

**Geotechnical Base Line Report
S-45-51 Emergency Bridge
Replacement over Black Mingo Creek
Williamsburg County, South Carolina
S&ME Project No. 1413-15-145**



Prepared for:
South Carolina Department of Transportation
955 Park Street, Room 406
Columbia, South Carolina 29202

Prepared by:
S&ME, Inc.
620 Wando Park Boulevard
Mt Pleasant, SC 29464

December 2, 2015



December 2, 2015

South Carolina Department of Transportation
955 Park Street, Room 406
Columbia, South Carolina 29202

Attention: Mr. Trapp Harris, P.E.

Reference: **Geotechnical Base Line Report**
S-45-51 Emergency Bridge Replacement Over Black Mingo Creek
Williamsburg County, South Carolina
S&ME Project No. 1413-15-145

Dear Mr. Harris:

We have completed our geotechnical exploration for the S-45-51 emergency bridge replacement over Black Mingo Creek in Williamsburg County, South Carolina. Our exploration was performed in general accordance with Work Order Number SME#10-18-29461.

S&ME, Inc. personnel were present at the above referenced site on November 25, 2015, to perform soil test borings (STB) and on November 30, 2015, to perform cone penetration test (CPT) soundings. Laboratory testing was assigned by S&ME, Inc. on November 27, 2015.

The borings and soundings were conducted in the existing roadway at the locations shown on Figure 1. STB-1 and CPT-2 were performed near the existing northern bridge end abutment in the southbound and northbound lanes, respectively. CPT-3 and STB-4 were performed near the existing southern bridge end abutment in the southbound and northbound lanes, respectively. The borings were conducted to the SCDOT requested depths and the soundings refused at depths shallower than requested. The soundings appear to have refused on a relatively thin cemented sand layer encountered in the borings. Groundwater levels were measured at the time of the CPT soundings. Soils encountered in the borings were visually classified in the field in general accordance with ASTM D 2488, and the borings were backfilled by S&ME with the cuttings. Groundwater levels were not obtained in the borings.

SPT hammer energy measurements were previously obtained with a Pile Driving Analyzer (PDA) on the CME 45D drill rig used to perform the borings on this project. The energy measurements were obtained on June 3, 2015. The N-values indicated on the logs are field values that have not been corrected for hammer efficiency, which is noted on the logs.

The boring logs and CPT sounding logs are attached. Test locations were initially located by S&ME personnel measuring distances from existing site features. After field work was completed, the test locations were surveyed by a licensed surveyor. The horizontal and vertical data are shown in the table in Figure 1. Station and offset were not estimated because plans were not provided.



Geotechnical Base Line Report
S-45-51 Emergency Bridge Replacement Over Black Mingo Creek

Williamsburg County, South Carolina
S&ME Project No. 1413-15-145

Laboratory testing on samples selected by S&ME, Inc. was conducted as part of this project. The laboratory testing included Wash No. 200 sieve analyses, Atterberg Limits, moisture content, and organic content. The laboratory testing results are attached.

The in situ and laboratory testing data are intended for SCDOT's engineering interpretation of the data collected.

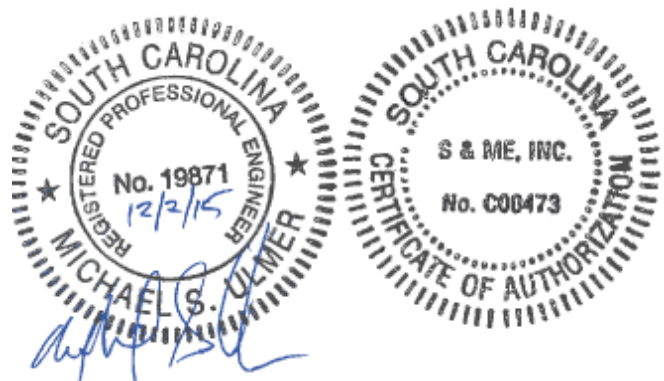
This data report has been prepared in accordance with generally applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made. The Geotechnical Engineer of Record for the project must review the data submitted in this report and develop their own interpretation of the testing results as they apply to design.

S&ME, Inc. appreciates this opportunity to work with SCDOT as your geotechnical consultant on this project. If you have any questions or need any further information in regard to this report, please do not hesitate to contact us at 843-884-0005.

Sincerely,

S&ME, Inc.

David L. Schoen, E.I.T.
Geotechnical Professional



Michael S. Ulmer, P.E.
Principal Engineer/Project Manager





Appendix

Test Location Plan (Figure 1)
Pictures of Rig at Test Locations
Soil Test Boring Logs
Cone Penetration Test Sounding Logs
Field Testing Parameters
Lab Data Summary Sheet
Individual Lab Data Sheets



Test No.	NORTH (ft.)	EAST (ft.)	LATITUDE	LONGITUDE	ELEV. (ft. NAVD 88)
STB-1	686095.71	2433140.93	33.710878	-79.575431	26.25
CPT-2	686102.64	2433149.33	33.710896	-79.575403	26.17
CPT-3	685920.66	2433109.09	33.710398	-79.575543	26.55
STB-4	685931.20	2433119.64	33.710426	-79.575508	26.53



-  Cone Penetration Test (CPT) Sounding Location
-  Soil Test Boring (STB) Location

NOTE: Locations as shown in this figure are approximate. Use locations in the table for design.

Project No.: 1413-15-145

Date / Drawn By: December 2015 / DLS


Not to Scale



TEST LOCATION PLAN
 EBRO Black Mingo Creek
 S-45-51 (Battery Park Rd)
 Williamsburg County, South Carolina

Figure:
1



	Date: 11/25/2015
	Photographer: D. Schoen
Location STB-1	

	Date: 11/25/2015
	Photographer: D. Schoen
Location STB-4	

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-1
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Alignment: Existing		
Elev.: 26.3 ft	North: 686095.71	East: 2433140.93
Date Started: 11/25/15		
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft
Date Completed: 11/25/2015		
Bore Hole Diameter (in): 3	Sampler Configuration	Liner Required: Y (N)
Liner Used: Y (N)		
Drill Machine: CME 45D	Drill Method: Mud Rotary	Hammer Type: Automatic
Energy Ratio: 81%		
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB N/A
24HR: N/A		

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE	PL	MC	LL	FINES CONTENT (%)
	0.0	ASPHALT = 11 inches												
	0.9	medium dense, moist, brownish yellow, subangular, silty fine SAND (SM), 10YR 6/6, fill		1.0	SS/1	10	12	9	21	●				
		--- loose		3.0	SS/2	6	5	5	10	●				
21.3		--- LL=NP, PL=NP, PI=NP, NMC=17.5, %200=15.8		5.0	SS/3	5	3	4	7	●	▲			
	7.0	loose, moist, dark gray, subangular, low plasticity fines, clayey fine SAND (SC), 2.5Y 4/1, fill		7.0	SS/4	4	4	3	7	●				
	9.0	very loose, moist, very dark gray, high plasticity fines, organic laden silty SAND (SM), 10YR 3/1, trace wood fragments, LL=167, PL=86, PI=81, alluvium		9.0	SS/5	WOR	WOH	1	1	●				
16.3		soft, wet, very dark gray, PEAT (PT), 10YR 3/1, alluvium		12.0										
	12.0	--- NMC=205.0, %200=6.4, OC=26.3		13.5	SS/6	1	1	2	3	●				
11.3		medium dense, moist, dark greenish gray, subangular, weakly reactive, silty fine SAND (SM), Gley 1 3/5GY, trace moderately cemented lenses, Pee Dee Formation		18.5	SS/7	14	19	10	29	●	○	▲		
6.3		--- LL=NP, PL=NP, PI=NP, NMC=15.2, %200=22.8												
	17.0	--- light yellowish brown, 2.5Y 6/4, few gravel, LL=NP, PL=NP, PI=NP, NMC=20.4, %200=13.1		23.5	SS/8	8	13	11	24	●	○	▲		

