REFERENCE: BR-0063

PROJECT: 67063

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0063	1	14

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY ANSON

PROJECT DESCRIPTION REPLACEMENT OF BRIDGE 030087 OVER RICHARDSON CREEK ON NC 742

SITE DESCRIPTION BRIDGE NO. 87 -L- (NC 742) OVER RICHARDSON CREEK AT -L- STA. 20+15

CONTENTS

CAUTION NOTICE

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CAMERON STRATTON

THOMAS PARK

INVESTIGATED BY CATLIN

DRAWN BY S. V. HUDSON, LG

CHECKED BY J. LEE STONE, LG

SUBMITTED BY S. V. HUDSON, LG

DATE JUNE 2023

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Engineers and Scientists

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V HUDSON

DocuSigned by:
Steven V Hudson 07/12/2023
01DB23BB74BD4B9... SIGNATURE DATE

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PROJECT REFERENCE NO.	SHEET NO.
BR-0063	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-45B
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] MOBILE B-57
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [X] TRICONE 2 7/8" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

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

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: LOCATIONS OBTAINED WITH A FEAL TIME KINEMATIC (RTK) GLOBAL POSITIONING SYSTEM (GPS) UTILIZING THE NORTH CAROLINA STATE PLANE NORTH AMERICAN DATUM 1983 ELEVATION: NAVD88 FEET

NOTES:

FIAD = FILLED IMMEDIATELY AFTER DRILLING

NAVD88 = NORTH AMERICAN VERTICAL DATUM 1988

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
BR–0063	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

DECREASING INTERLOCKING OF ROCK PIECES ⇩

SURFACE CONDITIONS

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very rough, fresh unweathered surfaces	Rough, slightly weathered, iron stained surfaces	Smooth, moderately weathered and altered surfaces	Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⇨

90			N/A	N/A
80				
70				
60				
50				
40				
30				
20				
10				
N/A	N/A			

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

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very Rough, fresh unweathered surfaces	Rough, slightly weathered surfaces	Smooth, moderately weathered and altered surfaces	Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

70	A			
60				
50		B	C	D E
40				
30				F
20				
10			G	H

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
BR-0063	3

SITE PLAN

0 30 60

FEET

-N-

19+00

20+00

21+00

22+00

)ODS

W

8", HDPE, Anson County Water

TO OAKBORO

NC 742

CONC BRIDGE

BRIDGE 030087

TO BURNSVILLE

F

C

B1-A

B2-A

EB1-A

-L-

EB2A

EB1-C

EB2-C

SKEW = 90°

EB1-B

B1-B

B2-B

EB2-B

EB1 BENT LINE

B1 BENT LINE

RICHARDSON CREEK

B2 BENT LINE

EB2 BENT LINE

F

WOODS

0 30 60
HORIZONTAL SCALE IN FEET
VE = 3.0

SKEW = 90°

PROFILE THROUGH BORINGS PROJECTED ALONG -L-

222291 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	4

EB1-A
18+67
6' LT

B1-A
19+93
13' LT

B2-A
20+40
17' LT

EB2-A
21+74
5' LT

SS-16
SS-17
SS-08
ST-01
6
11
ST-01
9
02/23
24
100/0.8
48
60/0.0
BT

APPROXIMATE LAND SURFACE

MEDIUM STIFF TO VERY STIFF, BROWN, REDDISH BROWN BEIGE, AND ORANGE, SANDY CLAY, SILTY CLAY, AND SILT. MOIST TO SAT. (RESIDUAL)

HARD, BLUE, BLACK, BEIGE, AND ORANGE, SILT. DRY (SAPROLITE)

WEATHERED ROCK (ARGILLITE)

RS-02
CREEK SURFACE ELEVATION
03-06-23

100/0.9
100/0.2
100/0.3
100/0.3
60/0.1
BT
FIAD

30
100/0.9
100/0.7
60/0.1
(0.5)
20%
(2.6)
52%
(2.7)
54%
(0.5)
10%
(1.2)
48%
BT
FIAD

(X.X)= RQD FT
XX%= RQD %

NON-CRYSTALLINE ROCK
TAN, GRAY, BROWN, BLACK, AND BLUE, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, SLIGHT TO MODERATELY WEATHERED ARGILLITE
(REC=98%, RQD=27%, GSI=60-70)

SS-19
SS-10
ST-02
2
17
ST-02
21
12
100/0.8
60/0.1
BT
DRY
(01/23)

SOFT TO VERY STIFF, BROWN, REDDISH BROWN BEIGE, AND ORANGE, SANDY CLAY, SILTY CLAY, AND SILT. MOIST TO WET. (RESIDUAL)

WEATHERED ROCK (ARGILLITE)

Ⓐ VERY STIFF TO HARD, BLUE, GRAY, BROWN, AND BLACK, SILT WITH TR. TO LITTLE ROCK FRAGS. MOIST (RESIDUAL)

