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April 9, 2015

TIP NUMBER:	W-5516
PROJECT NO.:	44105.1.FD
COUNTY:	Rowan
DESCRIPTION:	Culvert Recommendations for Town Branch and UT Cold Water Creek
SUBJECT:	**Geotechnical Report – Design and Construction Recommendations**

ICA Engineering, Inc. has completed the subsurface investigation for this project and submits the following recommendations for the proposed culverts.

-L- Station 31+84.5 - Town Branch Culvert

- **The bottom of the culvert elevation will be at or near rock line. Up to 2 ft. of rock excavation will be required beneath the proposed culvert. Use a 12 in. blanket of foundation conditioning material below the proposed culvert. See Section 414 of the Standard Specifications.**

-L- Station 108+21.0 - UT Cold Water Creek Culvert

- **The bottom of the culvert elevation will be at or near rock line. Up to 2 ft. of rock excavation will be required beneath the proposed culvert. Use a 12 in. blanket of foundation conditioning material below the proposed culvert. See Section 414 of the Standard Specifications.**

Prepared by,

DocuSigned by:
Kenneth R. Bussey, Jr.
22A188C7B3D7442...
6/3/2015

Kenneth R. Bussey, Jr., PE
Project Engineer

REFERENCE: W-5516

PROJECT: 44105

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5516	1	32

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Rowan*

PROJECT DESCRIPTION *Old Beatty Ford Road from West of Bostian Road Intersection to Lentz Road*

SITE DESCRIPTION *Bridge #399 on Old Beatty Ford Road over Cold Water Creek*

CONTENTS

CAUTION NOTICE

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

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *Wesley Shuecraft*

CHECKED BY *Kevin Walker*

SUBMITTED BY *HDR|ICA*

DATE *February 27, 2015*

NORTH CAROLINA PROFESSIONAL SEAL 037631 ENGINEER KEVIN E. WALKER

DocuSigned by:
Kevin E Walker
BB515A52DEA4417...
SIGNATURE

6/3/2015
DATE

PROJECT REFERENCE NO.	SHEET NO.
W-5516	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: -BL- 13802-15
-L- Sta. 61+91.63, 189.59 Rt., -Y- Sta. 46+14.72, 13.59' Lt.
N 653192.7790, E 1531803.8290 ELEVATION: 669.32 FEET

NOTES:

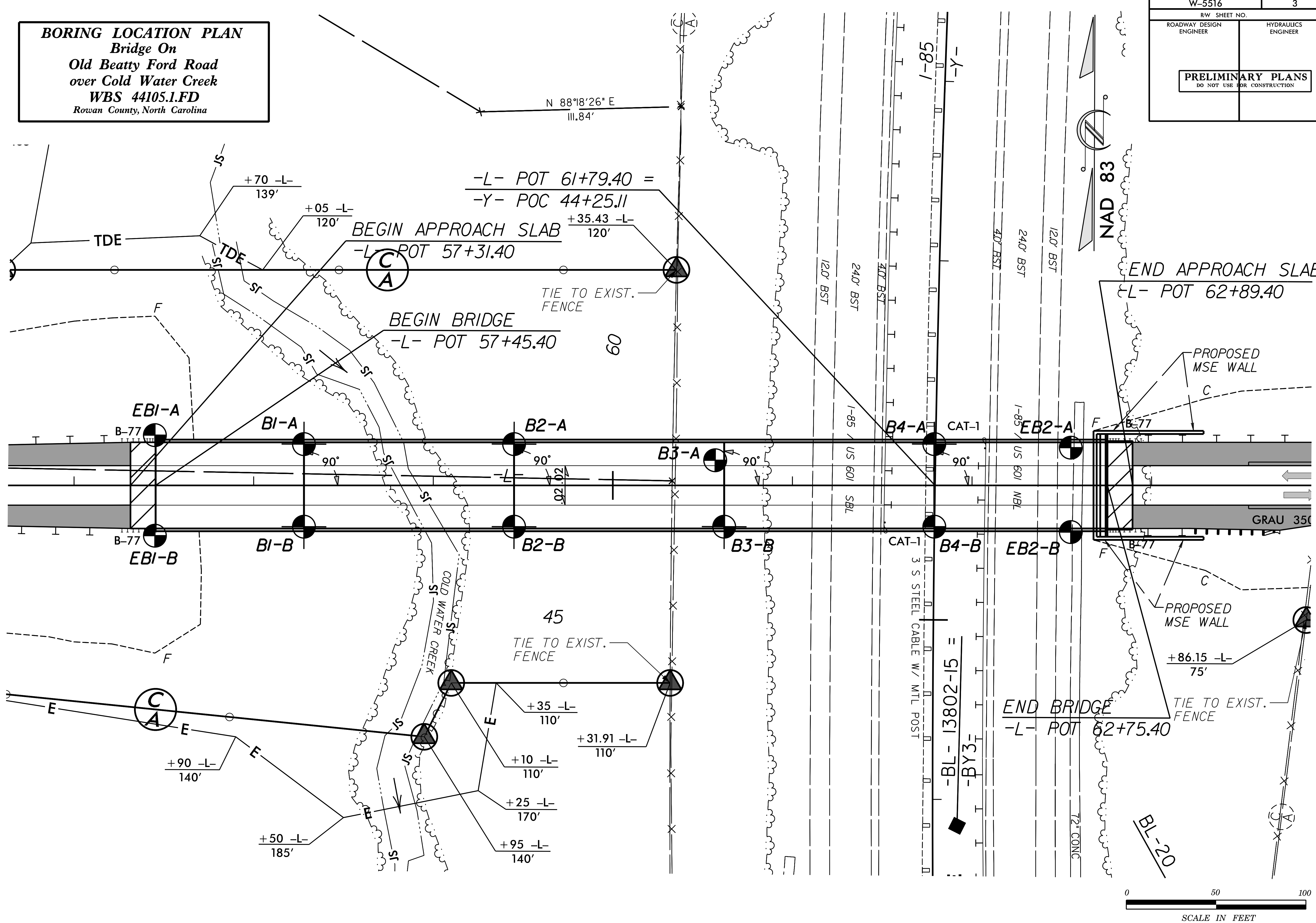
DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
W-5516	3
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

BORING LOCATION PLAN
Bridge On
Old Beatty Ford Road
over Cold Water Creek
WBS 44105.1.FD
Rowan County, North Carolina

REVISIONS



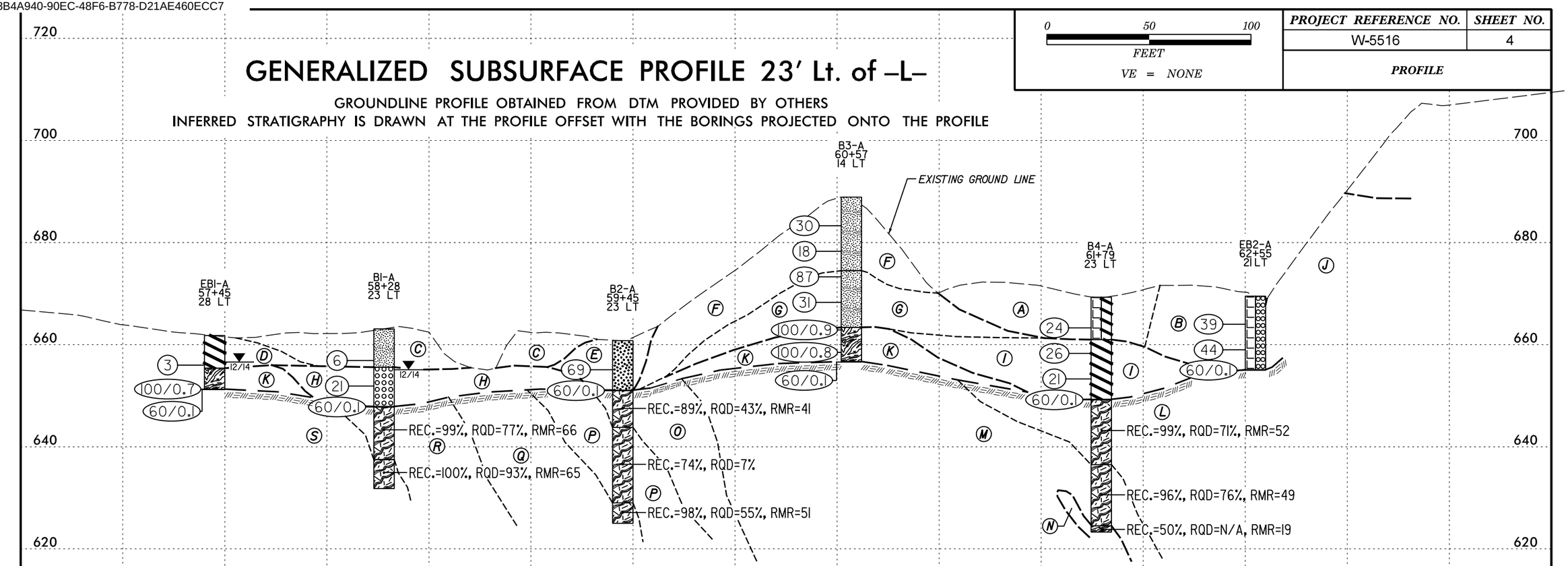
N 88°18'26" E
111.84'
-L- POT 61+79.40 =
-Y- POC 44+25.11
+70 -L-
139'
+05 -L-
120'
BEGIN APPROACH SLAB
-L- POT 57+31.40
+35.43 -L-
120'
TIE TO EXIST. FENCE
BEGIN BRIDGE
-L- POT 57+45.40
TDE
60
I-85
-Y-
NAD 83
120' BST
240' BST
40' BST
END APPROACH SLAB
-L- POT 62+89.40
PROPOSED MSE WALL
EB1-A
B1-A
B2-A
B3-A
B4-A
CAT-1
EB2-A
B-77
90°
-L-
I-85 / US 601 SBL
I-85 / US 601 NBL
EB1-B
B1-B
B2-B
B3-B
B4-B
EB2-B
GRAU 350
3 S STEEL CABLE W/ MTL POST
COLD WATER CREEK
45
TIE TO EXIST. FENCE
+86.15 -L-
75'
+35 -L-
110'
+31.91 -L-
110'
+10 -L-
110'
+90 -L-
140'
+25 -L-
170'
+50 -L-
185'
+95 -L-
140'
-BL- 13802-15 =
-BY3-
END BRIDGE
-L- POT 62+75.40
TIE TO EXIST. FENCE
72" CONC
BL-20
0
50
100
SCALE IN FEET

PROJECT REFERENCE NO.	SHEET NO.
W-5516	4
PROFILE	

0 50 100
FEET
VE = NONE

GENERALIZED SUBSURFACE PROFILE 23' Lt. of –L–

GROUNDLINE PROFILE OBTAINED FROM DTM PROVIDED BY OTHERS
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE



A *ROADWAY EMBANKMENT:* Orange-tan, red, v. stiff, wet, f. sandy, silty CLAY w/rock frags.

B *ROADWAY EMBANKMENT:* Red, tan, dense, moist to wet, silty, f. to cse. SAND w/rock frags.

C *ALLUVIAL:* Tan, brown, black, med. stiff, moist, f. sandy SILT.

D *ALLUVIAL:* Brown, tan-orange, soft, saturated, f. sandy, silty, high plasticity CLAY.

E *RESIDUAL:* Tan, gray, black, v. dense, moist, silty, SAND w/black frags.

F *RESIDUAL:* Tan-red-orange, white & pink, v. stiff, dry to moist, sli. micaceous, saprolitic, f. to cse. sandy SILT.

G *RESIDUAL:* Pink-white & orange-tan, hard, dry, non-plastic, sli. micaceous, saprolitic, f. to cse. sandy SILT w/WR seams.

H *RESIDUAL:* Tan, gray-green, brown, med. dense, moist, silty, f. SAND w/rock frags.

I *RESIDUAL:* Tan, brown, green, v. stiff, wet, f. sandy, silty, high plasticity CLAY.

J *RESIDUAL:* Green, tan-orange, black, red, dry, non-plastic, sli. micaceous, saprolitic, f. to cse. sandy SILT w/WR seams.

K *WR:* METATUFF.

L *CR:* Pink-brown, tan-orange stain, blue-gray, mod. to mod. sev. weathered, v. close to close fracs. w/iron stain & clay, mod. hard to hard METATUFF w/vugs & flow texture.

M *CR:* Green, pink-orange, purple-maroon, gray, tan-brown-orange stain, sli. to mod. weathered w/seams sev. to completely weathered, close fracs., hard, calcareous METATUFF w/flow texture, veins & pyrite grain nodules.

N *WR:* Brown-orange stain, pink-orange, gray, sev. to v. sev. weathered, med. hard w/hard frags., METATUFF.

O *CR:* Red-maroon, orange-tan stain, mod. to mod. sev. weathered w/sev. weathering along frac. faces, mod. hard to hard, v. close to close fracs. v. fine grain matrix w/f. to pebble size frags. some calcareous, feldspar METATUFF w/scat. vugs.

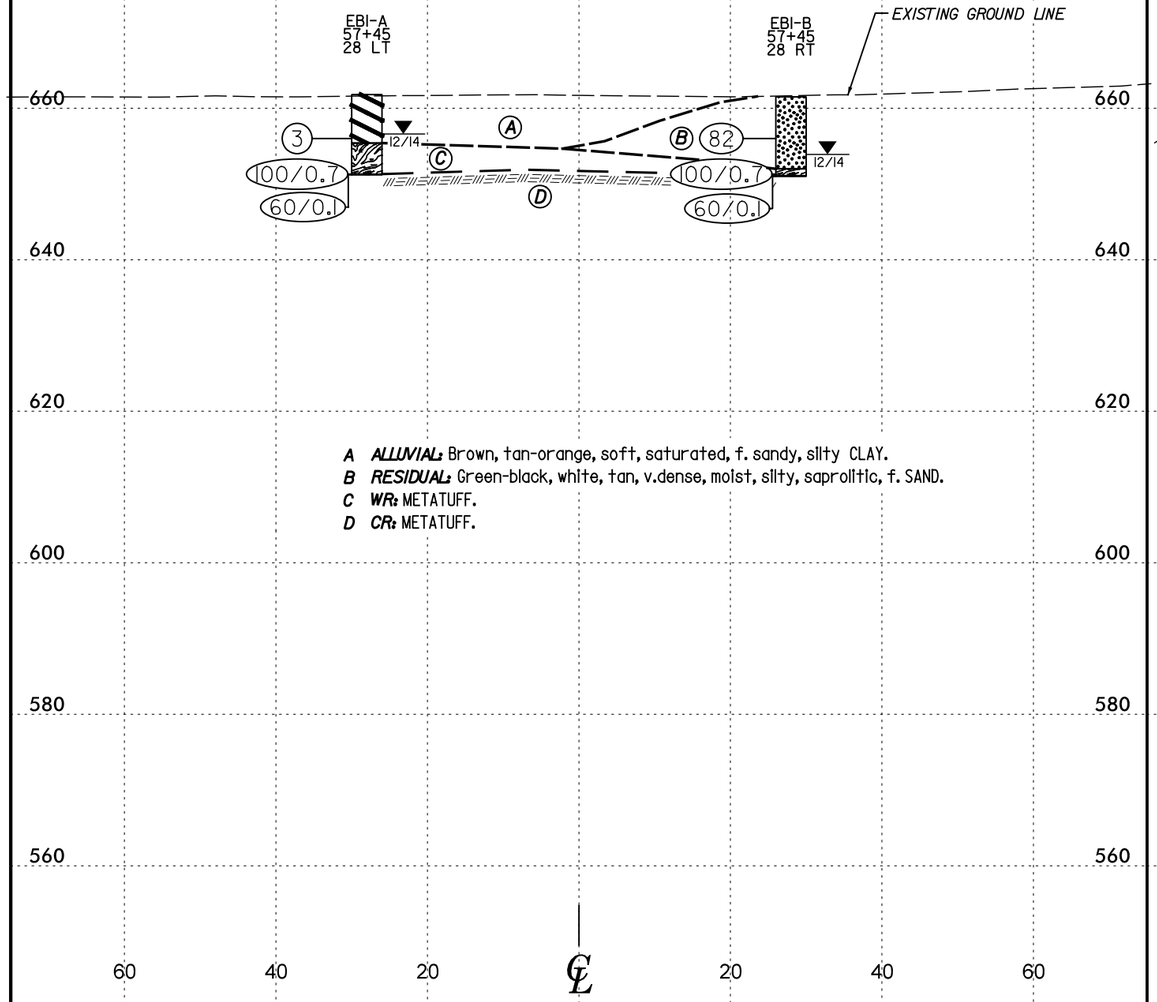
P *CR:* Pink-red, gray, green, brown-orange stain, mod. sev. weathered w/seams sev. to completely weathered, mod. hard to hard, v. close to close fracs., med. grain w/seams f. grain METATUFF.