LEGEND

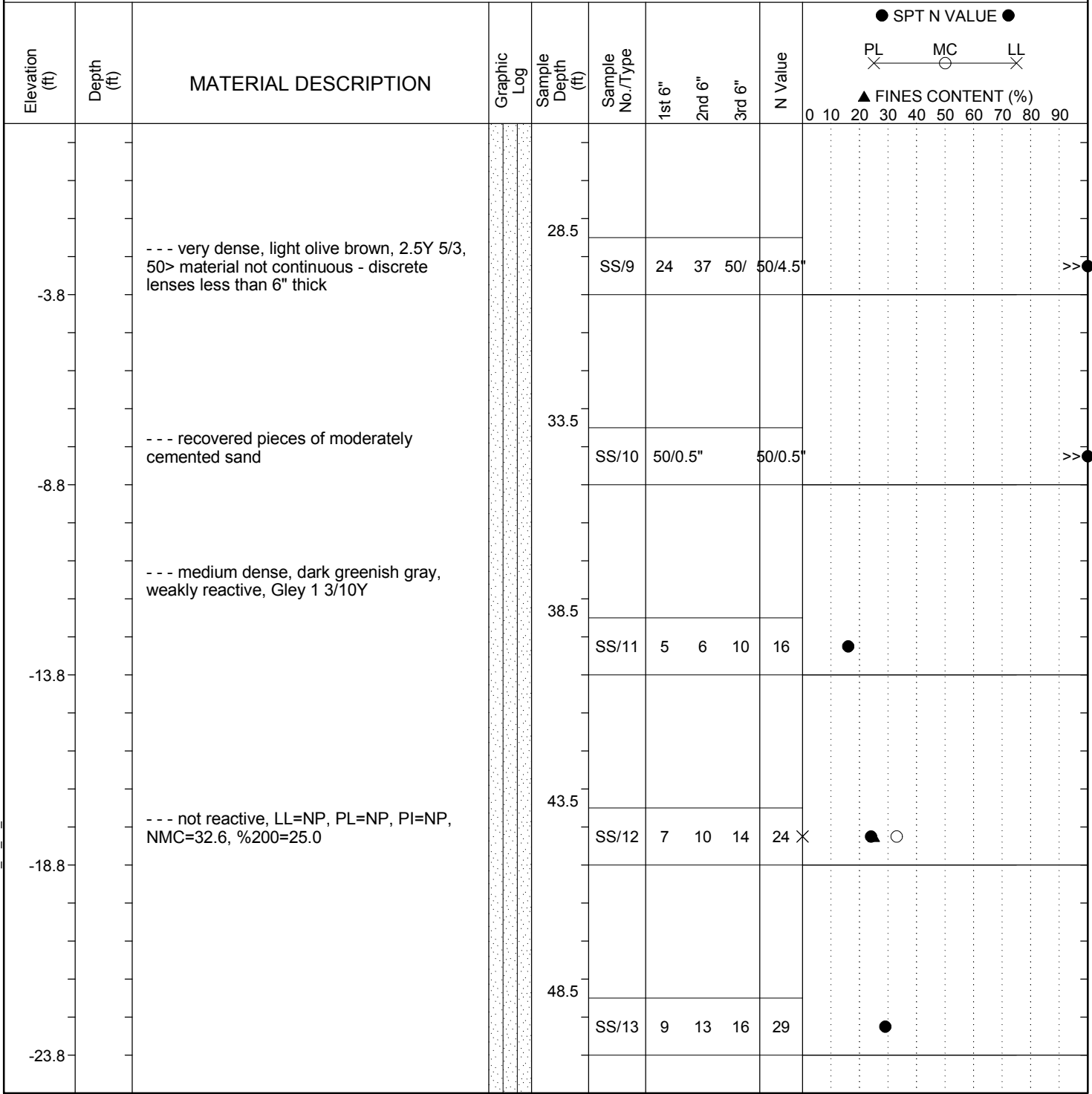
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT_1413-15-145-STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-1
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Alignment: Existing		
Elev.: 26.3 ft	North: 686095.71	East: 2433140.93
Date Started: 11/25/15		
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft
Date Completed: 11/25/2015		
Bore Hole Diameter (in): 3	Sampler Configuration	Liner Required: Y (N)
Liner Used: Y (N)		
Drill Machine: CME 45D	Drill Method: Mud Rotary	Hammer Type: Automatic
Energy Ratio: 81%		
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB N/A
24HR: N/A		



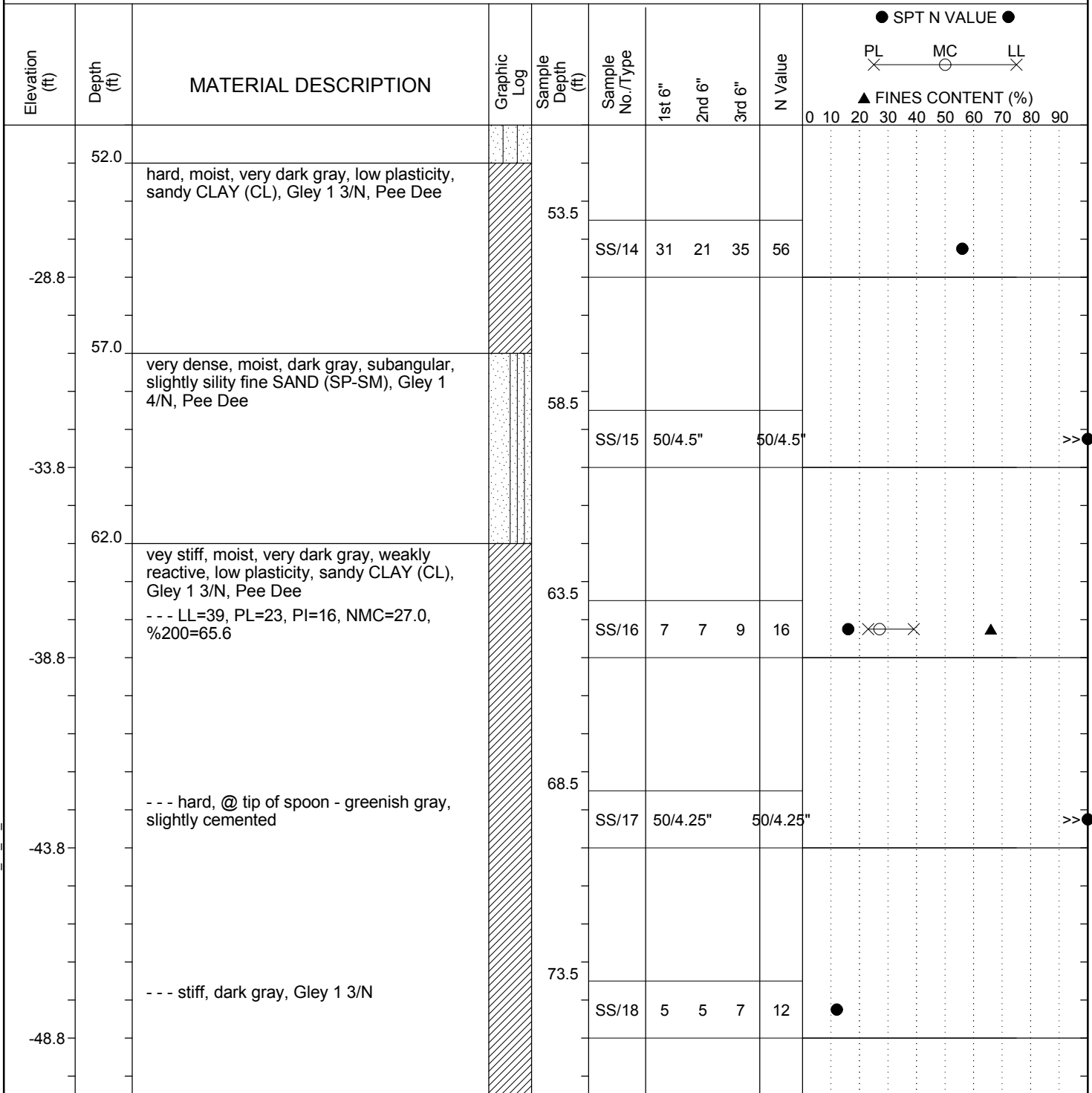
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SAMPLER TYPE		DRILLING METHOD	
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SC_DOT_1413-15-145 STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID:	P029461		County:	Williamsburg		Boring No.:	STB-1	
Site Description:	S-45-51 EBRO Black Mingo Creek					Route:	S-45-51	
Eng./Geo.:	D. Schoen		Boring Location:	N/A		Offset:	N/A	
Elev.:	26.3 ft		North:	686095.71		East:	2433140.93	
Date Started:	11/25/15		Date Completed:	11/25/2015				
Total Depth:	100 ft		Soil Depth:	N/A ft		Core Depth:	N/A ft	
Bore Hole Diameter (in):	3		Sampler Configuration			Liner Required:	Y (N)	
Liner Used:	Y (N)		Drill Machine:	CME 45D		Drill Method:	Mud Rotary	
Hammer Type:	Automatic		Energy Ratio:	81%				
Core Size:	N/A		Driller:	Carolina Drilling		Groundwater:	TOB N/A	
24HR:	N/A							



