STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5318	1	16

REFERENCE: B-5318

PROJECT: 46032.1.1

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *WAKE*

PROJECT DESCRIPTION *BRIDGE NO. 126 ON -L- (LIGON MILL ROAD) OVER SMITH CREEK BETWEEN MAIN STREET AND US 401*

CONTENTS

CAUTION NOTICE

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

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SUBMITTED BY *SCHNABEL ENG.*

DATE *JULY 2021*

NORTH CAROLINA PROFESSIONAL SEAL 030395 ENGINEER JACOB C. WESSELL

DocuSigned by:

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7/28/2021

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-5318	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- 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:
- [X] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

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: BM-2, N 793495 E 2139827 -BL- STA 14+65.00
OFFSET 76' LT, R/R SPIKE IN 11" GUM
ELEVATION: 201.04 FEET

NOTES:
FIAD = FILLED IN AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B–5318	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

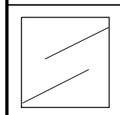
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

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

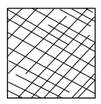
GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

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



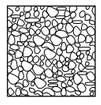
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets

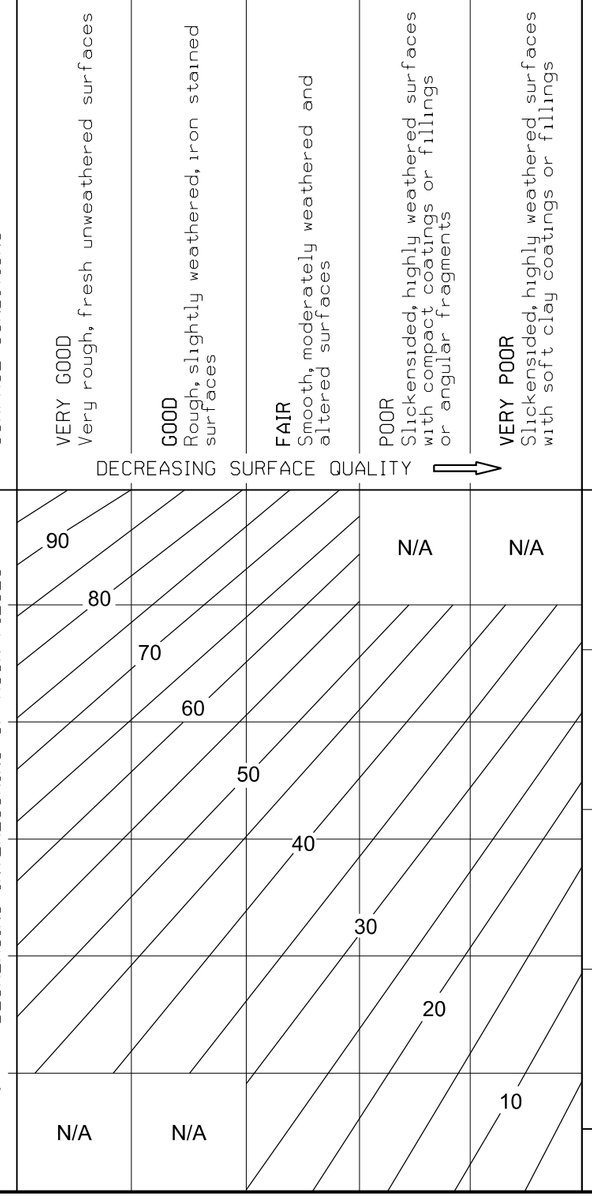
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets

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

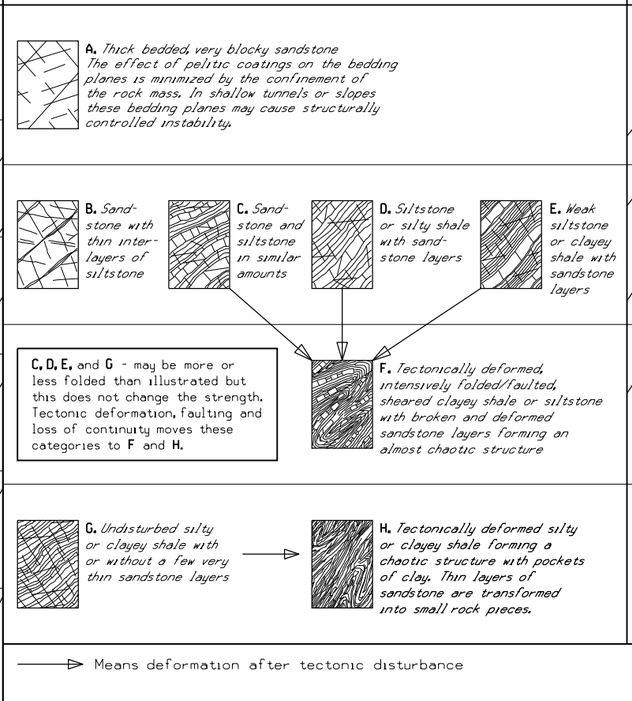


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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



DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-5318	3

SITE PLAN

0 60 120
FEET

BRIDGE #126
SKEW 90°

BEGIN CONSTRUCTION
-Y1- POC STA.12+25.00

-Y1- PT Sta.

S 55°55'48.8" W

END BRIDGE
-L- POT Sta.20+73.00+/-

-MUT1- POT Sta. 10+00.00

BEGIN BRIDGE
-L- POT Sta. 18+73.00+/-

S 59° 38' 42.0" W

CREEK

EB1-A
B1-A
B2-A
B2-A1
EB2-A

-L-
S 30° 21' 18.0" E

-MUT1-

B1-B
B2-B
EB2-B
EB1-B

-EL-

MILL ROAD - SR 2044
26' BST

TO S.MAIN ST.