Q *CR:* White, pale maroon, lt. green-gray, tan-orange stain, sli. to mod. weathered, hard, close fracs., feldspar-quartz METATUFF w/trc. pyrite & vugs.

R *CR:* Black, green, gray, white & pink, v. sli. to sli. weathered, hard, close fracs., f. grain METATUFF w/abundant calcite-gypsum veining, med. to cse. grain inclusions & flow structures, trcs. pyrite grains.

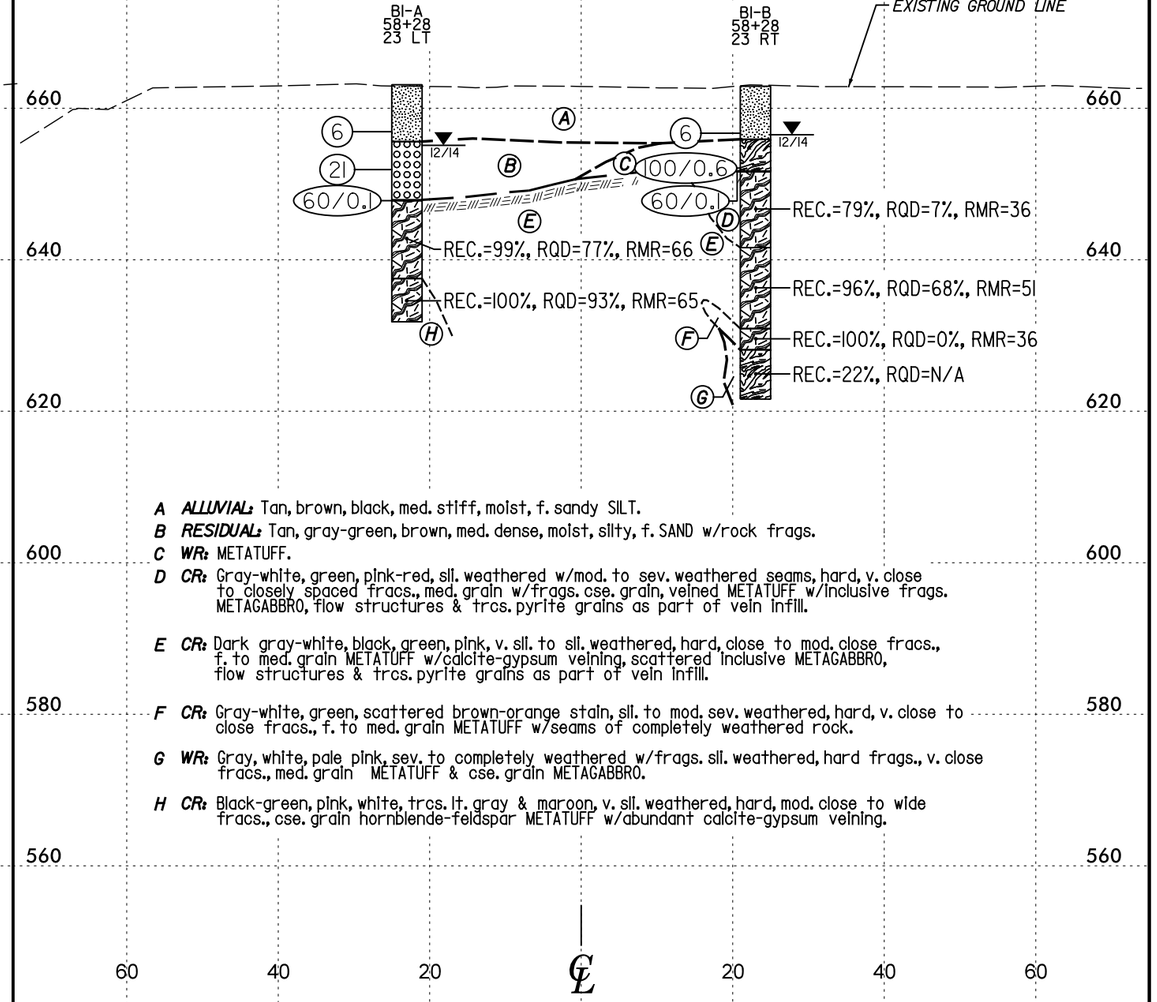
S *CR:* Black-green, pink, white, trcs. lt. gray & maroon, v. sli. weathered, hard, mod. close to wide fracs., cse. grain hornblende-feldspar METATUFF w/abundant calcite-gypsum veining.

PROJECT REFERENCE NO.	SHEET NO.
W-5516	5



A ***ALLUVIAL:*** Brown, tan-orange, soft, saturated, f. sandy, silty CLAY.
B ***RESIDUAL:*** Green-black, white, tan, v.dense, moist, silty, saprolitic, f. SAND.
C ***WR:*** METATUFF.
D ***CR:*** METATUFF.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **END BENT 1 – CROSS SECTION**



A ***ALLUVIAL:*** Tan, brown, black, med. stiff, moist, f. sandy SILT.
B ***RESIDUAL:*** Tan, gray-green, brown, med. dense, moist, silty, f. SAND w/rock frags.
C ***WR:*** METATUFF.
D ***CR:*** Gray-white, green, pink-red, sli. weathered w/mod. to sev. weathered seams, hard, v. close to closely spaced fracs., med. grain w/frags. cse. grain, veined METATUFF w/inclusive frags. METAGABBRO, flow structures & trcs. pyrite grains as part of vein infill.

E ***CR:*** Dark gray-white, black, green, pink, v. sli. to sli. weathered, hard, close to mod. close fracs., f. to med. grain METATUFF w/calcite-gypsum veining, scattered inclusive METAGABBRO, flow structures & trcs. pyrite grains as part of vein infill.

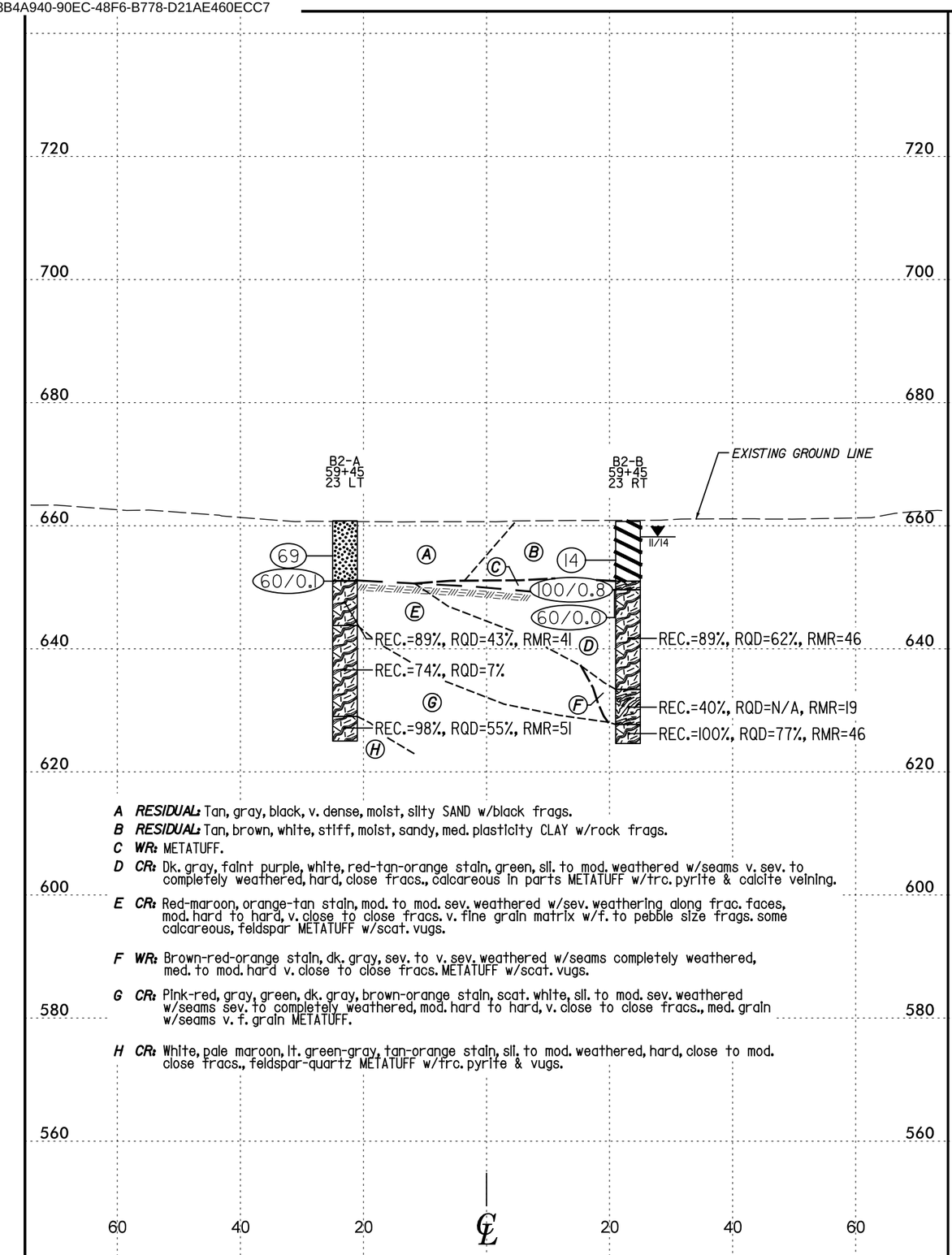
F ***CR:*** Gray-white, green, scattered brown-orange stain, sli. to mod. sev. weathered, hard, v. close to close fracs., f. to med. grain METATUFF w/seams of completely weathered rock.

G ***WR:*** Gray, white, pale pink, sev. to completely weathered w/frags. sli. weathered, hard frags., v. close fracs., med. grain METATUFF & cse. grain METAGABBRO.

H ***CR:*** Black-green, pink, white, trcs. lt. gray & maroon, v. sli. weathered, hard, mod. close to wide fracs., cse. grain hornblende-feldspar METATUFF w/abundant calcite-gypsum veining.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | **BENT 1 – CROSS SECTION**

PROJECT REFERENCE NO.	SHEET NO.
W-5516	6



A ***RESIDUAL:*** Tan, gray, black, v. dense, moist, silty SAND w/black frags.

B ***RESIDUAL:*** Tan, brown, white, stiff, moist, sandy, med. plasticity CLAY w/rock frags.

C ***WR:*** METATUFF.

D ***CR:*** Dk. gray, faint purple, white, red-tan-orange stain, green, sil. to mod. weathered w/seams v. sev. to completely weathered, hard, close fracs., calcareous in parts METATUFF w/trc. pyrite & calcite veining.

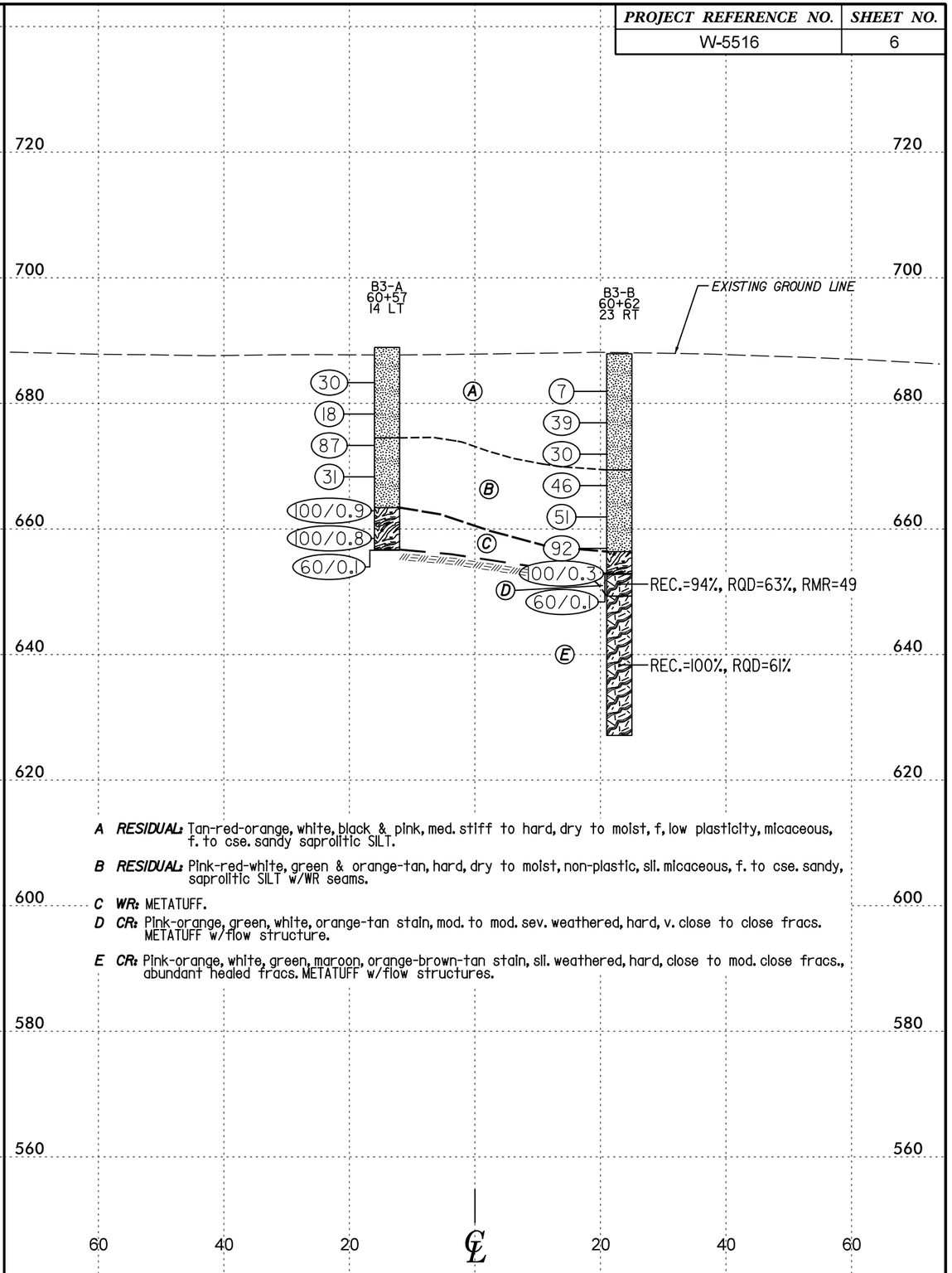
E ***CR:*** Red-maroon, orange-tan stain, mod. to mod. sev. weathered w/sev. weathering along frac. faces, mod. hard to hard, v. close to close fracs. v. fine grain matrix w/f. to pebble size frags. some calcareous, feldspar METATUFF w/scat. vugs.

