STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5600	1	20

REFERENCE: W-5600

PROJECT: 50056

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY JOHNSTON

PROJECT DESCRIPTION US 70 FROM EAST OF US 70 BUSINESS TO WEST OF NEUSE RIVER

SITE DESCRIPTION RETAINING WALL 1 ON -WL1- FROM 10+00.00 TO 22+58.72 AND RETAINING WALL 2 ON -WL2- FROM 10+00.00 TO 24+04.64

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

M. ARNOLD

S. WOODS

M. DURWAY

S. DAVIS

D. AIELLO

T. SHARPE

A. STURCHIO

INVESTIGATED BY F&R, Inc.

DRAWN BY T.T. WALKER

CHECKED BY C. WANG

SUBMITTED BY P. ALTON, P.E.

DATE JULY 2018

SINCE 1881

Prepared in the Office of:

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302 | USA
T 919.828.3441 | F 919.828.5751
www.fandr.com

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
W-5600	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	< 4	
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	> 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	< 2	< 0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	> 30	> 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
- 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
- [X] CME-55
- [ ] CME-550
- [ ] 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-135= N: 663354.9350, E: 2194610.616, -L- STA. 216+33.31, 58.59' LT, BL-136= N: 663090.861, E: 2194994.322 -L STA. 220+94.43, 18.45' LT ELEVATION: 200.72 FEET

NOTES:

FIAD= FILLED IMMEDIATELY AFTER DRILLING

NM= NOT MEASURED

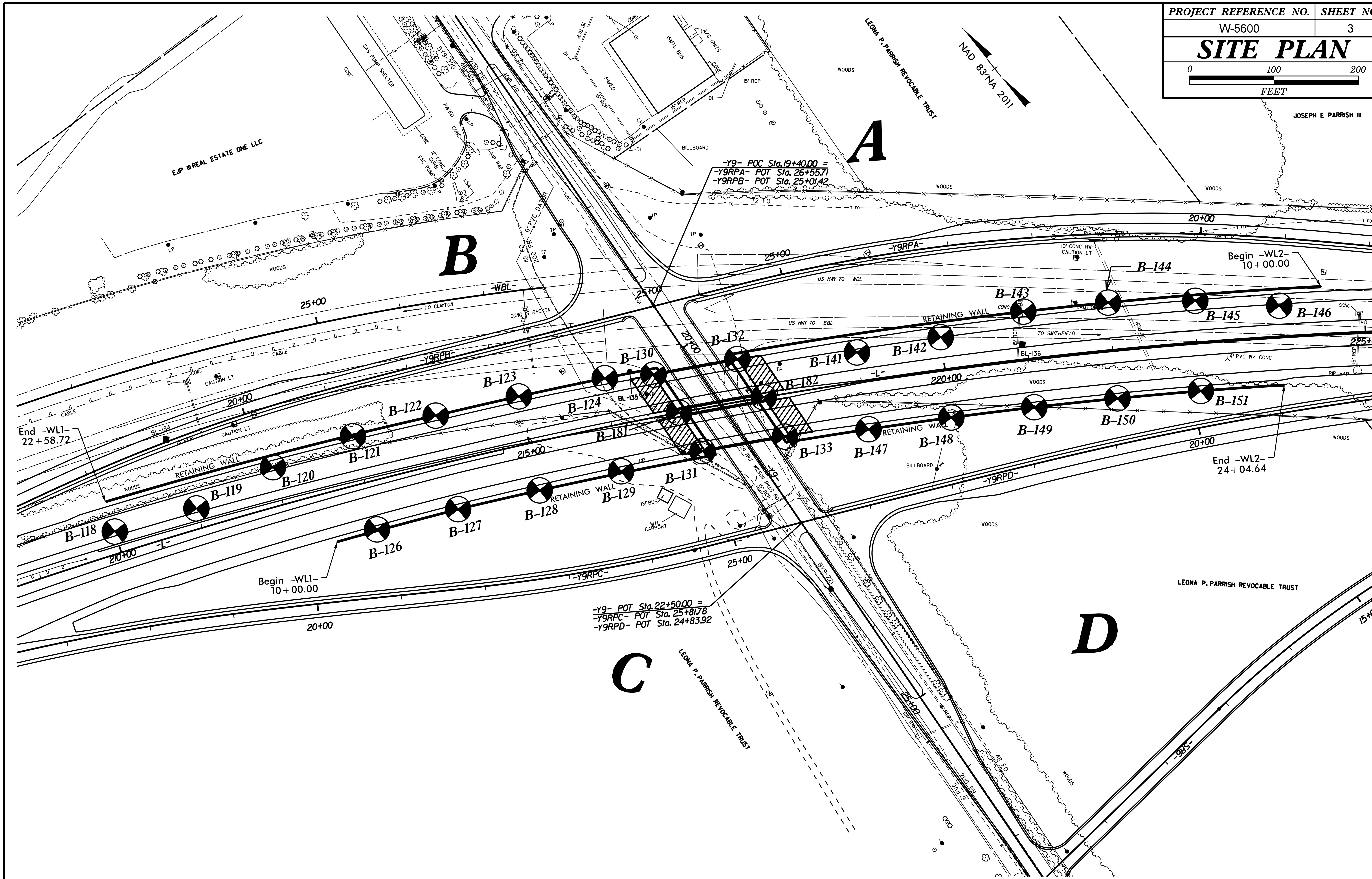
BL-135: B-118 to B-124, B-126 to B-133, B-147 to B-151, B-181, B-182

BL-136: B-141 to B-146

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
W-5600	3

SITE PLAN



PROJECT REFERENCE NO.	SHEET NO.
W5600	4

Ⓐ **Roadway Embankment:** Dense, Orange-Brown, Moist, Clayey Fine to Coarse SAND (A-2-6) Trace Gravel and Organics

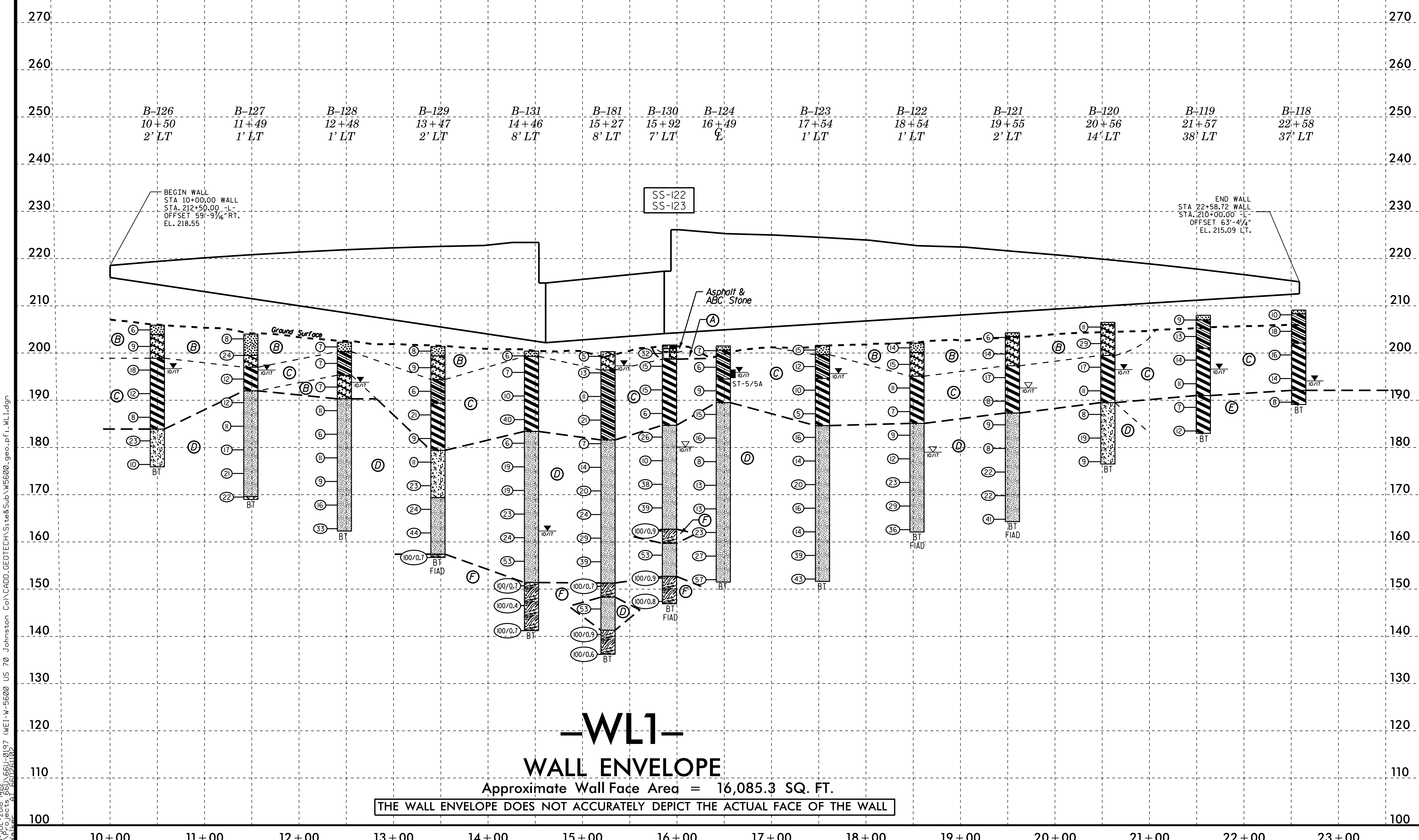
Ⓑ **Coastal Plain:** Loose to Medium Dense, Orange and Gray-Brown, Moist to Wet, Silty and Clayey Fine to Coarse SAND (A-2-4) and (A-2-6) with Trace Organics and Gravel

Ⓒ **Coastal Plain:** Medium Stiff to Hard, Red-Orange and Brown-Gray, Moist to Saturated, Fine to Coarse Sandy and Silty CLAY (A-6) and (A-7) with Trace Organics

Ⓓ **Residual:** Medium Stiff to Hard, Orange-Brown-Gray, Moist to Wet, Fine to Coarse Sandy SILT (A-4) and Clayey SILT (A-5) with Trace Mica and Gravel

Ⓔ **Residual:** Medium Stiff to Stiff, Tan-Orange, Wet, Fine Sandy Silty CLAY (A-7)

Ⓕ **Weathered Rock:** Blue-Green and Brown-Gray (BIOTITE GNEISS)



-WL1-

WALL ENVELOPE

Approximate Wall Face Area = 16,085.3 SQ. FT.

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL FACE OF THE WALL

PROJECT REFERENCE NO.	SHEET NO.
W5600	5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

(A) **Roadway Embankment:** Medium Stiff, Dark Brown, Moist, Silty CLAY (A-7) with Trace Gravel and Organics

(B) **Roadway Embankment:** Loose to Medium Dense, Gray-Brown and Dark Brown, Moist, Silty and Clayey Fine to Coarse SAND (A-2-4) and (A-2-6) with Trace Organics

(C) **Coastal Plain:** Loose to Medium Dense, Brown, Moist, Silty and Clayey Fine to Coarse SAND (A-2-4) and (A-2-6) with Trace Organics

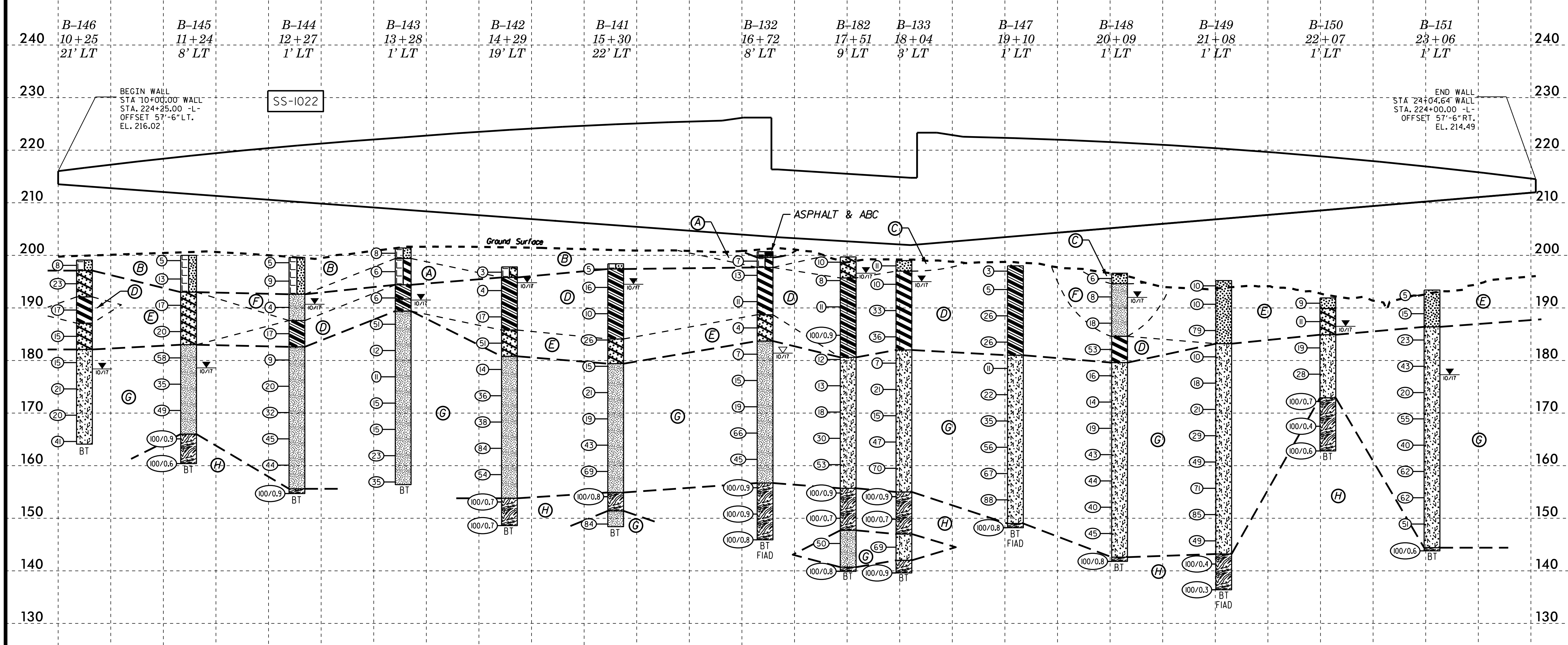
(D) **Coastal Plain:** Soft to Hard, Red-Orange and Brown-Gray, Moist to Wet, Fine to Coarse Sandy and Silty CLAY (A-6) and (A-7) with Trace Organics and Trace to Little Gravel

(E) **Coastal Plain:** Loose to Very Dense, Red-Brown and Gray, Moist, Silty Fine SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics

(F) **Coastal Plain:** Soft to Very Stiff, Gray-Orange and Dark Gray, Moist to Wet, Fine to Coarse Sandy SILT (A-4)

(G) **Residual:** Medium Stiff to Hard, Brown-Blue and Green-Gray, Moist to Wet, Fine Sandy SILT (A-4) and Clayey SILT (A-5) with Trace Mica

(H) **Weathered Rock:** Blue-Green and Brown-Gray (BIOTITE GNEISS)



–WL2–

WALL ENVELOPE

Approximate Wall Face Area = 18,469.0 SQ. FT.