BRIDGE NO.126

MTL

TO US 401

-L- POC Sta. 23+01.37 =
-Y1- POT Sta. 14+47.83

-L- PC Sta. 22+56.90

-MUT1- POT Sta. 13+35.00

SMITH

WOODS

OVERGROWN SOIL

WLB

WM

WCO

WE-1 WE-2 WE-3 WE-4 WE-5 WE-6 WE-7 WE-8 WE-9 WE-10

WG-1 WG-2 WG-3 WG-4

WH-1 WH-2 WH-3 WH-4 WH-5 WH-6 WH-7

20

10

5/14/99

0	50	100
FEET		

VE = 1:5

PROJECT REFERENCE NO.	SHEET NO.
B-5318	4

BRIDGE OVER SMITH CREEK
PROFILE ON -L-

BRIDGE #126
SKEW 90°

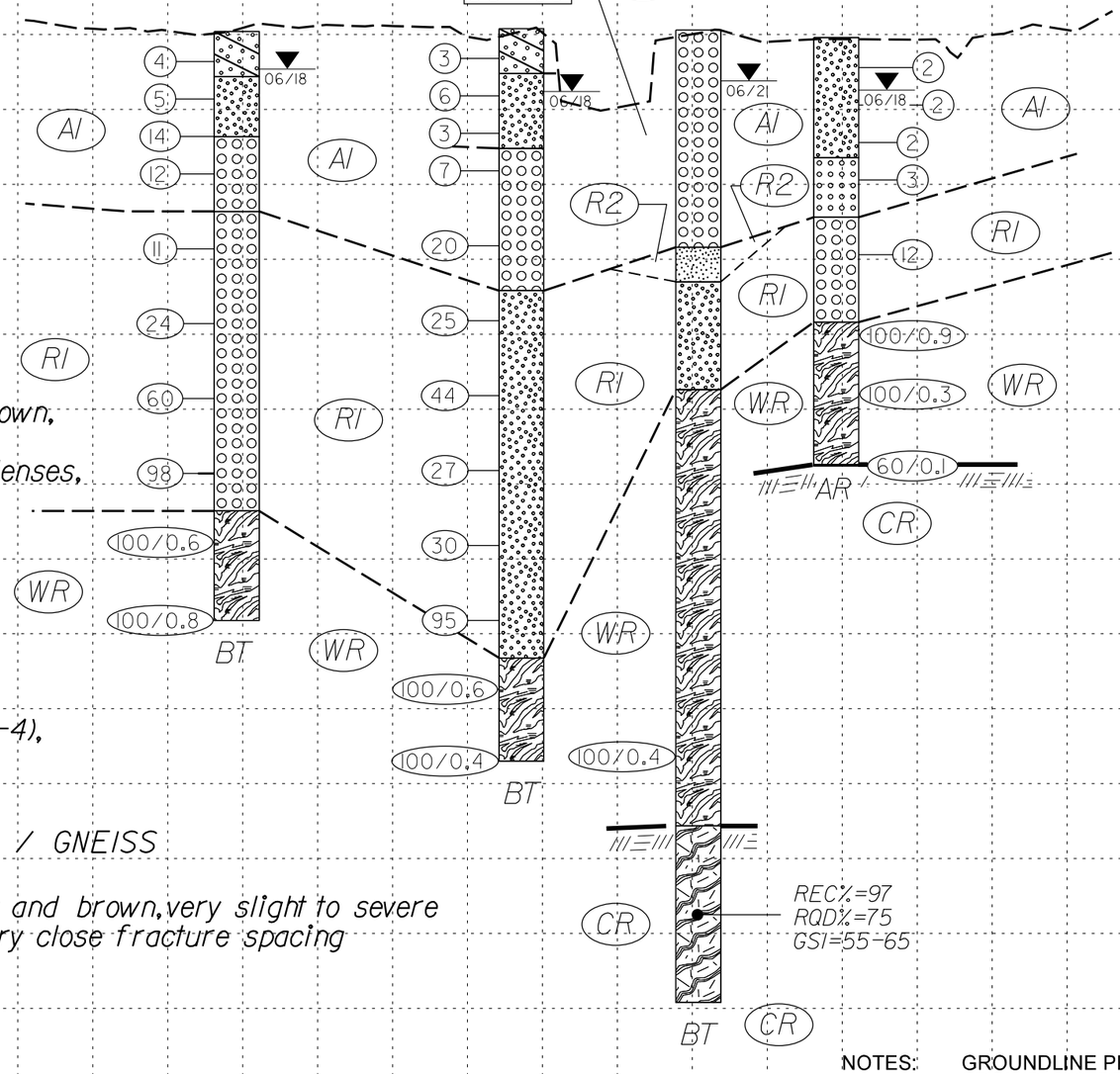
EB1-A
21' LT
SS-129

B1-A
25' LT
SS-109

B2-A1
24' LT

EB2-A
29' LT
SS-140

220 / 210 / 200 / 190 / 180 / 170 / 160 / 150 / 140 / 130



A1 ALLUVIAL: Very loose to medium dense, orange, brown, and gray, SAND and CLAYEY SAND (A-2-6, A-2-4, A-3, A-1-b), with clay lenses, micaceous, moist to saturated

R1 RESIDUAL: Medium dense to very dense, brown, orange, green, and gray, SAND (A-2-4, A-1-b), micaceous with rock fragments, moist to saturated

R2 RESIDUAL: Stiff, green and gray, sandy SILT (A-4), micaceous, saprolitic, moist to wet

WR WEATHERED ROCK: Gray and brown, GRANITE / GNEISS

CR CRYSTALLINE ROCK: GRANITE / GNEISS, gray and brown, very slight to severe weathering, soft to hard, very close fracture spacing

NOTES:

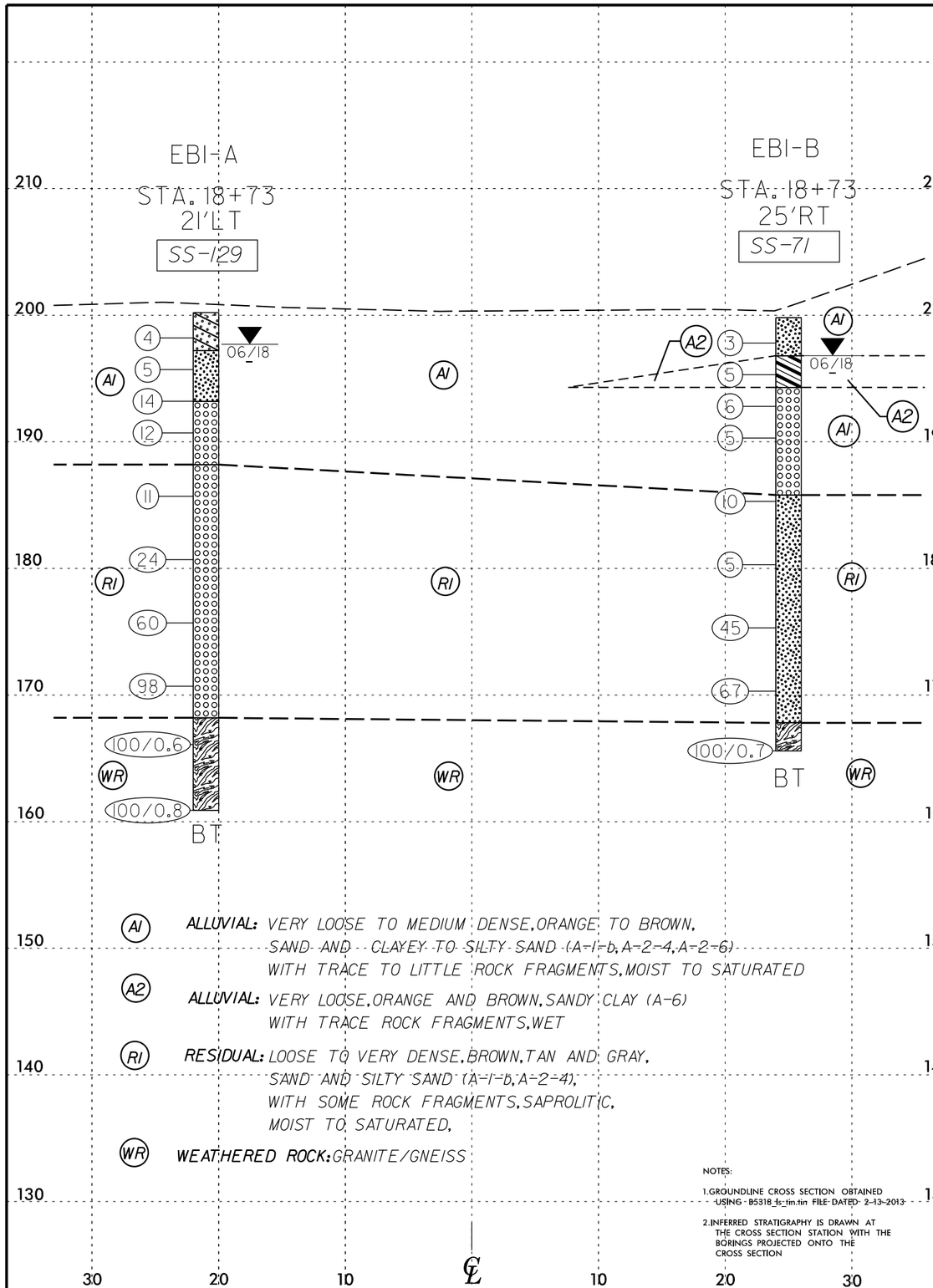
GROUNDLINE PROFILE OF -L- TAKEN FROM B5318_RDY_PFL08 DATED 8/16/18.

