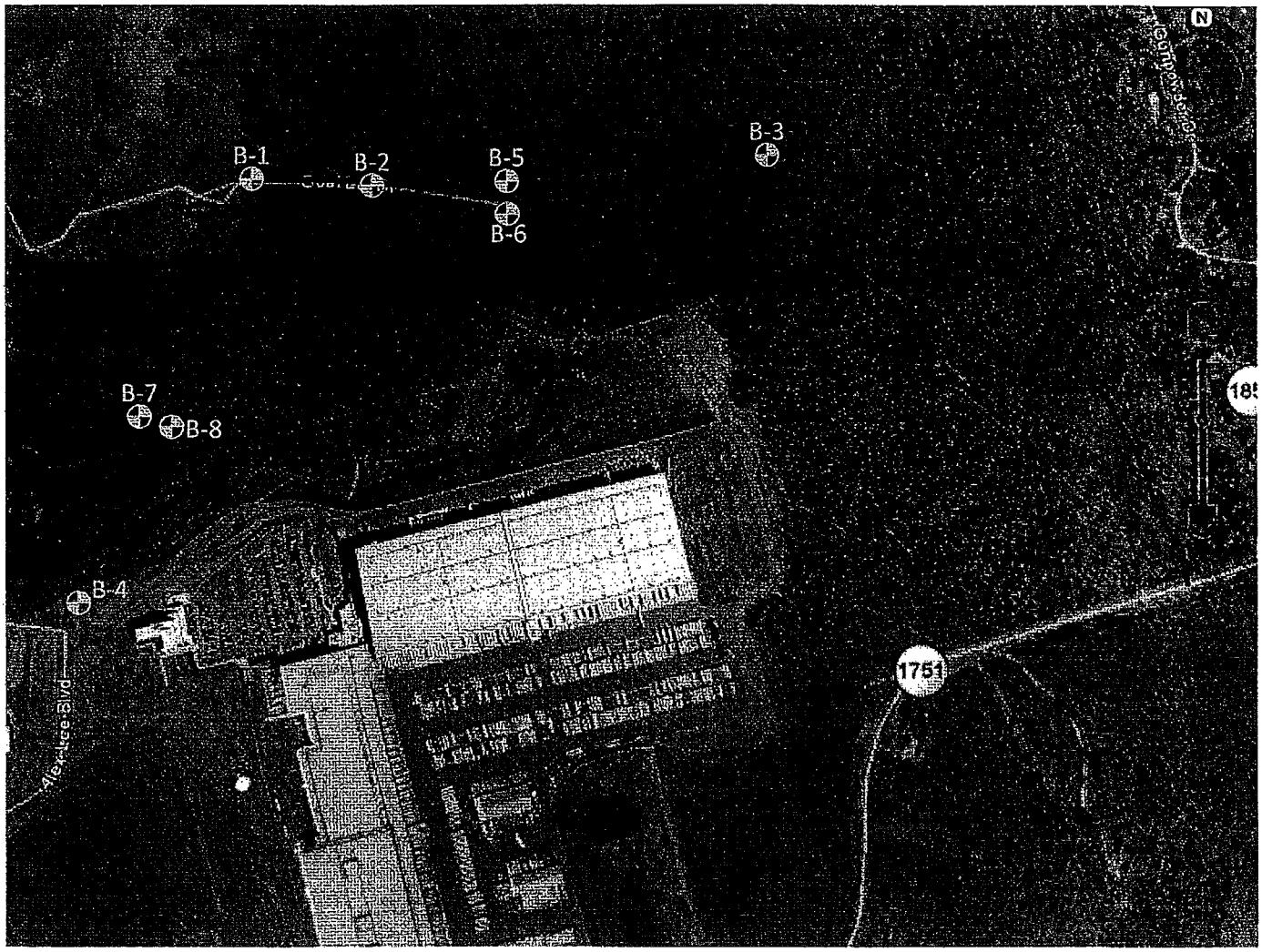

BORING LOCATION PLAN

Grace Chapel Road
US 321 Connector
Granite Falls, North Carolina

Prepared For:

The Louis Berger Group

LEGEND

- Approximate Location of Soil Test Boring

SINCE 1881
Froehling & Robertson, Inc.
2505 Hutchison-McDonald Road
Charlotte, North Carolina 28269

Proj.: 63L-0063	Date: 07/31/09	Drawing No. 2 of 2

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 63L-0063	**ID.** Grace Chapel Road	**COUNTY** Caldwell County	**GEOL/ENGR** E. Freeburg
SITE DESCRIPTION See Attached Drawing			**GROUND WATER (ft)**
BORING NO. B-1	**BORING LOCATION** 25+25	**OFFSET** CL	**ALIGNMENT** L-Line — **0 HR.** DRY
COLLAR ELEV. 1102 ft	**NORTHING**	**EASTING**	**24 HR.**
TOTAL DEPTH 35.00 ft	**DRILL MACHINE** CME-550X	**DRILL METHOD** 2.25" HSA	**HAMMER TYPE** Automatic
DATE STARTED 7/2/09	**COMPLETED** 7/2/09	**SURFACE WATER DEPTH**	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1102.00									1102.00ft 0.00ft
	0.00	2	5	5	10		M		1101.83ft Surficial Organic Laden Soil (2") 0.17ft
1100	1.50	4	5	9	14		M		RESIDUAL - Stiff to very stiff tan and orange moist silty CLAY (A-7-5)
	3.00	6	6	7	13		M		
	4.50	9	9	10	19		M		
1095	8.50	9	8	10	18		M		
1090	13.50	10	11	13	24		M		1090.00ft 12.00ft
									Medium dense and very dense gray, tan and white moist silty fine to medium SAND (A-2-4)
1085	18.50	32	24	47	71		M		
1080	23.50	22	13	17	30		M		
1075	28.50	47	28	29	57		M		
1070	33.50	39	50/5"				M		1068.00ft 34.00ft
									1067.00ft SOFT WEATHERED ROCK - Sampled as tan and white silty SAND 35.00ft
									Boring terminated at a depth of approximately 35 feet below existing grades

