



Geotechnical Subsurface Data Report (GSDR)  
Route S-12-58 Bridge Replacement over Little Rocky Creek  
Chester County, South Carolina  
SCDOT Project ID P038060  
S&ME Project No. 1361-20-048

**PREPARED FOR:**

**South Carolina Department of Transportation  
955 Park Street  
Columbia, South Carolina 29201**

**PREPARED BY:**

**S&ME, Inc.  
134 Suber Road  
Columbia, South Carolina 29210**

**March 19, 2021**



March 19, 2021

South Carolina Department of Transportation  
955 Park Street  
Columbia, South Carolina 29201

Attention: Mr. Trapp Harris, P.E.

Reference: **Closed and Load-Restricted Bridge Package 2021-1**  
**Geotechnical Subsurface Data Report (GSDR)**  
**Route S-12-58 Bridge Replacement over Little Rocky Creek**  
**Chester County, South Carolina**  
SCDOT Project ID P038060  
S&ME Project No. 1361-20-048

Dear Mr. Harris:

The purpose of this report is to convey geotechnical information to the South Carolina Department of Transportation (SCDOT) for use by a contractor and is typically used with traditional design-bid-build projects. Our services were performed in general accordance with the *Scope of Services* provided in the *On-Call Consultant Work Order Request* by SCDOT, dated September 10, 2020, and the SCDOT *Geotechnical Design Manual (GDM)*, Version 2.0, dated January 2019.

S&ME appreciates this opportunity to work with you as your geotechnical engineering consultant on this project. Please contact us at (803) 561-9024 if you have any questions or need any additional information regarding this report.

Sincerely,

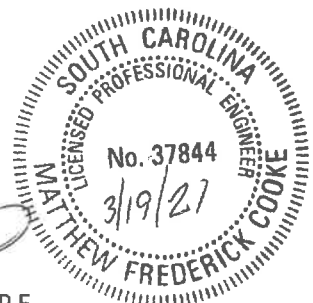
**S&ME, Inc.**

John P. Lewis, P.E.  
Project Engineer

Robert C. Bruorton, P.E.  
Senior Engineer



Matthew F. Cooke, P.G., P.E.  
Project Manager





# Table of Contents

1.0 Project Description .....1

2.0 Objective .....1

3.0 Scope of Work.....1

4.0 Test Locations .....1

5.0 Exploration Procedures .....2

    5.1 Encroachment .....2

    5.2 Traffic Control.....2

    5.3 Standard Penetration Test (SPT) Borings .....2

        5.3.1 Ground Water .....3

    5.4 SPT Energy Measurements .....3

    5.5 Wireline Rock Coring.....3

6.0 Classification of Recovered Soil Samples.....4

7.0 Classification of Recovered Rock Samples.....4

8.0 Laboratory Physical Tests.....5

9.0 Closing .....5

## List of Tables

Table 1-1 – Bridge Location Summary ..... 1

Table 5-1 – Boring Summary ..... 2

Table 5-2 – Ground Water Measurement Summary ..... 3

Table 5-3 – S&ME Drilling Equipment Summary ..... 3

## Appendices

- Appendix I – Figures
- Appendix II – Tables
- Appendix III – Soil Test Boring Records



Appendix IV – Laboratory Test Results – Split-Spoon Samples

Appendix V – Laboratory Test Data Sheets – Corrosion Series Testing

Appendix VI – Laboratory Test Data Sheets – Rock Cores

Appendix VII – SPT Hammer Energy Measurements



## 1.0 Project Description

The proposed construction for this project includes replacement of the existing Moffitt Creek Road (S-12-58) bridge over Little Rocky Creek located in Chester County, South Carolina, as shown in the *Site Location Plan*, attached as Figure 1 in Appendix I.

**Table 1-1 – Bridge Location Summary**

Project ID	Route	Route Name	Crossing	County	Latitude	Longitude
P038060	S-12-58	Moffitt Creek Road	Little Rocky Creek	Chester	34.58998	-81.08206

From our review of the provided information, the existing bridge was built in 1967 and is 105 feet in length with two travel lanes. The proposed replacement bridge will be 120 feet in length, with two travel lanes. Additional information regarding the proposed replacement bridge has not been provided at this time.

