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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4571	1	18

REFERENCE: B-4571

PROJECT: 38414

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY LINCOLN

SITE DESCRIPTION BRIDGE NO. 7 ON NC 182 OVER INDIAN CREEK AT -L- STATION 17+40

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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DATE DECEMBER 2018

NORTH CAROLINA LICENSED SEAL 2029 GEOLOGIST KEVIN BENNETT MILLER

Docusigned by:
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12/17/2018

SIGNATURE DATE

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PROJECT REFERENCE NO.	SHEET NO.
B-4571	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/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	< 4	
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	N/A
	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 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
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-550X
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [ ] -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= RR SPIKE IN 24" OAK -L- STA. 19+10, 85' LT
NORTHING: 624339, EASTING: 1291651
ELEVATION: 817.74 FEET

NOTES:

FIAD= FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B–4571	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

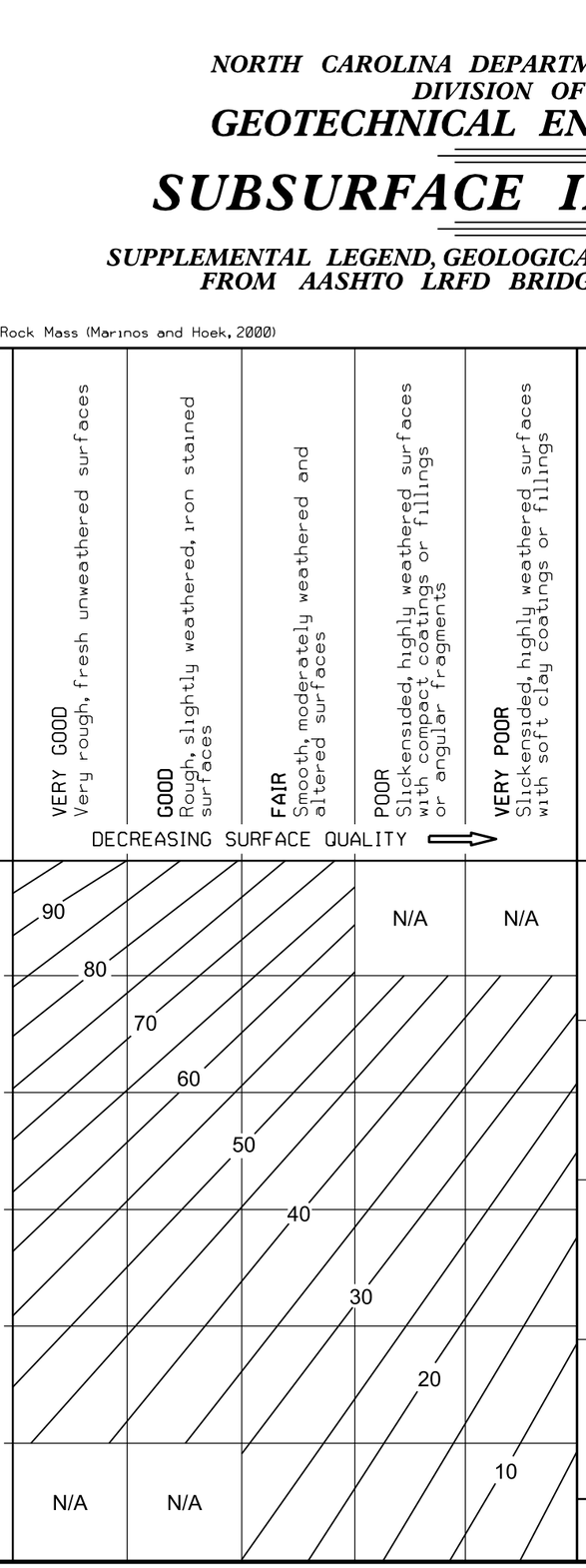
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