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL FACE OF THE WALL

10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00

5/14/99

24-JUL-2018 08:39
F:\Projects 66U\66U-0197 (WEI-W-5600 US 70 Johnston Co)\CADD_GEOTECH\Site&Sub\W5600_geo_pfl_WL2.dgn

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-126	**STATION** 10+50	**OFFSET** 2 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 15.8
COLLAR ELEV. 205.9 ft	**TOTAL DEPTH** 30.0 ft	**NORTHING** 663,395	**EASTING** 2,194,260	**24 HR.** 9.2
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/09/17	**COMP. DATE** 10/09/17	**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))
210										
	205.9	0.0	1	4	2	6		M		205.9 / 0.0 GROUND SURFACE
205										**COASTAL PLAIN**
	202.4	3.5	3	4	5	9		W		203.9 / 2.0 Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)
200										Orange-Brown, Clayey Fine to Coarse SAND (A-2-6)
	197.4	8.5	5	8	10	18		W		198.9 / 7.0 Orange-Gray-Brown, Fine to Coarse Sandy Silty CLAY (A-7)
195										
	192.4	13.5	3	6	6	12		W		
190										
	187.4	18.5	3	3	5	8		W		
185										
	182.4	23.5	5	9	14	23		W		183.9 / 22.0 **RESIDUAL** Tan-Orange-Gray, Clayey SILT (A-5) with Trace Gravel and Mica
180										
	177.4	28.5	2	4	6	10		W		175.9 / 30.0 Boring Terminated at Elevation 175.9 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-127	**STATION** 11+49	**OFFSET** 1 ft LT	**ALIGNMENT** -WL1-	**0 HR.** Dry
COLLAR ELEV. 204.0 ft	**TOTAL DEPTH** 35.0 ft	**NORTHING** 663,354	**EASTING** 2,194,350	**24 HR.** 7.6
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/09/17	**COMP. DATE** 10/09/17	**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
205										
	204.0	0.0	1	4	4	8		M		204.0 GROUND SURFACE 0.0
200	200.5	3.5	6	13	11	24		M		**COASTAL PLAIN** Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)
	195.5	8.5	3	5	7	12		W		199.5 / 4.5 Red-Gray, Clayey Fine to Coarse SAND (A-2-6)
195										197.0 / 7.0 Brown-Red, Silty CLAY (A-7)
190	190.5	13.5	3	5	7	12		M		192.0 / 12.0 **RESIDUAL** Tan-Orange, Fine Sandy SILT (A-4)
185	185.5	18.5	3	5	6	11		M		
180	180.5	23.5	5	8	9	17		M		
175	175.5	28.5	7	10	11	21		M		
170	170.5	33.5	9	10	12	22		M		169.6 / 34.4 169.0 / 35.0 Gray-Blue, Fine Sandy Clayey SILT (A-5) with Trace Mica Boring Terminated at Elevation 169.0 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-128	**STATION** 12+48	**OFFSET** 1 ft LT	**ALIGNMENT** -WL1-	**0 HR.** Dry
COLLAR ELEV. 202.3 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 663,311	**EASTING** 2,194,440	**24 HR.** 8.5
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/09/17	**COMP. DATE** 10/09/17	**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)
205											
	202.3	0.0								202.3 GROUND SURFACE	0.0
200			2	3	4	7		M		**COASTAL PLAIN**	
	198.8	3.5								200.3 Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	2.0
			2	3	4	7		W		Red-Gray, Fine to Coarse Sandy CLAY (A-6)	
195										195.3	7.0
	193.8	8.5						W		Gray-Red, Clayey Fine to Coarse SAND (A-2-6)	
			3	2	5	7					
190										190.3	12.0
	188.8	13.5						W		**RESIDUAL** Tan-Gray-Blue, Fine Sandy SILT (A-4) with Trace Mica	
			4	5	6	11					
185											
	183.8	18.5						W			
			2	2	4	6					
180											
	178.8	23.5						W			
			9	5	6	11					
175											
	173.8	28.5						W			
			3	4	5	9					
170											
	168.8	33.5						W			
			5	5	11	16					
165											
	163.8	38.5						W			
			7	11	22	33				162.3	40.0
										Boring Terminated at Elevation 162.3 ft in SILT (Residual)	

Notes:
1. Surficial Organics Soil=0.0'-0.2'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-129	**STATION** 13+47	**OFFSET** 2 ft LT	**ALIGNMENT** -WL1-	**0 HR.** Dry
COLLAR ELEV. 201.4 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 663,269	**EASTING** 2,194,529	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/09/17	**COMP. DATE** 10/09/17	**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
205										
	201.4	0.0								201.4 GROUND SURFACE 0.0
200			5	5	3	8	SS-900	12%		**COASTAL PLAIN**
	197.9	3.5								199.4 Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Organics 2.0
			3	5	4	9		M		Tan-Gray, Clayey Fine to Coarse SAND (A-2-6)
195										194.4 7.0
	192.9	8.5								Gray-Red, Fine to Coarse Sandy CLAY (A-6)
			3	3	3	6		M		
190										189.4 12.0
	187.9	13.5								Tan-Gray, Fine to Coarse Sandy Silty CLAY (A-7-5)
			5	8	13	21	SS-903	22%		
185										
	182.9	18.5								
			2	3	6	9		M		
180										
	177.9	23.5								
			3	4	7	11		M		
175										
	172.9	28.5								
			7	10	13	23		M		
170										169.4 32.0
	167.9	33.5								Gray-Blue, Fine to Coarse Sandy SILT (A-4) with Trace Mica
			5	10	14	24		M		
165										
	162.9	38.5								
			11	16	28	44		M		
160										
	157.9	43.5								157.4 44.0
			25	51	49/0.2	100/0.7				156.7 44.7
										WEATHERED ROCK Blue (BIOTITE GNEISS)
										Boring Terminated at Elevation 156.7 ft in Weathered Rock (BIOTITE GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-131(EB1-B)	**STATION** 14+46	**OFFSET** 8 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 58.0
COLLAR ELEV. 200.4 ft	**TOTAL DEPTH** 59.2 ft	**NORTHING** 663,228	**EASTING** 2,194,619	**24 HR.** 38.1
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/10/17	**COMP. DATE** 10/10/17	**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)
205											
200	200.4	0.0	1	3	3	6		M		200.4 GROUND SURFACE	0.0
	196.9	3.5								199.3 **COASTAL PLAIN** Gray-Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)	1.1
195			4	4	3	7		W		Red-Orange-Brown, Fine to Coarse Sandy Silty CLAY (A-7)	
	191.9	8.5									
190			1	5	5	10		W			
	186.9	13.5									
185			10	17	23	40		M			
	181.9	18.5								183.4 **RESIDUAL** Blue-Gray, Fine Sandy SILT (A-4) with Trace Mica	17.0
180			2	3	3	6	SS-72	20%			
	176.9	23.5									
175			4	7	12	19		W			
	171.9	28.5									
170			4	9	10	19		W			
	166.9	33.5									
165			4	10	13	23		W			
	161.9	38.5									
160			5	11	13	24		W			
	156.9	43.5									
155			11	22	31	53		M			
	151.9	48.5								151.4 **WEATHERED ROCK** Blue-Gray (BIOTITE GNEISS)	49.0
150			17	47	53/0.2	100/0.7					
	146.9	53.5	100/0.4			100/0.4					
145											
	141.9	58.5	50	50/0.2		100/0.7				141.2 Boring Terminated at Elevation 141.2 ft in Weathered Rock (BIOTITE GNEISS)	59.2

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-181(EB1-C)	**STATION** 15+27	**OFFSET** 8 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 20.0
COLLAR ELEV. 200.3 ft	**TOTAL DEPTH** 64.1 ft	**NORTHING** 663,281	**EASTING** 2,194,626	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/19/17	**COMP. DATE** 10/19/17	**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	
205											
200	200.3	0.0	1	2	3	5		M		200.3 GROUND SURFACE	0.0
	196.8	3.5								**COASTAL PLAIN** Gray-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)	
195			4	6	7	13		M		196.4	3.9
	191.8	8.5								Orange-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)	
190			3	5	6	11		M			
	186.8	13.5									
185			7	11	10	21		M			
	181.8	18.5								181.6 **RESIDUAL** Gray-Blue-Green, Fine Sandy SILT (A-4) with Trace Mica	18.7
180			3	2	5	7		M			
	176.8	23.5									
175			3	6	8	14		M			
	171.8	28.5									
170			4	9	11	20		M			
	166.8	33.5									
165			5	9	15	24		M			
	161.8	38.5									
160			7	11	18	29		M			
	156.8	43.5									
155			8	20	19	39		M			
	151.8	48.5								151.3 **WEATHERED ROCK** Blue-Green (BIOTITE GNEISS)	49.0
150			44	56	44/0.2	100/0.7				148.3 **RESIDUAL** Gray-Blue-Green, Fine Sandy SILT (A-4) with Trace Mica	52.0
145	146.8	53.5	14	33	20	53		M			
	141.8	58.5	20	44	56/0.4	100/0.9				141.3 **WEATHERED ROCK** Blue Green (BIOTITE GNEISS)	59.0
140	136.8	63.5	73	27/0.1		100/0.6				136.2 Boring Terminated at Elevation 136.2 ft in Weathered Rock (BIOTITE GNEISS)	64.1

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-130(EB1-A)	**STATION** 15+92	**OFFSET** 7 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 21.6
COLLAR ELEV. 201.7 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 663,335	**EASTING** 2,194,631	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**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)
205										
	200.9	0.8								201.7 — GROUND SURFACE — 0.0
200			4	16	16	32		M		200.9 — ASPHALT — 0.8
	198.2	3.5								200.2 — ABC STONE — 1.5
			5	7	8	15		M		198.7 — **ROADWAY EMBANKMENT** — 3.0 Orange-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel and Organics
195										**COASTAL PLAIN** Orange-Brown, Fine Sandy Silty CLAY (A-7) with Trace Organics (Roots)
	193.2	8.5								
			4	7	8	15		M		
190										
	188.2	13.5								
			3	3	3	6		M		
185										
	183.2	18.5								184.7 — 17.0
			9	13	13	26	SS-122	27%		**RESIDUAL** Orange-Brown-Gray, Fine Sandy SILT (A-4) with Trace Mica
180										
	178.2	23.5								
			2	5	5	10	SS-123	20%		
175										
	173.2	28.5								
			7	14	24	38		M		
170										
	168.2	33.5								
			5	15	24	39		M		
165										
	163.2	38.5								162.7 — 39.0
			17	40	60/0.4	100/0.9				**WEATHERED ROCK** Gray-Tan (BIOTITE GNEISS)
160										159.7 — 42.0
	158.2	43.5								**RESIDUAL** Blue-Green, Fine Sandy SILT (A-4)
			12	22	31	53		M		
155										
	153.2	48.5								152.7 — 49.0
			11	47	53/0.4	100/0.9				**WEATHERED ROCK** Gray-Blue-Green (BIOTITE GNEISS)
150										
	148.2	53.5								146.9 — 54.8
			19	65	35/0.3	100/0.8				Boring Terminated at Elevation 146.9 ft in Weathered Rock (BIOTITE GNEISS)

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-124	**STATION** 16+49	**OFFSET** CL	**ALIGNMENT** -WL1-	**0 HR.** NM
COLLAR ELEV. 201.5 ft	**TOTAL DEPTH** 50.0 ft	**NORTHING** 663,367	**EASTING** 2,194,583	**24 HR.** 5.6
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/12/17	**COMP. DATE** 10/12/17	**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
205										
	201.5	0.0								201.5 — GROUND SURFACE — 0.0
200			2	4	3	7		M		200.6 — **COASTAL PLAIN** — 0.9 Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)
	198.0	3.5								Tan, Fine to Coarse Sandy CLAY (A-6)
			2	3	3	6				
195								16%		194.7 — 6.8
	193.0	8.5								Gray-Brown, Fine To Coarse Sandy Silty CLAY (A-7)
			3	4	5	9		M		
190										
	188.0	13.5								189.5 — 12.0
			4	6	9	15		M		**RESIDUAL** Brown-Gray and Blue-Gray, Fine Sandy SILT (A-4)
185										
	183.0	18.5								
			5	7	9	16		M		
180										
	178.0	23.5								
			3	4	4	8		M		
175										
	173.0	28.5								
			3	6	7	13		M		
170										
	168.0	33.5								
			4	5	8	13		M		
165										
	163.0	38.5								
			7	9	14	23		M		
160										
	158.0	43.5								
			9	10	17	27		M		
155										
	153.0	48.5								
			11	20	37	57		M		151.5 — 50.0
										Boring Terminated at Elevation 151.5 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

Other Samples:
ST-5 (5.0 - 7.0)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-123	**STATION** 17+54	**OFFSET** 1 ft LT	**ALIGNMENT** -WL1-	**0 HR.** NM
COLLAR ELEV. 201.5 ft	**TOTAL DEPTH** 50.0 ft	**NORTHING** 663,414	**EASTING** 2,194,490	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/10/17	**COMP. DATE** 10/10/17	**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)
	201.5	0.0	4	9	6	15		M		201.5 GROUND SURFACE	0.0
										COASTAL PLAIN	
										199.5 Tan-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	2.0
	198.0	3.5	6	6	6	12		M		Gray-Tan-Brown, Fine to Coarse Sandy CLAY (A-6)	
										194.5 Red-Gray, Silty CLAY (A-7)	7.0
	193.0	8.5	2	4	6	10		M			
	188.0	13.5	2	2	3	5		Sat.			
										184.5 **RESIDUAL**	17.0
	183.0	18.5	5	7	9	16		M		Yellow-Brown and Blue Gray, Fine to Coarse Sandy SILT (A-4) with Trace Mica	
	178.0	23.5	5	6	8	14		M			
	173.0	28.5	6	8	12	20		M			
	168.0	33.5	6	8	8	16		M			
	163.0	38.5	5	6	8	14		M			
	158.0	43.5	9	14	25	39		M			
	153.0	48.5	15	19	24	43		M		151.5	50.0

Boring Terminated at Elevation 151.5 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-122	**STATION** 18+54	**OFFSET** 1 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 23.1
COLLAR ELEV. 202.1 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 663,457	**EASTING** 2,194,398	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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
	202.1	0.0	3	8	6	14		M		202.1 GROUND SURFACE 0.0
										COASTAL PLAIN
										200.1 Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) 2.0
	198.6	3.5	12	8	7	15		M		Gray, Clayey Fine to Coarse SAND (A-2-6)
										195.1 Red-Gray, Silty CLAY (A-7) 7.0
	193.6	8.5	3	5	6	11		M		
	188.6	13.5	2	3	4	7		M		
										185.1 **RESIDUAL** 17.0
	183.6	18.5	3	4	5	9		M		Yellow-Tan, Fine Sandy SILT (A-4) with Trace Mica
	178.6	23.5	2	6	6	12		M		
	173.6	28.5	6	10	13	23		M		
	168.6	33.5	9	13	16	29		M		
	163.6	38.5	9	16	20	36		M		162.1 40.0

Boring Terminated at Elevation 162.1 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-121	**STATION** 19+55	**OFFSET** 2 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 11.7
COLLAR ELEV. 204.3 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 663,499	**EASTING** 2,194,307	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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)
205	204.3	0.0	1	3	3	6		M		204.3 GROUND SURFACE	0.0
										203.5 **COASTAL PLAIN** Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	0.8
200	200.8	3.5	5	7	7	14		M		Dark Brown and Tan, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Trace Gravel	
										197.3 Red-Brown, Silty CLAY (A-7)	7.0
195	195.8	8.5	6	7	10	17		M			
190	190.8	13.5	4	3	5	8		M			
										187.3 **RESIDUAL** Tan-Blue, Fine Sandy SILT (A-4)	17.0
185	185.8	18.5	2	4	5	9		W			
180	180.8	23.5	2	3	5	8		M			
175	175.8	28.5	5	9	13	22		M			
170	170.8	33.5	6	10	12	22		M			
165	165.8	38.5	11	17	24	41		M		164.3	40.0

Boring Terminated at Elevation 164.3 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-120	**STATION** 20+56	**OFFSET** 14 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 10.1
COLLAR ELEV. 206.5 ft	**TOTAL DEPTH** 30.0 ft	**NORTHING** 663,530	**EASTING** 2,194,210	**24 HR.** 10.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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	
210	206.5	0.0	1	4	7	11		M		206.5 GROUND SURFACE	0.0
										206.0 **COASTAL PLAIN** Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	0.5
205	203.0	3.5	6	12	17	29		M		Orange-Brown, Clayey Fine to Coarse SAND (A-2-6)	
200	198.0	8.5	6	7	10	17		M		199.5 Red-Gray-Orange, Fine to Coarse Sandy Silty CLAY (A-7)	7.0
195	193.0	13.5	3	5	6	11		W			
190	188.0	18.5	2	5	3	8		W		189.5 **RESIDUAL** Tan-Orange, Fine to Coarse Sandy Clayey SILT (A-5) with Trace Gravel	17.0
185	183.0	23.5	5	8	11	19		W			
180	178.0	28.5	3	4	5	9		W		176.5	30.0

