

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 38576.1.1 (B-4806) F.A. PROJ. BRZ-2409(1)  
COUNTY ROCKINGHAM  
PROJECT DESCRIPTION REPLACEMENT OF BRIDGE NO.3 OVER  
TROUBLESOME CREEK ON SR-2409

SITE DESCRIPTION BRIDGE NO.3 OVER TROUBLESOME CREEK  
ON SR-2409

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**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.

**PERSONNEL**

E. MAYR

B. RATTI

J. WALKER

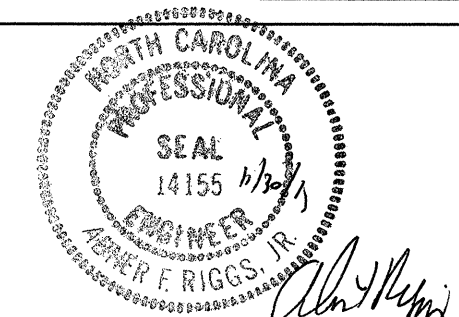
M. MEDLIN

INVESTIGATED BY S&ME, INC.

CHECKED BY A.F. RIGGS, JR.

SUBMITTED BY S&ME, INC.

DATE NOVEMBER 30, 2011



**PROJECT: 38576.1.1 ID: B-4806**

DRAWN BY: B. RATTI

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.

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

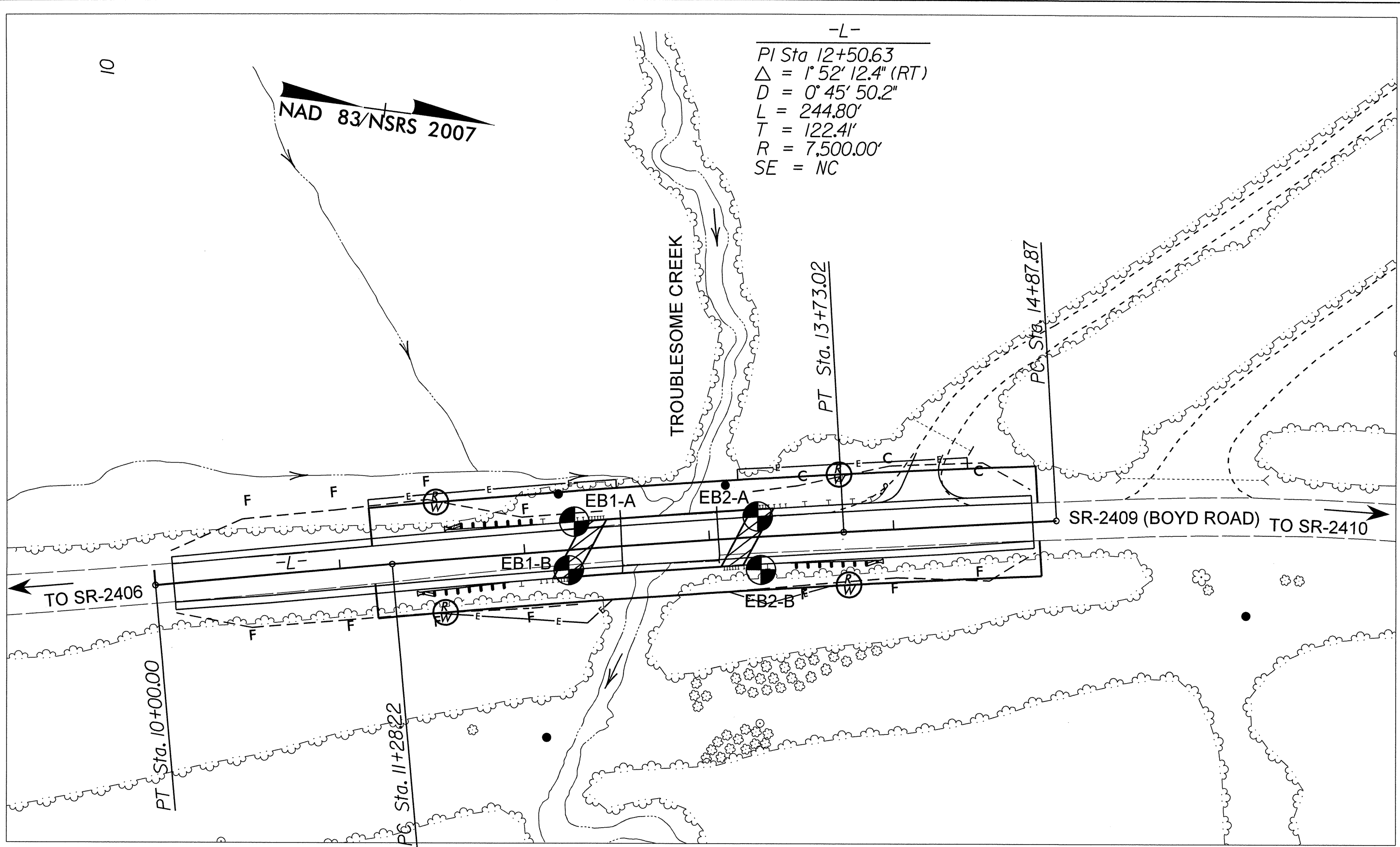
PROJECT REFERENCE NO. 38576.11 (B-4806)	SHEET NO. 2
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**SUBSURFACE INVESTIGATION**