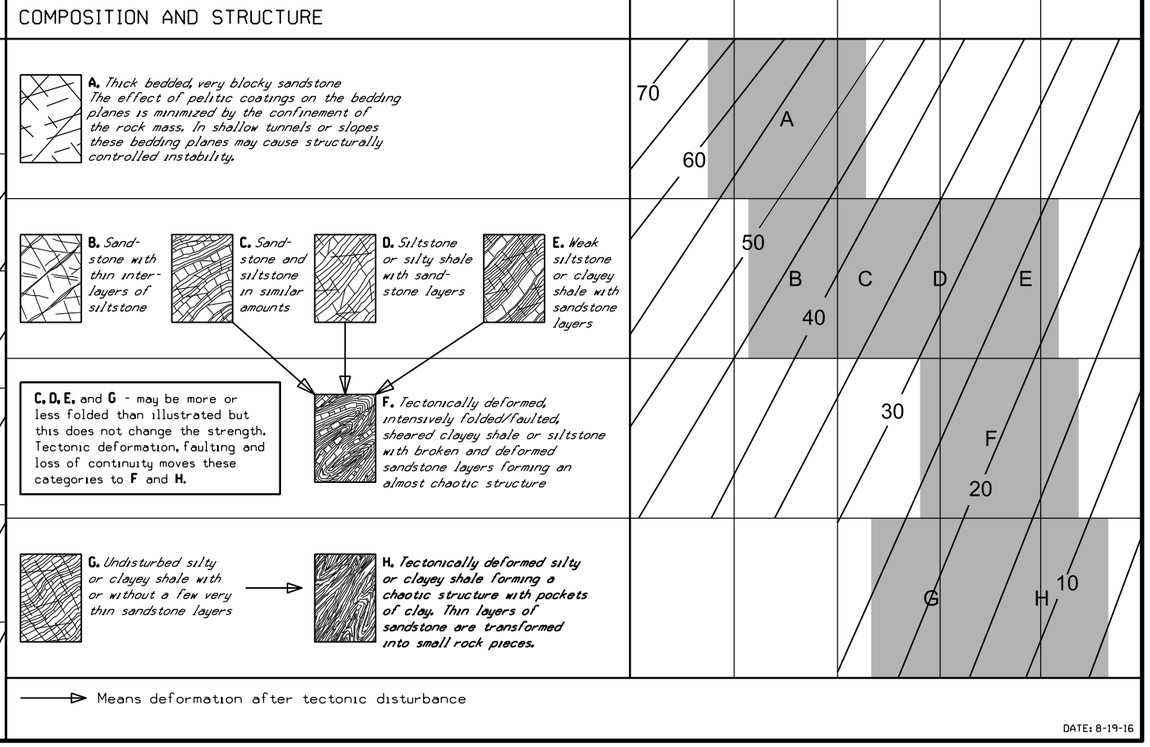


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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.
B-4571	3

SITE PLAN

0 60 120

FEET

SKEW = 60°

NAD 83/CORS96 NC GRID

WOODS

15

20

Begin Bridge
-L- Sta.16+40.00

End Bridge
-L- Sta.18+40.00

SECONDARY GROWTH

PASTURE

BM-2

45°NW W/ ISBW

B1–A

B2–A

CONC

2

3

4

8:1

To SR 1667
Leohardt Rd.

-L-

EB1–A

EB2–A

Bridge
No. 7

NC 182

B4571-2

45BW

B1–B

B2–B

EB1–B

EB2–B

ISBW

WOODS

8:1

To SR 1668 Johnston Rd.

INDIAN CREEK

CULTIVATED FIELD

SECONDARY GROWTH

WOODS

SECONDARY GROWTH

WOODS

PROJECT REFERENCE NO.	SHEET NO.
B-4571	4

CROSS SECTION THROUGH END BENT 1
AT –L– STATION 16+40.00
SKEW=60°

0 10 20
FEET
VE = 1:1

EB1–A
16+28
10' LT

℄

EB1–B
16+55
28' RT

Ground Surface

Roadway Embankment:

Soft to Medium — Stiff, Brown-Orange, Moist, Micaceous Sandy Silty CLAY

Alluvial:

Very Soft to Soft, Tan-Orange-Gray, — Moist, Sandy Silty CLAY and Silty Sandy CLAY

Alluvial: Loose to Dense, Orange-Tan, — Moist, Clayey Silty SAND with Gravel

Residual:

Loose to Medium Dense, Brown-Tan-White, — Moist, Micaceous, Clayey Silty Fine SAND

Weathered Rock:

Crystalline Rock: (GNEISS) — Brown-White (GNEISS)

	EB1–A	EB1–B
	7	
	3	
	2	WOH
	3	3
	50	6
	5	21
	14	21
	100/0.2	100/0.8
		100/1.0
	BT FIAD	BT FIAD

10/18 (EB1–A)
10/18 (EB1–B)

830 820 810 800 790 780 770 760 750

50 40 30 20 10 0 10 20 30 40 50 60

GROUNDLINE TAKEN FROM .TIN FILE RECIEVED BY NCDOT DATED 11/27/2018.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
B-4571	5

CROSS SECTION THROUGH BENT 1
AT -L- STATION 16+95.00
SKEW=60°

0 10 20
FEET
VE = 1:1

B1-A
16+70
18' LT

B1-B
17+05
23' RT

℄

Ground Surface

Alluvial: Very Soft, Red-Orange, Moist, Silty Sandy CLAY

WOH 10/18

3

17

6

6

10

13

18

39

100/0.9

1 10/18

3

29

7

11

15

8

13

18

45

Alluvial: Very Loose to Medium Dense, Brown-Orange-Gray, Moist, Silty Clayey Fine SAND and Clayey Silty SAND with Gravel

