

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.14.R.10	1	10

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

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STRUCTURE  
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 17BP.14.R.10 F.A. PROJ. N/A  
COUNTY HAYWOOD  
PROJECT DESCRIPTION 17BP BRIDGE REPLACEMENT - GROUP 'W'

SITE DESCRIPTION BRIDGE NO. 216 ON SR 1380 OVER TURKEY CREEK

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-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO 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.

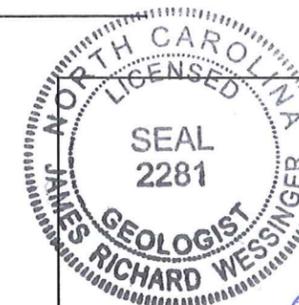
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NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

INVESTIGATED BY R. WESSINGER PERSONNEL D. HARRIS  
CHECKED BY M. RAHMAN T. MARTIN  
SUBMITTED BY J. STEWART  
DATE 5.4.2012

PROJECT: 17BP.14.R.10 ID:

DRAWN BY: J. STEWART



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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

# SUBSURFACE INVESTIGATION

## SOIL AND ROCK LEGEND, TERMS, AND ABBREVIATIONS

### SOIL DESCRIPTION

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 (ASTHO 1206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE ASTHO 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:  
VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

### SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRAVULAR MATERIALS (≤ 35% PASSING #200)	SILT-CLAY MATERIALS (> 35% PASSING #200)	ORGANIC MATERIALS
GROUP A-1	A-1-1, A-1-2, A-1-3	A-2, A-2-1, A-2-2, A-2-3, A-2-4, A-2-5, A-2-6, A-2-7	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-1-4	A-1-4	A-1-4	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-3	A-3	A-3	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-4	A-4	A-4	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-5	A-5	A-5	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-6	A-6	A-6	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-7	A-7	A-7	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-8	A-8	A-8	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-9	A-9	A-9	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-10	A-10	A-10	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-11	A-11	A-11	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-12	A-12	A-12	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-13	A-13	A-13	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-14	A-14	A-14	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-15	A-15	A-15	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-16	A-16	A-16	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-17	A-17	A-17	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-18	A-18	A-18	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-19	A-19	A-19	A-1, A-2, A-3, A-4, A-5, A-6, A-7
GROUP A-20	A-20	A-20	A-1, A-2, A-3, A-4, A-5, A-6, A-7

### GRADATION

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) - 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: ANGLAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

### MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

### COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE  
MODERATELY COMPRESSIBLE  
HIGHLY COMPRESSIBLE

### PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	20 - 35% SOME
HIGHLY ORGANIC	>10%	>20%	HIGHLY

### GROUND WATER

WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING  
STATIC WATER LEVEL AFTER 24 HOURS  
PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA  
SPRING OR SEEP

### MISCELLANEOUS SYMBOLS

ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION

SOIL SYMBOL

ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT

INFERRED SOIL BOUNDARY

INFERRED ROCK LINE

ALLUVIAL SOIL BOUNDARY

DIP & DIP DIRECTION OF ROCK STRUCTURES

CONE PENETROMETER TEST

SOUNDING ROD

TEST BORING WITH CORE

TEST BORING W/ CORE

SPT N-VALUE

SPT REFUSAL

MONITORING WELL

PREZOMETER INSTALLATION

SLOPE INDICATOR INSTALLATION

TEST BORING

AUGER BORING

CORE BORING

MONITORING WELL

PREZOMETER INSTALLATION

SLOPE INDICATOR INSTALLATION

SPT REFUSAL

SPT N-VALUE

TEST BORING W/ CORE

SPT REFUSAL

### ABBREVIATIONS

AR - AUGER REFUSAL  
BT - BORING TERMINATED  
CL - CLAY  
CPT - CONE PENETRATION TEST  
CSE - COARSE  
ORG - ORGANIC  
DPT - DILATOMETER TEST  
DRT - DYNAMIC PENETRATION TEST  
e - VOID RATIO  
F - FINE  
FOSS - FOSSILIFEROUS  
FRAC - FRACTURED, FRACTURES  
FRAGS - FRAGMENTS  
HI - HIGHLY  
V - VERY

ME - MEDIUM  
MICA - WEATHERED  
MO - MODERATELY  
NP - NON PLASTIC  
ORG - ORGANIC  
PAT - PRESSUREMETER TEST  
SAP - SAPROLITE  
SD - SAND, SANDY  
SL - SILT, SILTY  
SLS - SLIGHTLY  
TOR - TRICONE REFUSAL  
W - MOISTURE CONTENT

