REFERENCE: R-2707D

PROJECT: 34497

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	28

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *STRUCTURES #5 AND #6 – DUAL BRIDGES OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238*

CONTENTS

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.

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.

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PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *CROCKETT, S.C.*

CHECKED BY *HUNSBERGER, W.S.*

SUBMITTED BY *FALCON ENG.*

DATE *DECEMBER 2022*

NORTH CAROLINA PROFESSIONAL SEAL 048207 ENGINEER STEPHEN C. CROCKETT

DocuSigned by:
Stephen Crockett 12/30/2022
C5CA5FED48E0435...
SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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 / DPT / DMT / VST / PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q

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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: 67 HLZ 1971

ELEVATION: 667.85 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

SITE PLAN

0 50 100
FEET

4-X PG 165

WESTLEY M. LAIL
DB 1629 PG 1844

00+846

00+850

LINE = CENTERLINE BUFFALO CREEK
N53°18'36"E 102.98

SHELBY ETJ LIMITS
N68°25'03"E 81.25

S81°36'46"E
36.38'

EXISTING R/W

S5 WBL EB1-A
S5 WBL EB1-C
S5 WBL EB1-B
S5 WBL B1-A
S5 WBL B1-B
S5 WBL B2-A
S5 WBL B2-C
S5 WBL EB2-A
S5 WBL EB2-C
S5 WBL EB2-B
S6 EBL EB1-A
S6 EBL EB1-C
S6 EBL EB1-B
S6 EBL B1-A
S6 EBL B1-C
S6 EBL B1-B
S6 EBL B2-A
S6 EBL B2-C
S6 EBL B2-B
S6 EBL EB2-A
S6 EBL EB2-C
S6 EBL EB2-B

BL-182
BY31

CONC
MTL
DI
15" RCP
6" STL
E01
TL
195
196
197
198
199

+51.72
+76.72

GATE
MAKESHIFT FENCE

100' EACH SIDE OF CENTERLINE
PER SITE PROJECT 8238

PROPERTY LINE = CENTERLINE BUFFALO
S62°34'12"W 161.26'

N14°41'26"E
22.47'

N52°58'36"E
00.00'

CITY OF SHELBY
CORPORATE
LIMITS
(PB 19 PG 147)

REBA

0 100 200 FEET	PROJECT REFERENCE NO.	SHEET NO.
VE = 5:1	R-2707D	4
	STRUCTURE #5, BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)	

Ⓐ **ROADWAY EMBANKMENT:** TAN RED AND BROWN, MOIST, V.LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND (A-2-4, A-2-5, A-2-6) WITH TRACE MICA, TRACE TO LITTLE GRAVEL, AND TRACE ASPHALT FRAGMENTS
Ⓑ **ROADWAY EMBANKMENT:** TAN GRAY AND BROWN, MOIST TO WET, SOFT TO STIFF, SANDY SILT AND SANDY CLAY (A-4, A-6) WITH TRACE TO LITTLE GRAVEL
Ⓒ **ALLUVIAL:** TAN BROWN AND GRAY, MOIST TO SATURATED, V.LOOSE TO DENSE, FINE TO COARSE SAND AND SILTY SAND (A-1-b, A-2-4) WITH TRACE GRAVEL MICA AND ORGANICS
Ⓓ **ALLUVIAL:** TAN AND BROWN, MOIST, SOFT TO MED, STIFF, SANDY AND CLAYEY SILT (A-4, A-5) WITH TRACE ORGANICS
Ⓔ **RESIDUAL:** TAN WHITE ORANGE AND GRAY, MOIST TO WET, LOOSE TO DENSE, SILTY SAND (A-2-4) SAPROLITIC WITH TRACE QUARTZ FRAGMENTS AND LITTLE MICA
Ⓕ **WEATHERED ROCK:** TAN, GRANITE
Ⓖ **CRYSTALLINE ROCK:** TAN, GRANITE

S5_WBL_EB1-C
42' LT

S5_WBL_B1-B
20' LT

S5_WBL_EB2-C
33' LT

S5_WBL_B2-C
42' LT

SPT REF.

SPT REF.

SPT REF. FIAD

SPT REF.

-L- (48 FT LT)

NOTES:

GROUNDLINE PROFILE TAKEN FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

PROFILE DRAWN AT AN OFFSET OF 48 FEET LEFT OF CENTERLINE

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

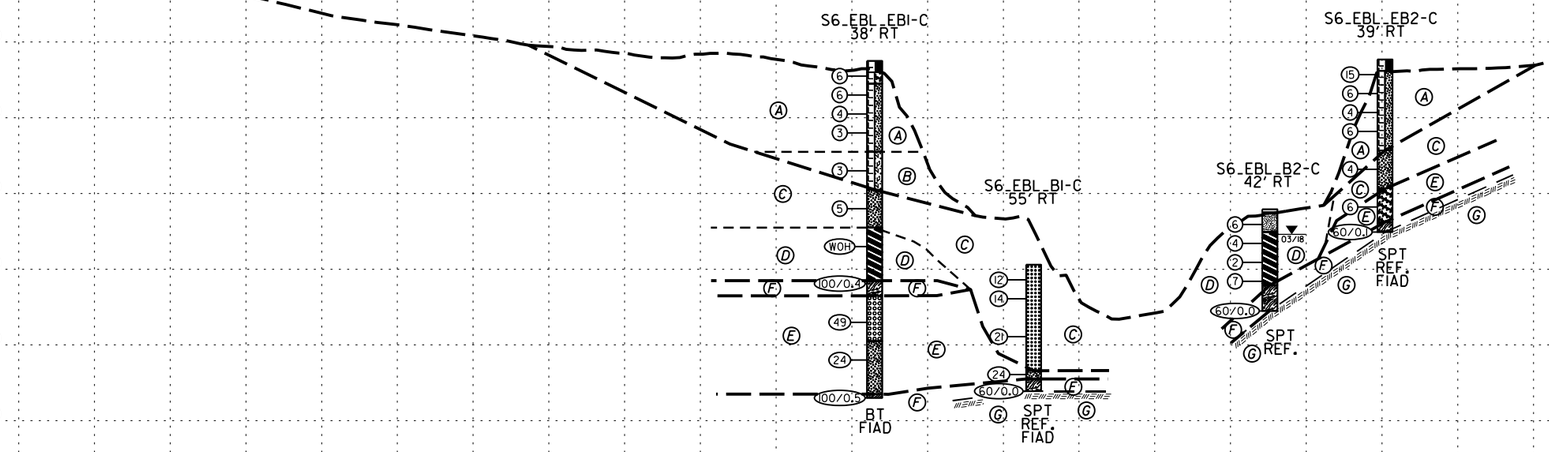
BRIDGE SKEW: 90°

720 710 700 690 680 670 660 650 640 630 620 610 600 590 580 570

842+00 843+00 844+00 845+00 846+00 847+00 848+00 849+00 850+00 851+00 852+00 853+00 854+00 855+00

0 100 200 FEET	PROJECT REFERENCE NO.	SHEET NO.
VE = 5:1	R-2707D	5
	STRUCTURE #6, BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)	

Ⓐ **ROADWAY EMBANKMENT:** TAN GRAY RED AND BROWN, MOIST TO WET, V.LOOSE TO MED.DENSE, SILTY AND CLAYEY SAND (A-2-4, A-2-6) WITH LITTLE GRAVEL
Ⓑ **ROADWAY EMBANKMENT:** RED-TAN, WET, SOFT, SANDY CLAYEY SILT (A-5) WITH LITTLE GRAVEL
Ⓒ **ALLUVIAL:** TAN AND GRAY, MOIST TO SATURATED, LOOSE TO MED.DENSE, SILTY SAND AND FINE SAND (A-2-4, A-3) WITH TRACE MICA, TRACE ORGANICS, AND TRACE TO LITTLE GRAVEL
Ⓓ **ALLUVIAL:** BROWN AND GRAY, MOIST TO WET, V.SOFT TO MED.STIFF, SANDY SILT AND SANDY SILTY CLAY (A-4, A-7)
Ⓔ **RESIDUAL:** WHITE TAN GRAY-BROWN RED AND BROWN, MOIST TO SAT., V.LOOSE TO V.DENSE, SILTY SAND WITH LITTLE TO SOME ROCK FRAGMENTS AND SOME MICA
Ⓕ **WEATHERED ROCK:** TAN, GRANITE
Ⓖ **CRYSTALLINE ROCK:** TAN, GRANITE



-L- (49 FT RT)

NOTES:

GROUNDLINE PROFILE TAKEN FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

PROFILE DRAWN AT AN OFFSET OF 49 FEET RIGHT OF CENTERLINE

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

BRIDGE SKEW: 90°

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	6

0 5 10

0 20 40
FEET

Ⓐ **ROADWAY EMBANKMENT:** TAN BROWN RED AND GRAY, MOIST TO WET, V. LOOSE TO MED. DENSE, SILTY AND CLAYEY SILTY SAND (A-2-4, A-2-5) WITH TRACE TO LITTLE GRAVEL, TRACE ASPHALT FRAGMENTS, AND TRACE ORGANICS
Ⓑ **ROADWAY EMBANKMENT:** TAN BROWN RED AND GRAY, WET, V. SOFT TO SOFT, SANDY SILT AND SANDY CLAY (A-4, A-6) WITH TRACE TO LITTLE GRAVEL AND TRACE ORGANICS
Ⓒ **ALLUVIAL:** BROWN, MOIST TO WET, V. SOFT TO MED. STIFF, SANDY SILT AND SANDY SILTY CLAY (A-4, A-7)
Ⓓ **ALLUVIAL:** TAN BROWN AND ORANGE, MOIST TO SATURATED, V. LOOSE TO MED. DENSE, GRAVEL AND SILTY SAND (A-1-a, A-2-4) WITH TRACE ORGANICS AND TRACE TO LITTLE GRAVEL
Ⓔ **RESIDUAL:** TAN RED ORANGE AND WHITE, MOIST TO SATURATED, LOOSE TO DENSE, FINE TO COARSE SAND, SILTY SAND, AND CLAYEY SILTY SAND (A-1-b, A-2-4, A-2-5) SAPROLITIC WITH TRACE QUARTZ FRAGMENTS AND LITTLE MICA
Ⓕ **WEATHERED ROCK:** TAN ORANGE AND WHITE, GRANITE
Ⓖ **CRYSTALLINE ROCK:** GRANITE (NOT SAMPLED)

S5_WBL_EBI-A 847+39
S5_WBL_EBI-C 847+10
S5_WBL_EBI-B 847+16
S6_EBL_EBI-A 847+20
S6_EBL_EBI-C 847+15
S6_EBL_EBI-B 847+23

SPT REF.
BT FIAD
BT

END BENT #1
847+40.00

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

8/23/9

$DATE$

8/23/9

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	7

0 20 40
FEET

Ⓒ **ALLUVIAL:** BROWN TAN AND GRAY, MOIST, SOFT, SANDY SILT AND CLAYEY SILT (A-4, A-5) WITH LITTLE MICA
Ⓓ **ALLUVIAL:** TAN BROWN AND GRAY, MOIST TO SATURATED, LOOSE TO DENSE, FINE TO COARSE SAND AND FINE SAND (A-1-b, A-3) WITH TRACE MICA AND ORGANICS AND LITTLE GRAVEL
Ⓔ **RESIDUAL:** TAN BROWN AND ORANGE, WET TO SATURATED, LOOSE TO V. DENSE, SILTY SAND (A-2-4) SAPROLITIC WITH TRACE TO LITTLE MICA
Ⓕ **WEATHERED ROCK:** TAN AND BROWN, GRANITE
Ⓖ **CRYSTALLINE ROCK:** GRAY, GRANITE

S5_WBL_BI-A
848+47
REC = 99%
ROD = 96%
BT

S5_WBL_BI-B
848+41
SPT
REF.

S6_EBL_BI-A
848+45
SPT
REF.
FIAD

S6_EBL_BI-C
848+20
SPT
REF.

S6_EBL_BI-B
848+32
REC = 99%
ROD = 99%
BT
FIAD

BENT #1
848+50.00

—℄—

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

$DATE$

8/23/9

0 20 40
FEET

Ⓒ **ALLUVIAL:** BROWN TAN AND GRAY, MOIST TO WET, V.SOFT TO MED.STIFF, SANDY SILT, CLAYEY SILT AND SANDY SILTY CLAY (A-4, A-5, A-7) WITH TRACE ORGANICS AND LITTLE MICA
Ⓓ **ALLUVIAL:** TAN BROWN AND GRAY, MOIST, V.LOOSE TO LOOSE, SILTY SAND AND CLAYEY SILTY SAND (A-2-4, A-2-5) WITH TRACE ORGANICS
Ⓔ **RESIDUAL:** TAN BROWN AND GRAY, MOIST TO WET, LOOSE TO DENSE, SILTY SAND (A-2-4) WITH TRACE TO LITTLE ROCK FRAGMENTS
Ⓕ **WEATHERED ROCK:** TAN BROWN AND GRAY, GRANITE
Ⓖ **CRYSTALLINE ROCK:** GRAY TAN AND GREEN, GRANITE

S5_WBL_B2-A 850+07
S5_WBL_B2-C 849+94
S5_WBL_B2-B 849+78
S6_EBL_B2-A 849+82
S6_EBL_B2-C 849+76
S6_EBL_B2-B 849+73

REC = 97%
ROD = 63%
REC = 100%
ROD = 100%
BT
SPT REF.
REC = 99%
ROD = 96%

BENT #2
849+80.00

NOTES:
GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED MARCH 2018.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
BRIDGE SKEW: 90°

$DATE$

8/23/9

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	9

0 5 10

0 20 40
FEET

Ⓐ **ARTIFICIAL FILL:** TAN AND BROWN, MOIST, LOOSE, SILTY SAND (A-2-4) WITH TRACE MICA
Ⓑ **ROADWAY EMBANKMENT:** TAN BROWN AND GRAY, MOIST, V. LOOSE TO MED. DENSE, SILTY AND CLAYEY SILTY SAND (A-2-4, A-2-5) WITH TRACE TO LITTLE GRAVEL AND TRACE MICA AND ORGANICS
Ⓒ **ROADWAY EMBANKMENT:** TAN BROWN AND GRAY, MOIST TO WET, V. SOFT TO MED. STIFF, SANDY SILT AND SANDY AND SILTY CLAY (A-4, A-6, A-7) WITH TRACE TO LITTLE GRAVEL AND TRACE MICA
Ⓓ **ALLUVIAL:** BROWN AND GRAY, MOIST, MED. STIFF, CLAYEY SILT (A-5) WITH TRACE ORGANICS
Ⓔ **ALLUVIAL:** TAN BROWN AND GRAY, MOIST, LOOSE, SILTY AND CLAYEY SILTY SAND (A-2-4, A-2-5) WITH TRACE ORGANICS AND LITTLE GRAVEL
Ⓕ **RESIDUAL:** TAN AND RED, MOIST TO SATURATED, LOOSE TO DENSE, SILTY AND CLAYEY SAND (A-2-4, A-2-6) SAPROLITIC WITH LITTLE MICA
Ⓖ **WEATHERED ROCK:** TAN, WHITE AND GRAY, GRANITE
Ⓗ **CRYSTALLINE ROCK:** TAN, GRANITE

S5_WBL_EB2-A
850+68

S5_WBL_EB2-C
850+52

S5_WBL_EB2-B
850+47

S6_EBL_EB2-A
850+52

S6_EBL_EB2-C
850+52

S6_EBL_EB2-B
850+54

SPT REF. DRY 03/18

SPT REF. FIAD

SPT REF. DRY 03/18

SPT REF. FIAD

SPT REF. FIAD

SPT REF.

END BENT #2
850+60.00

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

$DATE$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB1-A	**STATION** 847+39	**OFFSET** 96 ft LT	**ALIGNMENT** -L-	**0 HR.** 12.0
COLLAR ELEV. 648.4 ft	**TOTAL DEPTH** 33.1 ft	**NORTHING** 557,433	**EASTING** 1,266,136	**24 HR.** 9.9
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/15/18	**COMP. DATE** 02/15/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650										648.4 GROUND SURFACE	0.0
	647.4	1.0								647.7 0.7' TOPSOIL	0.7
			1	2	3	5		M		**ALLUVIAL**	
645	644.9	3.5								645.4 BROWN, FINE SANDY SILT (A-4)	3.0
			1	1	2	3		W		TAN AND BROWN, SILTY SAND (A-2-4) WITH TRACE GRAVEL	
	642.4	6.0								642.9 BROWN, FINE SANDY SILTY CLAY (A-7)	5.5
			1	2	3	5		M		640.4	8.0
640	639.9	8.5								**RESIDUAL**	
			3	5	4	9				RED AND TAN, SILTY CLAYEY SAND (A-2-5)	
										635.4	13.0
635	634.9	13.5								**WEATHERED ROCK**	
			34	66/0.4		100/0.9				633.4 TAN, GRANITE	15.0
										RESIDUAL	
630	629.9	18.5								TAN, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b)	
			12	16	26	42		M			
										626.4	22.0
625	624.9	23.5								TAN, SILTY SAND (A-2-4)	
			4	4	5	9		W			
										618.4	30.0
620	619.9	28.5								**WEATHERED ROCK**	
			2	15	80	95		W		TAN, GRANITE	
	615.3	33.1	60/0.0			60/0.0				615.3	33.1

Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 615.3 ft ON CRYSTALLINE ROCK: GRANITE

AREA - D

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB1-C	**STATION** 847+10	**OFFSET** 42 ft LT	**ALIGNMENT** -L-	**0 HR.** 33.2
COLLAR ELEV. 666.4 ft	**TOTAL DEPTH** 43.5 ft	**NORTHING** 557,438	**EASTING** 1,266,075	**24 HR.** 25.1
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/26/18	**COMP. DATE** 03/26/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670										666.4 GROUND SURFACE	0.0
										665.9 0.5' TOPSOIL	0.5
665	665.4	1.0								**ROADWAY EMBANKMENT**	
			2	1	2	3		M		663.4 TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL	3.0
	662.9	3.5								660.4 RED-BROWN, SANDY CLAY (A-6) WITH LITTLE GRAVEL	6.0
			1	2	7	9		W		RED-TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL AND ASPHALT FRAGMENTS	
660	660.4	6.0									
			1	1	2	3		M			
	657.9	8.5									
			1	1	1	2		M			
655											
	652.9	13.5									
			2	2	2	4		M			
650											
	647.9	18.5								649.4 GRAY AND BROWN, SANDY SILT (A-4) WITH TRACE GRAVEL	17.0
			2	1	2	3		M			
645										644.4 BROWN, CLAYEY SILTY SAND (A-2-5)	22.0
	642.9	23.5									
			2	2	2	4					
640										639.4	27.0
	637.9	28.5								**RESIDUAL**	
			12	7	4	11		M		TAN WHITE ORANGE-TAN AND TAN-GRAY, SILTY SAND (A-2-4) SAPROLITIC WITH TRACE QUARTZ FRAGMENTS AND LITTLE MICA	
	632.9	33.5									
			2	3	4	7		W			
630											
	627.9	38.5									
			2	5	5	10		W			
625											
	622.9	43.5	60/0.0			60/0.0				622.9	43.5

Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 622.9 ft ON CRYSTALLINE ROCK: GRANITE

AREA - D

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB1-B	**STATION** 847+16	**OFFSET** 4 ft LT	**ALIGNMENT** -L-	**0 HR.** 27.8
COLLAR ELEV. 667.2 ft	**TOTAL DEPTH** 43.1 ft	**NORTHING** 557,417	**EASTING** 1,266,043	**24 HR.** 26.0
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/14/18	**COMP. DATE** 02/24/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.2 GROUND SURFACE	0.0
	666.2	1.0								666.6 0.6' TOPSOIL	0.6
665			2	1	1	2		M		**ROADWAY EMBANKMENT** TAN AND RED, SILTY SAND (A-2-4) WITH TRACE GRAVEL	
	663.7	3.5	WOH	2	1	3		M			
	661.2	6.0	WOH	1	1	2		M			
660											
	658.7	8.5	WOH	1	2	3		W		659.2 RED TAN AND BROWN, SANDY SILTY CLAY (A-7) WITH TRACE ORGANICS	8.0
655										655.2 GRAY AND TAN, SILTY SAND (A-2-4)	12.0
	653.7	13.5	WOH	WOH	WOH	0		W			
650											
	648.7	18.5	WOH	WOH	WOH	0		W		647.7 GRAY, SANDY SILT (A-4) WITH TRACE ORGANICS (WOOD FRAGMENTS)	19.5
645										645.2 BROWN, SILTY SANDY CLAY (A-6)	22.0
	643.7	23.5	WOH	WOH	3	3		W			
640										640.2 **ALLUVIAL** TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL	27.0
	638.7	28.5	3	5	2	7		M		GRAVEL LAYER @ 31.5'-33'	
635										634.2 **RESIDUAL** ORANGE AND TAN, SILTY SAND (A-2-4)	33.0
	633.7	33.5	2	2	4	6		W			
630											
	628.7	38.5	2	4	3	7		W		626.2 **WEATHERED ROCK**	41.0
625											
	624.1	43.1	60/0.0			60/0.0				624.1 TAN AND WHITE, GRANITE	43.1
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 624.1 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_B1-A	**STATION** 848+47	**OFFSET** 70 ft LT	**ALIGNMENT** -L-	**0 HR.** 12.0
COLLAR ELEV. 647.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 557,324	**EASTING** 1,266,156	**24 HR.** 11.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/15/18	**COMP. DATE** 02/15/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650										647.7 GROUND SURFACE	0.0
	646.7	1.0								647.0 0.7' TOPSOIL	0.7
645			WOH	1	2	3		M		**ALLUVIAL**	
	644.2	3.5								644.7 BROWN, FINE SANDY SILT (A-4) WITH LITTLE MICA	3.0
	641.7	6.0	2	3	2	5		M		TAN AND BROWN, SILTY FINE SAND (A-2-4)	
640			2	2	3	5		M			
	639.2	8.5								639.7 TAN AND GRAY, SANDY CLAYEY SILT (A-5)	8.0
			2	1	2	3		M			
635	634.2	13.5								635.7 TAN AND GRAY, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b) WITH LITTLE GRAVEL	12.0
			5	7	18	25		Sat.			
630	629.2	18.5								629.7 **WEATHERED ROCK**	18.0
			100/0.4			100/0.4				627.7 TAN, GRANITE	20.0
625	624.2	23.5								**RESIDUAL** ORANGE AND TAN, SILTY SAND (A-2-4) WITH TRACE MICA	
			3	3	57	60		W		622.7	25.0
620	619.2	28.5								**WEATHERED ROCK** TAN AND BROWN, GRANITE	
			55	45/0.3		100/0.8					
615	615.4	32.3	60/0.0			60/0.0				615.4	32.3
										CRYSTALLINE ROCK LIGHT GRAY, GRANITE	
610											
605										602.6	45.1
										Boring Terminated at Elevation 602.6 ft IN CRYSTALLINE ROCK: GRANITE	
										AREA - D	

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)			**GROUND WTR (ft)**
BORING NO. S5_WBL_B1-A	**STATION** 848+47	**OFFSET** 70 ft LT	**ALIGNMENT** -L- **0 HR.** 12.0
COLLAR ELEV. 647.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 557,324	**EASTING** 1,266,156 **24 HR.** 11.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 02/15/18	**COMP. DATE** 02/15/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 12.8 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
615.28											Begin Coring @ 32.3 ft	
615	615.4	32.3	3.0	3:40/1.0 5:10/1.0 3:50/1.0	(2.9) 97%	(2.7) 90%		(12.7) 99%	(12.3) 96%		615.4 **CRYSTALLINE ROCK** VERY SLIGHT WEATHERING TO FRESH, HARD TO VERY HARD, LIGHT GRAY GRANITE W/ CLOSE TO MODERATELY CLOSE FRACTURE SPACING; MEDIUM TO COARSE GRAINED/ MEGACRYSTIC	32.3
	612.4	35.3										
610			5.0	4:51/1.0 3:27/1.0 2:24/1.0 3:40/1.0 4:23/1.0	(5.0) 100%	(4.8) 96%						
	607.4	40.3										
605			4.8	4:36/1.0 5:55/1.0 5:38/1.0 7:45/1.0 10:54/0.8	(4.8) 100%	(4.8) 100%						
	602.6	45.1									602.6	45.1
											Boring Terminated at Elevation 602.6 ft IN CRYSTALLINE ROCK: GRANITE	
											AREA - D	

NCDOT CORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

BORING S5_WBL_B1-A, BOX 1 OF 2, 32.3 FEET TO 40.3 FEET.

BORING S5_WBL_B1-A, BOX 2 OF 2, 40.3 FEET TO 45.1 FEET.