Residual: Medium Stiff to Hard, Tan-Yellow-Brown-White, Moist, Thinly Layered Silty Fine Sandy CLAY with Some Mica

Residual: Medium Stiff to Very Stiff, Tan-Gray-Orange-White, Moist, Fine Sandy Clayey SILT

Weathered Rock: Tan-Gray-White with Thin Crystalline Rock Layers (GNEISS)

Crystalline Rock: Gray to White (GNEISS)

REC=93%
RQD=74%
GSI= 70-85

REC=91%
RQD=76%
GSI= 60-85

BT
FIAD

BT
FIAD

820 810 800 790 780 770 760 750 740 730

50 40 30 20 10 0 10 20 30 40 50 60

GROUNDLINE TAKEN FROM .TIN FILE RECIEVED BY NCDOT DATED 11/27/2018.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
B-4571	6

CROSS SECTION THROUGH BENT 2
AT -L- STATION 17+85.00
SKEW=60°

0 10 20
FEET
VE = 1:1

B2-A
17+75
20' LT

B2-B
17+95
18'.5 RT

℄

Ground Surface

Alluvial: Very Soft to Soft, Orange-Gray.

Alluvial: Moist, Sandy Silty and Silty Sandy CLAY

Weathered Rock: Tan-Brown-Gray-White (GNEISS)

Loose to Very Dense.

Residual: Brown-White-Tan-Orange, Moist, Micaceous

Clayey Silty fine SAND

Weathered Rock: Tan-Brown-Gray-White (GNEISS)

Crystalline Rock: Gray to White (MICA SCHIST to GNEISS)

REC=84%
RQD=83%
GSI= 60-85

BT
FIAD

REC=96%
RQD=98%
GSI= 60-85

BT
FIAD

(A) **Alluvial:** Very Loose, Gray, Moist, Gravel

GROUNDLINE TAKEN FROM .TIN FILE RECIEVED BY NCDOT DATED 11/27/2018.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJECT REFERENCE NO.	SHEET NO.
B-4571	7

CROSS SECTION THROUGH END BENT 2
AT -L- STATION 18+40.00
SKEW=60°

0 10 20
FEET
VE = 1:1

EB2-A
18+38
5' LT

EB2-B
18+57
30' RT

Ground Surface

Roadway Embankment:
Soft, Brown-Orange, Moist, Micaceous Sandy Clayey SILT

Alluvial:
Very Soft to Medium Stiff, Gray-Tan-Orange-Yellow, Moist, Sandy Silty and Sandy CLAY

Residual:
Soft to Medium Stiff, Tan-Gray-Orange, Moist, Very Micaceous Sandy Clayey SILT

Residual:
Loose to Medium Dense, Orange-Tan-Gray to Brown-White, Moist, Micaceous, Clayey Silty Fine SAND

Weathered Rock: Brown-White (GNEISS)

Crystalline Rock: (GNEISS)

	EB2-A	EB2-B
A	4	WOH
	2	5
	3	2
	4	5
	11	2
	5	36
	7	31
	4	100/0.8
	14	37
	27	
	18	
	100/0.3	

10/18
10/18
BT
BT
FIAD

GROUNDLINE TAKEN FROM .TIN FILE RECIEVED BY NCDOT DATED 11/27/2018.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 16+28	**OFFSET** 10 ft LT	**ALIGNMENT** -L-	**0 HR.** 21.3
COLLAR ELEV. 819.5 ft	**TOTAL DEPTH** 39.5 ft	**NORTHING** 624,082	**EASTING** 1,291,513	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/16/18	**COMP. DATE** 10/16/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
820												
										GROUND SURFACE	819.5	0.0
815	815.3	4.2	2	3	4	7		M		**ROADWAY EMBANKMENT** Brown-Orange, Micaceous, Sandy Silty CLAY		
810	810.3	9.2	1	1	2	3		M				
805	805.3	14.2	1	1	1	2		M			804.3	15.2
										ALLUVIAL Tan-Orange, Sandy Silty CLAY		
800	800.3	19.2	WOH	1	2	3		M			800.3	19.2
										Gray, Silty Sandy CLAY		
795	795.3	24.2	13	28	22	50		M			795.7	23.8
										Orange-Tan, Clayey Silty SAND with Gravel		
790	790.3	29.2	3	2	3	5		M			792.2	27.3
										RESIDUAL Brown-White, Clayey Silty Fine SAND		
785	785.3	34.2	1	3	11	14		M				
780	780.3	39.2	100/0.2			100/0.2		M			781.5	38.0
										WEATHERED ROCK Brown-White (GNEISS)	780.0	39.5
										Boring Terminated with Casing Advancer Refusal at Elevation 780.0 ft on CRYSTALLINE ROCK (GNEISS)		
										Note: Blow counts effected by gravel		

