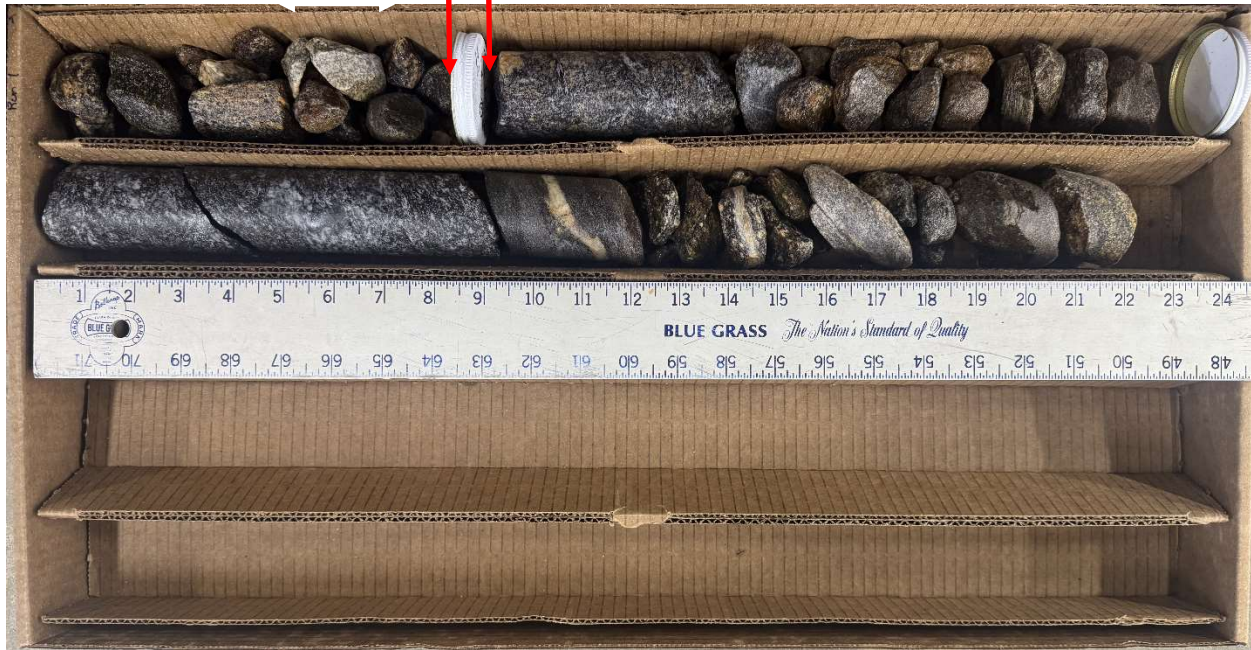
SPT 5.5 to 5.8 feet: N=100/0.3'
Begin Run 2 @ 5.8 feet

End Run 2
@10.8 feet
& SPT 10.8-
12.2':
N=100/0.4'

Begin Run 1
1.5 feet

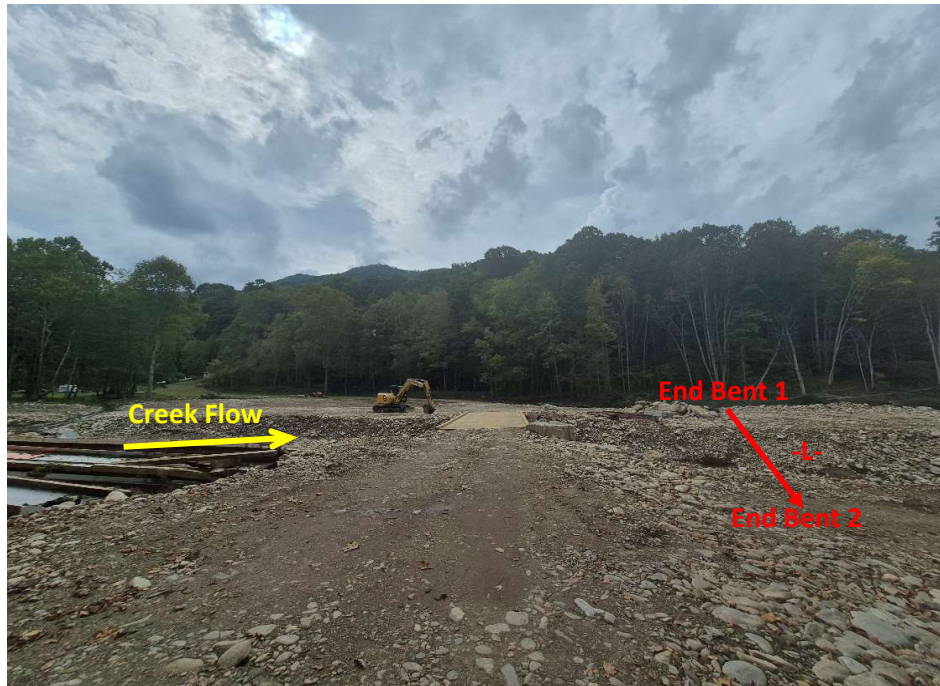
Begin Run 3
12.2 feet

End Run 3
16.0 feet

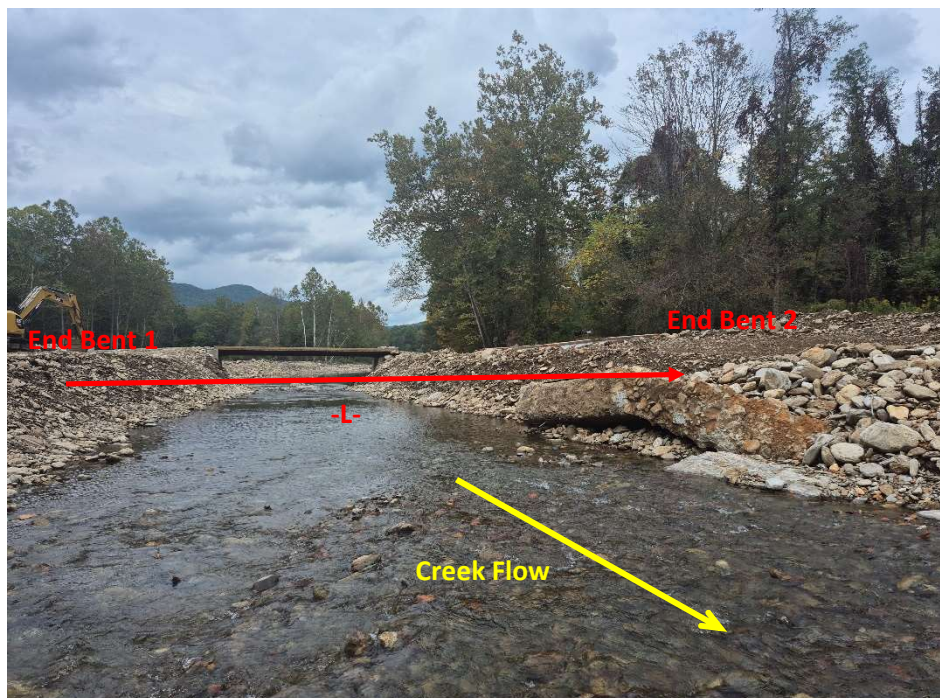




SITE PHOTOGRAPHS: Bridge over Cane River on South Face Lane



Photograph No. 1: Looking west at the existing and proposed bridges



Photograph No. 2: Looking south at the existing and proposed bridges