NOTES: GROUNDLINE PROFILE ALONG -L- GENERATED FROM br0063_ls_tin.tin PROVIDED NOV. 2022

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

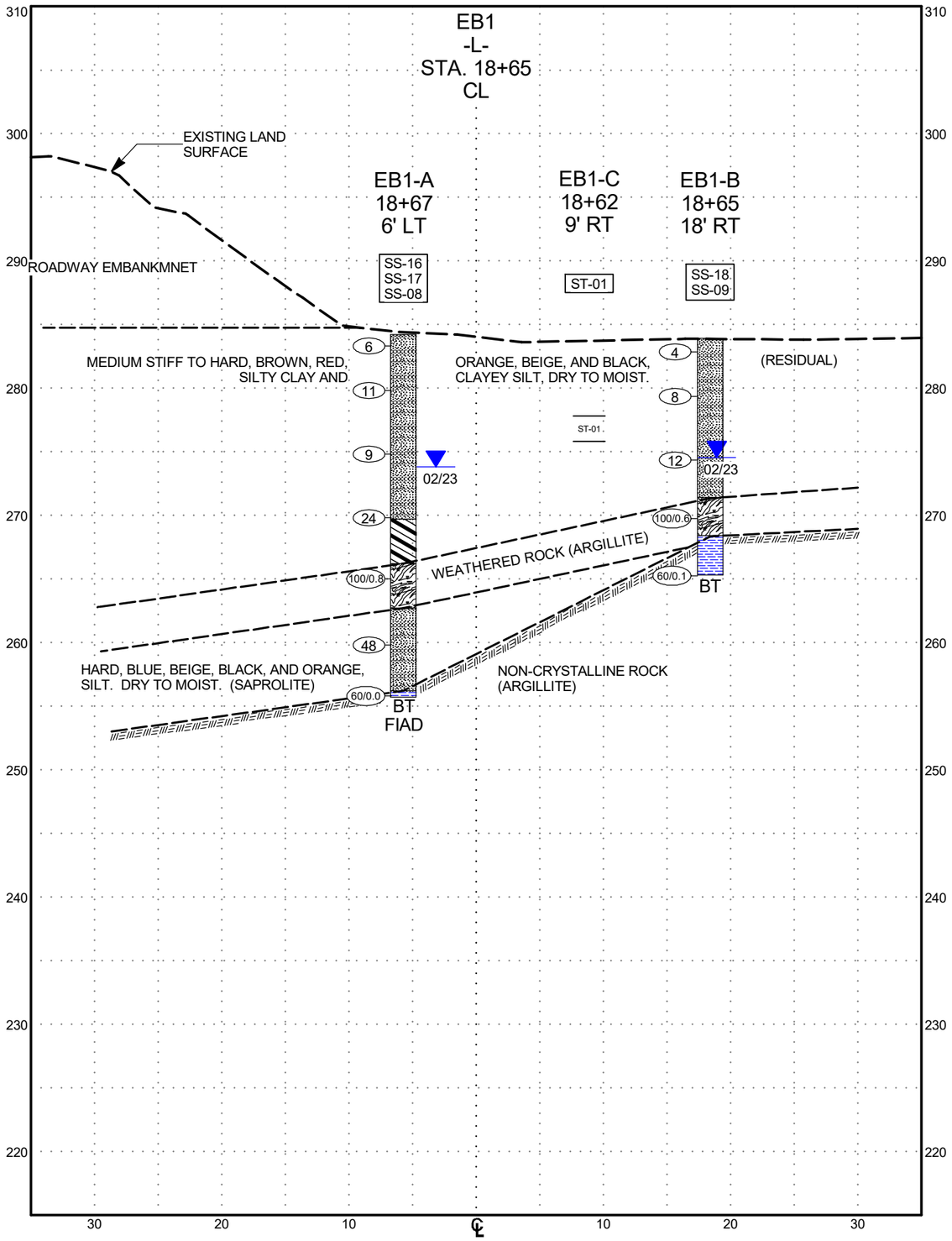
320 310 300 290 280 270 260 250 240 230

18+00 18+50 19+00 19+50 20+00 20+50 21+00 21+50 22+00

P:\2022\222291 NCDOT - BR-0063 - BRIDGE-87 OVER RICHARDSON CREEK - GEOTECH\BR0063_GEO_BRDG_GINT-PROFILE.GDW

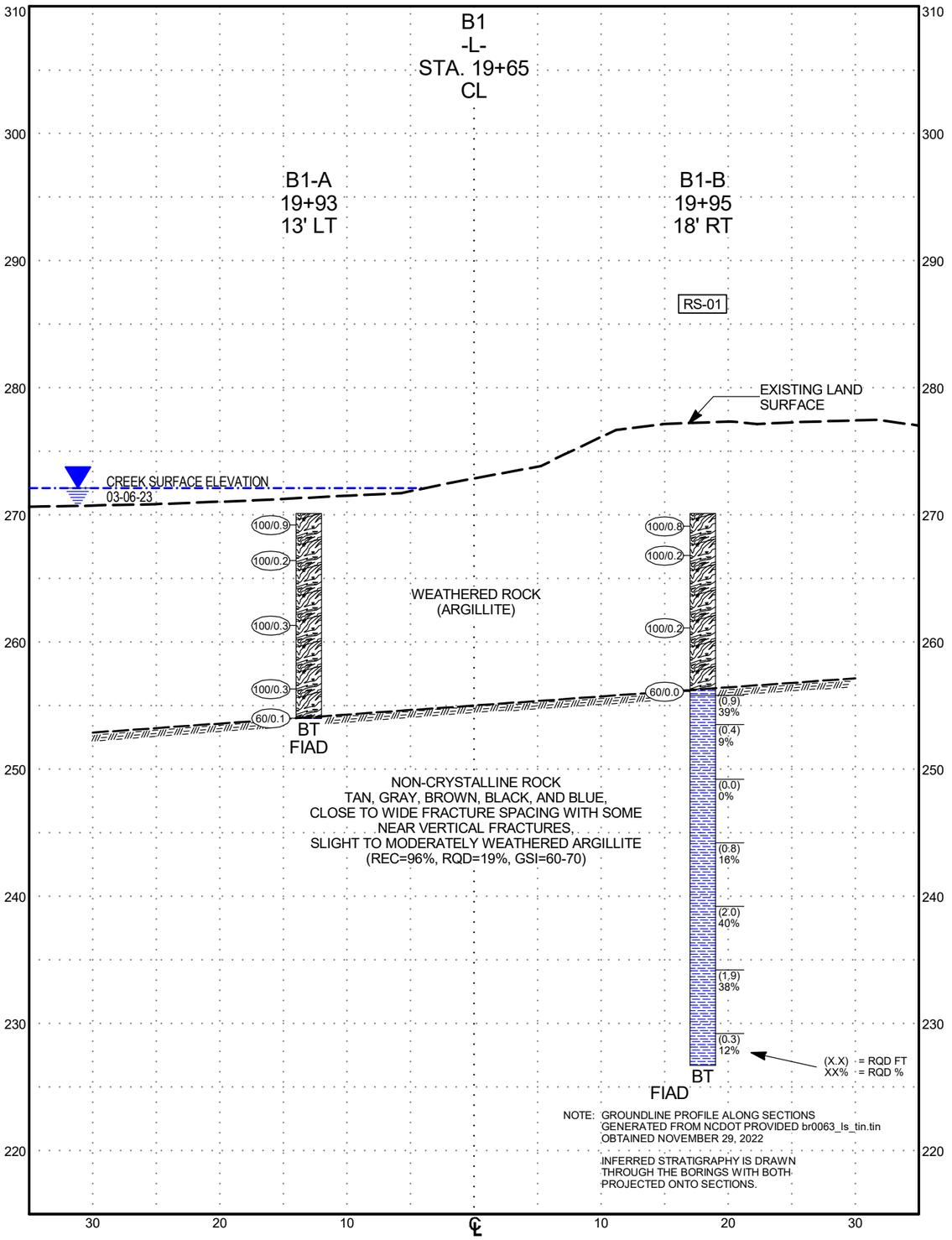
0 10 20
HORIZONTAL SCALE IN FEET
VE = 1.0

