

REFERENCE: B-5604

PROJECT: 45559

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY PERQUIMANS
PROJECT DESCRIPTION BRIDGE NO. 19 ON US 17
BUSINESS OVER MILL CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5604	1	12

CAUTION NOTICE

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

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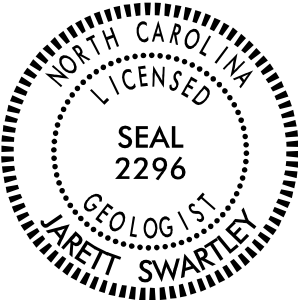
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PERSONNEL

J.R. SWARTLEY
T.J. WHITE
K.S. HARDEE
D.L. MOSS

INVESTIGATED BY J.R. SWARTLEY
DRAWN BY J.R. SWARTLEY
CHECKED BY S.S. LANEY
SUBMITTED BY S.S. LANEY
DATE AUGUST 2017



SIGNATURE _____ DATE _____
**DOCUMENT NOT CONSIDERED FINAL
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, *VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6*

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)						SILT-CLAY MATERIALS (> 35% PASSING #200)						ORGANIC MATERIALS					
GROUP CLASS.	A-1		A-3		A-2		A-4		A-5		A-6		A-7		A-1, A-2		A-4, A-5	
SYMBOL	A-1-a	A-1-b	A-2-4		A-2-5		A-2-6		A-2-7		A-4		A-5		A-6		A-7	
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN	35 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP		40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0		0		4 MX		8 MX		12 MX		16 MX		NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS							
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR						FAIR TO POOR		POOR		UNSUITABLE	
PI OF A-7-5 SUBGROUP IS ≤ LL - 30; PI OF A-7-6 SUBGROUP IS > LL - 30																		

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	4.75	2.00	0.42	0.25	0.075	0.053
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CSE. SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						

GRAIN SIZE

GRAIN SIZE	MM IN.	305	75	2.0	0.25	0.05	0.005
		12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	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.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:
ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

▽

WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING

▼

STATIC WATER LEVEL AFTER 24 HOURS

▽PW

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

25/025

DIP & DIP DIRECTION OF ROCK STRUCTURES

SPT DMT VST PMT

AUGER BORING

CORE BORING

MONITORING WELL

PIEZOMETER INSTALLATION

SLOPE INDICATOR INSTALLATION

CONE PENETROMETER TEST

SOUNDING ROD

TEST BORING WITH CORE

SPT N-VALUE

RECOMMENDATION SYMBOLS

UNDERCUT

SHALLOW UNDERCUT

UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE

UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK

UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

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 - TRI-CONE REFUSAL
w - MOISTURE CONTENT
V - VERY

VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
☐ CME-45C
☐ CME-55
☐ CME-550
☐ VANE SHEAR TEST
☐ PORTABLE HOIST
☒ CME-550X
☐

ADVANCING TOOLS:
☐ CLAY BITS
☐ 6" CONTINUOUS FLIGHT AUGER
☐ 8" HOLLOW AUGERS
☐ HARD FACED FINGER BITS
☐ TUNG-CARBIDE INSERTS
☒ CASING ☐ W/ ADVANCER
☒ TRICONE 2 15/16" STEEL TEETH
☐ TRICONE " TUNG.-CARB.
☐ CORE BIT
☒ BWJ RODS

HAMMER TYPE:
☒ AUTOMATIC ☐ MANUAL

CORE SIZE:
☐ -B ☐ -H ☐ -N

HAND TOOLS:
☐ POST HOLE DIGGER
☐ HAND AUGER
☐ SOUNDING ROD
☐ VANE SHEAR TEST
☐

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)

CRYSTALLINE ROCK (CR)

NON-CRYSTALLINE ROCK (NCR)

COASTAL PLAIN SEDIMENTARY ROCK (CP)

NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.

FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.