**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

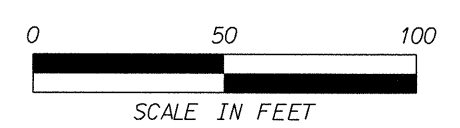
SOIL DESCRIPTION					GRADATION					ROCK DESCRIPTION					TERMS AND DEFINITIONS														
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD 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, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY 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.  THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.					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. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:  WEATHERED ROCK (WR)  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.  CRYSTALLINE ROCK (CR)  FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.  NON-CRYSTALLINE ROCK (NCR)  FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.  COASTAL PLAIN SEDIMENTARY ROCK (CP)  COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.					ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (IN OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 60 BLOWS. STRATA CORE RECOVERY (SCREC.) - 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.														
SOIL LEGEND AND AASHTO CLASSIFICATION					MINERALOGICAL COMPOSITION					COMPRESSIONIBILITY					WEATHERING														
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.					SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50					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 STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.														
PERCENTAGE OF MATERIAL					GROUND WATER					MISCELLANEOUS SYMBOLS					ROCK HARDNESS														
ORGANIC MATERIAL GRANULAR SOILS SILT-CLAY SOILS OTHER MATERIAL TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC >10% >20% HIGHLY 35% AND ABOVE					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					ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES					SPT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD					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 GROUVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROUVED 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.									
CONSISTENCY OR DENSENESS					TEXTURE OR GRAIN SIZE					ABBREVIATIONS					EQUIPMENT USED ON SUBJECT PROJECT														
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F <sup>2</sup> )					U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053					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					MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST CME-45B					ADVANCING TOOLS: CLAY BITS 6" CONTINUOUS FLIGHT AUGER 6" HOLLOW AUGERS HARD FACED FINGER BITS TUNG. CARBIDE INSERTS CASING w/ ADVANCER TRICONE 2-15/16" STEEL TEETH TRICONE * TUNG. CARB. CORE BIT 3 1/4" H.S.A.				
SOIL MOISTURE - CORRELATION OF TERMS					PLASTICITY					FRACTURE SPACING					BEDDING														
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION					PLASTICITY INDEX (PI) DRY STRENGTH NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH					TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FEET VERY CLOSE LESS THAN 0.16 FEET					TERM THICKNESS VERY THICKLY BEDDED > 4 FEET THICKLY BEDDED 1.5 - 4 FEET THINLY BEDDED 0.16 - 1.5 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET														
SATURATED (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE					WET (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE					FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.					MODERATELY INDOURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.														
MOIST (M) SOLID; AT OR NEAR OPTIMUM MOISTURE					DRY (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE					INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.					EXTREMELY INDOURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.														
COLOR					FRACURE SPACING					INDURATION																			
DESCRIPTORS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.					FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.					HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL  CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -N <input type="checkbox"/> -H  HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST																			

S:\PROJECTS-1-270 Bridge No.3 over Troublesome Creek\Standard DOT Structure\GEO TECH DOT\Cadd Files\TIP\ip\*\_GEO.BRIG\*\_\*\*\_modifier\CADD.GEOTECH\Sub\B4806.ROY.PLAN.DGN



SKEW ANGLE FOR BENTS 105° TYPICAL

BENCHMARK:  
 NCDOT TRAVERSE STATION REBAR & CAP STAMPED "BL-4"  
 LOCATED AT STATION 12+41.84 14.55 LT -L-  
 N 937406.84 E 1784598.55  
 ELEV. 708.07'



**S&ME**  
 ENVIRONMENTAL SERVICES  
 ENGINEERING TESTING

APPROVED BY: AFR

DATE: NOV. 20 11

JOB NO. 105 1-11-270

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**BORING LOCATION PLAN**

BRIDGE NO. 3 OVER TROUBLESOME CREEK  
 ON SR-2409 (BOYD ROAD)