0 4" 8"
INCHES

FALCON ENGINEERING
FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513
PHONE: 919.871.0800

ROCK CORE PHOTOGRAPHS

STRUCTURES #5&6 - DUAL BRIDGES OVER
BUFFALO CREEK ON US 74 BETWEEN
SR 2325 AND SR 2238
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_B1-B	**STATION** 848+41	**OFFSET** 20 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 634.4 ft	**TOTAL DEPTH** 15.0 ft	**NORTHING** 557,309	**EASTING** 1,266,108	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 03/27/18	**COMP. DATE** 03/27/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
635	634.4	0.0								634.4 GROUND SURFACE	0.0
			2	6	32	38		Sat.		**ALLUVIAL** TAN-BROWN, FINE TO COARSE SAND (A-1-b) WITH LITTLE GRAVEL	
630	629.4	5.0	16	11	37	48				631.4	3.0
										RESIDUAL TAN, SILTY SAND (A-2-4) SAPROLITIC	
625	624.4	10.0	100/0.2			100/0.2				627.9	6.5
										WEATHERED ROCK TAN, GRANITE	
620	619.4	15.0	60/0.0			60/0.0				619.4	15.0
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 619.4 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_B2-A	**STATION** 850+07	**OFFSET** 64 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 649.4 ft	**TOTAL DEPTH** 24.8 ft	**NORTHING** 557,175	**EASTING** 1,266,215	**24 HR.** 13.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650										649.4 GROUND SURFACE	0.0
	648.4	1.0								648.7 0.7' TOPSOIL	0.7
			WOH	1	1	2		M		**ALLUVIAL**	
	645.9	3.5								646.4 RED-TAN, SILTY FINE SAND (A-2-4) WITH TRACE WOOD FRAGMENTS	3.0
645			1	1	1	2		M		643.9 TAN, FINE SANDY SILT (A-4) WITH LITTLE MICA	5.5
	643.4	6.0									
			2	2	2	4		M		641.4 TAN-GRAY, CLAYEY SILT (A-5) WITH TRACE ORGANICS (ROOTLETS)	8.0
	640.9	8.5									
640			WOH	1	2	3		M		639.2 GRAY-TAN, SILTY CLAY (A-7) WITH TRACE ORGANICS (ROOTLETS)	10.2
	637.6	11.8								637.6 **RESIDUAL**	11.8
			60/0.0			60/0.0				TAN AND WHITE, SILTY SAND (A-2-4) WITH LITTLE ROCK FRAGMENTS	
635										634.6 **CRYSTALLINE ROCK** GREEN-TAN, GRANITE	14.8
										LIGHT GRAY, GRANITE	
630											
625										624.6	24.8
										Boring Terminated at Elevation 624.6 ft IN CRYSTALLINE ROCK: GRANITE	
										AREA - D	

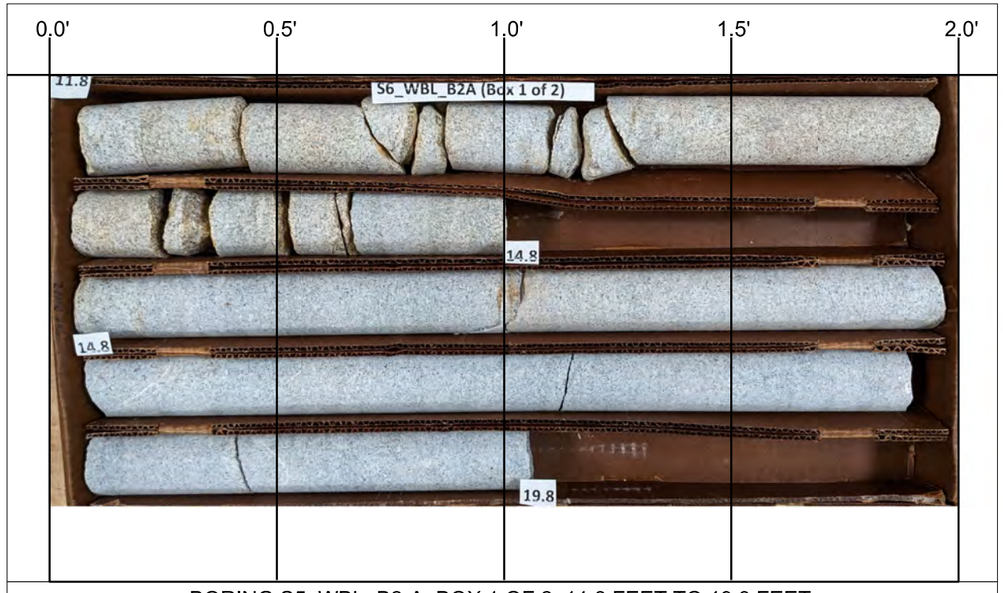
NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
CORE LOG

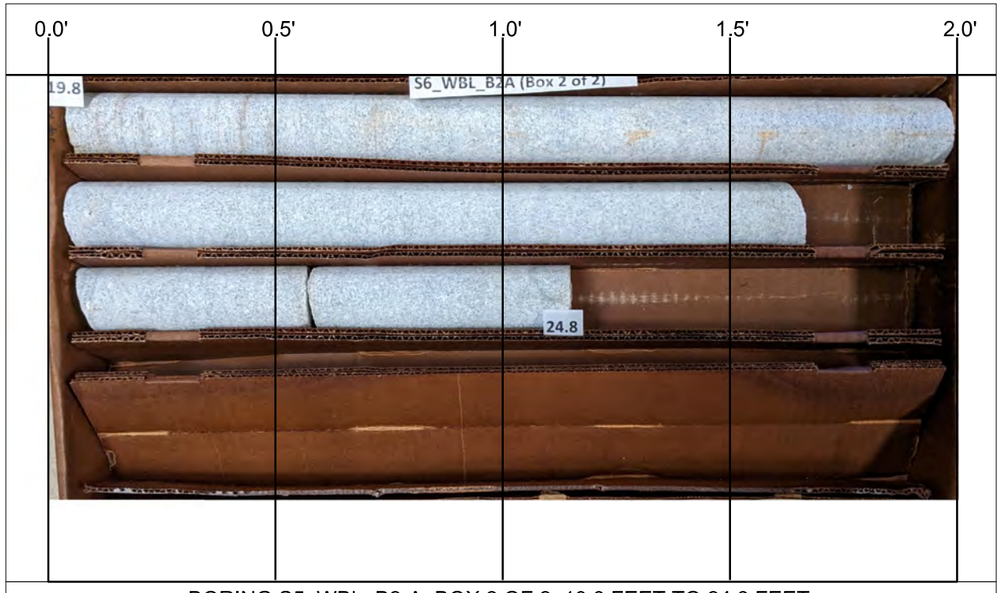
WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)			**GROUND WTR (ft)**
BORING NO. S5_WBL_B2-A	**STATION** 850+07	**OFFSET** 64 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 649.4 ft	**TOTAL DEPTH** 24.8 ft	**NORTHING** 557,175	**EASTING** 1,266,215	**24 HR.** 13.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 13.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
637.6											Begin Coring @ 11.8 ft	
	637.6	11.8	3.0	2:22	(2.9)	(1.9)		(2.9)	(1.9)		637.6 **CRYSTALLINE ROCK**	11.8
635				1:36	97%	63%		97%	63%		SLIGHT TO VERY SLIGHT WEATHERING, HARD, LIGHT GREEN-TAN,	
	634.6	14.8		1:22							634.6 GRANITE WITH CLOSE TO VERY CLOSE FRACTURE SPACING.	14.8
			5.0	1:44	(5.0)	(5.0)		(10.0)	(10.0)		FRESH, VERY HARD, LIGHT GRAY, GRANITE, WITH WIDE	
				1:30	100%	100%		100%	100%		FRACTURE SPACING.	
630	629.6	19.8		1:40								
				1:39								
			5.0	1:47								
				1:49	(5.0)	(5.0)						
				2:13	100%	100%						
625				2:41								
	624.6	24.8		2:51							624.6	24.8
				4:07							Boring Terminated at Elevation 624.6 ft IN CRYSTALLINE ROCK: GRANITE	
											AREA - D	

NCDOT CORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22



BORING S5_WBL_B2-A, BOX 1 OF 2, 11.8 FEET TO 19.8 FEET.



BORING S5_WBL_B2-A, BOX 2 OF 2, 19.8 FEET TO 24.8 FEET.

0 4" 8"
INCHES

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513
PHONE: 919.871.0800

ROCK CORE PHOTOGRAPHS

STRUCTURES #5&6 - DUAL BRIDGES OVER
BUFFALO CREEK ON US 74 BETWEEN
SR 2325 AND SR 2238
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_B2-C	**STATION** 849+94	**OFFSET** 42 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 649.5 ft	**TOTAL DEPTH** 11.3 ft	**NORTHING** 557,178	**EASTING** 1,266,190	**24 HR.** 9.3
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/22/18	**COMP. DATE** 03/22/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650											
	648.5	1.0	1	2	1	3		M		649.5 GROUND SURFACE	0.0
										648.7 0.8' TOPSOIL	0.8
	646.0	3.5						M		**ALLUVIAL**	
645			1	1	1	2				646.5 TAN-BROWN, SILTY SAND (A-2-4) WITH TRACE ORGANICS AND MICA	3.0
	643.5	6.0						M		TAN-BROWN, SILT (A-4) MOTTLED AND TRACE ORGANICS (WOOD FRAGMENTS)	
			1	2	2	4				641.5	8.0
	641.0	8.5						M		TAN, CLAYEY SILT (A-5) WITH TRACE ORGANICS	
640			WOH	2	2	4				639.0	10.5
	638.2	11.3								638.2 **WEATHERED ROCK**	11.3
			60/0.0			60/0.0				TAN, GRANITE	
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 638.2 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_B2-B	**STATION** 849+78	**OFFSET** 10 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 648.1 ft	**TOTAL DEPTH** 10.8 ft	**NORTHING** 557,166	**EASTING** 1,266,134	**24 HR.** 6.6
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/22/18	**COMP. DATE** 03/22/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650											
	647.1	1.0	WOH	4	3	7		M		648.1 GROUND SURFACE	0.0
										647.3 0.8' TOPSOIL	0.8
	644.6	3.5						M		**ALLUVIAL**	
645			WOH	2	1	3				TAN-BROWN, SANDY SILT (A-4) WITH TRACE ORGANICS	
	642.1	6.0						M		644.1	4.0
			2	1	1	2				642.6 TAN-BROWN, SILTY SAND (A-2-4)	5.5
	639.6	8.5								TAN, FINE SANDY CLAYEY SILT (A-5)	
640			WOH	5	32	37				638.6	9.5
	637.3	10.8								637.3 **RESIDUAL**	10.8
			60/0.0			60/0.0				BROWN-GRAY, SILTY SAND (A-2-4) WITH TRACE ROCK FRAGMENTS	
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 637.3 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB2-A	**STATION** 850+68	**OFFSET** 100 ft LT	**ALIGNMENT** -L-	**0 HR.** 8.5
COLLAR ELEV. 650.7 ft	**TOTAL DEPTH** 10.6 ft	**NORTHING** 557,134	**EASTING** 1,266,273	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/22/18	**COMP. DATE** 03/22/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
655											
650	649.7	1.0	2	3	3	6		M		650.7 GROUND SURFACE	0.0
										650.2 0.5' TOPSOIL	0.5
	647.2	3.5	3	2	3					**ROADWAY EMBANKMENT** BROWN, FINE SANDY SILT (A-4) WITH TRACE MICA AND GRAVEL	
645	644.7	6.0	2	1	2	5				645.2	5.5
	642.2	8.5	2	1	34	3 35				**ALLUVIAL** BROWN AND GRAY, CLAYEY SILT (A-5) WITH TRACE ORGANICS (ROOTS)	
	640.1	10.6	60/0.0			60/0.0				640.7	10.0
										640.1 **WEATHERED ROCK** TAN, GRANITE	10.6
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 640.1 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB2-C	**STATION** 850+52	**OFFSET** 33 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 667.3 ft	**TOTAL DEPTH** 23.9 ft	**NORTHING** 557,121	**EASTING** 1,266,205	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/26/18	**COMP. DATE** 03/26/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
665	666.3	1.0	15	9	7	16		M		667.3 GROUND SURFACE	0.0
										665.8 1.0' BITUMINOUS CONCRETE 0.5' AGGREGATE BASE COURSE	1.5
	663.8	3.5	3	2	2	4		M		**ROADWAY EMBANKMENT** TAN-BROWN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL AND TRACE MICA	
660	661.3	6.0	4	2	3	5		M		661.8 TAN, SANDY CLAY (A-6) WITH TRACE GRAVEL	5.5
	658.8	8.5	4	6	5	11		M		659.3 TAN BROWN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL	8.0
655	653.8	13.5	2	3	5	8		M		655.3 BROWN, SILTY CLAYEY SAND (A-2-5) WITH LITTLE GRAVEL	12.0
650	648.8	18.5	3	3	2	5		M		650.3 **ALLUVIAL** BROWN-GRAY, SILTY SAND (A-2-4) WITH LITTLE GRAVEL AND TRACE ORGANICS	17.0
645	643.8	23.5	100/0.3			100/0.3				646.8 **WEATHERED ROCK** TAN, GRANITE	20.5
	643.4	23.9	60/0.0			60/0.0				643.4 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 643.4 ft ON CRYSTALLINE ROCK: GRANITE	23.9
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #6 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (LEFT LANE)				**GROUND WTR (ft)**
BORING NO. S5_WBL_EB2-B	**STATION** 850+47	**OFFSET** 7 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 667.3 ft	**TOTAL DEPTH** 20.8 ft	**NORTHING** 557,115	**EASTING** 1,266,180	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/16/18	**COMP. DATE** 02/16/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.3 GROUND SURFACE	0.0
	666.3	1.0	2	2	4	6		M		666.6 0.7' TOPSOIL	0.7
665	663.8	3.5	1	2	1	3		M		**ROADWAY EMBANKMENT** TAN AND GRAY, SILTY SAND (A-2-4) WITH TRACE TO LITTLE GRAVEL	
	661.3	6.0	1	2	3	5		M			
660	658.8	8.5	WOH	2	6	8		M			
655	653.8	13.5	2	4	4	8		M			
650	648.8	18.5	4	7	5	12				647.0 WEATHERED ROCK	20.3
	646.5	20.8	60/0.0			60/0.0				646.8 WHITE AND GRAY, GRANITE Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 646.5 ft ON CRYSTALLINE ROCK: GRANITE	20.5
										AREA - D	

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB1-A	**STATION** 847+20	**OFFSET** 11 ft RT	**ALIGNMENT** -L-	**0 HR.** 29.1
COLLAR ELEV. 667.1 ft	**TOTAL DEPTH** 43.0 ft	**NORTHING** 557,407	**EASTING** 1,266,031	**24 HR.** 26.0
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/14/18	**COMP. DATE** 02/14/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.1 0.4' TOPSOIL	0.0
	666.1	1.0	2	1	1	2		M		**ROADWAY EMBANKMENT** BROWN TAN AND GRAY, SILTY SAND (A-2-4) WITH LITTLE GRAVEL AND TRACE ORGANICS (WOOD FRAGMENTS)	
665	663.6	3.5	2	2	2	4		M			
	661.1	6.0	2	4	3	7		M			
660	658.6	8.5	2	3	3	6		M			
655	653.6	13.5	6	20	6	26		M			
650	648.6	18.5	WOH	WOH	1	1		W		647.6 GRAY, FINE SANDY SILT (A-4)	19.5
645	643.6	23.5	1	1	2	3		W		645.1 BROWN, SILTY SANDY CLAY (A-6)	22.0
640	638.6	28.5	5	5	14	19		M		640.1 **ALLUVIAL** TAN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL	27.0
635	633.6	33.5	2	3	10	13		Sat.		637.1	30.0
630	628.6	38.5	1	5	100/0.3	100/0.3				636.1 1.0' GRAVEL LAYER	31.0
625	624.1	43.0	60/0.0			60/0.0				TAN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL 632.6 **RESIDUAL** WHITE AND TAN, SILTY SAND (A-2-4)	34.5
										627.6 **WEATHERED ROCK** ORANGE AND TAN, GRANITE	39.5
										624.1 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 624.1 ft ON CRYSTALLINE ROCK: GRANITE	43.0
										AREA - D	

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB1-C	**STATION** 847+15	**OFFSET** 38 ft RT	**ALIGNMENT** -L-	**0 HR.** 30.5
COLLAR ELEV. 667.5 ft	**TOTAL DEPTH** 44.5 ft	**NORTHING** 557,401	**EASTING** 1,266,004	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/28/18	**COMP. DATE** 03/28/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.5 GROUND SURFACE	0.0
	666.5	1.0								666.0 1.1' BITUMINOUS CONCRETE 0.4' AGGREGATE COURSE BASE	1.5
665	664.0	3.5	6	3	3	6		M		664.5 **ROADWAY EMBANKMENT** RED-BROWN, SILTY CLAYEY SAND (A-2-6) WITH LITTLE GRAVEL TAN AND RED, SILTY SAND (A-2-4) WITH LITTLE GRAVEL	3.0
	661.5	6.0	2	3	3	6		M			
660	659.0	8.5	2	2	2	4		M			
			1	2	1	3		W		655.5 RED-TAN, SANDY CLAYEY SILT (A-5) WITH LITTLE GRAVEL	12.0
655	654.0	13.5	WOH	1	2	3		W			
650	649.0	18.5	2	2	3	5		W		650.5 **ALLUVIAL** TAN, SILTY SAND (A-2-4) WITH TRACE ORGANICS AND GRAVEL	17.0
645	644.0	23.5	WOH	WOH	WOH	0		W		645.5 BROWN, SANDY SILTY CLAY (A-7)	22.0
640	639.0	28.5	6	100/0.4		100/0.4		W		638.5 **WEATHERED ROCK** TAN, GRANITE	29.0
635	634.0	33.5	8	24	25	49		W		636.5 **RESIDUAL** TAN AND WHITE, SLIGHTLY FINE TO COARSE SAND (A-1-b)	31.0
630	629.0	38.5	5	10	14	24		W		630.5 TAN, SILTY SAND (A-2-4)	37.0
625	624.0	43.5	2	100/0.5		100/0.5				623.5 **WEATHERED ROCK** TAN, GRANITE Boring Terminated at Elevation 623.0 ft IN WEATHERED ROCK: GRANITE AREA - D	44.0 44.5

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB1-B	**STATION** 847+23	**OFFSET** 78 ft RT	**ALIGNMENT** -L-	**0 HR.** 23.8
COLLAR ELEV. 655.9 ft	**TOTAL DEPTH** 34.1 ft	**NORTHING** 557,377	**EASTING** 1,265,971	**24 HR.** 16.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/27/18	**COMP. DATE** 03/27/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
660											
655	654.9	1.0								655.9 GROUND SURFACE	0.0
			1	2	1	3		M		655.3 0.6' TOPSOIL	0.6
	652.4	3.5				7		M		**ROADWAY EMBANKMENT** TAN-BROWN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL AND TRACE WOOD FRAGMENTS	
650	649.9	6.0	1	3	4			M			
			2	5	4	9		M		647.9 **ALLUVIAL** BROWN, SANDY SILT (A-4) WITH TRACE GRAVEL	8.0
	647.4	8.5	1	2	1	3		M		643.9 TAN-BROWN, SANDY SILTY CLAY (A-7)	12.0
645	642.4	13.5									
640			2	2	2	4		M			
	637.4	18.5								638.9 TAN-BROWN, SILTY SAND (A-2-4) WITH LITTLE GRAVEL	17.0
635			8	6	5	11		M			
	632.4	23.5								633.8 **WEATHERED ROCK** TAN, GRANITE	22.1
630			59	41/0.3		100/0.8					
	627.4	28.5	100/0.4			100/0.4					
625											
	622.4	33.5	85	15/0.1		100/0.6				621.8 Boring Terminated at Elevation 621.8 ft IN WEATHERED ROCK: GRANITE AREA - D	34.1

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B1-A	**STATION** 848+45	**OFFSET** 27 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 634.3 ft	**TOTAL DEPTH** 19.4 ft	**NORTHING** 557,286	**EASTING** 1,266,067	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** Wash Boring	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/27/18	**COMP. DATE** 03/28/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
635	634.3	0.0	4	2	8	10		Sat.		634.3 GROUND SURFACE	0.0
										634.2 0.1' BITUMINOUS CONCRETE	0.1
										633.6 0.6' CONCRETE	0.7
630	629.3	5.0	70	30/0.1		100/0.6				631.8 **ALLUVIAL** TAN-BROWN, FINE TO COARSE SAND (A-1-b) (W/ CASING ADVANCER SET CASING TO 5')	2.5
										WEATHERED ROCK TAN, GRANITE (W/ CASING ADVANCER SET CASING TO 10')	
625	624.3	10.0	13	39	34	73		W		625.3 **RESIDUAL** TAN-BROWN, SILTY SAND (A-2-4) (W/ CASING ADVANCER SET CASING TO 14.8')	9.0
620	619.5	14.8	100/0.3			100/0.3				621.8 **WEATHERED ROCK** TAN, GRANITE	12.5
615	614.9	19.4	60/0.0			60/0.0				614.9 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 614.9 ft ON CRYSTALLINE ROCK: GRANITE AREA - D	19.4

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B1-C	**STATION** 848+20	**OFFSET** 55 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.5
COLLAR ELEV. 640.6 ft	**TOTAL DEPTH** 16.7 ft	**NORTHING** 557,298	**EASTING** 1,266,031	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 04/02/18	**COMP. DATE** 04/02/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
645											
640	639.6	1.0	50	6	6	12		M		640.6 LOOSE SAND/HR BOULDERS/RIP RAP	0.0
	637.1	3.5	6	7	7	14		M		**ALLUVIAL** TAN, FINE SAND (A-3) WITH TRACE MICA, LITTLE BOULDERS AND COBBLES, AND LITTLE GRAVEL	
635	632.1	8.5	10	16	5	21		Sat.			
630	627.1	13.5	6	18	6	24		W		626.6 **RESIDUAL** TAN-BROWN, SILTY SAND (A-2-4)	14.0
625	623.9	16.7	60/0.0			60/0.0				625.5 **WEATHERED ROCK** TAN, GRANITE	15.1
										623.9 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 623.9 ft ON CRYSTALLINE ROCK: GRANITE AREA - D	16.7

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B1-B	**STATION** 848+32	**OFFSET** 76 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 638.6 ft	**TOTAL DEPTH** 34.5 ft	**NORTHING** 557,278	**EASTING** 1,266,017	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** Wash Boring	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 04/02/18	**COMP. DATE** 04/02/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
640											
	638.6	0.0	WOH	1	2	3		M		638.6 GROUND SURFACE	0.0
635	635.1	3.5	5	4	2	6		Sat.		**ALLUVIAL** TAN, FINE SAND (A-3) WITH TRACE ORGANICS	
630										635.6 TAN, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b) WITH LITTLE GRAVEL AND TRACE ORGANICS	3.0
	628.2	10.4	1	2	1	3		Sat.			
625	623.2	15.4	1	2	2	4		Sat.		623.2 **RESIDUAL** TAN, SILTY SAND (A-2-4) WITH LITTLE MICA	15.4
620	618.2	20.4								618.4	20.2
	617.8	20.8	100/0.2 60/0.0			100/0.2 60/0.0				617.8 **WEATHERED ROCK** TAN, GRANITE	20.8
615										**CRYSTALLINE ROCK** LIGHT GRAY, GRANITE	
610											
605										604.1	34.5
										Boring Terminated at Elevation 604.1 ft IN CRYSTALLINE ROCK: GRANITE	
										AREA - D	

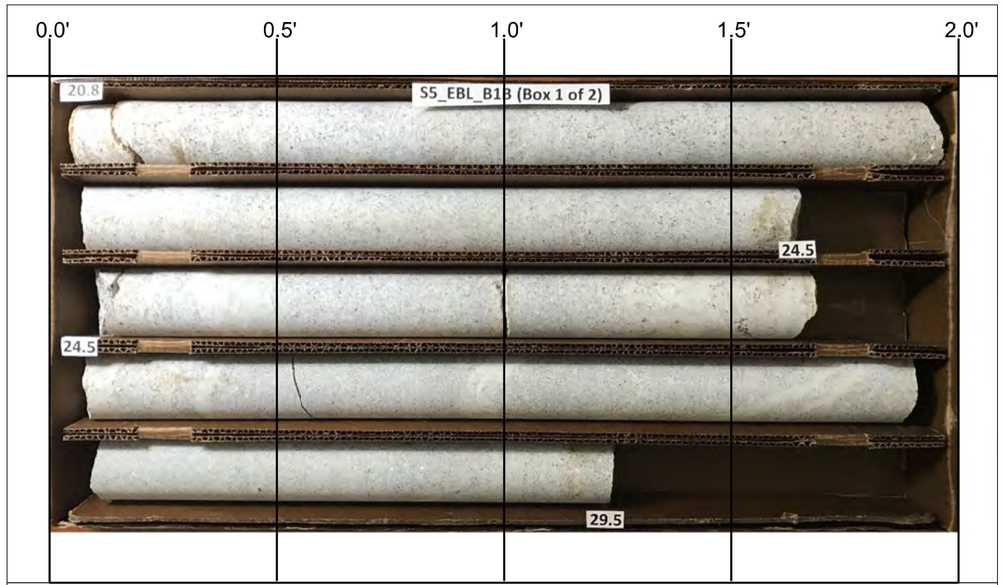
NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
CORE LOG

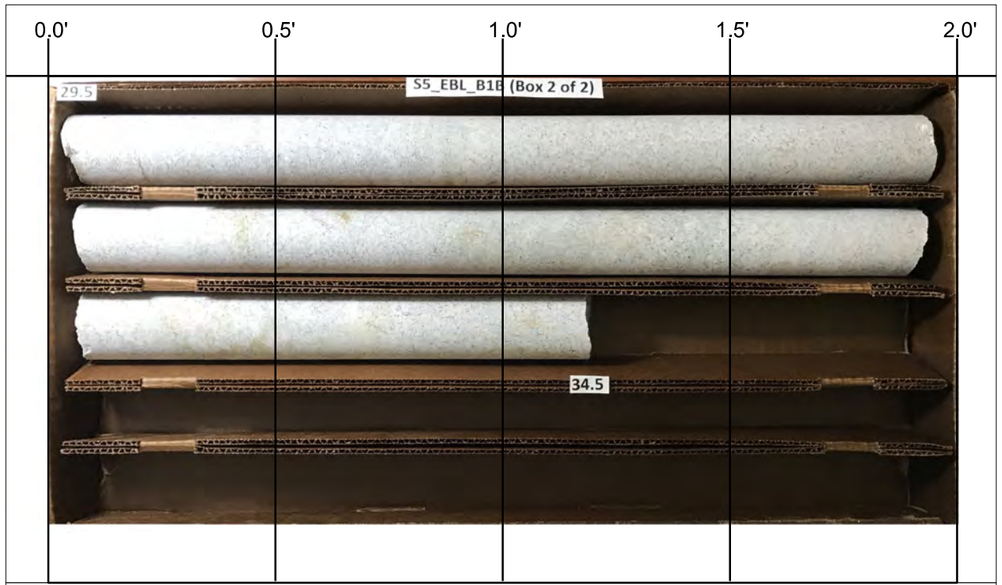
WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)			**GROUND WTR (ft)**
BORING NO. S6_EBL_B1-B	**STATION** 848+32	**OFFSET** 76 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 638.6 ft	**TOTAL DEPTH** 34.5 ft	**NORTHING** 557,278	**EASTING** 1,266,017	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** Wash Boring	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 04/02/18	**COMP. DATE** 04/02/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 13.7 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
617.76											Begin Coring @ 20.8 ft	
	617.8	20.8	3.7	1:13/1.0 1:11/1.0 1:05/1.0 1:20/0.7	(3.7) 100%	(3.6) 97%		(13.6) 99%	(13.5) 99%		617.8 **CRYSTALLINE ROCK** VERY SLIGHT WEATHERING TO FRESH, HARD TO VERY HARD, LIGHT GRAY, GRANITE WITH MODERATELY CLOSE TO WIDE FRACTURE SPACING	20.8
615	614.1	24.5	5.0	1:17/1.0 1:21/1.0 1:25/1.0 1:48/1.0 1:35/1.0	(4.9) 98%	(4.9) 98%						
610	609.1	29.5	5.0	1:48/1.0 1:36/1.0 1:45/1.0 1:38/1.0 1:50/1.0	(5.0) 100%	(5.0) 100%						
605	604.1	34.5									604.1 Boring Terminated at Elevation 604.1 ft IN CRYSTALLINE ROCK: GRANITE AREA - D	34.5

NCDOT CORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22



BORING S6_EBL_B1-B, BOX 1 OF 2, 20.8 FEET TO 29.5 FEET.



BORING S6_EBL_B1-B, BOX 2 OF 2, 29.5 FEET TO 34.5 FEET.