VST - VANE SHEAR TEST  
WEA - WEATHERED  
WUA - UNIT WEIGHT  
γ<sub>d</sub> - DRY UNIT WEIGHT

S - BULK  
SS - SPLIT SPOON  
ST - SHELBLY TUBE  
RS - ROCK  
RT - RECOMPACTED TRIAXIAL  
CBR - CALIFORNIA BEARING RATIO

### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:	HAND TOOLS:
<input type="checkbox"/> MOBILE B-	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC	<input type="checkbox"/> POST HOLE DIGGER
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	<input type="checkbox"/> CORE SIZE:	<input type="checkbox"/> HAND AUGER
<input type="checkbox"/> OME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	<input type="checkbox"/> B-	<input type="checkbox"/> SOUNDING ROD
<input type="checkbox"/> OME-550	<input type="checkbox"/> HARD FACED FINGER BITS	<input checked="" type="checkbox"/> N-Q	<input type="checkbox"/> VANE SHEAR TEST
<input type="checkbox"/> OME-55	<input type="checkbox"/> TUNG-CARBIDE INSERTS	<input type="checkbox"/> H-	
	<input type="checkbox"/> CASING	<input type="checkbox"/> W/ ADVANCER	
	<input type="checkbox"/> TRICONE	<input type="checkbox"/> STEEL TEETH	
	<input type="checkbox"/> TRICONE	<input type="checkbox"/> TUNG-CARB.	
	<input type="checkbox"/> CORE BIT		
	<input checked="" type="checkbox"/> 6" HOLLOW AUGERS		

### ROCK DESCRIPTION

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:

WEATHERED ROCK (WR)	CRYSTALLINE ROCK (CR)	NON-CRYSTALLINE ROCK (NCR)	COASTAL PLAIN SEDIMENTARY ROCK (CP)	WEATHERING
NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.	FINE TO COARSE GRANIGENOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	FINE TO COARSE GRAN, METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLITE, SLATE, SANDSTONE, ETC.	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.	WEATHERING

FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.  
VERY SLIGHT 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 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 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 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 SCRATCHED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK.  
SEVERE (MOD. SEV.) *TESTED, WOULD YIELD SPT REFUSAL*  
ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN.  
VERY SEVERE *TESTED, YIELDS SPT N VALUES > 100 BPF*  
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 SOIL WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *TESTED, YIELDS SPT N VALUES < 100 BPF*  
COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

### ROCK HARDNESS

VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.  
HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.  
MODERATELY 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 CAN BE EXCAVATED 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 CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

### FRACTURE SPACING

TERM	SPACING	THICKNESS
VERY WIDE	MORE THAN 10 FEET	> 4 FEET
WIDE	3 TO 10 FEET	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	0.008 - 0.03 FEET

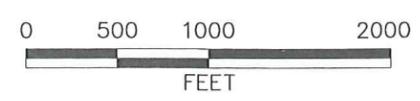
### BEDDING

INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.  
FRIABLE RUBBING WITH FINGER FRIES NUMEROUS GRAINS.  
MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE.  
INDURATED GRAINS ARE DIFFICULT TO BREAK WITH HAMMER.  
EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE.  
SAMPLE BREAKS ACROSS GRAINS.

### TERMS AND DEFINITIONS

ALLUVIAL (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, 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.  
COLLUVIAL - 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.  
FLOOD - 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.  
SLICKENSIDE - 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 STRIPED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.  
STRATA CORE RECOVERY (SRCR) - 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.

NOTES:  
GEO TECHNICAL EXPLORATION PERFORMED BY:  
BENCH MARK: \_\_\_\_\_ ELEVATION: \_\_\_\_\_ FT.  
F&ME CONSULTANTS  
7500 E. INDEPENDENCE BLVD., SUITE 100  
CHARLOTTE, NORTH CAROLINA 28277  
3112 DEVINE STREET  
COLUMBIA, SOUTH CAROLINA 29205



