



**CULVERT FOUNDATION RECOMMENDATIONS REPORT  
REPLACEMENT OF BRIDGE 890356 ON SR 2133  
(SANDY RIDGE ROAD) OVER LITTLE RICHARDSON CREEK**

**WBS No.: 17BP.10.R.17  
Tip No.: NA  
County: UNION**

**Prepared by:**

**AMEC Environment and Infrastructure, Inc.  
4021 Stirrup Creek Drive, Suite 100  
Durham, North Carolina 27703  
(Project No. 6469-12-1040)**

**Prepared for:**

**NCDOT**

**July 23, 2012**



July 23, 2012

Division Bridge Program Manager  
NCDOT Division 10 Office  
716 W. Main Street  
Albemarle, North Carolina 28001

Attention: Mr. James Wally, E.I.:

Subject: **Culvert Foundation Recommendation Report  
Replacement of Bridge No. 890356 on SR 2133 (Sandy Ridge Road) over  
Little Richardson Creek  
WBS No.: 17BP.10.R.17  
TIP No.: NA  
County: Union  
AMEC Project Number: 6469-12-1040**

Dear Mr. Wally:

AMEC Environment and Infrastructure, Inc. (AMEC) is pleased to transmit the Culvert Foundation Recommendations Report in association with the replacement of Bridge No. 356 on SR 2133 (Sandy Ridge Road) over Little Richardson Creek. The recommended structure type is two Reinforced Concrete Box Culverts (2 @ 12' x 5'). The Structure Subsurface Investigation Report provided by NCDOT and the additional Structure Subsurface Report performed by AMEC are provided in the Appendix of this report. The Foundations Recommendations Report has been prepared using boring data obtained by AMEC and others.

INCLUDE AS NOTE ON PLANS

**RECOMMENDATIONS**

- Excavate 1 foot below culvert and footings and replace with foundation conditioning material in accordance with Article 414 of the Standard Specifications.
- Recommend including 25 cubic yards of undercut of soft foundation soils as a contingency item to be used at the discretion of the Engineer.
- Recommend including 25 cubic yards of Select Material Class VI to be used as backfill as a contingency item to be used at the discretion of the Engineer.

Correspondence:  
AMEC E&I, Inc.  
4021 Stirrup Creek Drive, Suite 100  
Durham, North Carolina 27703  
Tel (919) 381-9900  
Fax (919) 381-9901  
Licensure: NC Engineering F-1253 NC Geology C-247

**N.C. DEPT. OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENG. UNIT-WRO**

- ACCEPTED
- ACCEPTED AS NOTED
- RETURNED FOR CORRECTIONS
- SEE LETTER

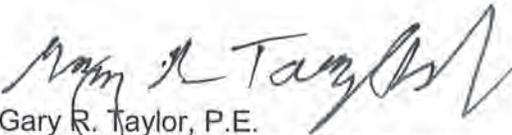
BY: Dean Hardister, PE

DATE: 08/20/2012

If you have any questions regarding recommendations contained in this report, please contact us at 919-381-9900.

Sincerely,  
**AMEC Environment and Infrastructure, INC.**

  
J. Shane Johnson, P.E., P.G.  
Senior Geotechnical Engineer  
Registered, North Carolina 037422

  
Gary R. Taylor, P.E.  
Geotechnical Department Manager  
Registered, North Carolina 18580



**N.C. DEPT. OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENG. UNIT-WRO**

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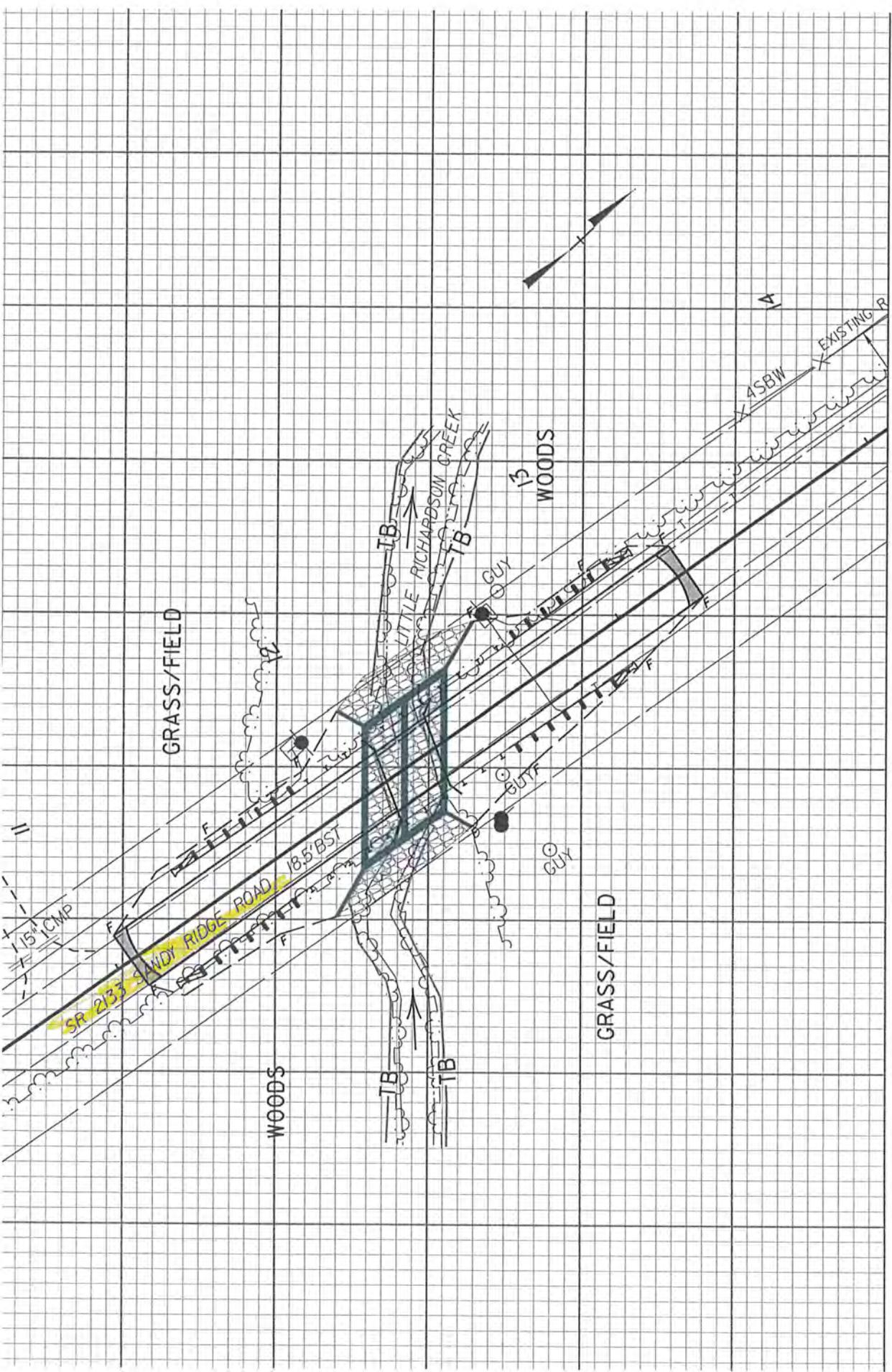
**BY:** Dean Hardister, PE