TIP No. B-4806 STATE PROJECT No. 38516.1.1 FEDERAL I.D. BRZ-2409(1)  
 ROCKINGHAM COUNTY, NORTH CAROLINA

SCALE: 1" = 50'

APPROVED BY: AFR

DRAWN BY: BTR

DATE: NOV. 20 11

APPROVED BY: AFR

DRAWN BY: BTR

JOB NO. 105 1-11-270

APPROVED BY: AFR

DRAWN BY: BTR

SHEET 3

WBS 38576.1.1	TIP B-4806	COUNTY ROCKINGHAM	GEOLOGIST E. Mayr
SITE DESCRIPTION Bridge No. 3 over Troublesome Creek on SR 2409 (Boyd Road)			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+28	OFFSET 15 ft LT	ALIGNMENT -L-
COLLAR ELEV. 708.3 ft	TOTAL DEPTH 33.3 ft	NORTHING 937,393	EASTING 1,784,601
DRILL RIG/HAMMER EFF./DATE S&ME CME-45B 87% 10/7/11		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER J. Walker	START DATE 10/04/11	COMP. DATE 10/04/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.3	GROUND SURFACE	0.0
705	704.1	4.2	2	2	1									701.6	ROADWAY EMBANKMENT Red-Brown Fine Sandy CLAY	6.7
700	701.5	6.8	2	1	3										ALLUVIAL Brown-Gray Fine Sandy CLAY	
	699.1	9.2	2	4	3											
695	694.1	14.2	2	2	3											
690	689.1	19.2	7	7	5											
685	684.5	23.8	30	70/0.5										688.8	Gray Silty Coarse to Fine SAND	19.5
														687.8	RESIDUAL Brown Micaceous Silty Fine SAND	20.5
680	679.5	28.8	68	32/0.2										684.0	WEATHERED ROCK (Gneiss)	24.3
675	675.0	33.3	60/0											675.0		33.3

Boring Terminated with Standard Penetration Test Refusal at Elevation 675.0 ft on Crystalline Rock (Gneiss)

- Advanced 3-1/4" H.S. Augers to 19.2 feet
- Advanced 2-15/16" Rollercone to 33.3 feet
- Creek Water Used as Drilling Fluid
- Approximate Drilling Fluid Density 62.4 pcf
- No Loss of Drilling Fluid Observed

WBS 38576.1.1	TIP B-4806	COUNTY ROCKINGHAM	GEOLOGIST E. Mayr
SITE DESCRIPTION Bridge No. 3 over Troublesome Creek on SR 2409 (Boyd Road)			GROUND WTR (ft)
BORING NO. EB1-B	STATION 12+23	OFFSET 11 ft RT	ALIGNMENT -L-
COLLAR ELEV. 708.3 ft	TOTAL DEPTH 34.4 ft	NORTHING 937,394	EASTING 1,784,627
DRILL RIG/HAMMER EFF./DATE S&ME CME-45B 87% 10/7/11		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER J. Walker	START DATE 10/04/11	COMP. DATE 10/04/11	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
710														708.3	GROUND SURFACE	0.0
705	704.1	4.2	7	6	6									701.6	ROADWAY EMBANKMENT Red-Brown Fine Sandy CLAY	6.7
700	701.5	6.8	4	5	3										ALLUVIAL Brown-Gray Fine Sandy CLAY	
	699.2	9.1	2	2	2									700.3	ALLUVIAL Brown Silty Fine SAND	8.0
695	694.2	14.1	2	1	2									699.3	Gray Coarse to Fine Sandy CLAY	9.0
690	689.2	19.1	3	4	5											
685	684.2	24.1	20	27	43									688.5	RESIDUAL Brown Micaceous Silty Fine SAND	19.8
680	679.7	28.6	68	32/0.1										679.8	WEATHERED ROCK (Gneiss)	28.5
675	674.7	33.6	100/0.3											673.9		34.4

Boring Terminated with Standard Penetration Test Refusal at Elevation 673.9 ft on Crystalline Rock (Gneiss)

- Advanced 3-1/4" H.S. Augers to 24.1 feet
- Advanced 2-15/16" Rollercone to 34.4 feet
- Creek Water Used as Drilling Fluid
- Approximate Drilling Fluid Density 62.4 pcf
- No Loss of Drilling Fluid Observed