Boring Terminated at Elevation 176.5 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-119	**STATION** 21+57	**OFFSET** 38 ft LT	**ALIGNMENT** -WL1-	**0 HR.** 15.3
COLLAR ELEV. 208.0 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** 663,548	**EASTING** 2,194,108	**24 HR.** 11.4
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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)
210											
	208.0	0.0	4	5	4	9		M		208.0 GROUND SURFACE	0.0
205	204.5	3.5	2	4	9	13		M		207.0 **COASTAL PLAIN** Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics	1.0
										Brown, Fine to Coarse Sandy CLAY (A-6)	
200	199.5	8.5	4	6	8	14		M		201.0 Red-Gray, Fine Sandy Silty CLAY (A-7)	7.0
195	194.5	13.5	3	5	6	11		W		191.0 **RESIDUAL** Tan-Orange, Fine Sandy Silty CLAY (A-7)	17.0
190	189.5	18.5	3	2	5	7		W			
185	184.5	23.5	4	5	7	12		W		183.0 Boring Terminated at Elevation 183.0 ft in CLAY (Residual)	25.0

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 1 on -WL1- from 10+00.00 to 22+58.72				**GROUND WTR (ft)**
BORING NO. B-118	**STATION** 22+58	**OFFSET** 37 ft LT	**ALIGNMENT** -WL1-	**0 HR.** NM
COLLAR ELEV. 209.1 ft	**TOTAL DEPTH** 20.0 ft	**NORTHING** 663,587	**EASTING** 2,194,016	**24 HR.** 15.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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
210										
	209.1	0.0	4	5	5	10	SS-914	7%		209.1 GROUND SURFACE 0.0
205	205.6	3.5	4	7	11	18		M		208.3 **COASTAL PLAIN** 0.8 Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) Red-Brown, Fine to Coarse Sandy CLAY (A-6)
200	200.6	8.5	5	7	9	16		M		202.1 Red-Gray, Fine Sandy Silty CLAY (A-7) 7.0
195	195.6	13.5	4	6	8	14		W		192.1 **RESIDUAL** 17.0 Tan-Orange, Fine Sandy Silty CLAY (A-7)
190	190.6	18.5	3	4	4	8		W		189.1 20.0 Boring Terminated at Elevation 189.1 ft in CLAY (Residual)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-146	**STATION** 10+25	**OFFSET** 21 ft LT	**ALIGNMENT** -WL2-	**0 HR.** NM
COLLAR ELEV. 199.1 ft	**TOTAL DEPTH** 35.0 ft	**NORTHING** 662,937	**EASTING** 2,195,261	**24 HR.** 20.7
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/18/17	**COMP. DATE** 10/18/17	**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)
200											
	199.1	0.0	1	3	5	8		M		199.1 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Dark Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)	
195	195.6	3.5	5	10	13	23		M		197.1	2.0
										COASTAL PLAIN Red-Brown, Clayey Fine to Coarse SAND (A-2-6)	
190	190.6	8.5	6	7	10	17		M		192.1 Red-Gray, Silty CLAY (A-7)	7.0
										187.1 Brown, Clayey Fine to Coarse SAND (A-2-6)	12.0
185	185.6	13.5	7	8	7	15		M			
180	180.6	18.5	5	7	8	15		M		182.1 **RESIDUAL** Brown-Gray, Clayey SILT (A-5)	17.0
175	175.6	23.5	7	9	12	21		M			
170	170.6	28.5	7	8	12	20	SS-1018	22%			
165	165.6	33.5	11	17	24	41		M		164.1 Boring Terminated at Elevation 164.1 ft in SILT (Residual)	35.0

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-145	**STATION** 11+24	**OFFSET** 8 ft LT	**ALIGNMENT** -WL2-	**0 HR.** NM
COLLAR ELEV. 200.0 ft	**TOTAL DEPTH** 39.6 ft	**NORTHING** 663,004	**EASTING** 2,195,187	**24 HR.** 21.4
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/18/17	**COMP. DATE** 10/18/17	**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)
200										200.0 GROUND SURFACE	0.0
	200.0	0.0	1	2	3	5		M		**ROADWAY EMBANKMENT** Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	
195	196.5	3.5	6	8	5	13		M		193.0	7.0
										COASTAL PLAIN Gray, Clayey Fine to Coarse SAND (A-2-6)	
190	191.5	8.5	10	10	7	17		M			
185	186.5	13.5	8	10	10	20		M			
180	181.5	18.5	6	17	41	58		M		183.0 **RESIDUAL** Dark Brown, Fine Sandy SILT (A-4)	17.0
175	176.5	23.5	13	17	18	35		M			
170	171.5	28.5	16	19	30	49		M			
165	166.5	33.5	18	34	66/0.4	100/0.9				166.0 **WEATHERED ROCK** Dark Gray (BIOTITIE GNEISS)	34.0
	161.5	38.5	16	70	30/0.1	100/0.6				160.4 Boring Terminated at Elevation 160.4 ft in Weathered Rock (BIOTITE GNEISS)	39.6

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-144	**STATION** 12+27	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 199.6 ft	**TOTAL DEPTH** 44.9 ft	**NORTHING** 663,066	**EASTING** 2,195,105	**24 HR.** 8.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/19/17	**COMP. DATE** 10/19/17	**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)
200											
	199.6	0.0	1	1	4	5		M		199.6 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)	
195	196.1	3.5	5	3	6	9		M			
										192.6 **COASTAL PLAIN** Dark Gray, Fine Sandy SILT (A-4) with Trace Organics (Roots and Wood Fragments)	7.0
190	191.1	8.5	1	2	2	4	SS-1022	18%			
										187.6 Brown, Fine to Coarse Sandy CLAY (A-6)	12.0
185	186.1	13.5	4	7	10	17		M			
										182.6 **RESIDUAL** Blue-Light Gray, Fine Sandy SILT (A-4)	17.0
180	181.1	18.5	3	4	5	9		M			
175	176.1	23.5	6	8	12	20		M			
170	171.1	28.5	10	13	19	32		M			
165	166.1	33.5	13	21	24	45		M			
160	161.1	38.5	16	18	26	44		M			
155	156.1	43.5	21	32	68/0.4	100/0.9		M		155.6 **WEATHERED ROCK** (BIOTITE GNEISS) 154.7	44.0 44.9
										Boring Terminated at Elevation 154.7 ft in Weathered Rock (BIOTITE GNEISS)	

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-143	**STATION** 13+28	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 39.5
COLLAR ELEV. 201.4 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 663,121	**EASTING** 2,195,019	**24 HR.** 9.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/19/17	**COMP. DATE** 10/19/17	**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
205										
	201.4	0.0	1	3	5	8		M		201.4 GROUND SURFACE 0.0
200										**ROADWAY EMBANKMENT**
	197.9	3.5	3	2	4	6		M		199.4 Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) 2.0
195										Dark Brown, Fine to Coarse Sandy Silty CLAY (A-7) with Trace Gravel and Organics (Roots)
	192.9	8.5	2	2	4	6				194.4 **COASTAL PLAIN** 7.0
190										Dark Gray-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)
	187.9	13.5	15	24	27	51				189.4 **RESIDUAL** 12.0
185								M		Orange-Gray-Blue, Fine Sandy SILT (A-4)
	182.9	18.5	4	5	7	12				
180										
	177.9	23.5	4	4	7	11		M		
175										
	172.9	28.5	4	6	9	15		M		
170										
	167.9	33.5	3	6	9	15		M		
165										
	162.9	38.5	6	9	14	23		M		
160										
	157.9	43.5	7	13	22	35		W		156.4 45.0
										Boring Terminated at Elevation 156.4 ft in SILT (Residual)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-142	**STATION** 14+29	**OFFSET** 19 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 19.6
COLLAR ELEV. 197.8 ft	**TOTAL DEPTH** 49.2 ft	**NORTHING** 663,158	**EASTING** 2,194,924	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/18/17	**COMP. DATE** 10/18/17	**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)
200											
	197.8	0.0	1	1	2	3		M		197.8 GROUND SURFACE	0.0
195	194.3	3.5	1	2	2	4		M		195.8 **ROADWAY EMBANKMENT** Gray-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)	2.0
190	189.3	8.5	4	8	9	17		M		**COASTAL PLAIN** Brown-Orange-Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Roots (3.5'-5.0') and Little Gravel	
185	184.3	13.5	22	27	24	51		W		185.8 Red-Orange, Clayey Fine to Coarse SAND (A-2-6)	12.0
180	179.3	18.5	2	6	8	14		M		180.8 **RESIDUAL** Green-Gray, Fine Sandy SILT (A-4) with Trace Mica	17.0
175	174.3	23.5	5	13	23	36		M			
170	169.3	28.5	11	19	19	38		M			
165	164.3	33.5	13	30	54	84		M			
160	159.3	38.5	10	20	34	54		M			
155	154.3	43.5	11	30	70/0.2	100/0.7		M		153.8 **WEATHERED ROCK** White-Brown-Gray (BIOTITE GNEISS)	44.0
150	149.3	48.5	50	50/0.2		100/0.7		M		148.6 Boring Terminated at Elevation 148.6 ft in Weathered Rock (BIOTITE GNEISS)	49.2

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-141	**STATION** 15+30	**OFFSET** 22 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 198.4 ft	**TOTAL DEPTH** 50.0 ft	**NORTHING** 663,205	**EASTING** 2,194,835	**24 HR.** 3.9
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/17/17	**COMP. DATE** 10/18/17	**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
200										
	198.4	0.0	1	3	2	5		M		198.4 GROUND SURFACE 0.0
195	194.9	3.5	5	7	9	16		M		197.4 **ROADWAY EMBANKMENT** Gray-Brown, Silty Fine to Coarse SAND (A-2-4) 1.0
190	189.9	8.5	5	5	5	10		W		**COASTAL PLAIN** Orange-Brown-Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots) from 1.0'-2.0' and Little Gravel
185	184.9	13.5	8	9	17	26		W		184.1 Orange-Gray, Clayey Fine to Coarse SAND (A-2-6) 14.3
180	179.9	18.5	3	7	8	15		M		179.4 **RESIDUAL** Gray-Green, Fine Sandy SILT (A-4) with Trace Mica 19.0
175	174.9	23.5	5	9	12	21		M		
170	169.9	28.5	4	9	10	19		M		
165	164.9	33.5	8	23	20	43		M		
160	159.9	38.5	12	24	45	69		M		
155	154.9	43.5	43	57/0.3		100/0.8		M		154.9 **WEATHERED ROCK** Gray Brown (BIOTITE GNEISS) 43.5
150	149.9	48.5	27	28	56	84		M		151.4 **RESIDUAL** Gray-Brown, Fine to Coarse Sandy SILT (A-4) 47.0
										148.4 Boring Terminated at Elevation 148.4 ft in SILT (Residual) 50.0

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-132(EB2-A)	**STATION** 16+72	**OFFSET** 8 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 19.3
COLLAR ELEV. 200.7 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 663,287	**EASTING** 2,194,720	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**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)
205										
200	199.9	0.8	1	3	4	7				200.7 GROUND SURFACE 0.0 199.9 ASPHALT 0.8 199.6 ABC STONE 1.1
	197.2	3.5	4	6	7	13		M		197.7 **ROADWAY EMBANKMENT** 3.0 Dark Brown, Silty CLAY (A-7) **COASTAL PLAIN** Orange-Red-Brown, Fine Sandy Silty CLAY (A-7) with Trace Organics (Roots)
195										
190	192.2	8.5	3	5	6	11		M		
	187.2	13.5	1	2	2	4		W		188.7 Orange-Brown, Clayey Fine to Coarse SAND (A-2-6) 12.0
185	182.2	18.5	2	2	5	7				183.7 **RESIDUAL** 17.0 Orange-Brown-Gray, Fine Sandy SILT (A-4) with Trace Mica
180	177.2	23.5	2	7	8	15		M		
175	172.2	28.5	3	8	11	19		M		
170	167.2	33.5	13	22	44	66		M		
165	162.2	38.5	9	22	23	45		M		
160	157.2	43.5	32	50	50/0.4	100/0.9				156.7 **WEATHERED ROCK** 44.0 Gray-Green (BIOTITIE GNEISS)
155	152.2	48.5	14	27	73/0.4	100/0.9				
150	147.2	53.5	16	42	58/0.3	100/0.8				145.9 Boring Terminated at Elevation 145.9 ft in Weathered Rock (BIOTITE GNEISS) 54.8

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-182(EB2-C)	**STATION** 17+51	**OFFSET** 9 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 30.6
COLLAR ELEV. 199.7 ft	**TOTAL DEPTH** 59.8 ft	**NORTHING** 663,232	**EASTING** 2,194,716	**24 HR.** 3.1
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/25/17	**COMP. DATE** 10/25/17	**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
200	199.7	0.0	2	4	6	10		M		199.7 GROUND SURFACE 0.0
	196.2	3.5	1	3	5	8		M		**COASTAL PLAIN** Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)
195	191.2	8.5	4	5	6	11		M		195.7 4.0 Orange-Brown-Gray, Fine Sandy CLAY (A-6)
190	186.2	13.5	20	22	78/0.4	100/0.9		M		
185	181.2	18.5	4	6	6	12		M		180.6 **RESIDUAL** 19.1 Gray-Tan-Green, Clayey SILT (A-5) with Trace Mica
180	176.2	23.5	3	6	7	13		M		
175	171.2	28.5	3	5	13	18		M		
170	166.2	33.5	5	11	19	30		M		
165	161.2	38.5	13	22	31	53		M		
160	156.2	43.5	13	41	59/0.4	100/0.9				155.7 **WEATHERED ROCK** 44.0 Brown-Green (BIOTITE GNEISS)
155	151.2	48.5	27	60	40/0.2	100/0.7				
150	146.2	53.5	8	15	35	50		M		147.7 **RESIDUAL** 52.0 Green-Brown, Fine Sandy SILT (A-4) with Trace Mica
145	141.2	58.5	20	45	55/0.3	100/0.8				140.7 139.9 **WEATHERED ROCK** 59.0 59.8 Blue-Green (BIOTITE GNEISS) Boring Terminated at Elevation 139.9 ft in Weathered Rock (BIOTITE GNEISS)
140										

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-133 (EB2-B)	**STATION** 18+04	**OFFSET** 3 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 5.9
COLLAR ELEV. 199.0 ft	**TOTAL DEPTH** 59.4 ft	**NORTHING** 663,181	**EASTING** 2,194,706	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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)
200											
	199.0	0.0	3	7	4	11		M		199.0 GROUND SURFACE	0.0
195	195.5	3.5	4	4	6	10		W		**COASTAL PLAIN** 197.0 Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)	2.0
										Gray-Orange-Brown, Fine to Coarse Sandy Silty CLAY (A-7)	
190	190.5	8.5	4	23	10	33		W			
185	185.5	13.5	10	20	16	36		W		182.0 **RESIDUAL**	17.0
180	180.5	18.5	3	3	4	7		W		Blue-Gray, Clayey SILT (A-5) with Trace Mica	
175	175.5	23.5	5	10	11	21		W			
170	170.5	28.5	4	5	10	15		W			
165	165.5	33.5	11	19	28	47		M			
160	160.5	38.5	14	27	43	70		M			
155	155.5	43.5	22	40	60/0.4	100/0.9				155.0 **WEATHERED ROCK**	44.0
150	150.5	48.5	52	48/0.2		100/0.7				Gray-Green-Brown (BIOTITE GNEISS)	
145	145.5	53.5	22	26	43	69		M		147.0 **RESIDUAL**	52.0
140	140.5	58.5	36	64/0.4		100/0.9				Gray-Green, Clayey SILT (A-5) with Trace Mica	
										142.0 **WEATHERED ROCK**	57.0
										139.6 Blue-Gray (BIOTITE GNEISS)	59.4
										Boring Terminated at Elevation 139.6 ft in Weathered Rock (BIOTITE GNEISS)	