**DATE:** 08/20/2012

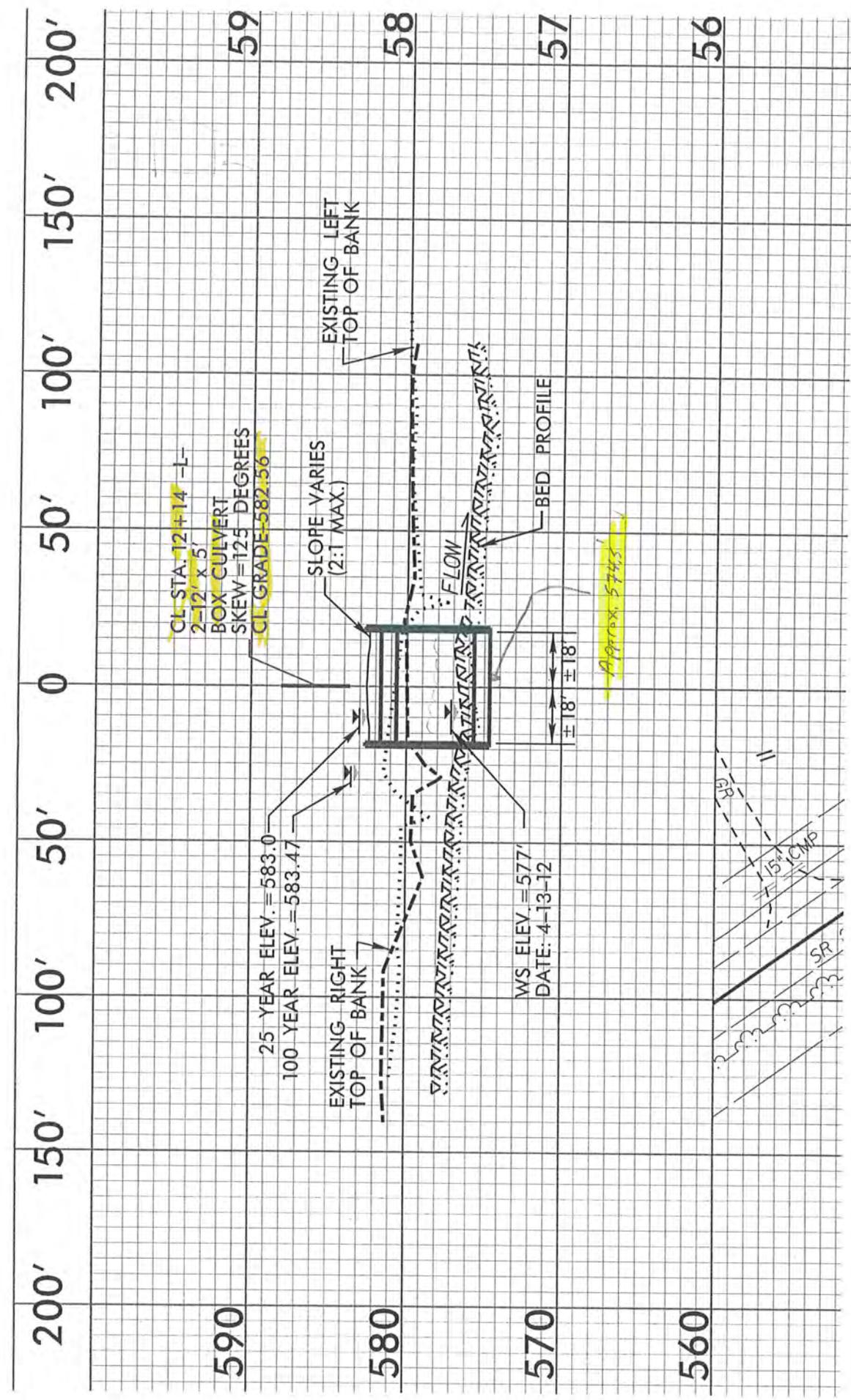
# **APPENDIX**

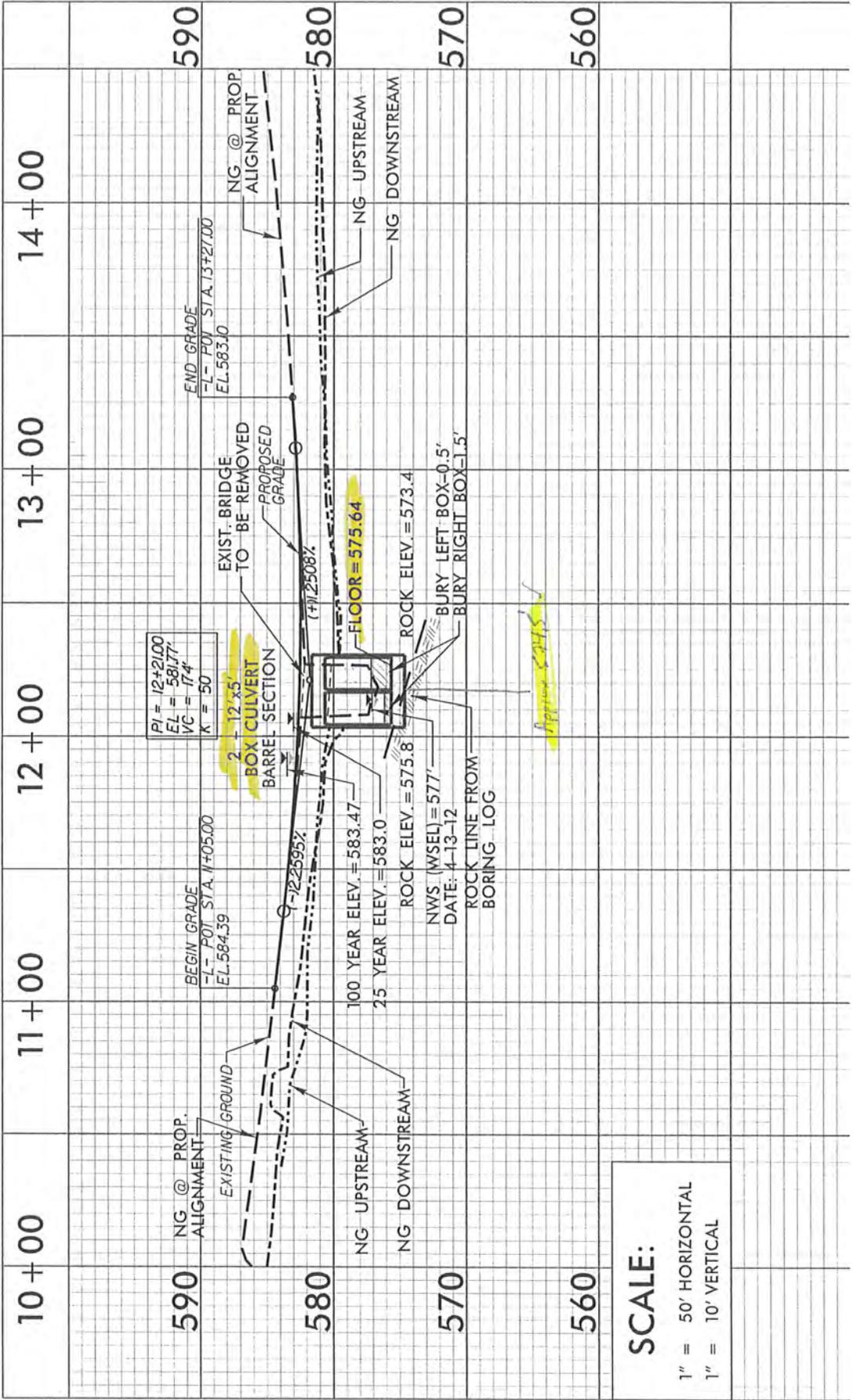
# **PROVIDED INFORMATION**



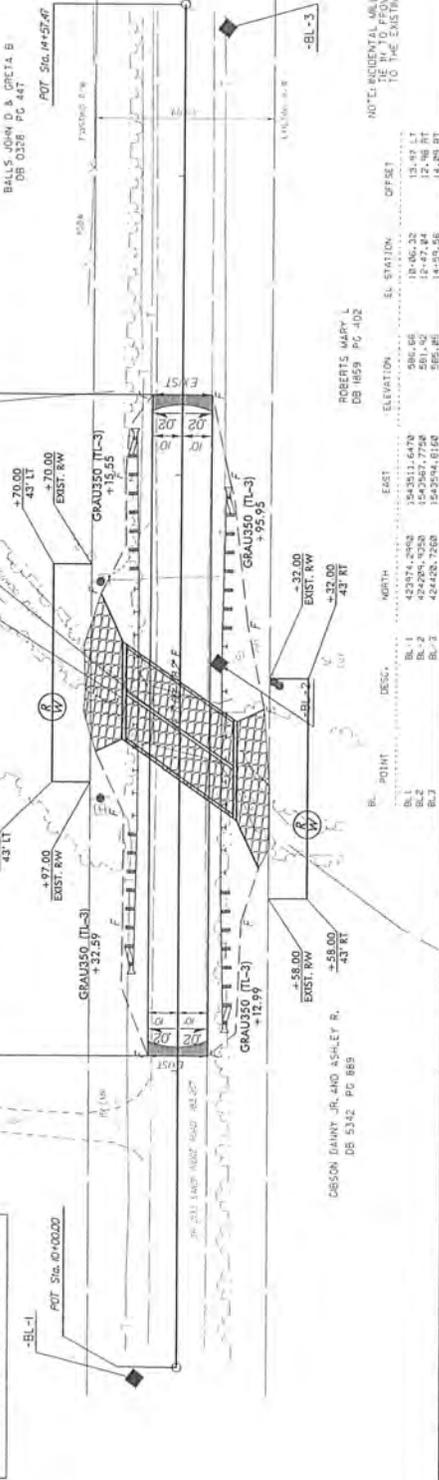


SITE DATA





**DATUM DESCRIPTION**  
 THE LOCALIZED COORDINATE SYSTEM ESTABLISHED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY THE MISSOURI DEPARTMENT OF TRANSPORTATION. THE STATE PLANE COORDINATES OF THE POINTS ARE: 474492.7511 (EASTING), 147874.4811 (NORTHING). THE AVERAGE CORNER GRID FACTOR USED IN THIS PROJECT IS 0.999994. LOCALIZED HORIZONTAL GRID DISTANCE FROM POINT TO POINT IS: 516.1744554. ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES. VERTICAL DATUM USED IS MVD 88.



NOTE: SUFFICIENT MBL BEFORE 26.15' ELEV. BEGUN TO PROVIDE A SMOOTH TRANSITION TO THE EXISTING ASPHALT PAVEMENT.

BL. POINT	DESC.	NORTH	EAST	ELEVATION	ST. STATION	OFFSET
BL. 1	423474.2492	1543811.6478	986.66	18+06.32		13.47 LT
BL. 2	424281.0288	1543877.7758	961.40	18+47.84		12.46 RT
BL. 3	424483.7488	1543944.8168	936.46	18+50.56		14.28 RT

STATION	ELEVATION	DESCRIPTION
592		
588		BEGIN GRADE -L- POT STA. 11+05.00 FL 584.30
584		
580		
576		
572		
568		
564		
560		
592		END GRADE -L- POT STA. 13+27.00 FL 583.10
588		
584		
580		
576		
572		
568		
564		
560		

10 11 12 13 14





# **FOUNDATION CALCULATIONS**



AMEC E&I, Inc.