F ***WR:*** Brown-red-orange stain, dk. gray, sev. to v. sev. weathered w/seams completely weathered, med. to mod. hard v. close to close fracs. METATUFF w/scat. vugs.

G ***CR:*** Pink-red, gray, green, dk. gray, brown-orange stain, scat. white, sil. to mod. sev. weathered w/seams sev. to completely weathered, mod. hard to hard, v. close to close fracs., med. grain w/seams v. f. grain METATUFF.

H ***CR:*** White, pale maroon, lt. green-gray, tan-orange stain, sil. to mod. weathered, hard, close to mod. close fracs., feldspar-quartz METATUFF w/trc. pyrite & vugs.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | ***BENT 2 – CROSS SECTION***



A ***RESIDUAL:*** Tan-red-orange, white, black & pink, med. stiff to hard, dry to moist, f, low plasticity, micaceous, f. to cse. sandy saprolitic SILT.

B ***RESIDUAL:*** Pink-red-white, green & orange-tan, hard, dry to moist, non-plastic, sil. micaceous, f. to cse. sandy, saprolitic SILT w/WR seams.

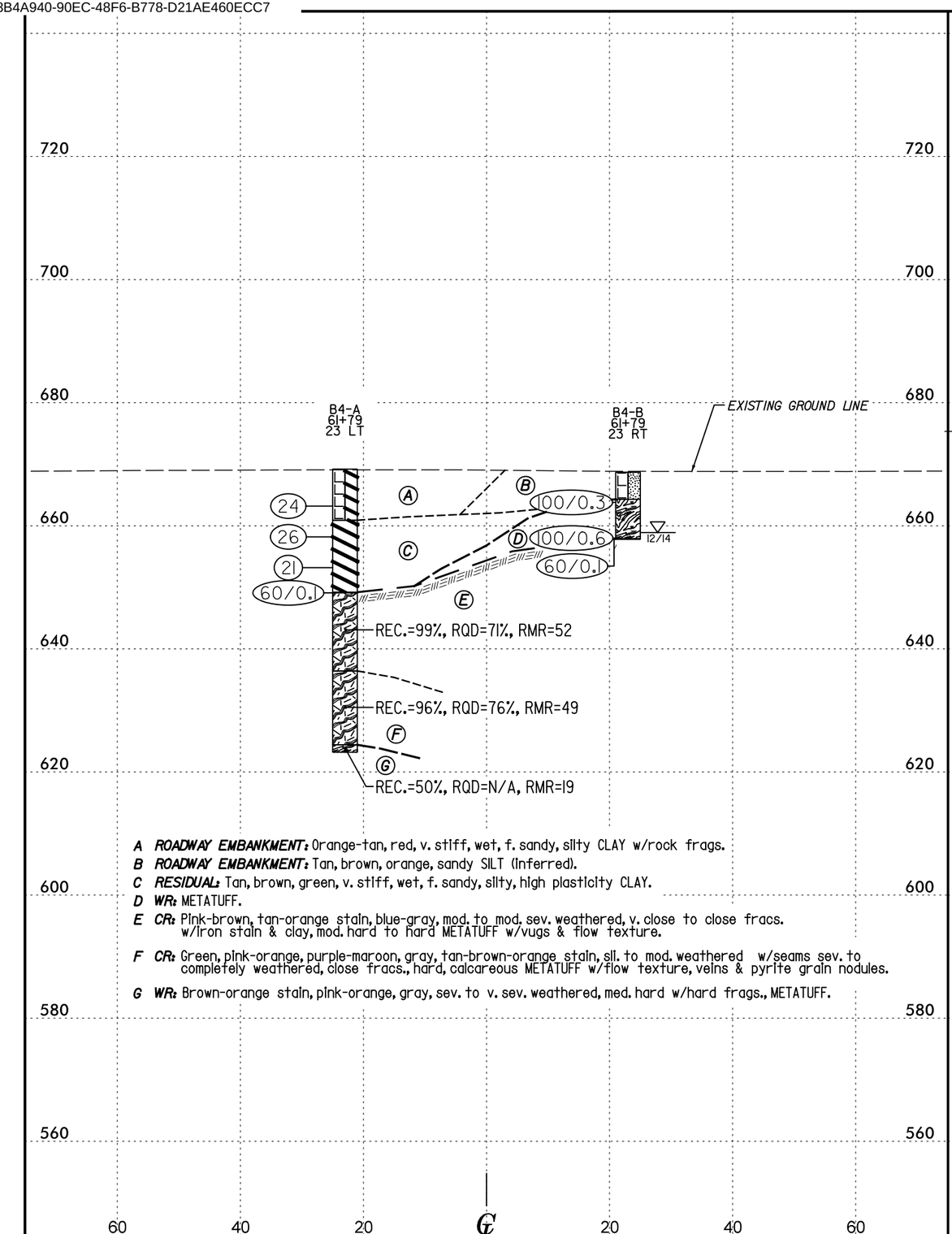
C ***WR:*** METATUFF.

D ***CR:*** Pink-orange, green, white, orange-tan stain, mod. to mod. sev. weathered, hard, v. close to close fracs. METATUFF w/flow structure.

E ***CR:*** Pink-orange, white, green, maroon, orange-brown-tan stain, sil. weathered, hard, close to mod. close fracs., abundant healed fracs. METATUFF w/flow structures.

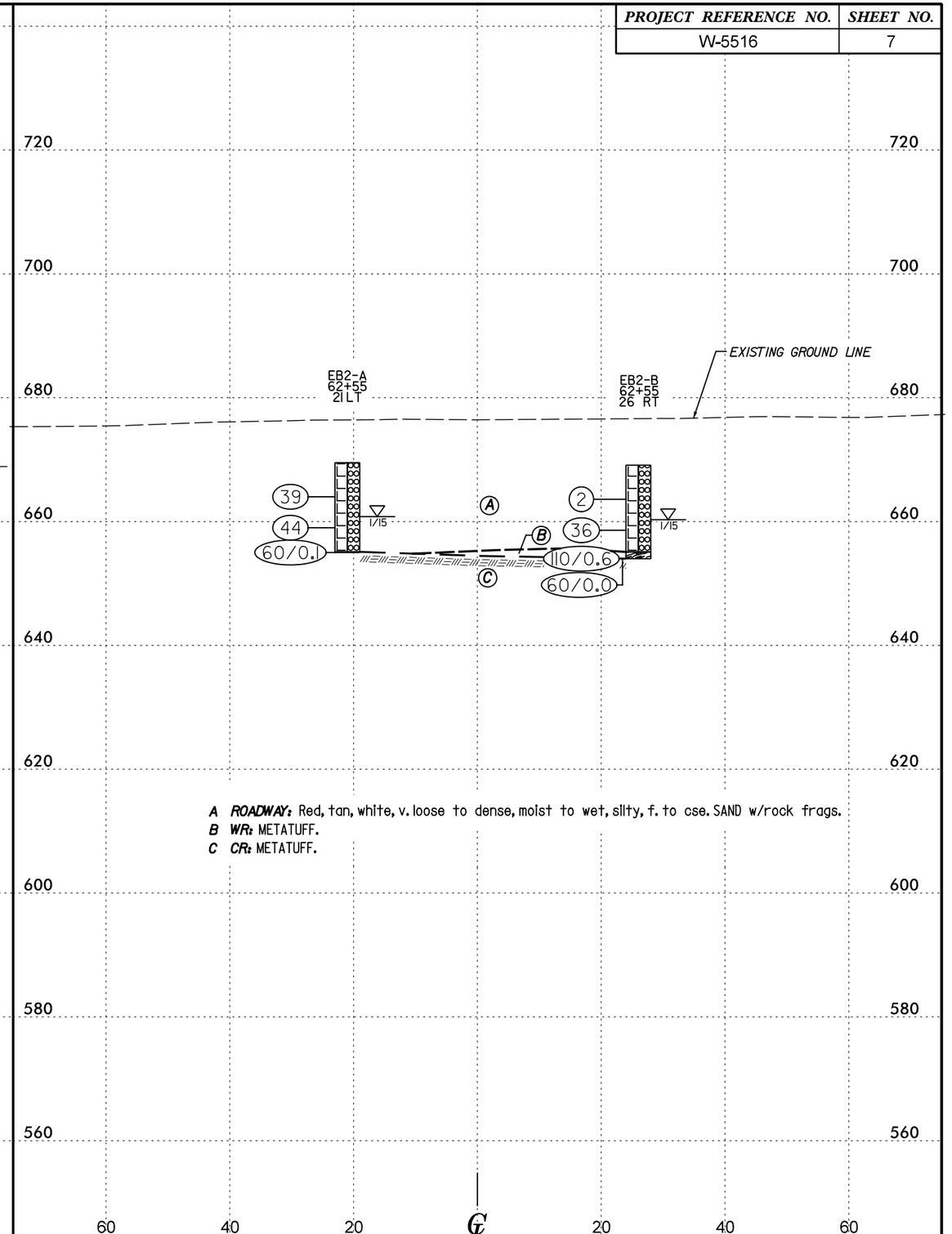
HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | ***BENT 3 – CROSS SECTION***

PROJECT REFERENCE NO.	SHEET NO.
W-5516	7



A ***ROADWAY EMBANKMENT:*** Orange-tan, red, v. stiff, wet, f. sandy, silty CLAY w/rock frags.
B ***ROADWAY EMBANKMENT:*** Tan, brown, orange, sandy SILT (Inferred).
C ***RESIDUAL:*** Tan, brown, green, v. stiff, wet, f. sandy, silty, high plasticity CLAY.
D ***WR:*** METATUFF.
E ***CR:*** Pink-brown, tan-orange stain, blue-gray, mod. to mod. sev. weathered, v. close to close fracs. w/iron stain & clay, mod. hard to hard METATUFF w/vugs & flow texture.
F ***CR:*** Green, pink-orange, purple-maroon, gray, tan-brown-orange stain, sli. to mod. weathered w/seams sev. to completely weathered, close fracs., hard, calcareous METATUFF w/flow texture, veins & pyrite grain nodules.
G ***WR:*** Brown-orange stain, pink-orange, gray, sev. to v. sev. weathered, med. hard w/hard frags., METATUFF.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | ***BENT 4 – CROSS SECTION***



A ***ROADWAY:*** Red, tan, white, v. loose to dense, moist to wet, silty, f. to cse. SAND w/rock frags.
B ***WR:*** METATUFF.
C ***CR:*** METATUFF.

HORIZ. SCALE (FEET) 0 20 40 | VE = NONE | ***END BENT 2 – CROSS SECTION***

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 57+45	**OFFSET** 28 ft LT	**ALIGNMENT** -L-	**0 HR.** 3.9
COLLAR ELEV. 661.8 ft	**TOTAL DEPTH** 10.6 ft	**NORTHING** 653,409	**EASTING** 1,531,357	**24 HR.** 5.2
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 12/11/14	**COMP. DATE** 12/11/14	**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)
665												
										GROUND SURFACE	661.8	0.0
660										**ALLUVIAL** Brown, tan-orange, soft, f. sandy, silty, high plasticity **CLAY** (A-7-6).		
	657.0	4.8	3	2	1	3		Sat.				
655										**WEATHERED ROCK** Metatuff	655.4	6.4
	652.0	9.8										
	651.3	10.5	19 60/0.1	81/0.2		100/0.7 60/0.1				**CRYSTALLINE ROCK** Metatuff	651.3	10.5
										Boring Terminated with Standard Penetration Test Refusal at Elevation 651.2 ft in Crystalline Rock (Metatuff).	651.2	10.6

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 57+45	**OFFSET** 28 ft RT	**ALIGNMENT** -L-	**0 HR.** 3.7
COLLAR ELEV. 661.5 ft	**TOTAL DEPTH** 10.5 ft	**NORTHING** 653,353	**EASTING** 1,531,357	**24 HR.** 7.6
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 12/11/14	**COMP. DATE** 12/11/14	**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)
665												
										GROUND SURFACE	661.5	0.0
660										**RESIDUAL** Green-black, white, tan, v. dense, silty, saprolitic, f. **SAND** (A-2-4).		
	657.0	4.5	21	29	53	82	SS-30	M				
655												
	652.0	9.5										
	651.1	10.4	40 60/0.1	60/0.2		100/0.7 60/0.1				**WEATHERED ROCK** Metatuff	651.1	10.4
										CRYSTALLINE ROCK Metatuff	651.0	10.5
										Boring Terminated with Standard Penetration Test Refusal at Elevation 651.0 ft in Crystalline Rock (Metatuff).		