**SITE LOCATION PLAN**  
 REPLACE BRIDGE NO. 216 ON SR 1380 OVER TURKEY CREEK

WBS: 17BP.14.R.10  
 HAYWOOD COUNTY, NORTH CAROLINA

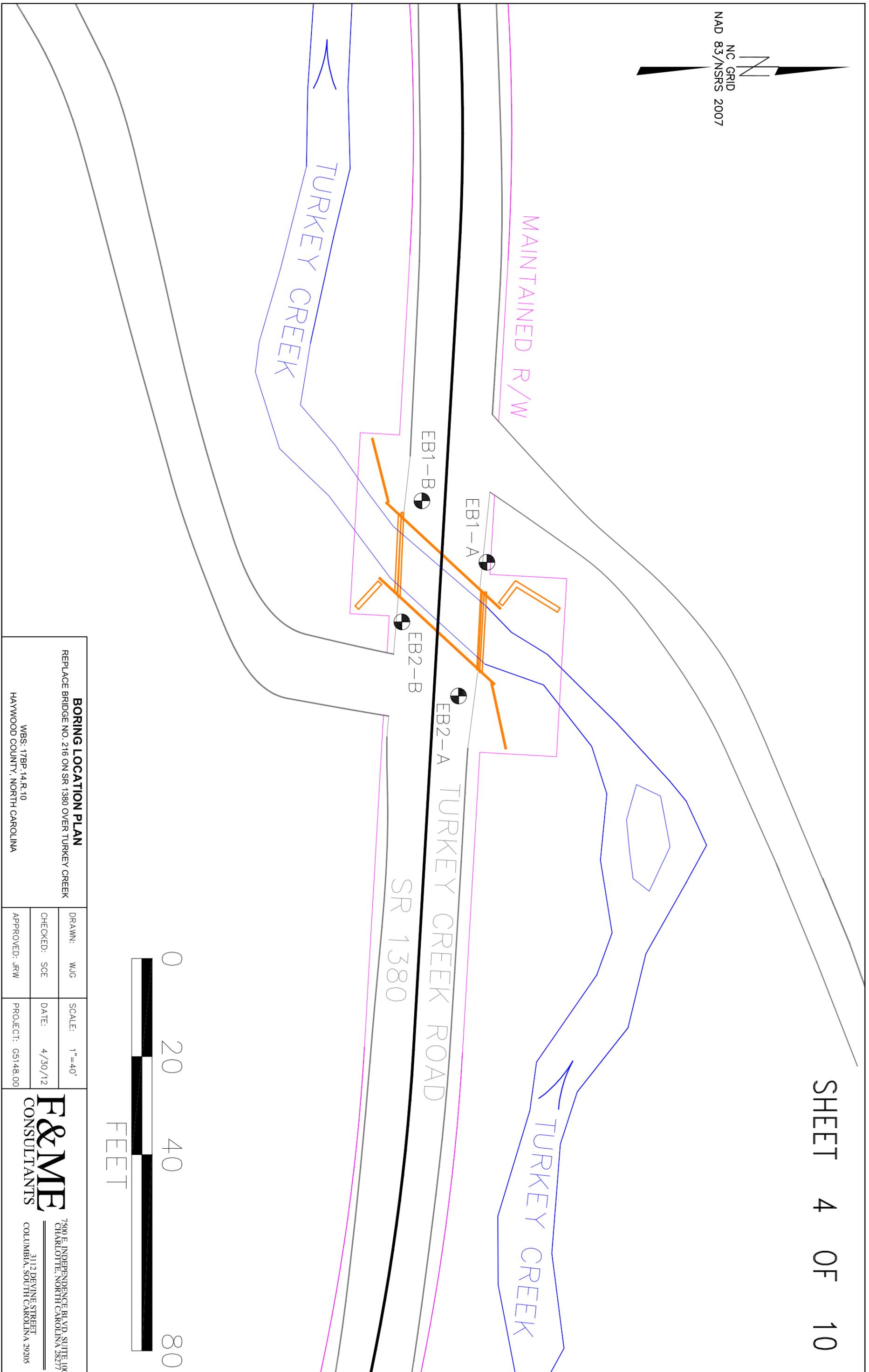
DRAWN: WJG	SCALE: 1"=1000'
CHECKED: SCE	DATE: 4/26/12
APPROVED: JRW	PROJECT: G5148.00

