

REFERENCE: SF-130262

PROJECT: 17BP.11.R.129

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-130262	1	17

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CALDWELL

PROJECT DESCRIPTION REPLACE BRIDGE NUMBER
262 ON SR 1107 OVER GUNPOWDER CREEK

SITE DESCRIPTION _____

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-17	BORING LOGS AND CORE PHOTOS

PERSONNEL

DC ElliottCJ CoffeyDO CheekDM MULLENINVESTIGATED BY JC KuhneDRAWN BY PQ Lockamy DSCHECKED BY JC Kuhne JKSUBMITTED BY JC KuhneDATE 1/4/2017**CAUTION NOTICE**

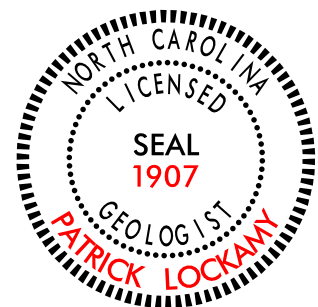
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF PREPARING THE SCOPE OF WORK TO BE INCLUDED IN THE REQUEST FOR PROPOSAL. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING 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.

SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. 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:

- 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.
- 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.



DocuSigned by:

Patrick Lockamy

1/4/2017

3255EECD SIGNATURE

DATE

**DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED**

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		
	A-1		A-3	A-2			A-4	A-5	A-6	A-7		A-1, A-2	A-4, A-5		
GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-7-5, A-7-6	A-3	A-6, A-7		
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	36 MN	36 MN		
MATERIAL PASSING #40 LL PI	— 6 MX		— 10 MX	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			
GROUP INDEX	0		0	0	4 MX	8 MX	12 MX	16 MX	NO MX				HIGHLY ORGANIC SOILS		
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS					HIGHLY ORGANIC 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 RESISTANCE (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 OPENING (MM)	4	10	40	60	200	270
	4.75	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 IN.	305 12	75 3	2.0	0.25	0.05	0.005

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)		FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL PLASTIC RANGE (PI) PL	LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
	PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM SL	OPTIMUM MOISTURE 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
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

MISCELLANEOUS SYMBOLS

SF-130262

2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS		
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 (INCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD 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 SL.)	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 (SL.)	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. <u>IF TESTED, WOULD YIELD SPT REFUSAL</u>			
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. <u>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</u>			
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. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u>			
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		BEDDING		
TERM	SPACING	TERM	THICKNESS	
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET	
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET	
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET	
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET	
VERY CLOSE	LESS THAN 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.			
BENCH MARK: TBM; NAIL IN POWER POLE BY NE CORNER OF BRIDGE		ELEVATION: 100.00 FEET		
NOTES: ASSUMED ELEVATION OF 100.00 USED FOR TBM				

DATE: 8-15-11

SF-130262

2B

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

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)

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

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

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

SURFACE CONDITIONS

VERY GOOD
Very rough, fresh unweathered surfaces

GOOD
Rough, slightly weathered, iron stained surfaces

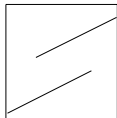
FAIR
Smooth, moderately weathered and altered surfaces

POOR
Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments

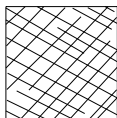
VERY POOR
Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

DECREASING SURFACE QUALITY →



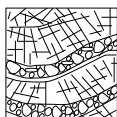
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities



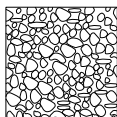
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets



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



BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity



DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces



LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES

90

80

70

60

50

40

30

20

10

N/A

N/A

N/A

N/A

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GEOTECHNICAL ENGINEERING UNIT**

SUBSURFACE INVESTIGATION

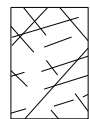
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)

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

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

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

COMPOSITION AND STRUCTURE



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



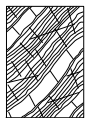
B. Sandstone with thin inter-layers of siltstone