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 16+55	**OFFSET** 28 ft RT	**ALIGNMENT** -L-	**0 HR.** 6.0
COLLAR ELEV. 806.5 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 624,076	**EASTING** 1,291,560	**24 HR.** 3.8
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/15/18	**COMP. DATE** 10/15/18	**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)
810												
										GROUND SURFACE	806.5	0.0
805										**ALLUVIAL** Tan-Orange, Sandy Silty CLAY		
	801.9	4.6	WOH	WOH	WOH	0		M				
800												
	796.9	9.6	1	1	2	3		M			794.5	12.0
795										Orange, Clayey Silty SAND with Gravel		
	791.9	14.6	1	3	3	6		M			787.2	19.3
790										**RESIDUAL** Brown-Tan-White, Micaceous, Clayey Silty Fine SAND		
	786.9	19.6	6	9	12	21		M				
785												
	781.9	24.6	4	6	15	21		M			776.9	29.6
780										**WEATHERED ROCK** Brown-White (GNEISS)		
	776.9	29.6	31	61	39/0.3	100/0.8		M				
775												
	771.9	34.6	22	44	56	100/1.0		M			770.4	36.1
										Boring Terminated at Elevation 770.4 ft in WEATHERED ROCK (GNEISS)		
										Note: Boulder buster broke and got hung up in casing; boring was terminated in WR due to failure at 36.1'		

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 16+70	**OFFSET** 18 ft LT	**ALIGNMENT** -L-	**0 HR.** 4.3
COLLAR ELEV. 809.4 ft	**TOTAL DEPTH** 70.0 ft	**NORTHING** 624,118	**EASTING** 1,291,536	**24 HR.** 5.5
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/12/18	**COMP. DATE** 10/12/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
810										809.4 GROUND SURFACE	0.0
										ALLUVIAL Red-Orange, Silty Sandy CLAY	
805	805.1	4.3	WOH	WOH	WOH	0		M			
										802.6 Brown-Gray, Silty Clayey Fine SAND	6.8
800	800.1	9.3	1	1	2	3		M			
										797.1 Orange-Gray, Clayey Silty SAND with Gravel	12.3
795	795.1	14.3	9	9	8	17		M			
790	790.1	19.3	5	3	3	6		M			
										785.1 **RESIDUAL** Tan-Yellow-White, Thinly Layered Silty Fine Sandy CLAY with Mica	24.3
785	785.1	24.3	3	2	4	6		M			
780	780.1	29.3	3	5	5	10		M			
775	775.1	34.3	2	5	8	13		M			
770	770.1	39.3	3	8	10	18		M			
765	765.1	44.3	5	12	27	39		M			
										762.8 **WEATHERED ROCK** Tan-Gray-White with Thin Crystalline Rock Layers (GNEISS)	46.6
760	760.1	49.3	20	80/0.4		100/0.9					
										755.6 **CRYSTALLINE ROCK** Gray to White (GNEISS)	53.8
755											
750											
745											
740										739.4 Boring Terminated at Elevation 739.4 ft in CRYSTALLINE ROCK (GNEISS)	70.0

NCDOT BORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 16+70	**OFFSET** 18 ft LT	**ALIGNMENT** -L-	**0 HR.** 4.3
COLLAR ELEV. 809.4 ft	**TOTAL DEPTH** 70.0 ft	**NORTHING** 624,118	**EASTING** 1,291,536	**24 HR.** 5.5
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/12/18	**COMP. DATE** 10/12/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NX	**TOTAL RUN** 16.2 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)
755.6											Begin Coring @ 53.8 ft	
755	755.6	53.8	1.2	NM/1.2	(0.8) 67%	(0.4) 33%		(15.0) 93%	(11.9) 73%		755.6 **CRYSTALLINE ROCK** Slightly Weathered, Hard, Close to Moderately Close Fracture Spacing, Gray to White GNEISS GSI = 70-85	53.8
	754.4	55.0	5.0	0:43/1.0 0:48/1.0 0:44/1.0 0:46/1.0 0:49/1.0	(4.8) 96%	(3.5) 70%						
750	749.4	60.0	5.0	1:30/1.0 1:34/1.0 1:38/1.0 1:31/1.0 1:32/1.0	(4.4) 88%	(3.0) 60%						
745	744.4	65.0	5.0	2:01/1.0 2:07/1.0 2:06/1.0 2:11/1.0 2:04/1.0	(5.0) 100%	(5.0) 100%						
740	739.4	70.0									739.4 Boring Terminated at Elevation 739.4 ft in CRYSTALLINE ROCK (GNEISS)	70.0

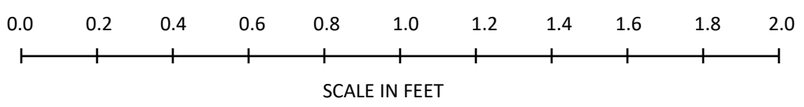
NCDOT CORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