## 2.0 Objective

The objective of this project was to explore the subsurface conditions along the proposed alignment as they pertain to the proposed improvements, and in conjunction with field and laboratory testing, to provide geotechnical data to be utilized for project design.

## 3.0 Scope of Work

As requested, representatives of S&ME were present for on-site field activities between October 8 and 13, 2020, to conduct the following testing:

- Two (2) Standard Penetration Test (SPT) borings (B-1 and B-2), with one boring near each proposed abutment location.

Testing was conducted at or near the requested locations provided in the *Scope of Services*, provided by SCDOT, dated September 10, 2020. Testing locations were modified as necessary due to utilities, terrain, to minimize traffic control impacts, and to facilitate safe working conditions.

Additionally, laboratory testing was performed on disturbed split-spoon and rock core samples collected in the field. The laboratory testing program is described in more detail in the following sections.

## 4.0 Test Locations

Testing locations for the proposed new bridge abutments were determined by subtracting the existing bridge length from the proposed new bridge length, dividing that distance by two, and measuring that divided distance



from the existing abutments. As-built survey of the testing locations was performed by Glenn Associates Surveying, Inc. The approximate testing locations are shown on the *Boring Location Plan*, included as Figure 2 in Appendix I. A summary of testing locations, including coordinates, elevation and alignment are presented in Table 1, *Test Location Summary*, in Appendix II. Surveyed coordinates are tabulated in decimal degree latitude and longitude as well as South Carolina State Plan northing and easting coordinates.

## 5.0 Exploration Procedures

The subsurface exploration for this project to date has included SPT borings. The following sections summarize the general outline of each test. The field testing data are organized into appendices of this report as follows:

- ◆ Appendix III – Soil Test Boring Records

### 5.1 Encroachment

S&ME contacted the Resident Maintenance Engineer for Chester County to coordinate the field testing and traffic control along the SCDOT rights-of-way in-lieu of applying for an encroachment permit.

### 5.2 Traffic Control

Traffic control for the project was provided by Area Wide Protective (AWP) under subcontract to S&ME. Traffic control was performed in accordance with SCDOT requirements for *Flagging Operations Two-Lane Two-Way Roadways without Intersections* – SCDOT Standard Drawing 610-005-10.

### 5.3 Standard Penetration Test (SPT) Borings

Two (2) soil test borings with SPT sampling were performed between the dates of October 8 and 13, 2020 using an ATV-mounted CME 550X drill rig. Soil test borings with SPT sampling were performed using mud rotary drilling techniques. The borings were performed to drill bit refusal, followed by wireline rock coring to termination depths. A summary of the SPT borings performed is provided in the table below:

**Table 5-1 – Boring Summary**

Route	Bridge ID	Boring No.	Refusal Depth (ft)	Total Boring Depth (ft)	Pavement	Purpose
S-12-58	1270005800100	B-1	84.5	98.5	Asphalt	Proposed Southwest Abutment
		B-2	70.5	80.5	Asphalt	Proposed Northeast Abutment

Soil sampling and penetration testing were performed in general accordance with ASTM D1586 *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. SPT was performed in each boring continuously in the upper 10 feet, followed by approximate 5-foot centers, thereafter. The split-barrel sampler was opened at the drill site and sloughed material was identified and separated from the recovered sample. The recovered sample was visually described and classified by S&ME's rig engineer. A selected portion of the sample was placed in a



glass jar with a moisture-proof lid. Where materials changed over the sample drive length, a sample of each material was retained. The sample jars were labeled, placed in cardboard boxes, and transported to the S&ME Columbia Office at the end of each workday.

### 5.3.1 Ground Water

Water level measurements were attempted immediately after completion of drilling and, where feasible, were repeated after a period of roughly 24 hours. We note that due to the use of drilling fluid additives in mud rotary borings, the water level readings recorded in the soil borings may not accurately reflect the ground water conditions at the site. Ground water readings were conducted in general accordance with ASTM D4750 *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. A summary of the measured ground water depths and rough elevations are provided in the table below:

**Table 5-2 – Ground Water Measurement Summary**

Boring No.	Existing Grade (ft.)	GW Depth at TOB (ft.)	GW Elevation at TOB (ft.)	24-hr GW Depth (ft.)	24-hr GW Elevation (ft.)
B-1	398.9	7.7	391.2	11.5	387.4
B-2	399.0	11.0	388.0	12.8	386.2

After ground water measurements were complete, the borings were backfilled with bentonite chips, auger cuttings, or clean fill to within 20 feet of the existing ground surface then abandoned with Portland cement/bentonite grout. The surface pavements at each boring location were patched with commercially available bagged asphalt cold patch materials.