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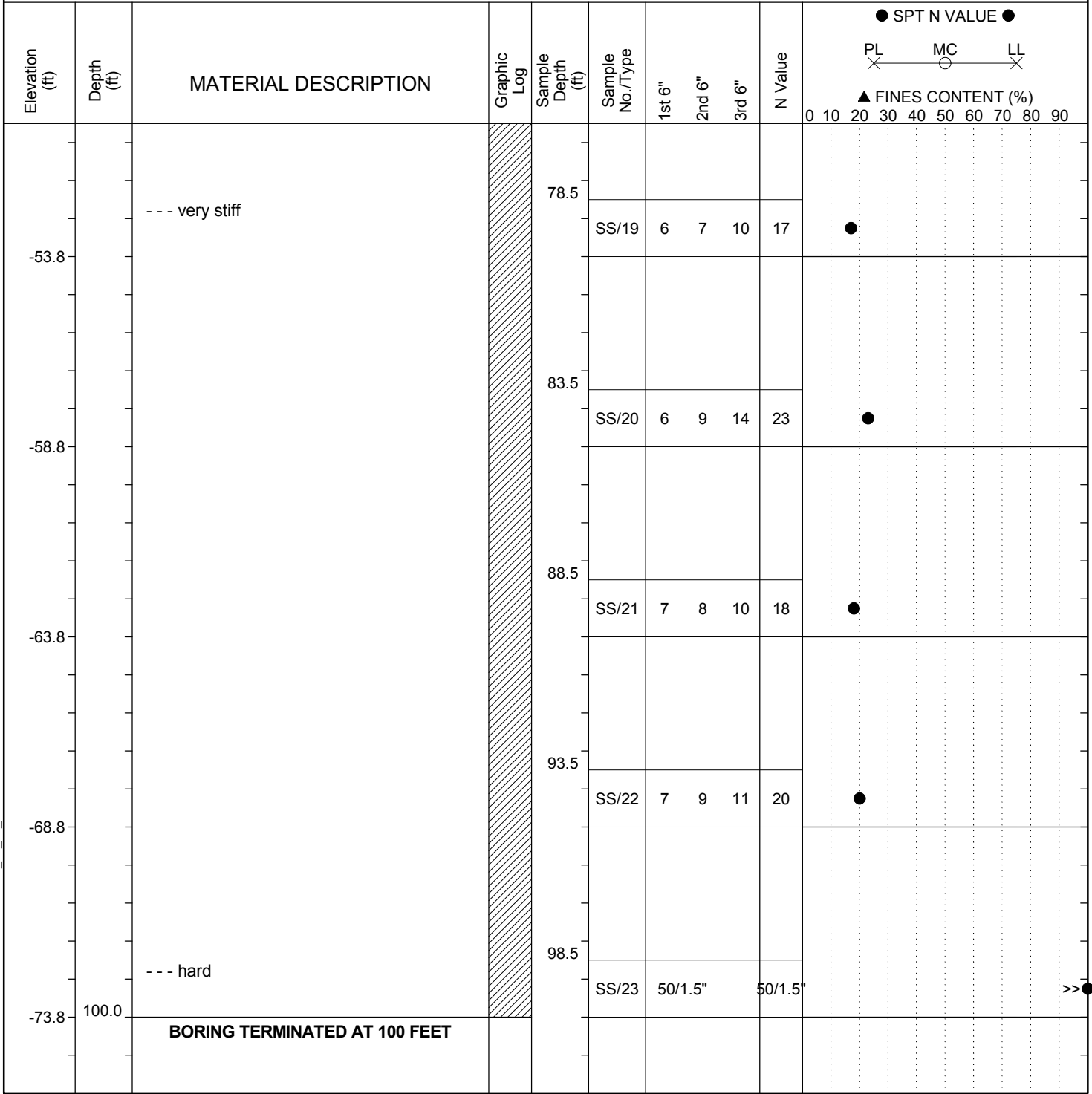
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-1
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Elev.: 26.3 ft	North: 686095.71	East: 2433140.93
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft
Bore Hole Diameter (in): 3	Sampler Configuration	Liner Required: Y (N)
Drill Machine: CME 45D	Drill Method: Mud Rotary	Hammer Type: Automatic
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB N/A
		Energy Ratio: 81%
		24HR: N/A



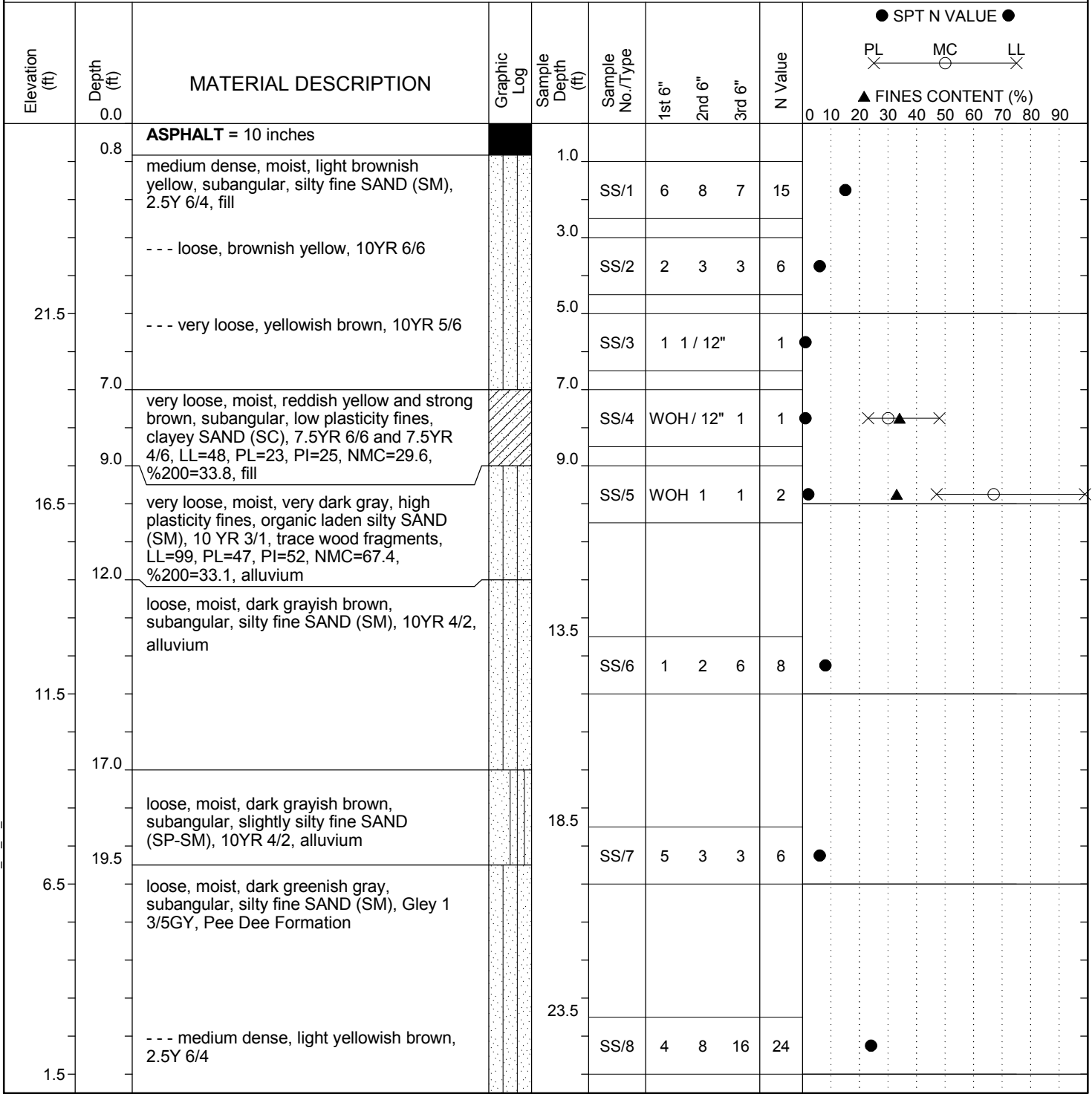
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT_1413-15-145 STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-4
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Alignment: Existing		
Elev.: 26.5 ft	North: 685931.2	East: 2433119.64
Date Started: 11/25/15		
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft
Date Completed: 11/25/2015		
Bore Hole Diameter (in): 3	Sampler Configuration	Liner Required: Y (N)
Liner Used: Y (N)		
Drill Machine: CME 45D	Drill Method: Mud Rotary	Hammer Type: Automatic
Energy Ratio: 81%		
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB N/A
24HR: N/A		