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 SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH
VERY SLIGHT (V SL.)
SLIGHT (SL.)
MODERATE (MOD.)
MODERATELY SEVERE (MOD. SEV.)
SEVERE (SEV.)
VERY SEVERE (V SEV.)
COMPLETE

ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
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.
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.
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.
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. *IF 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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
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
HARD
MODERATELY HARD
MEDIUM HARD
SOFT
VERY SOFT

CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
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.
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.
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.
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
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE
MODERATELY INDURATED
INDURATED
EXTREMELY INDURATED

RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.
ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED 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 (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
STRATA ROCK QUALITY DESIGNATION (SROD) - 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.

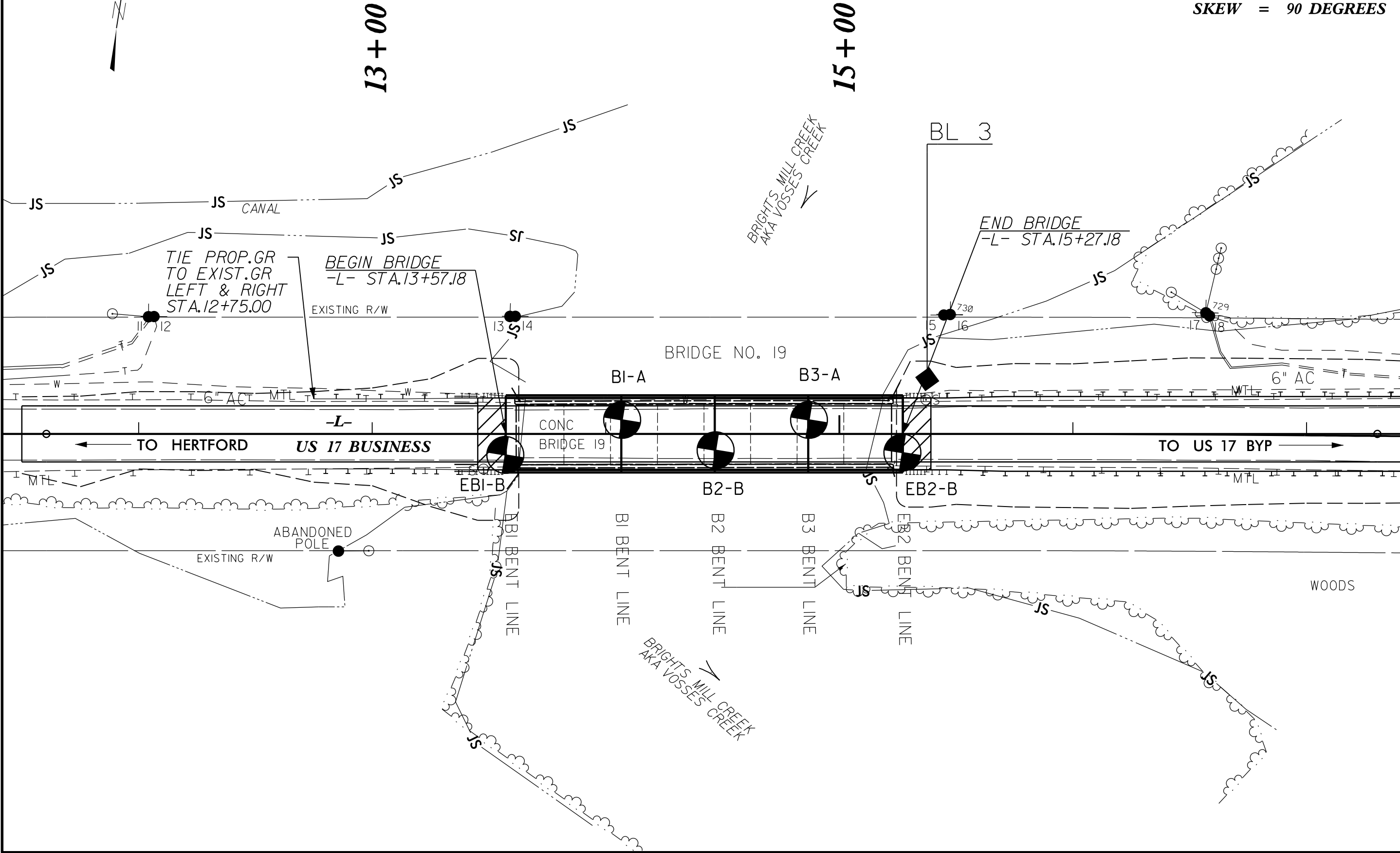
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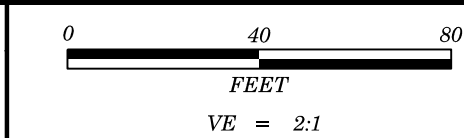
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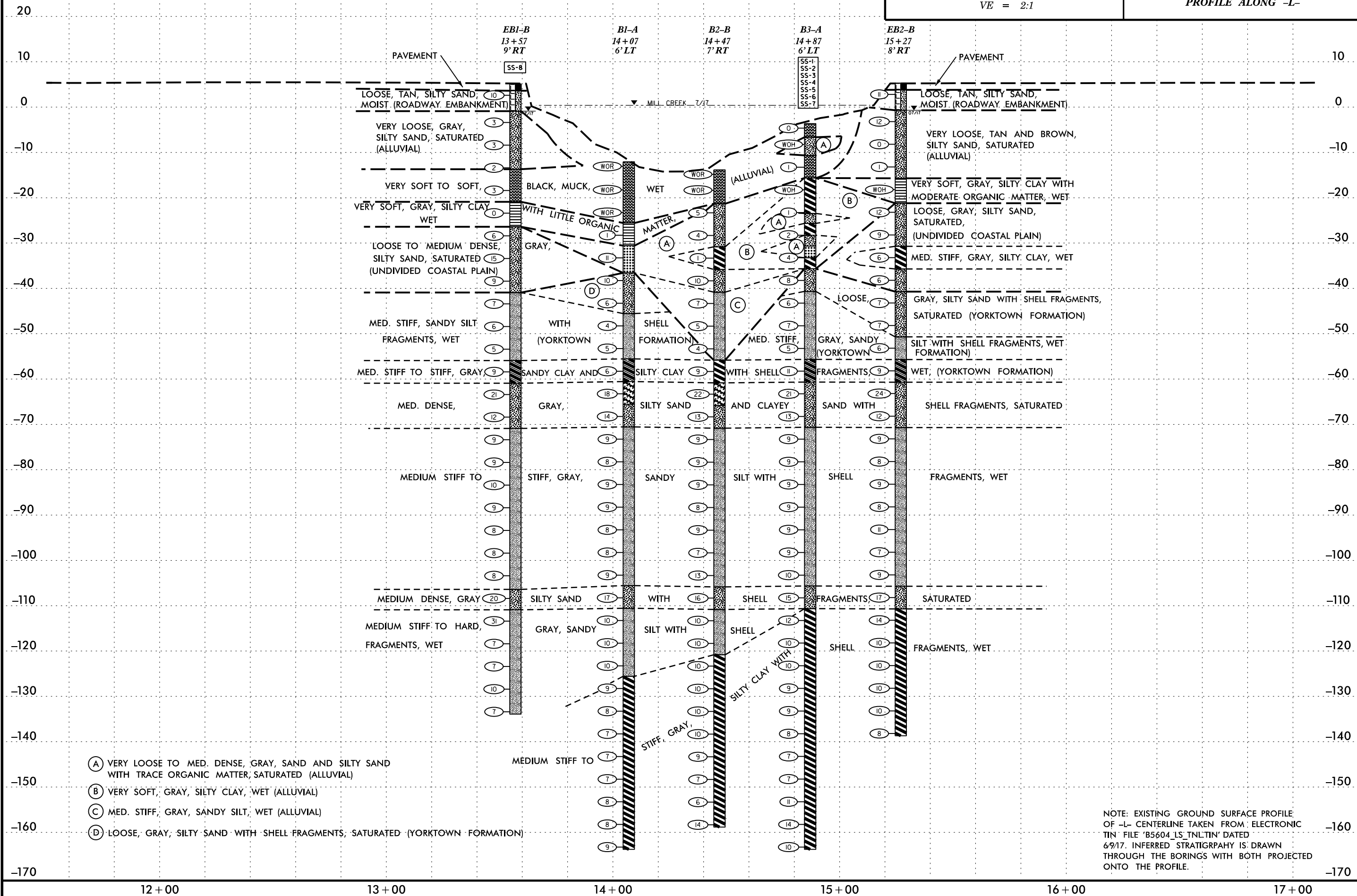
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5/14/99