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-147	**STATION** 19+10	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 198.0 ft	**TOTAL DEPTH** 49.8 ft	**NORTHING** 663,126	**EASTING** 2,194,789	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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
200										
	198.0	0.0	1	1	2	3		W		198.0 GROUND SURFACE 0.0
195	194.5	3.5	2	2	3	5		W		**COASTAL PLAIN** Dark Gray-Black-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots) from 0.0'-1.5' and Trace Gravel
190	189.5	8.5	7	10	16	26		W		
185	184.5	13.5	12	14	12	26		W		
180	179.5	18.5	4	4	7	11		W		181.0 **RESIDUAL** 17.0
175	174.5	23.5	6	10	12	22		M		Blue-Gray, Clayey SILT (A-5) with Trace Mica
170	169.5	28.5	7	13	22	35		M		
165	164.5	33.5	14	23	33	56		M		
160	159.5	38.5	18	33	34	67		M		
155	154.5	43.5	15	34	54	88		M		
150	149.5	48.5	29	47	53/0.3	100/0.8				149.0 49.0
										148.2 **WEATHERED ROCK** 49.8
										Green-Brown (BIOTITE GNEISS)
										Boring Terminated at Elevation 148.2 ft in Weathered Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-148	**STATION** 20+09	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 196.9 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 663,076	**EASTING** 2,194,875	**24 HR.** 4.6
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/12/17	**COMP. DATE** 10/12/17	**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)
200											
	196.9	0.0								196.9 GROUND SURFACE	0.0
195			2	2	4	6	SS-78	11%		**COASTAL PLAIN**	
	193.4	3.5								Dark Gray, Silty Fine SAND (A-2-4) with Trace Organics (Roots)	
			4	4	4	8	SS-80	20%		194.9	2.0
190										Gray-Orange, Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots) 3.5'-5.0'	
	188.4	8.5									
			6	7	11	18	SS-81	15%			
185										184.9	12.0
	183.4	13.5								Orange-Brown, Fine to Coarse Sandy Silty CLAY (A-7)	
			8	14	39	53		W			
180										179.9	17.0
	178.4	18.5								**RESIDUAL**	
			4	8	8	16		M		Blue-Gray, Clayey SILT (A-5) with Trace Mica	
175											
	173.4	23.5									
			5	6	8	14		M			
170											
	168.4	28.5									
			6	8	11	19		M			
165											
	163.4	33.5									
			12	18	25	43		M			
160											
	158.4	38.5									
			10	18	26	44		M			
155											
	153.4	43.5									
			13	20	20	40		M			
150											
	148.4	48.5									
			16	17	28	45		M			
145											
	143.4	53.5									
			20	30	70/0.3	100/0.8				142.9	54.0
										142.1 **WEATHERED ROCK**	54.8
										Gray-Green (BIOTITE GNEISS)	
										Boring Terminated at Elevation 142.1 ft in Weathered Rock (BIOTITE GNEISS)	

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-149	**STATION** 21+08	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 195.2 ft	**TOTAL DEPTH** 58.8 ft	**NORTHING** 663,024	**EASTING** 2,194,959	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/12/17	**COMP. DATE** 10/12/17	**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
200										
	195.2	0.0								195.2 GROUND SURFACE 0.0
195			2	4	6	10		M		**COASTAL PLAIN**
	191.7	3.5								Dark Gray-Dark Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)
			3	4	6	10		M		
190										
	186.7	8.5								
			13	35	44	79		M		
185										
	181.7	13.5								183.2 12.0
			3	4	6	10		M		**RESIDUAL**
180										Orange-Brown and Gray-Brown, Clayey SILT (A-5) with Trace Mica
	176.7	18.5								
			4	7	11	18		M		
175										
	171.7	23.5								
			5	9	12	21		M		
170										
	166.7	28.5								
			7	11	18	29		M		
165										
	161.7	33.5								
			11	21	28	49		M		
160										
	156.7	38.5								
			22	19	52	71		M		
155										
	151.7	43.5								
			19	25	60	85		M		
150										
	146.7	48.5								
			21	23	26	49		M		
145										
	141.7	53.5								
			100/0.4			100/0.4				143.2 52.0
140										**WEATHERED ROCK**
	136.7	58.5								Dark Gray (BIOTITE GNEISS)
			100/0.3			100/0.3				136.4 58.8
										Boring Terminated at Elevation 136.4 ft in Weathered Rock (BIOTITE GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-150	**STATION** 22+07	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** 20.9
COLLAR ELEV. 191.9 ft	**TOTAL DEPTH** 29.1 ft	**NORTHING** 662,971	**EASTING** 2,195,043	**24 HR.** 5.4
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER D. Aiello	**START DATE** 10/16/17	**COMP. DATE** 10/17/17	**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)
195											
	191.9	0.0	3	3	6	9		M		191.9 GROUND SURFACE	0.0
190										**COASTAL PLAIN**	
	188.4	3.5	7	5	6	11				189.9 Dark Gray-Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)	2.0
185										Gray-Orange, Clayey Fine to Coarse SAND (A-2-6)	
	183.4	8.5	8	10	9	19		M		184.9	7.0
180										**RESIDUAL** Brown to Blue-Gray, Clayey SILT (A-5) with Trace Mica	
	178.4	13.5	9	13	15	28		M			
175											
	173.4	18.5	19	50	50/0.2	100/0.7				172.9 **WEATHERED ROCK** Gray (BIOTITE GNEISS)	19.0
170											
	168.4	23.5	22	100/0.4		100/0.4					
165											
	163.4	28.5	68	32/0.1		100/0.6				162.8 Boring Terminated at Elevation 162.8 ft in Weathered Rock (BIOTITE GNEISS)	29.1

Notes:
1. Surficial Organics Soil=0.0'-0.1'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Retaining Wall 2 on -WL2- from 10+00.00 to 24+04.64				**GROUND WTR (ft)**
BORING NO. B-151	**STATION** 23+06	**OFFSET** 1 ft LT	**ALIGNMENT** -WL2-	**0 HR.** Dry
COLLAR ELEV. 193.4 ft	**TOTAL DEPTH** 49.6 ft	**NORTHING** 662,916	**EASTING** 2,195,125	**24 HR.** 16.1
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/17/17	**COMP. DATE** 10/17/17	**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
195										
	193.4	0.0	1	1	4	5		M		193.4 GROUND SURFACE 0.0
190										**COASTAL PLAIN** Gray-Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots)
	189.9	3.5	6	9	6	15		M		
185	184.9	8.5	6	11	12	23		M		186.4 7.0
180										**RESIDUAL** Brown-Blue-Gray, Clayey SILT (A-5) with Trace Mica
	179.9	13.5	8	18	25	43		M		
175	174.9	18.5	7	9	11	20		M		
170	169.9	23.5	12	23	32	55		M		
165	164.9	28.5	7	17	23	40		M		
160	159.9	33.5	10	25	37	62		M		
155	154.9	38.5	12	22	40	62		M		
150	149.9	43.5	11	17	34	51		M		
145	144.9	48.5	28	72	28/0.1	100/0.6				144.4 49.0
										143.8 **WEATHERED ROCK** 49.6 Gray (BIOTITE GNEISS) Boring Terminated at Elevation 143.8 ft in Weathered Rock (BIOTITE GNEISS)

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: W-5600
DESCRIPTION: US-70 Improvement from US 70 Business to the Neuse River Bridge

REPORT ON SAMPLES OF: SOIL FOR QUALITY

F&R PROJECT #: 66U-0197
DATE SAMPLED: 9/17 to 10/17
SAMPLED FROM: Various
SUBMITTED BY: Cheng Wang

COUNTY: Johnston
RECEIVED: 10/17 to 12/17
REPORTED: 10/17 to 12/17
BY: D. Jenks
Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	SS-1022	SS-79	SS-900	SS-941	SS-122	SS-123	ST-5	ST-5A
BORING NO.	B-144	B-148	B-129	B-118	B-130	B-130	B-124	B-124
Retained #4 Sieve %	0.0	NT	NT	NT	0.0	0.0	0.1	0.0
Passing #10 Sieve %	100.0	NT	NT	NT	99.9	100.0	8.8	100.0
Passing #40 Sieve %	86.9	NT	NT	NT	94.1	99.7	31.6	94.2
Passing #200 Sieve %	56.5	NT	NT	NT	57.3	68.6	59.5	67.2
SOIL MORTAR - 100%								
Coarse Sand Ret - #60 %	21.0	NT	NT	NT	11.8	3.1	16.9	12.0
Fine Sand Ret - #270 %	30.3	NT	NT	NT	44.4	40.1	29.2	28.1
Silt 0.053 - 0.010 mm %	33.9	NT	NT	NT	29.0	44.5	27.8	20.6
Clay < 0.010 mm %	14.8	NT	NT	NT	14.8	12.3	26.2	39.3
L.L.	19	NT	NT	NT	27	34	31	44
P.L.	NP	NT	NT	NT	NP	NP	12	18
P.I.	NP	NT	NT	NT	NP	NP	19	16
AASHTO Classification	A-4(0)	NT	NT	NT	A-4	A-4	A-6(8)	A-7-6(15)
Station	12+27	20+09	13+47	22+58	15+92	15+92	16+49	16+49
Offset	1'Lt	1'Lt	2'Lt	37'Lt	7'Lt	7'Lt	CL	CL
Depth (ft)	8.5	0.1	0.0	0.0	18.5	23.5	5.0	6.8
to	10.0	1.5	1.5	1.5	20.0	25.0	6.8	7.0
Alignment	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-
Moisture Content (%)	18.4	11.3	12.3	7.2	27.1	19.7	15.6	15.6
Organic Content (%)	2.6	2.7	2.0	1.6	NT	NT	NT	NT

NP = Not plastic
NT = Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, P.E.
Soils Engineer

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5600	1	11

REFERENCE: W-5600

PROJECT: 50056

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *JOHNSTON*

PROJECT DESCRIPTION *US 70 IMPROVEMENTS FROM EAST OF US 70 BUSINESS TO WEST OF THE NEUSE RIVER*

SITE DESCRIPTION *DUAL BRIDGES ON US 70 (-L-) OVER WILSON'S MILL ROAD (-Y9-, SR 1913) BETWEEN SR 1501 AND SR 1915*

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

M. DURWAY

S. DAVIS

D. AIELLO

T. SHARPE

A. STURCHIO

M. ARNOLD

INVESTIGATED BY *F&R, Inc.*

DRAWN BY *T.T. WALKER*

CHECKED BY *C. WANG*

SUBMITTED BY *P. ALTON*

DATE *MARCH 2018*

SINCE 1881

Prepared in the Office of:

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302 | USA
T 919.828.3441 | F 919.828.5751
www.fandr.com

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
W-5600	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		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	50 MX 25 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	< 4	
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	> 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	< 2	< 0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	> 30	> 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
- 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
- [X] CME-55
- [ ] CME-550
- [ ] 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-135= N: 663354.9350, E: 2194610.616, -L- STA. 216+33.31 58.59' LT
ELEVATION: 200.72 FEET

NOTES:
FIAD= FILLED IMMEDIATELY AFTER DRILLING
NM= NOT MEASURED

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
W-5600	3

SITE PLAN

0 50 100

FEET

SKEW = 67 DEGREES

NAD 83/NA 2011

-Y9- POC Sta.19+40.00 =
-Y9RPA- POT Sta. 26+55.71
-Y9RPB- POT Sta. 25+01.42

-Y9RPC- POT Sta. 25+81.78
-Y9RPD- POT Sta. 24+83.92

EB1-A
EB1-B
EB1-C
EB2-A
EB2-B
EB2-C

Begin Bridge
-L- 216+76.59

End Bridge
-L- 217+73.79

-L-
-Y9-
-Y9RPA-
-Y9RPB-
-Y9RPC-
-Y9RPD-

TO CLAYTON
TO SMITHFIELD
US HWY 70 WBL
US HWY 70 EBL
SR 1913
WILSON MILLS RD
BY9-221
BL-135
CONC IS BROKEN
15" RCP
EXISTING R/W
ISFBUS
MTL CARPORT
BILLBOARD
WOODS
25+00
20+00
215+00
220+00

PROJECT REFERENCE NO.	SHEET NO.
W-5600	4

PROFILE BORINGS PROJECTED ALONG THE ℄ OF –L–

0 10 20
FEET
VE = 1:1

EB1–C
216+81
℄

EB2–C
217+83
℄

Ground Surface

Roadway Embankment

Coastal Plain: Loose to Medium Dense, Gray–Brown, Moist, Clayey Fine to Coarse SAND (A–2–6) with Trace Organics (Roots)

Coastal Plain:

Medium Stiff to Very Stiff, Orange–Brown–Gray, Moist, Fine to Coarse Sandy CLAY (A–6) with Trace Organics (Roots)

Residual:

Medium Stiff to Hard, Gray–Tan–Green, Moist, Fine Sandy SILT (A–4) and Clayey SILT (A–5) with Trace Mica

Weathered Rock: Blue–Green (BIOTITE GNEISS)

Residual:

Hard, Gray–Green–Brown, Moist, Fine Sandy SILT (A–4) with Trace Mica

Weathered Rock: Blue–Green (BIOTITE GNEISS)

EB1–C: 5, 13, 11, 21, 7, 14, 20, 24, 29, 39, 100/0.7, 53, 100/0.9, 100/0.6 BT; 10/17

EB2–C: 10, 8, 11, 100/0.9, 12, 13, 18, 30, 53, 100/0.9, 100/0.7, 50, 100/0.3 BT; 10/17

210 200 190 180 170 160 150 140 130

217+00 218+00

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

PROJECT REFERENCE NO.	SHEET NO.
W-5600	5

CROSS SECTION THROUGH END BENT 1
STA. 216+76.59.00
SKEW=66.5 DEGREES

0 10 20
FEET
VE = 1:1

EB1-A
216+60
50' LT

EB1-C
216+81
℄

EB1-B
217+00
50' RT

SS-122
SS-123

SS-72

ASPHALT & ABC

Ground Surface

Loose, Gray-Brown, Moist, Silty and Clayey Fine to Coarse SAND (A-2-4) and (A-2-6) with Trace Organics (Roots)

Coastal Plain:

Medium Stiff to Hard, Red-Orange-Brown, Moist to Wet, Fine Sandy and Silty CLAY (A-7) and (A-6) with Trace Organics (Roots)

Residual:

Medium Stiff to Hard, Orange-Brown and Blue-Gray, Moist to Wet, Fine Sandy SILT (A-4) with Trace Mica

Weathered Rock:

Residual:

Hard, Gray-Blue-Green, Moist, Fine Sandy SILT (A-4)

Weathered Rock:

Gray-Blue (BIOTITE GNEISS)

Gray-Blue (BIOTITE GNEISS)

BT

FIAD

10/17

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

Ⓐ **Roadway Embankment:** Dense, Orange-Brown, Moist, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel and Roots

PROJECT REFERENCE NO.	SHEET NO.
W-5600	6

CROSS SECTION THROUGH END BENT 2
STA. 217+73.79
SKEW=65.6 DEGREES

0 10 20
FEET
VE = 1:1

EB2-A
217+60
50' LT

EB2-C
217+83
℄

EB2-B
218+00
50' RT

℄

ASPHALT & ABC STONE

Ⓐ Loose to Medium Dense, Brown, Moist, Silty

Coastal Plain: Medium Stiff to Hard, Red-Orange-Brown-Gray,

Ⓑ

Residual: Medium Stiff to Hard, Orange-Brown-Blue-Gray, Moist to Wet,

Weathered Rock: Hard,

BT

FIAD

Coastal Plain: Fine SAND (A-2-4) and Clayey Fine to Coarse SAND

Moist to Wet, Fine Sandy and Silty CLAY (A-6) and (A-7) with

Residual: Gray-Green-Brown, Moist, Fine Sandy SILT (A-4) and Fine Sandy SILT (A-4) and Clayey SILT (A-5) with Trace Mica

Weathered Rock: Gray-Green (BIOTITE GNEISS)