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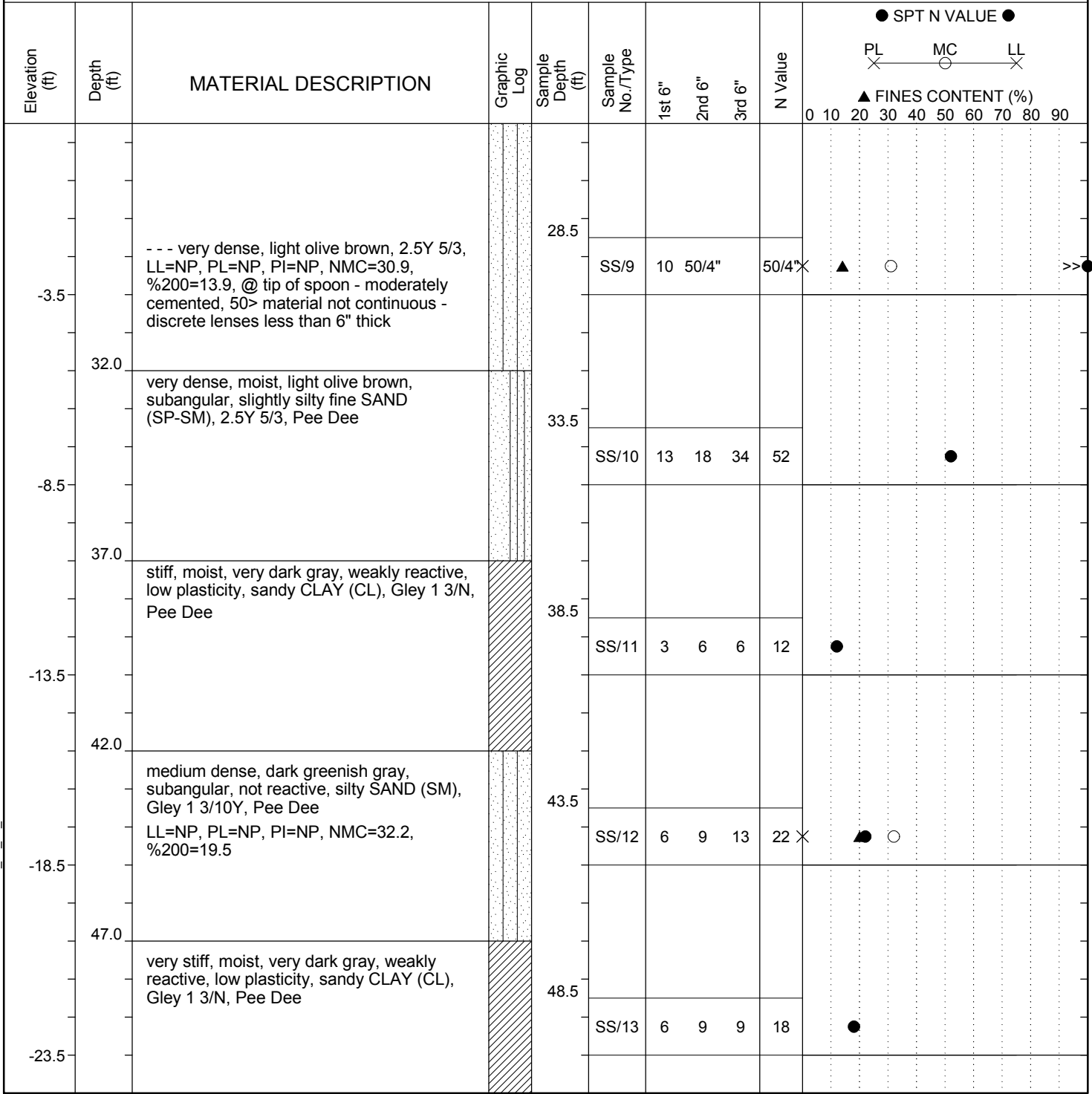
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT_1413-15-145-STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg		Boring No.: STB-4	
Site Description: S-45-51 EBRO Black Mingo Creek			Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A		Offset: N/A	Alignment: Existing
Elev.: 26.5 ft	North: 685931.2	East: 2433119.64	Date Started: 11/25/15	
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft	Date Completed: 11/25/2015	
Bore Hole Diameter (in): 3		Sampler Configuration		Liner Required: Y (N)
Drill Machine: CME 45D		Drill Method: Mud Rotary	Hammer Type: Automatic	Energy Ratio: 81%
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB	N/A	24HR: N/A



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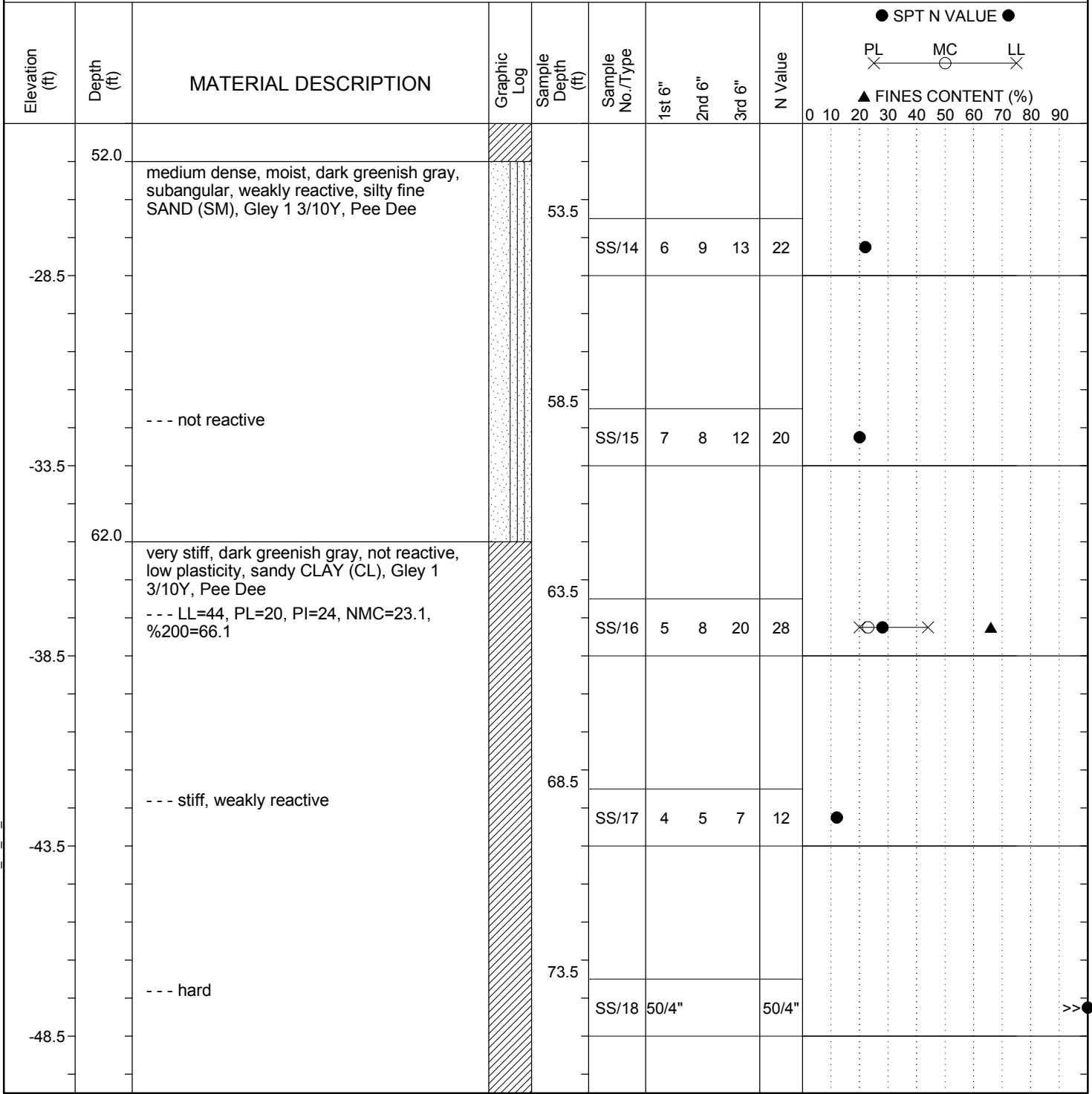
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SAMPLER TYPE		DRILLING METHOD	
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UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
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SC_DOT_1413-15-145 STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-4
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Alignment: Existing		
Elev.: 26.5 ft	North: 685931.2	East: 2433119.64
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24HR: N/A		



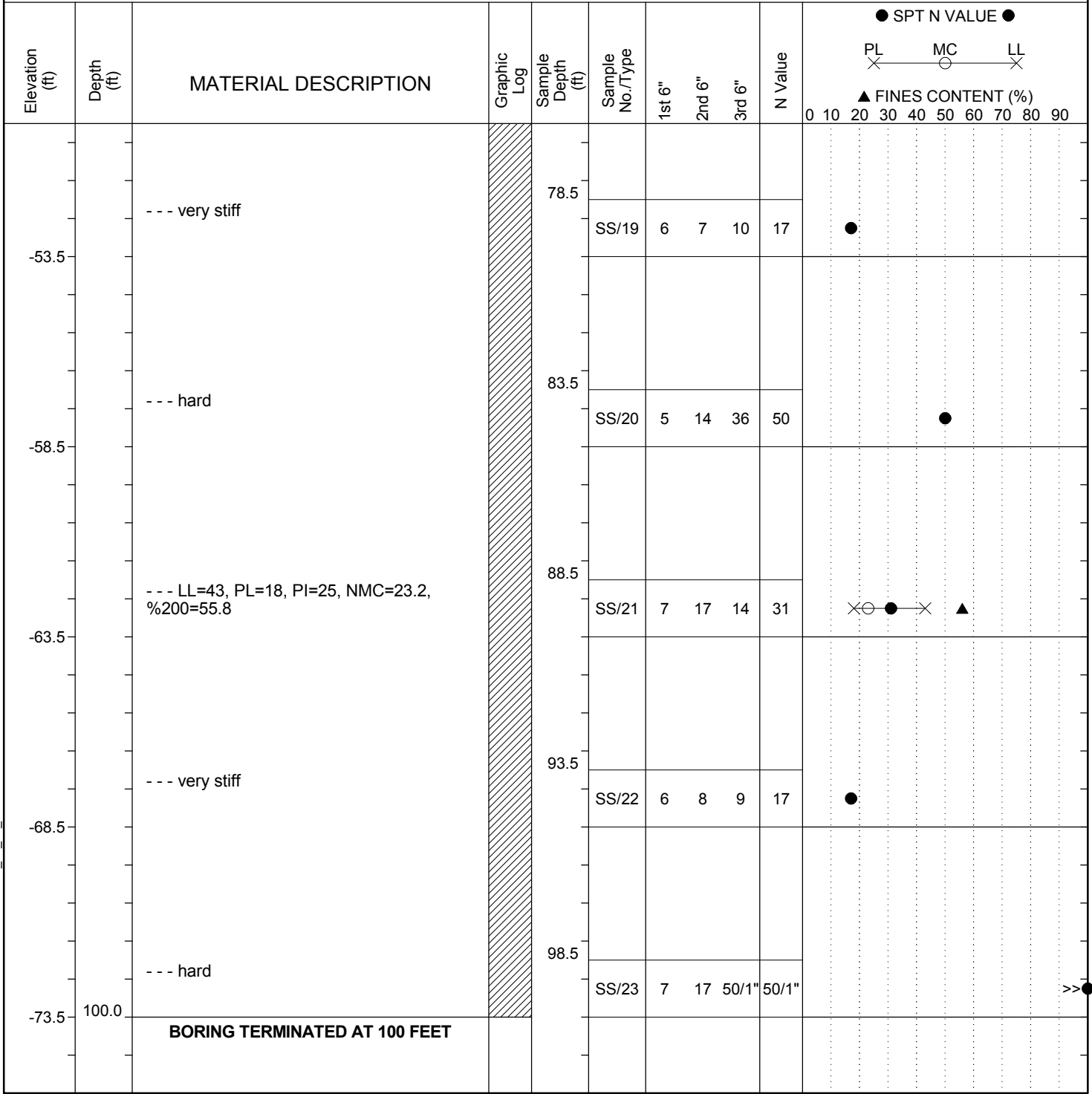
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SAMPLER TYPE		DRILLING METHOD	
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SC_DOT_1413-15-145 STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15