0 4" 8"
INCHES

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513
PHONE: 919.871.0800

ROCK CORE PHOTOGRAPHS

STRUCTURES #5&6 - DUAL BRIDGES OVER
BUFFALO CREEK ON US 74 BETWEEN
SR 2325 AND SR 2238
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B2-A	**STATION** 849+82	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 6.0
COLLAR ELEV. 647.8 ft	**TOTAL DEPTH** 12.0 ft	**NORTHING** 557,172	**EASTING** 1,266,136	**24 HR.** 5.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/22/18	**COMP. DATE** 03/22/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650											
	646.8	1.0	WOH	WOH	1	1		M		647.8 GROUND SURFACE	0.0
645	644.3	3.5	WOH	WOH	1	1				647.2 0.6' TOPSOIL	0.6
	641.8	6.0	WOH	1	1	2		M		**ALLUVIAL** TAN-BROWN AND GRAY, FINE SANDY SILT (A-4) WITH TRACE ORGANICS, LITTLE MICA, AND INTERMITTENT LENSES OF SAND	
640	639.3	8.5	WOH	25	75/0.3	100/0.8				638.8	9.0
	635.8	12.0	60/0.0			60/0.0				TAN, GRANITE	
										635.8 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 635.8 ft ON CRYSTALLINE ROCK: GRANITE	12.0
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B2-C	**STATION** 849+76	**OFFSET** 42 ft RT	**ALIGNMENT** -L-	**0 HR.** 12.0
COLLAR ELEV. 647.9 ft	**TOTAL DEPTH** 13.4 ft	**NORTHING** 557,160	**EASTING** 1,266,106	**24 HR.** 3.3
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650											
	646.9	1.0	1	3	3	6		M		647.9 GROUND SURFACE	0.0
645	644.4	3.5	1	2	2	4				647.4 0.5' TOPSOIL	0.5
	641.9	6.0	1	1	1	2		M		**ALLUVIAL** 644.9 BROWN, SANDY SILT (A-4) WITH LITTLE MICA	3.0
640	639.4	8.5	1	2	5	7				LIGHT GRAY, FINE SANDY SILTY CLAY (A-7) WITH TRACE ORGANICS	
	634.5	13.4	60/0.0			60/0.0				637.9	10.0
										WEATHERED ROCK TAN, GRANITE	
										634.5 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 634.5 ft ON CRYSTALLINE ROCK: GRANITE	13.4
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_B2-B	**STATION** 849+73	**OFFSET** 69 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.9
COLLAR ELEV. 647.6 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 557,152	**EASTING** 1,266,080	**24 HR.** 3.3
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
650										647.6 GROUND SURFACE	0.0
	646.6	1.0								647.1 0.5' TOPSOIL	0.5
645			2	2	1	3				**ALLUVIAL**	
	644.1	3.5								644.6 TAN-BROWN, SANDY SILT (A-4) WITH LENSES OF SAND	3.0
			WOH	WOH	1	1		W		642.1 GRAY-TAN, FINE SANDY SILTY CLAY (A-7) WITH TRACE ROOTLETS	5.5
	641.6	6.0								639.6 LIGHT GRAY, CLAYEY SILTY SAND (A-2-5)	8.0
640			2	2	2	4		M		637.4 TAN AND GRAY, SILTY FINE SAND (A-2-4)	10.2
	639.1	8.5								**RESIDUAL**	
			3	4	5	9		M		633.6 TAN, SILTY SAND (A-2-4) WITH LITTLE ROCK FRAGMENTS	14.0
635	634.1	13.5								632.8 **WEATHERED ROCK** TAN, GRANITE	14.8
	632.8	14.8	5	100/0.4		100/0.4				**CRYSTALLINE ROCK** LIGHT GRAY, GRANITE	
			60/0.0			-60/0.0					
630											
625										622.6	25.0
										Boring Terminated at Elevation 622.6 ft IN CRYSTALLINE ROCK: GRANITE	
										AREA - D	

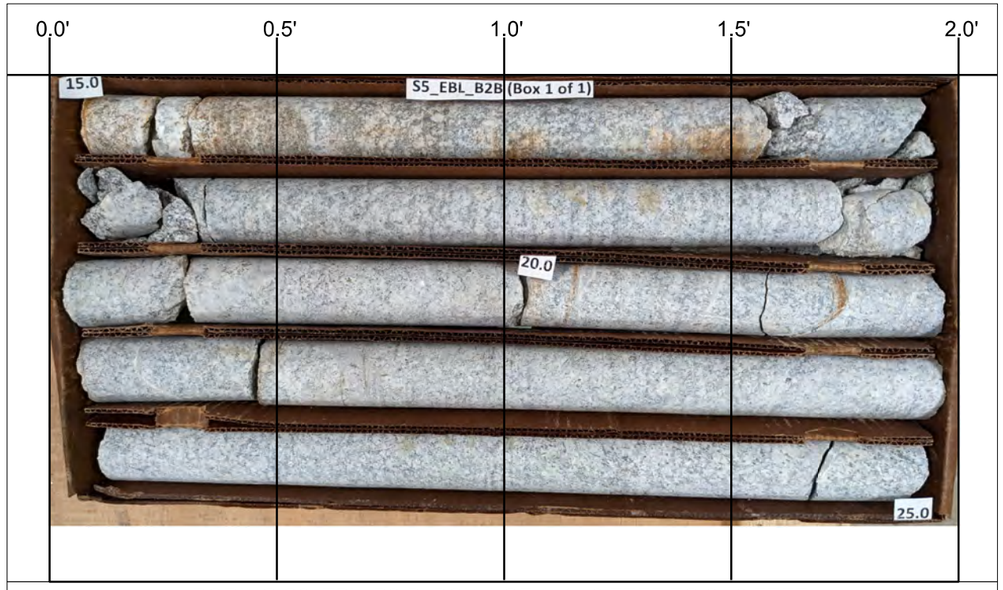
NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)			**GROUND WTR (ft)**
BORING NO. S6_EBL_B2-B	**STATION** 849+73	**OFFSET** 69 ft RT	**ALIGNMENT** -L- **0 HR.** 4.9
COLLAR ELEV. 647.6 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 557,152	**EASTING** 1,266,080 **24 HR.** 3.3
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A
CORE SIZE N/A	**TOTAL RUN** 10.0 ft		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
632.55											Begin Coring @ 15.0 ft	
	632.6	15.0	5.0	3:05/1.0	(4.9)	(4.6)		(9.9)	(9.6)		**CRYSTALLINE ROCK**	
630				3:09/1.0	98%	92%		99%	96%		VERY SLIGHT WEATHERING TO FRESH, HARD TO VERY HARD, LIGHT GRAY, GRANITE WITH MOD. CLOSE TO WIDE FRACTURE SPACING.	
				3:41/1.0								
				4:41/1.0								
	627.6	20.0		2:49/1.0								
			5.0	1:46/1.0	(5.0)	(5.0)						
625				2:05/1.0	100%	100%						
				2:33/1.0								
				2:38/1.0								
	622.6	25.0		3:16/1.0							622.6	25.0
											Boring Terminated at Elevation 622.6 ft IN CRYSTALLINE ROCK: GRANITE	
											AREA - D	

NCDOT CORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22



BORING S6_EBL_B2-B, BOX 1 OF 1, 15.0 FEET TO 25.0 FEET.

0 4" 8"
INCHES

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513
PHONE: 919.871.0800

ROCK CORE PHOTOGRAPHS

STRUCTURES #5&6 - DUAL BRIDGES OVER
BUFFALO CREEK ON US 74 BETWEEN
SR 2325 AND SR 2238
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB2-A	**STATION** 850+52	**OFFSET** 13 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 667.8 ft	**TOTAL DEPTH** 23.4 ft	**NORTHING** 557,103	**EASTING** 1,266,163	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/16/18	**COMP. DATE** 02/16/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.8	0.0
	666.8	1.0	3	4	6	10		M		0.4' TOPSOIL	
665										**ROADWAY EMBANKMENT** TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL	
	664.3	3.5	3	4	3	7		M		664.8	3.0
	661.8	6.0	2	2	2	4		M		TAN AND GRAY, SANDY CLAY (A-6) WITH LITTLE GRAVEL	
660										662.3	5.5
	659.3	8.5	WOH	1	1	2		M		TAN, SILTY SAND (A-2-4) WITH TRACE TO LITTLE GRAVEL	
655	654.3	13.5	2	1	2	3		M			
650	649.3	18.5	2	1	1	2		W		649.8 TAN, SANDY SILTY CLAY (A-7) WITH LITTLE GRAVEL	18.0
645	644.4	23.4	60/0.0			60/0.0				645.8 **WEATHERED ROCK** 644.4 TAN, GRANITE	22.0 23.4
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 644.4 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB2-C	**STATION** 850+52	**OFFSET** 39 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 667.7 ft	**TOTAL DEPTH** 22.8 ft	**NORTHING** 557,092	**EASTING** 1,266,140	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 03/28/18	**COMP. DATE** 03/28/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670											
										667.7 GROUND SURFACE	0.0
	666.7	1.0	10	9	6	15		M		666.2 1.0' BITUMINOUS CONCRETE 0.5' AGGREGATE BASE COURSE	1.5
665										**ROADWAY EMBANKMENT** GRAY AND TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL AND MICA	
	664.2	3.5	3	3	3	6		M			
	661.7	6.0	4	2	2	4		M			
660	659.2	8.5	11	3	3	6		M			
655	654.2	13.5	4	2	2	4		M		655.7 **ALLUVIAL** GRAY AND TAN, CLAYEY SILTY SAND (A-2-5) WITH TRACE WOOD FRAGMENTS	12.0
650	649.2	18.5	1	2	4	6		M		650.7 **RESIDUAL** RED-TAN, SILTY CLAYEY SAND (A-2-6) WITH LITTLE MICA	17.0
645	645.0	22.7	60/0.1			60/0.1				646.2 645.0 **WEATHERED ROCK** 644.9 TAN, GRANITE **CRYSTALLINE ROCK** TAN, GRANITE	21.5 22.7 22.8
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 644.9 ft IN CRYSTALLINE ROCK: GRANITE	
										AREA - D	

NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 12/30/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #5 - BRIDGE OVER BUFFALO CREEK ON US 74 BETWEEN SR 2325 AND SR 2238 (RIGHT LANE)				**GROUND WTR (ft)**
BORING NO. S6_EBL_EB2-B	**STATION** 850+54	**OFFSET** 83 ft RT	**ALIGNMENT** -L-	**0 HR.** 11.1
COLLAR ELEV. 653.8 ft	**TOTAL DEPTH** 15.9 ft	**NORTHING** 557,073	**EASTING** 1,266,100	**24 HR.** 7.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 03/23/18	**COMP. DATE** 03/23/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
655										653.8	0.0
										0.4' TOPSOIL	
	652.8	1.0								**ARTIFICIAL FILL**	
			1	2	2	4		M		TAN-BROWN, SILTY SAND (A-2-4) WITH TRACE MICA	
650	650.3	3.5								650.8	3.0
			4	11	28	39		M		**RESIDUAL**	
	647.8	6.0								TAN, SILTY SAND (A-2-4) SAPROLITIC	
			21	17	13	30					
645	645.3	8.5								645.8	8.0
			100/0.2			100/0.2				**WEATHERED ROCK**	
										TAN, GRANITE	
640	640.3	13.5									
			100/0.2			100/0.2					
	637.9	15.9								637.9	15.9
			60/0.0			60/0.0				Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 637.9 ft ON CRYSTALLINE ROCK: GRANITE	
										AREA - D	

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	12

REFERENCE: R-2707D

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *STRUCTURE #1 – BRIDGE OVER US 74 BYPASS ON SR 2067 (FAIRVIEW RD.) BETWEEN SR 2052 (ELIZABETH AVENUE) AND NC 150 (CHERRYVILLE RD.)*

CONTENTS

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.

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.

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NOTES:
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2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *HILL, M.J.*

CHECKED BY *HUNSBERGER, W.S.*

SUBMITTED BY *FALCON ENG.*

DATE *APRIL 2018*

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAAS

4/6/18

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N 02

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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: BL-149 N: 573599.52 E: 1259358.58

ELEVATION: 884.28 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

DATE: 9-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

0 30 60
FEET

667+00
666+00
665+00

19+00
20+00
21+00

END BENT #1
STATION 18+82.63 (Y1)

BENT #1
STATION 19+82.46 (Y1)

END BENT #2
STATION 20+80.38 (Y1)

S1_EB1-A
S1_B1-A
S1_EB2-A

STRUCTURE #1

-Y1-

105°40'7"

S1_EB1-B
S1_B1-B
S1_EB2-B

-L-

NC GRID
NAD 83 NA 2011

DATE: 9-15-14

0	100	200

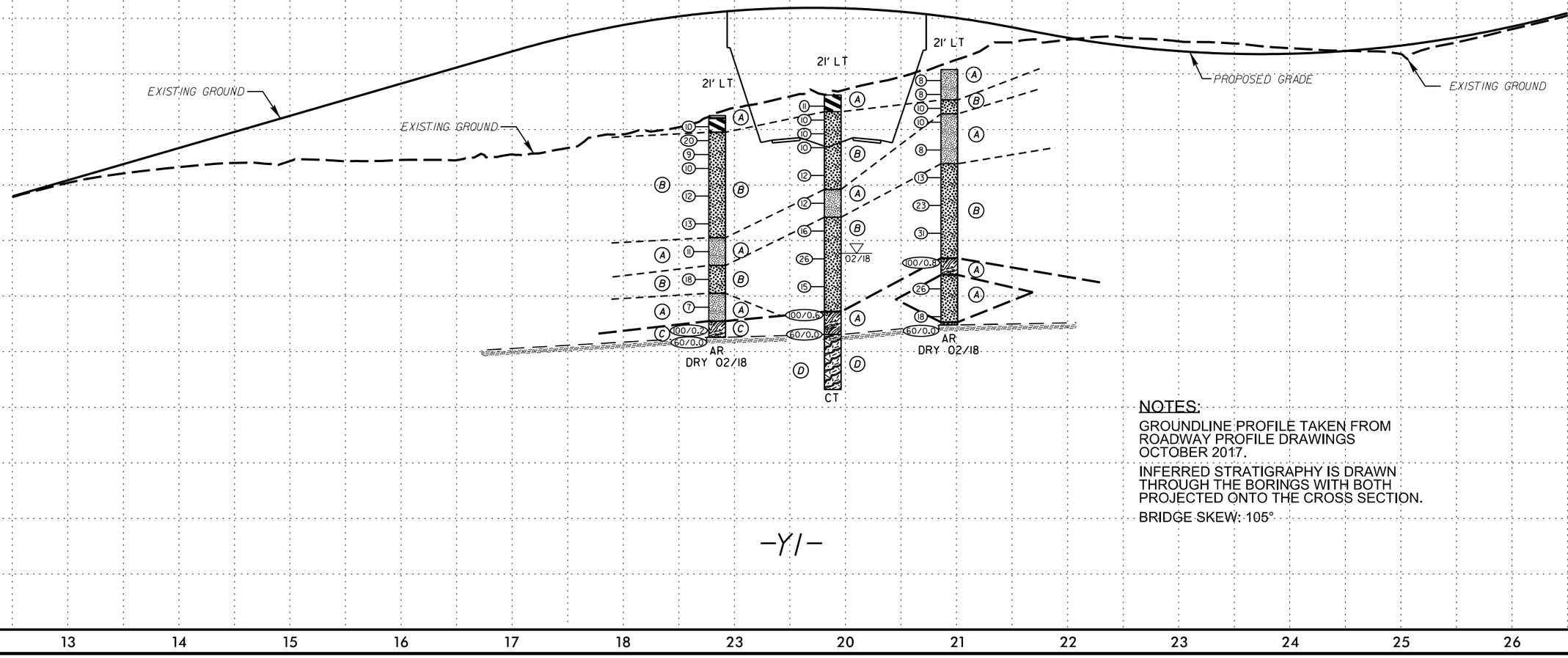
FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

STRUCTURE #1, BRIDGE OVER US 74 BYPASS ON SR 2052 ELIZABETH AVE.

(A) **RESIDUAL:** TANAND RED, MOIST, MED. STIFF TO STIFF, SANDY SILT AND SANDY SILTY CLAY WITH SOME MICA
(B) **RESIDUAL:** TAN AND RED, MOIST, LOOSE TO DENSE, SILTY SAND, WITH LITTLE MICA AND TRACE ROCK FRAGMENTS
(C) **WEATHERED ROCK:** TAN GRAY AND BROWN, BIOTITE GNEISS GRANITE AND META-MORPHOSED GRANITE
(D) **CRYSTALLINE ROCK:** PINK AND GRAY, META-MORPHOSED GRANITE



NOTES:

GROUNDLINE PROFILE TAKEN FROM ROADWAY PROFILE DRAWINGS OCTOBER 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 105°

-Y/-

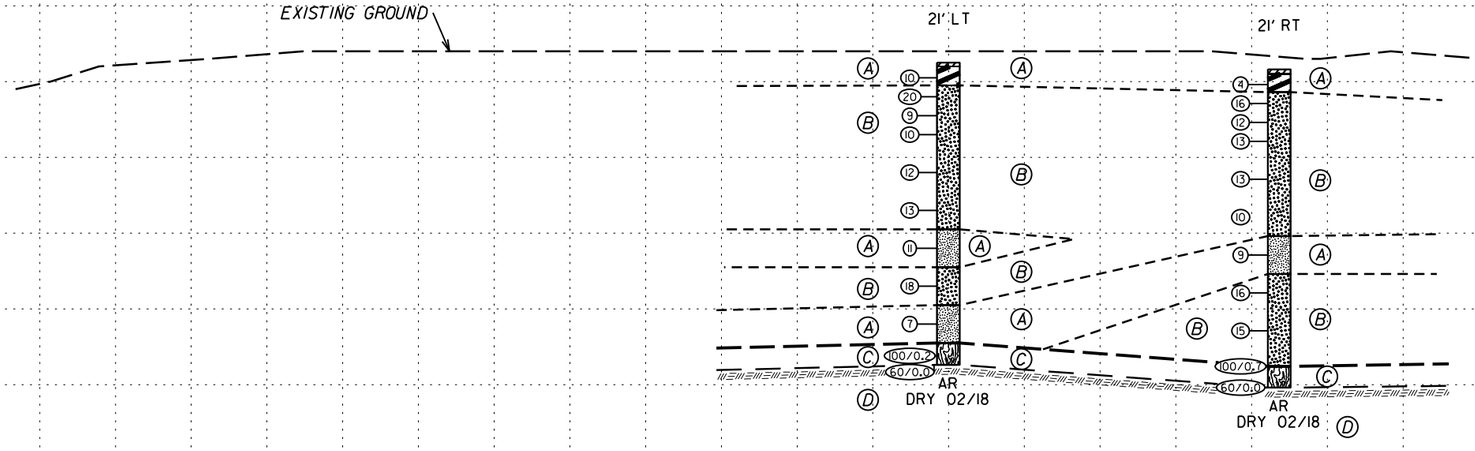
8/23/99

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	5

0 5 10

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN RED AND BROWN, MOIST, SOFT TO STIFF, SANDY SILTY CLAY AND SANDY SILT WITH SOME MIICA
Ⓑ **RESIDUAL:** TAN AND RED, MOIST, LOOSE TO MED. DENSE, SILTY SAND WITH LITTLE MICA AND TRACE ROCK FRAGMENTS
Ⓒ **WEATHERED ROCK:** TAN GRAY AND BROWN, BIOTITE GNEISS AND META-MORPHOSED GRANITE
Ⓓ **CR:** META-MORPHOSED GRANITE



END BENT #1
18+82.63

-Y/-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 105°

$DATE$

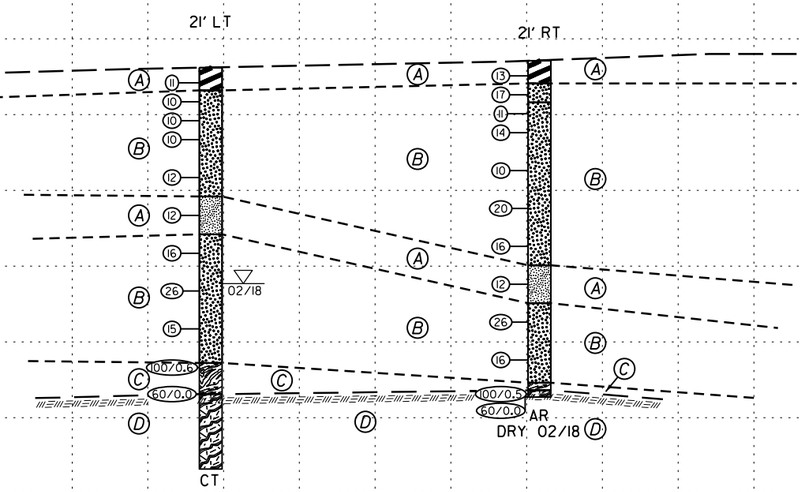
8/23/99

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	6

0 5 10

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN RED AND BROWN, MOIST, STIFF, SANDY SILTY CLAY AND SANDY SILT WITH SOME MICA
Ⓑ **RESIDUAL:** RED AND TAN, MOIST, MED. DENSE, SILTY SAND AND SILTY CLAYEY SAND WITH LITTLE TO SOME MICA
Ⓒ **WEATHERED ROCK:** TAN AND WHITE, MET-AMORPHOSED GRANITE AND GNEISS
Ⓓ **CR:** TAN GRAY PINK AND WHITE, MET-AMORPHOSED GRANITE AND GNEISS



BENT #1
19+82.46

-Y/-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 105°

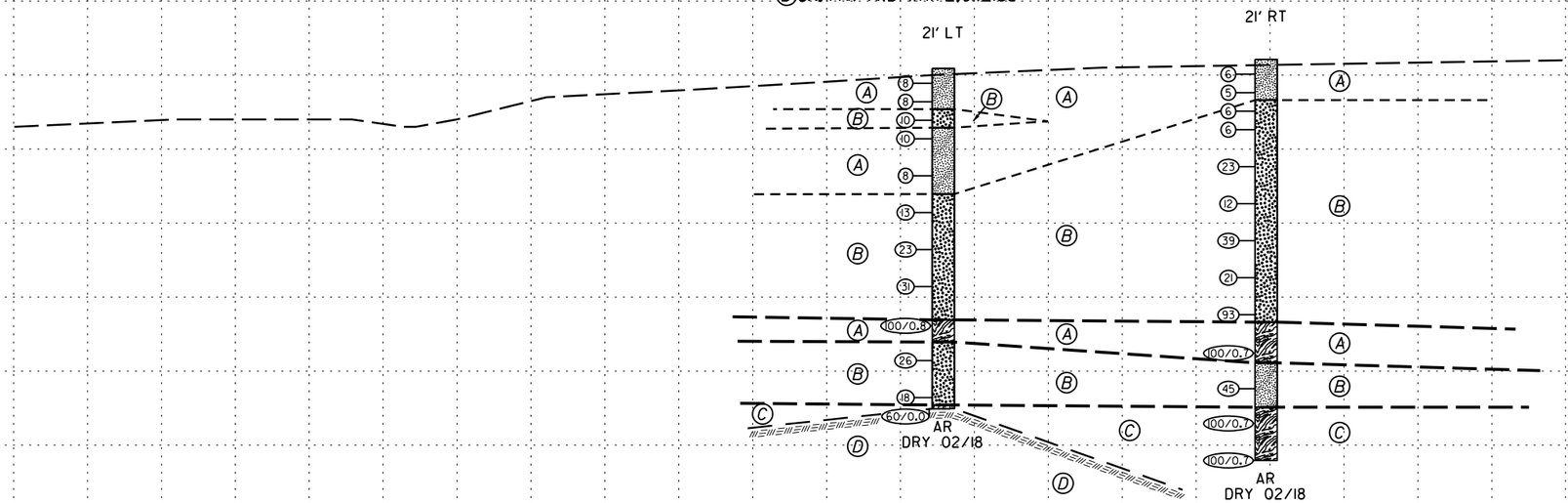
$DATE$

8/23/99

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	7

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN AND RED, MOIST, MED. STIFF TO HARD, SANDY SILT WITH SOME TO LITTLE MICA
Ⓑ **RESIDUAL:** TAN AND GRAY, MOIST, LOOSE TO DENSE, SILTY SAND WITH SOME MICA
Ⓒ **WEATHERED ROCK:** TAN AND WHITE, GNEISS
Ⓓ **CR:** TAN AND WHITE, GNEISS



END BENT #2
20+80.38

–Y/–

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 105°

$DATE$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_EB1-A	**STATION** 18+84	**OFFSET** 21 ft LT	**ALIGNMENT** -Y1- (D)	**0 HR.** Dry
COLLAR ELEV. 882.7 ft	**TOTAL DEPTH** 39.9 ft	**NORTHING** 573,686	**EASTING** 1,259,464	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/09/18	**COMP. DATE** 02/09/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
885										
	882.7	0.0								882.7 / 0.0
	882.2	0.5								0.5' TOPSOIL
										RESIDUAL
880	881.7	1.0	2	3	7	10		M		879.7 / 3.0 TAN AND RED, SANDY SILTY CLAY (A-7)
	879.2	3.5	6	10	10	20		M		TAN AND RED, SILTY SAND (A-2-4) WITH LITTLE MICA AND TRACE ROCK FRAGMENTS
	876.7	6.0	6	5	4	9		M		
875	874.2	8.5	4	5	5	10		M		
870	869.2	13.5	4	6	6	12		M		
865	864.2	18.5	4	5	8	13		M		
860	859.2	23.5	3	4	7	11		M		860.7 / 22.0 TAN, SANDY SILT (A-4) WITH SOME MICA
855	854.2	28.5	6	9	9	18		M		855.7 / 27.0 TAN, SILTY SAND (A-2-4)
850	849.2	33.5	3	3	4	7		M		850.7 / 32.0 TAN, SANDY SILT (A-4) HIGHLY MICACEOUS
845	844.2	38.5	100/0.2			100/0.2				845.7 / 37.0 **WEATHERED ROCK**
	842.8	39.9	60/0.0			60/0.0				TAN AND GRAY, METAMORPHOSED GRANITIC ROCK
										842.8 / 39.9 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 842.8 ft ON CRYSTALLINE ROCK: METAMORPHOSED GRANITIC ROCK

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_EB1-B	**STATION** 18+72	**OFFSET** 21 ft RT	**ALIGNMENT** -Y1- (D)	**0 HR.** Dry
COLLAR ELEV. 881.6 ft	**TOTAL DEPTH** 42.0 ft	**NORTHING** 573,729	**EASTING** 1,259,467	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/09/18	**COMP. DATE** 02/09/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
885										
	881.6	0.0								881.6 / 0.0
	881.0	0.6								0.6' TOPSOIL
										RESIDUAL
880	880.6	1.0	4	2	2	4		M		878.6 / 3.0 RED AND BROWN, SANDY SILTY CLAY (A-7)
	878.1	3.5	5	7	9	16		M		TAN AND RED, SILTY SAND (A-2-4)
	875.6	6.0	5	5	7	12		M		
875	873.1	8.5	5	6	7	13		M		
870	868.1	13.5	5	6	7	13		M		
865	863.1	18.5	3	4	6	10		M		
860	858.1	23.5	4	4	5	9		M		859.6 / 22.0 TAN, SANDY SILT (A-4) WITH SOME MICA
855	853.1	28.5	6	8	8	16		M		854.6 / 27.0 TAN, SILTY SAND (A-2-4)
850	848.1	33.5	5	8	7	15		M		
845	843.1	38.5	25	75/0.2		100/0.7				842.4 / 39.2 **WEATHERED ROCK**
840	839.6	42.0	60/0.0			60/0.0				BROWN AND GRAY, BIOTITE GNEISS
										839.6 / 42.0 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 839.6 ft ON CRYSTALLINE ROCK: BIOTITE GNEISS

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_B1-A	**STATION** 19+88	**OFFSET** 21 ft LT	**ALIGNMENT** -Y1- (D)	**0 HR.** 28.5
COLLAR ELEV. 886.4 ft	**TOTAL DEPTH** 53.0 ft	**NORTHING** 573,676	**EASTING** 1,259,362	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/06/18	**COMP. DATE** 02/08/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
890											
										886.4	0.0
										0.4' TOPSOIL	
885	885.4	1.0	4	5	6	11				**RESIDUAL** TAN AND RED, SANDY SILTY CLAY (A-7)	
	882.9	3.5	3	5	5	10		M		883.4	3.0
880	880.4	6.0	4	4	6	10		M		RED AND TAN, SILTY SAND (A-2-4)	
	877.9	8.5	3	5	5	10		M			
875											
	872.9	13.5	4	6	6	12		M		869.4	17.0
870										TAN, SANDY SILT (A-4) WITH SOME MICA	
	867.9	18.5	3	6	6	12		M		864.4	22.0
865											
	862.9	23.5	11	9	7	16		M		TAN, SILTY SAND (A-2-4) WITH SOME MICA	
860											
	857.9	28.5	5	9	17	26		M			
855											
	852.9	33.5	4	7	8	15		M			
850											
	847.9	38.5	22	23	77/0.1	100/0.6				847.4	39.0
845										**WEATHERED ROCK** TAN AND WHITE, METAMORPHOSED GRANITIC ROCK	
	843.3	43.1	60/0.0			60/0.0				843.3	43.1
840										**CRYSTALLINE ROCK** PINK AND GRAY, METAMORPHOSED GRANITIC ROCK	
835										833.4	53.0
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 833.4 ft ON CRYSTALLINE ROCK: METAMORPHOSED GRANITIC ROCK	

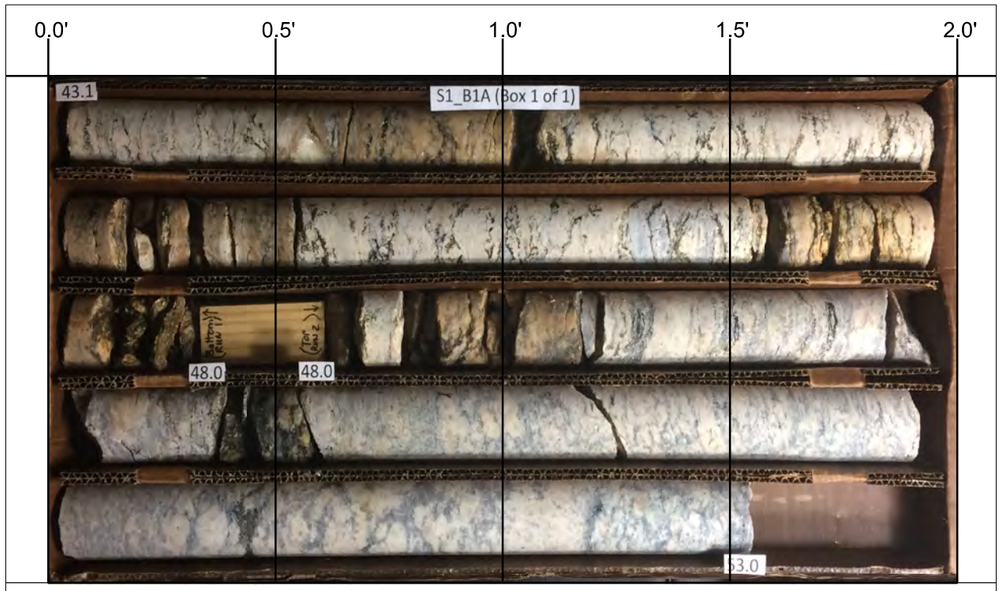
NCDOT BORE DOUBLE R2707_GEO_BORINGS - COPY.GPJ NC_DOT.GDT 3/23/18

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_B1-A	**STATION** 19+88	**OFFSET** 21 ft LT	**ALIGNMENT** -Y1- (D)	**0 HR.** 28.5
COLLAR ELEV. 886.4 ft	**TOTAL DEPTH** 53.0 ft	**NORTHING** 573,676	**EASTING** 1,259,362	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/06/18	**COMP. DATE** 02/08/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 9.9 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
843.3											Begin Coring @ 43.1 ft	
	843.3	43.1	4.9	2.04/1.0 1.15/1.0 0.54/1.0 1.42/1.0	(4.2) 86%	(3.0) 61%		(9.0) 91%	(7.0) 71%		843.3 **CRYSTALLINE ROCK** VERY SLIGHT WEATHERING TO FRESH, HARD TO VERY HARD, PINK AND GRAY, METAMORPHOSED GRANITIC ROCK WITH CLOSE TO MODERATELY CLOSE FRACTURE SPACING *MOSTLY MECHANICAL BREAKS *MORE WEATHERED AND FRACTURED WITHIN MICA-RICH ZONES	43.1
840												
	838.4	48.0										
			5.0	0.56/0.9 2.04/1.0 4.28/1.0 5.11/1.0 6.24/1.0	(4.8) 96%	(4.0) 80%						
835												
	833.4	53.0		9.45/1.0							833.4 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 833.4 ft ON CRYSTALLINE ROCK: METAMORPHOSED GRANITIC ROCK	53.0

NCDOT CORE DOUBLE R2707_GEO_BORINGS - COPY.GPJ NC_DOT.GDT 3/23/18



BORING S1_B1-A, BOX 1 OF 1, 43.1 FEET TO 53.0 FEET.