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 58+28	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 663.1 ft	**TOTAL DEPTH** 31.3 ft	**NORTHING** 653,404	**EASTING** 1,531,440	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/10/14	**COMP. DATE** 12/10/14	**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)
665											
										663.1 GROUND SURFACE	0.0
660										**ALLUVIAL** Tan, brown, black, med. stiff, f. sandy **SILT** (A-4).	
	657.9	5.2	2	2	4	6	SS-29	M			
655										655.6	7.5
	652.9	10.2	6	8	13	21	SS-32	M		**RESIDUAL** Tan, gray-green, brown, med. dense, silty, f. **SAND** w/rock frags. (A-1-b).	
650											
	647.9	15.2	60/0.1			60/0.1				647.9	15.2
645										647.8 **CRYSTALLINE ROCK** Metatuff	15.3
							RS-8			**CRYSTALLINE ROCK** Metatuff	
640											
										637.5 Metatuff	25.6
635							RS-11				
										631.8	31.3
										Boring Terminated at Elevation 631.8 ft in Crystalline Rock (Metatuff). Driller did not obtain immediate water table reading.	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

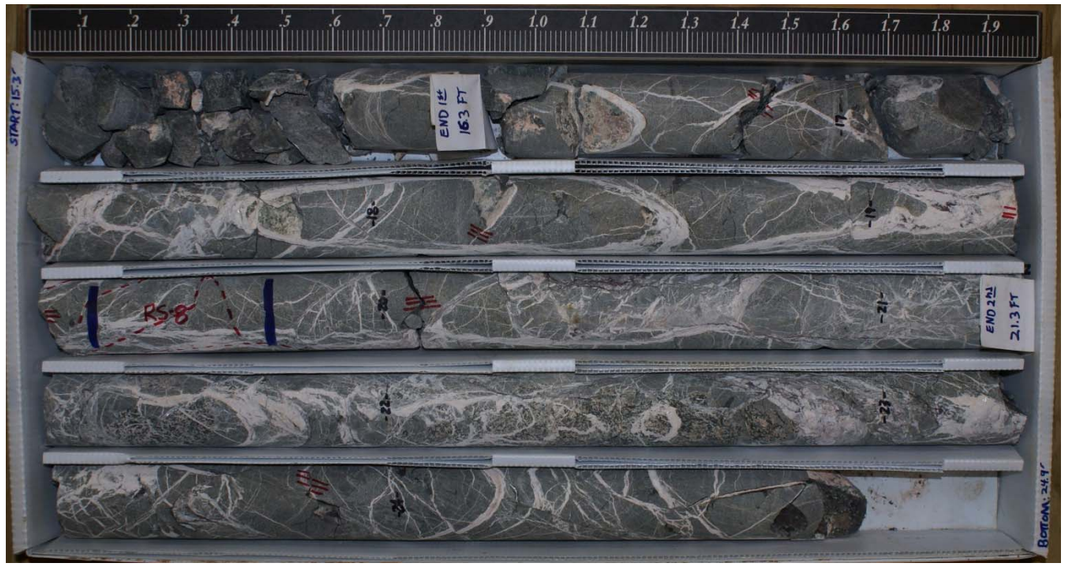
WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 58+28	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 663.1 ft	**TOTAL DEPTH** 31.3 ft	**NORTHING** 653,404	**EASTING** 1,531,440	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/10/14	**COMP. DATE** 12/10/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**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
647.8											Begin Coring @ 15.3 ft
	647.8	15.3	1.0	2:54	(0.9)	(0.0)		(10.2)	(7.9)		ELEV. (ft) 647.8 **CRYSTALLINE ROCK** DEPTH (ft) 15.3
	646.8	16.3		2:29	90%	0%		99%	77%		Black, green, gray, white & pink, v. slight to slightly weathered, hard,
645			5.0	2:58	(5.0)	(4.0)					close to mod. close frac. spacing, fine grain metatuff w/abundant calcite,
				2:48	100%	80%					vein infill to 10 mm, med. to cse. grain inclusions & some flow structures,
				3:03			RS-8				trace pyrite.
	641.8	21.3		3:33							3 60° jts. w/calcite infill to 5 mm; 3 30° jts. w/calcite & gypsum infill to 3
			5.0	3:15	(5.0)	(4.4)					mm; 1 0° jt. w/rough walls.
640				3:43	100%	88%					R1=2, R2=17, R3=20, R4=20, R5=7, RMR=66
				3:42							Rock Type D
				3:19							
	636.8	26.3		3:18							ELEV. (ft) 637.5 DEPTH (ft) 25.6
			5.0	3:00	(5.0)	(4.8)		(5.7)	(5.3)		Black-green, pink, white, trcs. lt. gray, maroon, v. slightly weathered,
635				3:45	100%	96%	RS-11	100%	93%		hard, mod. close to wide frac. spacing, cse. grain hornblende, feldspar,
				3:20							metatuff w/abundant calcite veining infill to 5 mm.
				3:13							3 50°-60° jts. rough w/trcs. clay; 2 25°-30° jts. w/trcs. clay or calcite infill
	631.8	31.3		2:29							to 2 mm.
											ELEV. (ft) 631.8 DEPTH (ft) 31.3
											R1=1, R2=20, R3=20, R4=20, R5=4, RMR=65
											Rock Type D
											Boring Terminated at Elevation 631.8 ft in Crystalline Rock (Metatuff).
											Driller did not obtain immediate water table reading.

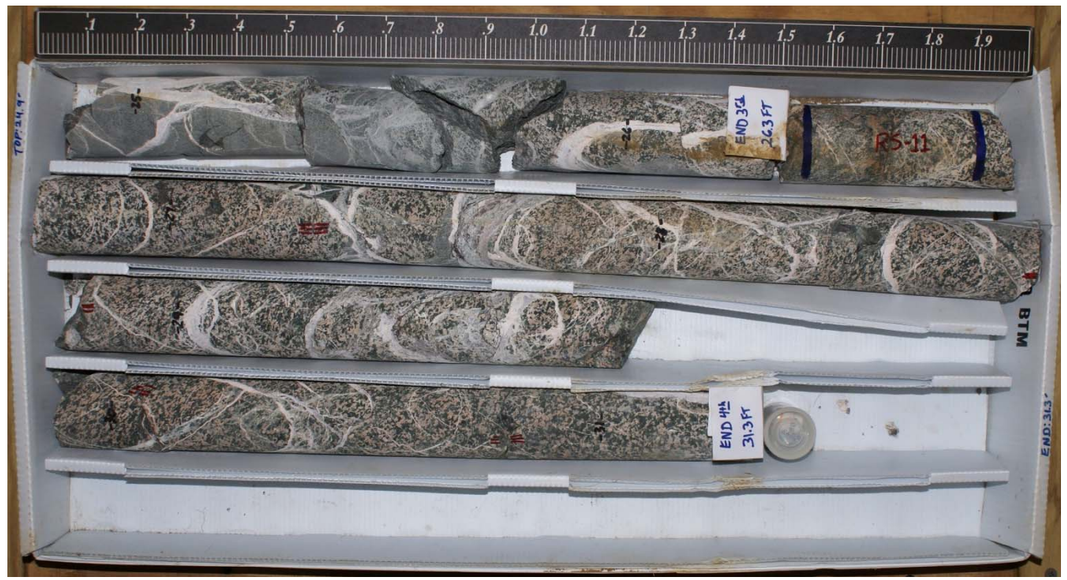
CORE PHOTOGRAPHIC RECORD

Bridge #339 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIP W-6615



B1-A, 58+28.40 @ 23’ LT. Box 1 of 2



B1-A, 58+28.40 @ 23’ LT. Box 2 of 2

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 58+28	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 662.9 ft	**TOTAL DEPTH** 41.3 ft	**NORTHING** 653,358	**EASTING** 1,531,440	**24 HR.** 6.4
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/10/14	**COMP. DATE** 12/11/14	**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)
665											
										662.9 GROUND SURFACE	0.0
660										**ALLUVIAL** Tan, brown, med. stiff, f. sandy **SILT** (A-4).	
	657.7	5.2	2	3	3	6		M			
655										655.9 **WEATHERED ROCK** Metatuff	7.0
	652.7	10.2									
	651.7	11.2	67	33/0.1		100/0.6				651.7	11.2
650			60/0.1			60/0.1				651.6 **CRYSTALLINE ROCK** Metatuff	11.3
										CRYSTALLINE ROCK Metatuff	
645							RS-4				
640							RS-5			641.6 Metatuff	21.3
635											
630										630.9 Metatuff	32.0
										628.1 **WEATHERED ROCK** Metatuff & Metagabbro	34.8
625											
										621.6	41.3
										Boring Terminated at Elevation 621.6 ft in Weathered Rock (Metatuff & Metagabbro). Driller did not obtain immediate water table reading.	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

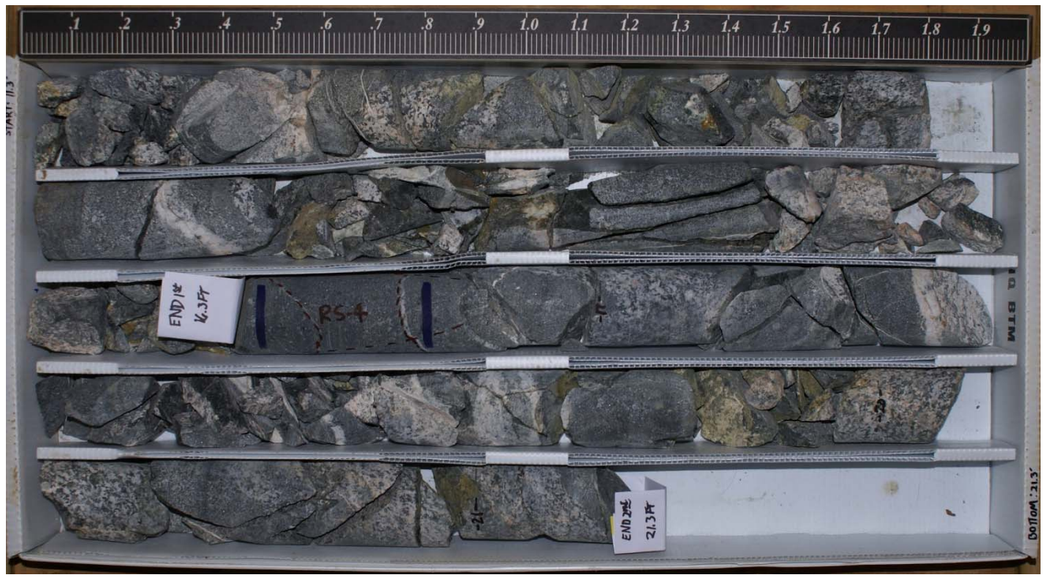
WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 58+28	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 662.9 ft	**TOTAL DEPTH** 41.3 ft	**NORTHING** 653,358	**EASTING** 1,531,440	**24 HR.** 6.4
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 12/10/14	**COMP. DATE** 12/11/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 30.0 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
651.6											Begin Coring @ 11.3 ft
650	651.6	11.3	5.0	2:28 2:29 3:28 3:36 2:27	(3.8) 76%	(0.0) 0%		(7.9) 79%	(0.7) 7%		**CRYSTALLINE ROCK** 11.3 Gray-white, green, pink-red, slightly weathered w/mod. weathered to sev. weathered seams, hard, v. close to closely spaced fracs., med. grain w/frags. cse. grain, veining, metatuff w/inclusive frags. metagabbro, trcs. pyrite grains lining jts. 4 70°-90° jts. trcs. clay; 11 50°-60° jts. some w/clay <1 mm; 20+ 0°-20° jts. clay & iron stain. R1=4, R2=3, R3=10, R4=12, R5=7, RMR=36 Rock Type D
645	646.6	16.3	5.0	2:49 2:08 2:11 4:27 2:23	(4.1) 82%	(0.7) 14%	RS-4				
640	641.6	21.3	5.0	2:10 2:51 2:11 2:16 4:28	(5.0) 100%	(3.8) 76%	RS-5	(10.3) 96%	(7.3) 68%		641.6 21.3 Dk. gray-white, green, v. slight to slight weathered, hard, close to mod. close fracs, f. to med. grain, metatuff w/veining & scattered inclusive metagabbro, trcs. pyrite grains as part of vein infill. 9 40°-65° jts. w/trac. clay; 14 10°-30° jts. w/iron stain. R1=4, R2=13, R3=10, R4=20, R5=4, RMR=51 Rock Type D
635	636.6	26.3	5.0	2:29 1:23 1:31 1:31 1:18	(4.6) 92%	(3.5) 70%					
630	631.6	31.3	5.0	1:38 2:34 1:57 2:37 2:30	(3.7) 74%	(0.0) 0%		(2.8) 100%	(0.0) 0%		630.9 32.0 Gray-white, green, scat. brown-orange stain, sli. to mod. sev. weathered, hard, v. close to closely spaced fracs., f. to med. grain, metatuff w/seams of completely weathered rock.
625	626.6	36.3	5.0	1:12 2:20 2:13 3:06 2:32	(1.2) 24%	N/A		(1.4) 22%	N/A		628.1 34.8 2+ 80°-90° jts. w/scat. pyrite & clay; 7+ 40°-50° jts. w/clay & iron stain; 10+ 20°-30° jts. w/iron stain & infill to 3 mm. R1=4, R2=3, R3=10, R4=12, R5=7, RMR=36 Rock Type D
	621.6	41.3									**WEATHERED ROCK** 621.6 41.3 Gray, white, pale pink, sev. to completely weathered w/frags. sli. weathered, hard frags., v. close frac. spacing, med. grain metatuff & cse grain metagabbro. Boring Terminated at Elevation 621.6 ft in Weathered Rock (Metatuff & Metagabbro). Driller did not obtain immediate water table reading.

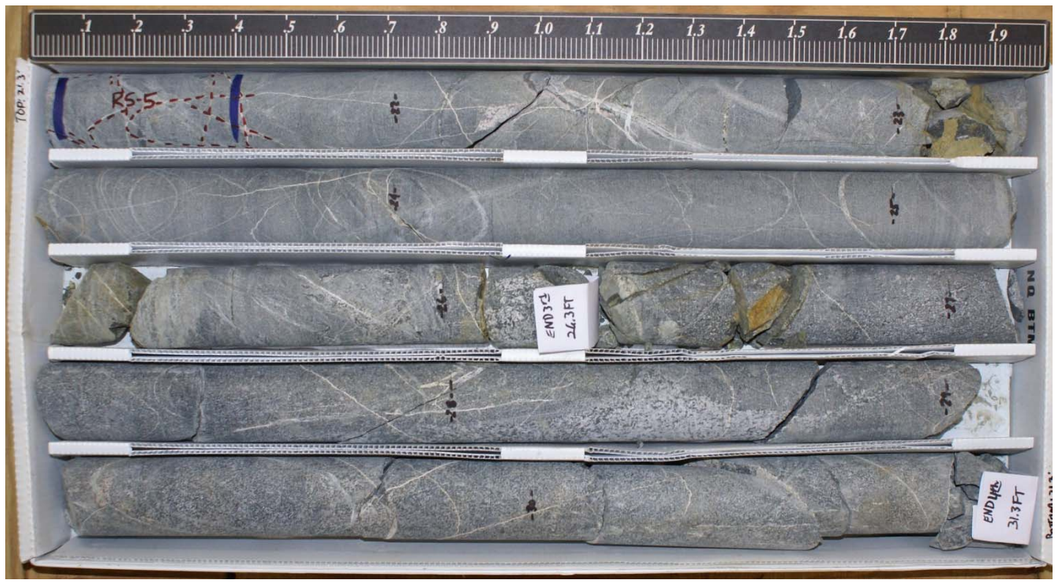
CORE PHOTOGRAPHIC RECORD

Bridge #399 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIPW-5516



B1-B, 58 + 28.40 @ 23’ RT. Box 1 of 3



B1-B, 58 + 28.40 @ 23’ RT. Box 2 of 3

B1-B, 58 + 28.40 @ 23’ RT. Box 3 of 3

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 59+45	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 660.8 ft	**TOTAL DEPTH** 35.8 ft	**NORTHING** 653,404	**EASTING** 1,531,567	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 11/22/14	**COMP. DATE** 11/24/14	**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)
665										
660										660.8 GROUND SURFACE 0.0
	656.1	4.7	11	17	52	69		M		**ROADWAY EMBANKMENT** Tan, gray, black, v. dense, silty **SAND** w/black frags. (A-2-4).
655										
	651.1	9.7	60/0.1			60/0.1				651.1 9.7
650										651.0 9.8 **CRYSTALLINE ROCK** Metatuff
							RS-3			**CRYSTALLINE ROCK** Metatuff
645										
										643.8 17.0 Metatuff
640										
635										
630										629.0 31.8 Metatuff
625										625.0 35.8
										Boring Terminated at Elevation 625.0 ft in Crystalline Rock (Metatuff). Driller did not obtain immediate water table reading.