## 5.4 SPT Energy Measurements

SPT hammer energy measurements with a Pile Driving Analyzer (PDA) were performed by S&ME at an off-site location for the drill rig used on the project in general accordance with ASTM D4633 *Standard Test Method for Energy Measurement for Dynamic Penetrometers*. The SPT energy test results are summarized below and provided in Appendix VII. The N-values indicated on the soil test boring records are field values and were not corrected for overburden stress, rod length, borehole diameter or hammer efficiency.

**Table 5-3 – S&ME Drilling Equipment Summary**

Rig Make/Model	Serial No.	Carrier Type	Average SPT Energy Transfer Ratio (ETR), %
CME 550X	290593	ATV	81.1

## 5.5 Wireline Rock Coring

Upon encountering refusal at the boring locations, wireline rock coring was performed to termination depths of 80.5 to 98.5 feet below the existing ground surface to explore the refusal materials in general accordance with ASTM D2113 *Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*. Rock coring was



performed using an NQ-size core barrel and wireline retrieval system. The recovered rock cores were visually logged by the S&ME rig geologist or engineer. The rock core samples were placed in cardboard core boxes and the boxes were labeled. Photographs were taken of each completed core box prior to any core being removed for laboratory testing. Completed core boxes were transported to the S&ME Columbia Office at the end of each workday. The rock cores were preserved, handled, and transported in general accordance with ASTM D5079.

## 6.0 Classification of Recovered Soil Samples

Recovered split-spoon samples were initially classified in general accordance with ASTM D2488 *Standard Practice for Description and Identification of Soils (Visual-Manual Method)*. After laboratory testing was completed, provisional field classifications were revised as necessary to provide a soil description that generally follows the terminology given by ASTM D2487 *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)* and AASHTO M145 *Recommended Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes*.

Interpreted subsurface conditions encountered by the SPT borings are shown on the boring records in Appendix III. These records represent our interpretation of the subsurface conditions based on the test data. Stratification lines on the boring records represent approximate boundaries between soil types; however, the actual transition may be gradual, and the thicknesses of the strata will vary across the site. The soil samples will be retained at our laboratory for a period of seven years, or until completion of substructure installation, whichever is earlier.

## 7.0 Classification of Recovered Rock Samples

Recovered rock core samples were reviewed and classified in general accordance with the SCDOT GDM Chapter 6, Section 6.3. Upon return to our laboratory, the rock core samples were reviewed by a Professional Geologist (PG). Recovered cores examined in the laboratory were assigned descriptive terms using Tables 6-15 through 6-22 of the GDM where applicable to the rock type. Rock lithologic descriptions, and applicable descriptive information are included on the Soil Test Boring Records in Appendix III. Discontinuities in the recovered cores were evaluated using the terminology in GDM Tables 6-23 through 6-29. The results of the discontinuity examination are tabulated in the *Rock Core Discontinuity Worksheets* for each cored borehole, included in Appendix III. After logging, selected sections of rock core were removed and prepared for laboratory compressive strength testing.

After laboratory testing was completed, the Rock Mass Rating (RMR) and Geological Strength Index (GSI) were computed in general accordance with Sections 6.3.12 and 6.3.11, respectively, of the GDM. A summary of the rock core is provided in Table 4 *Rock Core – Laboratory Testing Summary*, in Appendix II.

Interpreted subsurface conditions encountered during rock coring activities are shown on the records in Appendix III. These records represent our interpretation of the subsurface conditions based on the test data. Stratification lines on the boring records represent approximate boundaries between rock types; however, the actual transition may be gradual, and the thicknesses of the strata will vary across the site. The rock samples will be retained at our laboratory for a period of seven years, or until completion of substructure installation, whichever is earlier.