Ground Surface

(A-2-6) with Trace Organics (Roots)

Trace Organics (Roots)

Mica

Clayey SILT (A-5) with Trace Mica

10/17

Ⓐ **Roadway Embankment:** Medium Stiff, Dark Brown, Moist, Silty CLAY (A-7)

Ⓑ **Coastal Plain:** Loose, Orange-Brown, Wet, Clayey Fine to Coarse SAND (A-2-6)

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/022017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915				**GROUND WTR (ft)**
BORING NO. B-130(EB1-A)	**STATION** 216+60	**OFFSET** 50 ft LT	**ALIGNMENT** -L-	**0 HR.** 21.6
COLLAR ELEV. 201.7 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 663,335	**EASTING** 2,194,631	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**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)
205											
	201.7	0.0								GROUND SURFACE	0.0
	200.9	0.8								ASPHALT	0.8
200	200.2	1.5	4	16	16	32		M		ABC STONE	1.5
	198.7	3.0								**ROADWAY EMBANKMENT** Orange-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel and Organics	
	198.2	3.5	5	7	8	15		M		**COASTAL PLAIN** Orange-Brown, Fine Sandy Silty CLAY (A-7) with Trace Organics (Roots)	
195	193.2	8.5	4	7	8	15		M			
190	188.2	13.5	3	3	3	6		M			
	184.7	17.0								**RESIDUAL** Orange-Brown-Gray, Fine Sandy SILT (A-4) with Trace Mica	
185	183.2	18.5	9	13	13	26	SS-122	27%			
180	178.2	23.5	2	5	5	10	SS-123	20%			
175	173.2	28.5	7	14	24	38		M			
170	168.2	33.5	5	15	24	39		M			
165	163.2	38.5	17	40	60/0.4	100/0.9					
	162.7	39.0								**WEATHERED ROCK** Gray-Tan (BIOTITE GNEISS)	
	159.7	42.0								**RESIDUAL** Blue-Green, Fine Sandy SILT (A-4)	
160	158.2	43.5	12	22	31	53		M			
155	153.2	48.5	11	47	53/0.4	100/0.9					
	152.7	49.0								**WEATHERED ROCK** Gray-Blue-Green (BIOTITE GNEISS)	
150	148.2	53.5	19	65	35/0.3	100/0.8					
	146.9	54.8								Boring Terminated at Elevation 146.9 ft in Weathered Rock (BIOTITE GNEISS)	

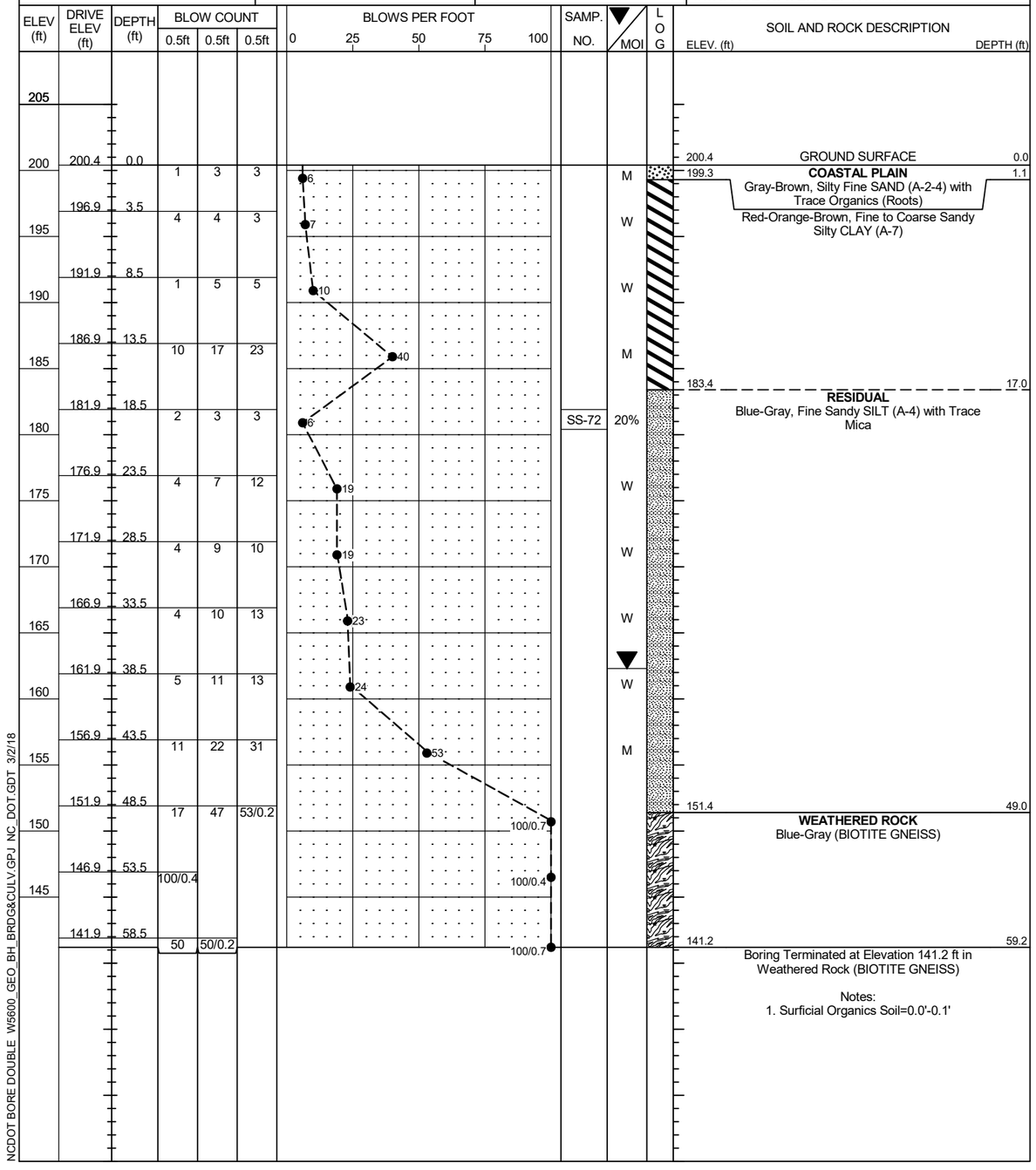
WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915				**GROUND WTR (ft)**
BORING NO. B-181(EB1-C)	**STATION** 216+81	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** 20.0
COLLAR ELEV. 200.3 ft	**TOTAL DEPTH** 64.1 ft	**NORTHING** 663,281	**EASTING** 2,194,626	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/19/17	**COMP. DATE** 10/19/17	**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	
205											
	200.3	0.0								GROUND SURFACE	0.0
200	196.8	3.5	1	2	3	5		M		**COASTAL PLAIN** Gray-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)	
	196.4	3.9								Orange-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)	
195	191.8	8.5	4	6	7	13		M			
190	186.8	13.5	3	5	6	11		M			
185	181.8	18.5	7	11	10	21		M			
180	176.8	23.5	3	2	5	7		M			
175	171.8	28.5	3	6	8	14		M			
170	166.8	33.5	4	9	11	20		M			
165	161.8	38.5	5	9	15	24		M			
160	156.8	43.5	7	11	18	29		M			
155	151.8	48.5	8	20	19	39		M			
	151.3	49.0								**WEATHERED ROCK** Blue-Green (BIOTITE GNEISS)	
	148.3	52.0								**RESIDUAL** Gray-Blue-Green, Fine Sandy SILT (A-4) with Trace Mica	
150	146.8	53.5	44	56	44/0.2	100/0.7					
145	141.8	58.5	14	33	20	53		M			
	141.3	59.0								**WEATHERED ROCK** Blue Green (BIOTITE GNEISS)	
140	136.8	63.5	20	43	56/0.4	100/0.9					
	136.2	64.1	73	27/0.1		100/0.6				Boring Terminated at Elevation 136.2 ft in Weathered Rock (BIOTITE GNEISS)	

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915			**GROUND WTR (ft)**
BORING NO. B-131(EB1-B)	**STATION** 217+00	**OFFSET** 50 ft RT	**ALIGNMENT** -L-	**0 HR.** 58.0
COLLAR ELEV. 200.4 ft	**TOTAL DEPTH** 59.2 ft	**NORTHING** 663,228	**EASTING** 2,194,619	**24 HR.** 38.1
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/10/17	**COMP. DATE** 10/10/17	**SURFACE WATER DEPTH** N/A	



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915				**GROUND WTR (ft)**
BORING NO. B-132(EB2-A)	**STATION** 217+60	**OFFSET** 50 ft LT	**ALIGNMENT** -L-	**0 HR.** 19.3
COLLAR ELEV. 200.7 ft	**TOTAL DEPTH** 54.8 ft	**NORTHING** 663,287	**EASTING** 2,194,720	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**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)
205										
200	199.9	0.8	1	3	4	7				200.7 — GROUND SURFACE — 0.0
										199.9 — ASPHALT — 0.8
	197.2	3.5								199.6 — ABC STONE — 1.1
195			4	6	7	13		M		197.7 — **ROADWAY EMBANKMENT** Dark Brown, Silty CLAY (A-7) — 3.0
	192.2	8.5								**COASTAL PLAIN** Orange-Red-Brown, Fine Sandy Silty CLAY (A-7) with Trace Organics (Roots)
190			3	5	6	11		M		
	187.2	13.5								188.7 — Orange-Brown, Clayey Fine to Coarse SAND (A-2-6) — 12.0
185			1	2	2	4		W		
	182.2	18.5								183.7 — **RESIDUAL** Orange-Brown-Gray, Fine Sandy SILT (A-4) with Trace Mica — 17.0
180			2	2	5	7				
	177.2	23.5								
175			2	7	8	15		M		
	172.2	28.5								
170			3	8	11	19		M		
	167.2	33.5								
165			13	22	44	66		M		
	162.2	38.5								
160			9	22	23	45		M		
	157.2	43.5								156.7 — **WEATHERED ROCK** Gray-Green (BIOTITIE GNEISS) — 44.0
155			32	50	50/0.4	100/0.9				
	152.2	48.5								
150			14	27	73/0.4	100/0.9				
	147.2	53.5								
			16	42	58/0.3	100/0.8				145.9 — Boring Terminated at Elevation 145.9 ft in Weathered Rock (BIOTITE GNEISS) — 54.8

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915				**GROUND WTR (ft)**
BORING NO. B-182(EB2-C)	**STATION** 217+83	**OFFSET** CL	**ALIGNMENT** -L-	**0 HR.** 30.6
COLLAR ELEV. 199.7 ft	**TOTAL DEPTH** 59.8 ft	**NORTHING** 663,232	**EASTING** 2,194,716	**24 HR.** 3.1
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/25/17	**COMP. DATE** 10/25/17	**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
200	199.7	0.0	2	4	6	10		M		199.7 — GROUND SURFACE — 0.0
	196.2	3.5								**COASTAL PLAIN** Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)
195			1	3	5	8		M		195.7 — Orange-Brown-Gray, Fine Sandy CLAY (A-6) — 4.0
	191.2	8.5								
190			4	5	6	11		M		
	186.2	13.5								
185			20	22	78/0.4	100/0.9				
	181.2	18.5								180.6 — **RESIDUAL** Gray-Tan-Green, Clayey SILT (A-5) with Trace Mica — 19.1
180			4	6	6	12		M		
	176.2	23.5								
175			3	6	7	13		M		
	171.2	28.5								
170			3	5	13	18		M		
	166.2	33.5								
165			5	11	19	30		M		
	161.2	38.5								
160			13	22	31	53		M		
	156.2	43.5								155.7 — **WEATHERED ROCK** Brown-Green (BIOTITE GNEISS) — 44.0
155			13	41	59/0.4	100/0.9				
	151.2	48.5								
150			27	60	40/0.2	100/0.7				
	146.2	53.5								147.7 — **RESIDUAL** Green-Brown, Fine Sandy SILT (A-4) with Trace Mica — 52.0
145			8	15	35	50		M		
	141.2	58.5								
140			20	45	55/0.3	100/0.8				140.7 — 139.9 — **WEATHERED ROCK** Blue-Green (BIOTITE GNEISS) — 59.0 — 59.8 Boring Terminated at Elevation 139.9 ft in Weathered Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) Between SR 1501 and SR 1915				**GROUND WTR (ft)**
BORING NO. B-133 (EB2-B)	**STATION** 218+00	**OFFSET** 50 ft RT	**ALIGNMENT** -L-	**0 HR.** 5.9
COLLAR ELEV. 199.0 ft	**TOTAL DEPTH** 59.4 ft	**NORTHING** 663,181	**EASTING** 2,194,706	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/11/17	**COMP. DATE** 10/11/17	**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)
200										
	199.0	0.0	3	7	4	11		M		199.0 GROUND SURFACE 0.0
195	195.5	3.5	4	4	6	10		W		**COASTAL PLAIN** 197.0 Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots) 2.0
										Gray-Orange-Brown, Fine to Coarse Sandy Silty CLAY (A-7)
190	190.5	8.5	4	23	10	33		W		
185	185.5	13.5	10	20	16	36		W		
180	180.5	18.5	3	3	4	7		W		182.0 **RESIDUAL** 17.0 Blue-Gray, Clayey SILT (A-5) with Trace Mica
175	175.5	23.5	5	10	11	21		W		
170	170.5	28.5	4	5	10	15		W		
165	165.5	33.5	11	19	28	47		M		
160	160.5	38.5	14	27	43	70		M		
155	155.5	43.5	22	40	60/0.4	100/0.9				155.0 44.0 **WEATHERED ROCK** Gray-Green-Brown (BIOTITE GNEISS)
150	150.5	48.5	52	48/0.2		100/0.7				147.0 **RESIDUAL** 52.0 Gray-Green, Clayey SILT (A-5) with Trace Mica
145	145.5	53.5	22	26	43	69		M		142.0 **WEATHERED ROCK** 57.0
140	140.5	58.5	36	64/0.4		100/0.9				139.6 Blue-Gray (BIOTITE GNEISS) 59.4
										Boring Terminated at Elevation 139.6 ft in Weathered Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: W-5600
DESCRIPTION: Dual Bridges on US 70 over Wilson's Mill Road -Y9- (SR 1913) between SR 1501 and SR 1915

REPORT ON SAMPLES OF: SOIL FOR QUALITY

F&R PROJECT #: 66U-0197
DATE SAMPLED: 9/17 to 10/17
SAMPLED FROM: Various
SUBMITTED BY: Cheng Wang

COUNTY: Johnston
RECEIVED: 10/17 to 12/17
REPORTED: 10/17 to 12/17
BY: D. Jenks
Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	SS-122	SS-123	SS-72												
BORING NO.	B-130	B-130	B-131												
	EB1-A	EB1-A	EB1-B												
Retained #4 Sieve %	0.0	0.0	0.0												
Passing #10 Sieve %	99.9	100.0	100.0												
Passing #40 Sieve %	94.1	99.7	99.2												
Passing #200 Sieve %	57.3	68.6	57.8												
SOIL MORTAR - 100%															
Coarse Sand Ret - #60 %	11.8	3.1	6.6												
Fine Sand Ret - #270 %	44.4	40.1	46.0												
Silt 0.053 - 0.010 mm %	29.0	44.5	25.2												
Clay < 0.010 mm %	14.8	12.3	22.2												
L.L.	27	34	38												
P.L.	NP	NP	33												
P.I.	NP	NP	5												
AASHTO Classification	A-4	A-4	A-4(2)												
Station	216+60	216+60	217+00												
Offset	50'Lt	50'Lt	50'Rt												
Depth (ft)	18.5	23.5	18.5												
to	20.0	25.0	20.0												
Alignment	-L-	-L-	-L-												
Moisture Content (%)	27.1	19.7	20.4												
Organic Content (%)	NT	NT	NT												

NP = Not plastic
NT = Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, P.E.
Soils Engineer