4021 Stirrup Creek Drive, Suite 100  
Durham, NC 27703

JOB NO. 6468-12-1103 SHEET 1 OF      X  
PHASE Group N Bridges TASK      X  
JOB NAME Union Co. Br. 356 X  
BY JSJ DATE 7/19/12 X  
CHECKED BY SA DATE 7/23/12 X

BR. 356 Union Co.

- Recommended structure = 2 @ 12' x 5' RCBC ✓
- Culvert Invert Elev. = (Floor = 575.64') } Estimated from preliminary CSR
- Btm. of structure =  $\approx$  574.5' ✓
- Existing Btm of creek =  $\approx$  577' ✓ (CSR)
- Proposed Grade @  $\phi$  = 582.56' ✓
- Amount of fill on top of culvert =  $\approx$  2' ✓
- Preliminary Roadway drawings and the preliminary CSR show minimal GRADE change.  $\approx$   $<$  2'
- NCDOT provided 2 Barring to Refusal on each side of the creek (4 total). See Inventory Report for locations. AMEC provided 1-Barring (w/Roots Carrying) on each side of the creek. See AMEC, Inventory Report for locations and logs.
- Collar Elevations for AMEC's Barring were referenced to NCDOT Benchmarks. Collar Elevations are relative to an assumed elevation (1.00') located on existing Bridge. AMEC Assigned collar elevations to NCDOT's Barring by using the provided (-L-) profile.



AMEC E&I, Inc.  
4021 Stirrup Creek Drive, Suite 100  
Durham, NC 27703

JOB NO. 6468-12-1103 SHEET 2 OF        X  
PHASE Group N Bridges TASK        X  
JOB NAME Unston Co. Br. 356 X  
BY JSJ DATE 7/20/12 X  
CHECKED BY SA DATE 7/23/12 X

END BENT 1 SIDE OF CULVERT (Down station of Creek)

<u>BORING</u>	<u>Collar Elev.</u>	<u>WR Elev.</u>	<u>HR Elev.</u>	<u>Btm. of Culvert Elev.</u>	<u>Depth to WR/HR</u>
B-1	≈ 582.5'	-	576.2' ✓	≈ 574.5'	-1.7' ✓
B-2	≈ 582.5'	577.5' ✓	576.2' ✓	≈ 574.5'	-3' ✓
B-5	≈ 582.3'	575.8' ✓	574' ✓	≈ 574.5'	-1.3' ✓

END BENT 2 Side of CULVERT (UP station of creek)

B-3	582'	-	573.4' ✓	≈ 574.5'	1.1'
B-4	582'	-	573.8' ✓	≈ 574.5'	0.7'
B-6	581.9' ✓	575.9' ✓	574.2' ✓	≈ 574.5'	-1.4' ✓

Summary

- The Btm of culvert on the E&I side is Approx. 1'-3" into WR/HR
- The Btm of culvert on the E&2 side is Approx. 1.5' Above WR to Approx 1.5' into WR/HR
- \* BASED ON THE BORINGS, The proposed Btm. of culvert is BEARING NEAR OR ON WR/HR.



AMEC E&I, Inc.  
4021 Stirrup Creek Drive, Suite 100  
Durham, NC 27703

JOB NO. 6468-12-1103 SHEET 3 OF        X  
PHASE Group N Bridges TASK        X  
JOB NAME UNION Co. Bridge 356 X  
BY JSJ DATE 7/20/12 X  
CHECKED BY SG DATE 7/28/12 X

## RECOMMENDATIONS

- Excavate 1-ft Below culvert and footings and replace with foundation conditioning material in accordance with Article 414 of the standard specifications.

\* Foundation conditioning material = CLASS VI (No. 57).

\* Culvert should not bear on W/HR (per 414 of standard specification).

- Due to Culvert Bearing on or near W/HR, we do not anticipate significant immediate or long term settlement of the culvert.

- Due to minimal fill required to reach proposed grade, we do not anticipate significant long term settlements.

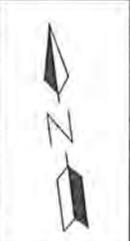
- If soft foundation soils are encountered, they should be undercut and replaced w/ CLASS VI select material. Quantity of undercut/backfill estimate is  $(0.5' \times 45' \times 30') = 675 \text{ ft}^3 \rightarrow 25 \text{ yd}^3$

\* USE this quantity as a contingency.