## 8.0 Laboratory Physical Tests

Laboratory testing consisting of index property testing, and corrosion series testing was performed on selected split-spoon samples, while unconfined compressive strength testing was performed on selected rock core samples. The testing was performed in general accordance with ASTM, AASHTO, or SC state test procedures as follows:

- Atterberg limits – ASTM D4318 / AASHTO T89/90
- Particle-size distribution – ASTM D422 / ASTM D6913 / AASHTO T88
- Percent-finer 200 sieve – ASTM D1140 / AASHTO T11
- Natural moisture content – ASTM D2216 / AASHTO T265
- Corrosion Series:
  - pH – ASTM G51 / AASHTO T289
  - Chloride – AASHTO T291
  - Sulfate – ASTM C1580 / AASHTO T290
  - Resistivity – AASHTO T288
- Unconfined Compression – ASTM D7012

Tables summarizing the laboratory test results are provided in Appendix II as follows:

- Table 2: Split Spoon Samples – Laboratory Classification Testing Summary
- Table 3: Split Spoon Samples – Corrosion Series Testing Summary
- Table 4: Rock Core Laboratory Testing Summary

The individual laboratory test data sheets are organized into appendices of this report as summarized below:

- Appendix IV: Laboratory Test Results – Split Spoon Samples
- Appendix V: Laboratory Test Data Sheets – Corrosion Series
- Appendix VI: Laboratory Test Data Sheets – Rock Cores

## 9.0 Closing

This data report has been prepared in general accordance with procedures in SCDOT GDM Chapter 21 and 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.

We relied on project information given to us to develop our exploration program. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes.

This report presents data from a limited field exploration program. Subsurface conditions will vary widely between explored areas. Some variations may not become evident until further exploration or construction. If