NCDOT_BORE 63L-0063.GPJ NCDOT.GDT 7/31/09

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 63L-0063	ID. Grace Chapel Road	COUNTY Caldwell County	GEOL/ENGR E. Freeburg
SITE DESCRIPTION See Attached Drawing			GROUND WATER (ft)
BORING NO. B-2	BORING LOCATION 33+00	OFFSET CL	ALIGNMENT L-Line	0 HR. DRY
COLLAR ELEV. 1052 ft	NORTHING	EASTING	24 HR.
TOTAL DEPTH 35.00 ft	DRILL MACHINE CME-550X	DRILL METHOD 2.25" HSA	HAMMER TYPE Automatic
DATE STARTED 7/2/09	COMPLETED 7/2/09	SURFACE WATER DEPTH	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1052.00									1052.00ft 0.00ft
	0.00	3	3	5	8		M		1051.92ft Surficial Organic Laden Soil (1") 0.08ft
1050	1.50	10	8	9	17		M		RESIDUAL - Firm to very stiff red, tan and brown moist slightly micaceous sandy SILT (A-4)
	3.00								
	4.50	11	9	8	17		M		
		10	11	11	22		M		
1045	8.50								1044.00ft 8.00ft
		10	8	9	17		M		Medium dense to dense tan and white moist silty fine to medium SAND (A-2-5)
1040	13.50								
		10	14	26	40		M		
1035	18.50								
		19	22	22	44		M		
1030	23.50								
		21	18	15	33		M		
1025	28.50								1024.00ft 28.00ft
		21	20	13	33		M		Hard orange and brown moist sandy SILT (A-4)
1020	33.50								
		28	49	50/3"			M		1017.50ft 34.50ft
									1017.00ft SOFT WEATHERED ROCK - Sampled as gray and white silty SAND 35.00ft
									Boring terminated at a depth of approximately 35 feet below existing grades

NCDOT_BORE 63L-0063.GPJ NCDOT.GDT 7/31/09

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 63L-0063	ID. Grace Chapel Road	COUNTY Caldwell County	GEOL/ENGR E. Freeburg
SITE DESCRIPTION See Attached Drawing			GROUND WATER (ft)
BORING NO. B-3	BORING LOCATION 46+50	OFFSET CL	ALIGNMENT L-Line	0 HR. DRY
COLLAR ELEV. 1075 ft	NORTHING	EASTING	24 HR.
TOTAL DEPTH 27.00 ft	DRILL MACHINE CME-550X	DRILL METHOD 2.25" HSA	HAMMER TYPE Automatic
DATE STARTED 7/2/09	COMPLETED 7/2/09	SURFACE WATER DEPTH	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1075.00									1075.00ft 0.00ft
	0.00	1	2	3	5		M		1074.92ft Surficial Organic Laden Soil (1") 0.08ft
	1.50	4	4	5	9		M		RESIDUAL - Firm to stiff brown and orange
	3.00	6	9	10	19		M		1072.00ft moist sandy SILT (A-4) 3.00ft
1070	4.50	13	15	11	26		M		Medium dense orange, tan and brown moist silty fine to medium SAND (A-2-4)
	8.50	12	17	8	25		M		
1065									1063.00ft 12.00ft
	13.50	20	15	9	24		M		Very stiff to hard brown and tan moist slightly micaceous silty CLAY (A-7-5)
1060	18.50	18	20	28	48		M		
1055									1053.00ft 22.00ft
	23.50	50/2"					M		SOFT WEATHERED ROCK - Sampled as brown sandy SILT
1050									1048.00ft 27.00ft
									Boring terminated upon encountering **Auger Refusal** at a depth of approximately 27 feet below existing grades

NCDOT_BORE 63L-0063.GPJ NCDOT.GDT 7/31/09

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 63L-0063	ID. Grace Chapel Road	COUNTY Caldwell County	GEOL/ENGR E. Freeburg
SITE DESCRIPTION See Attached Drawing			GROUND WATER (ft)
BORING NO. B-4	BORING LOCATION 14+00	OFFSET CL	ALIGNMENT Y1-Line	0 HR. DRY
COLLAR ELEV. 1105 ft	NORTHING	EASTING	24 HR.
TOTAL DEPTH 45.00 ft	DRILL MACHINE CME-550X	DRILL METHOD 2.25" HSA	HAMMER TYPE Automatic
DATE STARTED 7/2/09	COMPLETED 7/2/09	SURFACE WATER DEPTH	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
1105.00									1105.00ft 0.00ft
	0.00	2	3	8	11		M		1104.75ft Organic Laden Soil (3") 0.25ft
	1.50	7	9	12	21		M		FILL - Stiff to very stiff brown and orange moist
	3.00	7	9	10	19		M		1102.00ft sandy SILT (A-4) with rock fragments 3.00ft
1100	4.50	7	8	10	18		M		RESIDUAL - Very stiff orange and tan moist sandy SILT (A-4)
	8.50	10	10	18	28		M		
1095									1093.00ft 12.00ft
	13.50	18	20	24	44		M		Dense to medium dense tan and white moist silty fine to medium SAND (A-2-5)
1090	18.50								
		10	12	15	27		M		
1085	23.50								1083.00ft 22.00ft
		7	14	17	31		M		Hard tan, brown and gray moist slightly micaceous sandy SILT (A-4)
1080	28.50								
		9	15	20	35		M		
1075	33.50								1073.00ft 32.00ft
		17	19	23	42		M		Dense to very dense tan and white moist silty fine to medium SAND (A-2-4)
1070	38.50								
		12	23	30	53		M		
1065	43.50								
		18	23	50/4"			M		1060.50ft 44.50ft
1060									1060.00ft SOFT WEATHERED ROCK - Sampled as tan and white silty SAND 45.00ft
									Boring terminated at a depth of approximately 45 feet below existing grades

NCDOT_BORE 63L-0063.GPJ NCDOT.GDT 7/31/09

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. 63L-0063	ID. Grace Chapel Road	COUNTY Caldwell County	GEOL/ENGR E. Freeburg
SITE DESCRIPTION See Attached Drawing			GROUND WATER (ft)
BORING NO. B-5	BORING LOCATION 37+50	OFFSET 20' Left	ALIGNMENT L-Line	0 HR. 7
COLLAR ELEV. 987 ft	NORTHING	EASTING	24 HR.
TOTAL DEPTH 33.00 ft	DRILL MACHINE CME-550X	DRILL METHOD 2.25" HSA	HAMMER TYPE Automatic
DATE STARTED 7/2/09	COMPLETED 7/2/09	SURFACE WATER DEPTH	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
987.00									987.00ft 0.00ft
	0.00	2	1	2	3		M		986.92ft Surficial Organic Laden Soil (1") 0.08ft
985	1.50	2	2	2	4		M		985.50ft RESIDUAL - Soft brown and orange moist sandy SILT (A-4) 1.50ft
	3.00								
	4.50	2	3	4	7		M		982.50ft Very loose to loose orange and tan wet silty fine to medium SAND (A-2-4) 4.50ft
		3	4	4	8		W		Firm to stiff brown wet micaceous sandy SILT (A-4)
980	8.50								
		2	4	5	9		W		
975	13.50								975.00ft 12.00ft
		10	8	7	15		W		Medium dense to dense tan and white wet silty fine to medium SAND (A-2-4)
970	18.50								
		22	15	20	35		W		
965	23.50								965.00ft 22.00ft
		3	4	7	11		M		Stiff brown and orange moist micaceous sandy SILT (A-4)
960	28.50								
		3	3	10	13		M		
955									954.00ft 33.00ft
									Boring terminated upon encountering **Auger Refusal** at a depth of approximately 33 feet below existing grades

NCDOT_BORE 63L-0063.GPJ NCDOT.GDT 7/31/09

HAND AUGER BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **63L-0063** Date: **July 2009**

Client: **The Louis Berger Group**

Project: **Grace Chapel Road US 321 Connector, Granite Falls, North Carolina**

Boring No.: **B-7** **(1 of 1)** Total Depth **6.0'** Elev: **1048.0 ±** Location: **Sta 22+50, 20' Lt, Y1-Line**

Type of Boring: **Hand Auger** Started: **7/8/09** Completed: **7/8/09** Driller: **D. Webb**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	Nc	REMARKS
		RESIDUAL - Loose to medium dense tan and brown moist to wet silty SAND (A-2-4)	3-6-6	0.0	6	
			3-4-6	1.0	5	
			5-6-6	2.0	6	
			6-8-8	3.0	8	
			7-8-8	4.0	8	
			25-25-25	5.0	25	
1042.0	6.0	Hand Auger Boring terminated upon encountering **Auger Refusal** at a depth of approximately 6 feet below existing grades		6.0		Borehole was dry at termination of drilling

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75". The average of the second and third increments of penetration is termed the penetration resistance, Nc.