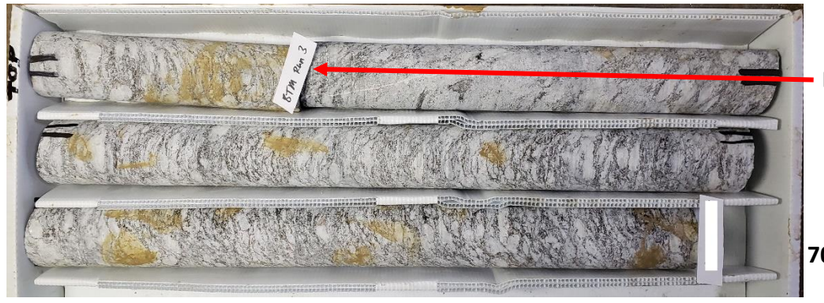
CORE PHOTOGRAPHS: Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40, B1-A 16+70, 18’ LT

Begin
53.8 feet

End Run 1
55.0 feet

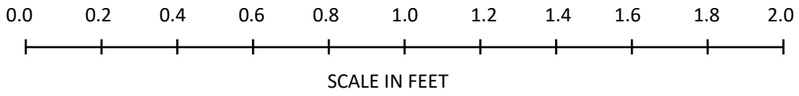
End Run 2
60.0 feet





End Run 3
65.0 feet

End
70.0 feet



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 17+05	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.7
COLLAR ELEV. 809.0 ft	**TOTAL DEPTH** 70.2 ft	**NORTHING** 624,116	**EASTING** 1,291,590	**24 HR.** 6.2
DRILL RIG/HAMMER EFF./DATE HFC0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/12/18	**COMP. DATE** 10/15/18	**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)
810										809.0 GROUND SURFACE	0.0
										ALLUVIAL Red-Orange, Silty Sandy CLAY	
805	804.4	4.6	WOH	WOH	1	1		M			
										801.9 Brown-Gray, Silty Clayey Fine SAND	7.1
800	799.4	9.6	1	1	2	3		M			
795	794.4	14.6	3	12	17	29		M		796.7 Orange-Gray, Clayey Silty SAND with Gravel	12.3
790	789.4	19.6	2	3	4	7		M			
785	784.4	24.6	2	4	7	11		M		784.4 **RESIDUAL** Tan-Brown-White, Silty Fine Sandy CLAY with Some Mica	24.6
780	779.4	29.6	3	6	9	15		M			
775	774.4	34.6	1	3	5	8		M		776.9 Tan-Gray-Orange-White, Fine Sandy Clayey SILT	32.1
770	769.4	39.6	1	5	8	13		M			
765	764.4	44.6	4	8	10	18		M		761.9 Tan-Brown-White, Silty Fine Sandy CLAY with Some Mica	47.1
760	759.4	49.6	7	21	24	45		M		756.6	52.4
755										754.8 **WEATHERED ROCK** (GNEISS)	54.2
750										**CRYSTALLINE ROCK** Gray to White (GNEISS to SCHIST)	
745											
740										738.8 Boring Terminated at Elevation 738.8 ft in CRYSTALLINE ROCK (GNEISS)	70.2

NCDOT BORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

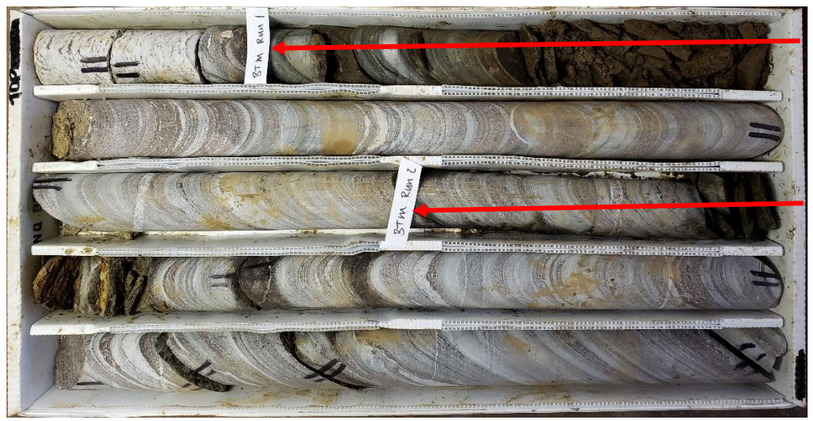
GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 17+05	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.7
COLLAR ELEV. 809.0 ft	**TOTAL DEPTH** 70.2 ft	**NORTHING** 624,116	**EASTING** 1,291,590	**24 HR.** 6.2
DRILL RIG/HAMMER EFF./DATE HFC0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/12/18	**COMP. DATE** 10/15/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NX	**TOTAL RUN** 16.0 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)
754.8											Begin Coring @ 54.2 ft	
	754.8 / 753.8	54.2 / 55.2	1.0	NM/1.0	(0.6) 60%	(0.4) 40%		(14.6) 91%	(12.1) 76%		754.8 **CRYSTALLINE ROCK** Slight to Moderately Severe Weathering, Hard, Gray to White, Close to Moderately Close Fracture Spacing, SCHIST and GNEISS GSI = 60-85	54.2
750	748.8	60.2	5.0	2:11/1.0 2:20/1.0 2:18/1.0 2:29/1.0 2:26/1.0	(4.1) 82%	(2.6) 52%						
745	743.8	65.2	5.0	1:52/1.0 1:55/1.0 1:49/1.0 2:00/1.0 2:11/1.0	(5.0) 100%	(4.2) 84%						
740	738.8	70.2	5.0	2:00/1.0 1:53/1.0 1:58/1.0 2:11/1.0 2:02/1.0	(4.9) 98%	(4.9) 98%					738.8 Boring Terminated at Elevation 738.8 ft in CRYSTALLINE ROCK (GNEISS)	70.2