0 4" 8"
INCHES

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607

PHONE: 919.871.0800
FAX: 919.871.0803

ROCK CORE PHOTOGRAPHS

STRUCTURE #1 - BRIDGE OVER US 74 BYPASS ON SR 2067 (FAIRVIEW. RD.) BETWEEN SR 2052 (ELISABETH AVE.) AND NC 150 (CHERRYVILLE RD.)
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_B1-B	**STATION** 19+77	**OFFSET** 21 ft RT	**ALIGNMENT** -Y1- (D)	**0 HR.** Dry
COLLAR ELEV. 887.3 ft	**TOTAL DEPTH** 44.4 ft	**NORTHING** 573,703	**EASTING** 1,259,362	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/06/18	**COMP. DATE** 02/06/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
890										887.3	0.0
										0.3' TOPSOIL	
	886.3	1.0								**RESIDUAL**	
885			4	6	7	13		M		RED AND BROWN, SANDY SILTY CLAY (A-7)	
	883.8	3.5								884.3	3.0
			6	7	10	17		M		TAN AND RED, SILTY CLAYEY SAND (A-2-5)	
	881.3	6.0								881.8	5.5
880			5	5	6	11		M		TAN, SILTY SAND (A-2-4) WITH LITTLE MICA	
	878.8	8.5									
			5	6	8	14		M			
875											
	873.8	13.5									
			4	4	6	10		M			
870											
	868.8	18.5									
			7	9	11	20		M			
865											
	863.8	23.5									
			5	7	9	16		M			
860										860.3	27.0
	858.8	28.5								TAN, SANDY SILT (A-4) WITH SOME MICA	
			4	5	7	12		M			
855										855.3	32.0
	853.8	33.5								TAN, SILTY SAND (A-2-4)	
			11	14	12	26		M			
850											
	848.8	38.5									
			16	10	6	16		M			
845										844.8	42.5
	843.8	43.5								**WEATHERED ROCK**	
	842.9	44.4	100/0.5			100/0.5				WHITE AND TAN, GNEISS	44.4
			60/0.0			60/0.0				Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 842.9 ft ON CRYSTALLINE ROCK: GNEISS	

NCDOT BORE DOUBLE R2707_GEO_BORINGS - COPY.GPJ NC_DOT.GDT 4/6/18

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_EB2-A	**STATION** 20+93	**OFFSET** 21 ft LT	**ALIGNMENT** -Y1- (D)	**0 HR.** Dry
COLLAR ELEV. 890.3 ft	**TOTAL DEPTH** 46.0 ft	**NORTHING** 573,645	**EASTING** 1,259,259	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/06/18	**COMP. DATE** 02/06/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
895										
890	889.3	1.0	3	4	4	8		M		890.3 / 0.0 — 0.4' TOPSOIL
	886.8	3.5	3	4	4	8		M		**RESIDUAL** TAN AND RED, SANDY SILT (A-4) WITH LITTLE MICA
885	884.3	6.0	3	4	6	10		M		884.8 / 5.5 — TAN, SILTY SAND (A-2-4)
	881.8	8.5	3	5	5	10		M		882.3 / 8.0 — TAN, SANDY SILT (A-4) HIGHLY MICACEOUS
880	876.8	13.5	3	4	4	8		M		
875	871.8	18.5	4	6	7	13		M		873.3 / 17.0 — TAN, SILTY SAND (A-2-4)
870	866.8	23.5	6	11	12	23		M		
865	861.8	28.5	12	20	11	31		M		
860	856.8	33.5	8	46	54/0.3	100/0.8				856.3 / 34.0 — **WEATHERED ROCK** TAN, GNEISS
855	851.8	38.5	9	12	14	26		M		853.3 / 37.0 — **RESIDUAL** TAN, SILTY SAND (A-2-4) WITH SOME MICA
850	846.8	43.5	3	7	11	18		M		
845	844.3	46.0	60/0.0			60/0.0				844.8 / 45.5 — 844.3 / 46.0 — **WEATHERED ROCK** TAN WHITE AND GRAY, GNEISS
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 844.3 ft ON CRYSTALLINE ROCK: GNEISS

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74 - SHELBY BYPASS				**GROUND WTR (ft)**
BORING NO. S1_EB2-B	**STATION** 20+81	**OFFSET** 21 ft RT	**ALIGNMENT** -Y1- (D)	**0 HR.** Dry
COLLAR ELEV. 891.6 ft	**TOTAL DEPTH** 54.2 ft	**NORTHING** 573,689	**EASTING** 1,259,263	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/06/18	**COMP. DATE** 02/06/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
895										
										891.6 / 0.0 — 0.3' TOPSOIL
890	890.6	1.0								**RESIDUAL** TAN AND RED, SANDY SILT (A-4)
	888.1	3.5	5	3	3	6		M		
885	885.6	6.0	4	3	2	5		M		886.1 / 5.5 — GRAY AND TAN, SILTY SAND (A-2-4) WITH LITTLE MICA
	883.1	8.5	3	3	3	6		M		
880	878.1	13.5	2	3	3	6		M		
875	873.1	18.5	7	11	12	23		M		
870	868.1	23.5	3	4	8	12		M		
865	863.1	28.5	6	9	30	39		M		
860	858.1	33.5	6	8	13	21		M		
855	853.1	38.5	7	45	48	93		M		856.1 / 35.5 — **WEATHERED ROCK** TAN, GNIESS
850	848.1	43.5	34	65	35/0.2	100/0.7				850.6 / 41.0 — **RESIDUAL** TAN, SANDY SILT (A-4) WITH SOME MICA
845	843.1	48.5	35	24	21	45		M		844.6 / 47.0 — **WEATHERED ROCK** TAN WHITE AND GRAY, GNEISS
840	838.1	53.5	38	62/0.2		100/0.7				837.4 / 54.2 — Boring Terminated at Elevation 837.4 ft IN WEATHERED ROCK: GNEISS
			74	26/0.2		100/0.7				

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	12

REFERENCE: R-2707D

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *STRUCTURE #2 – BRIDGE ON ELIZABETH AVE. (–Y2–) OVER US 74 BYPASS (–L–) BETWEEN SR 2067 (FAIRVIEW RD.) AND SR 2047 (BORDERS RD.)*

CONTENTS

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2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *CROCKETT, S.C.*

CHECKED BY *HUNSBERGER, W.S.*

SUBMITTED BY *FALCON ENG.*

DATE *AUGUST 2018*

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

DocuSigned by:
Jeremy R Hamm
ED7938089E22487...
8/24/2018 4:18:44 PM EDT

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q

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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: BL-152
STATION -L- POT 20+92.42, 48.06' RT
N: 571156.9, E: 1259127.9 ELEVATION: 900.20 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

0 30 60
FEET

NC GRID NAD 83/95

18+00
19+00
693+00
20+00
21+000
22+00

END BENT #1
STA. 19+16.80 (Y2)

BENT #1
STA. 20+16.72 (Y2)

END BENT #2
STA. 21+18.64 (Y2)

S2_EB1-A
S2_B1-A
S2_EB2-A

692+00
-Y2+
STRUCTURE #2

S2_EB1-B
S2_B1-B
S2_EB2-B

691+00
BL-152

BRIDGE SKEW: 72°55'55"

DATE: 9-15-14

0	100	200

FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

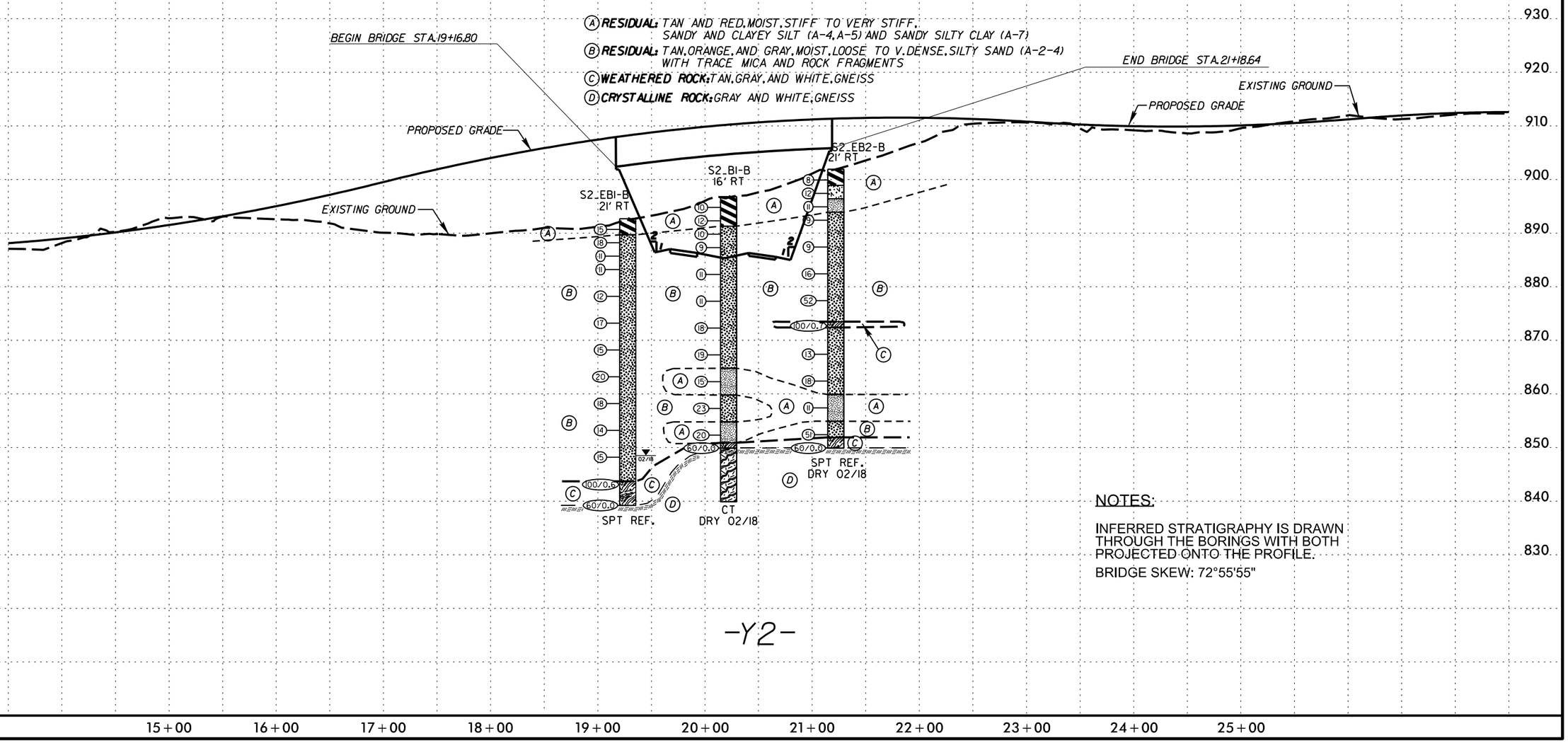
STRUCTURE #2– BRIDGE ON ELIZABETH AVE. (–Y2–) OVER US 74 BYPASS (–L–)

Ⓐ **RESIDUAL:** TAN AND RED, MOIST, STIFF TO VERY STIFF, SANDY AND CLAYEY SILT (A-4, A-5) AND SANDY SILTY CLAY (A-7)

Ⓑ **RESIDUAL:** TAN, ORANGE, AND GRAY, MOIST, LOOSE TO V. DENSE, SILTY SAND (A-2-4) WITH TRACE MICA AND ROCK FRAGMENTS

Ⓒ **WEATHERED ROCK:** TAN, GRAY, AND WHITE, GNEISS

Ⓓ **CRYSTALLINE ROCK:** GRAY AND WHITE, GNEISS



–Y2–

NOTES:

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

BRIDGE SKEW: 72°55'55"

0 5 10

0 20 40
FEET

(A) **RESIDUAL:** TAN AND RED, MOIST, MED. STIFF TO STIFF, SANDY SILT (A-4) AND SILTY CLAY (A-7)
(B) **RESIDUAL:** TAN, ORANGE, AND WHITE, MOIST TO WET, LOOSE TO MED. DENSE, SILTY SAND (A-2-4) WITH LITTLE MICA
(C) **WEATHERED ROCK:** TAN AND WHITE, GNEISS
(D) **CRYSTALLINE ROCK:** TAN AND GRAY, GNEISS

EXISTING GROUND

S2_EBI-A
19+15

S2_EBI-B
19+28

7 11 12 11 13 21 14 19 16 20 11 21 12 29 50/0.1

SPT REFUSAL
DRY 02/18

15 18 11 11 12 17 15 20 18 14 15 100/0.6 50/0.0

02/18

SPT REFUSAL

920 910 900 890 880 870 860 850 840 830 820

145 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

END BENT #1
19+16.80

-Y2-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 72°55'55"

8/23/9

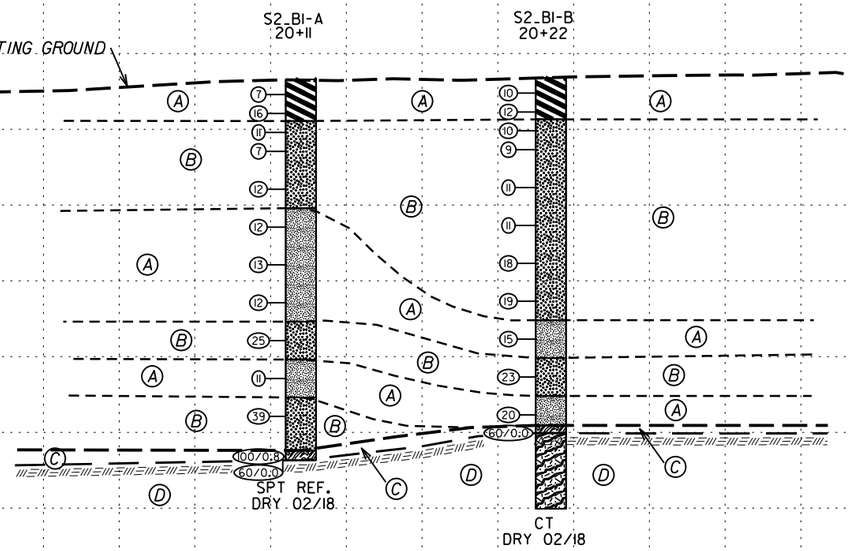
$DATE$

8/23/9

145 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN AND RED, MOIST, MED. STIFF TO V. STIFF, SANDY SILT (A-4) AND SILTY CLAY (A-7)
Ⓑ **RESIDUAL:** TAN, WHITE, AND GRAY, MOIST, LOOSE TO V. DENSE, SILTY SAND (A-2-4) WITH TRACE MICA AND ROCK FRAGMENTS
Ⓒ **WEATHERED ROCK:** TAN AND WHITE, GNEISS
Ⓓ **CRYSTALLINE ROCK:** TAN AND WHITE, GNEISS



920 910 900 890 880 870 860 850 840 830 820

BENT #1
20+16.72

-Y2-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 72°55'55"

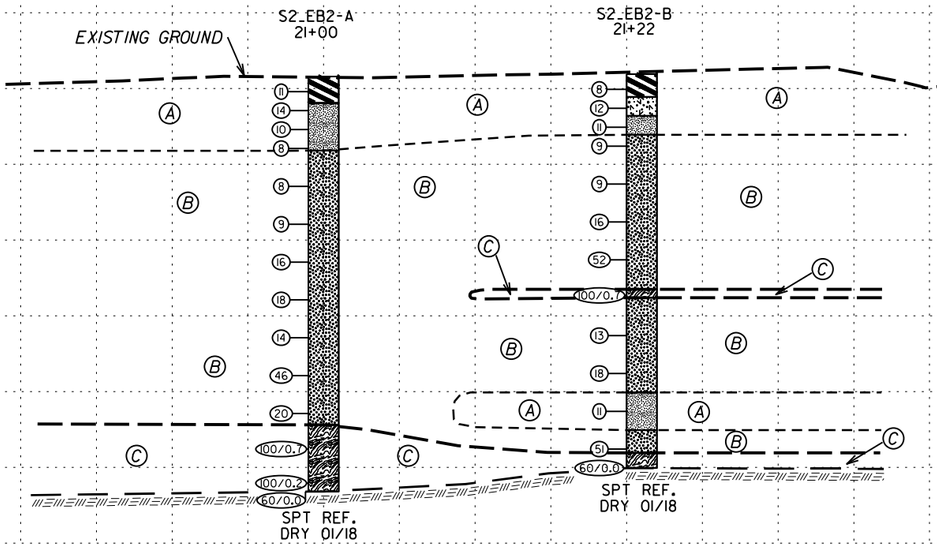
$DATE$

8/23/9

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	7

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN AND RED, MOIST, STIFF, SANDY SILT (A-4) AND SILTY CLAY (A-7)
Ⓑ **RESIDUAL:** TAN, ORANGE, AND WHITE, MOIST, LOOSE TO DENSE, SILTY SAND (A-2-4) WITH LITTLE MICA
Ⓒ **WEATHERED ROCK:** GRAY, TAN AND WHITE, GNEISS
Ⓓ **CRYSTALLINE ROCK:** GRAY AND WHITE, GNEISS



END BENT #2
21+17.77

-Y2-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 72°55'55"

$DATE$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)				**GROUND WTR (ft)**
BORING NO. S2_EB1-A	**STATION** 19+15	**OFFSET** 21 ft LT	**ALIGNMENT** -Y2- (D)	**0 HR.** 48.8
COLLAR ELEV. 891.9 ft	**TOTAL DEPTH** 61.5 ft	**NORTHING** 571,039	**EASTING** 1,259,277	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/01/18	**COMP. DATE** 02/01/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
895											
										891.9	0.0
										0.3' TOPSOIL / GRAVEL	
890	890.9	1.0	2	3	4	7		M		**RESIDUAL**	
	888.4	3.5	4	5	6	11		M		TAN AND RED, SANDY SILTY CLAY (A-7)	
885	885.9	6.0	4	5	7	12		M		888.9	3.0
	883.4	8.5	4	6	5	11		M		RED AND TAN, CLAYEY SANDY SILT (A-4)	
880	878.4	13.5	4	6	7	13		M		886.4	5.5
875	873.4	18.5	6	9	12	21		M		RED AND TAN, SILTY SAND (A-2-4)	
870	868.4	23.5	4	7	7	14		M			
865	863.4	28.5	8	8	11	19		M			
860	858.4	33.5	7	6	10	16		M			
855	853.4	38.5	7	7	13	20		M			
850	848.4	43.5	3	5	6	11		M		849.9	42.0
845	843.4	48.5	4	9	12	21		M		TAN, SANDY SILT (A-4) HIGHLY MICACEOUS	
840	838.4	53.5	5	5	7	12		W		844.9	47.0
835	833.4	58.5	12	15	14	29		M		TAN, SILTY SAND (A-2-4) WITH LITTLE MICA	
	830.5	61.4	60/0.1			60/0.1				830.8	61.1
										830.5	61.4
										830.4	61.5
										WEATHERED ROCK TAN AND WIHTE, GNEISS	
										CRYSTALLINE ROCK TAN WHITE AND GRAY, GNEISS	
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 830.4 ft IN CRYSTALLINE ROCK: GNEISS	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)				**GROUND WTR (ft)**
BORING NO. S2_EB1-B	**STATION** 19+28	**OFFSET** 21 ft RT	**ALIGNMENT** -Y2- (D)	**0 HR.** 47.6
COLLAR ELEV. 892.7 ft	**TOTAL DEPTH** 53.5 ft	**NORTHING** 571,083	**EASTING** 1,259,277	**24 HR.** 44.2
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 02/01/18	**COMP. DATE** 02/01/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
895											
										892.7	0.0
										0.3' TOPSOIL	
	891.7	1.0	4	6	9	15		M		**RESIDUAL**	
890	889.2	3.5	7	9	9	18		M		TAN AND RED, SANDY SILTY CLAY (A-7)	
	886.7	6.0	4	5	6	11		M		889.7	3.0
885	884.2	8.5	5	5	6	11		M		ORANGE AND TAN, SILTY SAND (A-2-4)	
880	879.2	13.5	5	6	6	12		M			
875	874.2	18.5	5	7	10	17		M			
870	869.2	23.5	6	7	8	15		M			
865	864.2	28.5	7	9	11	20		M			
860	859.2	33.5	5	8	10	18		M			
855	854.2	38.5	8	7	7	14		M			
850	849.2	43.5	12	8	7	15		M			
845	844.2	48.5	14	84	16/0.1	100/0.6				843.7	49.0
840	839.2	53.5	60/0.0			60/0.0				**WEATHERED ROCK** TAN AND WHITE, GNEISS	
										839.2	53.5
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 839.2 ft ON CRYSTALLINE ROCK: GNEISS	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)			**GROUND WTR (ft)**
BORING NO. S2_B1-A	**STATION** 20+11	**OFFSET** 17 ft LT	**ALIGNMENT** -Y2- (D)	**0 HR.** Dry
COLLAR ELEV. 896.6 ft	**TOTAL DEPTH** 50.3 ft	**NORTHING** 571,071	**EASTING** 1,259,186	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 01/31/18	**COMP. DATE** 01/31/18	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
900										896.6	0.0
										0.4' TOPSOIL	
895	895.6	1.0	2	3	4	7		M		**RESIDUAL** TAN AND RED, SANDY SILTY CLAY (A-7)	
	893.1	3.5	5	7	9	16		M		891.1	5.5
890	890.6	6.0	4	5	6	11		M		ORANGE AND TAN, SILTY SAND (A-2-4)	
	888.1	8.5	3	3	4	7		M			
885	883.1	13.5	7	7	5	12		M			
880	878.1	18.5	4	6	6	12		M		879.6	17.0
875	873.1	23.5	3	6	7	13		M		TAN, SANDY SILT (A-4) SOME TO HIGHLY MICACEOUS	
870	868.1	28.5	4	6	6	12		M			
865	863.1	33.5	6	12	13	25		M		864.6	32.0
860	858.1	38.5	3	4	7	11		M		TAN, SILTY SAND (A-2-4)	
855	853.1	43.5	12	15	24	39		M		859.6	37.0
850	848.1	48.5	15	33	67/0.3	100/0.8				TAN, SANDY SILT (A-4) WITH SOME MICA	
	846.3	50.3	60/0.0			60/0.0				854.6	42.0
										TAN AND WHITE, SILTY SAND (A-2-4)	
										847.6	49.0
										WEATHERED ROCK	
										846.3 WHITE AND TAN, GNEISS	50.3
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 846.3 ft IN CRYSTALLINE ROCK: GNEISS	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)				**GROUND WTR (ft)**
BORING NO. S2_B1-B	**STATION** 20+22	**OFFSET** 16 ft RT	**ALIGNMENT** -Y2- (D)	**0 HR.** Dry
COLLAR ELEV. 896.8 ft	**TOTAL DEPTH** 56.9 ft	**NORTHING** 571,106	**EASTING** 1,259,186	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/31/18	**COMP. DATE** 02/02/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										896.8	0.0
										0.4' TOPSOIL	
900											
	895.8	1.0								**RESIDUAL**	
895			3	4	6	10		M		TAN AND RED, SANDY SILTY CLAY (A-7)	
	893.3	3.5									
			4	6	6	12		M			
	890.8	6.0								891.3	5.5
890			4	5	5	10		M		ORANGE TAN AND RED, SILTY SAND (A-2-4) WITH LITTLE MICA	
	888.3	8.5									
			3	4	5	9		M			
885											
	883.3	13.5									
			4	5	6	11		M			
880											
	878.3	18.5									
			5	6	5	11		M			
875											
	873.3	23.5									
			7	9	9	18		M			
870											
	868.3	28.5									
			5	9	10	19		M			
865											
	863.3	33.5								864.8	32.0
			4	6	9	15		M		TAN, SANDY SILT (A-4) HIGHLY MICACEOUS	
860										859.8	37.0
	858.3	38.5								TAN, SILTY SAND (A-2-4)	
			11	12	11	23		M			
855										854.8	42.0
	853.3	43.5								TAN, SANDY SILT (A-4) WITH SOME MICA	
			10	9	11	20		M			
850	849.9	46.9								850.9	45.9
			60/0.0			60/0.0				849.9 **WEATHERED ROCK** GRAY AND WHITE, BIOTITE GNEISS FRESH TO VERY SLIGHT WEATHERING, HARD TO VERY HARD, GRAY AND WHITE BIOTITE GNEISS WITH CLOSE TO MODERATLEY CLOSE FRACTURE SPACING	46.9
845											
										839.9	56.9
840										Boring Terminated at Elevation 839.9 ft IN CRYSTALLINE ROCK: GNEISS	

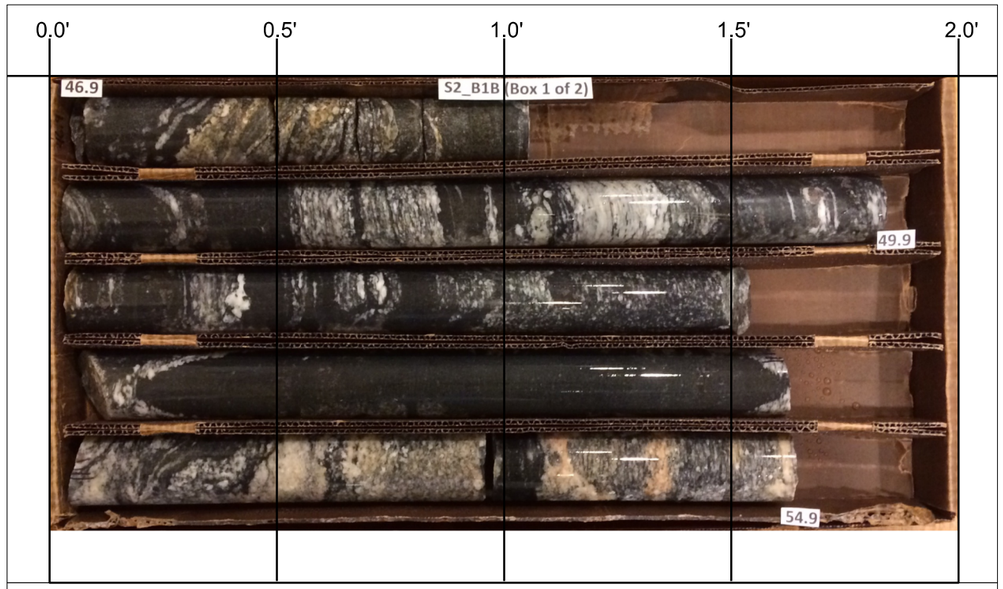
NCDOT BORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 8/3/18

GEOTECHNICAL BORING REPORT
CORE LOG

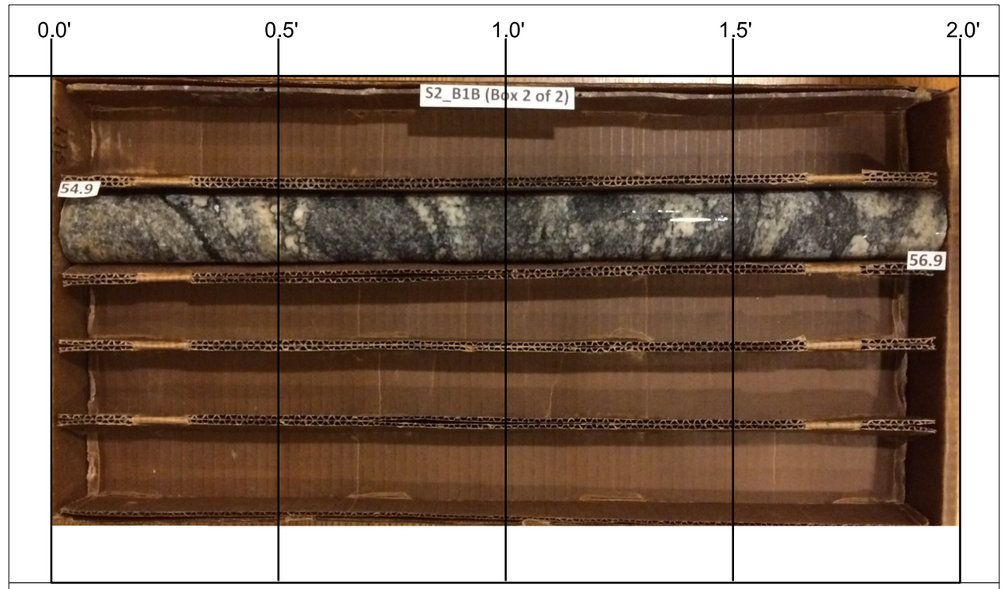
WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)			**GROUND WTR (ft)**
BORING NO. S2_B1-B	**STATION** 20+22	**OFFSET** 16 ft RT	**ALIGNMENT** -Y2- (D)	**0 HR.** Dry
COLLAR ELEV. 896.8 ft	**TOTAL DEPTH** 56.9 ft	**NORTHING** 571,106	**EASTING** 1,259,186	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/31/18	**COMP. DATE** 02/02/18	**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 REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
849.86											Begin Coring @ 46.9 ft	
	849.9	46.9	3.0	1:40/1.0	(2.9)	(2.3)		(9.9)	(9.3)		849.9 FRESH TO VERY SLIGHT WEATHERING, HARD TO VERY HARD, GRAY	46.9
	846.9	49.9		1:36/1.0	97%	77%		99%	93%		AND WHITE BIOTITE GNEISS WITH CLOSE TO MODERATLEY CLOSE	
				2:37/1.0							FRACTURE SPACING	
845			5.0	2:50/1.0	(5.0)	(5.0)						
				2:21/1.0	100%	100%						
				1:48/1.0								
				2:40/1.0								
	841.9	54.9		5:15/1.0								
840	839.9	56.9	2.0	7:20/1.0	(2.0)	(2.0)					839.9	56.9
				9:35/1.0	100%	100%					Boring Terminated at Elevation 839.9 ft IN CRYSTALLINE ROCK: GNEISS	

NCDOT CORE SINGLE R2707_GEO_BORINGS CURRENT.GPJ NC_DOT.GDT 8/3/18



BORING S2_B1-B, BOX 1 OF 2, 46.9 FEET TO 54.9 FEET.