DCP LOG 63L-0063 (HA).GPJ F&R.GDT 7/31/09

HAND AUGER BORING LOG

SINCE 1881

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ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **63L-0063** Date: **July 2009**

Client: **The Louis Berger Group**

Project: **Grace Chapel Road US 321 Connector, Granite Falls, North Carolina**

Boring No.: **B-7** **(1 of 1)** Total Depth **6.0'** Elev: **1048.0 ±** Location: **Sta 22+50, 20' Lt, Y1-Line**

Type of Boring: **Hand Auger** Started: **7/8/09** Completed: **7/8/09** Driller: **D. Webb**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	Nc	REMARKS
		RESIDUAL - Loose to medium dense tan and brown moist to wet silty SAND (A-2-4)	3-6-6	0.0	6	
			3-4-6	1.0	5	
			5-6-6	2.0	6	
			6-8-8	3.0	8	
			7-8-8	4.0	8	
			25-25-25	5.0	25	
1042.0	6.0	Hand Auger Boring terminated upon encountering **Auger Refusal** at a depth of approximately 6 feet below existing grades		6.0		Borehole was dry at termination of drilling

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75". The average of the second and third increments of penetration is termed the penetration resistance, Nc.

DCP LOG 63L-0063 (HA).GPJ F&R.GDT 7/31/09

HAND AUGER BORING LOG

SINCE 1881

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ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **63L-0063** Date: **July 2009**

Client: **The Louis Berger Group**

Project: **Grace Chapel Road US 321 Connector, Granite Falls, North Carolina**

Boring No.: **B-8** **(1 of 1)** Total Depth **7.0'** Elev: **1048.0 ±** Location: **Sta 22+50, 20' Rt, Y1-Line**

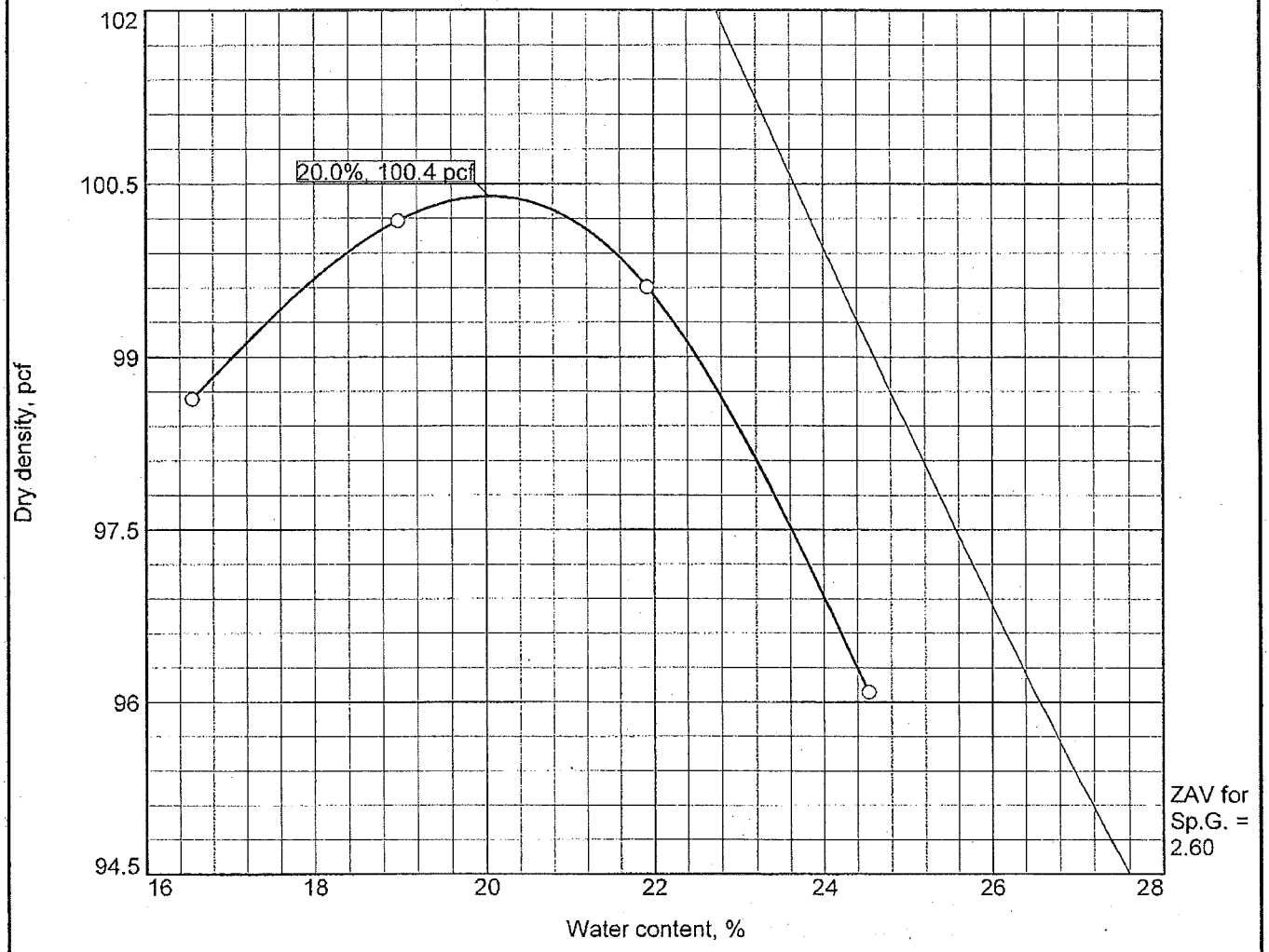
Type of Boring: **Hand Auger** Started: **7/8/09** Completed: **7/8/09** Driller: **D. Webb**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	Nc	REMARKS
		RESIDUAL - Firm and stiff brown and orange moist sandy SILT (A-4)	4-6-9	0.0	7.5	
			8-8-9	1.0	8.5	
			9-9-12	2.0	10.5	
			6-8-9	3.0	8.5	
1044.0	4.0	Medium dense orange, tan and gray moist clayey SAND (A-2-6)	6-10-14	4.0	12	
			14-25-25	5.0	25	
			25-25-25	6.0	25	
1041.0	7.0	Hand Auger Boring terminated upon encountering **Auger Refusal** at a depth of approximately 7 feet below existing grades		7.0		Borehole was dry at termination of drilling

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75". The average of the second and third increments of penetration is termed the penetration resistance, Nc.