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5600	1	19

REFERENCE: W-5600

PROJECT: 50056

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *JOHNSTON*

PROJECT DESCRIPTION *US 70 IMPROVEMENTS FROM EAST OF US 70 BUSINESS TO WEST OF THE NEUSE RIVER*

SITE DESCRIPTION *BRIDGE ON SWIFT CREEK ROAD (-Y7-, SR 1501) OVER US 70 (-L-) BETWEEN SR 1913 AND SR 1907*

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

M. DURWAY

S. DAVIS

D. AIELLO

T. SHARPE

A. STURCHIO

S. WOODS

INVESTIGATED BY *F&R, Inc.*

DRAWN BY *T.T. WALKER*

CHECKED BY *C. WANG*

SUBMITTED BY *P. ALTON*

DATE *JULY 2018*

SINCE 1881

Prepared in the Office of:

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302 | USA
T 919.828.3441 | F 919.828.5751
www.fandr.com

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
W-5600	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		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	< 4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	> 50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	< 2	< 0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	> 30	> 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
- 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
- [X] CME-55
- [ ] CME-550
- [ ] 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: W-5600 4A= N: 665822.07, E: 2189197.88, -Y7- STA. 27+52.78, 71.57' RT
ELEVATION: 193.2 FEET

NOTES:
FIAD= FILLED IMMEDIATELY AFTER DRILLING
NM= NOT MEASURED

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
W-5600	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

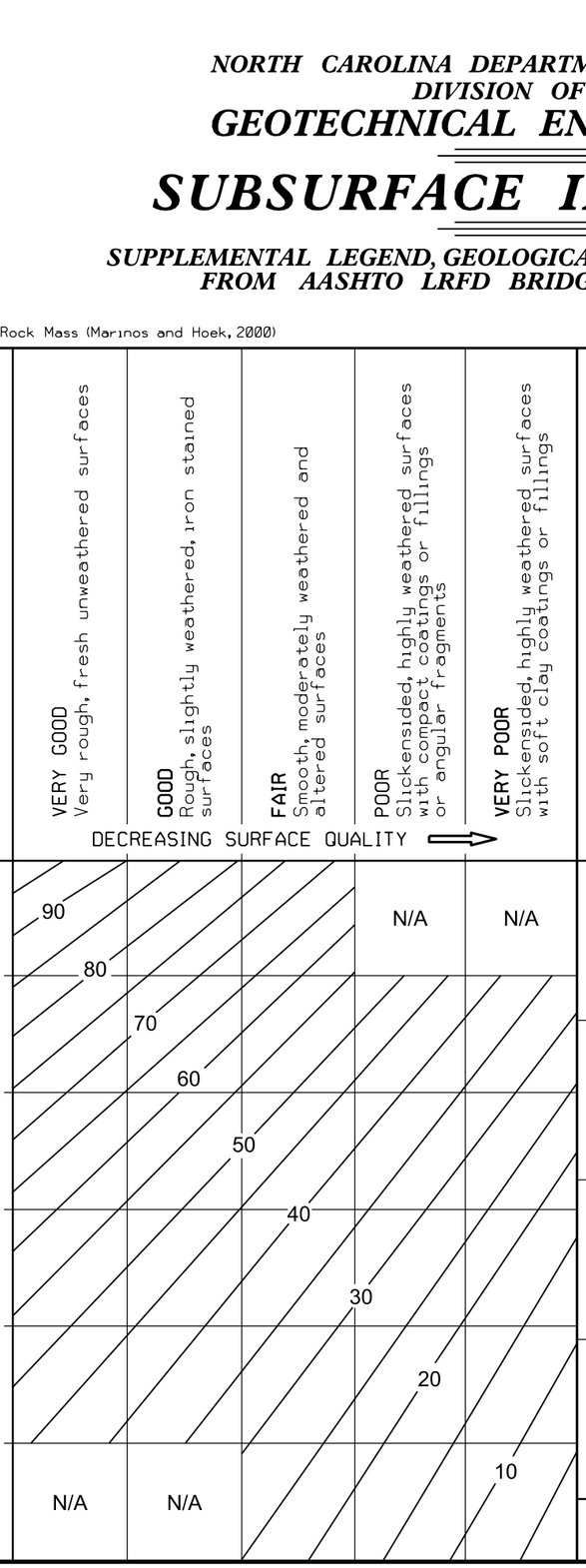
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

STRUCTURE

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

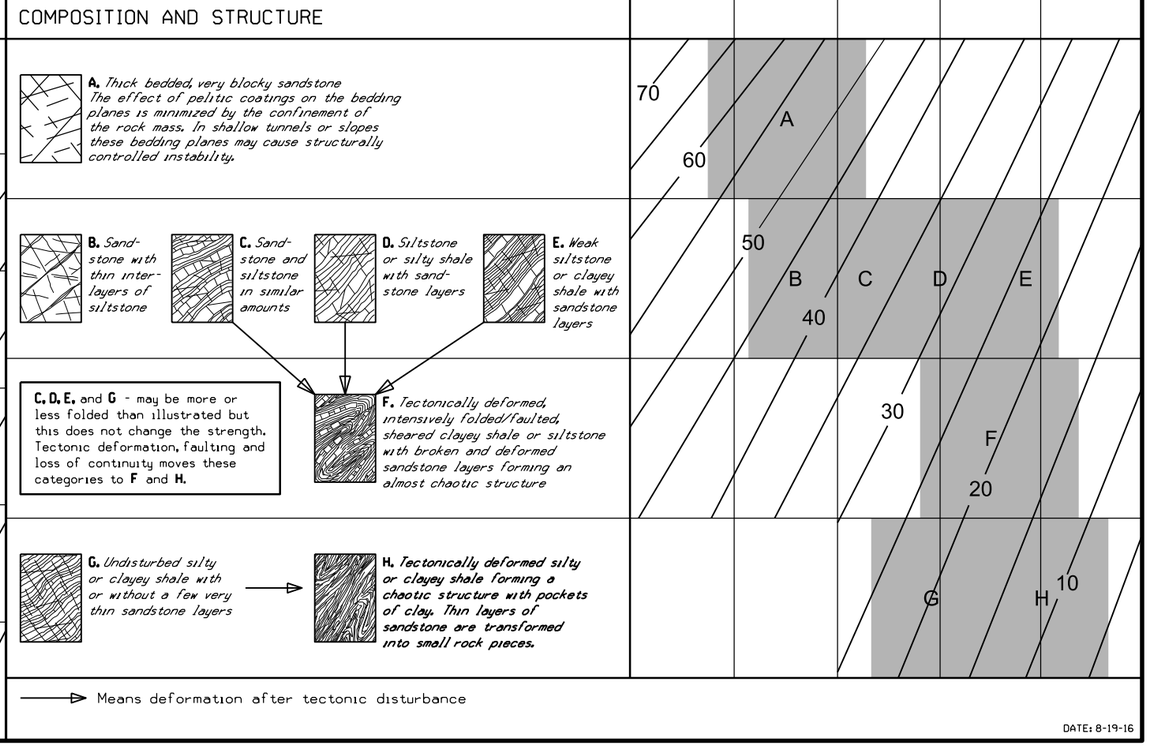


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE



A. *Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.*

B. *Sandstone with thin interlayers of siltstone*

C. *Sandstone and siltstone in similar amounts*

D. *Siltstone or silty shale with sandstone layers*

E. *Weak siltstone or clayey shale with sandstone layers*

C, D, E, and **G** - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to **F** and **H.**

F. *Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure*

G. *Undisturbed silty or clayey shale with or without a few very thin sandstone layers*

H. *Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.*

→ Means deformation after tectonic disturbance

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
W-5600	3

SITE PLAN

0 60 120

FEET

SKEW = 105 DEGREES

KENNETH R. JONES

NAD 83/NA 2011

-Y7LPA-
Sta. 10+00.00=
-L- Sta.
158+00.00, 47' LT.

15+00

TO SMITHFIELD

US HWY 70 WBL

US HWY 70 EBL

-L-

B1-A

B1-C

B1-B

EB1-A

EB1-B

-Y7-

EB2-A

EB2-B

End Bridge
-Y7- 27+99.16

Begin Bridge
-Y7- 26+04.66

-Y7LPC-

-Y7RPA-

-DR2-

SR 1501 SWIFT CREEK RD

BY7-215

BY7-216

WILSONS MILLS CHRISTIAN CHURCH

TO CLAYTON

POPLAR CREEK

WOODS

KENNETH R. JONES

-Y7RPA- POT Sta. 28+84.03=
-Y7- POT Sta. 22+94.00
-Y7LPA- POT Sta. 21+08.55=
-Y7- POT Sta. 23+20.00
-DR2- POT Sta. 10+00.00=
-Y7- POT Sta. 23+40.00

EB2-B

27+00

-Y7-

B-77C

B-77B

B-77D

B-77A

38

0 30 60

FEET

PROJECT REFERENCE NO.	SHEET NO.
W-5600	4

PROFILE BORINGS PROJECTED ALONG ℄ OF –Y7–

0 10 20
FEET
VE = 2:1

EB1–A
26+00
30' LT

B1–A
27+00
30' LT

EB2–A
28+00
40' LT

RS–1
RS–2

Asphalt

Ground Surface

ABC Stone

Roadway Embankment:

Soft to Stiff, Sandy

Red-Brown-Gray, Moist to Wet, Fine to Coarse CLAY (A-6) with Trace Organics (Roots) and Gravel

Coastal Plain: Soft to Stiff, Red-Orange-Brown-Gray, Moist to Saturated Silty CLAY (A-7) with Trace Mica

Residual:

Very Loose to Dense, Tan-Orange-Brown, Wet, Silty and Clayey Fine to Coarse SAND (A-2-4) and (A-2-6) with Trace Mica

Gray-Tan-Brown (BIOTITE GNEISS)

Residual:

Stiff to Hard, Orange-Brown, Moist, Fine to Coarse Sandy SILT (A-4) with Trace Mica

Weathered Rock:

Tan-Brown, Medium Hard to Hard Fracture Spacing

Crystalline Rock:

Moderate to Very Slightly Weathered, (BIOTITE GNEISS) with Close to Wide

REC=87%
RQD=73%
GSI=50-70

Weathered Rock:

Gray-White (BIOTITE GNEISS)

BT
REF
FIAD

Ⓐ **Roadway Embankment:** Very Loose to Loose, Dark Brown, Moist to Wet, Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Gravel

Ⓑ **Residual:** Medium Stiff, Tan, Dark Brown, Wet, Fine to Coarse Sandy SILT (A-4)

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

210 200 190 180 170 160 150 140 130

26+00 27+00 28+00

PROJECT REFERENCE NO.	SHEET NO.
W-5600	5

CROSS SECTION THROUGH END BENT 1
AT STA. 26+04.66
SKEW=104.8 DEGREES

0 10 20
FEET
VE = 1:1

EB1–A
26+00
30' LT

EB1–B
26+00
30' RT

℄

ST-6

ABC Stone
Asphalt
Ground Surface

Coastal Plain: Soft to Stiff, Moist, Gray-Orange to Tan-Brown, Silty CLAY (A-7-5)

ST-6 10/17 with Trace Mica

Coastal Plain: Loose to Dense, Wet, Gray-Brown, Silty Fine SAND (A-2-4)

Residual: Very Stiff to Hard, Moist, Orange-Brown to Dark Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica

(BIOTITE GNEISS)

(BIOTITE GNEISS)

Fine SAND (A-2-4)

Residual: Dense, Moist, White-Tan, Silty Gray-White to Brown Gray-Brown

Crystalline Rock: (BIOTITE GNEISS)

Weathered Rock:

Crystalline Rock:

Weathered Rock: Gray-White (BIOTITE GNEISS)

EB1–A		EB1–B	
33		19	
7		6	
3		4	
8	10/17	8	
11		10	
8		40	
15		20	
38		100/0.9	BT REF
43		60/0.1	
93		49	
66		60/0.0	
100/0.8			
60/0.1			
100/0.3	BT FJAD		

Ⓐ **Roadway Embankment:** Medium Dense to Dense, Moist, Orange-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel and Organics (Roots)

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

220 210 200 190 180 170 160 150 140 130

50 40 30 20 10 0 10 20 30 40 50

PROJECT REFERENCE NO.	SHEET NO.
W-5600	6

CROSS SECTION THROUGH BENT 1
AT STA. 27+02.10
SKEW=104.8 DEGREES

0 10 20
FEET
VE = 1:1

B1-A
27+00
30' LT

RS-1
RS-2

B1-C
27+00
℄

B1-B
27+00
30' RT

RS-3
RS-4

Asphalt

ABC Stone

Roadway Embankment: CLAY (A-6) and Silty

Coastal Plain: Soft to Medium Stiff, Saturated, Black-Silty CLAY (A-7) with Trace Coarse Sand and Mica

Residual: Very Loose, Wet, Tan-Orange-Brown, Fine SAND (A-2-6) with Trace Mica

Crystalline Rock: Tan-Brown, Moderate to Very Slightly Weathered, (BIOTITE GNEISS) with Close to Wide

Medium Stiff to Stiff, CLAY (A-7) with Trace Gravel

Brown, Clayey

Medium Hard to Hard Fracture Spacing

REC=87%
RQD=73%
GSI=50-70

BT
FIAD

Moist to Wet, Red-Brown to and Organics (Roots)

Stiff to Fine Sandy SILT with Trace Mica

REF
FIAD

Residual: Hard, Moist, Gray, (A-2-4)

Tan-Gray, Moderately Severely Hard (BIOTITE GNEISS) Close Fracture Spacing

Tan-Gray, Moderately to Slightly (BIOTITE GNEISS) with Very Fracture Spacing

Weathered Rock: Tan-Gray, Slightly Weathered Hard (BIOTITE GNEISS) with

BT

REC=100%
RQD=96%
GSI=45-65

Ground Surface

Orange-Gray, Fine to Coarse Sandy

Weathered, Very Soft to Moderately with Very Close to Moderately

REC=49%
RQD=13%
GSI=25-40

Weathered, Medium Hard to Hard, Close to Moderately Close

REC=96%
RQD=64%
GSI=45-65

(BIOTITE GNEISS)

to Fresh, Moderately Hard to Moderately Close to Wide Fracture Spacing

Ⓐ **Weathered Rock:** Tan-Brown and Gray (BIOTITE GNEISS)

Ⓑ **Residual:** Stiff to Hard, Moist, Gray, Fine Sandy SILT (A-4) with Trace Mica

Ⓒ **Residual:** Loose to Medium Dense, Moist, Tan-Orange-Brown, Clayey Fine SAND (A-2-6) with Trace Gravel

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/02/2017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
W-5600	7

CROSS SECTION THROUGH END BENT 2
AT STA. 27+99.16
SKEW=105.0 DEGREES

0 10 20
FEET
VE = 1:1

EB2-A
28+00
40' LT

EB2-B
27+86
30' RT

℄

Asphalt

Ground Surface

Roadway Embankment: Loose to Medium Dense, Moist to Wet, Red-Gray-Brown, Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel and Organics (Roots)

Residual: Medium Stiff to Very Stiff, Moist to Wet, Orange-Tan-Gray-Brown, Fine to Coarse Sandy SILT (A-4) and Clayey SILT (A-5) with Trace Mica

Weathered Rock: Red-Gray (BIOTITE GNEISS)

Crystalline Rock: Brown-Orange-Gray (BIOTITE GNEISS)

A	9	9	
B	3	10/17	
C	98	60/0.1	BT REF FIAD

	7		
	8		
	27	10/17	
	4		
	17		
	29		
	100/0.4	60/0.1	BT REF

Ⓐ **Roadway Embankment:** Stiff, Moist, Brown-Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Gravel

Ⓑ **Roadway Embankment:** Soft, Wet, Dark Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)

Ⓒ **Residual:** Very Dense, Wet, Tan, Silty Fine to Coarse SAND (A-2-4)

GROUNDLINE TAKEN FROM .TIN FILE PROVIDED BY WETHERILL ENGINEERING DATED 11/022017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