BORING S2_B1-B, BOX 2 OF 2, 54.9 FEET TO 56.9 FEET.

0 4" 8"

INCHES

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

PHONE: 919.871.0800

ROCK CORE PHOTOGRAPHS

STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-)
OVER US 74 BYPASS (-L-) BETWEEN SR 2067
(FAIRVIEW RD.) AND SR 2047 (BORDERS RD.)
CLEVELAND COUNTY, NORTH CAROLINA
WBS: 34497.1.F56 | TIP NO.:R-2707D
FALCON PROJECT NO.: G17053.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)				**GROUND WTR (ft)**
BORING NO. S2_EB2-A	**STATION** 21+09	**OFFSET** 21 ft LT	**ALIGNMENT** -Y2- (D)	**0 HR.** 53.1
COLLAR ELEV. 901.6 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 571,096	**EASTING** 1,259,092	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/30/18	**COMP. DATE** 01/31/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
905											
										901.6	0.5' TOPSOIL 0.0
900	900.6	1.0	2	4	7	11		M			**RESIDUAL** TAN AND RED, SANDY SILTY CLAY (A-7)
	898.1	3.5	4	7	7	14		M		898.1	3.5
895	895.6	6.0	4	5	5	10		M			RED AND TAN, FINE SANDY SILT (A-4) WITH LITTLE MICA
	893.1	8.5	3	4	4	8		M		891.8	9.8
890	888.1	13.5									TAN WHITE AND BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS
			3	4	4	8		M			
885	883.1	18.5									
			3	4	5	9		M			
880	878.1	23.5									
			13	9	7	16		M			
875	873.1	28.5									
			13	12	6	18		M			
870	868.1	33.5									
			6	7	7	14		M			
865	863.1	38.5									
			18	20	26	46		M			
860	858.1	43.5									
			10	11	9	20		M			
855	853.1	48.5								855.6	46.0
			65	35/0.2		100/0.7					**WEATHERED ROCK** TAN AND WHITE, GRANITE
850	848.1	53.5									
	846.8	54.8	100/0.2			100/0.2				846.8	54.8
			60/0.0			60/0.0					Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 846.8 ft ON CRYSTALLINE ROCK: GRANITE

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #2 - BRIDGE ON ELIZABETH AVE. (-Y2-) OVER US 74 BYPASS (-L-)				**GROUND WTR (ft)**
BORING NO. S2_EB2-B	**STATION** 21+22	**OFFSET** 21 ft RT	**ALIGNMENT** -Y2- (D)	**0 HR.** Dry
COLLAR ELEV. 901.9 ft	**TOTAL DEPTH** 52.0 ft	**NORTHING** 571,140	**EASTING** 1,259,092	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/31/18	**COMP. DATE** 01/31/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
905										
										901.9 GROUND SURFACE 0.0
900	900.9	1.0	3	3	5	8		M		**RESIDUAL** TAN AND RED, SANDY SILTY CLAY (A-7)
	898.4	3.5	4	6	6	12		M		898.9 3.0
895	895.9	6.0	3	5	6	11		M		TAN AND RED, SANDY CLAYEY SILT (A-5) WITH TRACE MICA 896.4 5.5
	893.4	8.5	3	4	5	9		M		RED AND TAN, SANDY SILT (A-4) WITH LITTLE MICA 893.9 8.0
890	888.4	13.5								TAN AND GRAY, SILTY SAND (A-2-4) WITH TRACE MICA AND SOME ROCK FRAGMENTS
			4	4	5	9		M		
885	883.4	18.5								
			5	8	8	16		M		
880	878.4	23.5								
			7	41	11	52		M		
875	873.4	28.5								873.5 28.4
			86	14/0.2		100/0.7				872.4 **WEATHERED ROCK** 29.5 TAN AND WHITE, GRANITE
870	868.4	33.5								**RESIDUAL** TAN, SILTY SAND (A-2-4) WITH LITTLE MICA
			5	6	7	13		M		
865	863.4	38.5								
			8	9	9	18		M		
860	858.4	43.5								859.9 42.0
			3	6	5	11		M		TAN, SANDY SILT (A-4) WITH SOME MICA
855	853.4	48.5								854.9 47.0
			15	35	16	51		M		GRAY AND TAN, SILTY SAND (A-2-4) WITH LITTLE MICA 851.9 50.0
850	849.9	52.0								**WEATHERED ROCK** 849.9 52.0
			60/0.0			60/0.0				Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 849.9 ft ON CRYSTALLINE ROCK: GNEISS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	12

REFERENCE: R-2707D

PROJECT: 34497

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *STRUCTURE #3 – BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.) BETWEEN SR 2052 (ELIZABETH AVE.) AND US 74 BUS. (E. MARION ST.)*

CONTENTS

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.

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.

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NOTES:
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2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *HILL, M.J.*

CHECKED BY *HUNSBERGER, W.S.*

SUBMITTED BY *FALCON ENG.*

DATE *MARCH 2018*

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

3/21/18

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: BY28-19 / GPS POINT 19
STATION -L- POT 757+63.92, 13.28' LT
N: 565153.7, E: 1261859.6 ELEVATION: 836.03 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

DATE: 9-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

0 30 60
FEET

S 45° 14' 24" E

22+00

23+00

758+00

24+00

757+00

756+00

END BENT #1
STATION 22+28.97 (Y3)

BENT #1
STATION 23+21.80 (Y3)

END BENT #2
STATION 24+47.80 (Y3)

S3_EB1-A

S3_B1-A

S3_EB2-A

-Y3-

STRUCTURE #3

73°12'55"

73°35'26"

71°23'08"

S3_EB1-B

S3_B1-B

S3_EB2-B

NC GRID
NAD 83 NA 2011

DATE: 9-15-14

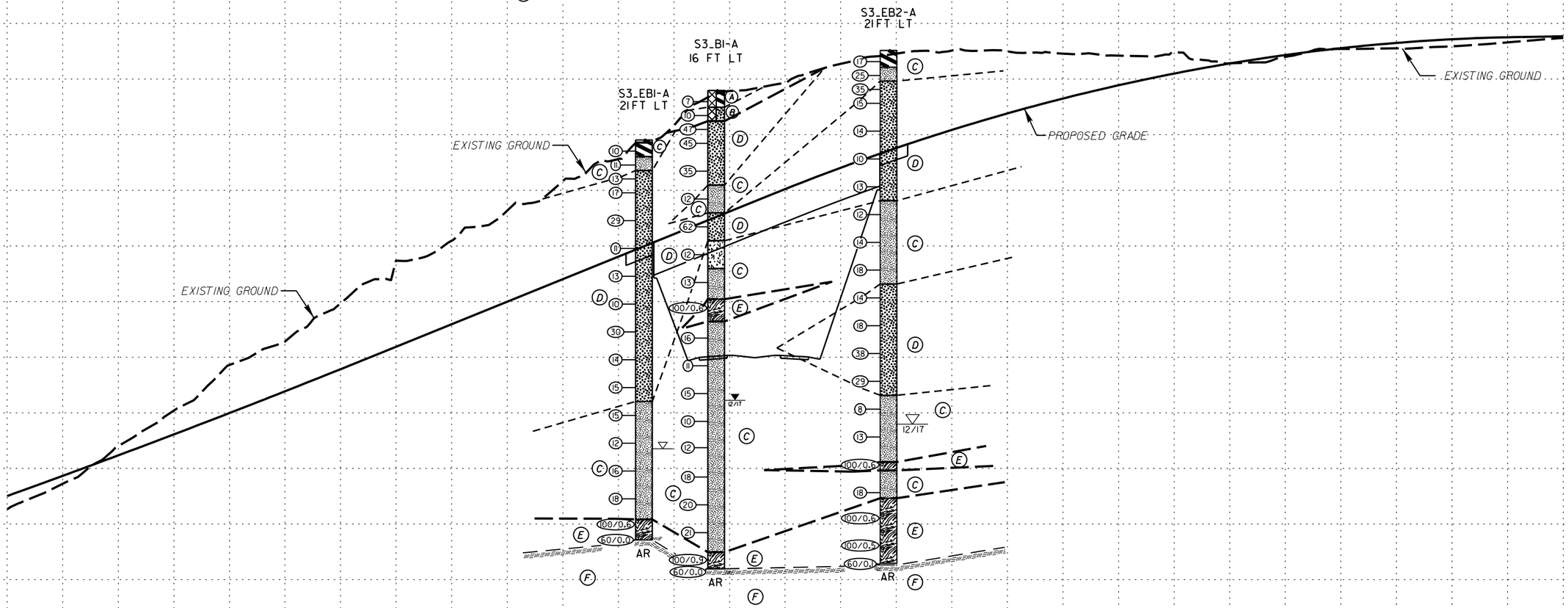
0	100	200
FEET		

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

STRUCTURE #3, BRIDGE ON US 74 BYPASS ON SR 2047 (BORDERS RD.)

(A) **ARTIFICIAL FILL:** RED, MOIST, MED. STIFF, SANDY CLAY, WITH TRACE GRAVEL
(B) **ARTIFICIAL FILL:** TAN, MOIST, MED. DENSE, SILTY SAND, WITH TRACE GRAVEL
(C) **RESIDUAL:** BROWN TAN AND RED, MOIST TO WET, STIFF TO V. STIFF, SANDY CLAYEY SILT AND SILTY CLAY, WITH TRACE TO LITTLE MICA
(D) **RESIDUAL:** RED TAN WHITE AND BROWN, MOIST, MED. DENSE TO V. DENSE, SILTY SAND, WITH TRACE TO LITTLE MICA
(E) **WEATHERED ROCK:** TAN AND BROWN, BIOTITE GNEISS GRANITE AND MICA SCHIST
(F) **CRYSTALLINE ROCK:** TAN AND BROWN, BIOTITE GNEISS GRANITE AND MICA SCHIST



NOTES:

GROUNDLINE PROFILE TAKEN FROM ROADWAY PROFILE DRAWINGS OCTOBER 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 73°

-Y3-

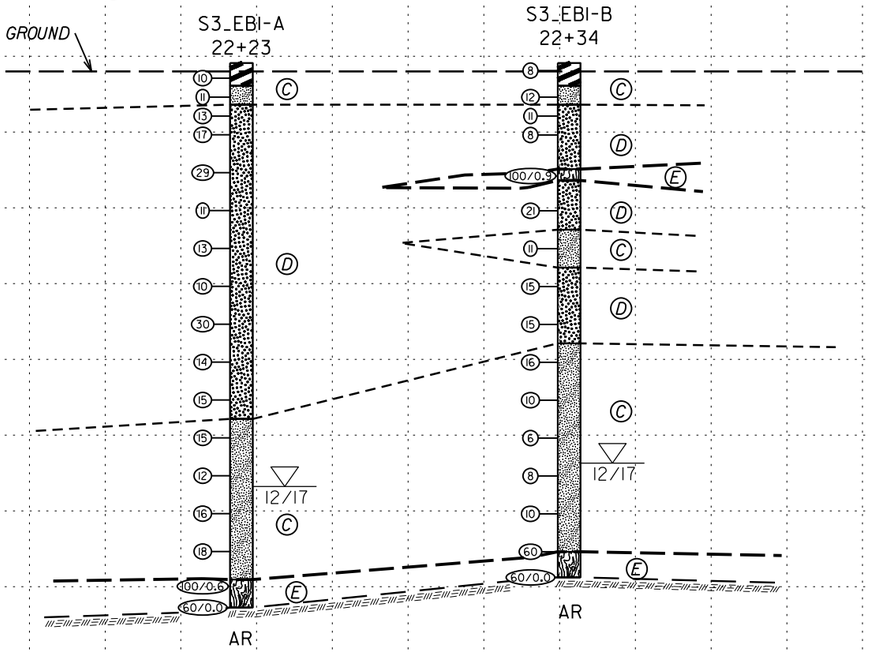
8/23/99

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	5

0 5 10

0 20 40
FEET

Ⓒ **RESIDUAL:** RED BROWN AND TAN, MOIST TO WET, MED. STIFF TO HARD, SANDY SILTY CLAY AND SILTY CLAY
Ⓓ **RESIDUAL:** RED TAN AND WHITE, MOIST, LOOSE TO MED. DENSE, SILTY SAND
Ⓔ **WEATHERED ROCK:** TAN BROWN AND WHITE, GRANITE AND MICA SCHIST



END BENT #1
22+28.97

-Y3-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 75° AT END BENT #1

$DATE$

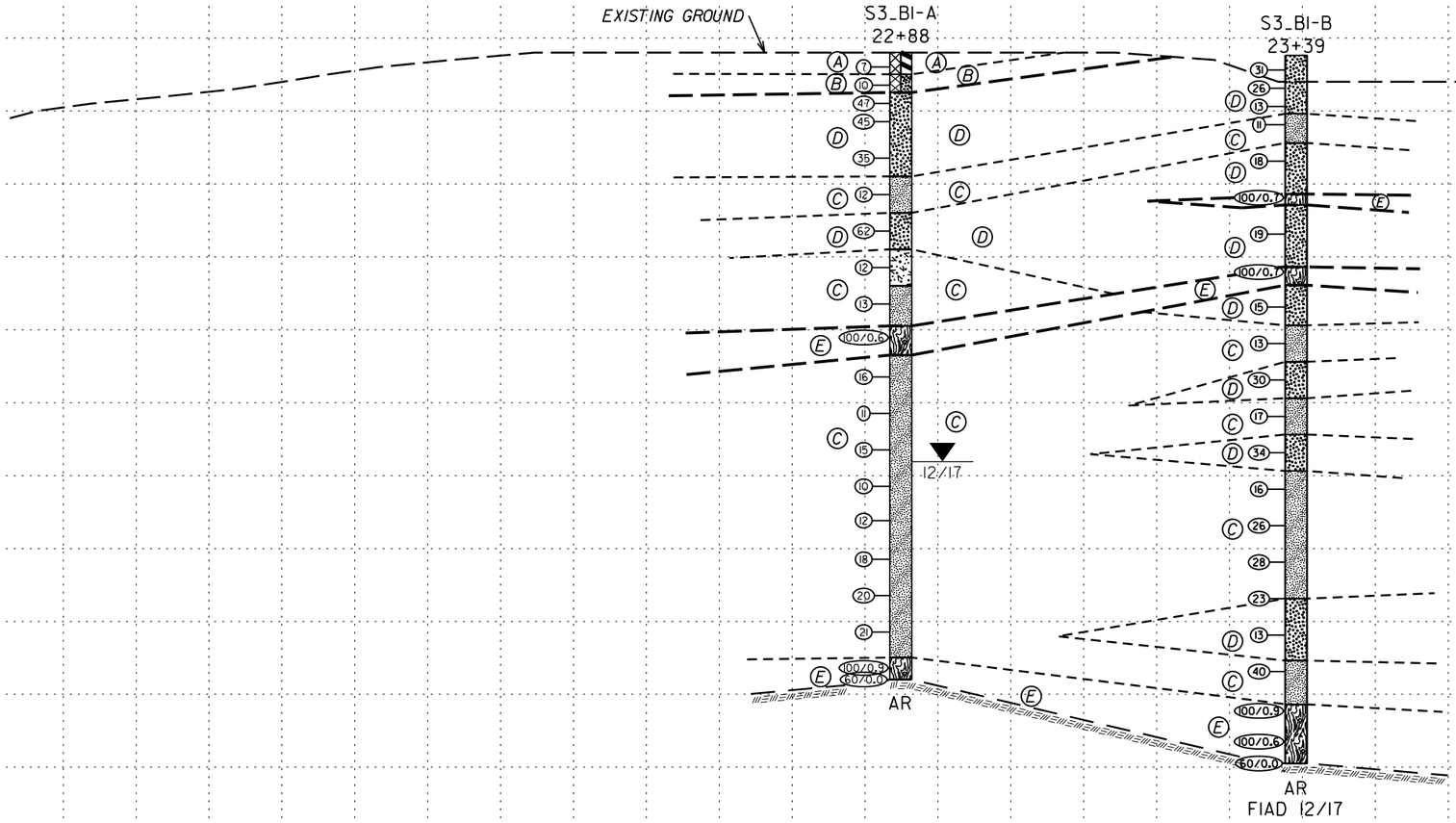
8/23/99

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	6

0 5 10

0 20 40
FEET

(A) **ARTIFICIAL FILL:** RED, MOIST, MED. STIFF, SANDY CLAY, WITH TRACE GRAVEL
(B) **ARTIFICIAL FILL:** TAN, MOIST, MED. DENSE SILTY SAND, WITH TRACE GRAVEL
(C) **RESIDUAL:** TAN RED AND GRAY, MOIST TO WET, STIFF TO HARD, SANDY SILT, WITH LITTLE MICA
(D) **RESIDUAL:** RED TAN WHITE AND BROWN, MOIST, MED. DENSE TO V. DENSE, SILTY SAND
(E) **WEATHERED ROCK:** TAN RED AND WHITE, GRANITE AND BIOTITE GNEISS



BENT #1
23+21.80

-Y3-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 73° AT BENT #1

$DATE$

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	7

0 5 10

0 20 40
FEET

Ⓒ **RESIDUAL:** RED BROWN AND TAN, MOIST, STIFF TO HARD, SANDY SILTY CLAY AND SANDY SILT, WITH TRACE TO LITTLE MICA
Ⓓ **RESIDUAL:** TAN BROWN RED AND WHITE, MOIST, MED. DENSE TO DENSE, SILTY SAND, WITH TRACE TO LITTLE MICA
Ⓔ **WEATHERED ROCK:** TAN BROWN AND GRAY, BIOTITE GNEISS AND MICA SCHIST

EXISTING GROUND

S3_EB2-A
24+43

S3_EB2-B
24+48

12/17

12/17

AR

BT

END BENT #2
24+47.80

-Y3-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 71° AT END BENT #2

$DATE$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB1-A	**STATION** 22+23	**OFFSET** 21 ft LT	**ALIGNMENT** -Y3-	**0 HR.** 55.5
COLLAR ELEV. 839.1 ft	**TOTAL DEPTH** 71.9 ft	**NORTHING** 565,313	**EASTING** 1,261,808	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/13/17	**COMP. DATE** 12/13/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
840											
	839.1	0.0								839.1 GROUND SURFACE	0.0
	838.1	1.0	3	4	6	10		M		**RESIDUAL** RED AND BROWN, SANDY SILTY CLAY (A-7)	
835	835.6	3.5	4	5	6	11		M		836.1	3.0
	833.1	6.0	8	7	6	13		M		RED AND TAN, SANDY SILT (A-4)	
830	830.6	8.5	8	8	9	17		M		833.6	5.5
	825.6	13.5	8	13	16	29		M		RED TAN AND WHITE, SILTY SAND (A-2-4)	
820	820.6	18.5	6	5	6	11		M			
815	815.6	23.5	5	6	7	13		M			
810	810.6	28.5	4	5	5	10		M			
805	805.6	33.5	11	17	13	30		M			
800	800.6	38.5	5	6	8	14		M			
795	795.6	43.5	4	6	9	15		M			
790	790.6	48.5	4	7	8	15		M			
785	785.6	53.5	4	6	6	12		M			
780	780.6	58.5	4	7	9	16		M			
775	775.6	63.5	5	7	11	18		W		792.1	47.0
										TAN, SANDY SILT (A-4)	
770	770.6	68.5	60	40/0.1		100/0.6				770.9	68.2
	767.2	71.9	60/0.0			60/0.0				**WEATHERED ROCK** TAN AND BROWN, GRANITE	
										767.2	71.9
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 767.2 ft ON CRYSTALLINE ROCK: MICA SCHIST	

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB1-B	**STATION** 22+34	**OFFSET** 21 ft RT	**ALIGNMENT** -Y3-	**0 HR.** 52.3
COLLAR ELEV. 839.1 ft	**TOTAL DEPTH** 67.9 ft	**NORTHING** 565,346	**EASTING** 1,261,780	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/13/17	**COMP. DATE** 12/13/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
840											
	839.1	0.0								839.1 GROUND SURFACE	0.0
	838.1	1.0	3	4	4	8		M		**RESIDUAL** RED AND BROWN, SANDY SILTY CLAY (A-7)	
835	835.6	3.5	5	6	6	12		M		836.1	3.0
	833.1	6.0	4	5	6	11		M		TAN AND RED, SANDY SILT (A-4)	
830	830.6	8.5	4	4	4	8		M		833.6	5.5
	825.6	13.5	17	41	59/0.4	100/0.9		M		RED AND TAN, SILTY SAND (A-2-4)	
820	820.6	18.5	8	14	7	21		M		825.1	14.0
815	815.6	23.5	4	5	6	11		M		**WEATHERED ROCK** WHITE, GRANITIC ROCK	
810	810.6	28.5	8	8	7	15		M		823.6	15.5
805	805.6	33.5	5	6	9	15		M		**RESIDUAL** TAN, SILTY SAND (A-2-4)	
800	800.6	38.5	5	8	8	16		M		817.1	22.0
795	795.6	43.5	4	4	6	10		M		TAN, FINE SANDY SILT (A-4)	
790	790.6	48.5	3	3	3	6		M		812.1	27.0
785	785.6	53.5	3	3	5	8		M	▽	TAN, SILTY SAND (A-2-4)	
780	780.6	58.5	3	4	6	10		W		802.1	37.0
775	775.6	63.5	6	9	51	60				TAN AND BROWN, FINE SANDY SILT (A-4)	
	771.2	67.9	60/0.0			60/0.0				774.1	65.0
										WEATHERED ROCK TAN AND BROWN, MICA SCHIST	
										771.2	67.9
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 771.2 ft ON CRYSTALLINE ROCK: MICA SCHIST	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_B1-A	**STATION** 22+88	**OFFSET** 16 ft LT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 848.0 ft	**TOTAL DEPTH** 86.0 ft	**NORTHING** 565,290	**EASTING** 1,261,746	**24 HR.** 55.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/15/17	**COMP. DATE** 12/15/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) — DEPTH (ft)
850										848.0 — 0.0 GROUND SURFACE
	847.0	1.0	4	4	3	7		M		**ARTIFICIAL FILL** RED, SANDY CLAY (A-7) WITH TRACE GRAVEL
845	844.5	3.5	3	4	6	10		M		845.0 — 3.0 TAN, SILTY SAND (A-2-4) WITH TRACE GRAVEL
	842.0	6.0	9	20	27	47		M		842.5 — 5.5 **RESIDUAL** RED AND TAN, SILTY SAND (A-2-4)
840	839.5	8.5	21	26	19	45		M		
835	834.5	13.5	12	21	14	35		M		
830	829.5	18.5	4	6	6	12		M		831.0 — 17.0 TAN, SANDY SILT (A-4)
825	824.5	23.5	8	42	20	62		M		826.0 — 22.0 TAN AND WHITE, SILTY SAND (A-2-4)
820	819.5	28.5	5	5	7	12		M		821.0 — 27.0 RED AND TAN, FINE SANDY CLAYEY SILT (A-5)
815	814.5	33.5	4	6	7	13		M		816.0 — 32.0 TAN, FINE SANDY SILT (A-4)
810	809.5	38.5	58	42/0.1		100/0.6				810.5 — 37.5 **WEATHERED ROCK** TAN AND WHITE, GRANITE
805	804.5	43.5	8	7	9	16		M		806.5 — 41.5 **RESIDUAL** TAN, SANDY SILT (A-4) WITH LITTLE MICA
800	799.5	48.5	5	5	6	11		M		
795	794.5	53.5	5	7	8	15		M		
790	789.5	58.5	3	4	6	10		W		
785	784.5	63.5	4	5	7	12		W		
780	779.5	68.5	6	8	10	18		M		
775	774.5	73.5	7	9	11	20		W		
770										

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_B1-A	**STATION** 22+88	**OFFSET** 16 ft LT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 848.0 ft	**TOTAL DEPTH** 86.0 ft	**NORTHING** 565,290	**EASTING** 1,261,746	**24 HR.** 55.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/15/17	**COMP. DATE** 12/15/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
770						Match Line				
	769.5	78.5	6	10	11	21		W		**RESIDUAL** TAN, SANDY SILT (A-4) WITH LITTLE MICA *(continued)*
765	764.5	83.5	35	65/0.4		100/0.9				765.0 — 83.0 **WEATHERED ROCK** TAN, BIOTITE GNEISS
	762.0	86.0	60/0.0			60/0.0				762.0 — 86.0 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 762.0 ft ON CRYSTALLINE ROCK: GNEISS