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

16+00 / 17+00 / 18+00 / 19+00 / 20+00 / 21+00 / 22+00

7/19/2021
B5318_GEO_BRDG_PFL04.dgn
12:43:45 PM

PROJECT REFERENCE NO.	SHEET NO.
B-5318	5



AI **ALLUVIAL:** *VERY LOOSE TO MEDIUM DENSE, ORANGE TO BROWN, SAND AND CLAYEY TO SILTY SAND (A-1-b, A-2-4, A-2-6) WITH TRACE TO LITTLE ROCK FRAGMENTS, MOIST TO SATURATED*

A2 **ALLUVIAL:** *VERY LOOSE, ORANGE AND BROWN, SANDY CLAY (A-6) WITH TRACE ROCK FRAGMENTS, WET*

RI **RESIDUAL:** *LOOSE TO VERY DENSE, BROWN, TAN AND GRAY, SAND AND SILTY SAND (A-1-b, A-2-4), WITH SOME ROCK FRAGMENTS, SAPROLITIC, MOIST TO SATURATED,*

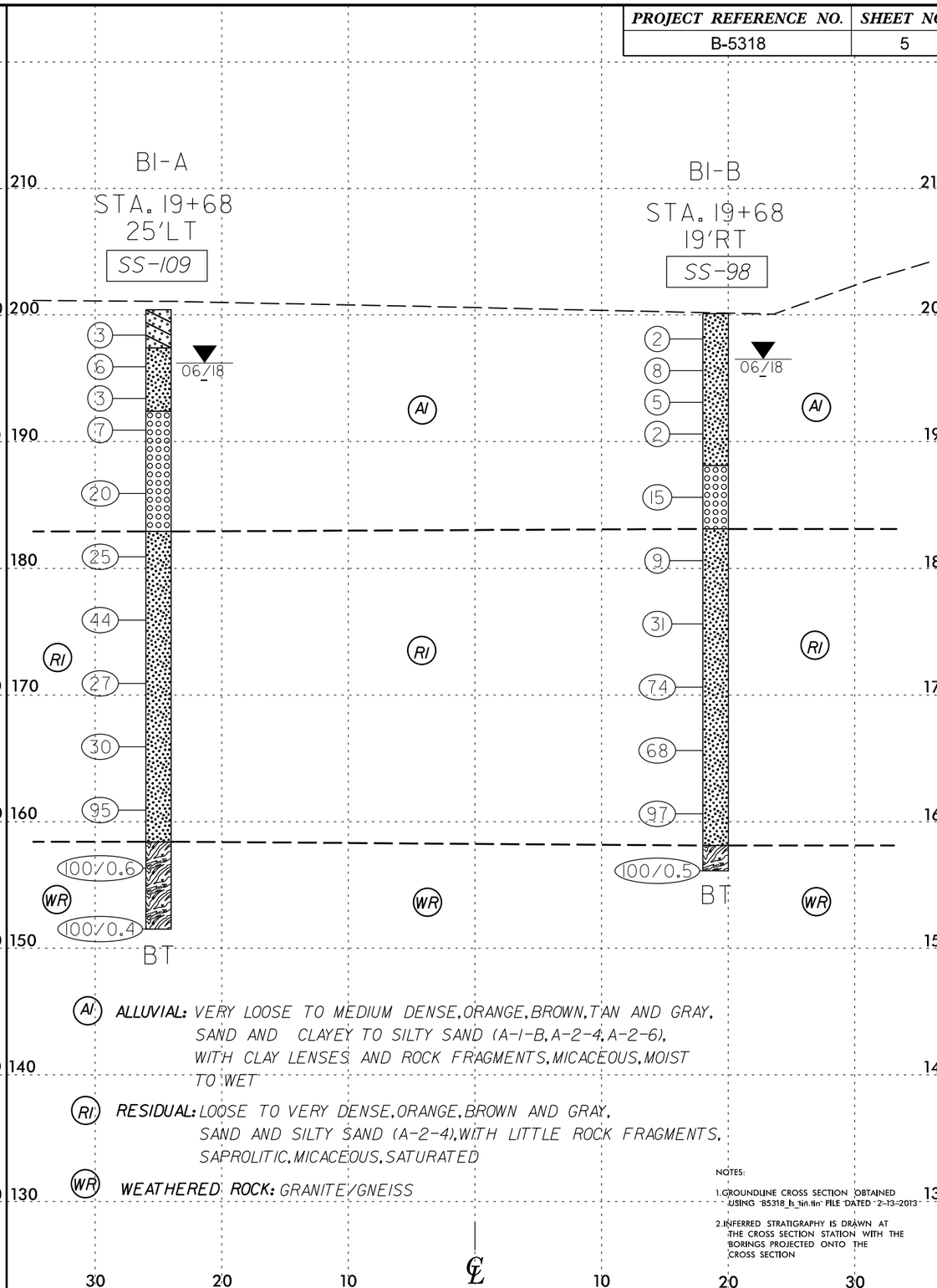
WR **WEATHERED ROCK:** *GRANITE/GNEISS*

NOTES:

1. GROUNDLINE CROSS SECTION OBTAINED USING - B5318_ls_tin.tin FILE DATED 2-13-2013
2. INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTION STATION WITH THE BORINGS PROJECTED ONTO THE CROSS SECTION

HORIZ. SCALE (FEET) 0 10 20 | VE = 1:1

END BENT 1 CROSS SECTION -L- STA. 18+73.00 - 90° SKEW



AI **ALLUVIAL:** *VERY LOOSE TO MEDIUM DENSE, ORANGE, BROWN, TAN AND GRAY, SAND AND CLAYEY TO SILTY SAND (A-1-B, A-2-4, A-2-6), WITH CLAY LENSES AND ROCK FRAGMENTS, MICACEOUS, MOIST TO WET*

RI **RESIDUAL:** *LOOSE TO VERY DENSE, ORANGE, BROWN AND GRAY, SAND AND SILTY SAND (A-2-4), WITH LITTLE ROCK FRAGMENTS, SAPROLITIC, MICACEOUS, SATURATED*