210 200 190 180 170 160 150 140 130

50 40 30 20 10 0 10 20 30 40 50

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-72(EB1-A)	**STATION** 26+00	**OFFSET** 30 ft LT	**ALIGNMENT** -Y7-	**0 HR.** 16.7
COLLAR ELEV. 196.3 ft	**TOTAL DEPTH** 63.8 ft	**NORTHING** 665,921	**EASTING** 2,189,352	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/23/17	**COMP. DATE** 10/23/17	**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)
200										
	196.3	0.0								196.3 — GROUND SURFACE — 0.0
	195.8	0.5	17	19	14	33		M		195.8 — ASPHALT — 0.5
195	194.6	1.7								194.6 — ABC STONE — 1.7
	193.3	3.0								193.3 — **ROADWAY EMBANKMENT** Orange-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel — 3.0
	192.8	3.5	6	3	4	7		M		**COASTAL PLAIN** Gray-Orange, Fine Sandy Silty CLAY (A-7-5)
190										
	187.8	8.5	3	1	2	3		M		
185										
	182.8	13.5	4	4	4	8		M		
180										
	177.8	18.5	4	5	6	11		M		
175										
	172.8	23.5	2	3	5	8		M		
170										
	167.8	28.5	4	5	10	15		M		
165										
	162.8	33.5	13	21	17	38		M		
160										
	157.8	38.5	5	14	29	43		M		
155										
	152.8	43.5	19	47	46	93		M		
150										
	147.8	48.5	20	28	38	66		M		
145										
	142.8	53.5	17	37	63/0.3	100/0.8		M		142.3 — **WEATHERED ROCK** Gray-White (BIOTITE GNEISS) — 54.0
140										139.3 — **CRYSTALLINE ROCK** Gray-Brown (BIOTITE GNEISS) — 57.0
	137.8	58.5	60/0.1			60/0.1		M		
135										134.3 — **WEATHERED ROCK** — 62.0
	132.8	63.5	100/0.3			100/0.3		M		132.5 — Gray-White (BIOTITE GNEISS) — 63.8 Boring Terminated at Elevation 132.5 ft in Weathered Rock (BIOTITE GNEISS)

Notes:
1. Harder Drilling indicated by driller at depths of 57.0', 58.5'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-73(EB1-B)	**STATION** 26+00	**OFFSET** 30 ft RT	**ALIGNMENT** -Y7-	**0 HR.** 23.5
COLLAR ELEV. 194.9 ft	**TOTAL DEPTH** 46.9 ft	**NORTHING** 665,945	**EASTING** 2,189,297	**24 HR.** 9.5
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/04/17	**COMP. DATE** 10/05/17	**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
195										
	194.9	0.0	5	12	7	19		M		194.9 — GROUND SURFACE — 0.0
	191.4	3.5								**ROADWAY EMBANKMENT**
190			2	3	3	6		M		192.9 — Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Roots — 2.0
	186.4	8.5								**COASTAL PLAIN** Tan-Brown, Fine Sandy Silty CLAY (A-7-5) with Trace Mica
185			2	1	3	4		43%		
	181.4	13.5						M		
180			2	4	4	8		W		
	176.4	18.5								
175			3	4	6	10		W		
	171.4	23.5								
170			5	9	31	40		W		
	166.4	28.5								167.9 — **RESIDUAL** — 27.0
165			8	9	11	20		M		Dark Brown, Clayey Fine Sandy SILT (A-4), Micaceous
	161.4	33.5								162.9 — **WEATHERED ROCK** — 32.0
160			31	69/0.4		100/0.9				Brown (BIOTITE GNEISS)
	156.4	38.5	60/0.1			60/0.1				156.4 — **CRYSTALLINE ROCK** — 38.5
155										Brown (BIOTITE GNEISS)
	151.4	43.5	9	15	34	49		M		152.9 — **RESIDUAL** — 42.0
150										White-Tan, Silty Fine SAND (A-2-4)
	148.0	46.9	60/0.0			60/0.0				148.0 — 46.9

Boring Terminated with Standard Penetration Test Refusal at Elevation 148.0 ft on Crystalline Rock (BIOTITE GNEISS)

Notes:
1.Surficial Organics Soil=0.0'-0.1'
2. Harder Drilling indicated by driller at depths of 35.4'-36.3'

Other Samples:
ST-6 (6.0 - 8.0)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-74(B1-A)	**STATION** 27+00	**OFFSET** 30 ft LT	**ALIGNMENT** -Y7-	**0 HR.** 10.8
COLLAR ELEV. 194.8 ft	**TOTAL DEPTH** 41.5 ft	**NORTHING** 665,830	**EASTING** 2,189,312	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**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)
195											
	193.9	0.9								194.8 GROUND SURFACE	0.0
			11	4	3	7		M		193.9 ASPHALT	0.9
	191.3	3.5								193.2 ABC STONE	1.6
190			4	4	4	8		M		**ROADWAY EMBANKMENT** Red-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Gravel	
	186.3	8.5									
185			2	3	2	5		W			
	181.3	13.5								182.8 **COASTAL PLAIN** Black-Brown, Silty CLAY (A-7) with Trace Coarse Sand and Mica	12.0
180			2	2	2	4		Sat.			
	176.3	18.5								177.8 **RESIDUAL** Tan-Orange-Brown, Clayey Fine SAND (A-2-6) with Trace Mica	17.0
175			2	1	2	3		W			
	171.3	23.5									
170			10	14	100/0.4	100/0.4				170.3 **WEATHERED ROCK** Tan-Brown (BIOTITE GNEISS)	24.5
	168.6	26.2	73	27/0.2		100/0.7				167.9 **CRYSTALLINE ROCK** Tan-Brown, Moderate to Very Slightly Weathered, Medium Hard to Hard (BIOTITE GNEISS) with Close to Wide Fracture Spacing RS-1: 29.4'-29.7', qu=13,917 psi, GSI=50-70 RS-2: 38.6-38.9', qu 21,117 psi, GSI=50-70	26.9
165							RS-1				
160											
155							RS-2			153.3	41.5
										Boring Terminated at Elevation 153.3 ft in Crystalline Rock (BIOTITE GNEISS)	

Notes:
1. Auger refusal at 26.2'
2. Begin coring at 26.9'

NCDOT BORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 7/20/18

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-74(B1-A)	**STATION** 27+00	**OFFSET** 30 ft LT	**ALIGNMENT** -Y7-	**0 HR.** 10.8
COLLAR ELEV. 194.8 ft	**TOTAL DEPTH** 41.5 ft	**NORTHING** 665,830	**EASTING** 2,189,312	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER S. Davis	**START DATE** 10/24/17	**COMP. DATE** 10/24/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 14.6 ft			

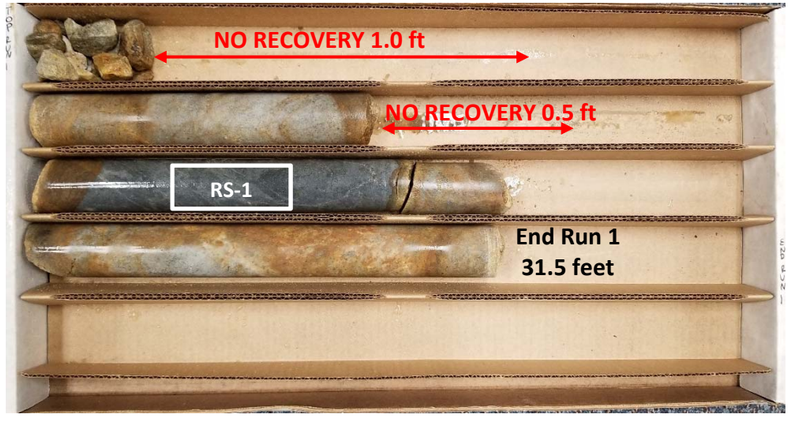
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
167.9											Begin Coring @ 26.9 ft	
	167.9	26.9	4.6	0:54/0.6 1:03/1.0 2:27/1.0 2:14/1.0 2:37/1.0	(3.5) 76%	(2.8) 61%		(12.7) 87%	(10.6) 73%		167.9 **CRYSTALLINE ROCK** Tan-Brown, Moderate to Very Slightly Weathered, Medium Hard to Hard (BIOTITE GNEISS) with Close to Wide Fracture Spacing RS-1: 29.4'-29.7', qu=13,917 psi, GSI=50-70 RS-2: 38.6-38.9', qu=21,117 psi, GSI=50-70	26.9
165							RS-1					
	163.3	31.5	5.0	2:25/1.0 2:59/1.0 2:47/1.0 2:56/1.0 2:36/1.0	(4.3) 86%	(3.5) 70%						
160												
	158.3	36.5	5.0	3:03/1.0 2:24/1.0 3:27/1.0 3:08/1.0 2:36/1.0	(4.9) 98%	(4.3) 86%						
155							RS-2					
	153.3	41.5									153.3 Boring Terminated at Elevation 153.3 ft in Crystalline Rock (BIOTITE GNEISS)	41.5

Notes:
1. Auger refusal at 26.2'
2. Begin coring at 26.9'

NCDOT CORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 7/20/18

CORE PHOTOGRAPHS: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907, B1-A: -Y7- Station 27+00, 30’ LT

Begin Run 1
26.9 feet



0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

Begin Run 2
31.5 feet

Begin Run 3
36.5 feet

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-75A(B1-C)	**STATION** 27+00	**OFFSET** CL	**ALIGNMENT** -Y7-	**0 HR.** 11.0
COLLAR ELEV. 194.3 ft	**TOTAL DEPTH** 16.1 ft	**NORTHING** 665,842	**EASTING** 2,189,285	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/27/17	**COMP. DATE** 10/27/17	**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)
195	194.3	0.0								194.3 GROUND SURFACE 0.0
			2	3	3	6		M		**ROADWAY EMBANKMENT** Orange-Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)
190	190.8	3.5	5	4	5	9		M		
185	185.8	8.5	5	6	8	14		M		185.5 8.8 **RESIDUAL** Gray, Fine Sandy SILT (A-4) with Trace Mica
180	180.8	13.5	12	24	21	45		M		178.5 15.8
	178.2	16.1	60/0.0			60/0.0				178.2 16.1 **WEATHERED ROCK** Gray (BIOTITE GNEISS) Boring Terminated with Standard Penetration Test Refusal at Elevation 178.2 ft on Crystalline Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'
2. Harder drilling indicated by driller at 15.8'
3. Auger refusal at 16.1'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-75(B1-B)	**STATION** 27+00	**OFFSET** 30 ft RT	**ALIGNMENT** -Y7-	**0 HR.** NM
COLLAR ELEV. 193.9 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 665,854	**EASTING** 2,189,257	**24 HR.** 8.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/25/17	**COMP. DATE** 10/25/17	**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)
195										
	193.9	0.0	3	3	5	8		M		193.9 GROUND SURFACE 0.0 **ROADWAY EMBANKMENT** Orange-Brown-Gray, Silty CLAY (A-7)
190	190.4	3.5	3	4	3	7		M		
	186.9	7.0								**RESIDUAL** Tan-Orange-Brown, Clayey Fine SAND (A-2-6) with Trace Gravel
185	185.4	8.5	9	17	100/0.4					184.4 9.5
	183.9	10.0	60/0.1			100/0.4 60/0.1				183.9 10.0 **WEATHERED ROCK** Tan-Brown (BIOTITE GNEISS) 183.8 10.1
180										**CRYSTALLINE ROCK** Tan-Gray (BIOTITE GNEISS) Tan-Gray, Moderately Severely Weathered, Very Soft to Moderately Hard (BIOTITE GNEISS) with Very Close to Moderately Close Fracture Spacing RS-3: 20.3'-20.6', qu=26,764 psi, GSI=25-40
175							RS-3			
170										
										167.8 26.1 Tan-Gray, Moderately to Very Slightly Weathered, Medium Hard to Hard, (BIOTITE GNEISS) with Very Close to Moderately Close Fracture Spacing RS-4: 30.1'-30.4', qu=20,382 psi, GSI=45-65
165							RS-4			
160										160.0 33.9 **WEATHERED ROCK** (BIOTITE GNEISS)
155										155.4 38.5 **CRYSTALLINE ROCK** Tan-Gray, Slightly Weathered to Fresh, Moderately Hard to Hard (BIOTITE GNEISS) with Moderately Close to Wide Fracture Spacing GSI=45-65
										152.8 41.1 Boring Terminated at Elevation 152.8 ft in Crystalline Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'
2. Auger refusal at 10.0'
3. Begin coring at 10.1'

NCDOT BORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 3/21/18

GEOTECHNICAL BORING REPORT
CORE LOG

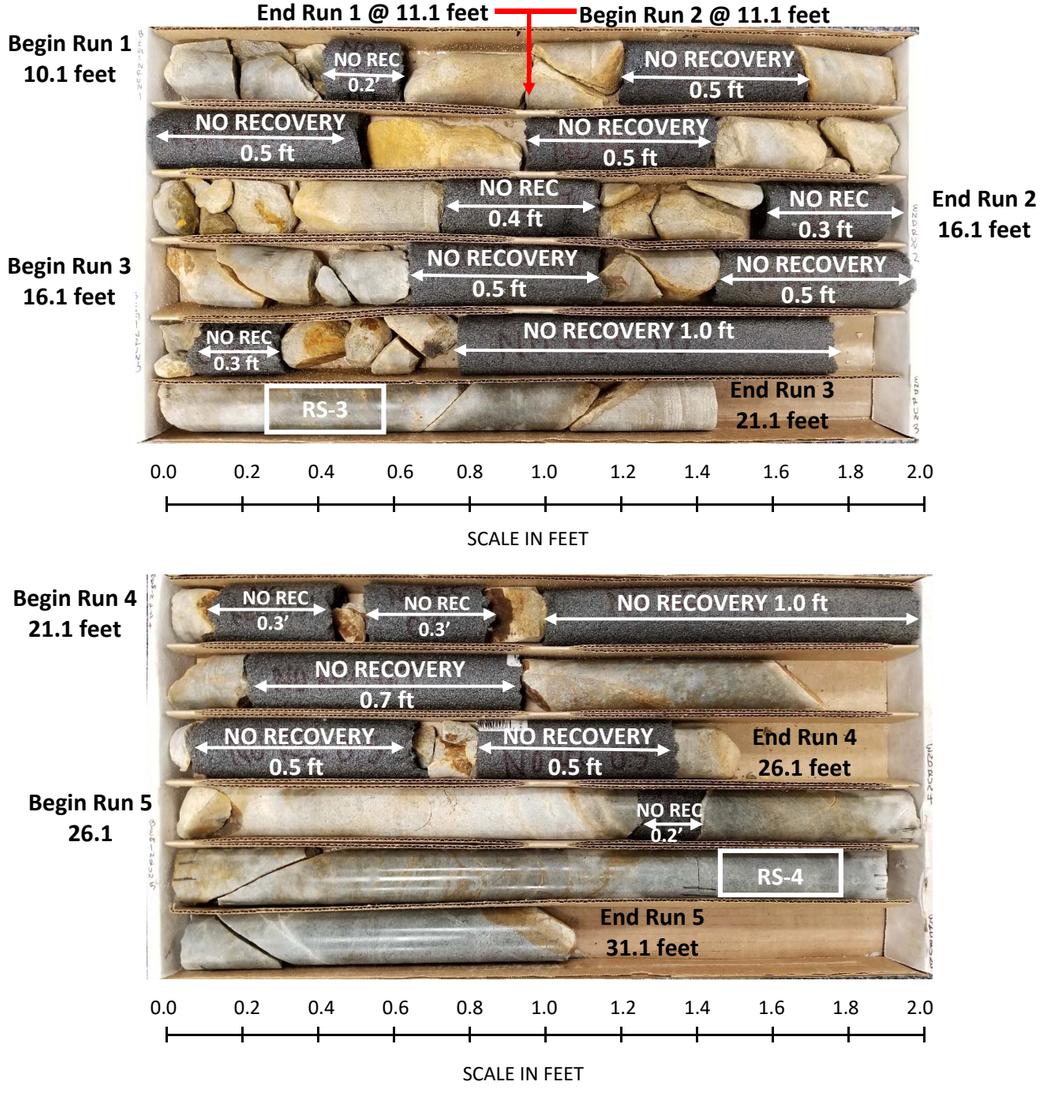
WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Arnold	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-75(B1-B)	**STATION** 27+00	**OFFSET** 30 ft RT	**ALIGNMENT** -Y7-	**0 HR.** NM
COLLAR ELEV. 193.9 ft	**TOTAL DEPTH** 41.1 ft	**NORTHING** 665,854	**EASTING** 2,189,257	**24 HR.** 8.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/25/17	**COMP. DATE** 10/25/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 31.0 ft			