NCDOT BORE DOUBLE R2707_GEO_BORINGS - COPY.GPJ NC_DOT.GDT 3/21/18

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_B1-B	**STATION** 23+39	**OFFSET** 25 ft RT	**ALIGNMENT** -Y3-	**0 HR.** N/A
COLLAR ELEV. 847.6 ft	**TOTAL DEPTH** 97.1 ft	**NORTHING** 565,308	**EASTING** 1,261,683	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/14/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
850											
	846.6	1.0								847.6 GROUND SURFACE	0.0
			5	14	17	31		M		**RESIDUAL** RED AND TAN, SILTY SAND (A-2-4)	
845	844.1	3.5									
			5	10	16	26		M			
	841.6	6.0									
			10	6	7	13		M			
840	839.1	8.5								839.6	8.0
			3	5	6	11		M		TAN, SANDY SILT (A-2-4)	
										835.6	12.0
835	834.1	13.5								TAN, SILTY SAND (A-2-4)	
			5	9	9	18		M			
830	829.1	18.5									
			13	29	71/0.2	100/0.7				828.6	19.0
										827.1 **WEATHERED ROCK** RED AND TAN, BIOTITE GNEISS	20.5
825	824.1	23.5								**RESIDUAL** TAN AND BROWN, SILTY SAND (A-2-4)	
			5	5	14	19		M			
820	819.1	28.5									
			20	80/0.2		100/0.7		M		818.6	29.0
										816.1 **WEATHERED ROCK** WHITE AND TAN, GRANITE	31.5
815	814.1	33.5								**RESIDUAL** TAN, SILTY SAND (A-2-4)	
			6	8	7	15		M			
810	809.1	38.5								810.6	37.0
			4	6	7	13		M		TAN, FINE SANDY SILT (A-4)	
										805.6	42.0
805	804.1	43.5								TAN, SILTY SAND (A-2-4)	
			13	13	17	30		M			
800	799.1	48.5								800.6	47.0
			10	7	10	17		M		TAN, FINE SANDY SILT (A-4)	
										795.6	52.0
795	794.1	53.5								TAN, SILTY SAND (A-2-4)	
			14	17	17	34		M			
790	789.1	58.5								790.6	57.0
			8	6	10	16		M		TAN, SANDY SILT (A-4)	
785											
	784.1	63.5									
			7	12	14	26		M			
780	779.1	68.5									
			13	13	15	28		M			
775	774.1	73.5									
			5	9	14	23		W		773.1	74.5
770										TAN, SILTY SAND (A-2-4)	

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_B1-B	**STATION** 23+39	**OFFSET** 25 ft RT	**ALIGNMENT** -Y3-	**0 HR.** N/A
COLLAR ELEV. 847.6 ft	**TOTAL DEPTH** 97.1 ft	**NORTHING** 565,308	**EASTING** 1,261,683	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/14/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
770						Match Line				
	769.1	78.5	4	5	8	13		M		TAN, SILTY SAND (A-2-4) *(continued)*
765	764.1	83.5	8	16	24	40		M		764.6 TAN AND GRAY, FINE SANDY SILT (A-4) WITH LITTLE MICA 83.0
760	759.1	88.5	13	37	63/0.4	100/0.9				758.6 **WEATHERED ROCK** TAN AND WHITE, BIOTITE GNEISS 89.0
755	754.1	93.5	18	82/0.1		100/0.6				
	750.5	97.1	60/0.0			60/0.0				750.5 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 750.5 ft ON CRYSTALLINE ROCK: BIOTITE GNEISS 97.1

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB2-A	**STATION** 24+43	**OFFSET** 21 ft LT	**ALIGNMENT** -Y3-	**0 HR.** 66.9
COLLAR ELEV. 855.2 ft	**TOTAL DEPTH** 92.3 ft	**NORTHING** 565,227	**EASTING** 1,261,604	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/14/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
860										
855										855.2 GROUND SURFACE 0.0
	854.2	1.0						M		**RESIDUAL** RED AND BROWN, SANDY SILTY CLAY (A-7)
	851.7	3.5	4	7	10	17		M		852.2 3.0
850			8	11	14	25		M		TAN AND RED, FINE SANDY SILT (A-4)
	849.2	6.0								849.7 5.5
			6	17	18	35		M		TAN BROWN RED AND WHITE, SILTY SAND (A-2-4) WITH TRACE TO LITTLE MICA
	846.7	8.5								
845			5	7	8	15		M		
	841.7	13.5								
840			6	7	7	14		M		
	836.7	18.5								
835			4	5	5	10		M		
	831.7	23.5								
830			4	6	7	13		M		
	826.7	28.5								
825			4	6	6	12		M		
	821.7	33.5								
820			5	7	7	14		M		
	816.7	38.5								
815			6	8	10	18		M		
	811.7	43.5								
810			5	6	8	14		M		
	806.7	48.5								
805			6	8	10	18		M		
	801.7	53.5								
800			18	13	25	38		M		
	796.7	58.5								
795			5	9	20	29		M		
	791.7	63.5								
790			3	4	4	8		M		
	786.7	68.5								
785			3	5	8	13		M		
	781.7	73.5								
780			24	71	29/0.1	100/0.6				828.2 27.0
										RED AND TAN, FINE SANDY SILT (A-4) WITH TRACE MICA
										813.2 42.0
										RED TAN AND WHITE, SILTY SAND (A-2-4) WITH LITTLE MICA
										793.2 62.0
										TAN, FINE SANDY SILT (A-4)
										781.2 74.0

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB2-A	**STATION** 24+43	**OFFSET** 21 ft LT	**ALIGNMENT** -Y3-	**0 HR.** 66.9
COLLAR ELEV. 855.2 ft	**TOTAL DEPTH** 92.3 ft	**NORTHING** 565,227	**EASTING** 1,261,604	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/14/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
780						Match Line				
775	776.7	78.5	7	7	11	18		M		779.7 75.5 **WEATHERED ROCK** TAN, MICA SCHIST *(continued)*
	771.7	83.5	70	30/0.1		100/0.6				**RESIDUAL** TAN, FINE SANDY SILT (A-4) WITH LITTLE MICA 774.7 80.5
770										**WEATHERED ROCK** TAN AND BROWN, MICA SCHIST
	766.7	88.5	100/0.5			100/0.5				
765										
	763.0	92.2	60/0.1			60/0.1				763.0 92.2 762.9 92.3 **NON-CRYSTALLINE ROCK** TAN AND BROWN, MICA SCHIST Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 762.9 ft IN CRYSTALLINE ROCK: MICA SCHIST

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB2-B	**STATION** 24+48	**OFFSET** 21 ft RT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 854.2 ft	**TOTAL DEPTH** 93.9 ft	**NORTHING** 565,264	**EASTING** 1,261,584	**24 HR.** 63.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/13/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
855										854.2 GROUND SURFACE	0.0
	853.2	1.0	5	10	12	22		M		**RESIDUAL** RED AND BROWN, SANDY SILTY CLAY (A-7)	
850	850.7	3.5	8	10	9	19		M		851.2 TAN RED AND WHITE, SILTY SAND (A-2-4)	3.0
	848.2	6.0	4	5	6	11		M			
845	845.7	8.5	7	14	17	31		M			
840	840.7	13.5	10	26	10	36		M			
835	835.7	18.5	5	7	9	16		M			
830	830.7	23.5	5	5	7	12		M		832.2 RED AND TAN, FINE SANDY SILT (A-4)	22.0
825	825.7	28.5	4	14	15	29		M		827.2 RED AND TAN, SILTY SAND (A-2-4)	27.0
820	820.7	33.5	5	7	18	25		M			
815	815.7	38.5	4	7	10	17		M		817.2 RED AND TAN, FINE SANDY SILT (A-4)	37.0
810	810.7	43.5	6	6	7	13		M			
805	805.7	48.5	4	11	13	24		M			
800	800.7	53.5	4	5	6	11		M			
795	795.7	58.5	10	9	9	18		M			
790	790.7	63.5	5	6	9	15		M			
785	785.7	68.5	5	8	9	17		M			
780	780.7	73.5	3	6	7	13		M			
775	775.7	78.5									

WBS 34497.1.F56	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #3 - BRIDGE OVER US 74 BYPASS ON SR 2047 (BORDERS RD.)				**GROUND WTR (ft)**
BORING NO. S3_EB2-B	**STATION** 24+48	**OFFSET** 21 ft RT	**ALIGNMENT** -Y3-	**0 HR.** Dry
COLLAR ELEV. 854.2 ft	**TOTAL DEPTH** 93.9 ft	**NORTHING** 565,264	**EASTING** 1,261,584	**24 HR.** 63.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 12/13/17	**COMP. DATE** 12/14/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
775						Match Line				
			6	14	22	36		M		773.7 RED AND TAN, FINE SANDY SILT (A-4) *(continued)* 80.5
770	770.7	83.5	25	65	35/0.2	100/0.7				**WEATHERED ROCK** TAN GRAY AND BROWN, BIOTITE GNEISS
765	765.7	88.5	27	50	50/0.2	100/0.7				
	760.7	93.5	100/0.4			100/0.4				760.3 93.9
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 760.3 ft IN WEATHERED ROCK: BIOTITE GNEISS

REFERENCE: R-2707D

PROJECT: 34497

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	12

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *STRUCTURE #4 – BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD. AND US 74*

CONTENTS

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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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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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *CROCKETT, S.C.*

CHECKED BY *HUNSBERGER, W.S.*

SUBMITTED BY *FALCON ENG.*

DATE *DECEMBER 2022*

NORTH CAROLINA PROFESSIONAL SEAL 048207 ENGINEER STEPHEN C. CROCKETT

DocuSigned by: Stephen Crockett C5CA5FED48E0435... 12/22/2022

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: BY28-19 / GPS POINT 19
STATION -L- POT 757+63.92, 13.28' LT
N: 565153.7, E: 1261859.6 ELEVATION: 836.03 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

0 30 60
FEET

NC GRID NAD 83 NA 2011

S4_EB1-A
S4_EB1-C
S4_EB1-B
S4_B1-A
S4_B1-C
S4_B1-B
S4_EB2-A
S4_EB2-C
S4_EB2-B

STRUCTURE #4

-RAMP A-

-L-

35+00
39+00
825+00
823+00

63°54'21"
71°56'29"
79°41'29"

END BENT #1
STATION 35+63.63 (RAMP A)

BENT #1
STATION 36+78.38 (RAMP A)
STATION 823+96.61 (L)

END BENT #2
STATION 37+95.88 (RAMP A)

0	100	200

FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

STRUCTURE #4, BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD. AND US 74

(B) RESIDUAL: TAN BROWN WHITE AND RED, MOIST TO WET, V. LOOSE TO V. DENSE, SILTY SAND (A-2-4)
(D) WEATHERED ROCK: TAN AND WHITE, GRANITE
(E) CRYSTALLINE ROCK: TAN, GRANITE

RAMP A STA 36+78.38 = -L- STA 823+96.61
ELEV 739.47

EXISTING GROUND

PROPOSED GRADE

S4_EB2-C
17 FT LT

S4_BI-C
19 FT LT

S4_EBI-C
20 FT LT

01/18

AR

DRY (01/18)

BT

790 780 770 760 750 740 730 720 710 700 690 680 670 660 650 640

30 31 32 33 34 35 36 37 38 39 40 41 42 43

-RAMP_A-

NOTES:

GROUNDLINE PROFILE TAKEN FROM ROADWAY PROFILE DRAWINGS OCTOBER 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

BRIDGE SKEW: 71°56'29"

0 20 40
FEET

Ⓐ **ARTIFICIAL FILL:** TAN, MOIST, V.LOOSE, SILTY SAND (A-2-4)
Ⓑ **RESIDUAL:** TAN BROWN WHITE AND RED, DRY TO WET, V.LOOSE TO V.DENSE, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS
Ⓓ **WEATHERED ROCK:** TAN BROWN AND WHITE, GRANITE
Ⓔ **CRYSTALLINE ROCK:** TAN, GRANITE

0.060 0.060 0.060
4:1
2:1
736.65

S4_EBI-A
35+37
S4_EBI-B
35+66
S4_EBI-C
35+59

(19) (17) (22) (25) (18) (13) (27) (38) (86) (90) 100/0.4 (67) 100/0.2 50/0.0
(3) (17) (13) (19) (16) (18) (12) (12) (16) (15) 100/0.3 100/0.6 100/0.3
(3) (18) (14) (13) (16) (13) (13) (17) (20) (21) (18) (13) (25) 100/0.7 100/0.5 100/0.7

01/18
01/18
BT
B.T.
FIAD (01/18)
AR
DRY (01/18)

END BENT #1
33+63.63

-RAMP_A-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 64°11'34" AT END BENT #1

8/23/9

$DATE$

8/23/9

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	6

0 5 10

0 20 40
FEET

Ⓑ **RESIDUAL:** TAN BROWN WHITE AND RED,DRY TO WET,V.LOOSE TO V.DENSE,SILTY SAND (A-2-4)
Ⓓ **WEATHERED ROCK:** TAN AND WHITE,GRANITE
Ⓔ **CRYSTALLINE ROCK:** TAN BROWN AND GRAY,GRANITE MICA SCHIST AND BIOTITE GNEISS

S4_BI-A
36+59

S4_BI-C
36+79

S4_BI-B
36+85

01/18

AR

DRY (01/18)

BENT #1
36+78.38

-RAMP_A-

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 71°56'29" AT BENT #1

$DATE$

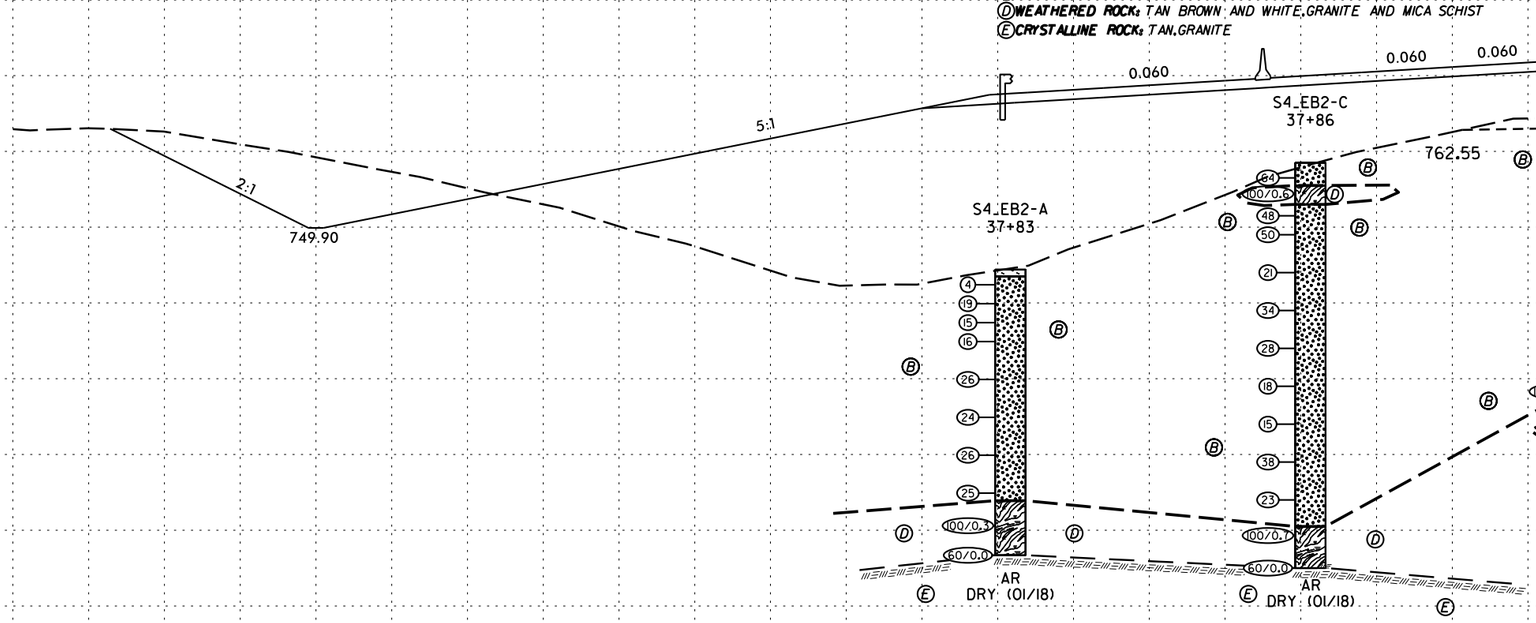
8/23/9

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	7

0 5 10

0 20 40
FEET

Ⓑ **RESIDUAL:** RED TAN WHITE AND BROWN,DRY,V.LOOSE TO V.DENSE,SILTY SAND (A-2-4)
Ⓒ **RESIDUAL:** ORANGE AND BROWN,DRY,HARD,SANDY SILT (A-4)
Ⓓ **WEATHERED ROCK:** TAN BROWN AND WHITE,GRANITE AND MICA SCHIST
Ⓔ **CRYSTALLINE ROCK:** TAN,GRANITE



END BENT #2
37+95.88

–RAMP_A–

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED AUGUST 2017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 79°52'33" AT END BENT #2

$DATE$

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB1-A	**STATION** 35+37	**OFFSET** 55 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** 20.9
COLLAR ELEV. 715.6 ft	**TOTAL DEPTH** 55.9 ft	**NORTHING** 559,484	**EASTING** 1,265,239	**24 HR.** 17.0
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/09/18	**COMP. DATE** 01/09/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
720										
715	714.6	1.0	6	7	12	19		M		715.6 GROUND SURFACE 0.0
	712.1	3.5	12	9	8	17		M		**RESIDUAL**
710	709.6	6.0	6	9	13	22		M		ORANGE, BROWN, AND GRAY, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC, WITH SOME ROCK FRAGMENTS
	707.1	8.5	13	12	13	25		M		
705	702.1	13.5	7	6	12	18		D		
700	697.1	18.5	4	5	8	13		M		
695	692.1	23.5	7	11	16	27		W		
690	687.1	28.5	15	17	21	38		M		
685	682.1	33.5	6	24	62	86		M		
680	677.1	38.5	19	30	60	90		W		
675	672.1	43.5	100/0.4			100/0.4				673.6 42.0
670	667.1	48.5	22	26	41	67				**WEATHERED ROCK** TAN AND WHITE, GRANITE
665	662.1	53.5	100/0.2			100/0.2				668.6 47.0
660	659.7	55.9	60/0.0			60/0.0				**RESIDUAL** GRAY, WHITE, AND TAN, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC
										663.6 52.0
										WEATHERED ROCK BROWN, TAN, AND WHITE, GRANITE
										659.7 55.9
										Boring Terminated at Elevation 659.7 ft ON CRYSTALLINE ROCK: GRANITE

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB1-C	**STATION** 35+59	**OFFSET** 20 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** N/A
COLLAR ELEV. 729.0 ft	**TOTAL DEPTH** 53.8 ft	**NORTHING** 559,521	**EASTING** 1,265,220	**24 HR.** 24.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/12/18	**COMP. DATE** 01/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
730										729.0 GROUND SURFACE 0.0
	728.0	1.0	2	1	2	3		M		**RESIDUAL**
725	725.5	3.5	5	8	9	17		M		RED AND TAN, SILTY SAND (A-2-4) WITH TRACE MICA
	723.0	6.0	4	6	7	13		M		
720	720.5	8.5	6	9	10	19		M		
715	715.5	13.5	6	7	9	16		M		
710	710.5	18.5	6	9	9	18		M		
705	705.5	23.5	4	5	7	12		M		
700	700.5	28.5	4	5	7	12		M		
695	695.5	33.5	3	6	10	16		W		
690	690.5	38.5	4	5	10	15		W		
685	686.0	43.0	40	60/0.4		100/0.9				687.5 41.5
680	680.5	48.5	75	25/0.1		100/0.6				**WEATHERED ROCK** TAN AND WHITE, GRANITE (WR)
	675.5	53.5	100/0.3			100/0.3				675.2 53.8
										Boring Terminated at Elevation 675.2 ft IN WEATHERED ROCK: GRANITE

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB1-B	**STATION** 35+66	**OFFSET** 16 ft RT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 741.6 ft	**TOTAL DEPTH** 69.2 ft	**NORTHING** 559,556	**EASTING** 1,265,214	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/15/18	**COMP. DATE** 01/15/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
745											
										741.6	GROUND SURFACE 0.0
740	740.6	1.0	2	1	2	3		M		740.1	**ARTIFICIAL FILL** TAN, SILTY SAND (A-2-4) 1.5
	738.1	3.5	6	9	9	18		M			**RESIDUAL** TAN AND WHITE, SILTY SAND (A-2-4) WITH TRACE TO LITTLE MICA
735	735.6	6.0	5	7	7	14		M			
	733.1	8.5	5	6	7	13		M			
730	728.1	13.5	6	7	9	16		M			
725	723.1	18.5	6	6	7	13		M			
720	718.1	23.5	6	6	7	13		M			
715	713.1	28.5	6	8	9	17		M			
710	708.1	33.5	8	9	11	20		M			
705	703.1	38.5	7	10	11	21		M			
700	698.1	43.5	7	8	10	18		M			
695	693.1	48.5	7	6	7	13		M			
690	688.1	53.5	7	10	15	25		M			
685	683.1	58.5	60	40/0.2		100/0.7				684.6	57.0
680	678.1	63.5	100/0.5			100/0.5					**WEATHERED ROCK** TAN, GRANITE
675	673.1	68.5	35	65/0.2		100/0.7				672.4	69.2
											Boring Terminated at Elevation 672.4 ft IN WEATHERED ROCK: GRANITE

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_B1-A	**STATION** 36+59	**OFFSET** 56 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 732.7 ft	**TOTAL DEPTH** 43.6 ft	**NORTHING** 559,482	**EASTING** 1,265,125	**24 HR.** 20.9
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/04/18	**COMP. DATE** 01/04/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
735										
										732.7 GROUND SURFACE 0.0
	731.7	1.0	1	2	2	4		M		731.7 1.0' TOPSOIL 1.0
730	729.2	3.5	8	10	10	20		M		**RESIDUAL** RED TAN AND ORANGE, SILTY SAND (A-2-4) WITH LITTLE MICA
	726.7	6.0	6	8	9	17		M		
725	724.2	8.5	7	8	10	18		M		
720	719.2	13.5	11	13	10	23		M		
715	714.2	18.5	6	8	9	17		M		
710	709.2	23.5	5	7	9	16		W		
705	704.2	28.5	10	19	25	44		W		
700	699.2	33.5	31	69	31/0.1	100/0.6				701.7 31.0
695	694.2	38.5	100/0.2			100/0.2				**WEATHERED ROCK** TAN, GRANITE
690	689.2	43.5	60/0.1			60/0.1				689.2 43.5
										689.1 43.6 **CRYSTALLINE ROCK** TAN, GRANITE
										Boring Terminated at Elevation 689.1 ft IN CRYSTALLINE ROCK: GRANITE

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_B1-C	**STATION** 36+79	**OFFSET** 19 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** 32.4
COLLAR ELEV. 747.0 ft	**TOTAL DEPTH** 49.8 ft	**NORTHING** 559,518	**EASTING** 1,265,103	**24 HR.** 30.1
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/12/18	**COMP. DATE** 01/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
750											
										747.0	0.0
										GROUND SURFACE	
										RESIDUAL	
										TAN, SILTY SAND (A-2-4) WITH A LITTLE MICA	
745	746.0	1.0	3	3	3	6		M			
	743.5	3.5	5	5	7	12		M			
740	741.0	6.0	3	4	5	9		M			
	738.5	8.5	5	6	7	13		M			
735	733.5	13.5	5	6	7	13		M			
730	728.5	18.5	9	14	14	28		M			
725	723.5	23.5	6	8	7	15		M			
720	718.5	28.5	12	17	18	35		M			
715	713.5	33.5	7	11	19	30		W			
710	708.5	38.5	31	65	35/0.2	100/0.7				708.5	38.5
										WEATHERED ROCK	
705	703.5	43.5	60	40/0.1		100/0.6				TAN, GRANITE (WR)	
700	698.5	48.5	100/0.3			100/0.3				698.5	48.5
	697.2	49.8	60/0.0			60/0.0				**CRYSTALLINE ROCK**	49.8
										GRANITE (CR)	
										Boring Terminated at Elevation 697.2 ft ON CRYSTALLINE ROCK: GRANITE	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_B1-B	**STATION** 36+85	**OFFSET** 24 ft RT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 760.3 ft	**TOTAL DEPTH** 68.6 ft	**NORTHING** 559,560	**EASTING** 1,265,092	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 12/21/17	**COMP. DATE** 12/21/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
765										
										760.3 GROUND SURFACE 0.0
760	759.3	1.0	4	13	19	32		D		**RESIDUAL** ORANGE AND BROWN, SILTY SAND (A-2-4)
	756.8	3.5	10	18	23	41		D		
755	754.3	6.0	17	45	55/0.4	100/0.9				753.8 6.5
	751.8	8.5	28	50	46	96		D		752.3 **WEATHERED ROCK** 8.0
750										ORANGE AND BROWN, BIOTITE GNEISS
	746.8	13.5	17	33	47	80		D		**RESIDUAL**
745	741.8	18.5	11	14	18	32		D		ORANGE, BROWN, AND WHITE, SILTY SAND (A-2-4)
740	736.8	23.5	7	9	16	25		D		
735	731.8	28.5	22	40	60			D		
730	726.8	33.5	11	11	14	25		D		
725	721.8	38.5	10	20	23	43		D		
720	716.8	43.5	16	26	20	46		D		
715	711.8	48.5	5	7	18	25		D		
710	706.8	53.5	100/0.3			100/0.3				709.3 51.0
705	701.8	58.5	100/0.2			100/0.2				**WEATHERED ROCK** GRAY, MICA SCHIST
700	696.8	63.5	100/0.2			100/0.2				704.3 56.0
695	691.8	68.5	60/0.1			60/0.1				**WEATHERED ROCK** ORANGE, BROWN, AND GRAY, BIOTITE GNEISS
										691.8 68.5
										691.7 **CRYSTALLINE ROCK** 68.6
										ORANGE, BROWN, AND GRAY, BIOTITE GNEISS
										Boring Terminated at Elevation 691.7 ft IN CRYSTALLINE ROCK: GRANITE

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB2-A	**STATION** 37+83	**OFFSET** 57 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 744.4 ft	**TOTAL DEPTH** 37.7 ft	**NORTHING** 559,464	**EASTING** 1,265,011	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/04/18	**COMP. DATE** 01/04/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
745												
	743.4	1.0								GROUND SURFACE	744.4	0.0
			2	2	2	4		M		0.9' TOPSOIL	743.5	0.9
	740.9	3.5								**RESIDUAL**		
740			5	9	10	19		M		RED AND TAN, SILTY SAND (A-2-4)		
	738.4	6.0								WITH LITTLE MICA		
			5	7	8	15		M				
	735.9	8.5										
735			6	8	8	16		M				
	730.9	13.5										
730			11	13	13	26		M				
	725.9	18.5										
725			8	12	12	24		M				
	720.9	23.5										
720			9	13	13	26		M				
	715.9	28.5										
715			10	16	9	25		W			713.9	30.5
	710.9	33.5								**WEATHERED ROCK**		
710			100/0.3			100/0.3				TAN, GRANITE		
	706.7	37.7									706.7	37.7
			60/0.0			60/0.0				Boring Terminated at Elevation 706.7 ft ON CRYSTALLINE ROCK: GRANITE		

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB2-C	**STATION** 37+86	**OFFSET** 17 ft LT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 758.5 ft	**TOTAL DEPTH** 53.5 ft	**NORTHING** 559,502	**EASTING** 1,264,999	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/15/18	**COMP. DATE** 01/15/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
760												
	757.5	1.0								GROUND SURFACE	758.5	0.0
			10	28	36	64		M		**RESIDUAL**		
755	755.0	3.5								TAN AND BROWN, SILTY SAND (A-2-4)	755.5	3.0
			80	20/0.1		100/0.6				**WEATHERED ROCK**		
	752.5	6.0								TAN AND BROWN, MICA SCHIST	753.0	5.5
			15	21	27	48		M		**RESIDUAL**		
750	750.0	8.5								TAN BROWN AND WHITE, SILTY SAND		
			16	21	29	50		M		(A-2-4) WITH LITTLE TO SOME MICA		
745	745.0	13.5										
			5	9	12	21		M				
740	740.0	18.5										
			12	17	17	34		M				
735	735.0	23.5										
			11	13	15	28		M				
730	730.0	28.5										
			7	9	9	18		M				
725	725.0	33.5										
			7	7	8	15		M				
720	720.0	38.5										
			8	5	33	38		W				
715	715.0	43.5										
			5	6	17	23		W				
710	710.0	48.5									710.5	48.0
			65	35/0.2		100/0.7				**WEATHERED ROCK**		
705	705.0	53.5								TAN, GRANITE		
			60/0.0			60/0.0					705.0	53.5
										Boring Terminated at Elevation 705.0 ft ON CRYSTALLINE ROCK: GRANITE		

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Crockett, S. C.	
SITE DESCRIPTION STRUCTURE #4 - BRIDGE OVER US 74 BYPASS ON US 74 RAMP/LOOP BETWEEN ANTHONY FARM RD AND U				**GROUND WTR (ft)**
BORING NO. S4_EB2-B	**STATION** 37+97	**OFFSET** 19 ft RT	**ALIGNMENT** -RAMP_A-	**0 HR.** Dry
COLLAR ELEV. 767.6 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 559,304	**EASTING** 1,264,998	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 12/21/17	**COMP. DATE** 12/21/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
770										767.6	0.0
	766.6	1.0								0.4' TOPSOIL	
765			7	13	26	39		D		**RESIDUAL** ORANGE AND BROWN, SANDY SILT (A-4), MICACEOUS, SAPROLITIC	
	764.1	3.5								763.6	4.0
			21	34	34	68		D		ORANGE AND BROWN, SILTY SAND (A-2-4) WITH TRACE ROCK FRAGMENTS, MICACEOUS	
	761.6	6.0									
760			17	50	50	100/1.0		D			
	759.1	8.5									
			16	30	42	72		D			
755											
	754.1	13.5									
			18	25	22	47		D			
750											
	749.1	18.5									
			17	39	60	99		D			
745											
	744.1	23.5									
			14	24	27	51		D			
740											
	739.1	28.5									
			13	18	27	45		D			
735											
	734.1	33.5									
			11	12	14	26		D			
730											
	729.1	38.5								729.1	38.5
			40	60/0.3		100/0.8				**WEATHERED ROCK** ORANGE AND BROWN, BIOTITIE GNEISS	
725										726.6	41.0
	724.1	43.5								**RESIDUAL** ORANGE AND BROWN, SILTY SAND (A-2-4) WITH TRACE ROCK FRAGMENTS, MICACEOUS	
			10	19	28	47		D		722.6	45.0
										Boring Terminated at Elevation 722.6 ft IN RESIDUAL: SILTY SAND (A-2-4)	

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	11

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

STRUCTURE SUBSURFACE INVESTIGATION

REFERENCE: R-2707D

PROJECT: 34497

COUNTY CLEVELAND

PROJECT DESCRIPTION US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)

SITE DESCRIPTION STRUCTURES #8 & #9 – DUAL BRIDGES ON US 74 BYPASS (–L–) OVER –SRVRD_5– BETWEEN SR 2047 (BORDERS RD.) AND US 74 BUSINESS (E. MARION ST.)