SCDOT Soil Test Log

Project ID: P029461	County: Williamsburg	Boring No.: STB-4
Site Description: S-45-51 EBRO Black Mingo Creek	Route: S-45-51	
Eng./Geo.: D. Schoen	Boring Location: N/A	Offset: N/A
Elev.: 26.5 ft	North: 685931.2	East: 2433119.64
Total Depth: 100 ft	Soil Depth: N/A ft	Core Depth: N/A ft
Bore Hole Diameter (in): 3	Sampler Configuration	Liner Required: Y (N)
Drill Machine: CME 45D	Drill Method: Mud Rotary	Hammer Type: Automatic
Core Size: N/A	Driller: Carolina Drilling	Groundwater: TOB N/A
		Energy Ratio: 81%
		24HR: N/A
		Liner Used: Y (N)



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
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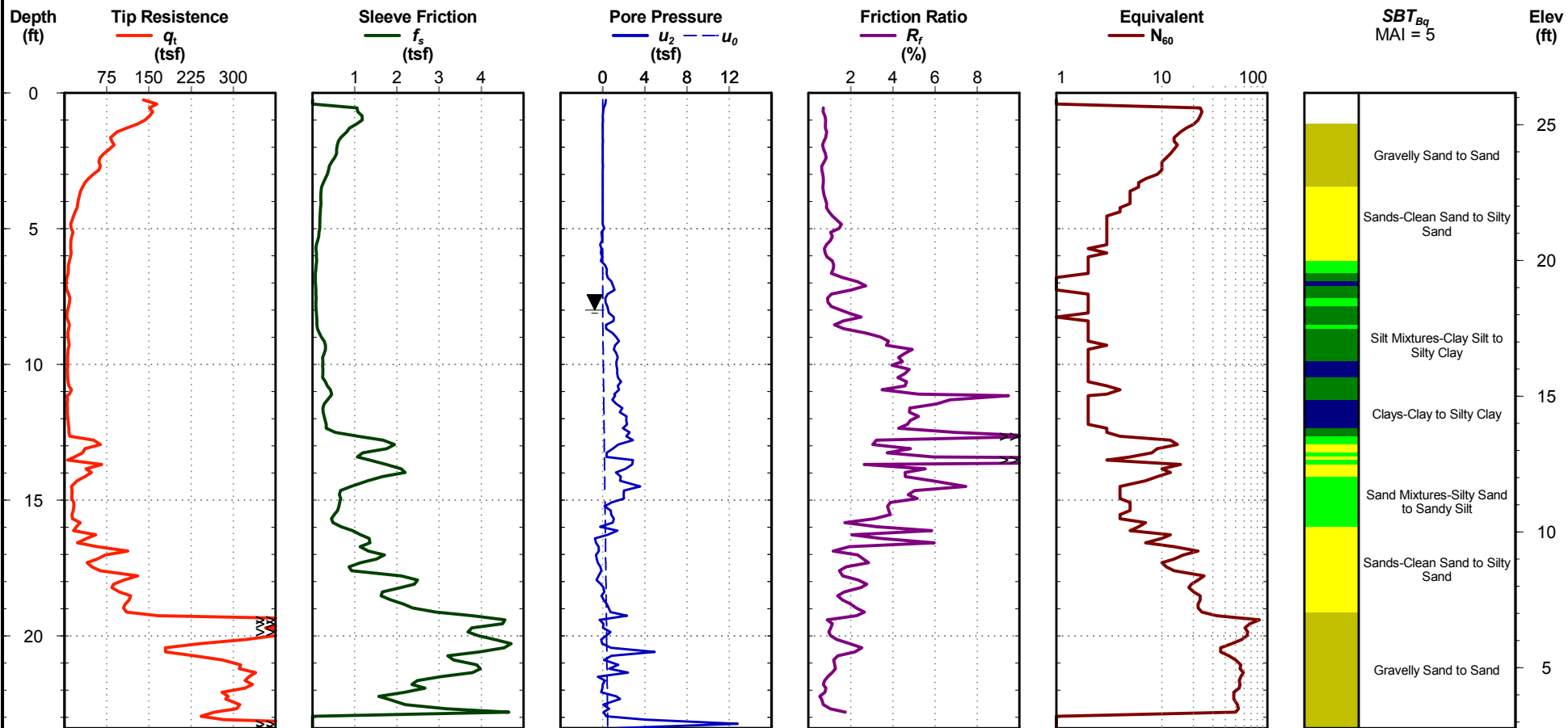
SC_DOT_1413-15-145 STB.GPJ SCDOT DATA TEMPLATE_12_30_2014.GDT 12/2/15



Date: Nov. 30, 2015
 Estimated Water Depth: 8 ft
 Rig/Operator: CPT Truck/A. Feix

Northing: 686102.64
 Easting: 2433149.33
 Elevation: 26.17 ft

Total Depth: 23.4 ft
 Termination Criteria: Maximum Reaction Force
 Cone Size: 1.75



CPT REPORT - STANDARD - SBT.BQ_1413-15-145.CPT.GPJ_S&ME.GDT_12/1/15



S-45-51 ERBO Black Mingo Creek
 Williamsburg County, South Carolina
 S&ME Project No: 1413-15-145

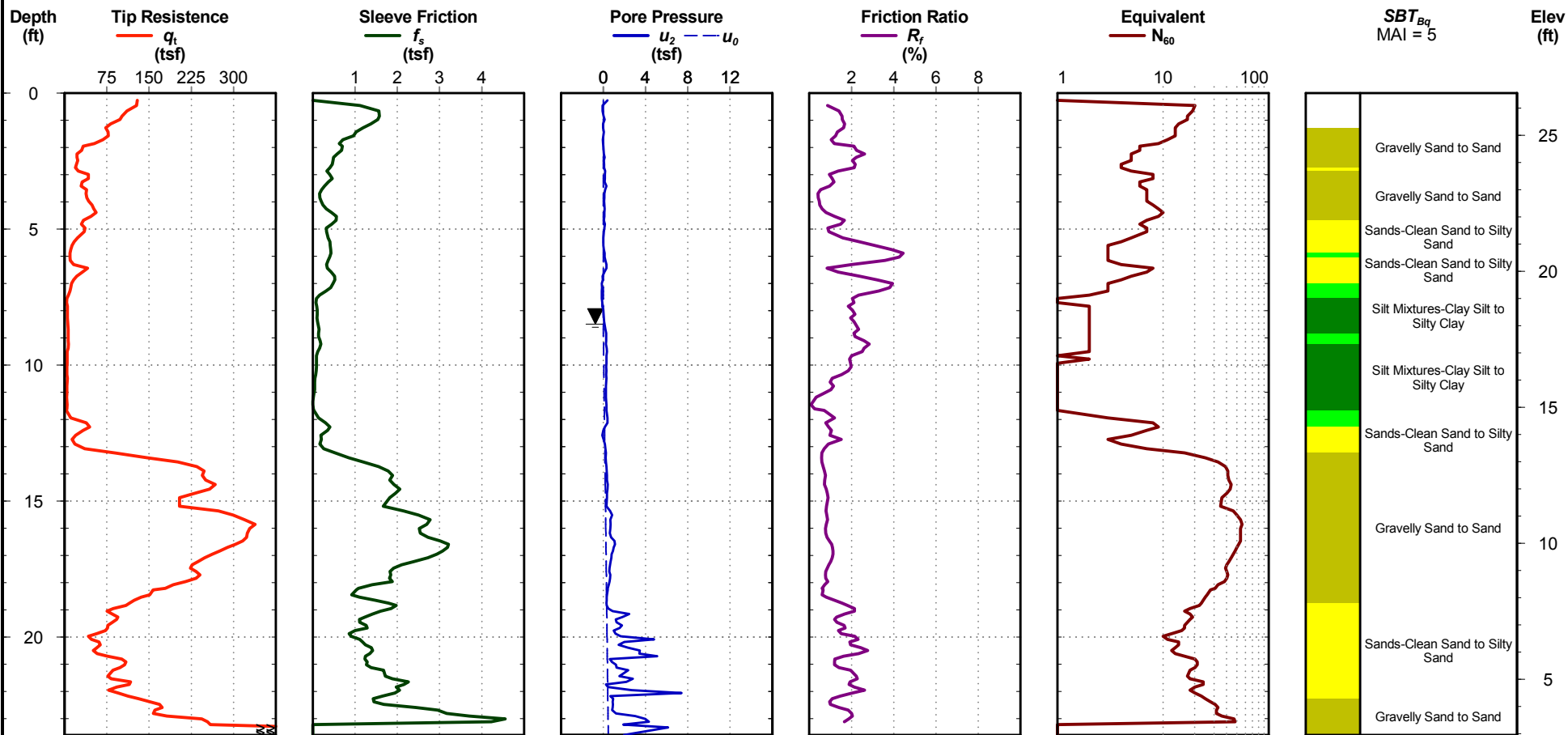
Cone Penetration Test

CPT-3

Date: Nov. 30, 2015
 Estimated Water Depth: 8.5 ft
 Rig/Operator: CPT Truck/A. Feix