WR **WEATHERED ROCK:** *GRANITE/GNEISS*

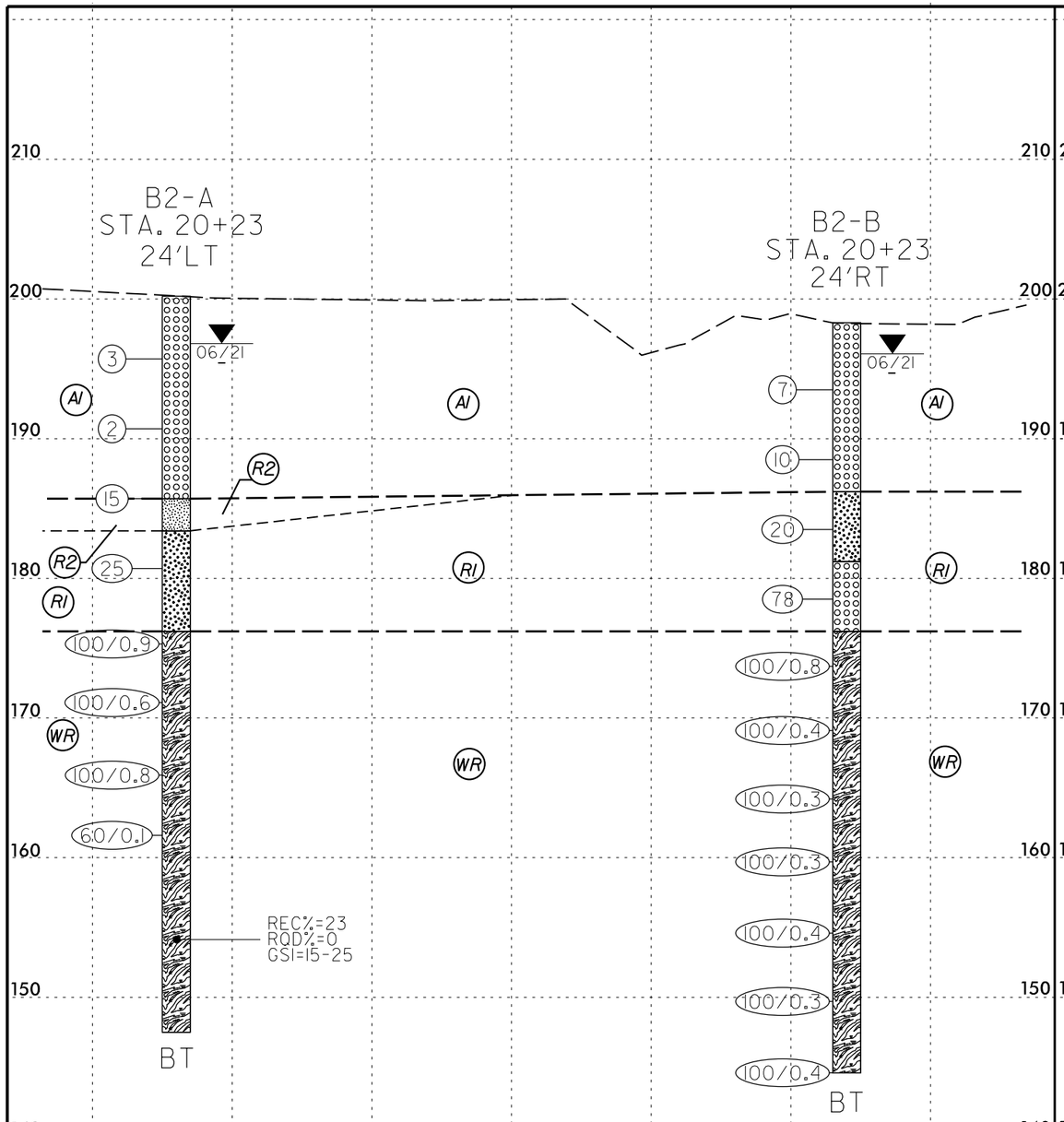
NOTES:

1. GROUNDLINE CROSS SECTION OBTAINED USING "B5318_ls_tin.tin" FILE DATED 2-13-2013
2. INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTION STATION WITH THE BORINGS PROJECTED ONTO THE CROSS SECTION

HORIZ. SCALE (FEET) 0 10 20 | VE = 1:1

BENT 1 - CROSS SECTION -L- STA. 19+68 - 90° SKEW

PROJECT REFERENCE NO.	SHEET NO.
B-5318	6



(AI) **ALLUVIAL:** *VERY LOOSE TO LOOSE, GRAY AND BROWN, SAND (A-1-b), MICACEOUS, SATURATED.*

(RI) **RESIDUAL:** *LOOSE TO VERY DENSE, DARK GREEN, GRAY AND BROWN, SAND AND SILTY SAND (A-1-B, A-2-4), WITH LITTLE TO SOME ROCK FRAGMENTS, SAPROLITIC, MICACEOUS, MOIST TO SATURATED*

(R2) **RESIDUAL:** *MEDIUM DENSE, GREEN-GRAY, SANDY SILT (A-4), SAPROLITIC, MICACEOUS, SATURATED.*

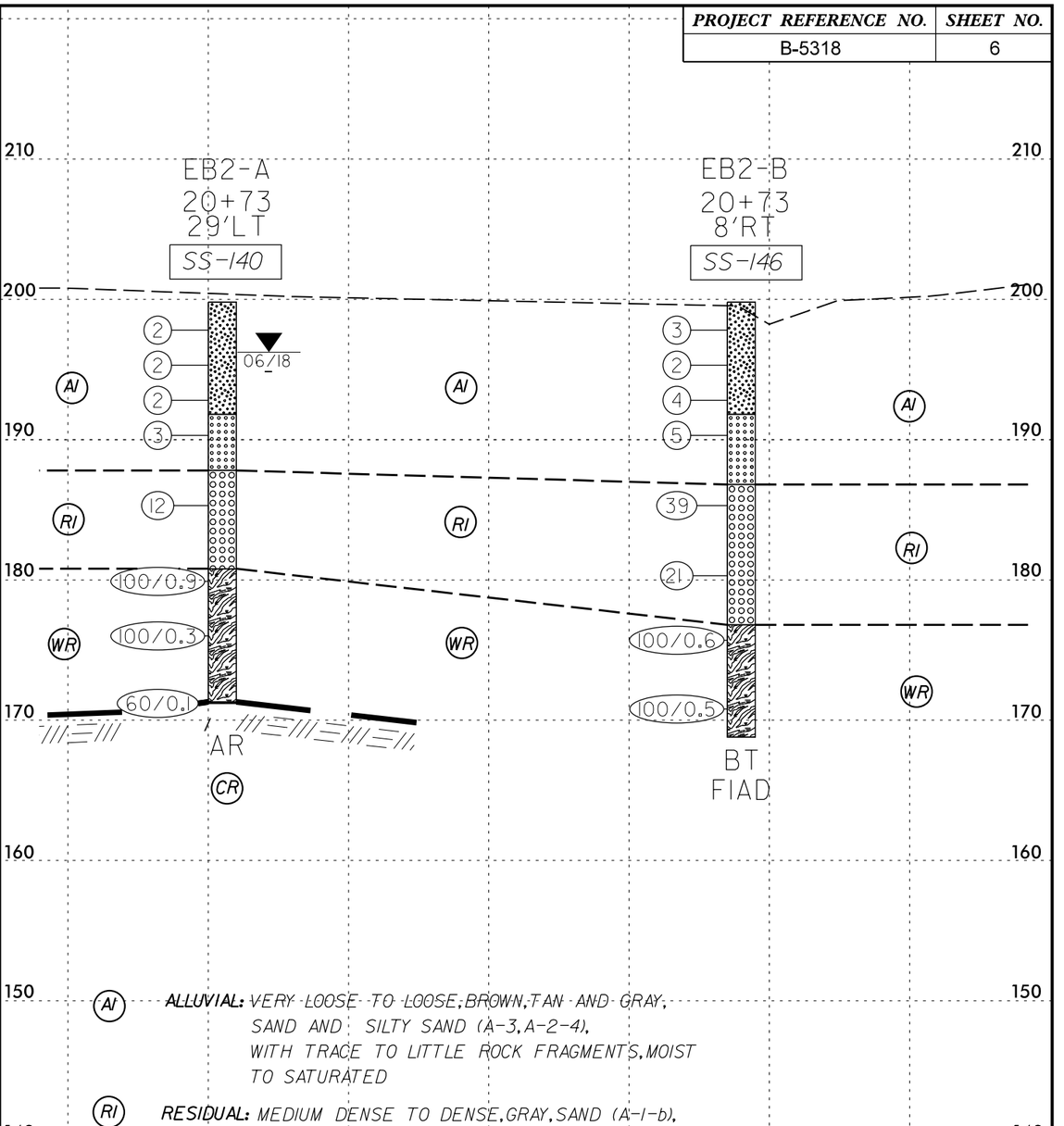
(WR) **WEATHERED ROCK:** *GRANITE/GNEISS*