PROJECT REFERENCE NO.	SHEET NO.
B-5604	4
PROFILE ALONG -L-	



NC DOT BORE DOUBLE B5604_GEO_BRDG0019.GPJ NC_DOT_GDT 8/31/17

WBS 45559.1.1			TIP B-5604			COUNTY PERQUIMANS			GEOLOGIST Swartley, J. R.							
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK									GROUND WTR (ft)							
BORING NO. EB1-B			STATION 13+57			OFFSET 9 ft RT			ALIGNMENT -L-							
COLLAR ELEV. 5.1 ft			TOTAL DEPTH 139.0 ft			NORTHING 902,335			EASTING 2,750,096							
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017									DRILL METHOD Mud Rotary			HAMMER TYPE Automatic				
DRILLER White, T.J.			START DATE 07/07/17			COMP. DATE 07/10/17			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						
-70						Match Line										
-75	-72.4	77.5	3	3	6	9						W		-70.9	GRAY, SANDY SILT WITH SHELL FRAGMENTS	76.0
-80	-77.4	82.5	3	4	5	9						W				
-85	-82.4	87.5	3	5	5	10						W				
-90	-87.4	92.5	3	4	5	9						W				
-95	-92.4	97.5	3	3	5	8						W				
-100	-97.4	102.5	3	3	5	8						W				
-105	-102.4	107.5	3	3	5	8						W				
-110	-107.4	112.5	7	9	11	20						W		-106.4	GRAY, SILTY SAND WITH SHELL FRAGMENTS	111.5
-115	-112.4	117.5	12	15	16	31						W		-110.9	GRAY, SANDY SILT WITH SHELL FRAGMENTS	116.0
-120	-117.4	122.5	3	3	4	7						W				
-125	-122.4	127.5	3	3	4	7						W				
-130	-127.4	132.5	3	4	6	10						W				
	-132.4	137.5	3	4	3	7						W		-133.9		139.0
														Boring Terminated at Elevation -133.9 ft IN YORKTOWN FORMATION (SANDY SILT)		

NC DOT BORE DOUBLE B5604_GEO_BRDG0019.GPJ NC_DOT_GDT 8/31/17

WBS 45559.1.1			TIP B-5604			COUNTY PERQUIMANS			GEOLOGIST Swartley, J. R.					
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK									GROUND WTR (ft)					
BORING NO. B1-A			STATION 14+07			OFFSET 6 ft LT			ALIGNMENT -L-			0 HR. N/A		
COLLAR ELEV. -12.1 ft			TOTAL DEPTH 151.7 ft			NORTHING 902,358			EASTING 2,750,142			24 HR. N/A		
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER White, T.J.			START DATE 07/12/17			COMP. DATE 07/13/17			SURFACE WATER DEPTH 12.3ft					
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				
-90						Match Line								
	-92.3	80.2	3	3	5	8						W		GRAY, SANDY SILT WITH SHELL FRAGMENTS (continued)
-95						8						W		
	-97.3	85.2	3	3	5	8						W		
-100												W		
	-102.3	90.2	2	4	5	9						W		
-105												W	-105.6	GRAY, SILTY SAND WITH SHELL FRAGMENTS 93.5
	-107.3	95.2	6	8	9	17						W		
-110												W	-110.6	GRAY, SANDY SILT WITH SHELL FRAGMENTS 98.5
	-112.3	100.2	3	4	6	10						W		
-115												W		
	-117.3	105.2	3	4	6	10						W		
-120												W		
	-122.3	110.2	4	5	5	10						W		
-125												W		
	-127.3	115.2	3	3	6	9						W	-125.6	GRAY, SILTY CLAY WITH SHELL FRAGMENTS 113.5
-130												W		
	-132.3	120.2	3	3	5	8						W		
-135												W		
	-137.3	125.2	2	3	4	7						W		
-140												W		
	-142.3	130.2	2	3	4	7						W		
-145												W		
	-147.3	135.2	2	3	4	7						W		
-150												W		
	-152.3	140.2	2	3	5	8						W		
-155												W		
	-157.3	145.2	3	3	5	8						W		
-160												W		
	-162.3	150.2	3	3	6	9						W	-163.8	Boring Terminated at Elevation -163.8 ft IN YORKTOWN FORMATION (SILTY CLAY) 151.7