SHEET NO. 3  
 W.B.S. NO.: 17BP, 10.R, 17  
 T.I.P. NO.: N/A  
 COUNTY: UNION

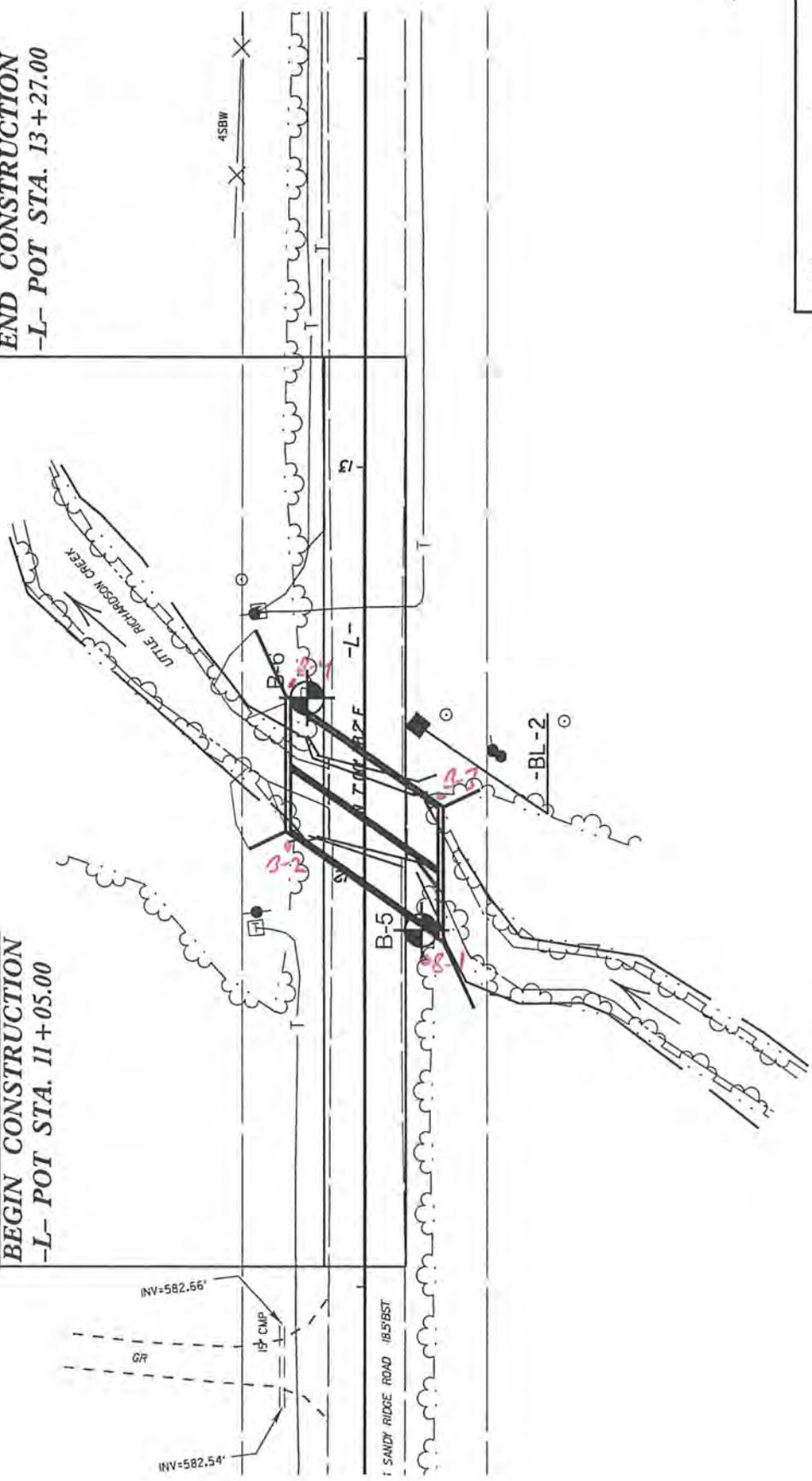


DESCRIPTION:  
 REPLACE BRIDGE 890356 ON SR 2133  
 (SANDY RIDGE ROAD) OVER LITTLE  
 RICHARDSON CREEK

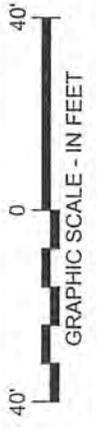


**BEGIN GRADE**  
**BEGIN CONSTRUCTION**  
**-L- POT STA. 11 + 05.00**

**END GRADE**  
**END CONSTRUCTION**  
**-L- POT STA. 13 + 27.00**

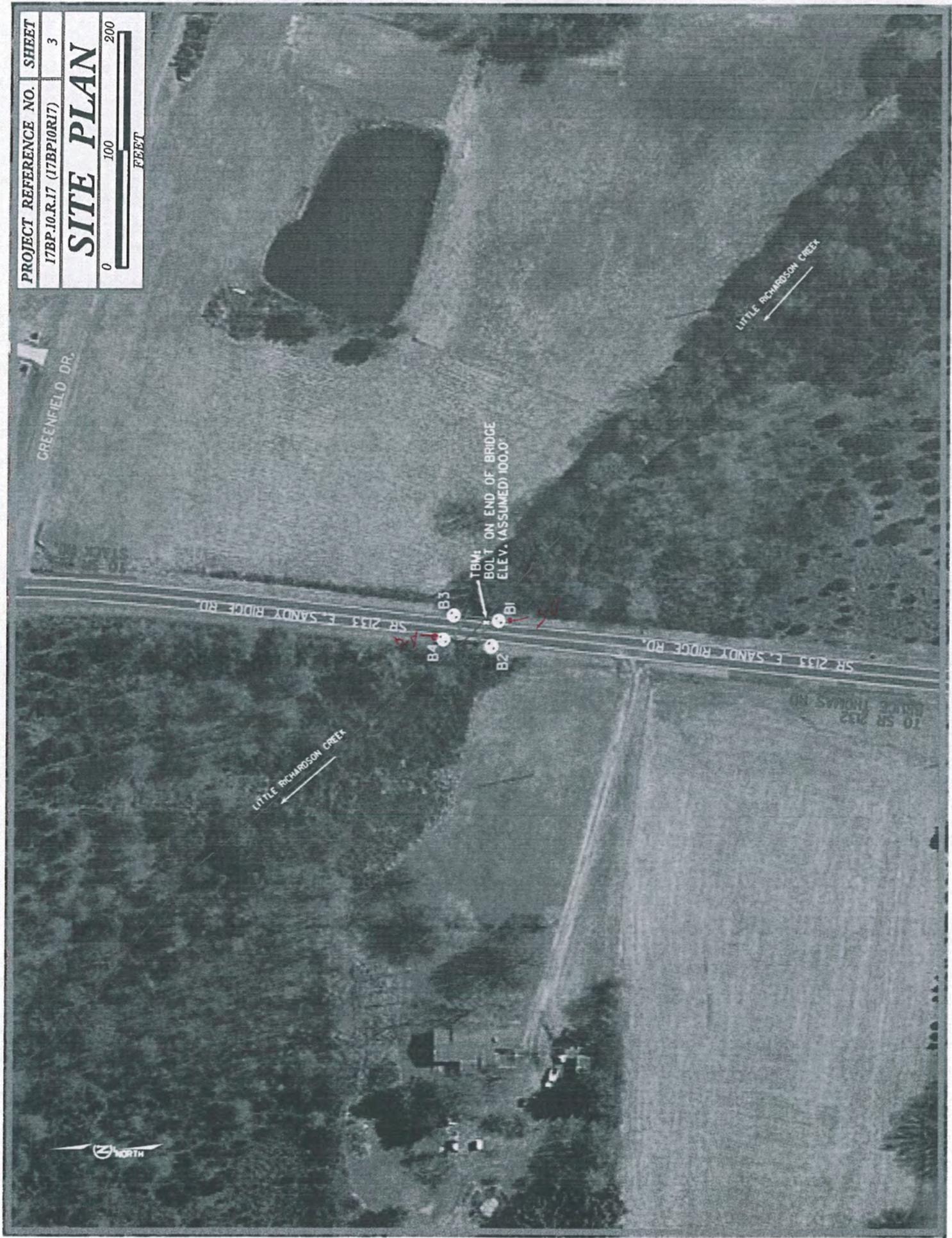


41



PROJECT REFERENCE NO. SHEET  
17BP-10.R.17 (17BP10R17) 3

# SITE PLAN







# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

71

WBS 17BP.10.R.17      TIP 17BP10R17      COUNTY UNION      GEOLOGIST Stickney, J. K.

SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK      GROUND WTR (ft)

BORING NO. B2      STATION N/A      OFFSET N/A      ALIGNMENT N/A      0 HR. Dry

COLLAR ELEV. 99.2 ft      TOTAL DEPTH 6.3 ft      NORTHING N/A      EASTING N/A      24 HR. NM

DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009      DRILL METHOD H.S. Augers      HAMMER TYPE Automatic

DRILLER Smith, C. L.      START DATE 10/20/11      COMP. DATE 10/20/11      SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
100															99.2	GROUND SURFACE	0.0
															97.2	ROADWAY EMBANKMENT RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)	2.0
95	95.4	3.8	3	6	5									94.7	ALLUVIAL	4.5	
														94.2	TAN-GRAY SOFT TO MED. STIFF MOIST SANDY CLAYEY SILT (A-4)	5.0	
														92.9	RESIDUAL BRN-GRAY MED. DENSE MOIST CLAYEY SILTY SAND (A-2-6) W/ SEV. WEATH. CRYSTALLINE ROCK FRAGS. WEATHERED ROCK SEV. WEATH. CRYSTALLINE ROCK	6.3	
																Boring Terminated BY AUGER REFUSAL at Elevation 92.9 ft ON CRYSTALLINE ROCK	

*Btm of Culvert ≈ 574.5'*

*wR = 577.5'*

*CR = 576.2'*



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

8/

WBS 17BP.10.R.17      TIP 17BP10R17      COUNTY UNION      GEOLOGIST Stickney, J. K.

SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK      GROUND WTR (ft)

BORING NO. B1      STATION N/A      OFFSET N/A      ALIGNMENT N/A      0 HR. Dry

COLLAR ELEV. 99.2 ft      TOTAL DEPTH 6.3 ft      NORTHING N/A      EASTING N/A      24 HR. NM

DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009      DRILL METHOD H.S. Augers      HAMMER TYPE Automatic

DRILLER Smith, C. L.      START DATE 10/20/11      COMP. DATE 10/20/11      SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
100															99.2	0.0
95	95.7	3.5	0	1	3										96.2	3.0
															93.7	5.5
															92.9	6.3

*Btm of culvert =  
≈ 574.5'*

*WR/HR = 576.2'*

NCDOT BORE SINGLE 090&000\_GEO\_BH\_BRDGG356\_UNION.GPJ NC\_DOT.GDT 11/30/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

91

WBS 17BP.10.R.17	TIP 17BP.10.R.17	COUNTY UNION	GEOLOGIST R. Clark
SITE DESCRIPTION Replace Bridge 890356 on SR 2133 (Sandy Ridge Rd.) over Little Richardson Creek			GROUND WTR (ft)
BORING NO. B-6	STATION 12+44	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 581.9 ft	TOTAL DEPTH 17.7 ft	NORTHING 424,220	EASTING 1,543,542
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER F. Cox	START DATE 05/24/12	COMP. DATE 05/24/12	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)	
585																
	581.9	0.0													581.9	0.0
580			1	2	3										579.4	2.5
	578.4	3.5	1	2	3										575.9	6.0
575															574.2	7.7
	574.2	7.7				60/0.0										
570																
565																
															564.2	17.7

*Stop of culvert @ 574.5'*

M  
W



Boring Terminated at Elevation 564.2 ft in Non-Crystalline Rock: METAVOLCANIC ROCK  
Driller indicates harder drilling at 6.0 feet. Auger refusal at 7.7 feet.



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

101

WBS 17BP.10.R.17	TIP 17BP10R17	COUNTY UNION	GEOLOGIST Stickney, J. K.
SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK			GROUND WTR (ft)
BORING NO. B4	STATION N/A	OFFSET N/A	ALIGNMENT N/A
COLLAR ELEV. 99.1 ft	TOTAL DEPTH 8.2 ft	NORTHING N/A	EASTING N/A
DRILL RIG/HAMMER EFF./DATE HFC0072 CME-550 89% 09/02/2009		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Smith, C. L.	START DATE 10/20/11	COMP. DATE 10/20/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
100														99.1	0.0	
														582'		
														98.1	3.0	
95	95.2	3.9	1	2	2								M	96.1		
														92.3	6.8	
														90.9	8.2	

Bits of Calvert = 574.5'

WR/HR = 573.8'

NCDOT BORE SINGLE 0908000\_GEO\_BH\_BRDG0356 UNION.GPJ NC\_DOT.GDT 11/30/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

11/

WBS 17BP.10.R.17      TIP 17BP10R17      COUNTY UNION      GEOLOGIST Stickney, J. K.

SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK      GROUND WTR (ft)

BORING NO. B3      STATION N/A      OFFSET N/A      ALIGNMENT N/A      0 HR. Dry

COLLAR ELEV. 99.1 ft      TOTAL DEPTH 8.6 ft      NORTHING N/A      EASTING N/A      24 HR. NM

DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009      DRILL METHOD H.S. Augers      HAMMER TYPE Automatic

DRILLER Smith, C. L.      START DATE 10/20/11      COMP. DATE 10/20/11      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)	
100															99.1	0.0
															96.1	3.0
95	95.3	3.8	2	4	4										92.5	6.6
															90.5	8.6

582'

GROUND SURFACE

ROADWAY EMBANKMENT

RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)

ALLUVIAL TAN-GRAY MED. STIFF MOIST SANDY CLAYEY SILT (A-4)

RESIDUAL BRN-GRAY MED. DENSE MOIST CLAYEY SILTY SAND (A-2-6)

Boring Terminated BY AUGER REFUSAL at Elevation 90.5 ft ON CRYSTALLINE ROCK

WR/HR = 573.4'

Btm of Culvert = 574.5'

NCDOT BORE SINGLE 09080000 GEO BH BRDG0356 UNION.GPJ NC.DOT.GDT 11/30/11

**STRUCTURE SUBSURFACE  
INVESTIGATION PROVIDED BY  
NCDOT**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.10.R.17	1	8

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.10.R.17 (17BP10R17) F.A. PROJ. \_\_\_\_\_

COUNTY UNION

PROJECT DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133  
(SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK

SITE DESCRIPTION \_\_\_\_\_

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-7	BORE LOGS
8	SOIL TEST RESULTS

PERSONNEL

J.K. STICKNEY

C.J. SMITH

INVESTIGATED BY J.E. BEVERLY

CHECKED BY C.B. LITTLE

SUBMITTED BY C.B. LITTLE

DATE NOVEMBER 2011

**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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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-PLACED) TEST DATA CAN BE RELED 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 MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: J.K. McClure



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

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGLARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, DRY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, MEDIUM PLASTIC, A-7-6</i>										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. ALSO POORLY GRADED GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.									
										ANGULARITY OF GRAINS									
										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS <u>ANGULAR</u> , <u>SUBANGULAR</u> , <u>SUBROUNDED</u> , OR <u>ROUNDED</u> .									
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1, A-2, A-3, A-4, A-5, A-6, A-7										COMPRESSIBILITY									
SYMBOL										SLIGHTLY COMPRESSIBLE MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE									
% PASSING #10 #40 #200										LIQUID LIMIT LESS THAN 31 LIQUID LIMIT EQUAL TO 31-50 LIQUID LIMIT GREATER THAN 50									
LIQUID LIMIT PLASTIC INDEX										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										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									
GEN. RATING AS A SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD										WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING									
FAIR TO POOR										STATIC WATER LEVEL AFTER 24 HOURS									
FAIR TO POOR										PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA									
POOR										SPRING OR SEEP									
UNSATURABLE																			
PI OF A-7-5 SUBGROUP IS <= LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30																			
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 <sup>2</sup> )										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION TEST BORING SOIL SYMBOL ALGER BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT CORE BORING INFERRED SOIL BOUNDARY MONITORING WELL INFERRED ROCK LINE PIEZOMETER INSTALLATION ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR INSTALLATION DIP & DIP DIRECTION OF ROCK STRUCTURES CONE PENETROMETER TEST SOUNDING ROD									
GENERALLY GRANULAR MATERIAL (NON-COHESIVE) VERY LOOSE 4 TO 10 MEDIUM DENSE 10 TO 30 DENSE 30 TO 50 VERY DENSE >50										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION TEST BORING SOIL SYMBOL ALGER BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT CORE BORING INFERRED SOIL BOUNDARY MONITORING WELL INFERRED ROCK LINE PIEZOMETER INSTALLATION ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR INSTALLATION DIP & DIP DIRECTION OF ROCK STRUCTURES CONE PENETROMETER TEST SOUNDING ROD									
GENERALLY SILT-CLAY MATERIAL (COHESIVE) VERY SOFT 2 TO 4 SOFT 4 TO 8 MEDIUM STIFF 8 TO 15 STIFF 15 TO 30 VERY STIFF >30										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION TEST BORING SOIL SYMBOL ALGER BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT CORE BORING INFERRED SOIL BOUNDARY MONITORING WELL INFERRED ROCK LINE PIEZOMETER INSTALLATION ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR INSTALLATION DIP & DIP DIRECTION OF ROCK STRUCTURES CONE PENETROMETER TEST SOUNDING ROD									
TEXTURE OR GRAIN SIZE										ABBREVIATIONS									
U.S. STD. SIEVE SIZE OPENING (#4) 4 10 40 60 200 270 4.75 2.00 0.42 0.25 0.075 0.053										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY 7 - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7g - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PNT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SO. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL FRAC. - FRACTURED, FRACTURES SLI. - SLIGHTLY FRAGS. - FRAGMENTS # - MOISTURE CONTENT HL. - HIGHLY V - VERY									
BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CSE, SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY 7 - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7g - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PNT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SO. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL FRAC. - FRACTURED, FRACTURES SLI. - SLIGHTLY FRAGS. - FRAGMENTS # - MOISTURE CONTENT HL. - HIGHLY V - VERY									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY 7 - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7g - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PNT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SO. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL FRAC. - FRACTURED, FRACTURES SLI. - SLIGHTLY FRAGS. - FRAGMENTS # - MOISTURE CONTENT HL. - HIGHLY V - VERY									
SOIL MOISTURE - CORRELATION OF TERMS										EQUIPMENT USED ON SUBJECT PROJECT									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
LL - LIQUID LIMIT - SATURATED - (SAT) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE										MOBILE B- BK-51 CME-45C CME-550 PORTABLE MOIST									
PL - PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE										CLAY BITS 6" CONTINUOUS FLIGHT AUGER 6" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING W/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG-CARB. CORE BIT									
OM - OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE										X CME-550 PORTABLE MOIST									
SL - SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										X CME-550 PORTABLE MOIST									
PLASTICITY										HAND TOOLS:									
NONPLASTIC LOW PLASTICITY MED. PLASTICITY HIGH PLASTICITY										POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST									
PLASTICITY INDEX (PI) DRY STRENGTH																			
0-5 VERY LOW 6-15 SLIGHT 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.																			

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

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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 60 BLOWS PER FOOT 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><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.  <b>ARTESIAN</b> - 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.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FALLT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.  <b>SAPROLITE (SAP)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - 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 INTRODUCED ROCKS.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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 60 BLOWS PER FOOT.  <b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - 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.  <b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p><b>WEATHERED ROCK (WR)</b>  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>			
<p><b>CRYSTALLINE ROCK (CR)</b>  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>			
<p><b>NON-CRYSTALLINE ROCK (NCR)</b>  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.</p>			
<p><b>COASTAL PLAIN SEDIMENTARY ROCK (CPS)</b>  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>			
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. <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, YIELDS SPT N VALUES &gt; 100 BPF.</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS 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 STRANGERS. 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 0.25 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 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 FEET	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 THE 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: TBM; BOLT ON END OF ORGANIC (S.E. CORNER)		(ASSUMED) ELEVATION: 100.00 FT.	
NOTES:			

NORTH

LITTLE RICHARDSON CREEK

TO SR 2132  
BRUCE THOMAS RD

SR 2133 E SANDY RIDGE RD.

SR 2133 E SANDY RIDGE RD.

B1  
B2  
B3  
B4

TBM  
BOLT ON END OF BRIDGE  
ELEV. (ASSUMED) 100.0'

GREENFIELD DR.

LITTLE RICHARDSON CREEK

PROJECT REFERENCE NO.	SHEET
17BP10.R17 (17BP10R17)	3
<b>SITE PLAN</b>	
0 100 200 FEET	



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.10.R.17		TIP 17BP10R17		COUNTY UNION		GEOLOGIST Stickney, J. K.											
SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK							GROUND WTR (ft)										
BORING NO. B1		STATION N/A		OFFSET N/A		ALIGNMENT N/A											
COLLAR ELEV. 99.2 ft		TOTAL DEPTH 6.3 ft		NORTHING N/A		EASTING N/A											
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Smith, C. L.		START DATE 10/20/11		COMP. DATE 10/20/11		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)		
100															99.2	GROUND SURFACE	0.0
															96.2	ROADWAY EMBANKMENT RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)	3.0
95	95.7	3.5	0	1	3										93.7	ALLUVIAL TAN-GRAY SOFT TO MED. STIFF MOIST SANDY CLAYEY SILT (A-4)	5.5
															92.9	RESIDUAL BRN-GRAY LOOSE MOIST CLAYEY SILTY SAND (A-2-6)	6.3
																Boring Terminated BY AUGER REFUSAL at Elevation 92.9 ft ON CRYSTALLINE ROCK	

NCDOT BORE SINGLE 090&000 GEO\_BH\_BRDGO356\_UNION.GPJ NC\_DOT.GDT 11/20/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.10.R.17	TIP 17BP10R17	COUNTY UNION	GEOLOGIST Stickney, J. K.
SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK			GROUND WTR (ft)
BORING NO. B2	STATION N/A	OFFSET N/A	ALIGNMENT N/A
COLLAR ELEV. 99.2 ft	TOTAL DEPTH 6.3 ft	NORTHING N/A	EASTING N/A
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Smith, C. L.	START DATE 10/20/11	COMP. DATE 10/20/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					ELEV. (ft)	DEPTH (ft)
100														99.2	0.0	GROUND SURFACE
														97.2	2.0	ROADWAY EMBANKMENT RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)
95	95.4	3.8	3	6	5									94.7	4.5	ALLUVIAL
														94.2	5.0	TAN-GRAY SOFT TO MED. STIFF MOIST SANDY CLAYEY SILT (A-4)
														92.9	6.3	RESIDUAL BRN-GRAY MED. DENSE MOIST CLAYEY SILTY SAND (A-2-6) W/ SEV. WEATH. CRYSTALLINE ROCK FRAGS. WEATHERED ROCK SEV. WEATH. CRYSTALLINE ROCK
																Boring Terminated BY AUGER REFUSAL at Elevation 92.9 ft ON CRYSTALLINE ROCK