NOTES:

1. GROUNDLINE CROSS SECTION OBTAINED USING B5318_ls_tin.tin FILE DATED 2-13-2013
2. INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTION STATION WITH THE BORINGS PROJECTED ONTO THE CROSS SECTION

HORIZ. SCALE (FEET) 0 10 20 | VE = 1:1

BENT 2 - CROSS SECTION -L- STA. 20+23 - 90° SKEW



(AI) **ALLUVIAL:** *VERY LOOSE TO LOOSE, BROWN, TAN AND GRAY, SAND AND SILTY SAND (A-3, A-2-4), WITH TRACE TO LITTLE ROCK FRAGMENTS, MOIST TO SATURATED*

(RI) **RESIDUAL:** *MEDIUM DENSE TO DENSE, GRAY, SAND (A-1-b), WITH SOME ROCK FRAGMENTS, SLIGHTLY MICACEOUS, WET*

(WR) **WEATHERED ROCK:** *GRANITE/GNEISS*

(CR) **CRYSTALLINE ROCK:** *BLACK, GRAY AND ORANGE, GRANITE/GNEISS*

NOTES:

1. GROUNDLINE CROSS SECTION OBTAINED USING B5318_ls_tin.tin FILE DATED 2-13-2013
2. INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTION STATION WITH THE BORINGS PROJECTED ONTO THE CROSS SECTION

HORIZ. SCALE (FEET) 0 10 20 | VE = 1:1

END BENT 2 CROSS SECTION -L- STA. 20+73.00 - 90° SKEW

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 18+73	**OFFSET** 21 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.2 ft	**TOTAL DEPTH** 39.3 ft	**NORTHING** 793,549	**EASTING** 2,139,823	**24 HR.** 2.5
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/14/18	**COMP. DATE** 06/14/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
205										
200	199.2	1.0	1	2	2	4 5				200.2 GROUND SURFACE 0.0
	196.7	3.5								**ALLUVIAL** Loose, orange and brown, clayey fine to medium SAND (A-2-6) 197.2 / 3.0
195	194.2	6.0	2	2	3			Sat.		Loose to medium dense, brown, slightly micaceous, silty fine to medium SAND (A-2-4)
	191.7	8.5	5	7	7	14	SS-129	24%		193.2 / 7.0
190			5	6	6	12		Sat.		Medium dense, brown, fine to coarse SAND (A-1-b) with little rock fragments
	186.7	13.5	9	7	4	11				188.2 / 12.0
185	181.7	18.5						Sat.		**RESIDUAL** Medium dense to very dense, tan and brown, saprolitic, silty fine to coarse SAND (A-1-b) with some rock fragments
180			16	14	10	24				
	176.7	23.5	7	23	37	60		Sat.		
175	171.7	28.5	21	33	65	98		Sat.		
170	166.7	33.5	46	54/0.1		100/0.6				168.2 / 32.0 **WEATHERED ROCK** (Granite/Gneiss)
165	161.7	38.5	25	75/0.3		100/0.8				160.9 / 39.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 160.9 ft In Weathered Rock (Granite/Gneiss)

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 18+73	**OFFSET** 25 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 199.8 ft	**TOTAL DEPTH** 34.2 ft	**NORTHING** 793,525	**EASTING** 2,139,784	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/12/18	**COMP. DATE** 06/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
200										
	198.8	1.0	2	1	2	3				199.8 GROUND SURFACE 0.0
195	196.3	3.5	1	2	3	5	SS-71	29%		**ALLUVIAL** Very loose, brown, silty fine to medium SAND (A-2-4) 196.8 / 3.0
	193.8	6.0	2	3	3	6		Sat.		Medium stiff, orange and brown, sandy CLAY (A-6) with trace rock fragments 194.3 / 5.5
190	191.3	8.5	2	3	2	5		Sat.		Medium dense, tan, fine to coarse SAND (A-1-b) with trace rock fragments
	186.3	13.5	2	5	5	10				185.8 / 14.0
185	181.3	18.5								**RESIDUAL** Loose to very dense, brown to gray, saprolitic, micaceous, silty fine to coarse SAND (A-2-4) with some rock fragments
180	176.3	23.5	3	2	3	5		Sat.		
175	171.3	28.5	17	21	24	45		Sat.		
170	166.3	33.5	24	31	36	67		Sat.		167.8 / 32.0 **WEATHERED ROCK** (Granite/Gneiss) 165.6 / 34.2
			70	30/0.2		100/0.7				Boring Terminated with Standard Penetration Test Refusal at Elevation 165.6 ft In Weathered Rock (Granite/Gneiss)