CROSS SECTION
END BENT 1
SKEW = 90°



0 10 20
HORIZONTAL SCALE IN FEET
VE = 1.0

CROSS SECTION
BENT 1
SKEW = 90°



NOTE: GROUNDLINE PROFILE ALONG SECTIONS GENERATED FROM NCDOT PROVIDED br0063_ls_tin.tin OBTAINED NOVEMBER 29, 2022

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

0 10 20
HORIZONTAL SCALE IN FEET
VE = 1.0

CROSS SECTION BENT 2 SKEW = 90°

B2
-L-
STA. 20+65
CL

B2-A
20+40
17' LT

B2-B
20+47
19' RT

RS-02

CREEK SURFACE ELEVATION
03-06-23

EXISTING MUDLINE

WEATHERED ROCK (ARGILLITE)

NON-CRYSTALLINE ROCK
TAN, GRAY, BROWN, BLACK, AND BLUE,
CLOSE TO MODERATELY CLOSE FRACTURE SPACING,
SLIGHT TO MODERATELY WEATHERED ARGILLITE
(REC=100%, RQD=38%, GSI=60-70)

	B2-A	B2-B
Ⓐ	30	85
	100/0.9	91
	100/0.7	60/0.1
	60/0.1	60/0.1
	(0.5) 20%	
	(2.6) 52%	
	(2.7) 54%	
	(0.5) 10%	
	(1:2) 48%	
	BT FIAD	BT FIAD

(X.X) = RQD FT
XX% = RQD %

Ⓐ VERY STIFF TO HARD, BLUE, GRAY, BROWN, AND BLACK, SILT WITH TR. TO LITTLE ROCK FRAGS. MOIST (RESIDUAL)

Ⓑ MEDIUM STIFF, TAN, BROWN, AND BLACK, CSE. SANDY SILT WITH TRACE CLAY AND GRAVEL. WET. (ALLUVIAL)

0 10 20
HORIZONTAL SCALE IN FEET
VE = 1.0

CROSS SECTION END BENT 2 SKEW = 90°

EB2
-L-
STA. 21+65
CL

EB2-A
21+74
5' LT

EB2-C
21+72
3' RT

EB2-B
21+68
24' RT

EXISTING LAND SURFACE

ROADWAY EMBANKMENT

SS-19
SS-10

SS-20
SS-11

ST-02

SOFT TO HARD, BROWN, RED, ORANGE, PINK, AND BLACK, SILTY CLAY, CLAYEY SILT, AND F. SANDY SILT. TRACE ROCK FRAGS. DRY TO MOIST. (RESIDUAL)

WEATHERED ROCK (ARGILLITE)

NON-CRYSTALLINE ROCK (ARGILLITE)