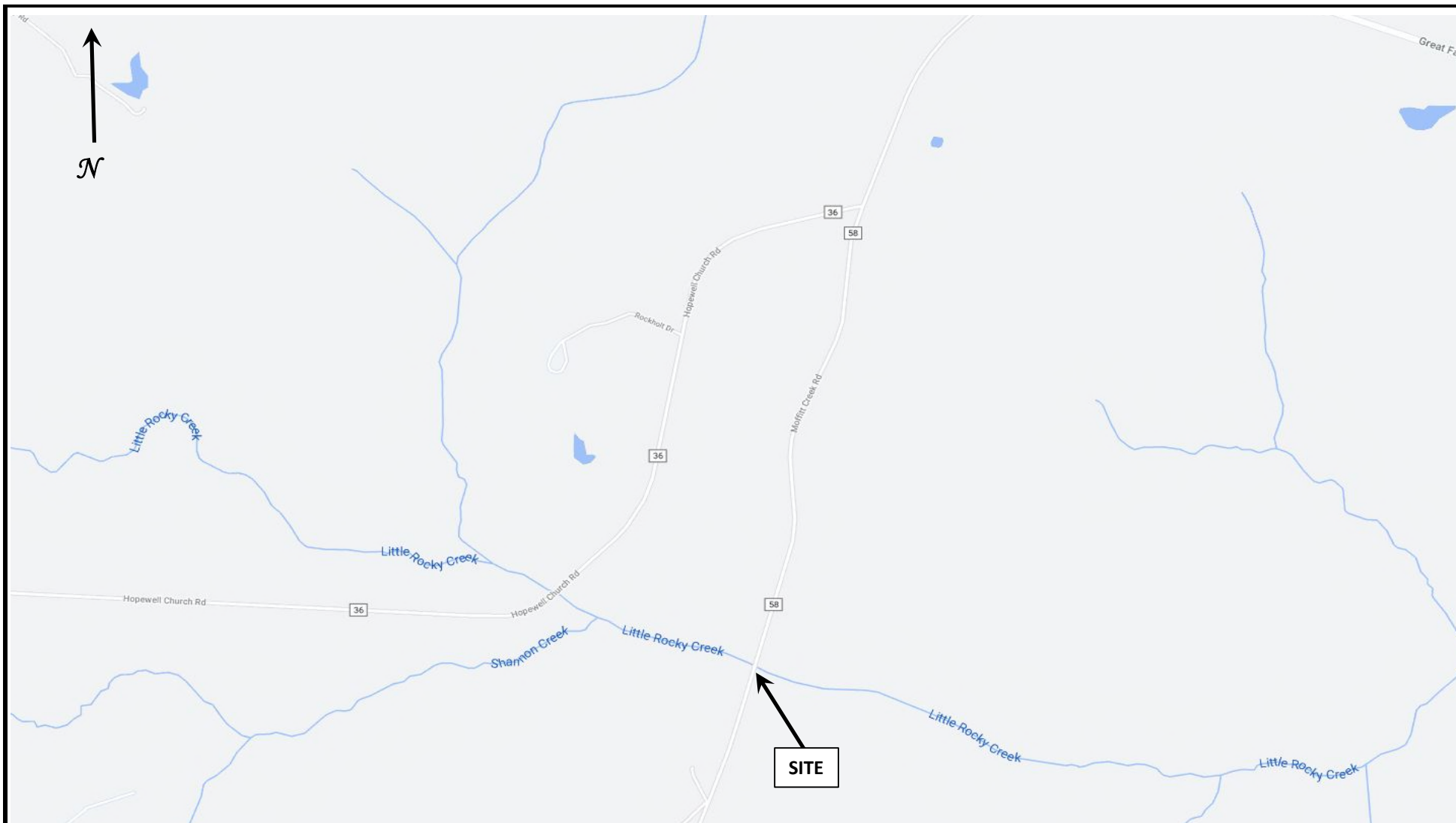


conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed.

## **Appendices**

## **Appendix I – Figures**



SOURCE: Google Maps



## SITE LOCATION PLAN: S-12-58

<b>JOB NAME:</b> S-12-58 Bridge over Little Rocky Creek		<b>FIGURE NO.</b>  <b>1</b>
<b>LOCATION:</b> S-12-58 (Moffitt Creek Road)		
<b>CITY, STATE:</b> Blackstock, South Carolina		
<b>JOB NO.:</b> 1361-20-048		
<b>SCALE:</b> NTS	<b>CHECKED BY:</b> MFC	
<b>DATE:</b> 3/19/2021	<b>DRAWN BY:</b> AKS	



Legend:

SOURCE: Google Earth



Approximate Boring Location



## BORING LOCATION PLAN: S-12-58

**JOB NAME:** S-12-58 Bridge over Little Rocky Creek  
**LOCATION:** S-12-58 (Moffitt Creek Road)  
**CITY, STATE:** Blackstock, South Carolina  
**JOB NO.:** 1361-20-048

FIGURE NO.

2

SCALE: NTS

CHECKED BY: MFC

DATE: 3/19/2021

DRAWN BY: AKS

## **Appendix II – Tables**



Table 1: Test Location Summary

Bridge ID	Boring No.	Test/SampleType(s)						SC State Plane Northing (ft.)	SC State Plane Easting (ft.)	Latitude (degrees)	Longitude (degrees)	Elevation (ft-msl)	Alignment
		SPT	CPT	DMT	Seismic	Bulk	UD						
S-12-58	B-1	X						1002940.3	1975299.8	34.58982	-81.08207	398.9	Existing
S-12-58	B-2	X						1003054.9	1975331.8	34.59013	-81.08196	399.0	Existing