NCDOT CORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

CORE PHOTOGRAPHS: Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40, B1-B 17+05, 23’ RT



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 17+75	**OFFSET** 20 ft LT	**ALIGNMENT** -L-	**0 HR.** 8.0
COLLAR ELEV. 805.5 ft	**TOTAL DEPTH** 74.7 ft	**NORTHING** 624,196	**EASTING** 1,291,606	**24 HR.** 6.5
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/15/18	**COMP. DATE** 10/15/18	**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)
810											
805										805.5 GROUND SURFACE	0.0
	801.6	3.9	WOH	WOH	WOH	0		M		**ALLUVIAL** Orange, Sandy Silty CLAY	
800											
	796.6	8.9	1	1	1	2		M			
795											
	791.6	13.9	3	1	2	3		M			
790											
	786.6	18.9	3	2	2	4		M		786.6	18.9
785										**RESIDUAL** Brown-White, Micaceous, Clayey Silty Fine SAND	
	781.6	23.9	1	1	9	10		M			
780											
	776.6	28.9	28	68	32/0.1	100/0.6				778.2	27.3
775										**WEATHERED ROCK** Tan-Brown-Gray-White (GNEISS)	
	771.6	33.9	33	40	29	69		M		773.3	32.2
770										Brown-White-Tan-Orange, Micaceous Clayey Silty Fine SAND	
	766.6	38.9	14	20	21	41		M			
765											
	761.6	43.9	5	6	9	15		M			
760											
	756.6	48.9	2	4	5	9		M			
755											
	751.6	53.9	11	53	47/0.3	100/0.8				751.1	54.4
750										**WEATHERED ROCK** Tan-Brown-Gray-White (GNEISS)	
745										749.1 **CRYSTALLINE ROCK** Gray to White (MICA SCHIST to GNEISS)	56.4
740											
735										730.8	74.7
										Boring Terminated at Elevation 730.8 ft in CRYSTALLINE ROCK (GNEISS)	

NCDOT BORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

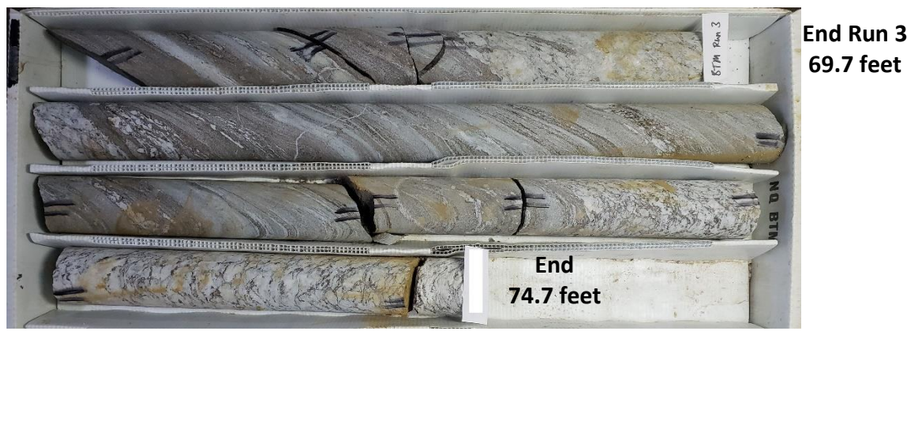
GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 17+75	**OFFSET** 20 ft LT	**ALIGNMENT** -L-	**0 HR.** 8.0
COLLAR ELEV. 805.5 ft	**TOTAL DEPTH** 74.7 ft	**NORTHING** 624,196	**EASTING** 1,291,606	**24 HR.** 6.5
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/15/18	**COMP. DATE** 10/15/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NX	**TOTAL RUN** 18.3 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)
749.1											Begin Coring @ 56.4 ft	
	749.1	56.4	3.3	NM/3.3	(0.5) 15%	(0.5) 15%		(15.3) 84%	(15.2) 83%		749.1 **CRYSTALLINE ROCK**	56.4
	745.8	59.7									Very Slightly Weathered, Hard, Wide Fracture Spacing, Thinly Foliated, Gray to White MICA SCHIST with Quartz Filled Fractures Change at 69.0' to GNEISS, Change at 73.1' to GNEISS GSI = 60-85	
745			5.0	1:41/1.0 1:47/1.0 1:32/1.0 1:40/1.0 1:48/1.0	(5.0) 100%	(5.0) 100%						
	740.8	64.7										
740			5.0	1:54/1.0 2:01/1.0 2:10/1.0 1:59/1.0 2:07/1.0	(4.8) 96%	(4.7) 94%						
	735.8	69.7										
735			5.0	1:44/1.0 1:51/1.0 1:47/1.0 1:53/1.0 1:46/1.0	(5.0) 100%	(5.0) 100%						
	730.8	74.7									730.8	74.7
											Boring Terminated at Elevation 730.8 ft in CRYSTALLINE ROCK (GNEISS)	