EB2-A	EB2-B
2	5
17	20
21	36
12	13
100/0.8	100/0.2
60/0.1	60/0.0
BT DRY	BT 02/23

NOTE: GROUNDLINE PROFILE ALONG SECTIONS GENERATED FROM NCDOT PROVIDED br0063_ls_tin.tin OBTAINED NOVEMBER 29, 2022

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

GEOTECHNICAL BORING REPORT
BORE LOG

222291 **CATLIN** Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	7

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton
SITE DESCRIPTION: BRIDGE NO. 87 ON NC 742 OVER RICHARDSON CREEK AT -L- STA. 20+15			**GROUND WTR (ft)**
BORING NO.: EB1-A	**STATION:** 18+67	**OFFSET:** 6 ft LT	**ALIGNMENT:** -L- **0 HR.** 10.5
COLLAR ELEV.: 284.2 ft	**TOTAL DEPTH:** 28.5 ft	**NORTHING:** 511,072	**EASTING:** 1,619,073 **24 HR.** 10.5
DRILL RIG/HAMMER EFF./DATE: CAT2002 MOBILE B-57 92.3% 12/23/22		**DRILL METHOD:** H.S. AUGERS	**HAMMER TYPE:** AUTOMATIC
DRILLER: T. Jason White	**START DATE:** 02/01/23	**COMP. DATE:** 02/01/23	**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. # RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
295											
290											
285	284.2	0.0								284.2 LAND SURFACE	0.0
			WOH	2	4	6	SS-16 A-4(8)	M		RESIDUAL	
280	280.7	3.5	5	5	6	11	SS-17 A-4(9)	M		REDDISH BROWN, LIGHT BROWN, LIGHT BLUE, GRAY, AND BLACK, SANDY SILT	
275	275.7	8.5	1	3	6	9					
270	270.7	13.5	37	13	11	24		D		269.7 ORANGE, BLUE, BIEGE, BROWN, SILTY CLAY, TR. ROCK FRAGS.	14.5
265	265.7	18.5	15	85/0.3		100/0.8		D		266.2 WEATHERED ROCK (ARGILLITE)	18.0
260	260.7	23.5	46	23	25	48	SS-08 A-4(7)	D		262.7 SAPROLITE BLUE, BIEGE, BLACK, ORANGE, SILT	21.5
	255.7	28.5	60/0.0			60/0.0		D		256.2 NON-CRYSTALLINE ROCK (ARGILLITE)	28.0
										255.7 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 255.7 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)	28.5

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton
SITE DESCRIPTION: BRIDGE NO. 87 ON NC 742 OVER RICHARDSON CREEK AT -L- STA. 20+15			**GROUND WTR (ft)**
BORING NO.: EB1-B	**STATION:** 18+65	**OFFSET:** 18 ft RT	**ALIGNMENT:** -L- **0 HR.** 11.2
COLLAR ELEV.: 283.9 ft	**TOTAL DEPTH:** 18.6 ft	**NORTHING:** 511,048	**EASTING:** 1,619,070 **24 HR.** 9.3
DRILL RIG/HAMMER EFF./DATE: CAT2002 MOBILE B-57 92.3% 12/23/22		**DRILL METHOD:** H.S. AUGERS	**HAMMER TYPE:** AUTOMATIC
DRILLER: T. Jason White	**START DATE:** 02/01/23	**COMP. DATE:** 02/01/23	**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. # RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
295										
290										
285	283.9	0.0								283.9 LAND SURFACE 0.0
			1	2	2	4		M		RESIDUAL
280	280.4	3.5	3	4	4	8	SS-18 A-4(9)	M		RED BROWN TO LIGHT BROWN, FINE, SANDY SILT
275	275.4	8.5	11	8	4	12	SS-09 A-4(2)			
270	270.4	13.5	80	20/0.1		100/0.6				271.4 WEATHERED ROCK (ARGILLITE) 12.5
	265.4	18.5	60/0.1			60/0.1				268.4 NON-CRYSTALLINE ROCK (ARGILLITE) 15.5
										265.3 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 265.3 ft IN NON-CRYSTALLINE ROCK (ARGILLITE) 18.6

NCDOT BORE DOUBLE BR0063_GEO_BRDG87_CATLIN.GPJ NCDOT_CATLIN.GDT 04/05/23

GEOTECHNICAL BORING REPORT
BORE LOG

222291 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	8

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton	
SITE DESCRIPTION: Bridge No. 87 on NC 742 over Richardson Creek at -L- Station 20+15				**GROUND WTR (ft)**
BORING NO.: B1-A	**STATION:** 19+93	**OFFSET:** 13 ft LT	**ALIGNMENT:** -L-	**0 HR.** 0.0
COLLAR ELEV.: 270.1 ft	**TOTAL DEPTH:** 16.1 ft	**NORTHING:** 511,074	**EASTING:** 1,619,199	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing w/ SPT	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 03/02/23	**COMP. DATE:** 03/02/23	**SURFACE WATER DEPTH:** 3.8ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
295												
290												
285												
280												
275												
270	270.1	0.0	27	73/0.4		100/0.9					270.1 MUDLINE	0.0
	266.6	3.5	100/0.2			100/0.2					WEATHERED ROCK (ARGILLITE)	
265												
	261.6	8.5	100/0.3			100/0.3						
260												
	256.6	13.5	100/0.3			100/0.3						
255	254.1	16.0	60/0.1			60/0.1					254.1 16.0 NON-CRYSTALLINE ROCK (ARGILLITE) 254.0 16.1	
											Boring Terminated WITH STANDARD PENETRATION TEST at Elevation 254.0 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)	