Table 2: Split Spoon Samples – Laboratory Classification Testing Summary

Route ID	Boring Number	Sample Number	Sample Depth (ft)	Natural Moisture (%)	Atterberg Limits			Percent Finer #10 (%)	Percent Finer #40 (%)	Percent Finer #200 (%)	Organic Content (%)	Soil Classification		
					LL	PL	PI					AASHTO	USCS	Strata
S-12-58	B-1	SS-6	13.5-15.0	19.0	-	-	-	89	51	23.0	-	-	SC	ALLUVIUM
	B-1	SS-7	23.5-25.0	13.5	-	-	-	67	35	7.5	-	-	SW-SM	ALLUVIUM
	B-1	SS-8	28.5-30.0	23.4	NP	NP	NP	-	-	22.0	-	-	SM	RESIDUUM
	B-1	SS-9	33.5-35.0	21.2	NP	NP	NP	-	-	20.6	-	-	SM	RESIDUUM
	B-1	SS-11	43.5-45.0	14.0	-	-	-	-	-	23.2	-	-	SM	RESIDUUM
	B-2	SS-2	2.0-4.0	20.1	56	21	35	96	70	42.4	-	A-7-6	SC	FILL
	B-2	SS-3	4.0-6.0	13.0	31	19	12	-	-	29.2	-	-	SC	FILL
	B-2	SS-5	8.0-10.0	33.0	51	26	25	99	88	75.0	-	A-7-6	CH	ALLUVIUM
	B-2	SS-6	13.5-15.0	25.4	35	20	15	-	-	45.1	-	-	SC	ALLUVIUM
	B-2	SS-7	18.5-20.0	15.6	-	-	-	56.8	27.2	6.2	-	-	SP-SC	ALLUVIUM
	B-2	SS-8	23.5-25.0	27.2	NP	NP	NP	-	-	23.6	-	-	SM	RESIDUUM
	B-2	SS-9	28.5-30.0	20.8	NP	NP	NP	-	-	21.6	-	-	SM	RESIDUUM

NT = Not Tested

NP = Non-plastic

Classification estimated based on test results and ASTM D2488 Visual Manual Procedure



Table 3: Split Spoon Samples - Corrosion Series Testing Summary

Route & Boring Number	Sample Depth (ft)	Sample Number	As-Rec'd Resistivity (Ohm-cm)	Minimum Resistivity (Ohm-cm)	Sulfates		Chlorides		pH
					(mg/kg)	(wt%)	(mg/kg)	(wt%)	
S-12-58 B-1	6.0 - 8.0	SS-4	25,460	18,760	31.1	0.0031	23.9	0.0024	6.4



**Table 4: Rock Core - Laboratory Testing Summary**

Route & Boring Number	Core Run No.	Core Run Top Depth	Core Run Bottom Depth	Recovery (%)	RQD	Sample Top Depth (ft)	Sample Bottom Depth (ft)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	RMR <sup>(1)</sup>	GSI <sup>(2)</sup> Range
S-12-58 B-1	RC-1	88.5	90.5	50	0	-	-	-	-	-	60
	RC-2	90.5	94.5	100	33	91.1	91.5	176	3,441	32	55
	RC-3	94.5	98.0	75	13	-	-	-	-	-	70
S-12-58 B-2	RC-1	70.5	75.5	94	46	-	-	-	-	-	60
	RC-2	75.5	80.5	78	20	-	-	-	-	-	60

Notes:

<sup>(1)</sup> RMR = Rock Mass Rating (Refer to SCDOT Geotechnical Design Manual, Chapter 6)

<sup>(2)</sup> GSI = Geologic Strength Index (Refer to SCDOT Geotechnical Design Manual, Chapter 6)

## **Appendix III – Soil Test Boring Records**

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

## SOIL TYPES

(Shown in Graphic Log)



Fill



Asphalt



Concrete



Topsoil



Gravel



Sand



Silt



Clay



Organic



Silty Sand



Clayey Sand



Sandy Silt



Clayey Silt



Sandy Clay



Silty Clay



Partially Weathered Rock



Cored Rock

## WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring

▼ = Water Level Taken After 24 Hours

◀ = Loss of Drilling Water

HC = Hole Cave

## CONSISTENCY OF COHESIVE SOILS

### CONSISTENCY

Very Soft  
Soft  
Firm  
Stiff  
Very Stiff  
Hard  
Very Hard

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 2  
3 to 4  
5 to 8  
9 to 15  
16 to 30  
31 to 50  
Over 50

## RELATIVE DENSITY OF COHESIONLESS SOILS

### RELATIVE DENSITY

Very Loose  
Loose  
Medium Dense  
Dense  
Very Dense

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 4  
5 to 10  
11 to 30  
31 to 50  
Over 50

## TERMS

**Standard Penetration Resistance** - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

**REC** - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

**RQD** - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.



Soil Test Log Descriptors

k

**Rock Type**

Indicate type of rock encountered (i.e. granite, limestone, shale, slate, etc.)

l

**Color**

Describe the sample color while sample is still moist, using Munsell color chart.

m

**Texture**

Describe the nonfracture structural features. Stratification is the layering of sedimentary rock and foliation is the layering of metaphoric rock

Descriptive Term	Criteria
Very Thickly Bedded	> 1.0 m
Thickly Bedded	0.5 to 1.0 m
Thinly Bedded	50 to 500 mm
Very Thinly Bedded	10 to 50 mm
Laminated	2.5 to 10 mm
Thinly Laminated	< 2.5 mm

n

**Grain Size and Shape**

Describe the size and shape of all visible grains, typically used on sedimentary rock.