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 59+45	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 660.8 ft	**TOTAL DEPTH** 35.8 ft	**NORTHING** 653,404	**EASTING** 1,531,567	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 11/22/14	**COMP. DATE** 11/24/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 26.0 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)
651											Begin Coring @ 9.8 ft
650	651.0	9.8	1.0	3:11	(0.7)	(0.6)		(6.4)	(3.1)		651.0 — **CRYSTALLINE ROCK** — 9.8
	650.0	10.8	5.0	2:10	70%	60%		89%	43%		Red-maroon, orange-tan stain, mod. to mod. sev. weathered w/sev. weathering along frac. faces, mod. hard to hard, v. close to closely spaced fracs., v. fine grain matrix w/f. to pebble size fragments, some calcareous, feldspar metatuff w/scattered vugs.
				4:06	(4.5)	(2.0)	RS-3				3 60°-70° jts. w/rough walls; 5 30°-50° jts. w/smooth to stepped walls; 14
645	645.0	15.8		2:16	90%	40%					0°-20° jts. w/trcs. clay < 1 mm.
				1:38							643.8 — 17.0
			5.0	3:38	(3.7)	(0.9)		(10.9)	(1.1)		R1=4, R2=8, R3=10, R4=12, R5=7, RMR=41
				1:49	74%	18%		74%	7%		Rock Type D
640	640.0	20.8		2:36							Pink-red, gray, green, brown-orange stain, mod. sev. weathered w/seams sev. to completely weathered, v. close to close frac. spacing, med. grain w/seams v. fine grain, metatuff.
				1:43							2 85°-90° jts. w/iron precipitate; 4+ 60° jts. w/heavy iron stain; 19+
				3:13							20°-30° jts. w/iron stain.
				4:23							
			5.0	1:57	(4.0)	(0.7)					
				1:43	80%	14%					
				2:13							
635	635.0	25.8		2:59							
				2:23							
			5.0	2:18	(4.1)	(0.0)					
				1:55	82%	0%					
				2:42							
				4:25							
630	630.0	30.8		2:14							629.0 — 31.8
			5.0	1:56	(4.2)	(2.8)		(3.9)	(2.2)		White, pale maroon, lt. green-gray, tan-orange stain, sli. to mod. weathered, hard, close to mod. close frac. spacing, feldspar, quartz, metatuff w/trace pyrite & vugs.
				2:29	84%	56%		98%	55%		1 90° jt. healed w/iron stain; 1 50° jt. w/iron stain; 5 10°-20° jts. w/iron
				3:49							stain.
				4:23							R1=4, R2=13, R3=10, R4=20, R5=4, RMR=51
625	625.0	35.8		2:51							Rock Type D
											625.0 — 35.8
											Boring Terminated at Elevation 625.0 ft in Crystalline Rock (Metatuff).

Driller did not obtain immediate water table reading.

CORE PHOTOGRAPHIC RECORD

Bridge #399 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIP W-5516

B2-A, 59 + 45.40 @ 23’ LT. Box 1 of 3

B2-A, 59 + 45.40 @ 23’ LT. Box 2 of 3

B2-A, 59 + 45.40 @ 23’ LT. Box 3 of 3

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 59+45	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** 2.7
COLLAR ELEV. 660.7 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 653,358	**EASTING** 1,531,567	**24 HR.** 2.5
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 11/21/14	**COMP. DATE** 11/22/14	**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)
665										
										660.7 GROUND SURFACE 0.0
660										**ROADWAY EMBANKMENT** Tan, brown, white, stiff, sandy, med. plasticity **CLAY** w/rock frags. (A-7-6).
	655.4	5.3	5	7	7	14	SS-33	M		
655										651.0 9.7
	650.4	10.3								**WEATHERED ROCK** Metatuff
650	649.6	11.1	41	59/0.3		100/0.8				649.6 11.1
			60/0.0			60/0.0				**CRYSTALLINE ROCK** Metatuff
645							RS-9			
640										
635										633.4 27.3
										WEATHERED ROCK Metatuff
630										627.7 33.0
										CRYSTALLINE ROCK Metatuff
625										624.6 36.1
										Boring Terminated at Elevation 624.6 ft in Crystalline Rock (Metatuff).

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

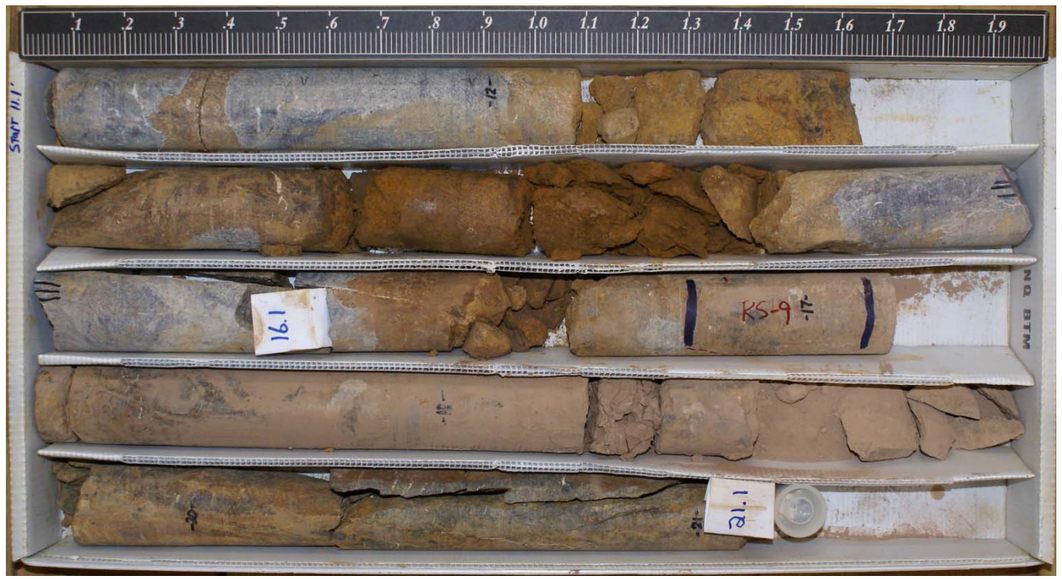
WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 59+45	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** 2.7
COLLAR ELEV. 660.7 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 653,358	**EASTING** 1,531,567	**24 HR.** 2.5
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 11/21/14	**COMP. DATE** 11/22/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 25.0 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
649.6											Begin Coring @ 11.1 ft
645	649.6	11.1	5.0	*N=60/0.0* 2:50 1:32 3:53 2:20 3:02	(4.0) 80%	(2.2) 44%		(14.4) 89%	(10.1) 62%		649.6 — **CRYSTALLINE ROCK** — 11.1 Dk. gray, lt. gray, faint purple, white, red-tan-orange stain, green, slight to mod. weathered w/seams v. sev. to completely weathered, hard, closely spaced fracs., calcareous in parts, metatuff w/trace pyrite & calcite veining. 3 85°-90° jts. w/iron precipitate & stain, <1mm; 2 80° jts. healed w/calcite crystals to 1 mm; 5 60°-70° jts. w/iron precipitate & clay to 1 mm; 23 0°-20° jts. w/iron precipitate, stain & clay. R1=4, R2=13, R3=10, R4=12, R5=7, RMR=46 Rock Type D
640	644.6	16.1	5.0	1:34 3:49 4:31 5:11 5:06	(4.2) 84%	(3.3) 66%	RS-9				
635	639.6	21.1	5.0	3:28 6:54 6:24 6:44 6:12	(5.0) 100%	(3.9) 78%					
630	634.6	26.1	5.0	6:05 4:17 2:02 3:08 3:35	(2.6) 52%	(0.7) 14%					633.4 — 27.3
625	629.6	31.1	5.0	2:31 4:47 5:58 4:17 4:28	(4.0) 80%	(2.4) 48%		(2.3) 40%	N/A		**WEATHERED ROCK** Brown-red-orange stain, dk. gray, sev. to v. sev. weathered w/seams completely weathered, med. to mod. hard, v. close to close frac. spacing, metatuff, contains scat. vugs. R1=1, R2=3, R3=5, R4=6, R5=4, RMR=19 Rock Type D 627.7 — 33.0
	624.6	36.1						(3.1) 100%	(2.4) 77%		**CRYSTALLINE ROCK** Dk. gray, gray, brown-orange stain, scat. white, sli. to mod. weathered, mod. hard to hard, close frac. spacing, metatuff. 1 50° jt. w/clay to 1mm; 6 0° jts. w/clay 1-2mm. R1=4, R2=13, R3=10, R4=12, R5=7, RMR=46 Rock Type D 624.6 — 36.1 Boring Terminated at Elevation 624.6 ft in Crystalline Rock (Metatuff).

CORE PHOTOGRAPHIC RECORD

Bridge #399 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIP W-5516



B2-B, 59 + 45.40 @ 23 RT. Box 1 of 3

B2-B, 59 + 45.40 @ 23 RT. Box 2 of 3

B2-B, 59 + 45.40 @ 23 RT. Box 3 of 3

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B3-A	**STATION** 60+57	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 688.9 ft	**TOTAL DEPTH** 32.3 ft	**NORTHING** 653,395	**EASTING** 1,531,668	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 79% 08/22/2013		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 11/19/13	**COMP. DATE** 11/20/13	**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
690										ELEV. (ft) DEPTH (ft)
										688.9 GROUND SURFACE 0.0
685	684.3	4.6	9	15	15	30		D		**RESIDUAL** Tan-red-orange, white & pink, v. stiff, low plasticity, sli. micaceous, saprolitic, f. to cse. sandy **SILT** (A-4).
680	679.3	9.6	4	7	11	18		M		
675	674.3	14.6	33	50	37	87		D		674.5 14.4 Pink-white & orange-tan, non-plastic to low plasticity, sli. micaceous, f. to cse. sandy, saprolitic **SILT** (A-4).
670	669.3	19.6	9	15	16	31		D		
665	664.3	24.6	10	21	79/0.4	100/0.9				663.4 25.5 **WEATHERED ROCK** Metatuff
660	659.3	29.6	31	69/0.3		100/0.8				
	656.7	32.2	60/0.1			60/0.1				656.7 32.2 656.6 32.3 **CRYSTALLINE ROCK** Metavolcanic flow rock/Metatuff Boring Terminated with Standard Penetration Test Refusal at Elevation 656.6 ft in Crystalline Rock (Metavolcanic Flow Rock/Metatuff).

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 60+62	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 687.9 ft	**TOTAL DEPTH** 60.8 ft	**NORTHING** 653,359	**EASTING** 1,531,674	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/08/14	**COMP. DATE** 12/09/14	**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)
690										
	687.9	0.0								**687.9 GROUND SURFACE 0.0**
685										**RESIDUAL** Tan-red-orange, white, black & pink, med. stiff to hard, low plasticity, micaceous, f. to cse. sandy, saprolitic **SILT** (A-4).
	682.9	5.0	2	3	4	7	SS-34	D		
680										
	677.9	10.0	7	9	30	39		D		
675										
	672.9	15.0	9	13	17	30	SS-35	D		
670										
	669.4	18.5								**669.4 18.5** Tan-pink, red, green, white, hard, saprolitic, f. to cse. sandy **SILT** (A-4).
	667.9	20.0	8	20	26	46		D		
665										
	662.9	25.0	14	22	29	51	SS-36	M		
660										
	657.9	30.0	21	39	53	92		M		
655										
	653.2	34.7								
	652.9	35.0	100/0.3			100/0.3				
			60/0.1			60/0.1	RS-10			
650										
										656.4 31.5 WEATHERED ROCK Metatuff
645										**652.9 35.0**
										652.8 35.1 CRYSTALLINE ROCK Metatuff
640										**649.3 38.6 CRYSTALLINE ROCK** Metatuff Metatuff
635										
630										**627.1 60.8** Boring Terminated at Elevation 627.1 ft in Crystalline Rock (Metatuff). Driller did not obtain immediate water table reading.