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Thomas Park	
SITE DESCRIPTION: Bridge No. 87 on NC 742 over Richardson Creek at -L- Station 20+15				**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 19+95	**OFFSET:** 18 ft RT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 270.1 ft	**TOTAL DEPTH:** 43.4 ft	**NORTHING:** 511,043	**EASTING:** 1,619,199	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Jordan Edmondson	**START DATE:** 02/27/23	**COMP. DATE:** 02/28/23	**SURFACE WATER DEPTH:** 3.7ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
295											
290											
285											
280											
275											
270	270.1	0.0	10	32	68/0.3	100/0.8					270.1 MUDLINE 0.0
	267.0	3.1	100/0.2			100/0.2					WEATHERED ROCK (ARGILLITE)
265											
	261.3	8.8	100/0.2			100/0.2					
260											
	256.3	13.8	60/0.0			60/0.0					256.3 13.8
255											255.8 NON-CRYSTALLINE ROCK 14.3
											TAN, GRAY, BROWN, BLACK, AND BLUE, SLIGHT TO MODERATELY WEATHERED ARGILLITE (REC=99%, RQD=22%, GSI=60-70)
250											
								RS-01			
245											
240											
235											
230											226.7 43.4
											Boring Terminated at Elevation 226.7 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Thomas Park
SITE DESCRIPTION: Bridge No. 87 on NC 742 over Richardson Creek at -L- Station 20+15			**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 19+95	**OFFSET:** 18 ft RT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 270.1 ft	**TOTAL DEPTH:** 43.4 ft	**NORTHING:** 511,043	**EASTING:** 1,619,199	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Jordan Edmondson	**START DATE:** 02/27/23	**COMP. DATE:** 02/28/23	**SURFACE WATER DEPTH:** 3.7ft	
CORE SIZE: NQ	**TOTAL RUN:** 29.1 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
255.8											Begin Coring @ 14.3 ft
255	255.8	14.3	2.3	2:09/1.0 2:41/1.0	(2.3) 100%	(0.9) 39%		(28.7) 99%	(6.3) 22%		ELEV. (ft) 255.8 — DEPTH (ft) 14.3 NON-CRYSTALLINE ROCK TAN, GRAY, BROWN, BLACK, AND BLUE, SLIGHT TO MODERATELY WEATHERED, CLOSE TO WIDE FRACTURES WITH SOME NEAR VERTICAL FRACTURES. HARD ARGILLITE
	253.5	16.6									
			4.3	0:29/0.3 0:51/1.0 2:46/1.0 1:02/1.0 1:32/1.0	(4.1) 95%	(0.4) 9%					
250	249.2	20.9									
			5.0	2:01/0.3 3:02/1.0 3:14/1.0 3:22/1.0 3:01/1.0 3:51/1.0	(4.8) 96%	(0.0) 0%	RS-01				
245	244.2	25.9									
			5.0	3:24/1.0 3:37/1.0 4:02/1.0 2:04/1.0 2:40/1.0	(5.0) 100%	(0.8) 16%					
240	239.2	30.9									
			5.0	1:19/1.0 2:03/1.0 2:05/1.0 2:13/1.0 1:51/1.0	(5.0) 100%	(2.0) 40%					
235	234.2	35.9									
			5.0	1:58/1.0 1:39/1.0 2:09/1.0 2:32/1.0 2:45/1.0	(5.0) 100%	(1.9) 38%					
230	229.2	40.9									
			2.5	1:49/1.0 1:41/1.0 0:51/0.5	(2.5) 100%	(0.3) 12%					
	226.7	43.4									ELEV. (ft) 226.7 — DEPTH (ft) 43.4 Boring Terminated at Elevation 226.7 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)

ROCK TEST RESULTS

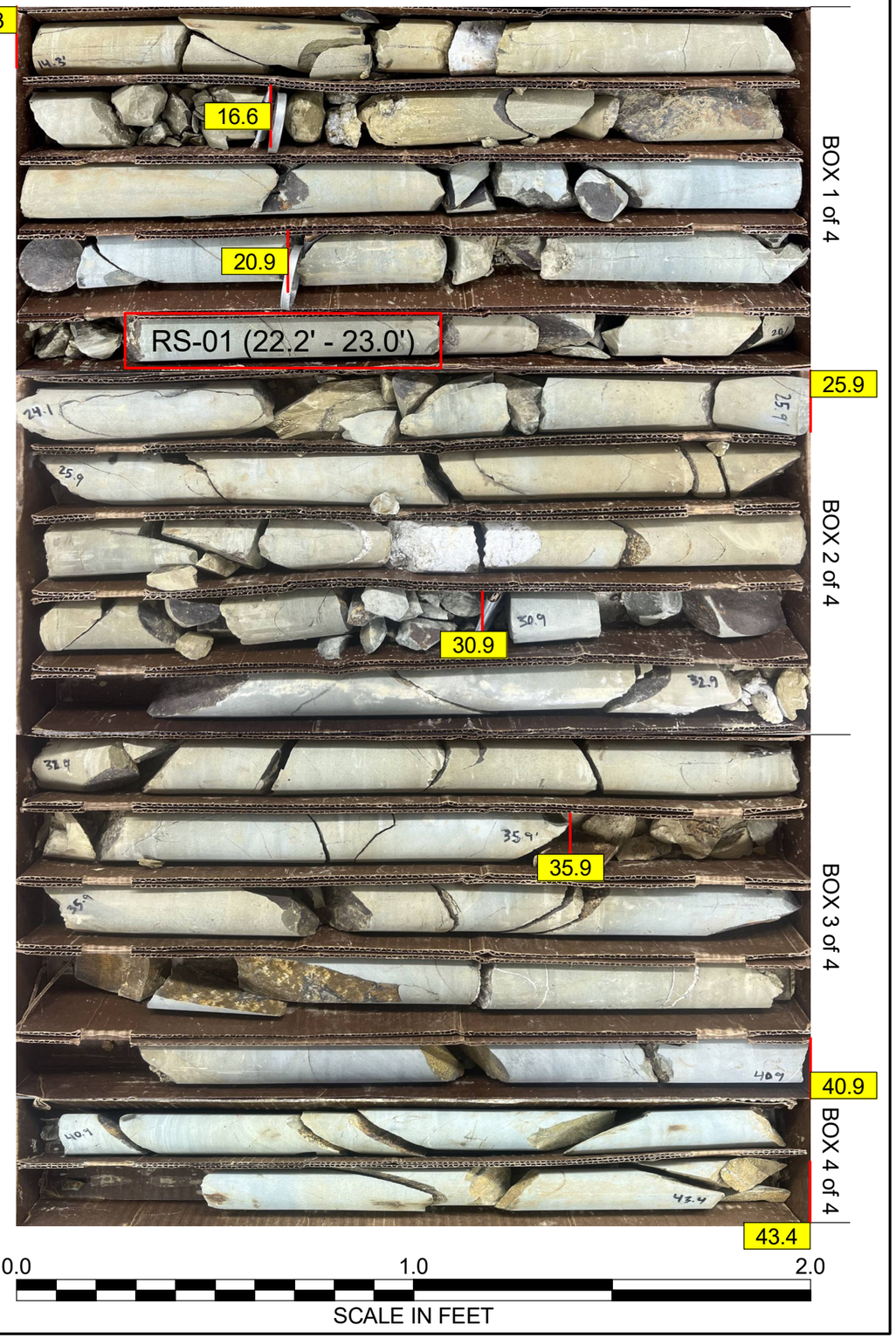
SAMPLE NUMBER	DEPTH INTERVAL	ROCK TYPE	UNIT WT. (lb/ft3)	UNIAXIAL COMPRESSIVE STRENGTH (psi)
RS-01	22.2' - 23.0'	ARGILLITE	162.9	14,720