NCDOT BORE SINGLE 0908000\_GEO\_BH\_BRDGC356\_UNION.GPJ NC\_DOT\_GDT 11/30/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.10.R.17	TIP 17BP10R17	COUNTY UNION	GEOLOGIST Stickney, J. K.
SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK			GROUND WTR (ft)
BORING NO. B3	STATION N/A	OFFSET N/A	ALIGNMENT N/A
COLLAR ELEV. 99.1 ft	TOTAL DEPTH 8.6 ft	NORTHING N/A	EASTING N/A
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Smith, C. L.	START DATE 10/20/11	COMP. DATE 10/20/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
100															99.1	GROUND SURFACE	0.0
																ROADWAY EMBANKMENT	
															96.1	RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)	3.0
95	95.3	3.8	2	4	4											ALLUVIAL TAN-GRAY MED. STIFF MOIST SANDY CLAYEY SILT (A-4)	
															92.5		6.6
															90.5	RESIDUAL BRN-GRAY MED. DENSE MOIST CLAYEY SILTY SAND (A-2-6)	8.6
Boring Terminated BY AUGER REFUSAL at Elevation 90.5 ft ON CRYSTALLINE ROCK																	



# NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.10.R.17		TIP 17BP10R17		COUNTY UNION		GEOLOGIST Stickney, J. K.											
SITE DESCRIPTION REPLACE BRIDGE NO. 356 ON SR 2133 (SANDY RIDGE RD.) OVER LITTLE RICHARDSON CREEK							GROUND WTR (ft)										
BORING NO. B4		STATION N/A		OFFSET N/A		ALIGNMENT N/A											
COLLAR ELEV. 99.1 ft		TOTAL DEPTH 8.2 ft		NORTHING N/A		EASTING N/A											
DRILL RIG/HAMMER EFF./DATE HFC0072 CME-550 89% 09/02/2009				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Smith, C. L.		START DATE 10/20/11		COMP. DATE 10/20/11		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MO	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)	
100															99.1	GROUND SURFACE	0.0
															96.1	ROADWAY EMBANKMENT RED-BRN MED. STIFF MOIST SILTY CLAY (A-6)	3.0
95	95.2	3.9	1	2	2								M		92.3	ALLUVIAL TAN-GRAY SOFT TO MED. STIFF MOIST SANDY CLAYEY SILT (A-4)	6.8
															90.9	RESIDUAL BRN-GRAY MED. DENSE MOIST CLAYEY SILTY SAND (A-2-6)	8.2
																Boring Terminated BY AUGER REFUSAL at Elevation 90.9 ft ON CRYSTALLINE ROCK	

NCDOT BORE SINGLE 0908000\_GEO\_BH\_BRDG0356 UNION.GPJ NC\_DOT.GDT 11/30/11

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAY  
MATERIALS & TESTS UNIT  
SOILS LABORATORY**

T. I. P. No. 17BP10R17**REPORT ON SAMPLES OF SOILS FOR QUALITY**

Project 17BP.10.R.17 County UNION Owner \_\_\_\_\_  
 Date: Sampled 10/20/11 Received 10/25/11 Reported 10/27/11  
 Sampled from BRIDGE By J E BEVERLY  
 Submitted by N WAINAINA 1995 Standard Specifications

775130 TO 775132  
11/30/11

**TEST RESULTS**

Proj. Sample No.		SS-1	SS-2	SS-3			
Lab. Sample No.		775130	775131	775132			
Retained #4 Sieve	%	-	46	-			
Passing #10 Sieve	%	96	45	97			
Passing #40 Sieve	%	93	38	91			
Passing #200 Sieve	%	86	32	77			

**MINUS NO. 10 FRACTION**

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	5.1	20.4	11.0			
Fine Sand Ret - #270	%	8.4	10.4	11.8			
Silt 0.05 - 0.005 mm	%	43.7	36.5	32.2			
Clay < 0.005 mm	%	42.9	32.7	44.9			
Passing #40 Sieve	%	-	-	-			
Passing #200 Sieve	%	-	-	-			

L. L.		30	36	32			
P. I.		10	14	9			
AASHTO Classification		A-4(8)	A-2-6(1)	A-4(6)			
Station							
Offset							
Alignment							
Location		B1	B2	B3			
Depth (Ft)		4.00	4.30	4.30			
	to	5.00	5.30	5.30			

cc: J E BEVERLY

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 Soils Engineer

**SUPPLEMENTAL STRUCTURE  
SUBSURFACE INVESTIGATION  
PROVIDED BY AMEC**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.10.R.17	1	10

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.10.R.17 F.A. PROJ. NA  
COUNTY UNION  
PROJECT DESCRIPTION DIVISION 10 GROUP N BRIDGE  
REPLACEMENT  
SITE DESCRIPTION REPLACE BRIDGE 890356 ON SR 2133  
(SANDY RIDGE ROAD) OVER LITTLE RICHARDSON CREEK

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND SHEETS
3	SITE PLAN
4-9	BORING LOGS

PERSONNEL

F. Cox

D. Rhodes

R. Clark

INVESTIGATED BY AMEC E&I, Inc.

CHECKED BY S. Johnson, P.G. P.E.

SUBMITTED BY M. Lear, P.G.

DATE July 2012

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF PREPARING THE SCOPE OF WORK TO BE INCLUDED IN THE REQUEST FOR PROPOSAL. 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.

SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA, AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. 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 DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: R. Rahie

**amec**  
AMEC E&I, Inc.  
4021 STIRRUP CREEK DRIVE, SUITE 100  
DURHAM, NORTH CAROLINA 27703  
(919) 381-9900

*Michael B. Lear*  
SIGNATURE  
NC Engineering F-1253 NC Geology C-247

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

<b>SOIL DESCRIPTION</b>	<b>GRADATION</b>
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED BY A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</i>	WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.
	<b>ANGULARITY OF GRAINS</b>
	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS <u>ANGULAR</u> , <u>SUBANGULAR</u> , <u>SUBROUNDED</u> , OR <u>ROUNDED</u> .