Northing: 685920.66
 Easting: 2433109.09
 Elevation: 26.55 ft

Total Depth: 23.6 ft
 Termination Criteria: Maximum Reaction Force
 Cone Size: 1.75



CPT REPORT - STANDARD - SBT.BQ_1413-15-145.CPT.GPJ_S&ME.GDT_12/1/15

CPT-3

SPT FIELD TESTING PROCEDURES

Soil Classifications

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our exploration, samples obtained during drilling operations are examined and visually classified according to color, texture, and relative density or consistency (based on standard penetration resistance). The consistency and relative density designations are as follows:

<u>SANDS</u>		<u>SILTS AND CLAYS</u>	
N (SPT)	Relative Density	N (SPT)	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
		9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
50+	Very Dense	31 - 50	Hard
		50+	Very Hard

Soil Test Borings

All boring and sampling operations were conducted in accordance with ASTM Designation D 1586. Initially, the borings were advanced by either mechanically augering or wash boring through the soils. Where necessary, a heavy drilling fluid is used below the water table to stabilize the side and bottom of the drill hole. At regular intervals soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil strength.

FIELD TESTING PROCEDURES

Cone Penetrometer Test (CPT) Sounding

The cone penetrometer test soundings (ASTM D 5778) were performed by hydraulically pushing an electronically instrumented cone penetrometer through the soil at a constant rate. As the cone penetrometer tip was advanced through the soil, nearly continuous readings of point stress, sleeve friction and pore water pressure were recorded and stored in the on-site computers. Using theoretical and empirical relationships, CPT data can be used to determine soil stratigraphy and estimate soil properties and parameters such as effective stress, friction angle, Young's Modulus and undrained shear strength.

The consistency and relative density designations, which are based on the cone tip resistance, q_t for sands and cohesive soils (silts and clays) are as follows:

<u>SANDS</u>		<u>SILTS AND CLAYS</u>	
Cone Tip Resistance, q_t (tsf)	Relative Density	Cone Tip Resistance, q_t (tsf)	Consistency
<20	Very Loose	<5	Very Soft
20 – 40	Loose	5 – 10	Soft
40 – 120	Medium Dense	10 – 15	Firm
		15 – 30	Stiff
120 – 200	Dense	30 – 60	Very Stiff
>200	Very Dense	>60	Hard

CPT Correlations

References are in parenthesis next to the appropriate equation.

General

p_a = atmospheric pressure (for unit normalization)

q_t = corrected cone tip resistance (tsf)

f_s = friction sleeve resistance (tsf)

$R_f = 100\% * (f_s/q_t)$

u_2 = pore pressure behind cone tip (tsf)

u_0 = hydrostatic pressure

$B_q = (u_2 - u_0)/(q_t - \sigma_{v0})$

$Q_t = (q_t - \sigma_{v0}) / \sigma'_{v0}$

$F_r = 100\% * f_s / (q_t - \sigma_{v0})$

$I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$

N-Value

$$N_{60} = (q_t/p_a) / [8.5(1 - I_c/4.6)] \quad (6)$$

(6) Jefferies, M.G. and Davies, M.P., (1993), "Use of CPTu to estimate equivalent SPT N60", ASTM Geotechnical Testing Journal, Vol. 16, No. 4

CPT Soil Classification Legend

Zone	Color	Q _t /N	Description
1		2	Sensitive, Fine Grained
2		1	Organic Soils-Peats
3		1.5	Clays-Clay to Silty Clay
4		2	Silt Mixtures-Clayey Silt to Silty Clay
5		3	Sand Mixtures-Silty Sand to Sandy Silt
6		4.5	Sands-Clean Sand to Silty Sand
7		6	Gravelly Sand to Sand
8		1	Very Stiff Clay to Clayey Sand*
9		2	Very Stiff, Fine Grained*

(*) Heavily Overconsolidated or Cemented

Robertson's Soil Behavior Type (SBT), 1990			
Group #	Description	I _c	
		Min	Max
1	Sensitive, fine grained	N/A	
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N/A	
9	Very stiff, fine grained (High OCR or cemented)	N/A	

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

Relative Density and Consistency Table			
SANDS		SILTS and CLAYS	
Cone Tip Stress, qt (tsf)	Relative Density	Cone Tip Stress, qt (tsf)	Consistency
Less than 20	Very Loose	Less than 5	Very Soft
20 - 40	Loose	5 - 15	Soft to Firm
40 - 120	Medium Dense	15 - 30	Stiff
120 - 200	Dense	30 - 60	Very Stiff
Greater than 200	Very Dense	Greater than 60	Hard

Laboratory Data Summary Sheet
S-45-51 Emergency Bridge Replacement Over Black Mingo Creek
S&ME Project No. 1413-15-145
SCDOT Project ID: P029461
2-Dec-15

BORING ID	SAMPLE NUMBER	SAMPLE TYPE	DEPTH (FT)	ELEVATION NAVD 88 (FT)	WATER CONTENT (%)	PASSING 200 SIEVE (%)	ATTERBERG LIMITS			Organic Content (%)	USCS	AASHTO
							LL	PL	PI			
STB-1	3	SS	5.0 to 6.5	21.3 to 19.8	17.5	15.8	NP	NP	NP	-	SM	A-2-4
STB-1	5	SS	9.0 to 10.5	17.3 to 15.8	-	-	167	86	81	-	SM*	nd
STB-1	6	SS	13.5 to 15.0	12.8 to 11.3	205.0	6.4	nd	nd	nd	26.3	PT	A-8
STB-1	7	SS	18.5 to 20.0	7.8 to 6.3	15.2	22.8	NP	NP	NP	-	SM	A-2-4
STB-1	8	SS	23.5 to 25.0	2.8 to 1.3	20.4	13.1	NP	NP	NP	-	SM	A-2-4
STB-1	12	SS	43.5 to 45.0	-17.3 to -18.8	32.6	25.0	NP	NP	NP	-	SM	A-2-4
STB-1	16	SS	63.5 to 65.0	-37.3 to -38.8	27.0	65.6	39	23	16	-	CL	A-6
STB-4	4	SS	7.0 to 8.5	19.5 to 18.0	29.6	33.8	48	23	25	-	SC	A-2-7
STB-4	5	SS	9.0 to 10.5	17.5 to 16.0	67.4	33.1	99	47	52	-	SM*	A-2-7
STB-4	9	SS	28.5 to 30.0	-2.0 to -3.5	30.9	13.9	NP	NP	NP	-	SM	A-2-4
STB-4	12	SS	43.5 to 45.0	-17.0 to -18.5	32.2	19.5	NP	NP	NP	-	SM	A-2-4
STB-4	16	SS	63.5 to 65.0	-37.0 to -38.5	23.1	66.1	44	20	24	-	CL	A-7-6
STB-4	21	SS	88.5 to 90.0	-62.0 to -63.5	23.3	55.8	43	18	25	-	CL	A-7-6

SS = Split Spoon

NP = Non Plastic

* = organic laden

nd = not determined (insufficient lab testing to determine)



Liquid Limit, Plastic Limit, and Plastic Index

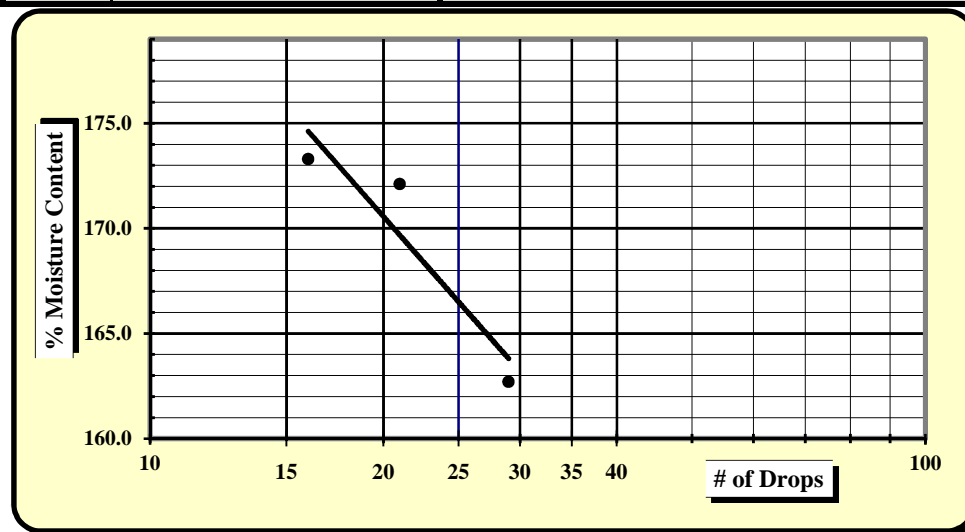
S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		
Boring #:	STB-1	Sample #:	SS-5
		Sample Date:	11-25-15
Location:	n/a	Offset:	n/a
		Depth	9-10.5 FT