DCP LOG 63L-0063 (HA).GPJ F&R.GDT 7/31/09

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0-10'		A-7-5	19.5		50	18		54.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 100.4 pcf Optimum moisture = 20.0 %	BROWN SILTY CLAY

Project No. L63-0063 **Client:** THE LOUIS BERGER GROUP
Project: GRACE CHAPEL ROAD

○ **Loc.:** GRANITE FALLS, NC **Depth:** 0-10' **Sample No.:** 1 (108502)

FROEHLING & ROBERTSON, INC.

Charlotte, NC

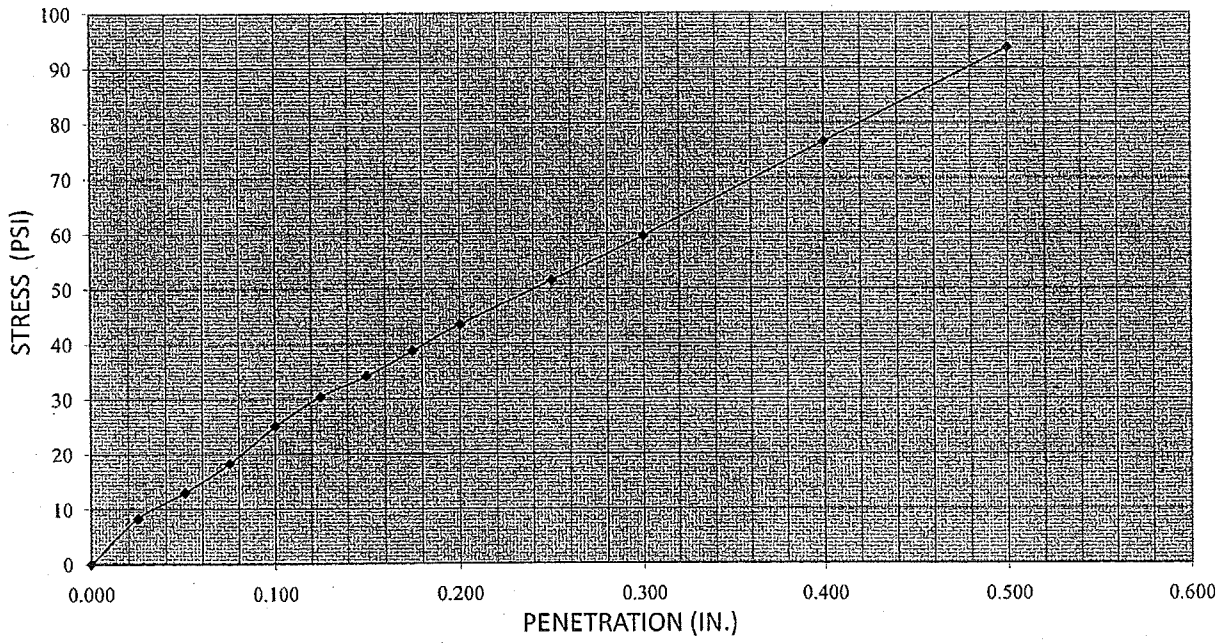
Remarks:
PROCTOR NO. 1
B-1
7-2-2009
E. FREEBURG

Figure 1

LABORATORY CBR TEST (REMOLDED)

(ASTM D1883 / AASHTO T193)

Project: Grace Chapel Road DATE: 21-Jul-09
Job Number: 63-L0063



Soil Sample Parameters

Boring No: B-1 Sample Depth (ft.): (0-10)ft
Soil Description: Brown Silty CLAY
LL: 50 PL: 32 PI: 18
Passing #200 54.9
Unified Soil Classification: A-7-5

ASTM Compaction Method:	D 698
Maximum Dry Density (pcf):	100.4
Optimum Moisture Content (%):	20
Natural Moisture Content (%):	19.5

Test Specimen Data

Molding MC(%): 20.3
Sample Condition: SOAKED
Surcharge Weight(lbs): 15

Dry Density(pcf): 96.0
Ave. MC after soaking,% 28.9
Top MC after soaking, % 34.8

Percent Compaction(pcf): 95.6
Final Dry Density(pcf): 93.2

Swell(%): 1.66 **CBR=** 3

Froehling & Robertson, Inc.
2505 Hutchison-McDonald Road
Charlotte, North Carolina
GEOTECHNICAL AND MATERIALS CONSULTANTS

SINCE F&R 1881

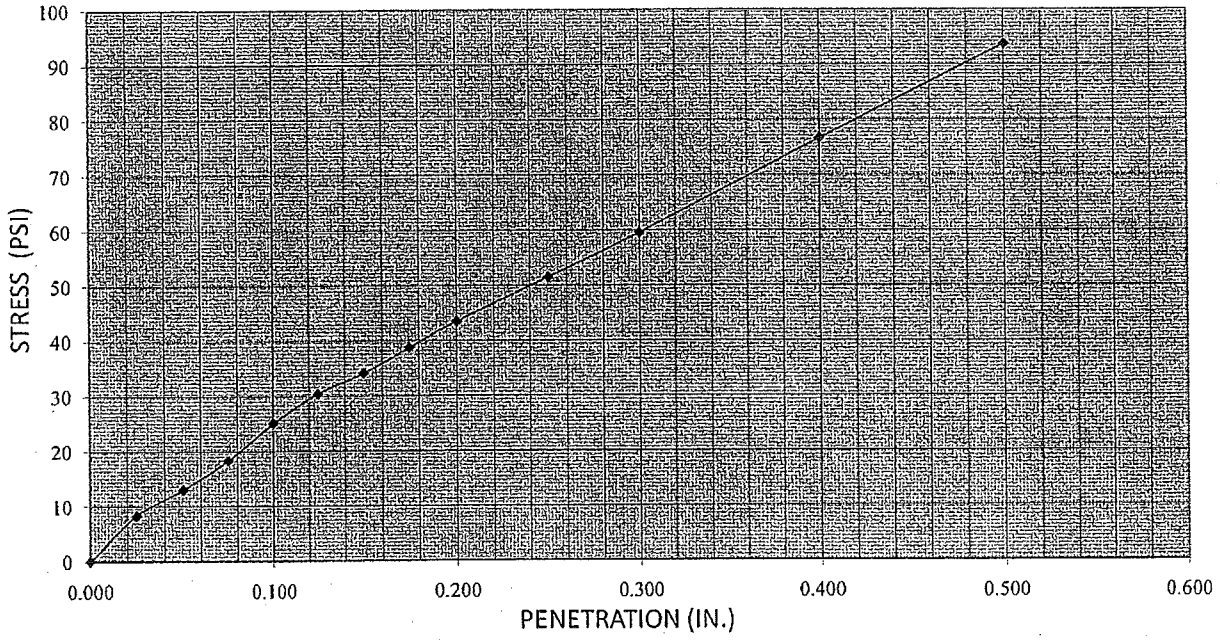
PLATE

LABORATORY CBR TEST (REMOLDED)