CONTENTS

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.

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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY GOODNIGHT, D.J.

DRAWN BY CROCKETT, S.C.

CHECKED BY HAMM, J.R.

SUBMITTED BY FALCON ENG.

DATE AUGUST 2018

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

DocuSigned by:
Jeremy R Hamm
ED7938089E22487...

8/28/2018 2:38:18 PM EDT

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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 / DPT / DMT / VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: BL-176
STATION -L- POT 809+59.85, 18.35' RT
N: 560843.2, E: 1264503.8 ELEVATION: 742.38 FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	3

0 30 60
FEET

NC GRID NAD 83/95

808+00
13+00
809+00
810+00
-SRVRD_5-
811+00
812+00

END BENT #1
STATION 809+41.25 (L)

S8_EB1-A
S8_EB2-A
STRUCTURE #8
S8_EB2-B
S8_EB1-B
12+00
BL-176
-L-
S9_EB2-A
S9_EB1-A
STRUCTURE #9
S9_EB1-B
S9_EB2-B
11+00
END BENT #1
STATION 809+47.17 (L)
END BENT #2
STATION 810+60.83 (L)
END BENT #2
STATION 810+53.75 (L)
GR
MTL BUS
BRIDGE SKEW: 90°

DATE: 9-15-14

0	100	200

FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

STRUCTURE #8, BRIDGE ON US 74 BYPASS OVER –SRVRD_5–

(A) **RESIDUAL:** TAN, BROWN, AND WHITE, DRY TO MOIST, MED. DENSE TO V. DENSE, FINE TO COARSE SAND AND SILTY SAND (A-1-b, A-2-4)

(B) **RESIDUAL:** TAN, MOIST, HARD, SANDY SILT (A-4), HIGHLY MICACEOUS

(C) **WEATHERED ROCK:** TAN, BROWN, AND WHITE, GRANITE AND MICA SCHIST

(C) **CRYSTALLINE ROCK:** TAN AND WHITE, GRANITE

EXISTING GROUND

PROPOSED GRADE

S8_EB1-A
60' LT

S8_EB2-A
55' LT

BT
DRY
01/18

SPT. REF.

750
740
730
720
710
700
690
680
670
660
650

805+00 806+00 807+00 808+00 809+00 810+00 811+00 812+00 813+00 814+00 815+00

NOTES:

GROUNDLINE PROFILE THROUGH CENTERLINE OF STRUCTURE GENERATED FROM TIN FILE R2707_LS_TNL_180309.TIN DATED MARCH, 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

–L–

0	100	200

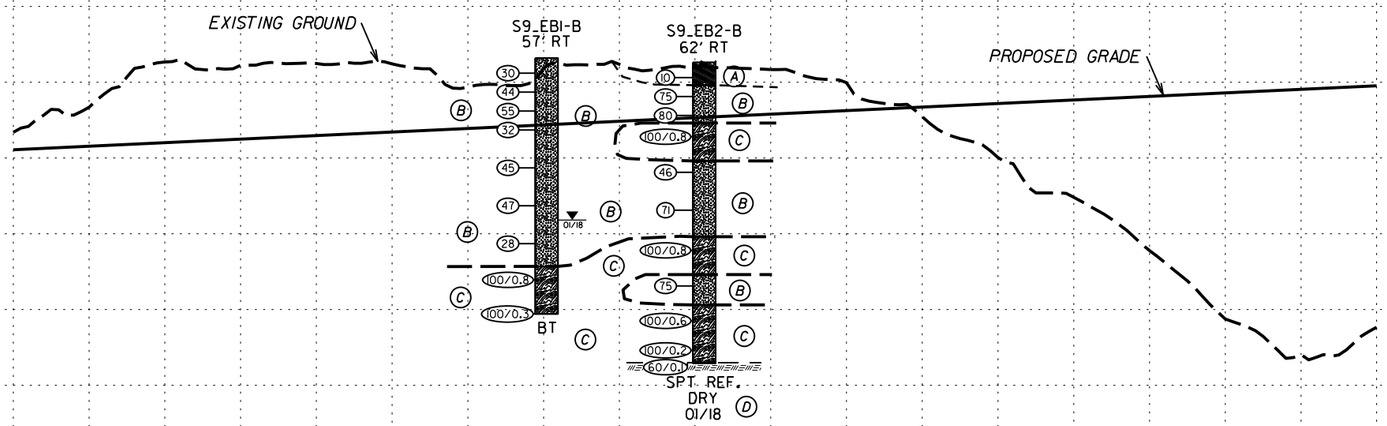
FEET

VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	5

STRUCTURE #9, BRIDGE ON US 74 BYPASS OVER –SRVRD_5–

(A) **RESIDUAL:** ORANGE, DRY, STIFF, SANDY CLAY (A-6) WITH TRACE ORGANICS
(B) **RESIDUAL:** ORANGE AND TAN, DRY TO MOIST, MED. DENSE TO V. DENSE, SILTY SAND (A-2-4)
(C) **WEATHERED ROCK:** TAN, ORANGE, BLACK, AND GRAY, GRANITE AND MICA SCHIST
(D) **WEATHERED ROCK:** GRAY, GRANITE



NOTES:

GROUNDLINE PROFILE THROUGH CENTERLINE OF STRUCTURE GENERATED FROM TIN FILE R2707_LS_TNL_180309.TIN DATED MARCH, 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

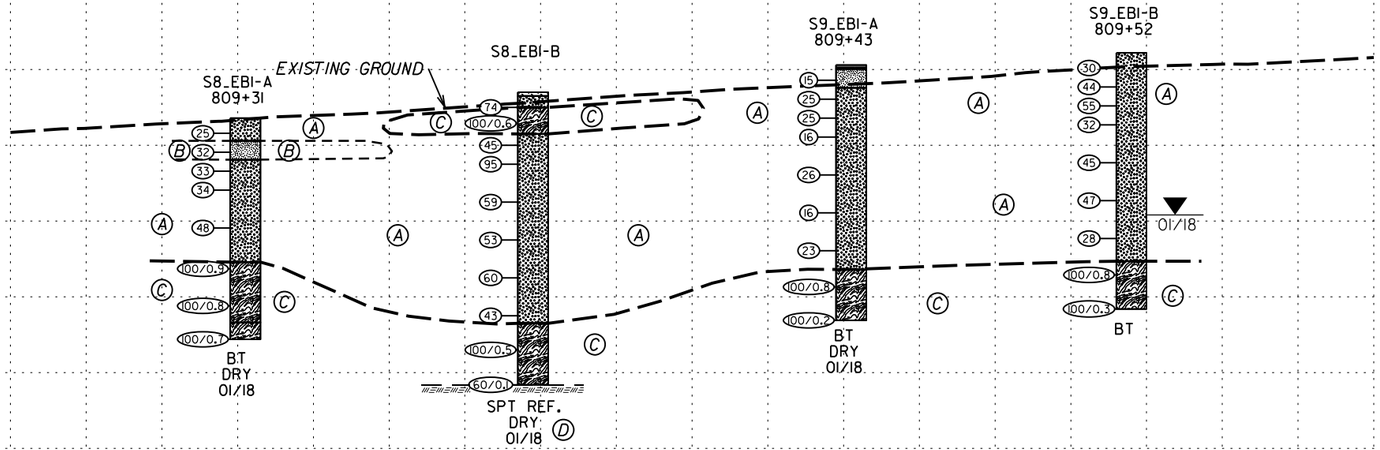
8/23/9

PROJ. REFERENCE NO.	SHEET NO.
R-2707D	6

0 5 10

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN, GRAY, AND BROWN, DRY TO MOIST, MED. DENSE TO V. DENSE, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS, LITTLE TO HIGHLY MICACEOUS
Ⓑ **RESIDUAL:** TAN, MOIST, HARD, SANDY SILT (A-4) HIGHLY MICACEOUS
Ⓒ **WEATHERED ROCK:** TAN, BROWN, AND GRAY, GRANITE AND MICA SCHIST
Ⓓ **CRYSTALLINE ROCK:** MICA SCHIST



760 750 740 730 720 710 700 690 680 670 660

145 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

END BENT #1
809+44.00

—L—

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

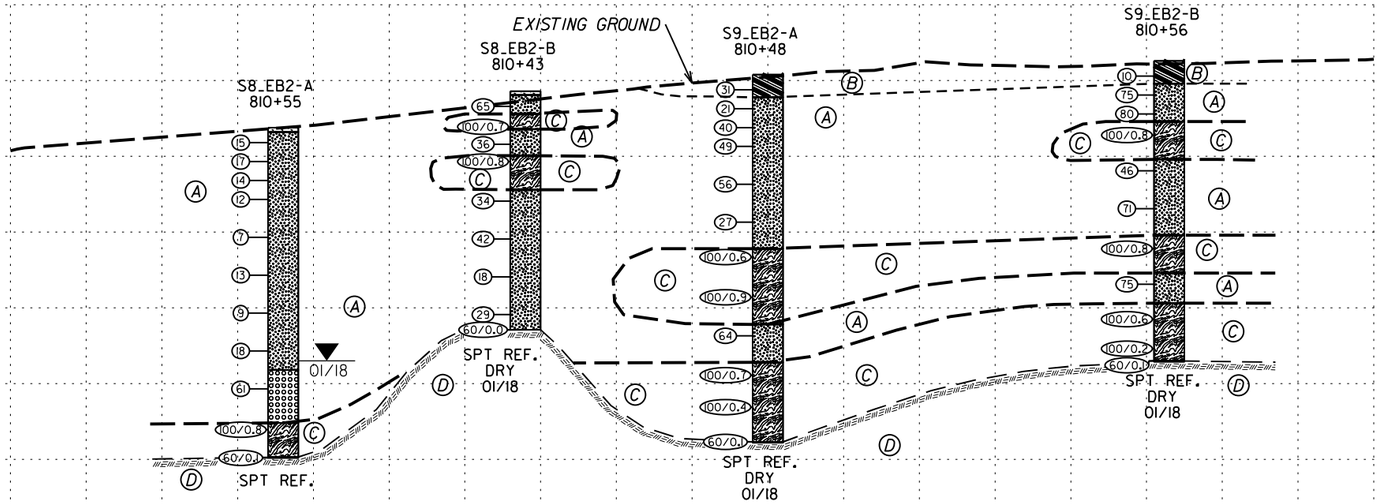
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH ALL PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

$DATE$

0 20 40
FEET

Ⓐ **RESIDUAL:** TAN, ORANGE, AND BLACK, DRY TO MOIST, MED. DENSE TO V. DENSE, SILTY SAND (A-2-4) WITH TRACE ROCK FRAGMENTS, MICACEOUS, SAPROLITIC
Ⓑ **RESIDUAL:** ORANGE, DRY, STIFF TO HARD, SANDY CLAY (A-6) WITH TRACE ORGANICS, MICACEOUS
Ⓒ **WEATHERED ROCK:** GRAY, TAN, AND ORANGE, GRANITE
Ⓓ **CRYSTALLINE ROCK:** GRAY, GRANITE



END BENT #2
810+57.00

NOTES:

GROUNDLINE CROSS SECTION ALONG BENT LINE DRAWN FROM TOPOGRAPHIC DATA FROM TIN FILE R2707_LS_TNL_180309 DATED MARCH 2018.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH ALL PROJECTED ONTO THE CROSS SECTION.

BRIDGE SKEW: 90°

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #8 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S8_EB1-A	**STATION** 809+31	**OFFSET** 60 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 734.6 ft	**TOTAL DEPTH** 29.2 ft	**NORTHING** 560,901	**EASTING** 1,264,564	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/17/18	**COMP. DATE** 01/17/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
735										734.6 GROUND SURFACE	0.0
	733.6	1.0	11	11	14	25		M		**RESIDUAL** RED AND TAN, SILTY SAND (A-2-4) WITH SOME MICA	
730	731.1	3.5	14	15	17	32		M		731.6 TAN, SANDY SILT (A-4) HIGHLY MICACEOUS	3.0
	728.6	6.0	8	8	25	33		M		729.1 BROWN, SILTY SAND (A-2-4) WITH SOME MICA	5.5
725	726.1	8.5	18	18	16	34		M			
720	721.1	13.5	16	20	28	48		M			
715	716.1	18.5	17	33	67/0.4	100/0.9				715.6 **WEATHERED ROCK** TAN, BROWN, AND WHITE, MICA SCHIST	19.0
710	711.1	23.5	39	55	45/0.3	100/0.8					
	706.1	28.5	45	55/0.2		100/0.7				707.6 TAN AND WHITE, GRANITE	27.0
										705.4 Boring Terminated at Elevation 705.4 ft IN WEATHERED ROCK: GRANITE	29.2

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #8 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S8_EB1-B	**STATION** 809+44	**OFFSET** 22 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 738.0 ft	**TOTAL DEPTH** 38.6 ft	**NORTHING** 560,874	**EASTING** 1,264,534	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/19/18	**COMP. DATE** 01/19/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
740										738.0 GROUND SURFACE 0.0
	737.0	1.0	8	22	52	74		M		737.5 0.5' TOPSOIL 0.5
735	734.5	3.5	87	13/0.1		100/0.6		M		736.0 **RESIDUAL** TAN AND BROWN, SILTY SAND (A-2-4) WITH SOME MICA 2.0
	732.0	6.0	10	24	21	45		M		732.5 **WEATHERED ROCK** TAN AND BROWN, MICA SCHIST 5.5
730	729.5	8.5	33	56	39	95		D		**RESIDUAL** TAN AND BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS AND LITTLE TO HIGHLY MICACEOUS
725	724.5	13.5	17	26	33	59		M		
720	719.5	18.5	20	23	30	53		M		
715	714.5	23.5	18	23	37	60		M		
710	709.5	28.5	17	17	26	43		M		707.5 **WEATHERED ROCK** BROWN AND WHITE, MICA SCHIST 30.5
705	704.5	33.5	100/0.5			100/0.5				
700	699.5	38.5	60/0.1			60/0.1				699.5 699.4 **CRYSTALLINE ROCK** MICA SCHIST 38.5 38.6 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 699.4 ft IN CRYSTALLINE ROCK: MICA SCHIST

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #8 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S8_EB2-A	**STATION** 810+55	**OFFSET** 55 ft LT	**ALIGNMENT** -L-	**0 HR.** 33.5
COLLAR ELEV. 733.8 ft	**TOTAL DEPTH** 43.6 ft	**NORTHING** 560,786	**EASTING** 1,264,609	**24 HR.** 30.8
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/17/18	**COMP. DATE** 01/17/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
735										
	732.8	1.0	3	7	8	15		M		733.8 / 0.0 GROUND SURFACE
	730.3	3.5								733.2 / 0.6 0.6' TOPSOIL
730			6	7	10	17		M		**RESIDUAL** TAN AND WHITE, SILTY SAND (A-2-4) WITH TRACE MICA
	727.8	6.0	4	7	7	14		M		
725	725.3	8.5								
			5	5	7	12		M		
720	720.3	13.5								
			3	4	3	7		M		
715	715.3	18.5								
			5	6	7	13		M		
710	710.3	23.5								
			4	5	4	9		M		
705	705.3	28.5								
			5	7	11	18		W		
700	700.3	33.5								
			7	33	28	61		W		
695	695.3	38.5								
			25	55	45/0.3	100/0.8		W		
	690.3	43.5	60/0.1			60/0.1				701.8 / 32.0 WHITE, SLIGHTLY SILTY FINE TO COARSE SAND (A-1-b) 694.8 / 39.0 **WEATHERED ROCK** TAN AND WHITE, GRANITE 690.3 / 43.5 690.2 / 43.6 **CRYSTALLINE ROCK** TAN AND WHITE, GRANITE Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 690.2 ft IN CRYSTALLINE ROCK: GRANITE

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #8 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S8_EB2-B	**STATION** 810+43	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 738.6 ft	**TOTAL DEPTH** 31.5 ft	**NORTHING** 560,784	**EASTING** 1,264,575	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/10/18	**COMP. DATE** 01/10/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
740										
	737.6	1.0	14	25	40	65		D		738.6 / 0.0 GROUND SURFACE
735	735.1	3.5								738.1 / 0.5 0.5' TOPSOIL
			11	48	52/0.2	100/0.7		D		**RESIDUAL** ORANGE, TAN, BLACK, AND WHITE, SILTY SAND (A-2-4) SAPROLITIC 735.6 / 3.0
	732.6	6.0	12	16	20	36		D		**WEATHERED ROCK** TAN, GRANITE 733.6 / 5.0
730	730.1	8.5								**RESIDUAL** TAN AND BROWN, SILTY SAND (A-2-4) MICACEOUS AND TRACE ROCK FRAGS 730.1 / 8.5
			63	37/0.3		100/0.8		D		**WEATHERED ROCK** TAN, GRANITE 725.6 / 13.0
725	725.1	13.5								**RESIDUAL** TAN, WHITE, BLACK, ORANGE, AND GRAY, SILTY SAND (A-2-4) TRACE ROCK FRAGS, SAPROLITIC, HIGHLY MICACEOUS
			14	14	20	34		D		
720	720.1	18.5								
			12	18	24	42		D		
715	715.1	23.5								
			9	9	9	18		M		
710	710.1	28.5								
			5	10	19	29		D		
	707.1	31.5	60/0.0			60/0.0				707.1 / 31.5 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 707.1 ft ON CRYSTALLINE ROCK: GRANITE

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #9 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S9_EB1-A	**STATION** 809+43	**OFFSET** 20 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 741.6 ft	**TOTAL DEPTH** 33.7 ft	**NORTHING** 560,858	**EASTING** 1,264,495	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/19/18	**COMP. DATE** 01/19/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
745											
										741.6	0.0
										GROUND SURFACE	
										741.1	0.5
										0.5' TOPSOIL	
										RESIDUAL	
										738.6	3.0
										TAN, SANDY SILT (A-4) WITH LITTLE MICA	
										TAN AND GRAY, SILTY SAND (A-2-4) LITTLE TO HIGHLY MICACEOUS	
740	740.6	1.0	3	6	9	15		M			
	738.1	3.5	11	12	13	25		M			
735	735.6	6.0	11	13	12	25		M			
	733.1	8.5	6	7	9	16		M			
730	728.1	13.5	11	11	15	26		M			
725	723.1	18.5	3	5	11	16		M			
720	718.1	23.5	6	9	14	23		M			
715	713.1	28.5	48	52/0.3		100/0.8				714.6	27.0
										WEATHERED ROCK	
										GRAY, MICA SCHIST	
710	708.1	33.5	100/0.2			100/0.2				707.9	33.7
										Boring Terminated at Elevation 707.9 ft IN WEATHERED ROCK: MICA SCHIST	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #9 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S9_EB1-B	**STATION** 809+52	**OFFSET** 57 ft RT	**ALIGNMENT** -L-	**0 HR.** 29.0
COLLAR ELEV. 743.2 ft	**TOTAL DEPTH** 33.8 ft	**NORTHING** 560,835	**EASTING** 1,264,465	**24 HR.** 21.4
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/19/18	**COMP. DATE** 01/19/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
745										
										743.2 GROUND SURFACE 0.0
										RESIDUAL
										TAN, SILTY SAND (A-2-4) LITTLE TO HIGHLY MICACEOUS
	742.2	1.0	6	11	19	30		M		
740	739.7	3.5	14	20	24	44		M		
	737.2	6.0	14	25	30	55		M		
735	734.7	8.5	11	14	18	32		M		
730	729.7	13.5	16	22	23	45		M		
725	724.7	18.5	11	22	25	47		M		
720	719.7	23.5	10	16	12	28		M		
715	714.7	28.5	34	66/0.3		100/0.8				715.7 27.5
										WEATHERED ROCK
										GRAY, MICA SCHIST
710	709.7	33.5	100/0.3			100/0.3				709.4 33.8
										Boring Terminated at Elevation 709.4 ft IN WEATHERED ROCK: MICA SCHIST

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #9 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S9_EB2-A	**STATION** 810+48	**OFFSET** 9 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 740.8 ft	**TOTAL DEPTH** 48.6 ft	**NORTHING** 560,766	**EASTING** 1,264,548	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/10/18	**COMP. DATE** 01/10/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
745											
740	739.8	1.0	6	12	19	31		D		740.8 GROUND SURFACE	0.0
	737.3	3.5	8	10	11	21		D		**RESIDUAL** ORANGE, SANDY CLAY (A-6) MICACEOUS	
735	734.8	6.0	12	18	22	40		D		737.8 ORANGE, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC	3.0
	732.3	8.5	18	23	26	49		D			
730	727.3	13.5	22	31	25	56		D			
725	722.3	18.5	9	11	16	27		M			
720	717.3	23.5	82	18/0.1		100/0.6				717.8 **WEATHERED ROCK** GRAY, TAN, AND ORANGE, GRANITE	23.0
715	712.3	28.5	29	71/0.4		100/0.9					
710	707.3	33.5	10	25	39	64		D		707.8 **RESIDUAL** ORANGE, BLACK, AND TAN, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC	33.0
705	702.3	38.5	22	64	36/0.2	100/0.7				702.8 **WEATHERED ROCK** ORANGE, GRAY, AND TAN, GRANITE	38.0
700	697.3	43.5	100/0.4			100/0.4					
695	692.3	48.5	60/0.1			60/0.1				692.3 692.2 **CRYSTALLINE ROCK** GRAY, GRANITE Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 692.2 ft IN CRYSTALLINE ROCK: GRANITE	48.5 48.6

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION STRUCTURE #9 - BRIDGE ON US 74 BYPASS (-L-) OVER -SRVRD_5-				**GROUND WTR (ft)**
BORING NO. S9_EB2-B	**STATION** 810+56	**OFFSET** 62 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 742.6 ft	**TOTAL DEPTH** 39.7 ft	**NORTHING** 560,738	**EASTING** 1,264,503	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/10/18	**COMP. DATE** 01/10/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
745											
										742.6 GROUND SURFACE	0.0
740	741.6	1.0	3	4	6	10		D		**RESIDUAL** ORANGE, SANDY CLAY (A-6) WITH TRACE ORGANICS	
	739.1	3.5	23	31	44	75		D		739.6 ORANGE AND BROWN, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC	3.0
735	736.6	6.0	26	36	44	80		D			
	734.1	8.5	29	57	43/0.3	100/0.8				734.6 **WEATHERED ROCK** TAN AND ORANGE, GRANITE	8.0
730	729.1	13.5	17	21	25	46		D		729.6 **RESIDUAL** ORANGE, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC	13.0
725	724.1	18.5	23	39	32	71		D			
720	719.1	23.5	11	36	64/0.3	100/0.8				719.6 **WEATHERED ROCK** ORANGE, TAN, AND BLACK, GRANITE	23.0
715	714.1	28.5	20	33	42	75		M		714.6 **RESIDUAL** ORANGE, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC	28.0
710	709.1	33.5	73	27/0.1		100/0.6				710.6 **WEATHERED ROCK** GRAY AND ORANGE, GRANITE	32.0
705	704.6	38.0	100/0.2			100/0.2					
	703.0	39.6	60/0.1			60/0.1				703.0 702.9 **CRYSTALLINE ROCK** GRAY, GRANITE Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 702.9 ft IN CRYSTALLINE ROCK: GRANITE	39.6 39.7

REFERENCE: R-2707D

PROJECT: 34497

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	6

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *CULVERT #1 – CULVERT ON –L– (US 74 BYPASS) STATION 717+13 OVER UNNAMED TRIBUTARY TO BUFFALO CREEK*

CONTENTS

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.

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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *CROCKETT, S.C.*

CHECKED BY *HAMM, J.R.*

SUBMITTED BY *FALCON ENG.*

DATE *OCTOBER 2018*

10/23/2018 11:28:38 PM EDT

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

DocuSigned by:
Jeremy R Hamm
ED7938089E22487...