Sample Description: very dark gray, organic laden silty SAND (SM)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	21.31	20.73	14.50				21.18	22.15	
B	Wet Soil Weight + A	37.78	35.37	28.33				25.35	25.89	
C	Dry Soil Weight + A	27.58	26.11	19.56				23.41	24.17	
D	Water Weight (B-C)	10.20	9.26	8.77				1.94	1.72	
E	Dry Soil Weight (C-A)	6.27	5.38	5.06				2.23	2.02	
F	% Moisture (D/E)*100	162.7%	172.1%	173.3%				87.0%	85.1%	
N	# OF DROPS	29	21	16						
LL	LL = F * FACTOR									
Ave.	Average									86.1%



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	167
Plastic Limit	86
Plastic Index	81
Group Symbol	MH
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez
Technician Name

Date

Telford Wood
Technical Responsibility

Date

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Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		
Boring #:	STB-1	Sample #:	SS-16
		Sample Date:	11-25-15
Location:	n/a	Offset:	n/a
		Depth	63.5-65 FT

Sample Description: very dark gray, sandy CLAY (CL, A-6)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3	4	5	6	7	8	9
A	Tare Weight	21.17						20.97	21.11	
B	Wet Soil Weight + A	50.93						26.25	26.42	
C	Dry Soil Weight + A	42.59						25.22	25.44	
D	Water Weight (B-C)	8.34						1.03	0.98	
E	Dry Soil Weight (C-A)	21.42						4.25	4.33	
F	% Moisture (D/E)*100	38.9%						24.2%	22.6%	
N	# OF DROPS	25								
LL	LL = F * FACTOR									
Ave.	Average									23.4%



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	39
Plastic Limit	23
Plastic Index	16
Group Symbol	CL
Multipoint Method	<input type="checkbox"/>
One-point Method	<input checked="" type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez
Technician Name

Date

Telford Wood
Technical Responsibility

Date

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Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

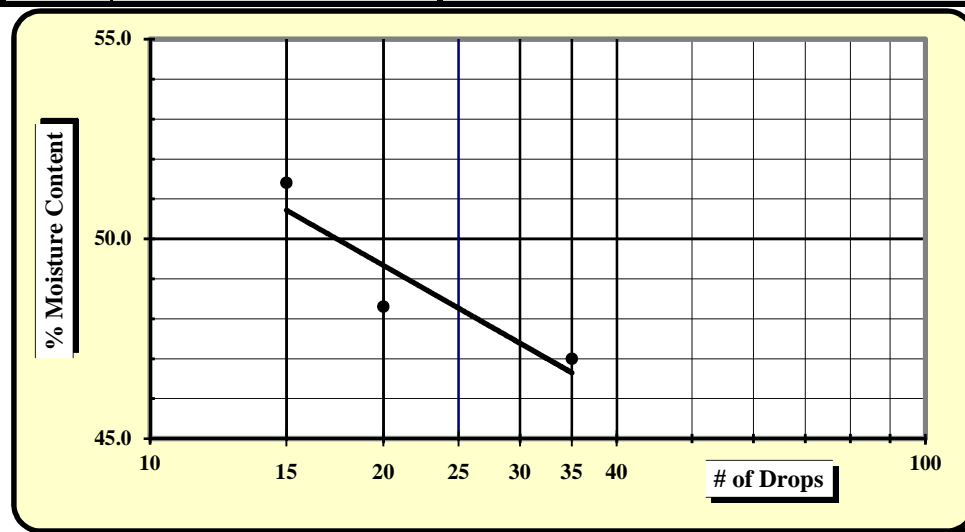
Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		

Boring #:	STB-4	Sample #:	SS-4	Sample Date:	11-25-15
Location:	n/a	Offset:	n/a	Depth	7-8.5 FT

Sample Description: reddish yellow and strong brown, clayey SAND (SC, A-2-7)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	21.27	21.48	21.95				14.66	14.36	
B	Wet Soil Weight + A	43.92	44.51	46.32				19.90	18.15	
C	Dry Soil Weight + A	36.68	37.01	38.05				18.93	17.42	
D	Water Weight (B-C)	7.24	7.50	8.27				0.97	0.73	
E	Dry Soil Weight (C-A)	15.41	15.53	16.10				4.27	3.06	
F	% Moisture (D/E)*100	47.0%	48.3%	51.4%				22.7%	23.9%	
N	# OF DROPS	35	20	15						
LL	LL = F * FACTOR									
Ave.	Average							23.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	48
Plastic Limit	23
Plastic Index	25
Group Symbol	CL
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez
Technician Name

Date

Telford Wood
Technical Responsibility

Date

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Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

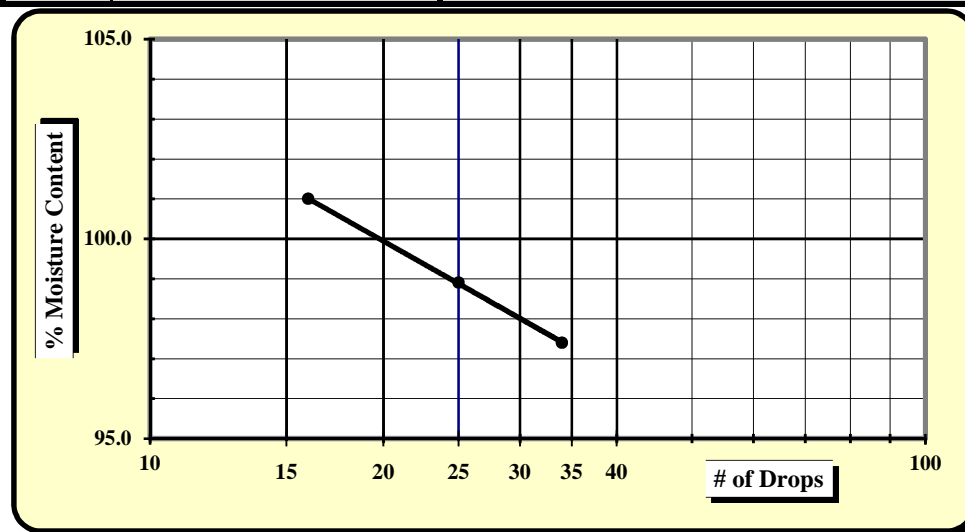
Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		

Boring #:	STB-4	Sample #:	SS-5	Sample Date:	11-25-15
Location:	n/a	Offset:	n/a	Depth	9.5-10 FT

Sample Description: very dark gray, organic laden silty SAND (SM, A-2-7)

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	22.46	21.06	21.12				21.25	20.91	
B	Wet Soil Weight + A	39.37	44.85	43.81				25.63	25.19	
C	Dry Soil Weight + A	30.96	33.11	32.41				24.19	23.85	
D	Water Weight (B-C)	8.41	11.74	11.40				1.44	1.34	
E	Dry Soil Weight (C-A)	8.50	12.05	11.29				2.94	2.94	
F	% Moisture (D/E)*100	98.9%	97.4%	101.0%				49.0%	45.6%	
N	# OF DROPS	25	34	16						
LL	LL = F * FACTOR									
Ave.	Average									47.3%



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	99
Plastic Limit	47
Plastic Index	52
Group Symbol	MH
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez
Technician Name

Date

Telford Wood
Technical Responsibility

Date

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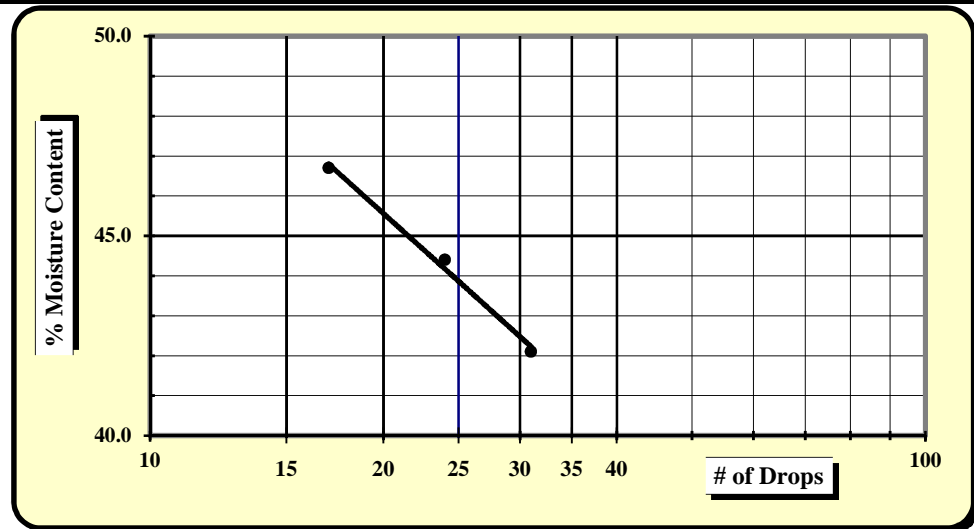
Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		
Boring #:	STB-4	Sample #:	SS-16
		Sample Date:	11-25-15
Location:	n/a	Offset:	n/a
		Depth	63.5-65 FT
Sample Description:	dark greenish gray, sandy CLAY (CL, A-7-6)		