(ASTM D1883 / AASHTO T193)

Project: Grace Chapel Road
Job Number: 63-L0063

DATE: 21-Jul-09



Soil Sample Parameters

Boring No: B-1
Sample Depth (ft.): (0-10)ft
Soil Description: Brown Silty CLAY
LL: 50 PL: 32 PI: 18
Passing #200 54.9
Unified Soil Classification: A-7-5

ASTM Compaction Method:	D 698
Maximum Dry Density (pcf):	100.4
Optimum Moisture Content (%):	20
Natural Moisture Content (%):	19.5

Test Specimen Data

Molding MC(%): 20.3
Dry Density(pcf): 96.0
Percent Compaction(pcf): 95.6
Sample Condition: SOAKED
Surcharge Weight(lbs): 15
Ave. MC after soaking,% 28.9
Top MC after soaking, % 34.8
Final Dry Density(pcf): 93.2

Swell(%): 1.66

CBR= 3

Froehling & Robertson, Inc.
2505 Hutchison-McDonald Road
Charlotte, North Carolina
GEOTECHNICAL AND MATERIALS CONSULTANTS

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PLATE

PROJECT REFERENCE NO.	SHEET NO.
U-5204 (45328.1.1)	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 TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLES:

VERY STIFF, GRAYISH 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											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#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			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
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				
GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 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 CPT PMT VST — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- WOH — SPT REFUSAL

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:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B-____
- [ ] -N-____
- [ ] -H-____

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS 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 PIECES 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 FEET
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 THE 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, 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 IN 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.

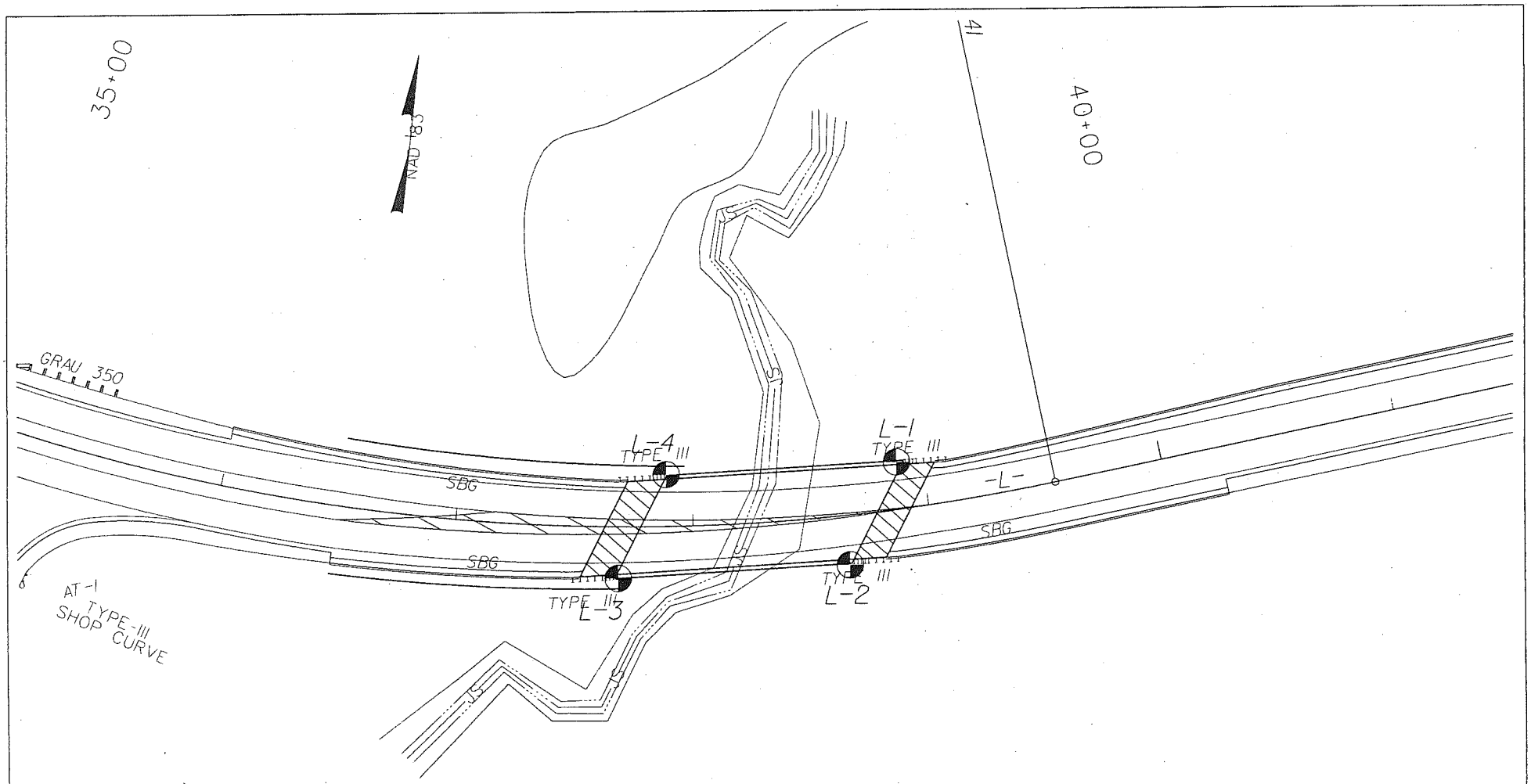
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: SURVEYS PERFORMED BY PROJECT SURVEYOR

ELEVATION: _____ FT.