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b			A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: ELEVATIONS TAKEN FROM R2707_LS_TNL_180309.TIN DATED 03/18

ELEVATION: FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R–2707D	3

0 50 100
FEET

EXISTING R/W
SOIL
HTR
HTR
RAD = 50'
W/LT 84
W/LT 85
W/LT 87
W/LT 86
48" WW
714+00
715+00
716+00
717+00
718+00
719+00
720+00
NC GRID NAD 83'95
JS NEU
JS
L_71965_84LT
L_71689_9RT
L_71582_96RT
CULVERT SKEW: 145°
DATE: 9-15-14

0 40 80
FEET
VE = 2:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

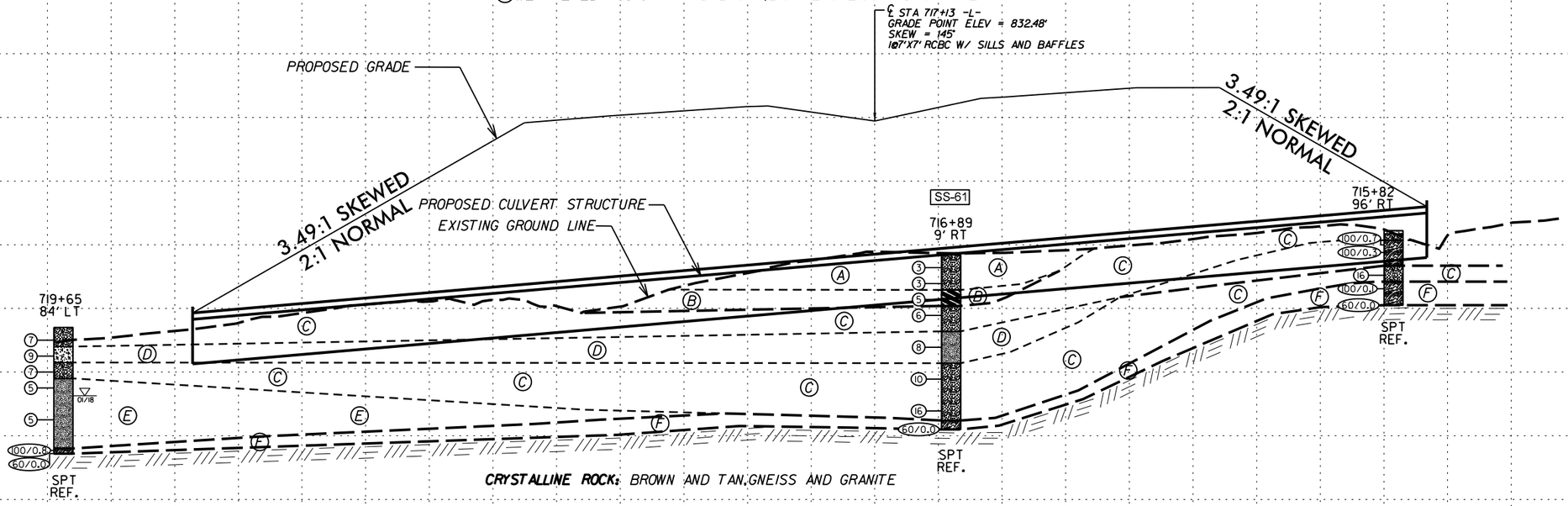
PROFILE OF CULVERT AT -L- STATION 717+13

-L-
717+13

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-61	9 FT RT	716+89	6.0'-7.5'	A-7-5	49	18	23	49	20	8	96	87	36	26	-

(A) **ALLUVIAL:** BROWN, MOIST TO WET, V. LOOSE, SILTY SAND (A-2-4)
(B) **ALLUVIAL:** GRAY, WET, MED. STIFF, SILTY CLAY (A-7-5) WITH TRACE GRAVEL AND ORGANICS
(C) **RESIDUAL:** TAN AND BROWN, MOIST TO WET, LOOSE TO MED. DENSE, SILTY SAND (A-2-4) WITH MICA AND TRACE ROCK FRAGMENTS
(D) **RESIDUAL:** TAN, ORANGE, AND BROWN, WET, MED. STIFF, SANDY SILT (A-4) WITH MICA AND TRACE ROCK FRAGMENTS
(E) **RESIDUAL:** TAN, WET, MED. STIFF, SANDY SILT (A-4) WITH MICA AND TRACE ROCK FRAGMENTS
(F) **WEATHERED ROCK:** TAN AND BROWN, BIOTITE GNEISS AND GRANITE



NOTES:

GROUNDLINE PROFILE ALONG CULVERT CENTERLINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED OCTOBER 2017.

CULVERT SKEW: 145 DEGREES

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_71582	**STATION** 715+82	**OFFSET** 96 ft RT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 812.2 ft	**TOTAL DEPTH** 11.7 ft	**NORTHING** 568,700	**EASTING** 1,259,470	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/29/18	**COMP. DATE** 01/29/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
815											
										812.2 GROUND SURFACE	0.0
	811.2	1.0	8	70	30/0.2			M		811.7 TOPSOIL 0.5'	0.5
810										810.7 **RESIDUAL** TAN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS	1.5
	809.1	3.1	100/0.3			100/0.7					
	806.2	6.0	9	7	9	16		M		806.7 **WEATHERED ROCK** TAN AND WHITE, GNEISS	5.5
805										804.2 **RESIDUAL** TAN AND BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS AND MICA	8.0
	803.7	8.5	85	15/0.1		100/0.1					
	800.5	11.7	60/0.0			60/0.0				800.5 **WEATHERED ROCK** TAN, GNEISS	11.7
										Boring Terminated at Elevation 800.5 ft ON CRYSTALLINE ROCK: GNEISS	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_71689	**STATION** 716+89	**OFFSET** 9 ft RT	**ALIGNMENT** -L-	**0 HR.** 10.1
COLLAR ELEV. 808.4 ft	**TOTAL DEPTH** 27.4 ft	**NORTHING** 568,625	**EASTING** 1,259,587	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/29/18	**COMP. DATE** 01/29/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
810											
	807.4	1.0	2	1	2	3		M		808.4 0.3' TOPSOIL	0.0
805	804.9	3.5	2	1	2	3		W		**ALLUVIAL** BROWN, SILTY SAND (A-2-4)	
	802.4	6.0	1	3	2	5	SS-61	W		802.9 GRAY, SILTY CLAY (A-7-5) WITH TRACE GRAVEL AND ORGANICS	5.5
800	799.9	8.5	2	2	4	6				800.4 **RESIDUAL** TAN, SILTY SAND (A-2-4) WITH A LITTLE MICA	8.0
	794.9	13.5	3	3	5	8		W		796.4 ORANGE AND TAN, SANDY SILT (A-4) WITH LITTLE MICA	12.0
795											
790	789.9	18.5	3	5	5	10		W		791.4 TAN, SILTY SAND (A-2-4)	17.0
785	784.9	23.5	5	10	6	16		W		782.4	26.0
	781.0	27.4	60/0.0			60/0.0				781.0 **WEATHERED ROCK** TAN, GRANITE	27.4
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 781.0 ft ON CRYSTALLINE ROCK: GRANITE	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_71965	**STATION** 719+65	**OFFSET** 84 ft LT	**ALIGNMENT** -L-	**0 HR.** 10.7
COLLAR ELEV. 797.0 ft	**TOTAL DEPTH** 19.8 ft	**NORTHING** 568,398	**EASTING** 1,259,767	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 01/29/18	**COMP. DATE** 01/29/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
800										797.0	0.0
										0.4' TOPSOIL	
	796.0	1.0								**RESIDUAL**	
795			1	4	3	7		M		TAN AND BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS	
	793.5	3.5								794.0	3.0
			2	3	6	9		M		RED AND BROWN, SANDY CLAYEY SILT (A-5) WITH TRACE ROCK FRAGMENTS	
	791.0	6.0								791.5	5.5
790			2	4	3	7		M		TAN AND BROWN, SILTY SAND (A-2-4) WITH TRACE MICA AND ROCK FRAGMENTS	
	788.5	8.5								789.0	8.0
			2	2	3	5				TAN, SANDY SILT (A-4) WITH MICA AND TRACE ROCK FRAGMENTS	
785											
	783.5	13.5	2	2	3	5		W			
780											
	778.5	18.5								778.5	18.5
	777.2	19.8	5	95/0.3		100/0.8				777.2	19.8
			60/0.0			60/0.0				**WEATHERED ROCK** BROWN, BIOTITE GNEISS	
										Boring Terminated BY AUGER REFUSAL at Elevation 777.2 ft ON CRYSTALLINE ROCK: BIOTITE GNEISS	

REFERENCE: R-2707D

PROJECT: 34497

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	6

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *CLEVELAND*

PROJECT DESCRIPTION *US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)*

SITE DESCRIPTION *CULVERT #2 – CULVERT ON –L– (US 74 BYPASS) STATION 743+18 OVER UNNAMED TRIBUTARY TO BUFFALO CREEK*

CONTENTS

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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NOTES:
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2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY *GOODNIGHT, D.J.*

DRAWN BY *CROCKETT, S.C.*

CHECKED BY *HAMM, J.R.*

SUBMITTED BY *FALCON ENG.*

DATE *OCTOBER 2018*

10/23/2018 11:28:38 PM EDT

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

DocuSigned by:
Jeremy R Hamm
ED7938089E22487...

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b			A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: ELEVATIONS TAKEN FROM R2707_LS_TNL_180309.TIN DATED 03/18

ELEVATION: FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R–2707D	3

0 50 100
FEET

NC GRID
NAD 83/95

740+00 741+00 742+00 743+00 744+00 745+00 746+00 747+00

L_74261_134LT

L_74300

L_74390_126RT

CULVERT SKEW: 66°

DATE: 9-15-14

0 40 80
FEET
VE = 2:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

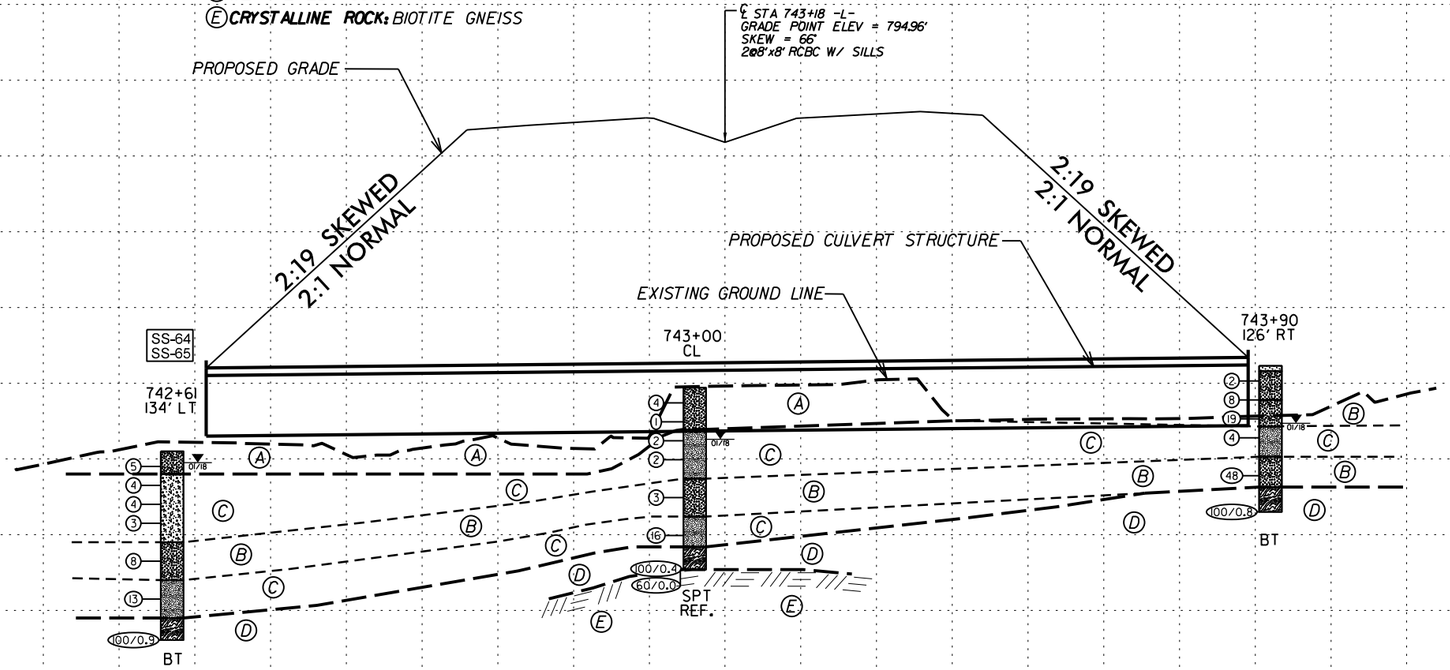
PROFILE OF CULVERT AT -L- STATION 743+18

-L-
743+18

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-64	134 FT LT	742+61	1.0'-2.5'	A-2-4	27	0	57	35	6	2	86	56	9	5	-
SS-65	134 FT LT	742+61	6.0'-7.5'	A-5	48	4	14	57	9	20	98	93	40	41	-

Ⓐ **ALLUVIAL:** RED, BROWN, AND TAN, MOIST TO WET, LOOSE, SILTY SAND (A-2-4) WITH SOME GRAVEL AND COBBLES
Ⓑ **RESIDUAL:** TAN, BROWN, AND GRAY, MOIST TO WET, V. LOOSE TO DENSE, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS AND MICA
Ⓒ **RESIDUAL:** BROWN, TAN, AND GRAY, MOIST TO WET, SOFT TO V. STIFF, SANDY AND CLAYEY SILT (A-4, A-5) WITH SOME ROCK FRAGMENTS AND MICA
Ⓓ **WEATHERED ROCK:** TAN AND BROWN, BIOTITE GNEISS
Ⓔ **CRYSTALLINE ROCK:** BIOTITE GNEISS



NOTES:

GROUNDLINE PROFILE ALONG CULVERT CENTERLINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED OCTOBER 2017.

CULVERT SKEW: 66 DEGREES

280 260 240 220 200 180 160 140 120 100 80 60 40 20 CL 20 40 60 80 100 120 140 160 180 200 220 240 260 280

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_74261	**STATION** 742+61	**OFFSET** 134 ft LT	**ALIGNMENT** -L-	**0 HR.** 2.0
COLLAR ELEV. 751.0 ft	**TOTAL DEPTH** 24.9 ft	**NORTHING** 566,461	**EASTING** 1,260,921	**24 HR.** 1.5
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER CAIN, J.	**START DATE** 01/24/18	**COMP. DATE** 01/24/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
755											
										751.0	0.0
										GROUND SURFACE	
750	750.0	1.0	2	3	2	5				**ALLUVIAL** TAN, MEDIUM TO CSE. SILTY SAND (A-2-4) WITH SOME GRAVEL AND COBBLES	
	747.5	3.5	1	2	2	4	SS-64	5%		748.0	3.0
745	745.0	6.0	1	2	2	4		W		**RESIDUAL** BROWN GRAY AND TAN, CLAYEY SILT (A-5) WITH LITTLE TO SOME MICA	
	742.5	8.5	1	1	2	3	SS-65	41%			
740								W			
	737.5	13.5	10	4	4	8				739.0	12.0
735										GRAY AND BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS	
	732.5	18.5	4	5	8	13		M		734.0	17.0
730										BROWN, SANDY SILT (A-4)	
										729.0	22.0
	727.5	23.5	21	27	73/0.4	100/0.9				**WEATHERED ROCK** TAN AND BROWN, BIOTITE GNEISS	
										726.1	24.9
										Boring Terminated at Elevation 726.1 ft IN WEATHERED ROCK: BIOTITE GNEISS	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_74300	**STATION** 743+00	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** 7.9
COLLAR ELEV. 759.4 ft	**TOTAL DEPTH** 24.0 ft	**NORTHING** 566,347	**EASTING** 1,260,840	**24 HR.** 6.8
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 01/24/18	**COMP. DATE** 01/25/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
760											
	758.4	1.0								759.4	0.0
			1	2	2	4				0.3' TOPSOIL	
755	755.9	3.5	WOH	WOH	1	1		M		**ALLUVIAL** RED BROWN AND TAN, SILTY SAND (A-2-4) WITH SOME GRAVEL	
	753.4	6.0	3	1	1	2		W		753.9	5.5
750	750.9	8.5	WOH	WOH	2	2				**RESIDUAL** TAN AND GRAY, FINE SANDY SILT (A-4) HIGHLY MICACEOUS	
	745.9	13.5	2	1	2	3		W		747.4	12.0
745										BROWN, SILTY SAND (A-2-4) WITH SOME MICA	
	740.9	18.5	2	9	7	16		Sat.		742.4	17.0
740										TAN AND BROWN, SANDY SILT (A-4) WITH SOME MICA AND ROCK FRAGMENTS	
	735.9	23.5	100/0.4			100/0.4		W		738.4	21.0
	735.4	24.0	60/0.0			60/0.0				**WEATHERED ROCK** TAN AND BROWN, BIOTITE GNEISS	
										735.4	24.0
										Boring Terminated at Elevation 735.4 ft ON CRYSTALLINE ROCK: BIOTITE GNEISS	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Goodnight, D. J.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_74390	**STATION** 743+90	**OFFSET** 126 ft RT	**ALIGNMENT** -L-	**0 HR.** 9.3
COLLAR ELEV. 762.3 ft	**TOTAL DEPTH** 19.3 ft	**NORTHING** 566,198	**EASTING** 1,260,798	**24 HR.** 7.6
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER CAIN, J.	**START DATE** 01/24/18	**COMP. DATE** 01/24/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
765											
										762.3 GROUND SURFACE	0.0
	761.3	1.0	1	1	1	2		M		761.6 0.7' TOPSOIL	0.7
760										**ALLUVIAL** TAN, SILTY SAND (A-2-4)	
	758.8	3.5	2	5	3	8		M		757.8	4.5
	756.3	6.0	2	9	10	19				**RESIDUAL** BROWN, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS	
755	753.8	8.5	1	2	2	4		W		754.3	8.0
										TAN AND BROWN, FINE SANDY SILT (A-4) WITH SOME MICA	
750										750.3	12.0
	748.8	13.5	17	12	36	48		W		BROWN AND GRAY, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS	
745										746.3	16.0
	743.8	18.5	20	80/0.3		100/0.8				**WEATHERED ROCK** TAN AND BROWN, BIOTITE GNIESS	
										743.0	19.3
										Boring Terminated at Elevation 743.0 ft IN WEATHERED ROCK: BIOTITE GNEISS	

REFERENCE: R-2707D

PROJECT: 34497

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	6

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY CLEVELAND

PROJECT DESCRIPTION US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD.)

SITE DESCRIPTION CULVERT #3 – CULVERT ON –L– (US 74 BYPASS) STATION 796+86 OVER UNNAMED TRIBUTARY TO BUFFALO CREEK

CONTENTS

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.

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 THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. 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.

PERSONNEL

HPC

GOODNIGHT, D.J.

INVESTIGATED BY GOODNIGHT, D.J.

DRAWN BY CROCKETT, S.C.

CHECKED BY HAMM, J.R.

SUBMITTED BY FALCON ENG.

DATE OCTOBER 2018

10/23/2018 11:28:38 PM EDT

NORTH CAROLINA PROFESSIONAL SEAL 039779 ENGINEER JEREMY R. HAMM

DocuSigned by:
Jeremy R Hamm
ED7938089E22487...

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2

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-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b			A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	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 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 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 RESISTENCE (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	4	10	40	60	200	270
OPENING (MM)	4.76	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	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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

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, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- 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
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - 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
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] 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)	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 YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	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 (SLI.)	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. *IF TESTED, WOULD YIELD SPT REFUSAL*
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. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 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 PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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	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.

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 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 (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 (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.

BENCH MARK: ELEVATIONS TAKEN FROM R2707_LS_TNL_180309.TIN DATED 03/18

ELEVATION: FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R–2707D	3

0 50 100
FEET

794+00
795+00
796+00
797+00
798+00
799+00
800+00

NC GRID NAD 83/95

L_79685_149LT

L_79700

L_79685_140RT

S 23° 50' 54.0" E

—L—

F

CULVERT SKEW: 87°

DATE: 9-15-14

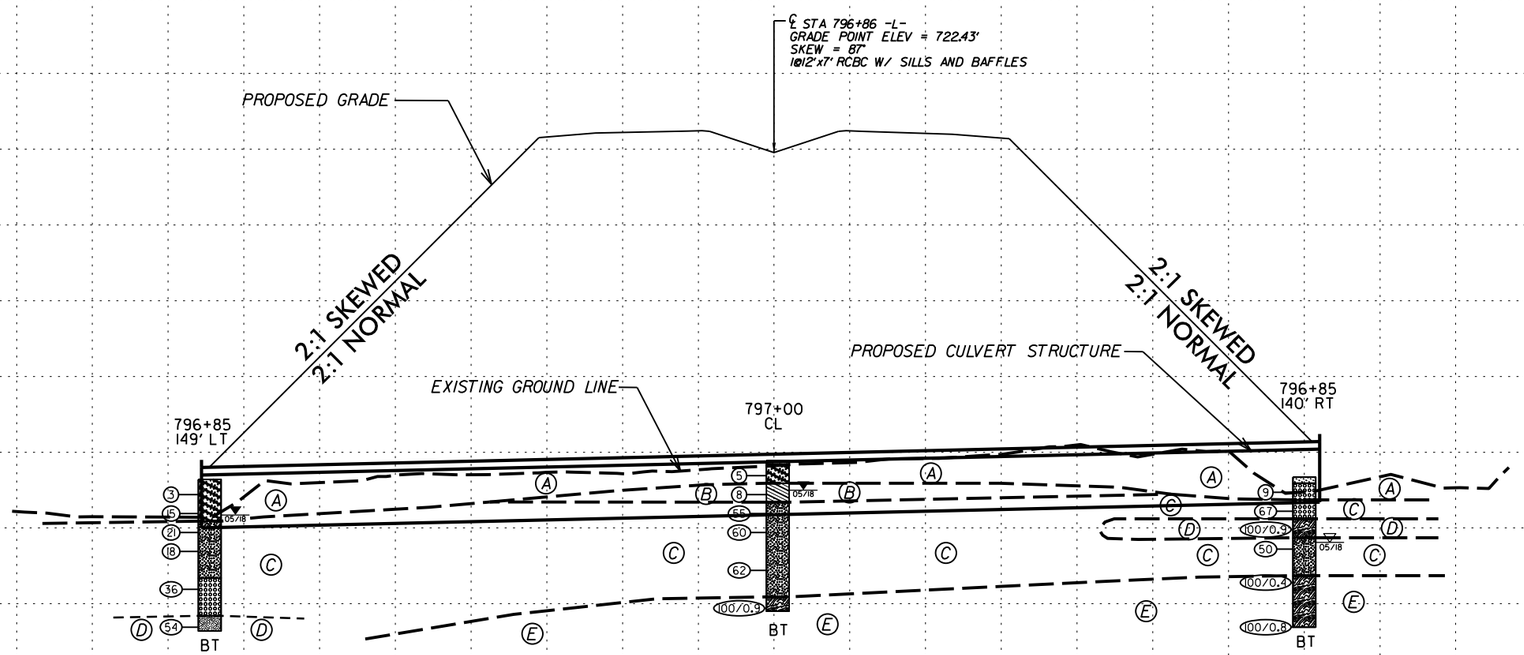
0 40 80
FEET
VE = 2:1

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	4

PROFILE OF CULVERT AT -L- STATION 796+86

-L-
796+86

Ⓐ **ALLUVIAL:** BROWN AND TAN, MOIST TO WET, V.LOOSE TO LOOSE, SAND AND CLAYEY SAND (A-1-b, A-2-6) WITH GRAVEL
Ⓑ **ALLUVIAL:** BROWN, WET, MED. STIFF, SANDY CLAY (A-6)
Ⓒ **RESIDUAL:** TAN, GRAY, AND WHITE, MOIST, MED. DENSE TO V.DENSE, F.TO CSE. SAND AND SILTY SAND (A-1-b, A-2-4) WITH ROCK FRAGMENTS
Ⓓ **RESIDUAL:** GRAY AND TAN, MOIST, HARD, SANDY SILT (A-4)
Ⓔ **WEATHERED ROCK:** WHITE AND TAN, MICA SCHIST



NOTES:

GROUNDLINE PROFILE ALONG CULVERT CENTERLINE DRAWN FROM TOPOGRAPHIC DATA FROM ELECTRONIC FILES RECEIVED FROM STANTEC DATED OCTOBER 2017.

CULVERT SKEW: 87 DEGREES

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Weis, J. M.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_79685_LT	**STATION** 796+85	**OFFSET** 149 ft LT	**ALIGNMENT** -L-	**0 HR.** 4.8
COLLAR ELEV. 676.4 ft	**TOTAL DEPTH** 20.0 ft	**NORTHING** 562,077	**EASTING** 1,264,141	**24 HR.** 4.7
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 04/30/18	**COMP. DATE** 04/30/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
680											
										676.4	0.0
										0.4' TOPSOIL	
675	675.4	1.0								**ALLUVIAL**	
			WOH	2	1	3		W		BROWN, CLAYEY SAND (A-2-6) WITH TRACE GRAVEL	
	672.9	3.5									
			2	4	11	15					
670	670.4	6.0								670.9	5.5
			5	11	10	21		M		**RESIDUAL**	
	667.9	8.5								TAN AND WHITE, SILTY SAND (A-2-4) WITH ROCK FRAGMENTS	
			6	7	11	18		M			
665											
	662.9	13.5								663.4	13.0
			17	10	26	36		M		WHITE, F. TO CSE. SAND (A-1-b) WITH ROCK FRAGMENTS	
660											
	657.9	18.5								658.4	18.0
			16	28	26	54		M		GRAY AND TAN, SANDY SILT (A-4)	
										656.4	20.0
										Boring Terminated at Elevation 656.4 ft IN RESIDUAL: SANDY SILT	

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Weis, J. M.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_79685_RT	**STATION** 796+85	**OFFSET** 140 ft RT	**ALIGNMENT** -L-	**0 HR.** 8.6
COLLAR ELEV. 676.7 ft	**TOTAL DEPTH** 19.8 ft	**NORTHING** 561,960	**EASTING** 1,263,877	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER Cain, J.	**START DATE** 05/01/18	**COMP. DATE** 05/01/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
680										
										676.7 GROUND SURFACE 0.0
										675.9 0.8' TOPSOIL 0.8
675	675.7	1.0								**ALLUVIAL**
			2	4	5	9		M		673.7 TAN, SAND (A-1-b) WITH GRAVEL 3.0
	673.2	3.5								**RESIDUAL**
			13	30	37	67		M		671.2 WHITE AND TAN, SAND (A-1-a) WITH ROCK FRAGMENTS AND MICA SHEETS 5.5
670	670.7	6.0								**WEATHERED ROCK**
			29	71/0.4		100/0.9				668.7 WHITE AND TAN, MICA SCHIST 8.0
	668.2	8.5						▽		**RESIDUAL**
			40	25	25	50		M		WHITE AND TAN, SILTY SAND (A-2-4) WITH ROCK FRAGMENTS
665										663.7 13.0
	663.2	13.5								**WEATHERED ROCK**
			100/0.4			100/0.4				WHITE AND TAN, MICA SCHIST
660										
	658.2	18.5								
			34	59	41/0.3	100/0.8				656.9 19.8
										Boring Terminated at Elevation 656.9 ft IN WR: MICA SCHIST

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34497.1.1	**TIP** R-2707D	**COUNTY** CLEVELAND	**GEOLOGIST** Weis, J. M.	
SITE DESCRIPTION US 74, Shelby Bypass from East of NC 150 to Existing US 17, West of SR 2238 (Long Branch Rd)				**GROUND WTR (ft)**
BORING NO. L_79700	**STATION** 797+00	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** 13.7
COLLAR ELEV. 678.9 ft	**TOTAL DEPTH** 19.9 ft	**NORTHING** 562,003	**EASTING** 1,264,011	**24 HR.** 3.9
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 85% 01/10/2018		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER Cain, J.	**START DATE** 04/30/18	**COMP. DATE** 04/30/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
680											
	678.9	0.0								GROUND SURFACE	0.0
	678.4	0.5								0.5' TOPSOIL	0.5
	677.9	1.0	2	2	3	5		W		**ALLUVIAL**	
675	675.4	3.5	3	3	5	8				BROWN, CLAYEY SAND (A-2-6) WITH GRAVEL	3.0
	672.9	6.0	18	21	34	55		M		BROWN, SANDY CLAY (A-6)	5.5
670	670.4	8.5	20	32	28	60		M		**RESIDUAL** TAN, GRAY AND WHITE, SILTY SAND (A-2-4) WITH TRACE ROCK FRAGMENTS	
665	665.4	13.5	14	26	36	62		M			
	660.9	18.0								**WEATHERED ROCK**	
660	660.4	18.5	18	49	51/0.4	100/0.9				TAN AND WHITE, MICA SCHIST	19.9
	659.0	19.9								Boring Terminated at Elevation 659.0 ft IN WEATHERED ROCK: MICA SCHIST	