C. Sandstone and siltstone in similar amounts



D. Siltstone or silty shale with sandstone layers

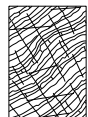


E. Weak siltstone or clayey shale with sandstone layers

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



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



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



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

—▷ Means deformation after tectonic disturbance

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

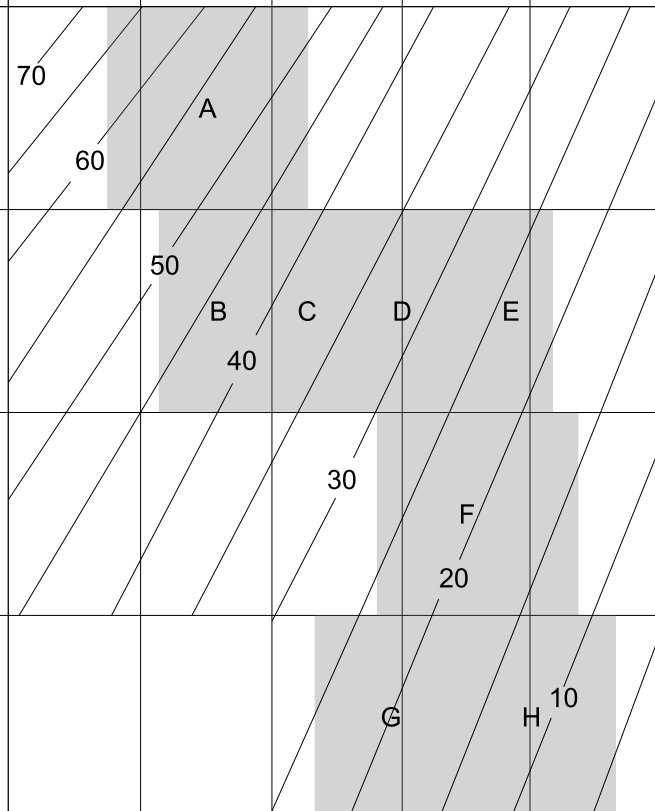
VERY GOOD - Very Rough, fresh unweathered surfaces

GOOD - Rough, slightly weathered surfaces

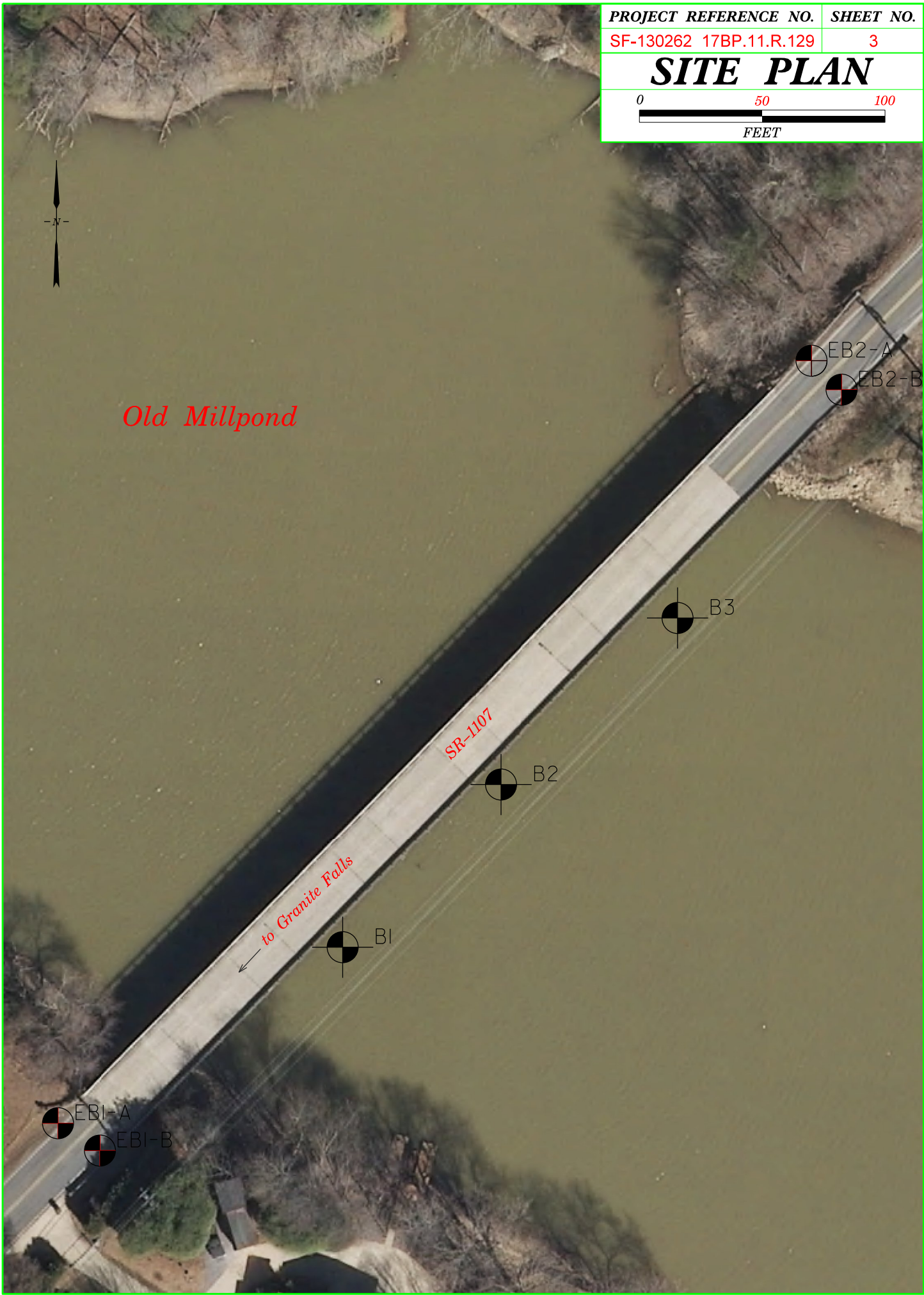
FAIR - Smooth, moderately weathered and altered surfaces

POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments

VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings



PROJECT REFERENCE NO.	SHEET NO.
SF-130262 17BP.11.R.129	3
SITE PLAN	
0 50 100 FEET	



GEOTECHNICAL BORING REPORT

BORE LOG

SHEET

WBS 17BP.11.R.129			TIP SF-130262			COUNTY CALDWELL			GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)	
BORING NO. EB1-B			STATION N/A			OFFSET N/A			ALIGNMENT N/A		
COLLAR ELEV. 108.5 ft			TOTAL DEPTH 25.2 ft			NORTHING 756,368			EASTING 1,284,495		
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 81% 01/29/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.			START DATE 12/14/16			COMP. DATE 12/14/16			SURFACE WATER DEPTH N/A		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
110																
															108.5	GROUND SURFACE
															107.9	RESIDUAL ASPHALT & ABC
105	105.1	3.4	4	6	5										105.5	ROADWAY EMBANKMENT EMBANKMENT
100	100.1	8.4	4	7	4											
95	95.1	13.4	3	6	7											
90	90.1	18.4	71	29/0.1											90.3	WEATHERED ROCK DARK GRAY WEATHERED ROCK
85	85.1	23.4	20	22	14										87.0	SAPROLITE DARK GRAY/DARK ORANGE SILTY, FINE-TO-COURSE SAND WITH TRACE MICA SAPROLITE
	83.4	25.1	60/0.1												83.4	CRYSTALLINE ROCK CRYSTALLINE ROCK (GNEISS)
															83.3	Boring Terminated with Standard Penetration Test Refusal at Elevation 83.3 ft IN CRYSTALLINE ROCK (GNEISS)

GEOTECHNICAL BORING REPORT

BORE LOG

SHEET

WBS 17BP.11.R.129			TIP SF-130262			COUNTY CALDWELL			GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)	
BORING NO. EB1-B			STATION N/A			OFFSET N/A			ALIGNMENT N/A		
COLLAR ELEV. 108.5 ft			TOTAL DEPTH 25.2 ft			NORTHING 756,368			EASTING 1,284,495		
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 81% 01/29/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.			START DATE 12/14/16			COMP. DATE 12/14/16			SURFACE WATER DEPTH N/A		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
110																
															108.5	GROUND SURFACE
															107.9	RESIDUAL ASPHALT & ABC
105	105.1	3.4	4	6	5										105.5	ROADWAY EMBANKMENT EMBANKMENT
100	100.1	8.4	4	7	4											SAPROLITE DARK GRAY/DARK ORANGE SILTY SAND WITH TRACE MICA SAPROLITE
95	95.1	13.4	3	6	7											
90	90.1	18.4	71	29/0.1											90.3	WEATHERED ROCK DARK GRAY WEATHERED ROCK
85	85.1	23.4	20	22	14										87.0	SAPROLITE DARK GRAY/DARK ORANGE SILTY, FINE-TO-COURSE SAND WITH TRACE MICA SAPROLITE
	83.4	25.1	60/0.1												83.4	CRYSTALLINE ROCK CRYSTALLINE ROCK (GNEISS)
															83.3	Boring Terminated with Standard Penetration Test Refusal at Elevation 83.3 ft IN CRYSTALLINE ROCK (GNEISS)