NOTES:

REVISED 09/23/09



SCALE (FEET)
0 40' 80'
1"=80'

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BORING LOCATION PLAN

PROJECT REFERENCE NO.: 45328.1.1		F&R PROJECT NO.: 63N-0005-0001
I.D. NO.: U-5204	F.A. PROJECT NO.: N/A	COUNTY:
PROJECT DESCRIPTION:		
SITE DESCRIPTION: Bridge on _____ over _____		DRAWING No.: 1
DRAWN BY: D. Racey	CHECKED BY: M. Walko, P.E.	
DATE: July 2011	SCALE: 1"=40'	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. N/A	ID. U-5204	COUNTY Caldwell	GEOLOGIST J. Harris
SITE DESCRIPTION Grace Chapel Road Bridge on -L- Line			GROUND WTR (ft)
BORING NO. L-1	STATION N/A	OFFSET N/A	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 1,002.7 ft	TOTAL DEPTH 15.0 ft	NORTHING N/A	EASTING N/A	24 HR. FIAD
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER C. Boyce	START DATE 05/25/11	COMP. DATE 05/25/11	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)
1005										
	1,002.7	0.0								1,002.7 GROUND SURFACE 0.0
			3	4	3	7		M		1,002.2 Surficial Organic Laden Soil (6") 0.5
1000	999.2	3.5								**RESIDUAL** Red-brown to tan and orange micaceous silty CLAY (A-7-5(7))
			2	4	4	8	SS-1	29%		
995	994.2	8.5								994.2 8.5
			4	5	4	9		M		Tan, orange and brown micaceous sandy SILT (A-4)
990	989.2	13.5								989.2 13.5
			60/0.0			60/0.0				987.7 **CRYSTALLINE ROCK** Gray and white QUARTZ DIORITE 15.0
985										Boring Terminated by Auger Refusal at Elevation 987.7 ft in CRYSTALLINE ROCK (QUARTZ DIORITE)
980										1) Driller indicated hard drilling at 13.5 feet.
975										2) 0-hr water level measured inside HSA.
970										
965										
960										
955										
950										
945										
940										
935										
930										
925										

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 6/17/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. N/A	ID. U-5204	COUNTY Caldwell	GEOLOGIST J. Harris
SITE DESCRIPTION Grace Chapel Road Bridge on -L- Line			GROUND WTR (ft)
BORING NO. L-1	STATION N/A	OFFSET N/A	ALIGNMENT -L-	0 HR. Dry
COLLAR ELEV. 1,002.7 ft	TOTAL DEPTH 15.0 ft	NORTHING N/A	EASTING N/A	24 HR. FIAD
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER C. Boyce	START DATE 05/25/11	COMP. DATE 05/25/11	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)
1005										
	1,002.7	0.0								1,002.7 GROUND SURFACE 0.0
	1,002.2	0.5	3	4	3	7		M		1,002.2 Surficial Organic Laden Soil (6") 0.5
1000	999.2	3.5								**RESIDUAL** Red-brown to tan and orange micaceous silty CLAY (A-7-5(7))
			2	4	4	8	SS-1	29%		
995	994.2	8.5								994.2 8.5
			4	5	4	9		M		Tan, orange and brown micaceous sandy SILT (A-4)
990	989.2	13.5								989.2 13.5
			60/0.0			60/0.0				987.7 **CRYSTALLINE ROCK** Gray and white QUARTZ DIORITE 15.0
985										Boring Terminated by Auger Refusal at Elevation 987.7 ft in CRYSTALLINE ROCK (QUARTZ DIORITE)
980										1) Driller indicated hard drilling at 13.5 feet.
975										2) 0-hr water level measured inside HSA.
970										
965										
960										
955										
950										
945										
940										
935										
930										
925										

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 6/17/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. N/A	**ID.** U-5204	**COUNTY** Caldwell	**GEOLOGIST** D. Miller
SITE DESCRIPTION Grace Chapel Road Bridge on -L- Line			**GROUND WTR (ft)**
BORING NO. L-3	**STATION** N/A	**OFFSET** N/A	**ALIGNMENT** -L- — 0 HR. 6.0
COLLAR ELEV. 987.1 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** N/A	**EASTING** N/A — 24 HR. 5.0
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER C. Boyce	**START DATE** 05/24/11	**COMP. DATE** 05/24/11	**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)
990										
	987.1	0.0								987.1 0.0 GROUND SURFACE
985			1	2	2	4		M		986.6 0.5 Surficial Organic Laden Soil (6")
	983.6	3.5								**RESIDUAL**
			0	1	2	3		W		Red-orange slightly micaceous silty fine to medium SAND (A-2-4) with rock fragments
980										
	978.6	8.5								978.6 8.5
			0	1	2	3		M		Red-brown and orange micaceous silty fine to medium SAND (A-2-5(0))
975										
	973.6	13.5								
			0	2	3	5	SS-3	34%		
970										
	968.6	18.5								968.6 18.5
			4	3	3	6		M		White and brown micaceous fine to coarse silty SAND (A-2-4)
965										
	963.6	23.5								
			3	3	3	6		M		
960										
	958.6	28.5								958.6 28.5
			4	3	5	8		W		Red, brown and gray micaceous sandy SILT (A-4) with rock fragments
955										
	953.6	33.5								953.6 33.5
			21	24	13	37		M		Brown, gray and white micaceous silty fine to medium SAND (A-2-4)
950										
	948.6	38.5								948.6 38.5
			85	15/0.0		100/0.5				947.1 40.0 **WEATHERED ROCK** Brown and white QUARTZ DIORITE
945										Boring Terminated at Elevation 947.1 ft in WEATHERED ROCK
940										1) Driller indicated hard drilling at 38.5 feet.
935										2) 0-hr water level measured inside HSA.
930										3) 24-hr water level measured in open borehole.
925										
920										
915										
910										

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 6/17/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. N/A	ID. U-5204	COUNTY Caldwell	GEOLOGIST D. Miller	
SITE DESCRIPTION Grace Chapel Road Bridge on -L- Line				GROUND WTR (ft)
BORING NO. L-4	STATION N/A	OFFSET N/A	ALIGNMENT -L-	0 HR. 6.0
COLLAR ELEV. 986.3 ft	TOTAL DEPTH 42.0 ft	NORTHING N/A	EASTING N/A	24 HR. 4.0
DRILL MACHINE CME-550X	DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
DRILLER C. Boyce	START DATE 05/24/11	COMP. DATE 05/24/11	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)
990										
	986.3	0.0								986.3 GROUND SURFACE 0.0
985			0	1	2	3		M		985.8 Surficial Organic Laden Soil (6") 0.5
	982.8	3.5								**RESIDUAL** Red and orange to white, black, gray and brown micaceous silty fine to coarse SAND (A-2-4) with rock fragments
980			1	1	2	3		W		
	977.8	8.5								
975			17	9	4	13		W		
	972.8	13.5								972.8 13.5
970			2	3	4	7		M		Brown, orange and black micaceous silty fine to medium SAND (A-2-5(0))
	967.8	18.5								
965			2	3	3	6	SS-4	31%		
	962.8	23.5								
960			2	2	4	6		M		
	957.8	28.5								957.8 28.5
955			12	9	4	13		M		Brown, gray and white silty fine to coarse SAND (A-2-4)
	952.8	33.5								952.8 33.5
950			3	5	6	11		W		Brown, orange and black micaceous sandy clayey SILT (A-5)
	947.8	38.5								
945			3	4	7	11		W		
	944.3	42.0								944.3 42.0
			60/0.0			60/0.0				Boring Terminated by Auger Refusal at Elevation 944.3 ft on CRYSTALLINE ROCK (QUARTZ DIORITE)
940										1) Driller indicated hard drilling at 42 feet.
935										2) 0-hr water level measured inside HSA.
930										3) 24-hr water level measured in open borehole.
925										
920										
915										
910										

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 6/17/11

Appendix C

PROJECT REFERENCE NO.	SHEET NO.
U-5204 (45328.1.1)	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 TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. 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	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5
CLASS.	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6	A-3	A-6, A-7
SYMBOL													
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#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			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
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 A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²) :
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

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

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)
GRAIN SIZE MM: 305	75	2.0	0.25	0.05	0.005	
GRAIN SIZE 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	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 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
- 25/825 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF — SPT REFUSAL

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_w - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B-____
- [ ] -N-____
- [ ] -H-____

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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, WOH & 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, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE ROCK IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS 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 PIECES 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 FEET
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 THE 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, 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.