Contact observed in split spoon at a depth of 14.0 feet.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 19+68	**OFFSET** 25 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.4 ft	**TOTAL DEPTH** 48.9 ft	**NORTHING** 793,469	**EASTING** 2,139,875	**24 HR.** 4.2
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/14/18	**COMP. DATE** 06/14/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
205											
200	199.4	1.0	2	2	1	3 6		M		200.4 GROUND SURFACE	0.0
	196.9	3.5								**ALLUVIAL** Very loose, orange, clayey fine to medium SAND (A-2-6)	
195	194.4	6.0	2	2	4					197.4	3.0
	191.9	8.5	1	1	2	3 7		Sat.		Loose to very loose, orange and gray, slightly micaceous, silty fine to medium SAND (A-2-4)	
190			1	4	3			Sat.		192.4	8.0
	186.9	13.5	11	11	9	20				Loose to medium dense, tan to gray, fine to coarse SAND (A-1-b) with rock fragments	
185	181.9	18.5	11	13	12	25		Sat.		182.9	17.5
180	176.9	23.5	9	17	27	44	SS-109	18% Sat.		**RESIDUAL** Medium dense to very dense, orange and brown, saprolitic, micaceous, silty fine to coasre SAND (A-2-4) with little rock fragments	
175	171.9	28.5	12	12	15	27		Sat.			
170	166.9	33.5	9	13	17	30		Sat.			
165	161.9	38.5	15	20	75	95		Sat.			
160	156.9	43.5	71	29/0.1		100/0.6				158.4	42.0
155	151.9	48.5	100/0.4			100/0.4				**WEATHERED ROCK** (Granite/Gneiss)	
										151.5	48.9
										Boring Terminated with Standard Penetration Test Refusal at Elevation 151.5 ft In Weathered Rock (Granite/Gneiss)	

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 19+68	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.1 ft	**TOTAL DEPTH** 44.0 ft	**NORTHING** 793,446	**EASTING** 2,139,837	**24 HR.** 3.6
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/13/18	**COMP. DATE** 06/13/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
205											
200	199.1	1.0	2	1	1	2 8		M		200.1 GROUND SURFACE	0.0
	196.6	3.5	WOH	3	5					**ALLUVIAL** Very loose to loose, brown, orange and gray, silty fine to medium SAND (A-2-4) with clay lenses	
195	194.1	6.0	3	2	3	5		Sat.			
	191.6	8.5	1	1	1	2		Sat.		188.1	12.0
190	186.6	13.5	3	5	10	15		Sat.		Medium dense, gray, fine to medium SAND (A-1-b) with rock fragments	
185	181.6	18.5	6	4	5	9		Sat.		183.1	17.0
180	176.6	23.5	14	16	15	31	SS-98	19% Sat.		**RESIDUAL** Loose to very dense, brown, orange and gray, saprolitic, micaceous, silty fine to coarse SAND (A-2-4) with little rock fragments	
175	171.6	28.5	5	18	56	74		Sat.			
170	166.6	33.5	25	37	31	68		Sat.			
165	161.6	38.5	20	40	57	97		Sat.			
160	156.6	43.5	100/0.5			100/0.5				158.1	42.0
										WEATHERED ROCK (Granite/Gneiss)	
										156.1	44.0
										Boring Terminated with Standard Penetration Test Refusal at Elevation 156.1 ft In Weathered Rock (Granite/Gneiss)	
										Split spoon sample at 13.5 feet resulted in no recovery.	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Moore, N. O.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 20+23	**OFFSET** 24 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.2 ft	**TOTAL DEPTH** 52.7 ft	**NORTHING** 793,420	**EASTING** 2,139,901	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 10/12/2020		**DRILL METHOD** NW Casing w/ Core	**HAMMER TYPE** Automatic	
DRILLER Walker, C. M.	**START DATE** 05/26/21	**COMP. DATE** 05/27/21	**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										200.2 GROUND SURFACE	0.0
	196.7	3.5	2	2	1	3		Sat.		**ALLUVIAL** Very loose to medium dense, gray and brown, micaceous, coarse SAND (A-1-b) , with trace silt	
195											
	191.7	8.5	1	1	1	2		Sat.			
190											
	186.7	13.5	2	5	10	15		Sat.		185.7	14.5
185										**RESIDUAL**	
	181.7	18.5	6	12	13	25		M		183.4 Stiff, green and gray, saprolitic, micaceous, sandy SILT (A-4) 16.8	
180										Medium dense, green and gray, saprolitic, micaceous, silty SAND (A-2-4)	
	176.7	23.5	10	28	72/0.4	100/0.9				176.2	24.0
175										**WEATHERED ROCK** Granite/Gneiss, gray-brown, very slight to severe weathering, soft to hard, very close fracture spacing	
	171.7	28.5	82	18/0.1		100/0.6				REC=23% (3.2') RQD=0% (0.0') GSI = 15-25	
170											
	166.7	33.5	38	62/0.3		100/0.8					
165											
	161.7	38.5	60/0.1			60/0.1					
160											
155											
150										147.5	52.7
										Boring Terminated due to core bit breaking off at Elevation 147.5 ft In Weathered Rock (Granite/Gneiss)	
										Hard drilling encountered at 20.5 feet.	

NCDOT BORE DOUBLE B5318_GEO_BORINGS.GPJ NC_DOT.GDT 6/22/21

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Moore, N. O.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 20+23	**OFFSET** 24 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.2 ft	**TOTAL DEPTH** 52.7 ft	**NORTHING** 793,420	**EASTING** 2,139,901	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 10/12/2020		**DRILL METHOD** NW Casing w/ Core	**HAMMER TYPE** Automatic	
DRILLER Walker, C. M.	**START DATE** 05/26/21	**COMP. DATE** 05/27/21	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 14.1 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)
161.6											Begin Coring @ 38.6 ft	
160	161.6	38.6	2.6	00:26/0.6 00:43/1.0 00:51/1.0	(0.1) 4%	(0.0) 0%		(3.2) 23%	(0.0) 0%		**WEATHERED ROCK***(continued)* Granite/Gneiss, gray-brown, very slight to severe weathering, soft to hard, very close fracture spacing	
	159.0	41.2	5.0	01:11/1.0 01:02/1.0 00:47/1.0 00:36/1.0 01:17/1.0	(0.0) 0%	(0.0) 0%					GSI = 15-25	
155	154.0	46.2	5.0	00:57/1.0 01:08/1.0 01:32/1.0 01:30/1.0 01:26/1.0	(3.1) 62%	(0.0) 0%						
150	149.0	51.2										
	147.5	52.7	1.5	03:19/1.0 03:19/0.5	(0.0) 0%	(0.0) 0%					147.5	52.7
											Boring Terminated due to core bit breaking off at Elevation 147.5 ft In Weathered Rock (Granite/Gneiss)	
											Hard drilling encountered at 20.5 feet.	

NCDOT CORE SINGLE B5318_GEO_BORINGS.GPJ NC_DOT.GDT 6/22/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Moore, N. O.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B2-A1	**STATION** 20+27	**OFFSET** 24 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.3 ft	**TOTAL DEPTH** 64.9 ft	**NORTHING** 793,417	**EASTING** 2,139,903	**24 HR.** 3.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 10/12/2020		**DRILL METHOD** NW Casing w/ Core	**HAMMER TYPE** Automatic	
DRILLER Walker, C. M.	**START DATE** 05/27/21	**COMP. DATE** 06/01/21	**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)
200.3										GROUND SURFACE	0.0
										SEE B2-A FOR SOIL DESCRIPTIONS	
179.1										**WEATHERED ROCK** (Granite/Gneiss)	21.2
152.2		48.1	100/0.4			100/0.4	RS-1			**CRYSTALLINE ROCK** Granite/Gneiss, black, gray and orange, slight weathering, moderately hard to hard, moderate to close fracture spacing REC=97% (11.4') RQD=75% (8.9') GSI = 55-65	53.1
							RS-2				
135.4		64.9								Boring Terminated at Elevation 135.4 ft In Crystalline Rock (Granite/Gneiss) Hard drilling encountered at 21.2 feet.	64.9