NCDOT CORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

CORE PHOTOGRAPHS: Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40, B2-A 17+75, 20’ LT



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 17+95	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 806.6 ft	**TOTAL DEPTH** 66.3 ft	**NORTHING** 624,185	**EASTING** 1,291,648	**24 HR.** 6.8
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/16/18	**COMP. DATE** 10/16/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
810										806.6	0.0
										GROUND SURFACE	
805										**ALLUVIAL** Orange, Sandy Silty CLAY	
	801.1	5.5	WOH	WOH	WOH	0		M		798.6	8.0
800										Gray, Silty Sandy CLAY	
	796.1	10.5	WOH	WOH	1	1		M		794.6	12.0
795										Gray, Gravel	
										792.6	14.0
	791.1	15.5	4	2	2	4		M		Gray, Silty Sandy CLAY	
790										790.6	16.0
	786.1	20.5	2	2	2	4		M		**RESIDUAL** Brown-White, Micaceous, Clayey Silty Fine SAND	
785											
	781.1	25.5	1	2	2	4		M			
780											
	776.1	30.5	2	3	6	9		M			
775											
	771.1	35.5	25	46	51	97		M			
770											
	766.1	40.5	12	16	23	39		M			
765											
	761.1	45.5	8	14	20	34		M			
760											
										757.2	49.4
755										756.9 **WEATHERED ROCK** (GNEISS)	49.7
										CRYSTALLINE ROCK Gray to White (GNEISS)	
750											
745										740.3	66.3
										Boring Terminated at Elevation 740.3 ft in CRYSTALLINE ROCK (GNEISS)	

NCDOT BORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

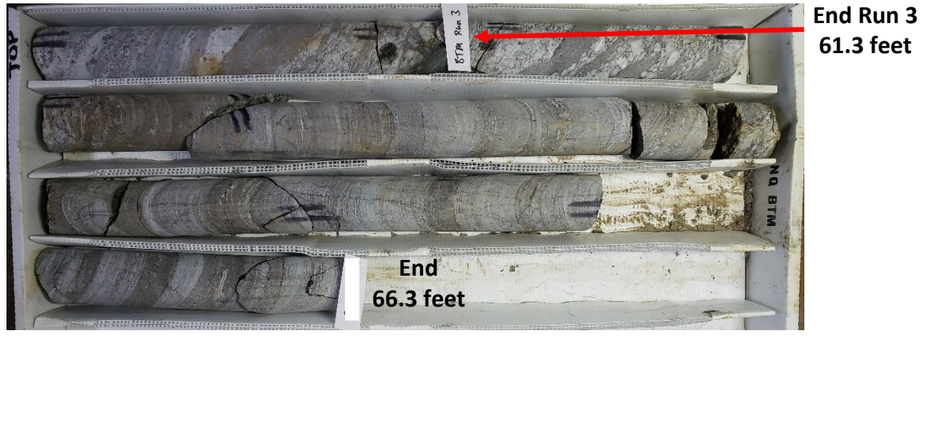
GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 17+95	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 806.6 ft	**TOTAL DEPTH** 66.3 ft	**NORTHING** 624,185	**EASTING** 1,291,648	**24 HR.** 6.8
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/16/18	**COMP. DATE** 10/16/18	**SURFACE WATER DEPTH** N/A	
CORE SIZE NX	**TOTAL RUN** 16.6 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)
756.9											Begin Coring @ 49.7 ft	
755	756.9	49.7	1.6	1:53/1.0 NM/0.6	(1.0) 63%	(1.0) 63%		(16.0) 96%	(14.9) 90%		756.9 **CRYSTALLINE ROCK** Slightly Weathered, Hard, Moderately Close Fracture Spacing, Gray to White GNEISS with Garnets GSI = 60-85	49.7
	755.3	51.3	5.0	2:04/1.0 2:10/1.0 2:07/1.0 2:15/1.0 2:00/1.0	(5.0) 100%	(4.9) 98%						
750	750.3	56.3	5.0	2:05/1.0 2:10/1.0 2:12/1.0 2:15/1.0 2:11/1.0	(5.0) 100%	(4.9) 98%						
745	745.3	61.3	5.0	2:13/1.0 2:18/1.0 2:20/1.0 2:08/1.0 2:01	(5.0) 100%	(4.1) 82%						
	740.3	66.3									740.3 Boring Terminated at Elevation 740.3 ft in CRYSTALLINE ROCK (GNEISS)	66.3