NCDOT BORE DOUBLE B4806\_GEO\_BRD0003\_GINT.GPJ NC\_DOT.GDT 12/14/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 38576.1.1	TIP B-4806	COUNTY ROCKINGHAM	GEOLOGIST E. Mayr
SITE DESCRIPTION Bridge No. 3 over Troublesome Creek on SR 2409 (Boyd Road)			GROUND WTR (ft)
BORING NO. EB2-A	STATION 13+27	OFFSET 11 ft LT	ALIGNMENT -L-
COLLAR ELEV. 708.7 ft	TOTAL DEPTH 47.0 ft	NORTHING 937,491	EASTING 1,784,585
DRILL RIG/HAMMER EFF./DATE S&ME CME-45B 87% 10/7/11		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER J. Walker	START DATE 10/04/11	COMP. DATE 10/04/11	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				
710													GROUND SURFACE	0.0
705	704.6	4.1	4	3	4							M	ROADWAY EMBANKMENT Red-Brown Fine Sandy CLAY with Trace of Gravel	
	702.1	6.6	6	8	7							M		
700	699.6	9.1	2	2	2							M	ALLUVIAL Brown Silty Fine SAND	8.2
695	694.6	14.1	10	9	5							Sat.	RESIDUAL Gray-Brown Silty Coarse to Fine SAND with Trace of Rock Fragments	13.0
690	689.6	19.1	6	5	4							Sat.		
685	684.6	24.1	3	2	2							Sat.	Orange-Brown Clayey Fine SAND	22.5
680	679.6	29.1	3	3	4							M	Orange-Brown Fine Sandy CLAY with Some Mica	27.5
675	674.6	34.1	3	4	7							Sat.	Orange -Brown Silty Fine SAND with Some Mica	32.5
670	671.1	37.6	8	32	68/0.5							Sat.	White-Brown and Gray Silty Course to Fine SAND	37.0
	669.6	39.1												
665	665.1	43.6	75	25/0.2									WEATHERED ROCK Weathered Rock (Gneiss)	40.1
	661.7	47.0	60/0										Boring Terminated with Standard Penetration Test Refusal at Elevation 661.7 ft on Crystalline Rock (Gneiss)	47.0

WBS 38576.1.1	TIP B-4806	COUNTY ROCKINGHAM	GEOLOGIST E. Mayr
SITE DESCRIPTION Bridge No. 3 over Troublesome Creek on SR 2409 (Boyd Road)			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+27	OFFSET 18 ft RT	ALIGNMENT -L-
COLLAR ELEV. 708.4 ft	TOTAL DEPTH 40.8 ft	NORTHING 937,497	EASTING 1,784,614
DRILL RIG/HAMMER EFF./DATE S&ME CME-45B 87% 10/7/11		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER J. Walker	START DATE 10/04/11	COMP. DATE 10/04/11	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				
710													GROUND SURFACE	0.0
705	704.4	4.0	2	1	2							M	ROADWAY EMBANKMENT Red-Brown Fine Sandy CLAY	
	701.7	6.7	2	3	2							M		
700	699.3	9.1	2	1	2							W	ALLUVIAL Orange-Brown-Gray Silty Coarse to Fine SAND	7.6
695	694.3	14.1	2	1	2							W	Gray Fine Sandy CLAY	12.5
690	689.3	19.1	3	1	2							W	RESIDUAL Orange -Brown Fine Sandy SILT	17.0
685	684.9	23.5	3	3	5							Sat.	Orange-Brown Gray Silty Fine SAND	22.0
680	679.9	28.5	3	3	5							W	Orange, White, Brown and Gray Coarse to Fine Sandy CLAY	27.0
675	674.9	33.5	8	14	16							Sat.	Orange-Brown Silty Fine SAND	32.0
670	669.9	38.5	13	50	50/0.1									
	667.6	40.8	60/0										WEATHERED ROCK (Gneiss)	39.0
													Boring Terminated with Standard Penetration Test Refusal at Elevation 667.6 ft on Crystalline Rock (Gneiss)	40.8

- 1) Advanced 3-1/4" H.S. Augers to 19.1 feet
- 2) Advanced 2-15/16" Rollercone to 40.8 feet
- 3) Creek Water Used as Drilling Fluid
- 4) Approximate Drilling Fluid Density 62.4 pcf
- 5) No Loss of Drilling Fluid Observed

NCDOT BORE DOUBLE B4806 GEO\_BRD30003\_GINT.GPJ NC\_DOT.GDT 12/14/11



# FIELD SCOUR REPORT

WBS: 38576.1.1 TIP: B-4806 COUNTY: Rockingham

DESCRIPTION(1): Bridge No.3 over Troublesome Creek

### EXISTING BRIDGE

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) Bridge Survey & Hydraulic Design Report

Bridge No.: 3 Length: 47'-8" Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2  
 Foundation Type: Timber Piles with steel crutch bents constructed at each ends of the Interior Bents

#### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Some erosion at each End Bent abutment walls  
Potential undermining at End Bent No.1 on East downstream side.