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	21.16	22.82	22.68				14.46	14.99	
B	Wet Soil Weight + A	42.03	46.32	44.86				17.85	16.84	
C	Dry Soil Weight + A	35.85	39.09	37.80				17.29	16.54	
D	Water Weight (B-C)	6.18	7.23	7.06				0.56	0.30	
E	Dry Soil Weight (C-A)	14.69	16.27	15.12				2.83	1.55	
F	% Moisture (D/E)*100	42.1%	44.4%	46.7%				19.8%	19.4%	
N	# OF DROPS	31	24	17						
LL	LL = F * FACTOR									
Ave.	Average							19.6%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	44
Plastic Limit	20
Plastic Index	24
Group Symbol	CL
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez Technician Name Date Telford Wood Technical Responsibility Date

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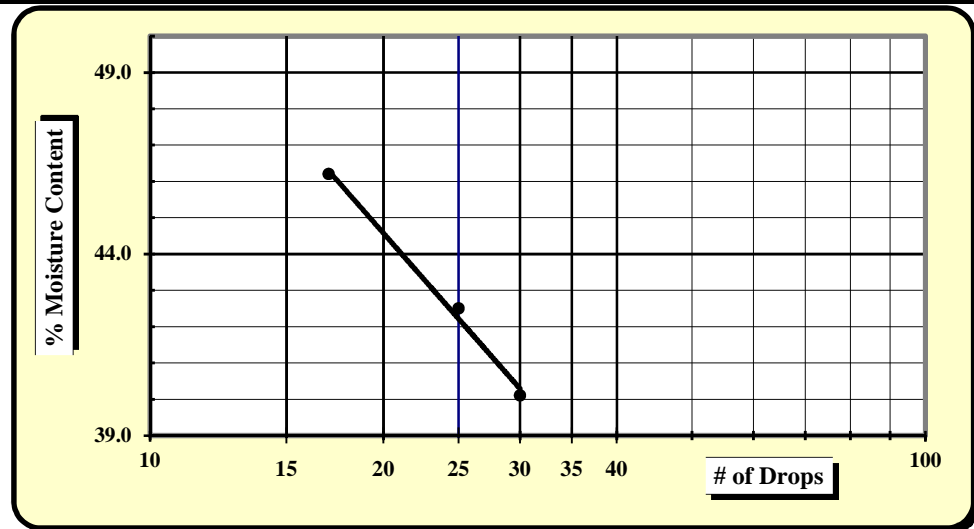
Liquid Limit, Plastic Limit, and Plastic Index

S&ME, Inc. 620 Wando Park Boulevard Mt. Pleasant, SC 29464

Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s)	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		
Boring #:	STB-4	Sample #:	SS-21
		Sample Date:	11-25-15
Location:	n/a	Offset:	n/a
		Depth	88.5-90 FT
Sample Description:	dark greenish gray, sandy CLAY (CL, A-7-6)		

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	7/22/2015	Grooving tool	10473	7/28/2015
LL Apparatus	6238	7/28/2015	Grooving tool		
Oven	13796	7/28/2015	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	21.45	21.06	21.24				22.64	21.77	
B	Wet Soil Weight + A	46.53	47.48	44.61				26.74	26.61	
C	Dry Soil Weight + A	39.35	39.60	37.23				26.11	25.85	
D	Water Weight (B-C)	7.18	7.88	7.38				0.63	0.76	
E	Dry Soil Weight (C-A)	17.90	18.54	15.99				3.47	4.08	
F	% Moisture (D/E)*100	40.1%	42.5%	46.2%				18.2%	18.6%	
N	# OF DROPS	30	25	17						
LL	LL = F * FACTOR									
Ave.	Average									18.4%



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	43
Plastic Limit	18
Plastic Index	25
Group Symbol	CL
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried Estimate the % Retained on the #40 Sieve: 10%

Notes / Deviations / References: Note and deviations from the test method are recorded.

Kim Gonzalez Technician Name Telford Wood Technical Responsibility Date

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Material Finer than the #200 Sieve

ASTM D1140

Quality Assurance

S&ME, Inc. Branch, Branch Address

Project #:	1413-15-145	Report Date:	12-2-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s):	11-28-15
Client Name:	SCDOT		
Client Address:	955 Park Street, Room 406: Columbia, SC 29201		
Sample by:	D. Schoen	Sample Dates:	11-25-15
Sampling Method:	Split Spoon	Drill Rig :	CME 45D

Method; A **B** Soaked Soak Time

Sample Identification	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
STB-1, SS-3, 5-6.5'	60.34	366.52	320.88	279.69	45.64	17.5%	15.8%
STB-1,SS6, 13.5-15'	60.89	255.24	124.61	120.55	130.63	205.0%	6.4%
STB-1, SS-7, 18.5-20'	60.33	392.13	348.25	282.64	43.88	15.2%	22.8%
STB-1,SS8,23.5-25'	60.62	407.04	348.25	310.43	58.79	20.4%	13.1%
STB-1,SS12,43.5-45'	60.99	401.19	317.46	253.41	83.73	32.6%	25.0%
STB-1,SS16,63.5-65'	60.29	357.29	294.11	140.73	63.18	27.0%	65.6%
STB-4,SS-4,7-8.5'	61.09	393.28	317.36	230.83	75.92	29.6%	33.8%
STB-4,SS-5,9-10.5'	61.08	356.73	237.74	179.18	118.99	67.4%	33.1%
STB-4,SS-9,28.5-30'	61.30	416.63	332.85	295.14	83.78	30.9%	13.9%
STB-4,SS-12,43.5-45'	60.04	360.49	287.34	242.97	73.15	32.2%	19.5%
STB-4,SS-16,63.5-65'	60.72	356.42	300.98	142.14	55.44	23.1%	66.1%
STB-4,SS-21,88.5-90'	62.01	364.74	307.57	170.48	57.17	23.3%	55.8%

Balance ID. **6976** Calibration Date: **7-21-15** #200 Sieve **10482** Calibration Date: **6-24-15**

Notes / Deviations / References:

Kim Gonzalez
 Technician Name

 Signature

Nicet 2
 Certification Type/No.

12/2/2015
 Date

Telford Wood
 Technical Responsibility

Signature

Location Coordinator
 Position

12/2/2015
 Date

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Moisture, Ash, and Organic Matter



ASTM D-2974

Quality Assurance

S&ME, Inc. Atlanta, 11420 Johns Creek Parkway, Duluth, GA 30097

Project #:	1413-15-145	Report Date:	12-1-15
Project Name:	S-45-51 EBRO Black Mingo Creek	Test Date(s):	11-28-15
Client Name:	SC DOT		
Client Address:	955 Park Street, Room 406; Columbia, SC 29201		
Boring No.	STB-1	Sample No.	SS-6
		Sample Date:	11-25-15
Location:	n/a	Offset:	n/a
		Depth	13.5-15'
Sample Description: very dark gray, PEAT (PT)			
Equipment: Balance: 0.01 g. Readability, 500g. Minimum Capacity			
Balance:	S&ME ID #:	25128	Cal. Date: 3/14/15 Due: 03/14/16

Method A: Moisture Content DeterminationRequired Oven Temperature: $105 \pm 5^\circ \text{C}$

Oven Temperature: 105 °C		Tare #	90
<i>t</i>	Tare Weight (Dish plus Aluminum Foil Cover)	grams	60.74
<i>a</i>	Mass of As-Received Specimen + Tare Wt.	grams	186.76
<i>b</i>	Mass of Oven Dry Specimen + Tare Wt.	grams	107.33
<i>w</i>	Water Weight	(a-b)	79.43
<i>A</i>	Mass of As-Received Specimen	(a-t)	126.02
<i>B</i>	Mass of Oven Dry Specimen	(b-t)	46.59
% Moisture Content as a % of As Received or Total Mass		(w/A)*100	63.0%
% Moisture Content as a % of Oven-dried Mass		(w/B)*100	170.5%

Oven	S&ME ID #:	25130	Cal. Date:	6/23/15	Due:	6/22/16
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Method C (440° C) or D (750° C): Ash Content and Organic Matter Determination

Muffle Furnace: 440 °C		Tare #	L
<i>t</i>	Tare Weight (Dish plus Aluminum Foil Cover)	grams	80.42
<i>b</i>	Mass of Oven Dry Specimen + Tare Wt.	grams	124.03
<i>c</i>	Ash Weight + Tare Wt.	grams	112.58
<i>C</i>	Ash Weight	<i>c-t</i>	32.16
<i>B</i>	Mass of Oven Dry Specimen	(b-t)	43.61
<i>D</i>	% Ash Content	(C/B)*100	73.7%
	% Organic Matter	100-D	26.3%

Muffle Furnace:	S&ME ID #:	26317	Cal. Date :	9/15/2015
------------------------	------------	-------	-------------	-----------

Notes / Deviations / References:Kim Gonzalez

Technician Name

12/1/2015

Date

Signature

Nicet 2

Level/Certification

Telford Wood

Technical Responsibility

Signature

Location Coordinator

Position

12/1/2015

Date

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