<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>MINERALOGICAL COMPOSITION</b>																																																							
GENERAL CLASS.					GRANULAR MATERIALS (≤ 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)					ORGANIC MATERIALS					MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.																																													
GROUP CLASS.		A-1		A-1-b		A-3		A-2		A-2-4		A-2-5		A-2-6		A-2-7		A-4		A-5		A-6		A-7		A-1, A-2		A-3		A-4, A-5		A-6, A-7																																	
SYMBOL		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]		[Pattern]																																			
% PASSING		* 10		* 40		* 200																																																											
LIQUID LIMIT		6 MX		NP		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		MUCK, PEAT																																			
GROUP INDEX		0		0		0		4 MX		0 MX		12 MX		16 MX		0 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 A 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																																																																	
<b>CONSISTENCY OR DENSENESS</b>										<b>COMPRESSIBILITY</b>																																																							
PRIMARY SOIL TYPE		COMPACTNESS OR CONSISTENCY		RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)		RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F <sup>2</sup> )				SLIGHTLY COMPRESSIBLE		MODERATELY COMPRESSIBLE		HIGHLY COMPRESSIBLE		LIQUID LIMIT LESS THAN 31		LIQUID LIMIT EQUAL TO 31-50		LIQUID LIMIT GREATER THAN 50																																													
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 TO 4 4 TO 8 8 TO 15 15 TO 30 >30		<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4																																																											
<b>TEXTURE OR GRAIN SIZE</b>										<b>MISCELLANEOUS SYMBOLS</b>																																																							
U.S. STD. SIEVE SIZE		4		10		40		60		200		270		ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST		TEST BORING W/ CORE		SPT N-VALUE		SPT REFUSAL		ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		MONITORING WELL		PIEZOMETER INSTALLATION		SLOPE INDICATOR INSTALLATION		CORE PENETROMETER TEST																															
OPENING (MM)		4.75		2.00		0.42		0.25		0.075		0.053		INFERRED SOIL BOUNDARY		INFERRED ROCK LINE		ALLUVIAL SOIL BOUNDARY		DIP & DIP DIRECTION OF ROCK STRUCTURES		SOUNDING ROD																																											
BOULDER (BLDR.)		COBBLE (COB.)		GRAVEL (GR.)		COARSE SAND (CSE, SO.)		FINE SAND (F SO.)		SILT (SL.)		CLAY (CL.)		25/825																																																			
GRAIN SIZE		MM		305		75		2.0		0.25		0.05		0.005																																																			
IN.		12		3																																																													
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>										<b>ABBREVIATIONS</b>																																																							
SOIL MOISTURE SCALE (ATTERBERG LIMITS)		FIELD MOISTURE DESCRIPTION		GUIDE FOR FIELD MOISTURE DESCRIPTION		AR - AUGER REFUSAL		BT - BORING TERMINATED		CL - CLAY		CPT - CONE PENETRATION TEST		CSE - COARSE		DMT - DILATOMETER TEST		DPT - DYNAMIC PENETRATION TEST		e - VOID RATIO		F - FINE		FOSS - FOSSILIFEROUS		FRAC - FRACTURED, FRACTURES		FRAGS - FRAGMENTS		HL - HIGHLY		MED. - MEDIUM		MICA - MICACEOUS		MOD. - MODERATELY		NP - NON PLASTIC		ORG. - ORGANIC		PMT - PRESSUREMETER TEST		SAP. - SAPROLITIC		SD. - SAND, SANDY		SL. - SILT, SILTY		SLI. - SLIGHTLY		TCR - TRICONE REFUSAL		w - MOISTURE CONTENT		V - VERY		YST - VANE SHEAR TEST		WEA. - WEATHERED		W - UNIT WEIGHT		W <sub>d</sub> - DRY UNIT WEIGHT	
LL - LIQUID LIMIT		- SATURATED - (SAT.)		USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE		CPT		DPT		e		F		FOSS		FRAC		FRAGS		HL		MED.		MICA		MOD.		NP		ORG.		PMT		SAP.		SD.		SL.		SLI.		TCR		w		V		YST		WEA.		W		W <sub>d</sub>											
PL - PLASTIC LIMIT		- WET - (W)		SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE		DPT		e		F		FOSS		FRAC		FRAGS		HL		MED.		MICA		MOD.		NP		ORG.		PMT		SAP.		SD.		SL.		SLI.		TCR		w		V		YST		WEA.		W		W <sub>d</sub>													
OM - OPTIMUM MOISTURE SHRINKAGE LIMIT		- MOIST - (M)		SOLID; AT OR NEAR OPTIMUM MOISTURE		DPT		e		F		FOSS		FRAC		FRAGS		HL		MED.		MICA		MOD.		NP		ORG.		PMT		SAP.		SD.		SL.		SLI.		TCR		w		V		YST		WEA.		W		W <sub>d</sub>													
SL - SHRINKAGE LIMIT		- DRY - (D)		REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		DPT		e		F		FOSS		FRAC		FRAGS		HL		MED.		MICA		MOD.		NP		ORG.		PMT		SAP.		SD.		SL.		SLI.		TCR		w		V		YST		WEA.		W		W <sub>d</sub>													
<b>PLASTICITY</b>										<b>EQUIPMENT USED ON SUBJECT PROJECT</b>																																																							
NONPLASTIC		PLASTICITY INDEX (PI)		DRY STRENGTH		DRILL UNITS:		ADVANCING TOOLS:		HAMMER TYPE:		CORE SIZE:		HAND TOOLS:																																																			
LOW PLASTICITY		0-5		VERY LOW		<input type="checkbox"/> MOBILE B-_____		<input type="checkbox"/> CLAY BITS		<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL		<input type="checkbox"/> B-_____		<input type="checkbox"/> POST HOLE DIGGER																																																			
MED. PLASTICITY		6-15		SLIGHT		<input type="checkbox"/> BK-51		<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER		<input checked="" type="checkbox"/> N-0		<input checked="" type="checkbox"/> H-_____		<input type="checkbox"/> HAND AUGER																																																			
HIGH PLASTICITY		16-25		MEDIUM		<input checked="" type="checkbox"/> CME-45C		<input type="checkbox"/> 8" HOLLOW AUGERS		<input type="checkbox"/> H-_____		<input type="checkbox"/> SOUNDING ROD		<input type="checkbox"/> VANE SHEAR TEST																																																			
		26 OR MORE		HIGH		<input type="checkbox"/> CME-550		<input type="checkbox"/> HARD FACED FINGER BITS																																																									
						<input type="checkbox"/> PORTABLE HOIST		<input type="checkbox"/> TUNG.-CARBIDE INSERTS																																																									
								<input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER																																																									
								<input checked="" type="checkbox"/> TRICONE 2 7/8" STEEL TEETH																																																									
								<input type="checkbox"/> TRICONE _____" TUNG.-CARB.																																																									
								<input checked="" type="checkbox"/> CORE BIT																																																									
<b>COLOR</b>										<b>DESCRIPTIONS</b>																																																							
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.																																																																	

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

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p><b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.</p> <p><b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p><b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.</p> <p><b>ARTESIAN</b> - 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.</p> <p><b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p><b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p><b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p><b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p><b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p><b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p><b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p><b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p><b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p><b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p><b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p><b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p><b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p><b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p><b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p><b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p><b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p><b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.</p> <p><b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p><b>SILL</b> - 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 INTRODUCED ROCKS.</p> <p><b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p><b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.</p> <p><b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p><b>STRATA ROCK QUALITY DESIGNATION (SROD)</b> - 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.</p> <p><b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p><b>WEATHERED ROCK (WR)</b></p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>		
<p><b>CRYSTALLINE ROCK (CR)</b></p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p><b>NON-CRYSTALLINE ROCK (NCR)</b></p> 	<p>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.</p>		
<p><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b></p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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, YIELDS SPT N VALUES &gt; 100 BPF.</u>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, YIELDS SPT N VALUES &lt; 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 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		BEDDING	
<b>TERM</b>	<b>SPACING</b>	<b>TERM</b>	<b>THICKNESS</b>
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 FEET	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 THE 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.		
		<p><b>BENCH MARK:</b> NCDOT REBAR &amp; CAP STAMPED BL-2 LOCATED AT STATION 12+47.04 (-EL-), 12.98 RT</p> <p style="text-align: right;"><b>ELEVATION:</b> 581.92 FT.</p>	
NOTES:			

SHEET NO. 3  
W/B S. NO.: 17BP.10.R.17  
T.I.P. NO.: N/A  
COUNTY: UNION

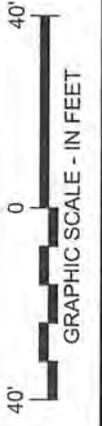
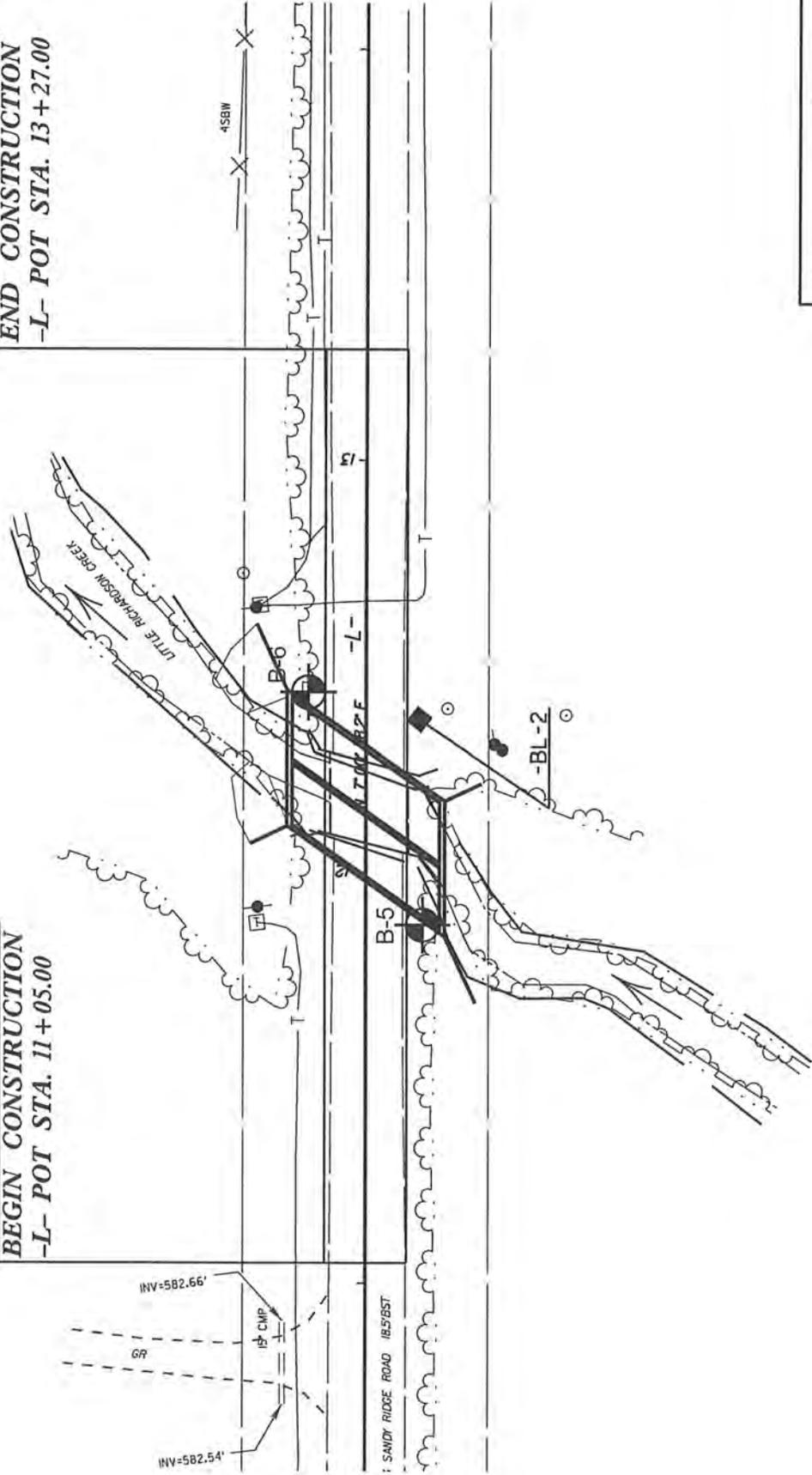