GEOTECHNICAL BORING REPORT

BORE LOG

SHEET

WBS 17BP.11.R.129			TIP SF-130262			COUNTY CALDWELL			GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)	
BORING NO. B1-B			STATION N/A			OFFSET N/A			ALIGNMENT N/A		
COLLAR ELEV. 72.9 ft			TOTAL DEPTH 23.0 ft			NORTHING 756,451			EASTING 1,284,594		
DRILL RIG/HAMMER EFF./DATE HFO0065 CME-45C 85% 01/09/2013						DRILL METHOD NW Casing w/ Advancer			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.			START DATE 12/13/16			COMP. DATE 12/13/16			SURFACE WATER DEPTH 22.2ft		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
75																
															72.9	LAKE BOTTOM SURFACE 0.0
70	70.4	2.5	8	13	10										70.8	ALLUVIAL LACUSTRINE MUD 2.1
65	65.4	7.5	11	13	14											
60	60.4	12.5	14	16	12											
	57.6	15.3	60/0.1												57.8	15.1
55															57.6	15.3
50															49.9	23.0
WEATHERED ROCK WEATHERED ROCK CRYSTALLINE ROCK CRYSTALLINE ROCK (GNEISS)																
Boring Terminated with Standard Penetration Test Refusal at Elevation 49.9 ft IN CRYSTALLINE ROCK (GNEISS)																

NCDOT BORE SINGLE SF130262_GEO_CALDWELL_BRDG_262_FALLS_AVE_MILLPOND.GPJ NC_DOT.GDT 1/4/17

GEOTECHNICAL BORING REPORT

CORE LOG

SHEET

WBS 17BP.11.R.129				TIP SF-130262		COUNTY CALDWELL				GEOLOGIST Elliott, D. C.			
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)			
BORING NO. B1-B				STATION N/A				OFFSET N/A				ALIGNMENT N/A	
COLLAR ELEV. 72.9 ft				TOTAL DEPTH 23.0 ft				NORTHING 756,451				EASTING 1,284,594	
DRILL RIG/HAMMER EFF./DATE HFO0065 CME-45C 85% 01/09/2013								DRILL METHOD NW Casing w/ Advancer				HAMMER TYPE Automatic	
DRILLER Cheek, D. O.				START DATE 12/13/16				COMP. DATE 12/13/16				SURFACE WATER DEPTH 22.2ft	
CORE SIZE nxwl				TOTAL RUN 7.6 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %				
57.53													
	57.5	15.4	2.6	0:47/0.6	(2.5)	(1.2)					Begin Coring @ 15.4 ft		
	55	18.0		1:27/1.0	96%	46%					CRYSTALLINE ROCK (continued)		
			5.0	1:13/1.0	(5.0)	(4.1)							
				1:27/1.0	100%	82%							
				1:20/1.0									
				1:19/1.0									
50	49.9	23.0		1:28/1.0								23.0	
Boring Terminated with Standard Penetration Test Refusal at Elevation 49.9 ft IN CRYSTALLINE ROCK (GNEISS)													



17BP.11.R.129 SF-130262
Caldwell County
Bridge No. 262 on SR-1107
Over Gunpowder Creek
Boring B1-B
Box 1 of 1
Depth: 15.4' – 23.0'

SHEET

NCDOT BORE SINGLE SF130262_GEO_CALDWELL_BRDG_262_FALLS AVE_MILLPOND.GPJ NC_DOT.GDT 1/4/17

GEOTECHNICAL BORING REPORT

CORE LOG

SHEET

WBS 17BP.11.R.129				TIP SF-130262		COUNTY CALDWELL				GEOLOGIST Elliott, D. C.			
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)			
BORING NO. B2-B				STATION N/A				OFFSET N/A		ALIGNMENT N/A		0 HR. N/A	
COLLAR ELEV. 67.3 ft				TOTAL DEPTH 19.5 ft				NORTHING 756,517		EASTING 1,284,658		24 HR. N/A	
DRILL RIG/HAMMER EFF./DATE HFO0065 CME-45C 85% 01/09/2013								DRILL METHOD NW Casing w/ Advancer			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.				START DATE 12/13/16				COMP. DATE 12/13/16		SURFACE WATER DEPTH 27.8ft			
CORE SIZE nxwl				TOTAL RUN 12.5 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %				
60.27													
	60.3	7.0	2.5	N=60/0.0 0:41/0.5 1:17/1.0 1:10/1.0	(2.1) 84%	(2.0) 80%					Begin Coring @ 7.0 ft		
	57.8	9.5	5.0	1:06/1.0 1:19/1.0 1:14/1.0 1:11/1.0	(5.0) 100%	(3.6) 72%					CRYSTALLINE ROCK (continued)		
55													
	52.8	14.5	5.0	1:23/1.0 1:18/1.0 1:14/1.0 1:09/1.0	(5.0) 100%	(3.7) 74%							
50													
	47.8	19.5		1:20/1.0							47.8	19.5	
Boring Terminated with Standard Penetration Test Refusal at Elevation 47.8 ft IN CRYSTALLINE ROCK (GNEISS)													