**F&ME**  
 CONSULTANTS

7500 E. INDEPENDENCE BLVD., SUITE 100  
 CHARLOTTE, NORTH CAROLINA 28277

3112 DEVINE STREET  
 COLUMBIA, SOUTH CAROLINA 29205

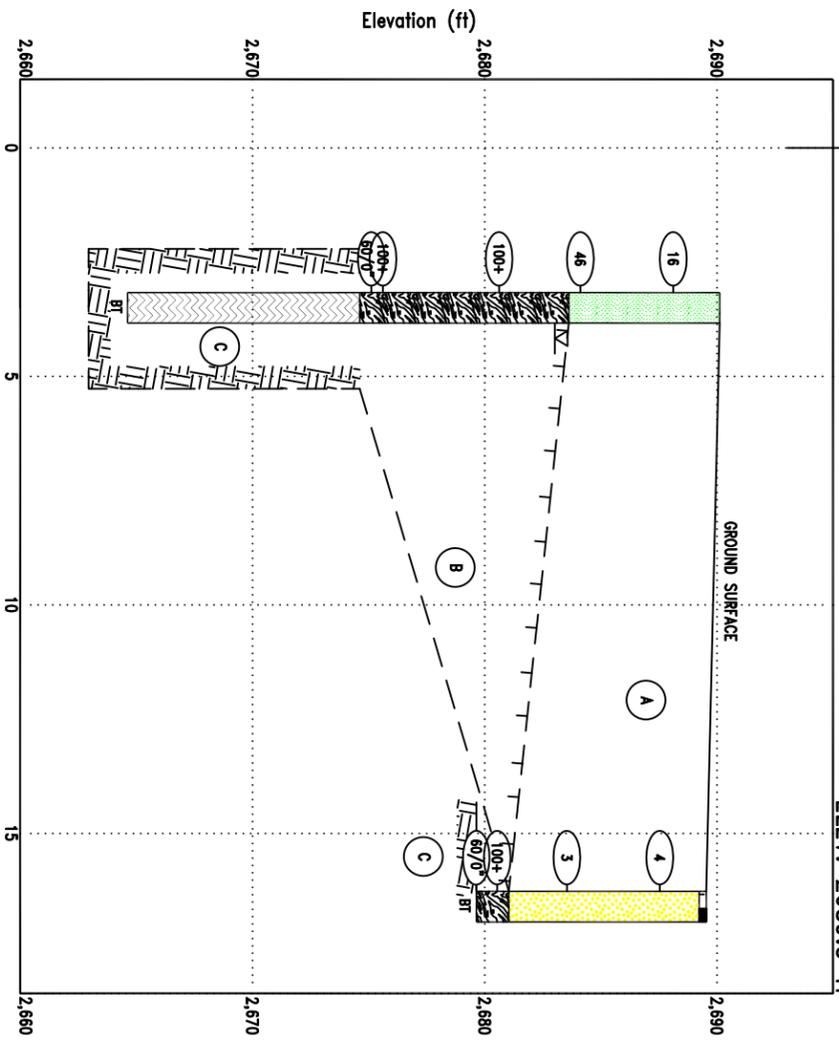
NC GRID  
NAD 83/NSRS 2007



<b>BORING LOCATION PLAN</b>		DRAWN: WJG		SCALE: 1"=40'
REPLACE BRIDGE NO. 216 ON SR 1380 OVER TURKEY CREEK		CHECKED: SCE	DATE: 4/30/12	
WBS: 17BP.14.R.10 HAYWOOD COUNTY, NORTH CAROLINA		APPROVED: JRW	PROJECT: G5148.00	
<b>F&amp;ME</b> CONSULTANTS		7500 E. INDEPENDENCE BL. VD. SUITE 100 CHARLOTTE, NORTH CAROLINA 28217		
		3112 DEVINE STREET COLUMBIA, SOUTH CAROLINA 29205		

**EB1-A**  
 12+01 -L-  
 3 ft RT  
 ELEV. 2690.1 ft

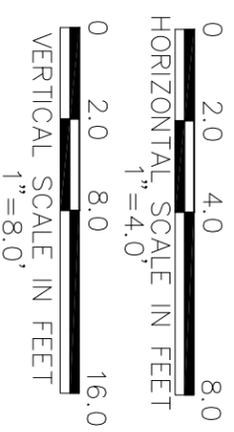
**EB1-B**  
 11+86 -L-  
 17 ft RT  
 ELEV. 2689.5 ft



Distance Along Baseline (ft)

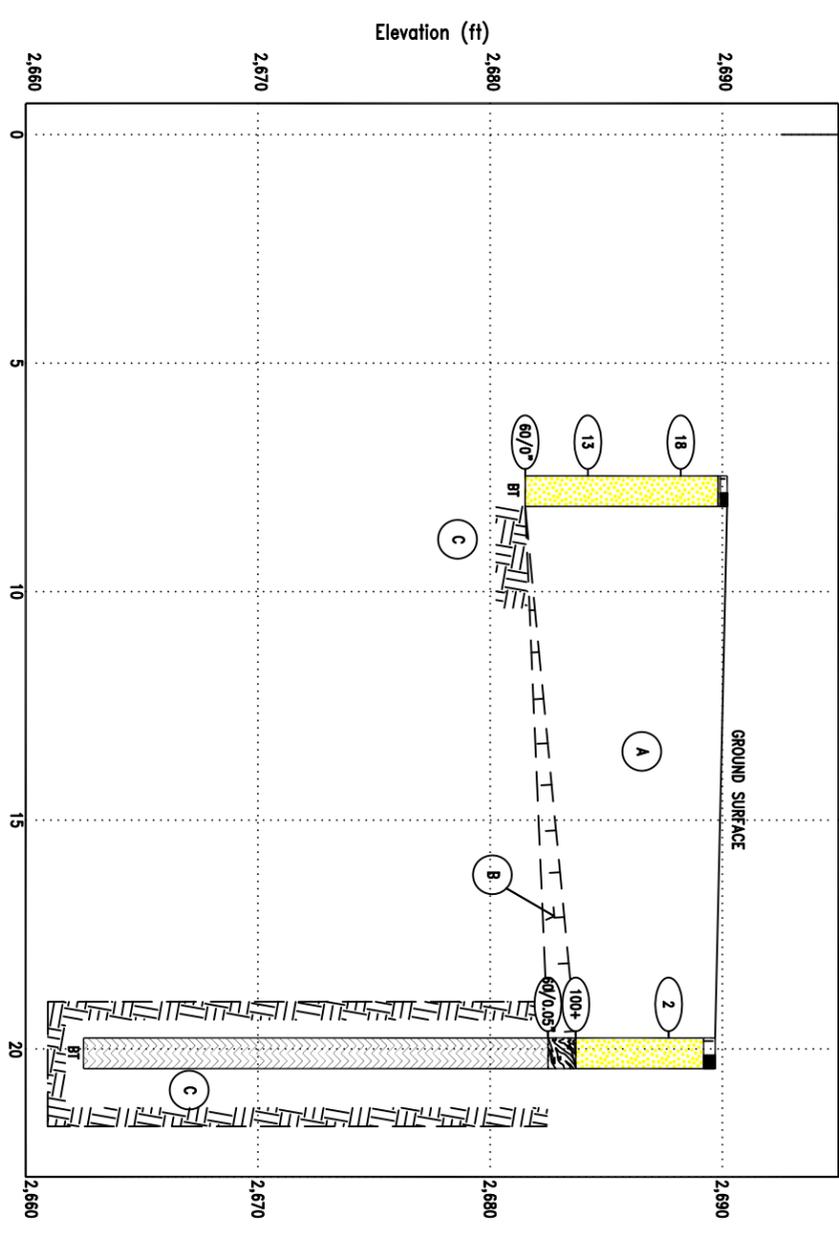
NOTE: SYMBOLS ABOVE ARE REFERENCED FROM SHEET 2 OF 10