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 60+62	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 687.9 ft	**TOTAL DEPTH** 60.8 ft	**NORTHING** 653,359	**EASTING** 1,531,674	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 12/08/14	**COMP. DATE** 12/09/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 25.7 ft			

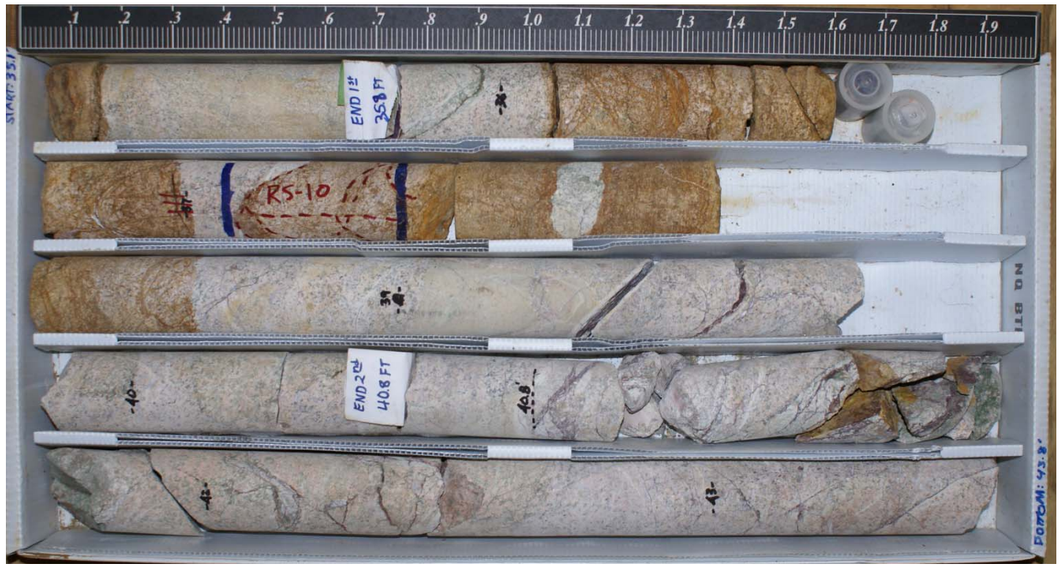
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
652.8											Begin Coring @ 35.1 ft
	652.8	35.1	0.7	3:35	(0.7)	(0.6)		(3.3)	(2.2)		**CRYSTALLINE ROCK**
	652.1	35.8		2:53	100%	86%		94%	63%		Pink-orange, green, white, orange-tan stain, mod. to mod. sev.
650			5.0	2:54			RS-10				weathered, hard, v. close to closely spaced fracs., metatuff w/flow
				4:03	(4.8)	(2.8)					structure.
				3:17	96%	56%					1 30° jt. w/iron stain; 1 50° jt. partially healed w/clay, <1mm; 6 0°-10° jts.
	647.1	40.8		3:38				(22.2)	(13.5)		w/iron stain; 2 60°-70° jts. healed w/clay, <1mm.
			5.0	2:56	(5.0)	(1.8)		100%	61%		R1=2, R2=13, R3=10, R4=20, R5=4, RMR=49
645				3:47	100%	36%					Rock Type D
				3:05							
				4:32							Pink-orange, white, green, maroon, orange-brown-tan stain, sli.
	642.1	45.8		6:20							weathered, hard, closely to mod. close fracs., abundant healed fracs.,
			5.0	3:50	(5.0)	(2.0)					metatuff w/flow structures.
640				2:46	100%	40%					8 70°-85° jts. w/clay, <1mm & one w/calcite infill to 7mm; 8 45°-60° jts.
				3:23							w/clay, <1mm or calcite infill to 7mm; 26 10°-30° jts. w/trcs. clay or iron
				2:57							stain.
	637.1	50.8		3:17							
			5.0	3:16	(5.0)	(3.7)					
635				3:12	100%	74%					
				4:00							
				3:40							
	632.1	55.8		3:22							
			5.0	3:22	(5.0)	(4.8)					
630				2:40	100%	96%					
				3:10							
				3:10							
	627.1	60.8		3:01							
											Boring Terminated at Elevation 627.1 ft in Crystalline Rock (Metatuff).
											Driller did not obtain immediate water table reading.

652.8 ELEV. (ft) — 35.1 DEPTH (ft)
649.3 ELEV. (ft) — 38.6 DEPTH (ft)
627.1 ELEV. (ft) — 60.8 DEPTH (ft)

CORE PHOTOGRAPHIC RECORD

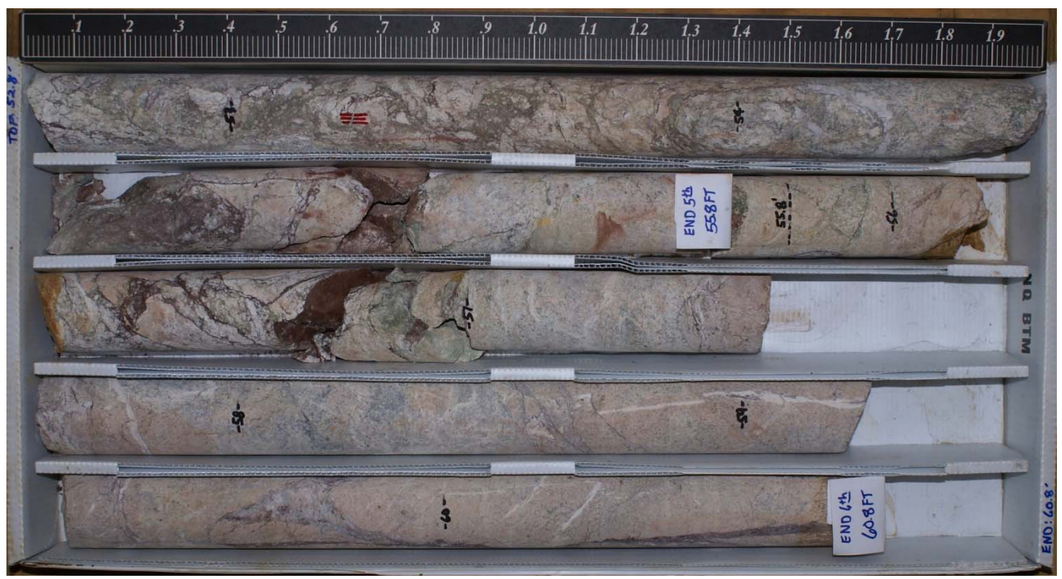
Bridge #399 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIP W-5516



B3-B, 60 + 62.40 @ 23’RT. Box 1 of 3

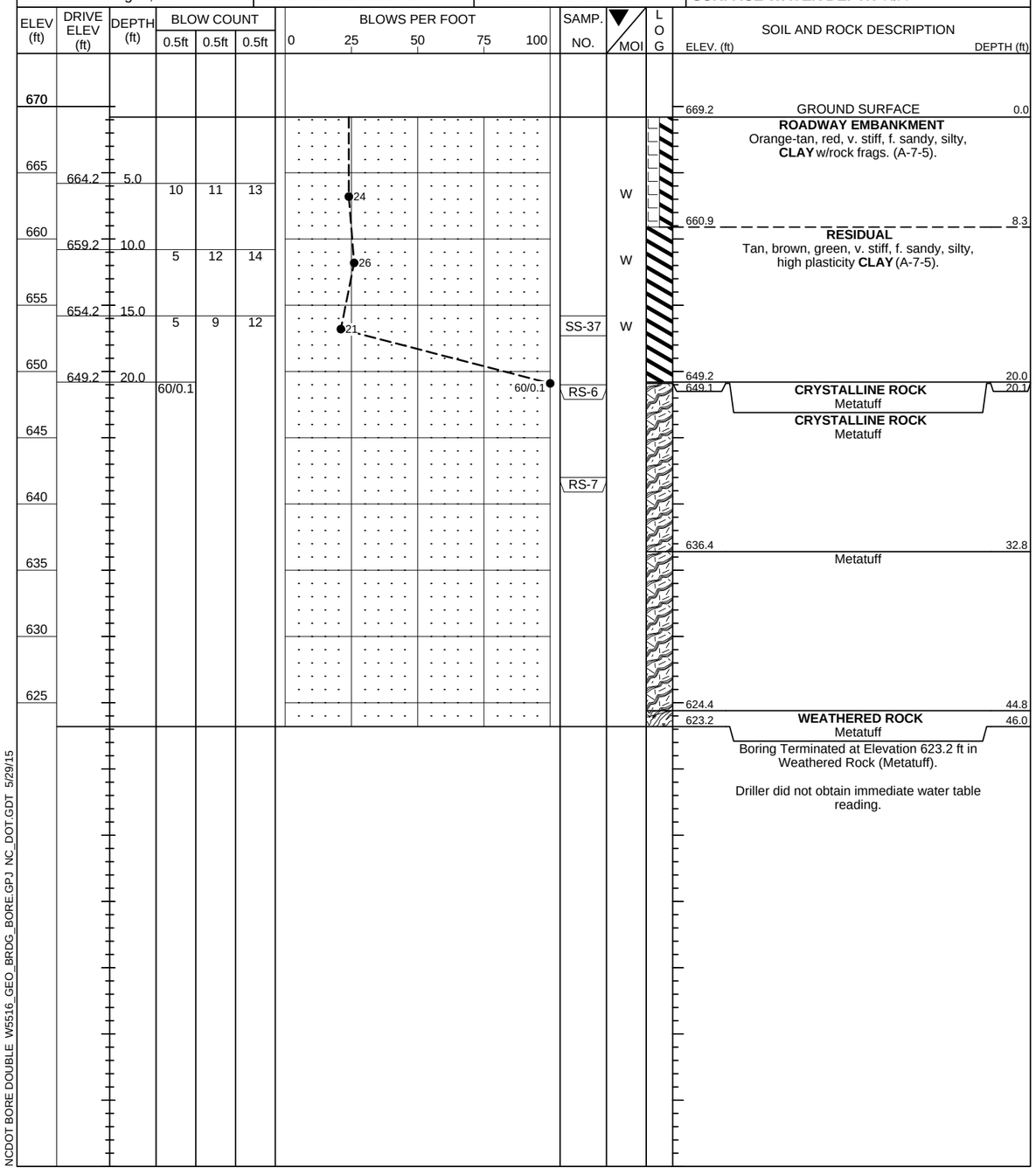
B3-B, 60 + 62.40 @ 23’RT. Box 2 of 3



B3-B, 60 + 62.40 @ 23’RT. Box 3 of 3

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 61+79	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 669.2 ft	**TOTAL DEPTH** 46.0 ft	**NORTHING** 653,405	**EASTING** 1,531,791	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/14/14	**COMP. DATE** 12/14/14	**SURFACE WATER DEPTH** N/A	



NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 61+79	**OFFSET** 23 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 669.2 ft	**TOTAL DEPTH** 46.0 ft	**NORTHING** 653,405	**EASTING** 1,531,791	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 12/14/14	**COMP. DATE** 12/14/14	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 25.9 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
649.1											Begin Coring @ 20.1 ft
	649.1	20.1	0.9	1:37	(0.9)	(0.7)	RS-6	(12.6)	(9.0)		649.1 **CRYSTALLINE ROCK** 20.1
	648.2	21.0	5.0	1:25	100%	78%		99%	71%		Pink-brown, tan-orange stain, blue-gray, mod. to mod. sev. weathered, v. close to mod. close frac. spacing w/iron stain & clay, hard to mod. hard, metatuff w/vugs & flow texture.
				2:10	(5.0)	(2.8)					1 70° jt. w/clay <1 mm; 7 40°-60° jts. w/iron stain & clay to 1 mm; 19 20° jts. w/heavy iron stain & clay to 1 mm; numerous healed jts. w/infill <1 mm.
645				1:58	100%	56%					R1=2, R2=13, R3=10, R4=20, R5=7, RMR=52
				1:54							Rock Type D
	643.2	26.0		1:39							
			5.0	1:38	(4.9)	(3.8)	RS-7				
				1:58	98%	76%					
640				1:52							
				1:51							
	638.2	31.0		2:38							
			5.0	2:20	(4.5)	(3.4)					636.4 32.8
				1:54	90%	68%					
635				3:59				(11.5)	(9.1)		Green, pink-orange, purple-maroon, gray, tan-brown-orange stain, slight to mod. weathered w/seams sev. to completely weathered (32.8'-34.3' & 38.4'-38.7'), hard, closely spaced fracs., calcareous, metatuff w/flow texture & vein infill to 5 mm, nodules w/pyrite grains.
				3:37				96%	76%		1 75° jt. w/calcite crystal growth to 2 mm; 11 0°-30° jts. w/iron stain.
	633.2	36.0		3:19							R1=2, R2=13, R3=10, R4=20, R5=4, RMR=49
			5.0	3:10	(5.0)	(4.0)					Rock Type D
				2:20	100%	80%					
630				6:28							
				3:37							
	628.2	41.0		3:51							
			5.0	3:50	(4.4)	(3.4)					
				3:11	88%	68%					
625				3:05							
				3:15							624.4 44.8
	623.2	46.0		1:44				(0.6)	NA		623.2 **WEATHERED ROCK** 46.0
								50%			Brown-orange stain, pink-orange, gray, sev. to v. sev. weathered, med. hard w/hard frags., metatuff.
											R1=1, R2=3, R3=5, R4=6, R5=4, RMR=19
											Rock Type D
											Boring Terminated at Elevation 623.2 ft in Weathered Rock (Metatuff).

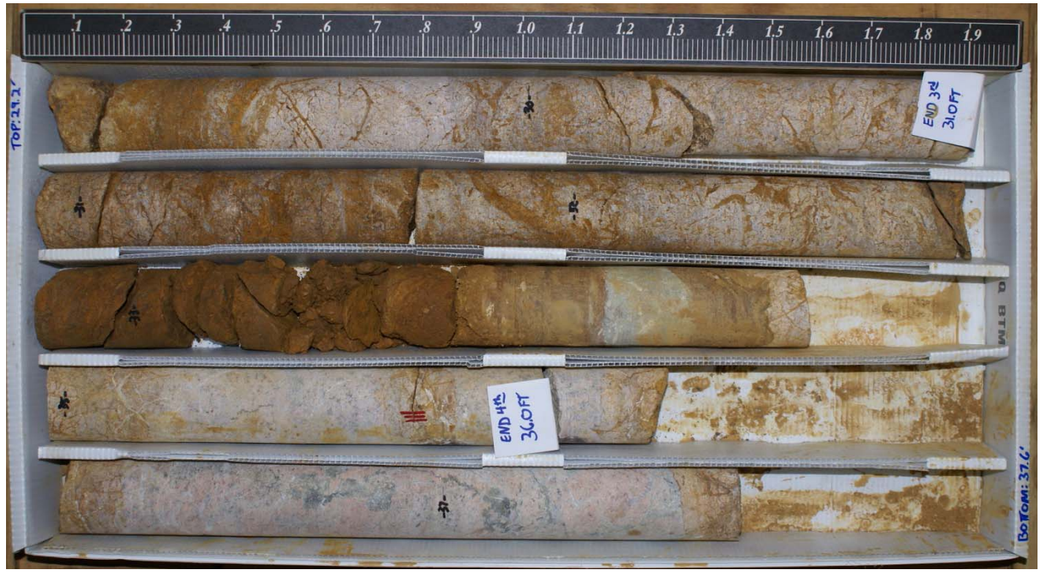
Driller did not obtain immediate water table reading.