NCDOT CORE W-PHOTO BR0063 GEO BRDG87 CATLIN.GPJ CATLIN.GDT 03/21/23

B1-B
DEPTH: 14.3 to 43.4 ft

222291 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	9



0.0 1.0 2.0

SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

222291 **CATLIN** Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	10

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton
SITE DESCRIPTION: Replace Bridge Number 87 on NC 742 over Richardson Creek			**GROUND WTR (ft)**
BORING NO.: B2-A	**STATION:** 20+40	**OFFSET:** 17 ft LT	**ALIGNMENT:** -L- **0 HR.** 0.0
COLLAR ELEV.: 270.4 ft	**TOTAL DEPTH:** 33.6 ft	**NORTHING:** 511,076	**EASTING:** 1,619,246 **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 03/03/23	**COMP. DATE:** 03/03/23	**SURFACE WATER DEPTH:** 3.7ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
295												
290												
285												
280												
275												
270	270.4	0.0	WOH	4	26				M		270.4 MUDLINE	0.0
											BLUE, GRAY, AND BROWN, SILT WITH TR. ROCK FRAGS.	
	266.9	3.5	49	51/0.4		100/0.9			M		267.4 WEATHERED ROCK (ARGILLITE)	3.0
265												
	261.9	8.5	48	52/0.2		100/0.7			D			
260												
	256.9	13.5	60/0.1			60/0.1					256.8 NON-CRYSTALLINE ROCK TAN, GRAY, BROWN, BLACK, AND BLUE, SLIGHT TO MODERATELY WEATHERED ARGILLITE (REC=100%, RQD=38%, GSI=60-70)	13.6
255								RS-02				
250												
245												
240											236.8 Boring Terminated at Elevation 236.8 ft IN NONCRYSTALLINE ROCK (ARGILLITE)	33.6

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton
SITE DESCRIPTION: Replace Bridge Number 87 on NC 742 over Richardson Creek			**GROUND WTR (ft)**
BORING NO.: B2-B	**STATION:** 20+47	**OFFSET:** 19 ft RT	**ALIGNMENT:** -L- **0 HR.** 0.0
COLLAR ELEV.: 270.0 ft	**TOTAL DEPTH:** 12.5 ft	**NORTHING:** 511,040	**EASTING:** 1,619,252 **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing w/ SPT	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 03/02/23	**COMP. DATE:** 03/02/23	**SURFACE WATER DEPTH:** 3.7ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
295											
290											
285											
280											
275											
270	270.0	0.0	7	24	61				M		270.0 MUDLINE 0.0
											269.5 ALLUVIAL TAN, BROWN, AND BLACK, CSE. SANDY SILT W/TR. CLAY AND GRAVEL 0.5
	266.5	3.5	27	23	68	85 91			D		RESIDUAL TAN, BEIGE, AND BLACK, SILT W/LITTLE ROCK FRAGS.
265											263.5 WEATHERED ROCK (ARGILLITE) 6.5
	261.5	8.5	60/0.1			60/0.1					261.5 NON-CRYSTALLINE ROCK (ARGILLITE) 8.5
260											
	257.6	12.4	60/0.1			60/0.1					257.5 Boring Terminated WITH STANDARD PENETRATION TEST AND TRICONE REFUSAL at Elevation 257.5 ft IN NONCRYSTALLINE ROCK (ARGILLITE) 12.5

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton
SITE DESCRIPTION: Bridge No. 87 on NC 742 over Richardson Creek at -L- Station 20+15			**GROUND WTR (ft)**
BORING NO.: B2-A	**STATION:** 20+40	**OFFSET:** 17 ft LT	**ALIGNMENT:** -L-	**0 HR.** 0.0
COLLAR ELEV.: 270.4 ft	**TOTAL DEPTH:** 33.6 ft	**NORTHING:** 511,076	**EASTING:** 1,619,246	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 85.8% 02/15/2022		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 03/03/23	**COMP. DATE:** 03/03/23	**SURFACE WATER DEPTH:** 3.7ft	
CORE SIZE: NQ	**TOTAL RUN:** 20.0 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
256.8											Begin Coring @ 13.6 ft
255	256.8	13.6	2.5	1:52/1.0 2:34/1.0 2:05/0.5	(2.5) 100%	(0.5) 20%		(20.0) 100%	(7.5) 38%		256.8 NON-CRYSTALLINE ROCK 13.6 BEIGE, ORANGE, LIGHT BLUE, GRAY, AND BLACK, MODERATE TO SLIGHTLY WEATHERED WITH SOME OXIDIZED ZONES, CLOSE TO MODERATELY CLOSE FRACTURE SPACING. HARD ARGILLITE
	254.3	16.1	5.0	2:25/1.0 2:54/1.0 3:04/1.0 3:40/1.0 3:44/1.0	(5.0) 100%	(2.6) 52%	RS-02				
250	249.3	21.1	5.0	2:45/1.0 3:30/1.0 3:23/1.0 2:43/1.0 3:01/1.0	(5.0) 100%	(2.7) 54%					
245	244.3	26.1	5.0	2:34/1.0 2:23/1.0 2:55/1.0 2:23/1.0 2:27/1.0	(5.0) 100%	(0.5) 10%					
240	239.3	31.1	2.5	2:33/1.0 3:47/1.0 1:07/0.5	(2.5) 100%	(1.2) 48%					
	236.8	33.6									236.8 33.6 Boring Terminated at Elevation 236.8 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)