- A** ALLUVIAL: VERY STIFF TO HARD, TAN/BROWN, FINE TO MEDIUM SANDY SILT, MOIST, NON-PLASTIC, (A-4)/  
 VERY LOOSE, TAN/BROWN, FINE TO COARSE SILTY SAND, MOIST, NON-PLASTIC, (A-2-4)
- B** WEATHERED ROCK: GRANITIC GNEISS
- C** CRYSTALLINE ROCK: BIOTITE GRANITIC GNEISS



**EB2-A**  
 12+29 -L-  
 8 ft RT  
 ELEV. 2690.2 ft

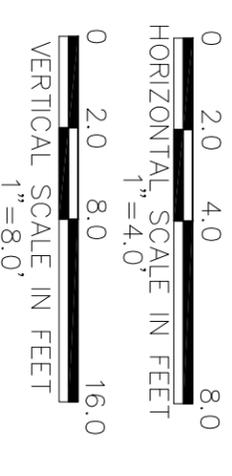
**EB2-B**  
 12+14 -L-  
 20 ft RT  
 ELEV. 2689.7 ft



Distance Along Baseline (ft)

NOTE: SYMBOLS ABOVE ARE REFERENCED FROM SHEET 2 OF 10

- A** ALLUVIAL: VERY LOOSE TO MEDIUM DENSE, TAN/ORANGE/BROWN, FINE TO COARSE SILTY SAND, MOIST, NON-PLASTIC, (A-2-4)
- B** WEATHERED ROCK: GRANITIC GNEISS
- C** CRYSTALLINE ROCK: BIOTITE GRANITIC GNEISS



**END BENT 1 CROSS SECTION**  
 REPLACE BRIDGE NO. 216 ON SR 1334 OVER TURKEY CREEK  
 WBS: 17BP-14.R.10  
 HAYWOOD COUNTY, NORTH CAROLINA

DRAWN: JPS  
 CHECKED: SCE  
 APPROVED: SCE

DATE: 4/30/12  
 PROJECT: G5148.00

**F&M E CONSULTANTS**  
 7300 E. INDEPENDENCE BLVD., SUITE 100  
 CHARLOTTE, NORTH CAROLINA 28277  
 3112 DENVINE STREET  
 COLUMBIA, SOUTH CAROLINA 29205

**END BENT 2 CROSS SECTION**  
 REPLACE BRIDGE NO. 216 ON SR 1334 OVER TURKEY CREEK  
 WBS: 17BP-14.R.10  
 HAYWOOD COUNTY, NORTH CAROLINA

DRAWN: JPS  
 CHECKED: SCE  
 APPROVED: SCE

DATE: 4/30/12  
 PROJECT: G5148.00

**F&M E CONSULTANTS**  
 7300 E. INDEPENDENCE BLVD., SUITE 100  
 CHARLOTTE, NORTH CAROLINA 28277  
 3112 DENVINE STREET  
 COLUMBIA, SOUTH CAROLINA 29205