Interior Bents: Erosion at Interior Bents No.1 and No.2 on downstream side.

Channel Bed: Some erosion in channel on downstream side.

Channel Bank: Channel bank on North downsteam side shows signs of erosion.Channel separates beaneath  
bridge and comes back together on East downstream side.

#### EXISTING SCOUR PROTECTION

Type(3): None observed. Vertical timber abutments with wingwalls at end bents.

Extent(4): Timber wingwalls

Effectiveness(5): Not effective on exposed channel bed adjacent to abutments.

Obstructions(6): Debris collected at Interior Bent 1.Channel island formed beaneath bridge due to scour on sides

#### INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

### DESIGN INFORMATION

Channel Bed Material(7): Brown Silty Fine SAND (A-2-4)

Channel Bank Material(8): Brown-Gray Fine Sandy CLAY (A-7-5)

Channel Bank Cover(9): Grass, brush and trees

Floodplain Width(10): Approximately 270' South and 85' North

Floodplain Cover(11): Hardwood trees, Cleared power easment parallels bridge on East side

Stream is(12): Aggrading \_\_\_\_\_ Degrading  Static \_\_\_\_\_

Channel Migration Tendency(13): South

Observations and Other Comments: Overhead telephone and fiberoptic line on west side of bridge  
Gas line markers located both north and south of bridge

Reported by: *Abner F. Riggs, Jr.* Date: 9/28/2011  
 Abner F. Riggs, Jr.

DESIGN SCOUR ELEVATIONS(14) Feet \_\_\_\_\_ Meters \_\_\_\_\_

#### BENTS

B1 B2



Comparison of DSE to Hydraulics Unit theoretical scour: \_\_\_\_\_

DSE determined by: \_\_\_\_\_ Date: \_\_\_\_\_

#### SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

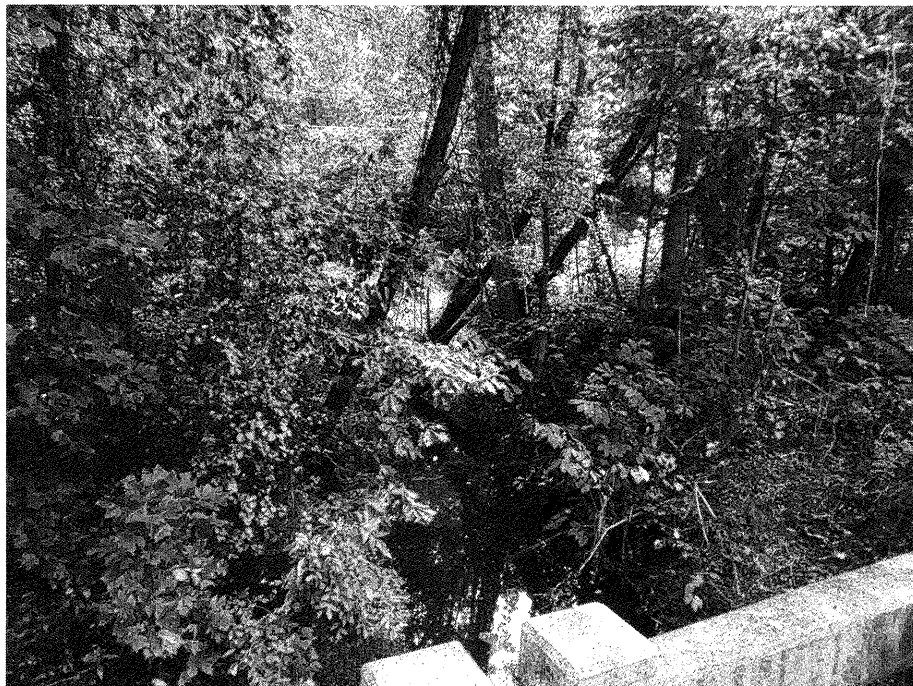
Bed or Bank											
Sample No.											
Retained #4											
Passed #10											
Passed #40											
Passed #200											
Coarse Sand											
Fine Sand											
Silt											
Clay											
LL											
PI											
AASHTO											
Station											
Offset											
Depth											



**Photograph No. 1:** This photograph was taken from the South approach, of the -L- alignment looking North.



**Photograph No. 3:** This photograph was taken from the left side of the -L- alignment, looking West (Upstream).



**Photograph No. 2:** This photograph was taken from the right side of the -L- alignment, looking East (Downstream).



**Photograph No. 4:** This photograph was taken from the North approach, of the -L- alignment, looking South.