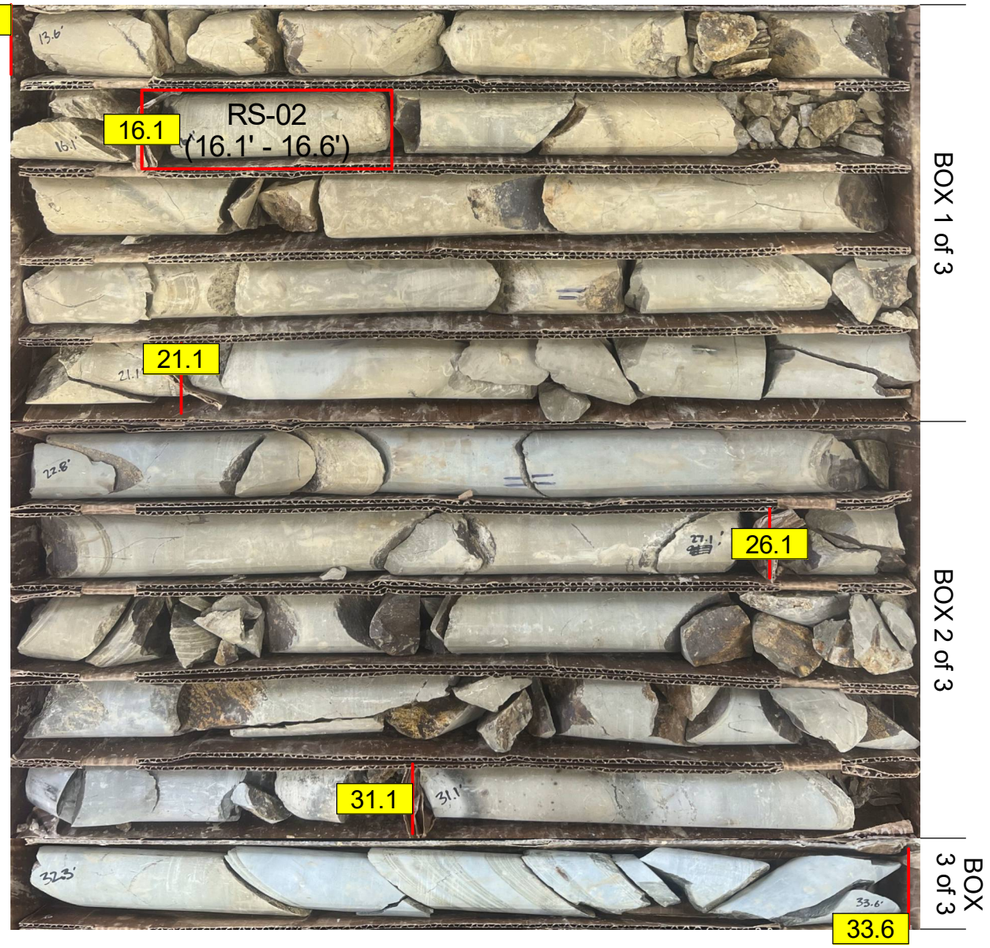
ROCK TEST RESULTS

SAMPLE NUMBER	DEPTH INTERVAL	ROCK TYPE	UNIT WT. (lb/ft3)	UNIAXIAL COMPRESSIVE STRENGTH (psi)
RS-02	16.1' - 16.6'	ARGILLITE	161.0	14,720

B2-A
DEPTH: 13.6 to 33.6 ft

222291 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0063	11



0.0 1.0 2.0
SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

222291 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0063 | SHEET: 12

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton	
SITE DESCRIPTION: BRIDGE NO. 87 ON NC 742 OVER RICHARDSON CREEK AT -L- STA. 20+15				**GROUND WTR (ft)**
BORING NO.: EB2-A	**STATION:** 21+74	**OFFSET:** 5 ft LT	**ALIGNMENT:** -L-	**0 HR.** Dry
COLLAR ELEV.: 293.1 ft	**TOTAL DEPTH:** 20.6 ft	**NORTHING:** 511,058	**EASTING:** 1,619,380	**24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE: CAT2002 MOBILE B-57 92.3% 12/23/22		**DRILL METHOD:** H.S. AUGERS	**HAMMER TYPE:** AUTOMATIC	
DRILLER: T. Jason White	**START DATE:** 01/31/23	**COMP. DATE:** 01/31/23	**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. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION / ELEV. (ft) / DEPTH (ft)
295										
	293.1	0.0	3	1	1	2		W		293.1 LAND SURFACE 0.0 RESIDUAL TAN, RED, BLACK, BROWN, SILTY CLAY
290	289.6	3.5	6	6	11	17	SS-19 A-6(11)	M		
285	284.6	8.5	6	9	12	21	SS-10 A-6(11)	M		
280	279.6	13.5	5	5	7	12		D		279.1 14.0 BLUE/GRAY SILT, TRACE ROCK FRAGS.
275	274.6	18.5	52	48/0.3		100/0.8		D		275.1 18.0 WEATHERED ROCK (ARGILLITE)
	272.6	20.5	60/0.1			60/0.1		D		273.1 20.0 272.5 20.6 NON-CRYSTALLINE ROCK (ARGILLITE) Boring Terminated BY AUGER REFUSAL at Elevation 272.5 ft IN NON-CRYSTALLINE ROCK (ARGILLITE)