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45559.1.1			TIP B-5604			COUNTY PERQUIMANS			GEOLOGIST Swartley, J. R.							
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK										GROUND WTR (ft)						
BORING NO. B3-A			STATION 14+87			OFFSET 6 ft LT			ALIGNMENT -L-			0 HR.	N/A			
COLLAR ELEV. -3.7 ft			TOTAL DEPTH 160.1 ft			NORTHING 902,370			EASTING 2,750,026			24 HR.	N/A			
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017							DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER White, T.J.			START DATE 07/05/17			COMP. DATE 07/06/17			SURFACE WATER DEPTH 3.9ft							
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)	
0																
	-3.7	0.0	1	0	0	0								-3.7	GROUND SURFACE	0.0
	-7.3	3.6	WOR	WOH	WOH	0								-6.7	ALLUVIAL BLACK MUCK	3.0
	-10													-10.7	GRAY, SILTY SAND WITH TRACE ORGANIC MATTER	7.0
	-12.3	8.6	WOH	WOH	1	1								-10.7	BLACK MUCK	7.0
	-15													-15.7		12.0
	-17.3	13.6	WOH	WOH	WOH	0								-15.7	GRAY, SILTY CLAY	12.0
	-20															
	-22.3	18.6	WOH	WOH	1	1								-23.5		19.8
	-25													-25.7	GRAY, SILTY SAND	22.0
	-27.3	23.6	1	1	1	2								-28.3	GRAY, SILTY CLAY	24.6
	-30													-30.7	GRAY, SILTY SAND AND SAND	27.0
	-32.3	28.6	2	2	2	4								-33.3		29.6
	-35													-35.7	GRAY, SILTY CLAY	32.0
	-37.3	33.6	3	2	6	8								-40.7	COASTAL PLAIN GRAY, SILTY SAND WITH SHELL FRAGMENTS (YORKTOWN FORMATION)	37.0
	-40													-40.7	GRAY, SANDY SILT WITH SHELL FRAGMENTS	37.0
	-42.3	38.6	2	3	3	6										
	-45															
	-47.3	43.6	2	2	5	7										
	-50															
	-52.3	48.6	2	2	3	5								-55.7		52.0
	-55													-55.7	GRAY, SANDY CLAY WITH SHELL FRAGMENTS	52.0
	-57.3	53.6	3	5	6	11								-60.7		57.0
	-60													-60.7	GRAY, SILTY SAND WITH SHELL FRAGMENTS	57.0
	-62.3	58.6	8	10	11	21										
	-65															
	-67.3	63.6	8	6	7	13								-70.7		67.0
	-70													-70.7	GRAY, SANDY SILT WITH SHELL FRAGMENTS	67.0
	-72.3	68.6	2	4	5	9										
	-75															
	-77.3	73.6	3	3	6	9										
	-80															