NCDOT CORE DOUBLE B4571_GEO_BH_BRDG0007.GPJ NC_DOT.GDT 12/6/18

CORE PHOTOGRAPHS: Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40, B2-B 17+95, 19’ RT



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 18+38	**OFFSET** 5 ft LT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 819.5 ft	**TOTAL DEPTH** 63.8 ft	**NORTHING** 624,232	**EASTING** 1,291,660	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/17/18	**COMP. DATE** 10/17/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
820										819.5 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Layers of Brown-Orange, Micaceous, Sandy Clayey SILT	
815	815.2	4.3	1	2	2	4		M			
810	810.2	9.3	1	1	1	2		M			
805	805.2	14.3	1	2	1	3		M		804.2	15.3
800	800.2	19.3	1	2	2	4		M		**ALLUVIAL** Gray-Tan, Sandy Silty CLAY	
795	795.2	24.3	17	8	3	11		M		794.2	25.3
790	790.2	29.3	1	2	3	5		M		**RESIDUAL** Orange-Tan-Gray, Micaceous Clayey Silty SAND	
785	785.2	34.3	1	2	5	7		M			
780	780.2	39.3	2	2	2	4		M			
775	775.2	44.3	4	6	8	14		M			
770	770.2	49.3	12	13	14	27		M			
765	765.2	54.3	4	5	13	18		M		763.5	56.0
760	760.2	59.3	100/0.3			100/0.3				**WEATHERED ROCK** Brown-White (GNEISS)	
										755.7	63.8
										Boring Terminated with Casing Advancer Refusal at Elevation 755.7 ft on CRYSTALLINE ROCK (GNEISS)	

WBS 38414.1.2	**TIP** B-4571	**COUNTY** LINCOLN	**GEOLOGIST** Stickney, J. K.	
SITE DESCRIPTION Bridge No. 7 on NC 182 over Indian Creek at -L- Station 17+40				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 18+57	**OFFSET** 30 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.7
COLLAR ELEV. 809.5 ft	**TOTAL DEPTH** 47.6 ft	**NORTHING** 624,222	**EASTING** 1,291,699	**24 HR.** 9.0
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550X 92% 08/15/2018		**DRILL METHOD** NW Casing w/ Advancer	**HAMMER TYPE** Automatic	
DRILLER Smith, C. L.	**START DATE** 10/16/18	**COMP. DATE** 10/16/18	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
810										809.5 GROUND SURFACE	0.0
										ALLUVIAL Orange, Sandy Silty CLAY	
805	804.2	5.3	WOH	WOH	WOH	0		M			
800	799.2	10.3	1	2	3	5		M		801.7	7.8
795	794.2	15.3	1	1	1	2		M		Gray-Yellow, Sandy CLAY with Gravel Layer at 13.7'-14.4'	
790	789.2	20.3	1	2	3	5		M		794.2	15.3
785	784.2	25.3	1	1	1	2		M		**RESIDUAL** Tan-Gray-Orange, Very Micaceous, Sandy Clayey SILT	
780	779.2	30.3	12	16	20	36		M			
775	774.2	35.3	8	12	19	31		M			
770	769.2	40.3	32	52	48/0.3	100/0.8				768.7	40.8
765	764.2	45.3	28	14	23	37		M		**WEATHERED ROCK** Brown-White (GNEISS)	
										766.0	43.5
										RESIDUAL Brown-White, Micaceous Clayey Silty SAND	
										761.9	47.6
										Boring Terminated with Casing Advancer Refusal at Elevation 761.9 ft on CRYSTALLINE ROCK (GNEISS)	

Bridge No. 7 on NC 182 over Indian Creek at –L- Station 17+40

Photograph No. 1: Looking at End Bent 1 toward End Bent 2

Photograph No. 2: Looking Upstream