NCDOT GEOTECHNICAL ENGINEERING UNIT  
BORELOG REPORT

WBS	17BP.14.R.10	TIP	N/A	COUNTY	HAYWOOD	GEOLOGIST	Ricky Wessinger	GROUND WTR (ft)	
SITE DESCRIPTION	Bridge No. 216 (Turkey Creek Road over Turkey Creek)			STATION	12+01	OFFSET	3 ft RT	ALIGNMENT	-L-
BORING NO.	EB1-A	TOTAL DEPTH	25.5 ft	NORTHING	728,984	EASTING	834,612	DRILL METHOD	Auger Boring/Core
COLLAR ELEV.	2,690.1 ft	DRILL RIG/HAMMER EFF./DATE	AME6515 CME-55 74% 02/01/2011	DRILL METHOD	Auger Boring/Core	HAMMER TYPE	Automatic	FLAD	24 HR.
DRILLER	Don Harris	START DATE	02/28/12	COMP. DATE	02/28/12	SURFACE WATER DEPTH	N/A	DEPTH (ft)	
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT	BLOWS PER FOOT	SAMP. NO.	MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
2695									
2690	2,689.1	1.0	4	12	SS-1	M	GROUND SURFACE	0.0	
2685	2,685.1	5.0	32	14	SS-2	M	ALLUVIAL Very stiff to Hard, Tan/Brown, Fine to Medium Sandy Silt, with Gravel, Moist, Non-Plastic, (A-4)	6.5	
2680	2,681.6	8.5	100/4		SS-3	D	WEATHERED ROCK Brown/Gray, Severely Weathered, GNEISS	15.5	
2675	2,676.6	13.5	12		SS-4	M	CRYSTALLINE ROCK (Metamorphic) Black/Green/Pink/White, Slightly to Moderately Weathered, Hard to Very Hard, Very Close Joints, Four (4) Joints at 10 to 30 Degrees, BIOTITE GRANITIC GNEISS	25.5	
2670	2,675.2	14.9	80/0		SS-5	M	Boring Terminated at Elevation 2,664.6 ft in Crystalline Rock	25.5	
2665									

- 1) Advanced 6" HSA to 15.5 feet
- 2) Advanced NQ core from 15.5 to 25.5 feet
- 3) Water from on-site Turkey Creek used as drilling fluid
- 4) Approximate drilling fluid density 82.4 pcf
- 5) No loss of drilling fluid noted



NCDOT GEOTECHNICAL ENGINEERING UNIT  
CORE BORING REPORT

WBS	17BP.14.R.10	TIP	N/A	COUNTY	HAYWOOD	GEOLOGIST	Ricky Wessinger	GROUND WTR (ft)		
SITE DESCRIPTION	Bridge No. 216 (Turkey Creek Road over Turkey Creek)			STATION	12+01	OFFSET	3 ft RT	ALIGNMENT	-L-	
BORING NO.	EB1-A	TOTAL DEPTH	25.5 ft	NORTHING	728,984	EASTING	834,612	DRILL METHOD	Auger Boring/Core	
COLLAR ELEV.	2,690.1 ft	DRILL RIG/HAMMER EFF./DATE	AME6515 CME-55 74% 02/01/2011	DRILL METHOD	Auger Boring/Core	HAMMER TYPE	Automatic	FLAD	24 HR.	
DRILLER	Don Harris	START DATE	02/28/12	COMP. DATE	02/28/12	SURFACE WATER DEPTH	N/A	DEPTH (ft)		
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/Hr)	REC. (%)	RUN (%)	SAMP. NO.	STRAATA REC. (%)	DESCRIPTION AND REMARKS	DEPTH (ft)
2674.62	2,674.6	15.5	5.0	3:00/1.0	(4.8)	(4.8)		(9.8)	Begin Coring @ 15.5 ft	15.5
2670	2,669.6	20.5	5.0	2:00/1.0	95%	95%		98%	CRYSTALLINE ROCK Black/Green/Pink/White, Slightly to Moderately Weathered, Hard to Very Hard, Very Close Joints, Four (4) Joints at 10 to 30 Degrees, BIOTITE GRANITIC GNEISS	25.5
2665	2,664.6	25.5	5.0	2:00/1.0	100%	100%		97%	Fresh to Slightly Weathered, Three (3) Natural Joints at 30 to 45 Degrees, Four (4) Mechanical Fractures	25.5

- 1) Advanced 6" HSA to 15.5 feet
- 2) Advanced NQ core from 15.5 to 25.5 feet
- 3) Water from on-site Turkey Creek used as drilling fluid
- 4) Approximate drilling fluid density 82.4 pcf
- 5) No loss of drilling fluid noted

WBS#: 17BP14.R.10	F&ME PROJECT NO.: G5148.00	LOCATION: HAYWOOD CO., NC	BORING NO.: EB1-A
SITE DESCRIPTION: BRIDGE NO. 216 (TURKEY CREEK ROAD OVER TURKEY CREEK)		DRILLER: D. HARRIS	
COLLAR ELEV.: 2,690.1 ft	CORE SIZE: NQ	EQUIPMENT: CME 55	GEOLOGIST: R. WESSINGER
ELEV. AT T.D.: 2,664.6 ft	TOTAL DEPTH: 25.5 ft	TOTAL RUN: 10.0 ft	DATE: 2/28/12