WBS 45559.1.1			TIP B-5604			COUNTY PERQUIMANS			GEOLOGIST Swartley, J. R.					
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK									GROUND WTR (ft)					
BORING NO. B3-A			STATION 14+87			OFFSET 6 ft LT			ALIGNMENT -L-			0 HR.	N/A	
COLLAR ELEV. -3.7 ft			TOTAL DEPTH 160.1 ft			NORTHING 902,370			EASTING 2,750,026			24 HR.	N/A	
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER White, T.J.			START DATE 07/05/17			COMP. DATE 07/06/17			SURFACE WATER DEPTH 3.9ft					
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				
-80						Match Line								
-85	-82.3	78.6	2	3	6	9					SS-6	W		GRAY, SANDY SILT WITH SHELL FRAGMENTS (continued)
-90	-87.3	83.6	3	3	6	9						W		
-95	-92.3	88.6	3	4	5	9						W		
-100	-97.3	93.6	2	3	6	9						W		
-105	-102.3	98.6	4	4	6	10						W		
-110	-107.3	103.6	6	7	8	15						Sat.		GRAY, SILTY SAND WITH SHELL FRAGMENTS
-115	-112.3	108.6	5	5	7	12						W		GRAY, SILTY CLAY WITH SHELL FRAGMENTS
-120	-117.3	113.6	3	5	5	10						W		
-125	-122.3	118.6	3	4	6	10						W		
-130	-127.3	123.6	3	3	6	9						W		
-135	-132.3	128.6	3	3	6	9						W		
-140	-137.3	133.6	2	3	5	8					SS-7	W		
-145	-142.3	138.6	1	3	4	7						W		
-150	-147.3	143.6	2	3	4	7						W		
-155	-152.3	148.6	2	4	7	11						W		
-160	-157.3	153.6	4	5	9	14						W		

NCDOT BORE DOUBLE B5604_GEO_BRDG0019.GPJ NC_DOT.GDT 8/31/17

GEOTECHNICAL BORING REPORT

BORE LOG

[illegible]

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45559.1.1			TIP B-5604			COUNTY PERQUIMANS			GEOLOGIST Swartley, J. R.						
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK									GROUND WTR (ft)						
BORING NO. EB2-B			STATION 15+27			OFFSET 8 ft RT			ALIGNMENT -L-						
COLLAR ELEV. 5.3 ft			TOTAL DEPTH 144.0 ft			NORTHING 902,362			EASTING 2,750,264						
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER White, T.J.			START DATE 07/11/17			COMP. DATE 07/12/17			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)
10															
5															
	3.8	1.5												5.3	GROUND SURFACE 0.0
			4	5	6									3.8	ROADWAY EMBANKMENT (PAVEMENT) 1.5
0															
	-2.2	7.5												-0.7	TAN, SILTY SAND
			4	6	6										
-5															ALLUVIAL 6.0
	-7.2	12.5													TAN AND BROWN, SILTY SAND
			1	0	0										
-10															
	-12.2	17.5													
			1	1	0										
-15															
	-17.2	22.5													
			WOH	WOH	WOH										
-20															
	-22.2	27.5													
			1	6	6										
-25															
	-27.2	32.5													
			1	2	7										
-30															
	-32.2	37.5													
			WOH	3	3										
-35															
	-37.2	42.5													
			2	3	3										
-40															
	-42.2	47.5													
			2	3	4										
-45															
	-47.2	52.5													
			2	3	4										
-50															
	-52.2	57.5													
			2	3	3										
-55															
	-57.2	62.5													
			3	4	5										
-60															
	-62.2	67.5													
			8	12	12										
-65															
	-67.2	72.5													
			6	6	6										
-70															