Size		Sieve size
Descriptor	mm	
Very coarse grained	> 4.75	Grain sizes greater than popcorn kernels
Coarse grained	2.00 – 4.75	Individual grains easy to distinguish by eye
Medium grained	0.425 – 2.00	Individual grains distinguished by eye
Fine grained	0.075 – 0.425	Individual grains distinguished with difficulty
Very Fine grained	< 0.075	Individual grains cannot be distinguished by unaided eye

Shape	
Descriptive Term	Criteria
Angular	Shows little wear; edges and corners are sharp
Subangular	Shows definite effects of wear; edges and corners are slightly rounded off
Subrounded	Shows considerable wear; edges and corners are rounded to smooth curves
Rounded	Shows extreme wear; edges and corners are smoother to broad curves
Well-rounded	Completely worn; edges and corners are not present

o

**Weathering / Alteration**

Weathering is the physical disintegration of the minerals by atmospheric processes. Alteration is disintegration of the minerals by geothermal processes.

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered / Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although the original fabric may be intact; material can be granulated by hand
Highly Weathered / Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 1-7/8 inch diameter sample can be easily broken readily by hand across rock fabric
Moderately Weathered / Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 1-7/8 inch diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered / Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh	Rock shows no discoloration, loss of strength, or other effect of weathering / alteration

Figure 6-16, SCDOT Soil Test Log Descriptors – Rock

6-38

January 2019

**SCDOT** Soil Test Log Descriptors

**p**

**Rock Strength**

Provide a qualitative assessment of the rock strength using either a geologic hammer or knife.

Description	Recognition	Approximately Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 – 150
Very Weak Rock	Can be peeled by pocket knife	150 – 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 – 3,500
Medium Strong Rock	Can be indented 3/16 inch with sharp end of pick	3,500 – 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 – 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 – 35,000
Extremely Strong Rock	Can only be chipped with hammer blows	> 35,000

**q**

**Strike and Dip**

Dip of fracture surface measured relative to horizontal with bearing and direction (i.e. N30°down, etc.)

**r**

**Discontinuity Type**

F - Fault  
J - Joint  
Sh - Shear  
Fo - Foliation  
V - Vein  
B - Bedding

**s**

**Discontinuity Width (millimeters)**

W - Wide (12.5 – 50)  
MW - Moderately Wide (2.5 – 12.5)  
N - Narrow (1.25 – 2.5)  
VN - Very Narrow (< 1.25)  
T - Tight (0)

**t**

**Amount of Infilling**

Su - Surface Stain  
Sp - Spotty  
Pa - Partially Filled  
Fi - Filled  
No - None

**u**

**Type of Infilling**

Cl - Clay  
Ca - Calcite  
Ch - Chloride  
Fe - Iron Oxide  
Gy - Gypsum/Talc  
H - Healed  
No - None  
Py - Pyrite  
Qz - Quartz  
Sd - Sand

**v**

**Surface Shape of Joint**

Wa - Wavy  
Pl - Planar  
St - Stepped  
Ir - Irregular

**w**

**Discontinuity Spacing (feet)**

EW - Extremely Wide (> 65)  
W - Wide (22 – 65)  
M - Moderate (7.5 – 22)  
C - Close (2 – 7.5)  
VC - Very Close (< 2)

**x**

**Roughness of Surface**

Slk - Slickensided (surface has smooth, glassy finish with visual evidence of striations)  
S - Smooth (surface appears smooth and feels so to the touch)  
SR - Slightly Rough (asperities on the discontinuity surfaces are distinguishable and can be felt)  
R - Rough (some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive)  
VR - Very Rough (near-vertical steps and ridges occur on the discontinuity surface)