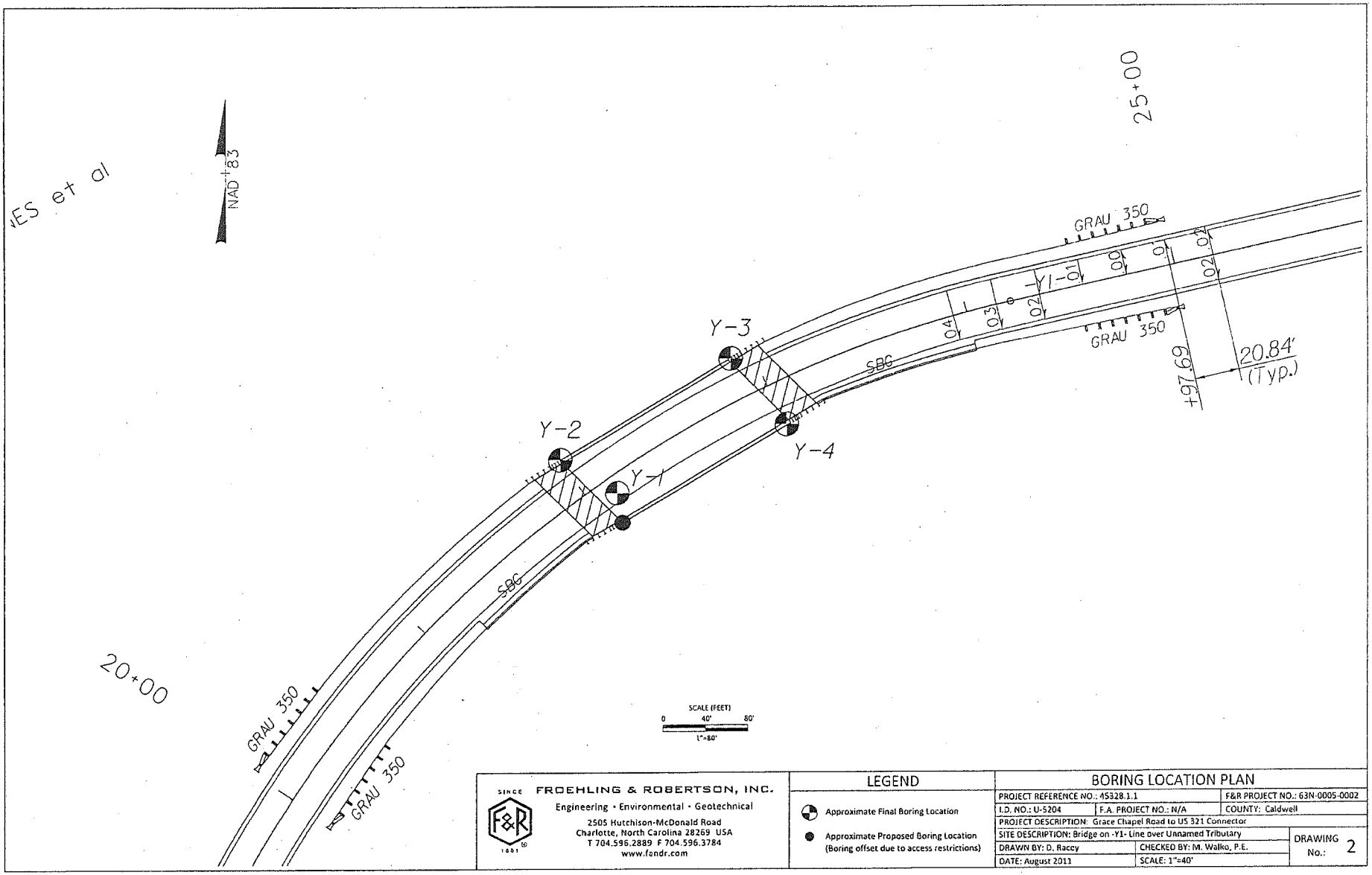
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: SURVEYS PERFORMED BY PROJECT SURVEYOR

ELEVATION: _____ FT.

NOTES:

REVISED 09/23/09



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LEGEND

- Approximate Final Boring Location
- Approximate Proposed Boring Location (Boring offset due to access restrictions)

BORING LOCATION PLAN

PROJECT REFERENCE NO.: 45328.1.1		F&R PROJECT NO.: 63N-0005-0002
I.D. NO.: U-5204	F.A. PROJECT NO.: N/A	COUNTY: Caldwell
PROJECT DESCRIPTION: Grace Chapel Road to US 321 Connector		
SITE DESCRIPTION: Bridge on -Y1- Line over Unnamed Tributary		DRAWING No.: 2
DRAWN BY: D. Racey	CHECKED BY: M. Walko, P.E.	
DATE: August 2011	SCALE: 1"=40'	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 45328.1.1	**ID.** U-5204	**COUNTY** Caldwell	**GEOLOGIST** D. Miller
SITE DESCRIPTION Grace Chapel Road Bridge on -Y- Line			**GROUND WTR (ft)**
BORING NO. Y-1	**STATION** 22+13	**OFFSET** 8 ft RT	**ALIGNMENT** -Y1-
COLLAR ELEV. 1,051.9 ft	**TOTAL DEPTH** 14.5 ft	**NORTHING** 745,741	**EASTING** 1,292,009
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER C. Boyce	**START DATE** 06/22/11	**COMP. DATE** 06/22/11	**SURFACE WATER DEPTH** N/A

0 HR. 9.0
24 HR. FIAD

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)
1055										
	1,051.9	0.0								1,051.9 GROUND SURFACE 0.0
			1	1	2	3	SS-1	5%		1,051.5 Surficial Organic Laden Soil (5") 0.4
1050										**RESIDUAL**
	1,048.4	3.5								Orange-brown silty fine to medium SAND (A-2-4(0)) 1,047.9 4.0
			9	63	37/0.1	100/0.6				**WEATHERED ROCK**
1045										Brown, white and orange QUARTZ DIORITE
	1,043.4	8.5								1,043.9 8.0
			4	7	11	18	SS-2	20%		**RESIDUAL**
1040										Brown, black, white and orange silty fine to medium SAND (A-2-4(0)) 1,041.9 10.0
										WEATHERED ROCK
	1,038.4	13.5								Brown, white and orange QUARTZ DIORITE 1,038.4 13.5
			60/0.0			60/0.0				1,037.4 **CRYSTALLINE ROCK** 14.5
1035										Orange, brown, white and gray QUARTZ DIORITE
1030										Boring Terminated by Auger Refusal at Elevation 1,037.4 ft in CRYSTALLINE ROCK (QUARTZ DIORITE)
1025										1) Driller indicated hard drilling from 4 to 8 feet and 10 to 14.5 feet with auger chattering.
1020										2) Driller indicated easier drilling from 8 to 10 feet.
1015										3) 0-hr water level measured inside HSA.
1010										
1005										
1000										
995										
990										
985										
980										
975										