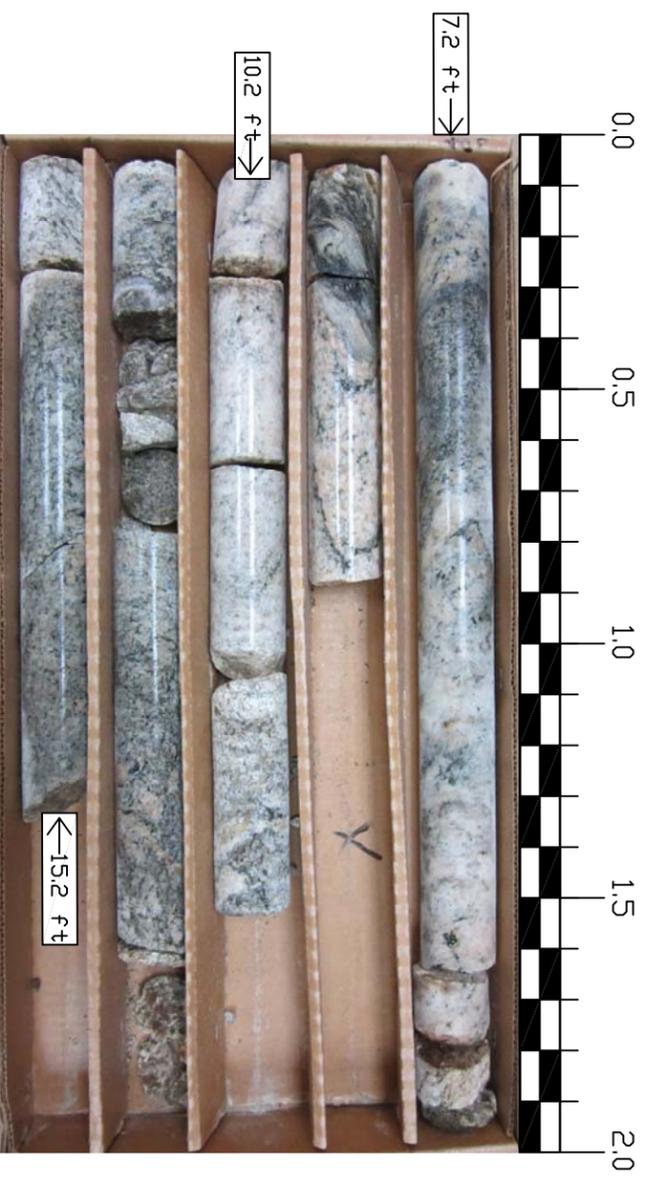


BOX 1 OF 1 (TOP OF BOX @ 3.5' / BOTTOM OF BOX @ 20.0')



CORE PHOTOS

WBS#: 17BP14.R.10	F&ME PROJECT NO.: G5148.00	LOCATION: HAYWOOD CO., NC	BORING NO.: EB2-B
SITE DESCRIPTION: BRIDGE NO. 216 (TURKEY CREEK ROAD OVER TURKEY CREEK)		DRILLER: D. HARRIS	
COLLAR ELEV.: 2,689.7 ft	CORE SIZE: NQ	EQUIPMENT: CME 55	GEOLOGIST: R. WESSINGER
ELEV. AT T.D.: 2,662.5 ft	TOTAL DEPTH: 27.2 ft	TOTAL RUN: 200 ft	DATE: 2/28/12



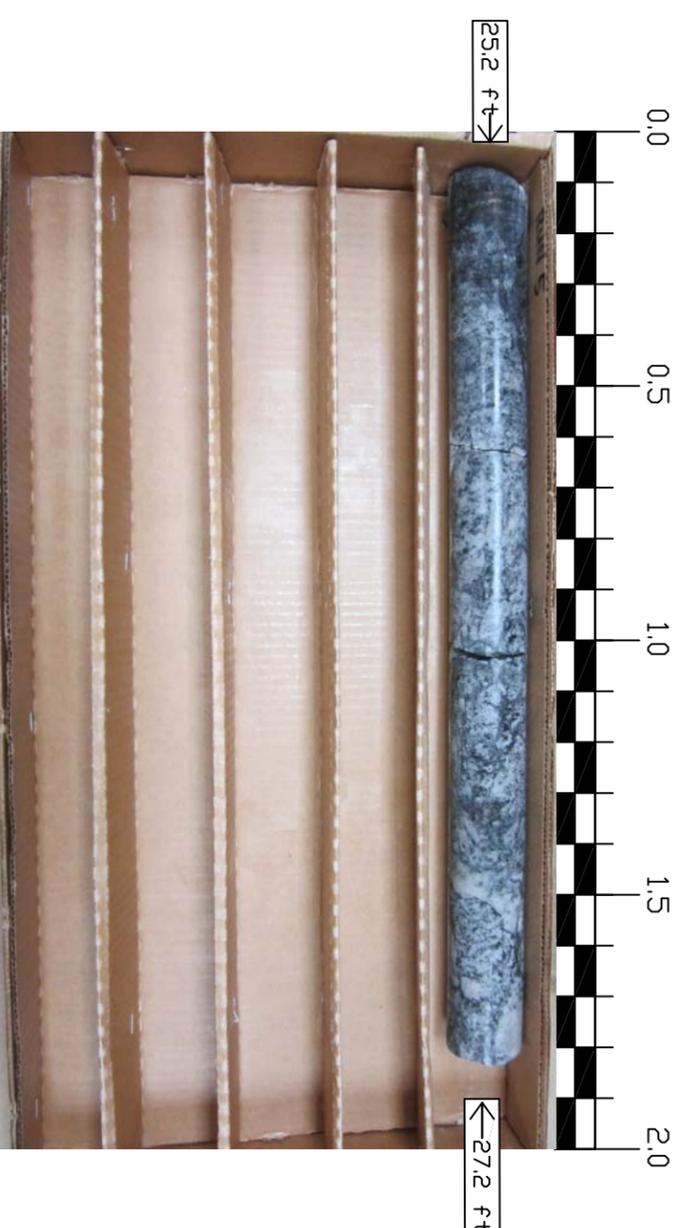
BOX 1 OF 3 (TOP OF BOX @ 7.2' / BOTTOM OF BOX @ 15.2')