CORE PHOTOGRAPHIC RECORD

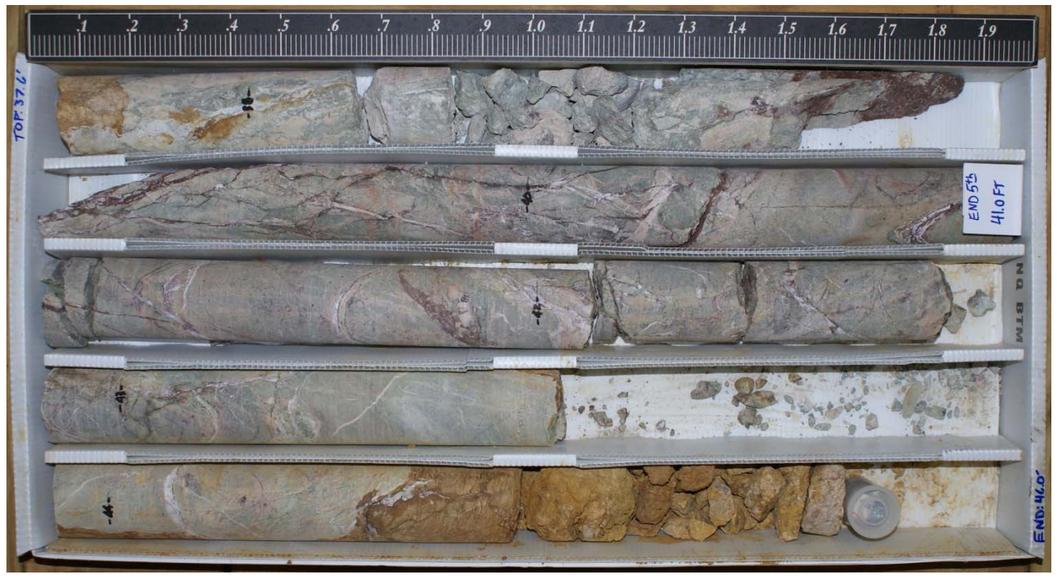
Bridge #399 on Old Beatty Ford Road over Cold Water Creek

WBS 44105.1.FD1 TIP W-5516

B4-A, 61 + 79.40 @ 23 LT. Box 1 of 3



B4-A, 61 + 79.40 @ 23 LT. Box 2 of 3



B4-A, 61 + 79.40 @ 23 LT. Box 3 of 3

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 61+79	**OFFSET** 23 ft RT	**ALIGNMENT** -L-	**0 HR.** 9.8
COLLAR ELEV. 668.7 ft	**TOTAL DEPTH** 10.9 ft	**NORTHING** 653,359	**EASTING** 1,531,791	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER Morgan, M.	**START DATE** 12/14/14	**COMP. DATE** 12/14/14	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
670										668.7 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT Inferred from cuttings, tan, brown, orange, sandy **SILT** (A-4).
665	664.1	4.6	100/0.3			100/0.3				664.3 4.4
										WEATHERED ROCK Metatuff
660	659.1	9.6	20	45	55/0.1					657.9 10.8
	657.9	10.8	60/0.1			100/0.6 60/0.1				657.8 10.9 **CRYSTALLINE ROCK** Metatuff
										Boring Terminated with Standard Penetration Test Refusal at Elevation 657.8 ft in Crystalline Rock (Metatuff).

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 62+55	**OFFSET** 21 ft LT	**ALIGNMENT** -L-	**0 HR.** 8.7
COLLAR ELEV. 669.5 ft	**TOTAL DEPTH** 14.5 ft	**NORTHING** 653,404	**EASTING** 1,531,866	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 01/20/15	**COMP. DATE** 01/20/15	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
670										669.5 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Red, tan, dense, silty, fine to cse. **SAND** w/rock frags. (A-1-b).	
665	665.0	4.5	14	20	19	39		M			
660	660.0	9.5	9	20	24	44		W			
655	655.1	14.4	60/0.1			60/0.1				655.1 / 655.0 **CRYSTALLINE ROCK** Metatuff	14.4 / 14.5
										Boring Terminated with Standard Penetration Test Refusal at Elevation 655.0 ft in Crystalline Rock (Metatuff).	

WBS 44105.1.FD1	**TIP** W-5516	**COUNTY** ROWAN	**GEOLOGIST** DeLost, R.	
SITE DESCRIPTION Bridge #399 on Old Beatty Ford Road over Cold Water Creek				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 62+55	**OFFSET** 26 ft RT	**ALIGNMENT** -L-	**0 HR.** 8.8
COLLAR ELEV. 669.1 ft	**TOTAL DEPTH** 15.1 ft	**NORTHING** 653,357	**EASTING** 1,531,867	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE ICA0404 CME-45C 90% 08/25/2014		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER Morgan, M.	**START DATE** 01/20/15	**COMP. DATE** 01/20/15	**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
670										669.1 GROUND SURFACE 0.0
										ROADWAY EMBANKMENT Red, tan, white, v. loose to dense, silty, cse. grain **SAND** w/rock frags. (A-1-b).
665	664.6	4.5	1	1	1	2	SS-31			
660	659.6	9.5	WOH	3	33	36				
655	654.6 / 654.0	14.5 / 15.1	76 / 60/0.0	34/0.1		110/0.6 / 60/0.0				655.1 / 654.0 **WEATHERED ROCK** Metatuff 14.0 / 15.1
										Boring Terminated with Standard Penetration Test Refusal at Elevation 654.0 ft on Crystalline Rock (Metatuff).

SUMMARY OF SOIL CLASSIFICATION

SAMPLE	OFFSET	STATION	DEPTH	AASHTO	LL	PI	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOIST	ORGAN
B1-A															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-29	23 LT	58+28	5.2-6.7	A-4(0)	25	4	6.9	44.2	33.3	15.7	99.0	97.0	57.5	22.4	-

EB1-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-30	28 RT	57+45	4.5-6.0	A-2-4(0)	NP	NP	40.8	35.5	18.4	5.3	86.7	62.3	26.2	9.2	-

EB2-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-31	26 RT	62+55	4.5-7.0	A-1-b(0)	NP	NP	84.1	12.9	1.5	1.5	95.6	35.2	3.6	6.8	-

B1-A															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-32	23 LT	58+28	10.2-11.7	A-1-b(0)	30	5	42.4	27	21.7	9	62.0	42.3	22.3	16.1	-

B2-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-33	23 RT	59+45	5.3-6.8	A-7-6(21)	50	23	6	9.6	30.5	53.9	95.3	91.8	83.1	27.6	-

SUMMARY OF SOIL CLASSIFICATIONS

SAMPLE	OFFSET	STATION	DEPTH	AASHTO	LL	PI	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOIST	ORGAN
B3-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-34	23 RT	60+62	5.0-6.5	A-4(0)	34	2	31.4	24.2	26.6	17.8	97.7	76.8	48.6	18.5	-

B3-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-35	23 RT	60+62	15.0-16.5	A-4(3)	40	5	18.6	29.3	38.3	13.8	97.7	85.6	58.9	28	-

B3-B															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-36	23 RT	60+62	25.0-26.5	A-4(1)	32	7	33.5	22.7	27.1	16.7	97.1	73.7	47.7	19.1	-

B4-A															
SOIL TEST RESULTS															
							% BY WEIGHT				% PASSING (SIEVES)			%	%
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-37	23 LT	61+79	15.0-16.5	A-7-5(27)	67	26	7.9	12.8	41.2	38.1	99.8	95.1	83.2	42.1	-

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 44105.1.FD1 **SHEET 32**
F.A. NO.: HSIP-1221(18)
COUNTY: ROWAN
RELOCATION OF OLD BEATTY ROAD

Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-3	B2-A	12.6-13.0	Metatuff	CZv	40%	4.02	1.98	152	4,829			mod. sev. wthd., vugs
RS-4	B1-B	16.3-16.7	Metatuff	CZv	14%	3.97	1.99	178	4,002			hld. fracs., veining
RS-5	B1-B	21.3-21.7	Metatuff	CZv	76%	4.11	1.98	172	5,491			hld. fracs., veining
RS-6	B4-A	20.2-20.5	Metatuff	CZv	78%	4.03	1.98	148	2,385			mod. sev. wthd., vugs
RS-7	B4-A	27.2-27.5	Metatuff	CZv	76%	4.00	1.98	135	1,842			mod. wthd., vugs
RS-8	B1-A	19.4-19.8	Metatuff	CZv	80%	4.08	1.99	153	2,266			veining
RS-9	B2-B	16.8-17.1	Metatuff	CZv	66%	4.02	1.98	160	3,708			sli. wthd.
RS-10	B3-B	37.0-37.4	Metatuff	CZv	56%	4.02	1.98	157	3,180			healed fracs.
RS-11	B1-A	26.4-26.7	Metatuff	CZv	96%	4.05	1.99	156	1,429			pt. hld. frac., veining

REFERENCE: W-5516

PROJECT: 44105

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5516	1	4

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY Rowan

PROJECT DESCRIPTION Old Beatty Ford Road from West of Bostian Road Intersection to Lentz Road

SITE DESCRIPTION 2@11'x8' RCBC, -L- STATION 31+84.5

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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THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY D. Michael Gragg

DRAWN BY Wesley Shuecraft

CHECKED BY Kenneth Bussey

SUBMITTED BY HDR|ICA

DATE 4-10-2015

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

DocuSigned by:
Kenneth R. Bussey, Jr.
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SIGNATURE

6/3/2015
DATE

PROJECT REFERENCE NO.	SHEET NO.
W-5516	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

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:

ELEVATION: FEET

NOTES:

DATE: 8-15-14

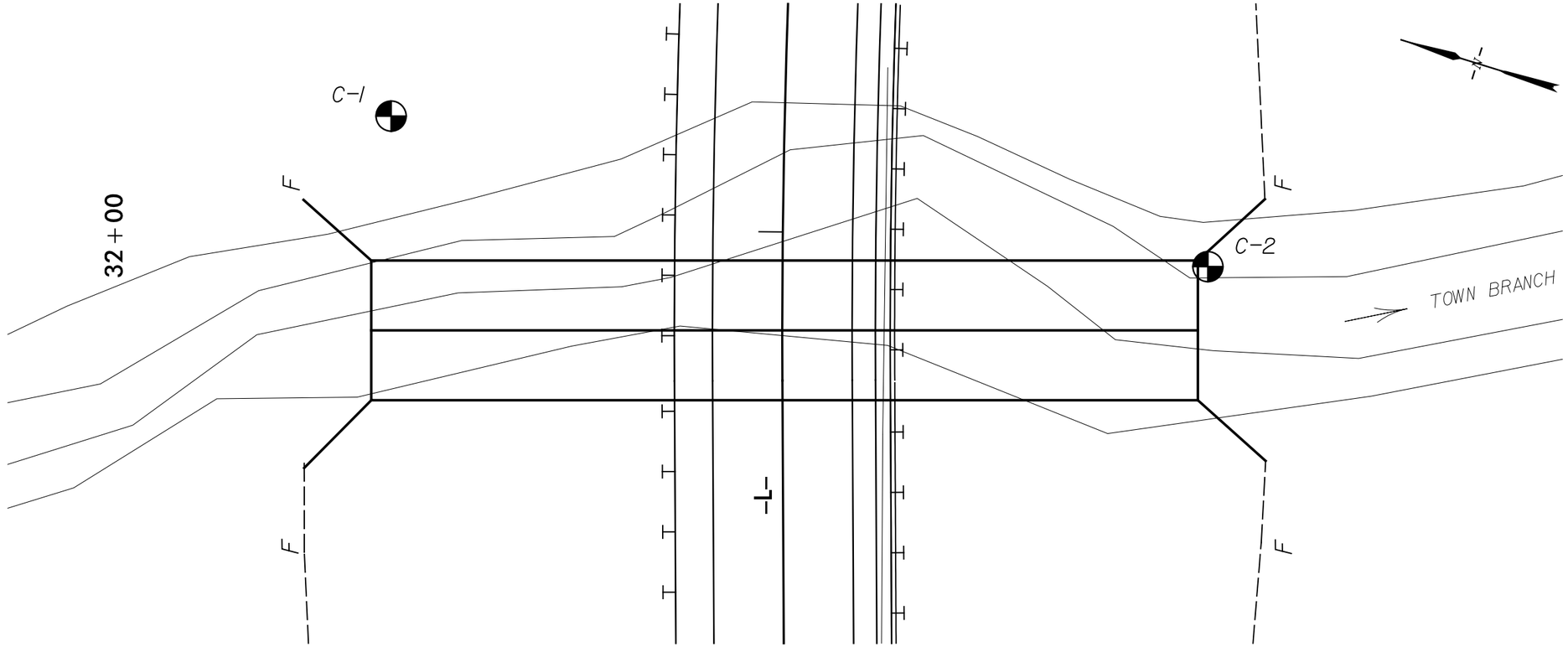
PROJECT REFERENCE NO.	SHEET NO.
W-5516	3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

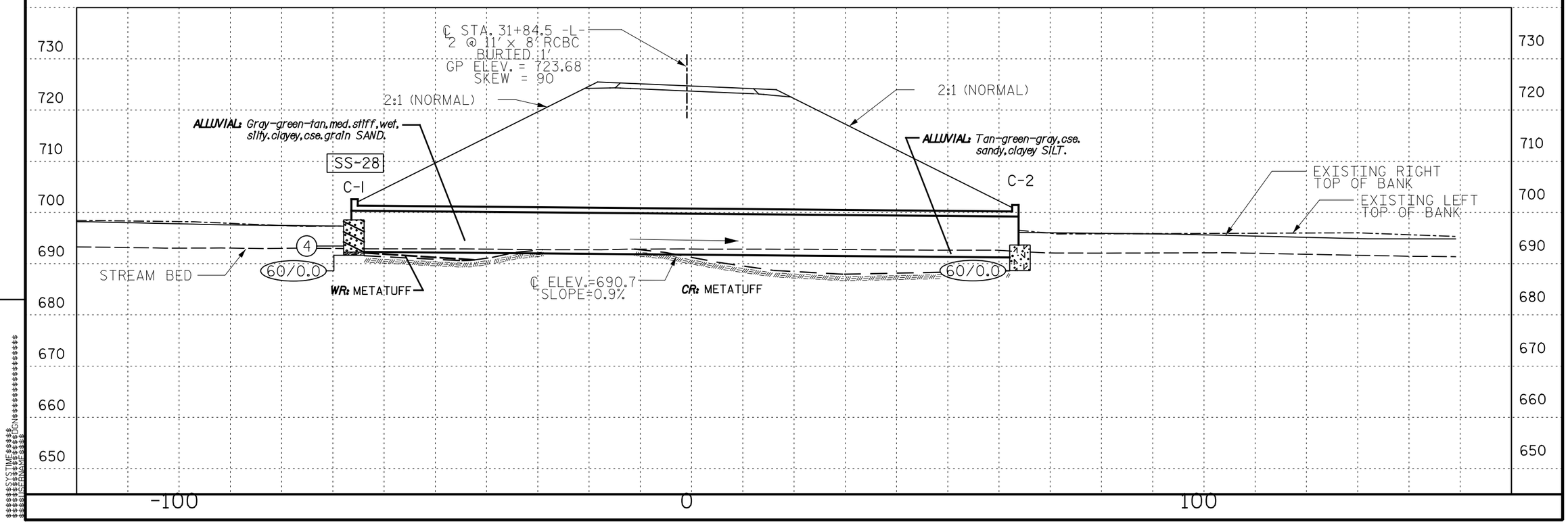
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

8/17/95

REVISIONS





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PROJECT REFERENCE NO.	SHEET NO.
W-5516	4

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-28	65 LT	31+85	4.1-5.6	A-2-6(0)	30	12	29.2	30.1	20.7	20	71.6	57.4	35.0	18.7	-

$$$$$$$$SYSTIME$$$$$$$$
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5516	1	3

REFERENCE: W-5516

PROJECT: 44105

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Rowan*

PROJECT DESCRIPTION *Old Beatty Ford Road from West of Bostian Road Intersection to Lentz Road*

SITE DESCRIPTION *1@8'x7' RCBC, -L- STATION 108+21.0*

CONTENTS

CAUTION NOTICE

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

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *Wesley Shuecraft*

CHECKED BY *Kenneth Bussey*

SUBMITTED BY *HDR|ICA*

DATE *4-10-2015*

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

DocuSigned by:
Kenneth R. Bussey, Jr.
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SIGNATURE