WBS 45559.1.1		TIP B-5604		COUNTY PERQUIMANS		GEOLOGIST Swartley, J. R.										
SITE DESCRIPTION BRIDGE NO. 19 ON US 17 BUSINESS OVER MILL CREEK							GROUND WTR (ft)									
BORING NO. EB2-B		STATION 15+27		OFFSET 8 ft RT		ALIGNMENT -L-		0 HR.	N/A							
COLLAR ELEV. 5.3 ft		TOTAL DEPTH 144.0 ft		NORTHING 902,362		EASTING 2,750,264		24 HR.	6.0							
DRILL RIG/HAMMER EFF./DATE SME9563 CME-550X 88% 08/10/2017				DRILL METHOD Mud Rotary			HAMMER TYPE Automatic									
DRILLER White, T.J.		START DATE 07/11/17		COMP. DATE 07/12/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100	MOI					
-70						Match Line										
-75	-72.2	77.5	3	4	5	9						W		70.7	GRAY, SANDY SILT WITH SHELL FRAGMENTS	76.0
-80	-77.2	82.5	3	3	5	8						W				
-85	-82.2	87.5	3	4	5	9						W				
-90	-87.2	92.5	3	4	4	8						W				
-95	-92.2	97.5	3	3	8	11						W				
-100	-97.2	102.5	2	3	4	7						W				
-105	-102.2	107.5	4	4	5	9						W				
-110	-107.2	112.5	6	7	10	17						Sat.		-105.7	GRAY, SILTY SAND WITH SHELL FRAGMENTS	111.0
-115	-112.2	117.5	5	6	8	14						W		-110.7	GRAY, SILTY CLAY WITH SHELL FRAGMENTS	116.0
-120	-117.2	122.5	4	5	5	10						W				
-125	-122.2	127.5	4	4	6	10						W				
-130	-127.2	132.5	3	5	5	10						W				
-135	-132.2	137.5	3	4	6	10						W				
	-137.2	142.5	3	3	5	8						W		-138.7	Boring Terminated at Elevation -138.7 ft IN YORKTOWN FORMATION (SILTY CLAY)	144.0

NCDOT BORE DOUBLE B5604_GEO_BRD0019.GPJ NC_DOT.GDT 8/31/17

SUMMARY OF LABORATORY TEST DATA
Soil Classification and Gradation



Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	6235-17-006	Date Report	7/27/2017
State Project No.:	45559.1.1	County:	Perquimans
Federal ID No.:	N/A	TIP No.:	B-5604

Project Name:	Br. No. 19 on us 17 Business over Mill Creek		
Client Name:	CALYX Engineers and Consultants, Inc.	Client Address:	Raleigh, NC

Sample No.	Station #:	Offset	Alignment	Sample Depth (ft)	AASHTO Classification	Total % Passing Sieve #					Total Mortar Fraction (%)				LL	PL	PI	Organic Content %	Moist. %
						10	40	60	200	270	Coarse Sand	Fine Sand	Silt	Clay					
SS-1	14+87	6' LT	L	8.6 - 10.1	A-5 (2)	99	93	85	42.8	39.9	14	46	26	14	68	61	7	23.5	223.4
SS-2	14+87	6' LT	L	13.6 - 15.1	A-7-5 (30)	100	100	99	94.3	93.3	1	6	47	46	65	41	24	ND	103.9
SS-3	14+87	6' LT	L	33.6 - 35.1	A-2-4 (0)	100	99	98	31.2	25.1	2	73	10	15	26	23	3	ND	ND
SS-4	14+87	6' LT	L	48.6 - 50.1	A-4 (5)	100	100	99	69.5	46.2	1	53	27	19	33	25	8	ND	ND
SS-5	14+87	6' LT	L	53.6 - 55.1	A-6 (7)	98	86	72	52.9	49.5	27	23	19	31	39	19	20	ND	ND
SS-6	14+87	6' LT	L	78.6 - 80.1	A-4 (4)	99	97	97	58.4	39.9	2	58	25	15	35	26	9	ND	ND
SS-7	14+87	6' LT	L	133.6 - 135.1	A-7-6 (21)	100	99	99	88.3	68.1	1	31	42	26	45	23	22	ND	ND
SS-8	13+57	9' RT	L	27.5 - 29.0	A-7-5 (25)	100	99	99	83.2	79.2	1	20	36	43	63	38	25	6.7	104.1

References / Comments / Deviations:	ND=Not Detemined.
AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT	AASHTO T89: Determining the Liquid Limit of Soils
AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils	AASHTO T265: Laboratory Determination of Moisture Content of Soils
AASHTO M145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes	

Mal Krajan, ET
Technician Name:


Signature

104-01-0703
Certification #

Jarett Swartley
Technical Responsibility:

Project Manager
Position

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.

SITE PHOTOGRAPH
Bridge No. 19 on -L- (US 17 BR) over Mill Creek



Looking East towards End Bent 2