WBS: 67063.1.1	**TIP:** BR-0063	**COUNTY:** ANSON	**GEOLOGIST:** Cameron Stratton	
SITE DESCRIPTION: BRIDGE NO. 87 ON NC 742 OVER RICHARDSON CREEK AT -L- STA. 20+15				**GROUND WTR (ft)**
BORING NO.: EB2-B	**STATION:** 21+68	**OFFSET:** 24 ft RT	**ALIGNMENT:** -L-	**0 HR.** 15.8
COLLAR ELEV.: 292.3 ft	**TOTAL DEPTH:** 18.5 ft	**NORTHING:** 511,029	**EASTING:** 1,619,373	**24 HR.** 12.9
DRILL RIG/HAMMER EFF./DATE: CAT2002 MOBILE B-57 92.3% 12/23/22		**DRILL METHOD:** H.S. AUGERS	**HAMMER TYPE:** AUTOMATIC	
DRILLER: T. Jason White	**START DATE:** 01/31/23	**COMP. DATE:** 01/31/23	**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. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
295										
	292.3	0.0	2	2	3	5	SS-20 A-6(12)	M		292.3 LAND SURFACE 0.0 RESIDUAL RED, LIGHT BLUE, BROWN, AND GRAY, OXIDIZED SILTY TO SANDY CLAY
290	288.8	3.5	8	10	10	20		M		
285	283.8	8.5	8	15	21	36		D		280.8 11.5 RED, BLUE, ORANGE, PINK, AND BLACK, CLAYEY SILT WITH TR. ROCK FRAGS. AND SAND
280	278.8	13.5	5	6	7	13	SS-11 A-4(5)	M		
	276.3	16.0	100/0.2			100/0.2		M		276.3 16.0 WEATHERED ROCK (ARGILLITE)
275	273.8	18.5	60/0.0			60/0.0				273.8 18.5 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 273.8 ft ON NON-CRYSTALLINE ROCK (ARGILLITE)

LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

(As modified by NCDOT, Material and Tests Unit, 2000.)

TEST RESULTS															
Proj. Sample Number	ST-01	ST-02	SS-16	SS-17	SS-08	SS-18	SS-09	SS-19	SS-10	SS-20	SS-11				
Lab Sample Number	ST-01	ST-02	SS-16	SS-17	SS-08	SS-18	SS-09	SS-19	SS-10	SS-20	SS-11				
Retained #4 Sieve %	0	1.3	0.1	0.4	0	0.1	1.5	0	5.4	18.2	10.4				
Passing #10 Sieve %	99.8	97.4	99.4	98.4	100	99.9	97.9	97.5	90.1	62.3	85.7				
Passing #40 Sieve %	91	96	98	96	100	99	85	95	85	55	80				
Passing #200 Sieve %	58	88	90	89	99	93	61	92	78	52	68				
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	23.7	2.9	3.0	3.9	0.5	2.3	26.4	2.9	8.0	12.9	11.5				
Fine Sand Ret.-#270 %	21.1	8.3	9.9	9.1	2.6	8.4	14.0	4.9	7.6	5.1	11.4				
Silt 0.05 - 0.005mm %	29.0	53.0	45.7	50.5	65.9	50.3	35.2	54.1	49.1	55.0	47.1				
Clay <0.005mm %	26.3	35.8	41.4	36.5	31.0	39.0	24.4	38.0	35.3	27.0	30.0				
Liquid Limit (LL)	25	36	32	36	32	33	25	33	36	38	29				
Plasticity Index (PI)	7	17	9	9	6	9	7	11	12	14	7				
AASHTO Classification /Group Index	A-4(2)	A-6(15)	A-4(8)	A-4(9)	A-4(7)	A-4(9)	A-4(2)	A-6(11)	A-6(11)	A-6(12)	A-4(5)				
Organic Content %	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A				
Station	18+62	21+72	18+67	18+67	18+67	18+65	18+65	21+74	21+74	21+68	21+68				
Offset	9ft RT	3ft RT	6ft LT	6ft LT	6ft LT	18ft RT	18ft RT	5ft LT	5ft LT	24ft RT	24ft RT				
Alignment	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-				
Boring Identification	EB1-C	EB2-C	EB1-A	EB1-A	EB1-A	EB1-B	EB1-B	EB2-A	EB2-A	EB2-B	EB2-B				
Depth (FT)	6.0	5.0	0.0	3.5	23.5	3.5	8.5	3.5	8.5	0.0	13.5				
to	8.0	7.0	1.5	5.0	25.0	5.0	10.0	5.0	10.0	1.5	15.0				
Field Moist. Content %															
Tested By	Geotechnics	Geotechnics	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON				
Submitted By	C. Stratton	C. Stratton	S.V. HUDSON	S.V. HUDSON	CDFUTRAL	S.V. HUDSON	CDFUTRAL	S.V. HUDSON	CDFUTRAL	S.V. HUDSON	CDFUTRAL				
Date Submitted	04/04/23	04/04/23	03/23/23	03/23/23	02/13/23	03/23/23	02/13/23	03/23/23	02/13/23	03/23/23	02/13/23				

NP = Non-Plastic

NEM = Not Enough Material for Analysis

N/A = Not Applicable / Not Analyzed

Michael D. Mason
Laboratory Manager

Report Date: 6/14/2023

SITE PHOTOGRAPHS

222291 CATLIN Engineers and Scientists	PROJECT REFERENCE	SHEET
	BR-0063	14

RIG ON EB1-C
FACING UP STATION

EB2 IN FOREGROUND
FACING DOWN STATION

NEAR EB2 FACING DOWN STATION