NCDOT CORE SINGLE SF130262_GEO_CALDWELL_BRDG_262_FALLS AVE. MILLPOND.GPJ NC_DOT.GDT 1/4/17



17BP.11.R.129 SF-130262
Caldwell County
Bridge No. 262 on SR-1107
Over Gunpowder Creek
Boring B2-B
Box 1 of 2
Depth: 7.0' – 16.5'



17BP.11.R.129 SF-130262
Caldwell County
Bridge No. 262 on SR-1107
Over Gunpowder Creek
Boring B2-B
Box 2 of 2
Depth: 16.5' – 19.5'

GEOTECHNICAL BORING REPORT

BORE LOG

SHEET

WBS 17BP.11.R.129			TIP SF-130262			COUNTY CALDWELL			GEOLOGIST Elliott, D. C.		
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)	
BORING NO. B3-B			STATION N/A			OFFSET N/A			ALIGNMENT N/A		
COLLAR ELEV. 82.8 ft			TOTAL DEPTH 27.5 ft			NORTHING 756,585			EASTING 1,284,730		
DRILL RIG/HAMMER EFF./DATE HFO0065 CME-45C 85% 01/09/2013						DRILL METHOD NW Casing w/ Advancer			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.			START DATE 12/12/16			COMP. DATE 12/12/16			SURFACE WATER DEPTH 12.2ft		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
85																	
															82.8	LAKE BOTTOM SURFACE 0.0	
80	80.3	2.5	5	5	6										79.9	ALLUVIAL LACUSTRINE MUD 2.9	
75	75.3	7.5	8	12	10											SAPROLITE DARK ORANGE/BROWN CLAYEY SILTY SAND WITH TRACE MICA SAPROLITE WITH SCHISTOSE FABRIC W/ A FEW CRYSTALLINE LAYERS	
70	70.3	12.5	29	22	31												
65	65.3	17.5	48	52/0.3											66.0		WEATHERED ROCK 16.8
	63.1	19.7	60/0.12												63.1		WEATHERED ROCK 19.7
60																CRYSTALLINE ROCK CRYSTALLINE ROCK (SCHIST & GNEISS)	
																55.2	Boring Terminated with Standard Penetration Test Refusal at Elevation 55.3 ft IN CRYSTALLINE ROCK (SCHIST & GNEISS) 27.6

GEOTECHNICAL BORING REPORT

CORE LOG

SHEET

WBS 17BP.11.R.129				TIP SF-130262		COUNTY CALDWELL				GEOLOGIST Elliott, D. C.			
SITE DESCRIPTION BRG # 262 OVER GUNPOWDER CREEK ON SR-1107										GROUND WTR (ft)			
BORING NO. B3-B				STATION N/A				OFFSET N/A		ALIGNMENT N/A		0 HR. N/A	
COLLAR ELEV. 82.8 ft				TOTAL DEPTH 27.5 ft				NORTHING 756,585		EASTING 1,284,730		24 HR. N/A	
DRILL RIG/HAMMER EFF./DATE HFO0065 CME-45C 85% 01/09/2013								DRILL METHOD NW Casing w/ Advancer			HAMMER TYPE Automatic		
DRILLER Cheek, D. O.				START DATE 12/12/16				COMP. DATE 12/12/16		SURFACE WATER DEPTH 12.2ft			
CORE SIZE nxwl				TOTAL RUN 7.8 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %				
63.01											Begin Coring @ 19.8 ft		
60	63.0	19.8	2.8	0:47/0.8	(2.7)	(0.8)					CRYSTALLINE ROCK (continued)		
	60.2	22.6		0:55/1.0	96%	29%							
			5.0	0:54/1.0	(5.0)	(0.8)							
				0:58/1.0	100%	16%							
				1:00/1.0									
	55.2	27.6		0:50/1.0									
				0:55/1.0									
											Boring Terminated with Standard Penetration Test Refusal at Elevation 55.3 ft IN CRYSTALLINE ROCK (SCHIST & GNEISS)	27.6	

NCDOT CORE SINGLE SF130262_GEO_CALDWELL_BRDG_262_FALLS_AVE_MILLPOND.GPJ NC_DOT.GDT 1/4/17



17BP.11.R.129 SF-130262
Caldwell County
Bridge No. 262 on SR-1107
Over Gunpowder Creek
Boring B3-B
Box 1 of 1
Depth: 19.8' – 27.6'

SHEET

NC DOT BORE SINGLE SF130262 GEO CALDWELL BRDG 262 FALLS AVE MILLPOND.GPJ NC DOT.GDT 1/4/17

SHEET

NCDOT BORE SINGLE SF130262 GEO CALDWELL BRDG 262 FALLS AVE MILLPOND.GPJ NC_DOT.GDT 1/4/17