NCDOT BORE DOUBLE B5318_GEO_BORINGS.GPJ NC_DOT.GDT 6/22/21

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Moore, N. O.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B2-A1	**STATION** 20+27	**OFFSET** 24 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 200.3 ft	**TOTAL DEPTH** 64.9 ft	**NORTHING** 793,417	**EASTING** 2,139,903	**24 HR.** 3.4
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 10/12/2020		**DRILL METHOD** NW Casing w/ Core	**HAMMER TYPE** Automatic	
DRILLER Walker, C. M.	**START DATE** 05/27/21	**COMP. DATE** 06/01/21	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 11.8 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
147.2											Begin Coring @ 53.1 ft	
	147.2	53.1	2.6	00:50/0.6 01:50/1.0 02:29/1.0	(2.6) 100%	(2.6) 100%	RS-1	(11.4) 97%	(8.9) 75%		147.2 **CRYSTALLINE ROCK** Granite/Gneiss, black, gray and orange, slight weathering, moderately hard to hard, moderate to close fracture spacing	53.1
145	144.6	55.7	4.2	01:59/1.0 02:04/1.0 01:29/1.0 01:15/1.0	(4.2) 100%	(2.8) 67%	RS-2				RS-1: 53.1'-54.1' RS-2: 57.7-58.1' GSI = 55-65 Qu =	
140	140.4	59.9	5.0	01:40/0.2 01:04/1.0 01:25/1.0 01:30/1.0 00:55/1.0	(4.6) 92%	(3.5) 70%						
	135.4	64.9		01:29/1.0							135.4 Boring Terminated at Elevation 135.4 ft In Crystalline Rock (Granite/Gneiss)	64.9
											Hard drilling encountered at 21.2 feet.	

NCDOT CORE SINGLE B5318_GEO_BORINGS.GPJ NC_DOT.GDT 6/22/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Moore, N. O.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 20+23	**OFFSET** 24 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 198.3 ft	**TOTAL DEPTH** 53.7 ft	**NORTHING** 793,396	**EASTING** 2,139,860	**24 HR.** 2.2
DRILL RIG/HAMMER EFF./DATE RFO0074 CME-55 92% 10/12/2020		**DRILL METHOD** NW Casing w/ Core	**HAMMER TYPE** Automatic	
DRILLER Walker, C. M.	**START DATE** 06/02/21	**COMP. DATE** 06/02/21	**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										
	198.3	0.0								GROUND SURFACE
										ALLUVIAL Loose, light gray, coarse SAND (A-1-b)
195	194.5	3.8	3	3	4	7		Sat.		
190	189.5	8.8	1	5	5	10		Sat.		
	186.2	12.1								**RESIDUAL** Medium dense, dark green and gray, saprolitic, micaceous, silty SAND (A-2-4)
185	184.5	13.8	7	8	12	20		M		
	181.2	17.1								Very dense, dark green, gray and brown, saprolitic, micaceous, coarse SAND (A-1-b)
180	179.5	18.8	20	35	43	78		M		
	176.2	22.1								**WEATHERED ROCK** (Granite/Gneiss)
175	174.5	23.8	48	52/0.3		100/0.8				
170	169.5	28.8	100/0.4			100/0.4				
165	164.5	33.8	100/0.3			100/0.3				
160	160.0	38.3	100/0.3			100/0.3				
155	155.0	43.3	100/0.4			100/0.4				
150	150.0	48.3	100/0.3			100/0.3				
145	145.0	53.3	100/0.4			100/0.4				
	144.6	53.7								Boring Terminated with Standard Penetration Test Refusal at Elevation 144.6 ft In Weathered Rock (Granite/Gneiss)

WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 20+73	**OFFSET** 29 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 199.8 ft	**TOTAL DEPTH** 28.6 ft	**NORTHING** 793,380	**EASTING** 2,139,931	**24 HR.** 3.5
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/14/18	**COMP. DATE** 06/14/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
200										
	199.8	0.0								GROUND SURFACE
	198.8	1.0	2	1	1	2		M		**ALLUVIAL** Very loose, brown, silty fine to medium SAND (A-2-4)
195	196.3	3.5	2	1	1	2		Sat.		
	193.8	6.0	1	1	1	2				
190	191.3	8.5	1	1	2	3	SS-140	35%		Very loose, brown, fine to coarse SAND (A-3) with little silt and trace rock fragments
	186.3	13.5	6	7	5	12		Sat.		**RESIDUAL** Medium dense, gray, fine to coarse SAND (A-1-b) with some rock fragments
185										
180	181.3	18.5	18	38	62/0.4	100/0.9				**WEATHERED ROCK** (Granite/Gneiss)
175	176.3	23.5	100/0.3			100/0.3				
	171.3	28.5	60/0.1			60/0.1				
	171.2	28.6								**CRYSTALLINE ROCK** (Granite/Gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 171.2 ft In Crystalline Rock (Granite/Gneiss)

GEOTECHNICAL BORING REPORT
BORE LOG

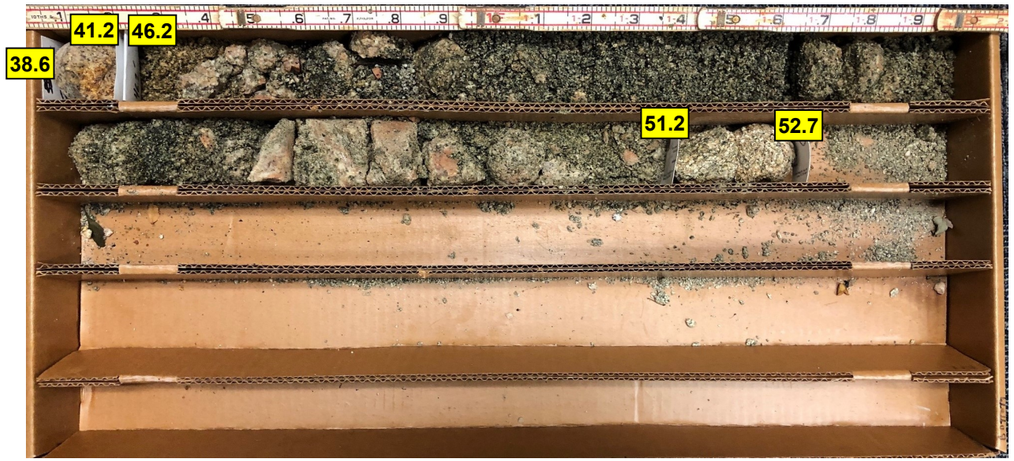
WBS 46032.1.1	**TIP** B-5318	**COUNTY** WAKE	**GEOLOGIST** Wescott, F.	
SITE DESCRIPTION Bridge No. 126 on -L- (Ligon Mill Road) Over Smith Creek Between Main Street and US 401				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 20+73	**OFFSET** 8 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 199.8 ft	**TOTAL DEPTH** 31.0 ft	**NORTHING** 793,361	**EASTING** 2,139,899	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE BRI8284 CME-45C 91% 2/26/2018		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Eister, G	**START DATE** 06/15/18	**COMP. DATE** 06/15/18	**SURFACE WATER DEPTH** N/A	