BOX 2 OF 3 (TOP OF BOX @ 15.2' / BOTTOM OF BOX @ 25.2')

SHEET 9 OF 10  
CORE PHOTOS

WBS#: 17BP14.R.10	F&ME PROJECT NO.: G5148.00	LOCATION: HAYWOOD CO., NC	BORING NO.: EB2-B
SITE DESCRIPTION: BRIDGE NO. 216 (TURKEY CREEK ROAD OVER TURKEY CREEK)		DRILLER: D. HARRIS	
COLLAR ELEV.: 2,689.7 ft	CORE SIZE: NQ	EQUIPMENT: CME 55	GEOLOGIST: R. WESSINGER
ELEV. AT T.D.: 2,662.5 ft	TOTAL DEPTH: 27.2 ft	TOTAL RUN: 200 ft	DATE: 2/28/12



BOX 3 OF 3 (TOP OF BOX @ 25.2' / BOTTOM OF BOX @ 27.2')

WBS	17BP.14.R.10	TIP	N/A	COUNTY	HAYWOOD	GEOLOGIST	Ricky Wessinger		
SITE DESCRIPTION	Bridge No. 216 (Turkey Creek Road over Turkey Creek)			GROUND WTR (ft)					
BORING NO.	EB1-B	STATION	11+86	OFFSET	17 ft RT	ALIGNMENT	-L-		
COLLAR ELEV.	2,689.5 ft	TOTAL DEPTH	9.9 ft	NORTHING	728,971	EASTING	834,599		
DRILL RIG/HAMMER EFF./DATE	AME6515	CME-55	74%	02/01/2011	DRILL METHOD H.S. Augers				
DRILLER	Don Harris	START DATE	04/04/12	COMP. DATE	04/04/12	DRILL TYPE Automatic			
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT	BLOWS PER FOOT	SAMP. NO.	MOI	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
2690		1.0	2	2			2,689.5	GROUND SURFACE	0.0
		1.0	4	4	SS-1		2,688.5	Asphalt	0.5
		5.0	2	2	SS-2		2,684.5	Very Loose, Orange/Brown, Fine to Coarse Silty Sand, Moist, Non-Plastic, (A-2-4)	0.5
		8.5	100/4.5		SS-3		2,681.0	WEATHERED ROCK	8.5
		9.8	60/0*		SS-4		2,679.6	Boring Terminated at Elevation 2,679.6 ft on Crystalline Rock	9.9

1) Advanced 6" HSA to 9.9 feet

WBS	17BP.14.R.10	TIP	N/A	COUNTY	HAYWOOD	GEOLOGIST	Contract Geologist		
SITE DESCRIPTION	Bridge No. 216 (Turkey Creek Road over Turkey Creek)			GROUND WTR (ft)					
BORING NO.	EB2-A	STATION	12+29	OFFSET	8 ft RT	ALIGNMENT	Turkey Creek Rd.		
COLLAR ELEV.	2,690.2 ft	TOTAL DEPTH	8.7 ft	NORTHING	728,978	EASTING	834,639		
DRILL RIG/HAMMER EFF./DATE	AME6515	CME-55	74%	02/01/2011	DRILL METHOD H.S. Augers				
DRILLER	Contract Driller	START DATE	04/04/12	COMP. DATE	04/04/12	DRILL TYPE Automatic			
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT	BLOWS PER FOOT	SAMP. NO.	MOI	ELEV. (ft)	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
2695									
		1.0	2	2	SS-1	M	2,689.2	GROUND SURFACE	0.0
		5.0	16	10	SS-2	M	2,685.2	Asphalt	0.5
		8.5	60/0*		SS-3		2,681.5	Medium Dense, Brown/Tan, Fine to Medium Silty Sand, with Gravel, Moist, Non-Plastic, (A-2-4)	0.5
		8.5	60/0*				2,681.5	Boring Terminated at Elevation 2,681.5 ft on Crystalline Rock	8.7

1) Advanced 6" HSA to 8.7 feet