6/3/2015
DATE

PROJECT REFERENCE NO.	SHEET NO.
W-5516	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	50 MX													
#40	30 MX		50 MX	51 MN										
#200	15 MX	25 MX		10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX			— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0			0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND					SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD								FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

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:

ELEVATION: FEET

NOTES:

DATE: 8-15-14

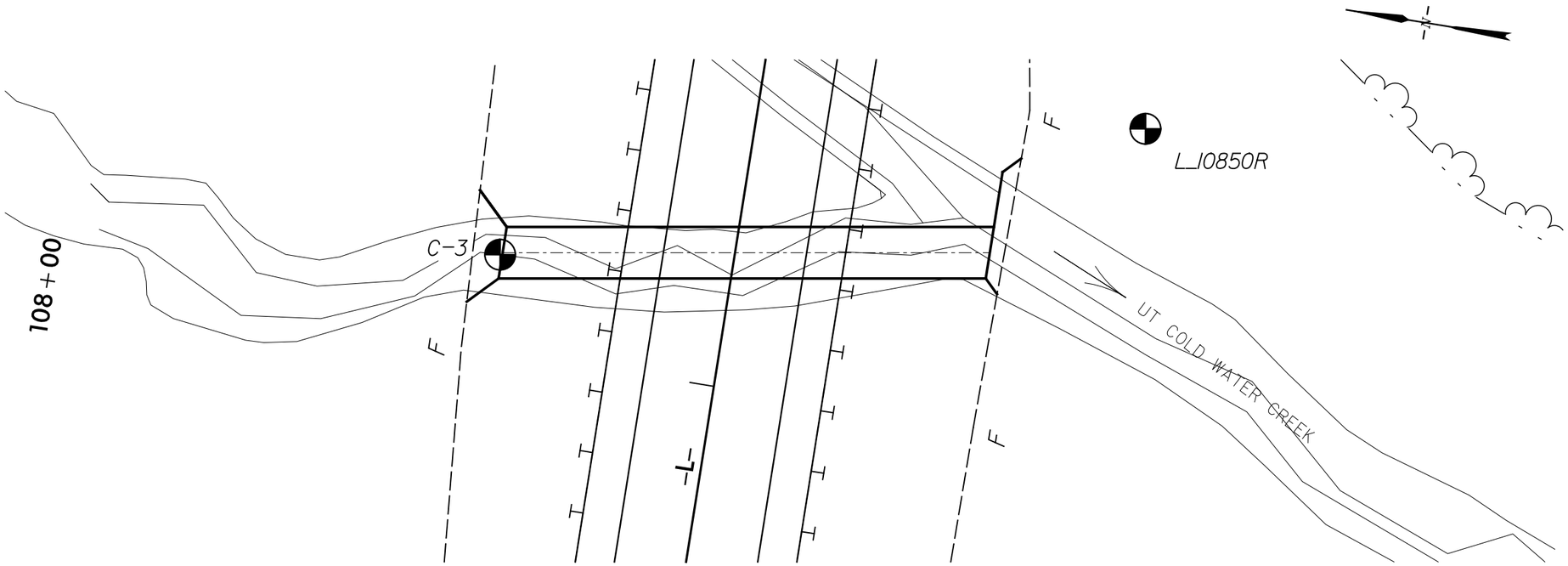
PROJECT REFERENCE NO.	SHEET NO.
W-5516	3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

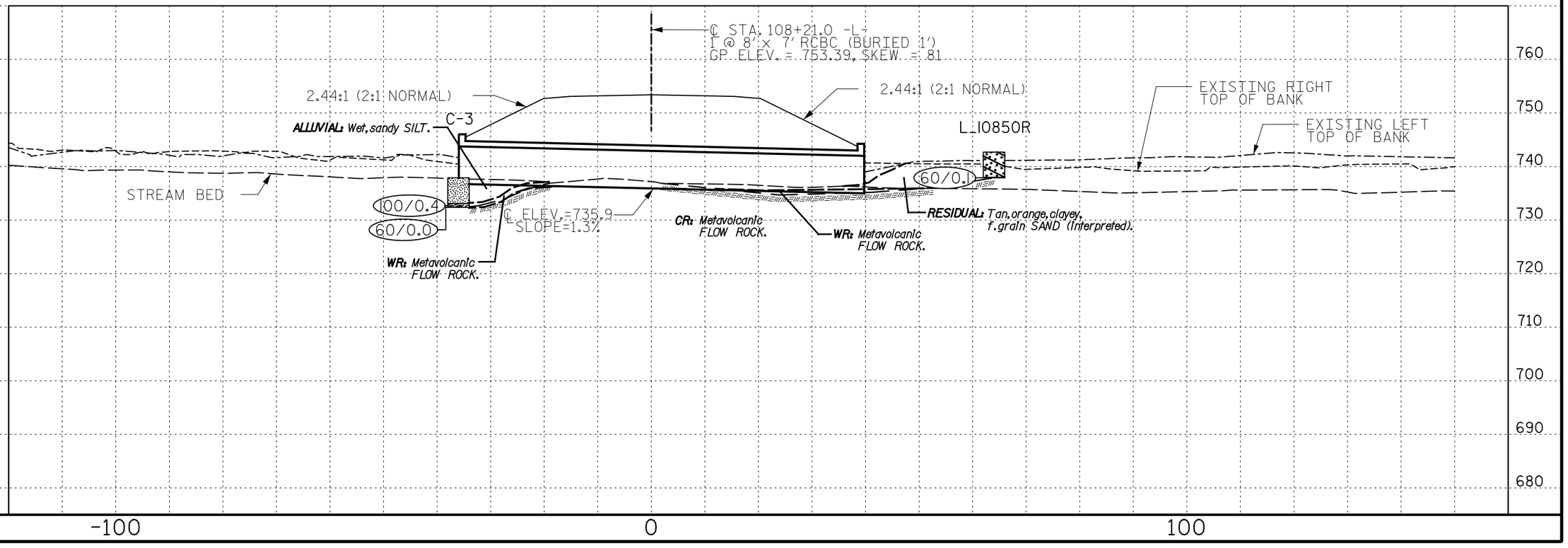
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

8/17/95

REVISIONS





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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5516	1	4

REFERENCE: W-5516

PROJECT: 44105

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *Rowan*

PROJECT DESCRIPTION *Old Beatty Ford Road from West of Bostian Road Intersection to Lentz Road*

SITE DESCRIPTION *WALL 1, END BENT 2 -L- STATION 62+69.39*

CONTENTS

CAUTION NOTICE

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

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

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NOTES:
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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

Robbie DeLost

Mike Morgan

Harold Morris

INVESTIGATED BY *D. Michael Gragg*

DRAWN BY *T. Rideout*

CHECKED BY *Kenneth Bussey*

SUBMITTED BY *HDR|ICA*

DATE *3/25/2015*

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

DocuSigned by:
Kenneth R. Bussey, Jr.
22A188C7B3D7442...

SIGNATURE

6/3/2015
DATE

PROJECT REFERENCE NO.	SHEET NO.
W-5516	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	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND					SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD								FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

- UNDERCUT EXCAVATION
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

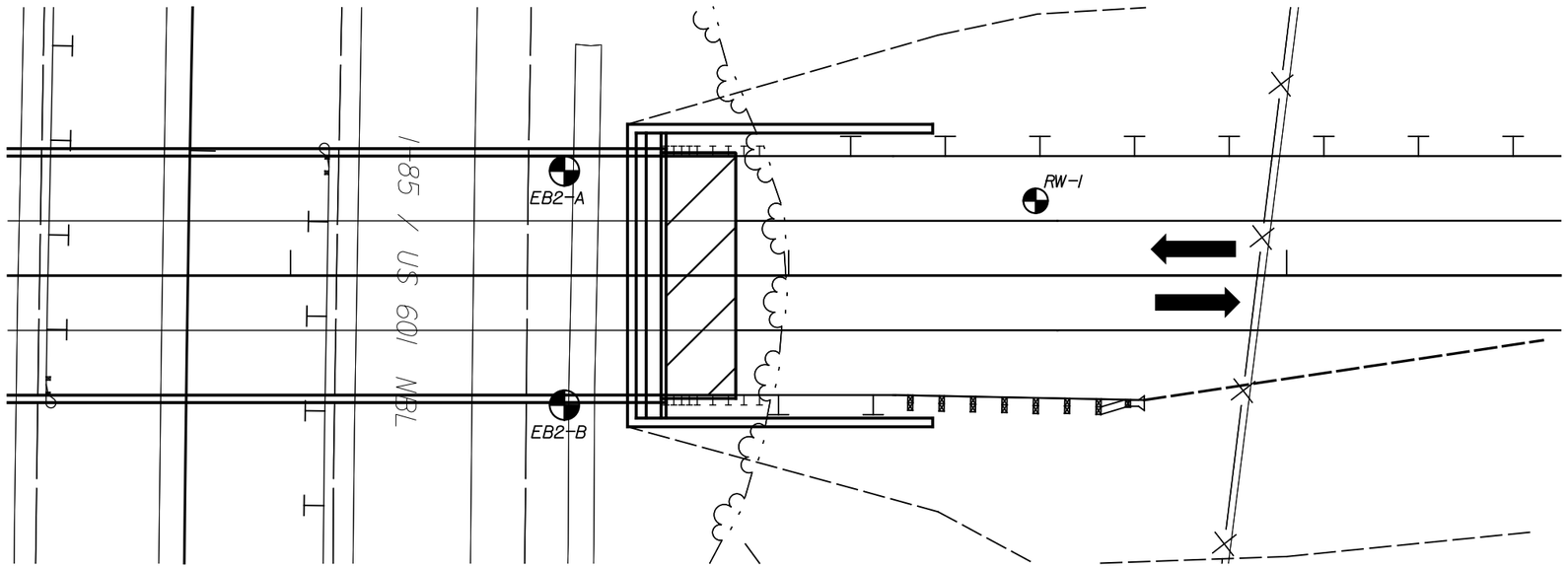
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

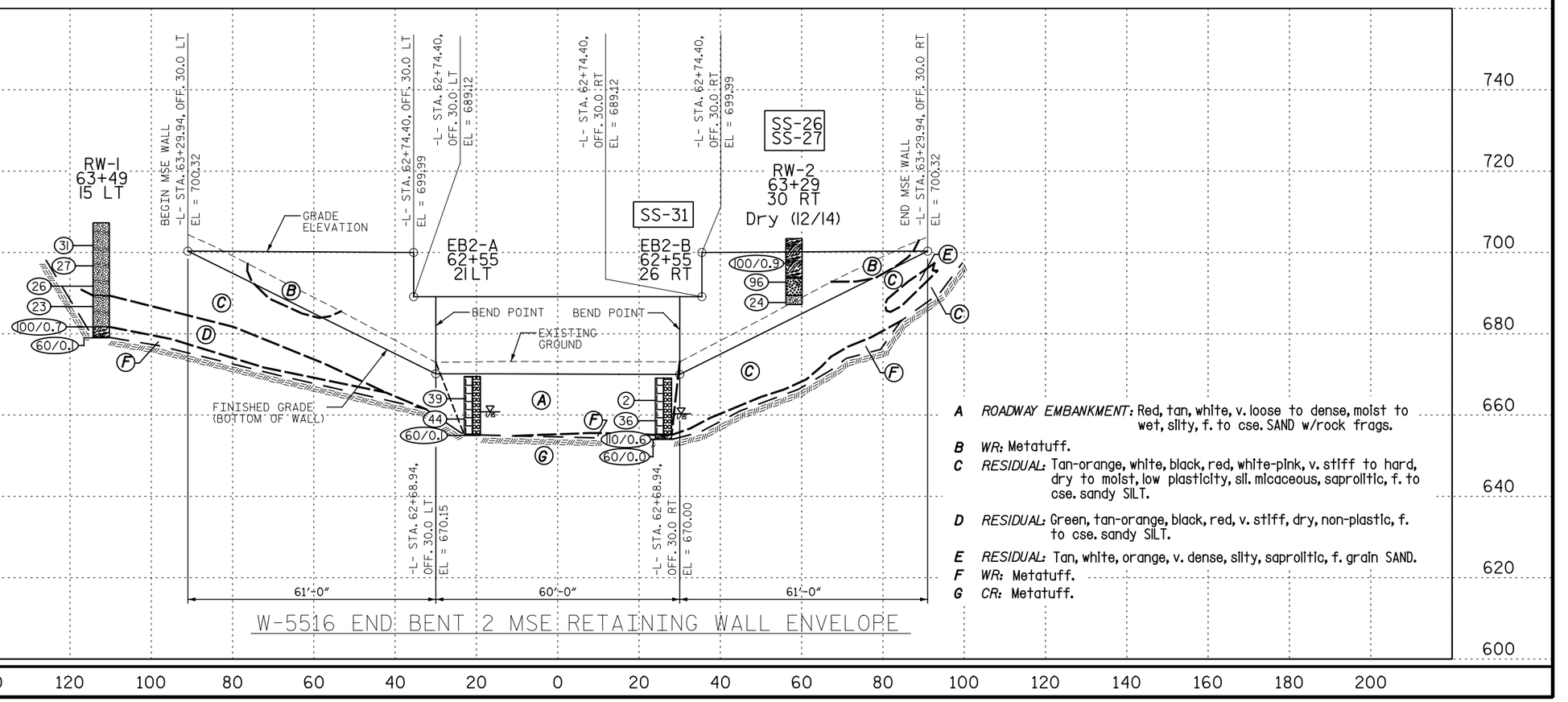
BENCH MARK: -BL- 13802-15
-L- Sta. 61+91.63, 189.59 Rt., -Y- Sta. 46+14.72, 13.59' Lt.
N 653192.7790, E 1531803.8290 ELEVATION: 669.32 FEET

NOTES:

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
W-5516	3





A ROADWAY EMBANKMENT: Red, tan, white, v. loose to dense, moist to wet, silty, f. to cse. SAND w/rock frags.

B WR: Metatuff.

C RESIDUAL: Tan-orange, white, black, red, white-pink, v. stiff to hard, dry to moist, low plasticity, sli. micaceous, saprolitic, f. to cse. sandy SILT.

D RESIDUAL: Green, tan-orange, black, red, v. stiff, dry, non-plastic, f. to cse. sandy SILT.

E RESIDUAL: Tan, white, orange, v. dense, silty, saprolitic, f. grain SAND.

F WR: Metatuff.

G CR: Metatuff.

W-5516 END BENT 2 MSE RETAINING WALL ENVELOPE

PROJECT REFERENCE NO.	SHEET NO.
W-5516	4

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-26	29.5 RT	63+28.94	9.7-11.2	A-2-4(0)	23	NP	40.9	29.2	20.5	9.4	98.1	71.4	34.6	7.7	-
SS-27	29.5 RT	63+28.94	14.7-16.2	A-4 (3)	36	8	24	23.9	32.4	19.7	99.5	84.5	58.6	18.9	-
SS-31	26 RT	62+55	4.5-7.0	A-1-b(0)	NP	NP	84.1	12.9	1.5	1.5	95.6	35.2	3.6	6.8	-

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