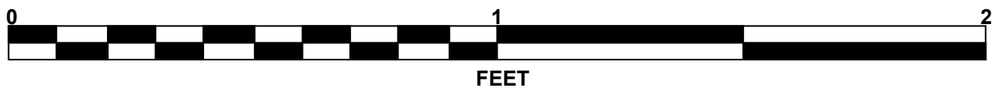
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
200										199.8 GROUND SURFACE 0.0
	198.8	1.0	2	1	2	3		M		**ALLUVIAL** Very loose to loose, brown, tan and gray, silty fine to medium SAND (A-2-4) with trace clay, with little rock fragments
	196.3	3.5	2	1	1	2	SS-146	29%		
195	193.8	6.0	1	2	2	4		Sat.		
	191.3	8.5								191.8 8.0
			2	3	2	5		Sat.		Loose, gray, fine to coarse SAND (A-3)
190	186.3	13.5								186.8 13.0
			12	21	18	39		Sat.		**RESIDUAL** Dense to medium dense, gray, slightly micaceous, fine to coarse SAND (A-1-b) with some rock fragments
185	181.3	18.5								
			10	9	12	21		Sat.		
180	176.3	23.5								176.8 23.0
			79	21/0.1		100/0.6				**WEATHERED ROCK** (Granite/Gneiss)
175										
	171.3	28.5	100/0.5			100/0.5				
170										168.8 31.0
										Boring Terminated with Standard Penetration Test Tricone Refusal at Elevation 168.8 ft On Weathered Rock (Granite/Gneiss)

CORE PHOTOGRAPHS

B2-A

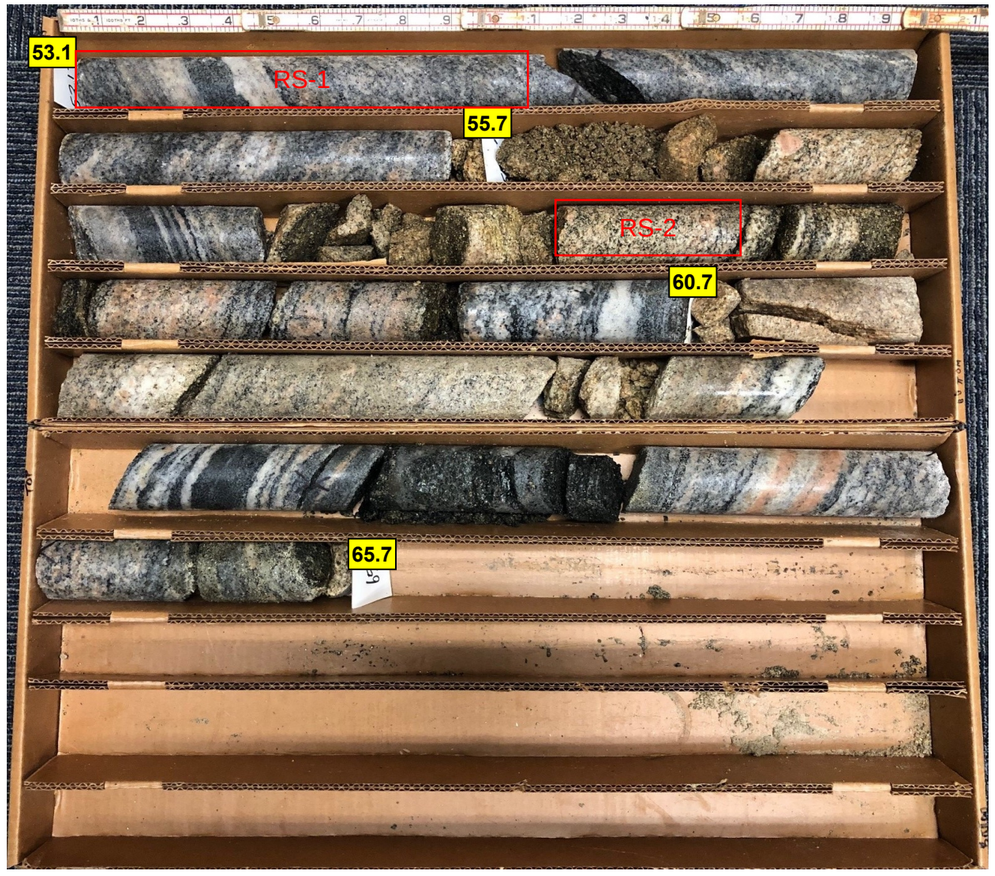
BOX 1: 38.6 - 52.7 FEET

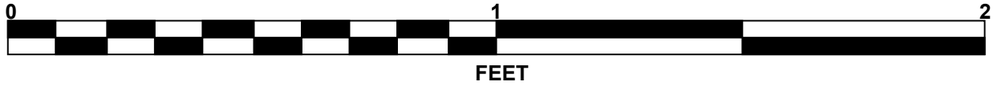




B2-A1

BOXES 1 & 2: 53.1 - 65.7 FEET





PROJECT REFERENCE NO.	SHEET NO.
B–5318	14

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-129	21' LT	18+73	6.0-7.5	A-1-b	-	NP	82.9	8.5	3.1	5.5	86	28	10	23.8	-
SS-71	25' RT	18+73	3.5-5.0	A-6(6)	37	16	9.5	42.4	21.0	27.1	99	96	54	28.4	-
SS-109	25' LT	19+68	23.5-25.0	A-2-4	-	NP	56.5	25.8	11.2	6.5	85	60	21	18.3	-
SS-98	19' RT	19+68	23.5-25.0	A-2-4	-	NP	49.5	29.7	14.5	6.3	89	65	25	19.0	-
SS-140	29' LT	20+73	8.5-10.0	A-3	-	NP	57.4	36.4	3.4	2.8	97	68	8	34.9	-
SS-146	8' RT	20+73	3.5-5.0	A-2-4	-	NP	48.8	28.8	9.6	12.7	98	64	25	29.0	-

DATE: 9-15-14

Schnabel Engineering South, P.C.
244 Princess Street, Suite 205 / Wilmington, NC 28401
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PROJECT NO.: 43032.1.1
PROJECT ID: B-5318
REPORT ON SAMPLES OF: ROCK QUALITY
PROJECT DESCRIPTION: BRIDGE NO. 126 ON SR 2044 (LIGON MILL ROAD) OVER SMITH CREEK

DATE SAMPLED: 6/8/2021
COUNTY: WAKE
SUBMITTED BY: N.O. MOORE

BORING NO.	SAMPLE NO.	DEPTH (FT)	ROCK TYPE	GEOLOGIC MAP UNIT	LENGTH (IN)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	YOUNG'S MODULUS (PSI)	SPLITTING TENSILE STRENGTH (PSI)	REMARKS
B2-A1	RS-1	53.1-54.2	Injected Gneiss	CZig	13	1.86	164.2	29,700	-	-	-
B2-A1	RS-2	57.8-58.2	Injected Gneiss	CZig	5	1.86	154.2	6,430	-	-	-

SITE PHOTOGRAPHS
BRIDGE NO. 126 OVER SMITH CREEK ON SR 2044

View of SR 2044 looking south.

View of Smith Creek looking west.