DESCRIPTION:  
REPLACE BRIDGE 890356 ON SR 2133  
(SANDY RIDGE ROAD) OVER LITTLE  
RICHARDSON CREEK



**BEGIN GRADE  
CONSTRUCTION**  
-L- POT STA. 11+05.00

**END GRADE  
CONSTRUCTION**  
-L- POT STA. 13+27.00





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.10.R.17	TIP 17BP.10.R.17	COUNTY UNION	GEOLOGIST R. Clark
SITE DESCRIPTION Replace Bridge 890356 on SR 2133 (Sandy Ridge Rd.) over Little Richardson Creek			GROUND WTR (ft)
BORING NO. B-5	STATION 11+87	OFFSET 14 ft RT	ALIGNMENT -L-
COLLAR ELEV. 582.3 ft	TOTAL DEPTH 18.0 ft	NORTHING 424,160	EASTING 1,543,563
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER F. Cox	START DATE 05/24/12	COMP. DATE 05/24/12	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
585																
	582.3	0.0													582.3	0.0
580			1	2	7										579.3	3.0
	578.8	3.5	WOH			1	4								575.8	6.5
575															574.0	8.3
	574.0	8.3	60/0.1							60/0.1					573.9	8.4
570																
565															564.3	18.0
<p>Boring Terminated at Elevation 564.3 ft in Non-Crystalline Rock: METAVOLCANIC ROCK</p> <p>Driller indicates harder drilling at 6.5 feet. Auger refusal at 8.3 feet.</p>																

NCDOT BORE SINGLE BRIDGE 356 LOGS.GPJ NC\_DOT.GDT 6/20/12



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## CORE BORING REPORT

WBS 17BP.10.R.17	TIP 17BP.10.R.17	COUNTY UNION	GEOLOGIST R. Clark
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**SITE DESCRIPTION** Replace Bridge 890356 on SR 2133 (Sandy Ridge Rd.) over Little Richardson Creek

BORING NO. B-5	STATION 11+87	OFFSET 14 ft RT	ALIGNMENT -L-	<b>GROUND WTR (ft)</b>
COLLAR ELEV. 582.3 ft	TOTAL DEPTH 18.0 ft	NORTHING 424,160	EASTING 1,543,563	

DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11	DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
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DRILLER F. Cox	START DATE 05/24/12	COMP. DATE 05/24/12	SURFACE WATER DEPTH N/A
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**CORE SIZE** NQ      **TOTAL RUN** 9.6 ft

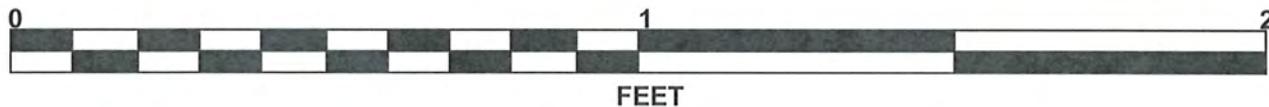
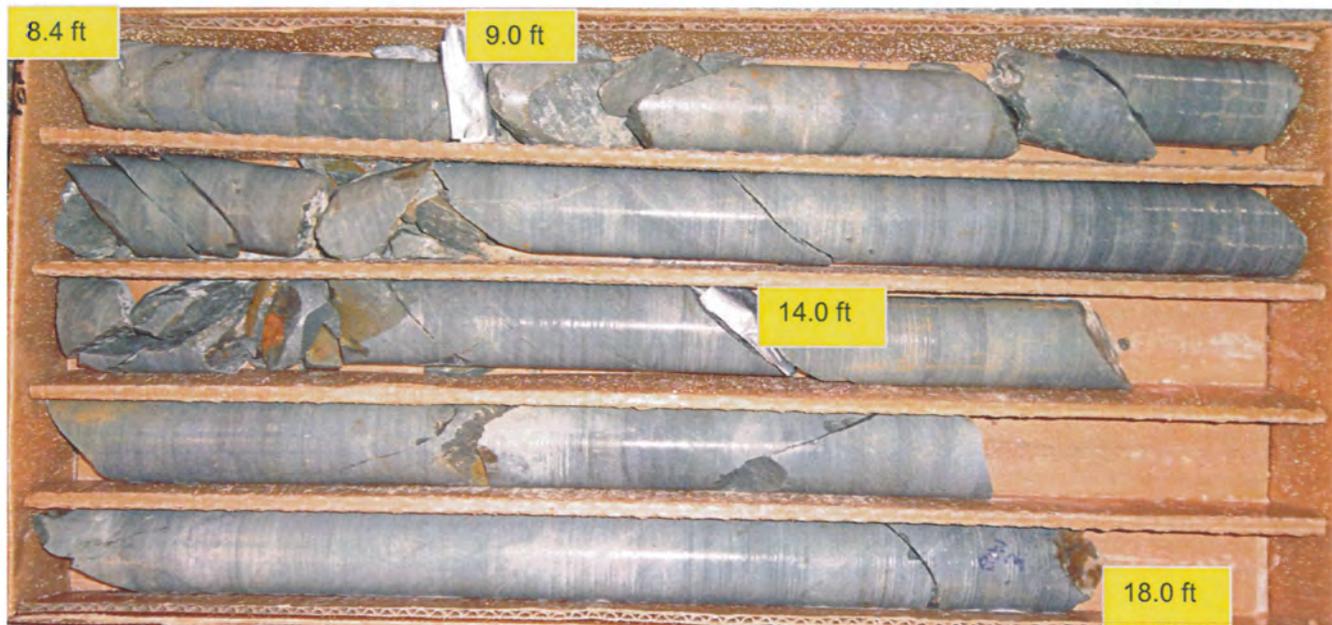
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
573.9											Begin Coring @ 8.4 ft	
	573.9	8.4	0.6	2:58/0.6	(0.6)	(0.0)		(8.7)	(5.1)		Gray, slightly weathered to fresh, moderately hard to hard, close to moderately close fracture spacing, METAVOLCANIC ROCK	8.4
	573.3	9.0	5.0	3:55	100%	0%						
570				3:47	(4.4)	(2.2)						
	568.3	14.0	4.0	4:12	88%	44%						
				4:08								
	565			3:51	(3.7)	(2.9)						
				4:05	93%	73%						
	564.3	18.0		4:22								
				4:15								
											Boring Terminated at Elevation 564.3 ft in Non-Crystalline Rock: METAVOLCANIC ROCK	18.0
											Driller indicates harder drilling at 6.5 feet. Auger refusal at 8.3 feet.	

NCDOT CORE SINGLE BRIDGE 356 LOGS.GPJ NC\_DOT.GDT 6/20/12

# CORE PHOTOGRAPHS

## B-5

BOX 1: 8.4 - 18.0 FEET







# NCDOT GEOTECHNICAL ENGINEERING UNIT

## CORE BORING REPORT

WBS 17BP.10.R.17		TIP 17BP.10.R.17		COUNTY UNION		GEOLOGIST R. Clark							
SITE DESCRIPTION Replace Bridge 890356 on SR 2133 (Sandy Ridge Rd.) over Little Richardson Creek									GROUND WTR (ft)				
BORING NO. B-6		STATION 12+44		OFFSET 14 ft LT		ALIGNMENT -L-		0 HR. 0.5					
COLLAR ELEV. 581.9 ft		TOTAL DEPTH 17.7 ft		NORTHING 424,220		EASTING 1,543,542		24 HR. 2.3					
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 81% 03/01/11				DRILL METHOD SPT Core Boring			HAMMER TYPE Automatic						
DRILLER F. Cox		START DATE 05/24/12		COMP. DATE 05/24/12		SURFACE WATER DEPTH N/A							
CORE SIZE NQ		TOTAL RUN 10.0 ft											
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %		REC. (ft) %	ROD (ft) %				
574.2											Begin Coring @ 7.7 ft		
	574.2	7.7	2.0	4:05	(2.0)	(1.7)		(9.9)	(9.1)		574.2	7.7	
	572.2	9.7		N=60/0.0 4:05 3:48	100%	85%		99%	91%				
570			5.0	4:21 4:18 4:33 4:40 3:58	(4.9)	(4.6)						Gray, slightly weathered to fresh, moderately hard to hard, close to moderately close fracture spacing, METAVOLCANIC ROCK	
	567.2	14.7											
565			3.0	3:39 3:51 4:06	(3.0)	(2.8)		100%	93%				
	564.2	17.7									564.2	17.7	
<p style="text-align: center;">Boring Terminated at Elevation 564.2 ft in Non-Crystalline Rock: METAVOLCANIC ROCK</p> <p style="text-align: center;">Driller indicates harder drilling at 6.0 feet. Auger refusal at 7.7 feet.</p>													

NCDOT CORE SINGLE BRIDGE 356 LOGS.GPJ NC\_DOT\_GDT 6/20/12

# CORE PHOTOGRAPHS

## B-6

BOXES 1 & 2: 7.7 - 17.7 FEET