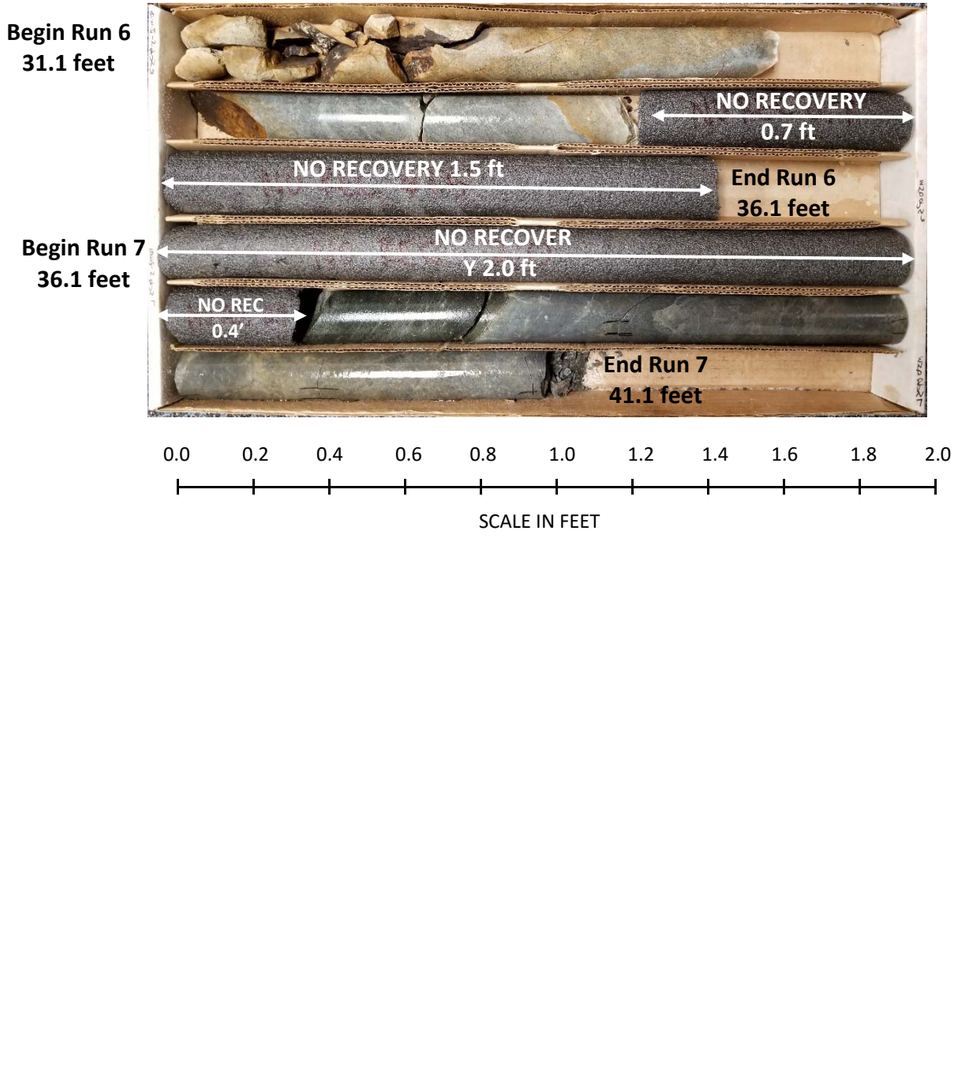
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
183.8											Begin Coring @ 10.1 ft
	183.8	10.1	1.0	2:36/1.0	(0.8)	(1.0)		(7.9)	(2.0)		183.8 Tan-Gray, Moderately Severely Weathered, Very Soft to Moderately Hard 10.1
	182.8	11.1	5.0	2:21/1.0	80%	100%		49%	13%		(BIOTITE GNEISS) with Very Close to Moderately Close Fracture Spacing
180				1:43/1.0	(2.8)	(0.3)					RS-3: 20.3'-20.6', qu=26,764 psi, GSI=25-40
				1:50/1.0	56%	6%					
	177.8	16.1		2:50/1.0							
			5.0	1:00/1.0							
175				1:40/1.0	(2.7)	(1.0)					
				0:45/1.0	54%	20%					
				0:35/1.0							
				1:49/1.0							
	172.8	21.1		4:34/1.0			RS-3				
			5.0	1:17/1.0	(1.6)	(0.7)					
170				0:30/1.0	32%	14%					
				0:58/1.0							
				2:01/1.0							
	167.8	26.1		1:12/1.0							167.8 26.1
			5.0	1:35/1.0	(4.7)	(4.0)		(7.5)	(5.0)		Tan-Gray, Moderately to Very Slightly Weathered, Medium Hard to Hard,
165				2:12/1.0	94%	80%		96%	64%		(BIOTITE GNEISS) with Very Close to Moderately Close Fracture Spacing
				2:28/1.0							RS-4: 30.1'-30.4', qu=20,382 psi, GSI=45-65
				3:00/1.0							
	162.8	31.1		2:42/1.0			RS-4				
			5.0	1:30/1.0	(2.8)	(1.0)					
160				2:29/1.0	56%	20%					
				1:46/1.0							
				1:34/1.0							
	157.8	36.1		1:33/1.0							160.0 33.9
			5.0	1:04/1.0	(2.6)	(2.5)		(0.0)	(0.0)		**WEATHERED ROCK**
155				0:58/1.0	52%	50%		0%	0%		(BIOTITE GNEISS)
				2:30/1.0							
				3:45/1.0							155.4 38.5
				3:48/1.0							**CRYSTALLINE ROCK**
								(2.6)	(2.5)		Tan-Gray, Slightly Weathered to Fresh, Moderately Hard to Hard (BIOTITE
								100%	96%		GNEISS) with Moderately Close to Wide Fracture Spacing
											GSI=45-65
	152.8	41.1									152.8 41.1
											Boring Terminated at Elevation 152.8 ft in Crystalline Rock (BIOTITE GNEISS)

Notes:
1. Surficial Organics Soil=0.0'-0.1'
2. Auger refusal at 10.0'
3. Begin coring at 10.1'

NCDOT CORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 3/21/18

CORE PHOTOGRAPHS: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907, B1-B: -Y7- Station 27+00 30'RT





GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-76(EB2-A)	**STATION** 28+00	**OFFSET** 40 ft LT	**ALIGNMENT** -Y7-	**0 HR.** 9.3
COLLAR ELEV. 193.7 ft	**TOTAL DEPTH** 23.5 ft	**NORTHING** 665,734	**EASTING** 2,189,281	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/23/17	**COMP. DATE** 10/23/17	**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)
195											
	193.7	0.0	3	4	5	9		M		193.7 GROUND SURFACE	0.0
										192.6 ASPHALT	1.1
										191.7 **ROADWAY EMBANKMENT** Brown-Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Gravel	2.0
190	190.2	3.5	6	5	4	9		M		Dark Brown, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	
										186.7	7.0
185	185.2	8.5	1	1	2	3		W		Dark Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Gravel	
										184.4	9.3
180	180.2	13.5	3	1	5	6		W		Dark Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)	
										181.7 **RESIDUAL** Tan-Dark Brown, Fine to Coarse Sandy SILT (A-4)	12.0
										176.7	17.0
175	175.2	18.5	28	55	43	98		W		Tan, Silty Fine to Coarse SAND (A-2-4)	
										173.1	20.6
										WEATHERED ROCK Brown (BIOTITE GNEISS)	
	170.3	23.4	60/0.1			60/0.1				170.3	23.4
										170.2 **CRYSTALLINE ROCK** Brown (BIOTITE GNEISS)	23.5

Boring Terminated with Standard Penetration Test Refusal at Elevation 170.2 ft in Crystalline Rock (BIOTITE GNEISS)

Notes:
1. Auger refusal at 23.4'
2. Harder drilling indicated by driller at depths of 20.6'-23.4'

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-77A(EB2-B)	**STATION** 28+00	**OFFSET** 30 ft RT	**ALIGNMENT** -Y7-	**0 HR.** 8.7
COLLAR ELEV. 192.2 ft	**TOTAL DEPTH** 22.9 ft	**NORTHING** 665,762	**EASTING** 2,189,217	**24 HR.** 8.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/03/17	**COMP. DATE** 10/03/17	**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
195										
	192.2	0.0	4	4	4	8		M		192.2 GROUND SURFACE 0.0
190	188.7	3.5	3	4	5	9		M		**ROADWAY EMBANKMENT** Brown, Fine to Coarse Sandy CLAY (A-6)
185	183.7	8.5	9	19	16	35		Sat.		185.2 Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel and Organics (Wood Fragments) 7.0
180	178.7	13.5	2	2	2	4		Sat.		
175	173.7	18.5	20	38	40	78		M		175.2 **RESIDUAL** Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel 17.0
										169.3 22.9

Boring Terminated at Elevation 169.3 ft in SAND (Residual)

Notes:
1. Boring terminated due to auger skew
2. Harder drilling indicated by driller at a depth of 22.6'

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-77B(EB2-B)	**STATION** 28+00	**OFFSET** 26 ft RT	**ALIGNMENT** -Y7-	**0 HR.** 8.0
COLLAR ELEV. 192.0 ft	**TOTAL DEPTH** 15.0 ft	**NORTHING** 665,761	**EASTING** 2,189,221	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/03/17	**COMP. DATE** 08/23/17	**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))
195										
	192.0	0.0	3	3	3	6		M		192.0 / 0.0 GROUND SURFACE
190										**ROADWAY EMBANKMENT** Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Wood Fragments)
	188.5	3.5	3	7	4	11		M		
185								▽		185.0 / 7.0 Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel
	183.5	8.5	11	54	13	67		Sat.		
180										180.0 / 12.0 **RESIDUAL** Gray, Fine Sandy SILT (A-4)
	178.5	13.5	4	5	5	10		W		177.0 / 15.0 Boring Terminated at Elevation 177.0 ft in SILT (Residual)

Notes:
1. Boring terminated due to auger skew
2. 2nd attempt at B-77

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** S. Woods	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-77C(EB2-B)	**STATION** 27+96	**OFFSET** 27 ft RT	**ALIGNMENT** -Y7-	**0 HR.** 8.6
COLLAR ELEV. 191.9 ft	**TOTAL DEPTH** 20.1 ft	**NORTHING** 665,765	**EASTING** 2,189,221	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER S. Davis	**START DATE** 10/03/17	**COMP. DATE** 10/03/17	**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))
195										
	191.9	0.0	4	4	2	6		M		191.9 / 0.0 GROUND SURFACE
190										**ROADWAY EMBANKMENT** Brown, Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)
	188.4	3.5	5	3	4	7		M		
185								▽		184.9 / 7.0 Gray, Fine to Coarse SAND (A-1-b) with Trace Gravel
	183.4	8.5	14	15	11	26		Sat.		
180										179.9 / 12.0 **RESIDUAL** Gray, Silty Fine SAND (A-2-4)
	178.4	13.5	2	3	5	8		Sat.		
175										
	173.4	18.5	2	8	91	99		Sat.		171.8 / 20.1 Boring Terminated at Elevation 171.8 ft in SAND (Residual)

Notes:
1. Auger refusal at 20.1'
2. 3rd attempt at B-77

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 50056.1.1	**TIP** W-5600	**COUNTY** JOHNSTON	**GEOLOGIST** M. Durway	
SITE DESCRIPTION Bridge on Swift Creek Road (SR 1501) over US 70 Between SR 1913 and SR 1907				**GROUND WTR (ft)**
BORING NO. B-77D(EB2-B)	**STATION** 27+86	**OFFSET** 30 ft RT	**ALIGNMENT** -Y7-	**0 HR.** 11.3
COLLAR ELEV. 192.5 ft	**TOTAL DEPTH** 30.3 ft	**NORTHING** 665,775	**EASTING** 2,189,223	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 88% 02/11/2017		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER D. Aiello	**START DATE** 10/27/17	**COMP. DATE** 10/27/17	**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)
	192.5	0.0								192.5 GROUND SURFACE	0.0
			2	4	3	7		M		**ROADWAY EMBANKMENT** Red-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	
	189.0	3.5	4	4	4	8		M		190.5 Red-Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel	2.0
	184.0	8.5	15	16	11	27		M		185.5 Gray, Silty Fine to Coarse SAND (A-2-4) with Some Gravel	7.0
	179.0	13.5	2	2	2	4		M		180.5 **RESIDUAL** Gray-Brown, Clayey SILT (A-5) with Trace Mica	12.0
	174.0	18.5	2	6	11	17		M			
	169.0	23.5	6	11	18	29		M		168.5 Orange-Tan-Brown, Fine Sandy SILT (A-4) with Trace Mica	24.0
	164.0	28.5	100/0.4			100/0.4				166.1 **WEATHERED ROCK** Red-Gray (BIOTITE GNEISS)	26.4
	162.3	30.2	60/0.1			60/0.1				162.3	30.2
										162.2 **CRYSTALLINE ROCK** Orange-Gray (BIOTITE GNEISS)	30.3

Boring Terminated with Standard Penetration Test Refusal at Elevation 162.2 ft in Crystalline Rock (BIOTITE GNEISS)

Notes:
1. Harder drilling indicated by driller at 26.4'
2. Auger refusal at 30.2'
3. 4th attempt at B-77

NCDOT BORE DOUBLE W5600_GEO_BH_BRDG&CULV.GPJ NC_DOT.GDT 3/5/18

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: W-5600
DESCRIPTION: Bridge on Swift Creek Road (SR1501) over Us 70 between SR 1913 and SR 1907

REPORT ON SAMPLES OF: SOIL FOR QUALITY

F&R PROJECT #: 66U-0197
DATE SAMPLED: 9/17 to 10/17
SAMPLED FROM: Various
SUBMITTED BY: Cheng Wang

COUNTY: Johnston
RECEIVED: 10/17 to 12/17
REPORTED: 10/17 to 12/17
BY: D. Jenks
Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	ST-6														
BORING NO.	B-73														
	EB1-B														
Retained #4 Sieve %	3.7														
Passing #10 Sieve %	3.7														
Passing #40 Sieve %	18.1														
Passing #200 Sieve %	74.4														
SOIL MORTAR - 100%															
Coarse Sand Ret - #60 %	7.6														
Fine Sand Ret - #270 %	18.4														
Silt 0.053 - 0.010 mm %	22.3														
Clay < 0.010 mm %	51.7														
L.L.	94														
P.L.	45														
P.I.	49														
AASHTO Classification	A-7-5(42)														
Station	26+00														
Offset	30'Rt														
Depth (ft)	6.0														
to	8.0														
Alignment	-Y7-														
Moisture Content (%)	42.9														
Organic Content (%)	NT														

NP = Not plastic
NT = Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, P.E.
Soils Engineer

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 50056.1.1
TIP NO.: W-5600
COUNTY: Johnston
DESCRIPTION: Bridge on Swift Creek Road (SR 1501) over US 70 between SR 1913 and SR 1907

Sample #	Boring #	Alignment	Station	Offset	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	Young's Modulus, E (ksi)	GSI
RS-1	B1-A	-Y7-	27+00	30' LT	29.4-29.7	Biotite Gneiss	CZbg	56%	4.35	1.78	164.2	13,917	1,905	50-70
RS-2	B1-A	-Y7-	27+00	30' LT	38.6-38.9	Biotite Gneiss	CZbg	86%	4.21	1.78	166.8	21,117	2,910	50-70
RS-3	B1-B	-Y7-	27+00	30' RT	20.3-20.6	Biotite Gneiss	CZbg	20%	4.36	1.78	162.5	26,764	2,726	30-50
RS-4	B1-B	-Y7-	27+00	30' RT	30.1-30.4	Biotite Gneiss	CZbg	80%	4.31	1.77	165.3	20,382	2,278	30-50