NCDOT BORE SINGLE 63N0005 GRACE CHAPEL ROAD BRIDGES.GPJ NC_DOT.GDT 7/28/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 45328.1.1	**ID.** U-5204	**COUNTY** Caldwell	**GEOLOGIST** D. Miller
SITE DESCRIPTION Grace Chapel Road Bridge on -Y- Line			**GROUND WTR (ft)**
BORING NO. Y-2	**STATION** 22+00	**OFFSET** 20 ft LT	**ALIGNMENT** -Y1- — **0 HR.** 5.0
COLLAR ELEV. 1,047.5 ft	**TOTAL DEPTH** 12.5 ft	**NORTHING** 745,756	**EASTING** 1,291,982 — **24 HR.** 3.5
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER C. Boyce	**START DATE** 06/22/11	**COMP. DATE** 06/22/11	**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)
1050										
	1,047.5	0.0								1,047.5 GROUND SURFACE 0.0
			2	1	2	3	SS-3	14%		1,047.1 Surficial Organic Laden Soil (5") 0.4
1045										RESIDUAL
	1,044.0	3.5	100/0.1			100/0.1				1,044.0 Dark brown, orange and white silty SAND (A-2-4(0)) with rock fragments 3.5
										WEATHERED ROCK
1040										Dark brown, white and orange QUARTZ DIORITE
	1,039.0	8.5								1,039.5 8.0
			10	8	3	11		M		RESIDUAL
1035										Dark brown, black, white and gray clayey SAND (A-2-6)
	1,035.0	12.5	60/0.0			60/0.0				1,035.5 12.0
										1,035.0 CRYSTALLINE ROCK 12.5
1030										Dark brown, black, white and gray QUARTZ DIORITE
										Boring Terminated by Auger Refusal at Elevation 1,035.0 ft on CRYSTALLINE ROCK (QUARTZ DIORITE)
1025										1) No recovery in the 3.5 to 5.0 feet sample.
										2) Driller indicated hard drilling from 2 to 8 feet and 12 to 12.5 feet with auger chattering.
1020										3) 0-hr water level measured inside HSA.
										4) 24-hr water level measured in open borehole.
1015										
1010										
1005										
1000										
995										
990										
985										
980										
975										
970										

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 7/19/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 45328.1.1	**ID.** U-5204	**COUNTY** Caldwell	**GEOLOGIST** D. Miller
SITE DESCRIPTION Grace Chapel Road Bridge on -Y- Line			**GROUND WTR (ft)**
BORING NO. Y-3	**STATION** 22+90	**OFFSET** 19 ft LT	**ALIGNMENT** -Y1- — **0 HR.** 14.5
COLLAR ELEV. 1,051.1 ft	**TOTAL DEPTH** 23.5 ft	**NORTHING** 745,803	**EASTING** 1,292,062 — **24 HR.** 10.0
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER C. Boyce	**START DATE** 06/21/11	**COMP. DATE** 06/21/11	**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)
1055											
1050	1,051.1	0.0	1	3	6	9		M		1,051.1 GROUND SURFACE	0.0
										1,050.6 Surficial Organic Laden Soil (6")	0.5
	1,047.6	3.5								RESIDUAL 1,047.6 Red and brown sandy CLAY (A-6)	3.5
1045			4	4	6	10	SS-4	19%		Brown, gray and orange silty fine to medium SAND (A-2-4(0)) with mica and trace organics	
	1,042.6	8.5								1,042.6	8.5
1040			10	5	9	14				Dark brown silty SAND (A-2-5) with rock fragments	
	1,037.6	13.5								1,037.6	13.5
1035			38	18	24	42	SS-5	15%		Dark gray, brown and orange silty fine to medium SAND (A-2-4(0))	
	1,032.6	18.5								1,032.6	18.5
1030			24	45	51	96		M		Black, white, orange and brown sandy SILT (A-4)	
	1,027.6	23.5								1,028.1	23.0
1025			60/0			60/0				1,027.6 CRYSTALLINE ROCK White, gray and black with orange QUARTZ DIORITE	23.5
1020										Boring Terminated by Auger Refusal at Elevation 1,027.6 ft on CRYSTALLINE ROCK (QUARTZ DIORITE)	
1015										1) Driller indicated hard drilling at 18 feet.	
1010										2) 0-hr water level measured inside HSA.	
1005										3) 24-hr water level measured in open borehole	
1000											
995											
990											
985											
980											
975											

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 7/19/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 45328.1.1	**ID.** U-5204	**COUNTY** Caldwell	**GEOLOGIST** D. Miller
SITE DESCRIPTION Grace Chapel Road Bridge on -Y- Line			**GROUND WTR (ft)**
BORING NO. Y-4	**STATION** 23+01	**OFFSET** 20 ft RT	**ALIGNMENT** -Y1- — **0 HR.** Dry
COLLAR ELEV. 1,047.1 ft	**TOTAL DEPTH** 5.5 ft	**NORTHING** 745,774	**EASTING** 1,292,091 — **24 HR.** Dry
DRILL MACHINE CME-550X	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER C. Boyce	**START DATE** 06/21/11	**COMP. DATE** 06/21/11	**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)
1050											
	1,047.1	0.0								1,047.1 GROUND SURFACE	0.0
			2	1	2	3	SS-6	14%		1,046.3 Surficial Organic Laden Soil (9")	0.8
1045										RESIDUAL	
	1,043.6	3.5								1,043.6 Red and brown silty fine to medium SAND (A-2-4(0))	3.5
			56	64/0.4		100/0.9				1,042.1 WEATHERED ROCK	5.0
	1,041.6	5.5								1,041.6 White, black and gray QUARTZ DIORITE	5.5
1040			60/0.0			60/0.0				CRYSTALLINE ROCK	
										White, black and gray QUARTZ DIORITE	
1035										Boring Terminated by Auger Refusal at Elevation 1,041.6 ft on CRYSTALLINE ROCK (QUARTZ DIORITE)	
1030										1) Driller indicated hard drilling below 2.5 feet with auger chattering.	
1025										2) 0-hr water level measured inside HSA.	
1020										3) 24-hr water level measured in open borehole.	
1015											
1010											
1005											
1000											
995											
990											
985											
980											
975											
970											

NCDOT BORE SINGLE 63N0005-1 GRACE CHAPEL -L- LINE.GPJ NC_DOT.GDT 7/19/11