**Figure 6-17, SCDOT Soil Test Log Descriptors – Rock (con't)**

# SCDOT Soil Test Log

<b>Project ID:</b>	P038060				<b>County:</b>	Chester		<b>Boring No.:</b>	B-1		
<b>Site Description:</b>	S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)							<b>Route:</b>	S-12-58		
<b>Eng./Geo.:</b>	BK		<b>Boring Location:</b>	7.5' S of SEB		<b>Offset:</b>	7' E of CL		<b>Alignment:</b>	Existing	
<b>Elev.:</b>	398.9 ft		<b>Latitude:</b>	34.5898164		<b>Longitude:</b>	-81.08206827		<b>Date Started:</b>	10/8/2020	
<b>Total Depth:</b>	98.5 ft		<b>Soil Depth:</b>	84.5 ft		<b>Core Depth:</b>	14 ft		<b>Date Completed:</b>	10/9/2020	
<b>Bore Hole Diameter (in):</b>	3 7/8		<b>Sampler Configuration</b>			<b>Liner Required:</b>	Y (N)		<b>Liner Used:</b>	Y (N)	
<b>Drill Machine:</b>	CME550X		<b>Drill Method:</b>	RW / DC / RC		<b>Hammer Type:</b>	Automatic		<b>Energy Ratio:</b>	81.1%	
<b>Core Size:</b>	NQ		<b>Driller:</b>	J. Little		<b>Groundwater:</b>	<b>TOB</b>	7.7 ft		<b>24HR</b>	11.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	SPT N VALUE	PL	MC	LL	FINES CONTENT (%)	RQD (%)	REC (%)
	0.0																
	0.6	<b>SURFACE MATERIALS</b> - 7 inches of ASPHALT.		0.0	SS-1	34	5	3	3	8	●						
		<b>FILL</b> - loose to medium dense, moist to dry, reddish brown, Clayey SAND (SC), 2.5YR 4/4, mostly fine to coarse sands, little high plasticity fines, trace mica.		2.0													
		@ 4.0 feet - trace gravel		4.0	SS-2	3	3	3	5	6	●						
393.9	6.0	Loose, wet, reddish brown, Silty SAND (SM), 2.5YR 4/4, mostly fine to coarse sands, little low plasticity fines, trace mica, trace gravel.		6.0	SS-3	4	4	7	8	11	●						
		NO RECOVERY		8.0	SS-4	3	3	3	3	6	●						
388.9	10.0				SS-5	2	3	2	4	5	●						
		<b>ALLUVIUM</b> - medium dense, saturated, light grey, Clayey SAND (SC), 10YR 7/1, mostly fine to coarse sands, little low plasticity fines, trace gravel.		13.5													
		@ 13.5 feet - NMC=19.0, %200=23.0			SS-6	3	2	9		11	●	○					
383.9	17.0																
		NO RECOVERY		18.5													
378.9	22.0				SS-7	4	2	1		3	●						
		<b>ALLUVIUM</b> - medium dense, saturated, light grey, Well Graded SAND with Silt and Gravel (SW-SM), 10YR 7/1, mostly fine to coarse sands, few low plasticity fines, little gravel, trace mica.		23.5													
373.9	27.0	@ 23.5 feet - NMC=13.5, %200=7.5			SS-8	2	3	12		15	▲	●					
		<b>PIEDMONT RESIDUUM</b> - medium dense, moist, brown and red, Silty SAND (SM), 7.5YR 4/3, 10R 5/8, mostly fine to coarse sand, some low plasticity fines, trace mica.		28.5													
368.9		LL=NP, PL=NP, PI=NP, NMC=23.4, %200 = 22.0			SS-9	5	6	7		13	●	▲					
		@ 33.5 feet - brown and light gray, 7.5YR 4/3, 10YR 7/1.		33.5													
363.9		LL=NP, PL=NP, PI=NP, NMC=21.2, %200 = 20.6			SS-10	7	8	11		19	●						
	37.0	Dense, moist, brown and light gray, Silty SAND (SM), 7.5YR 4/3, 10YR 7/1, mostly fine to coarse sands, little low plasticity fines,		38.5													
					SS-11	16	21	24		45							

## LEGEND

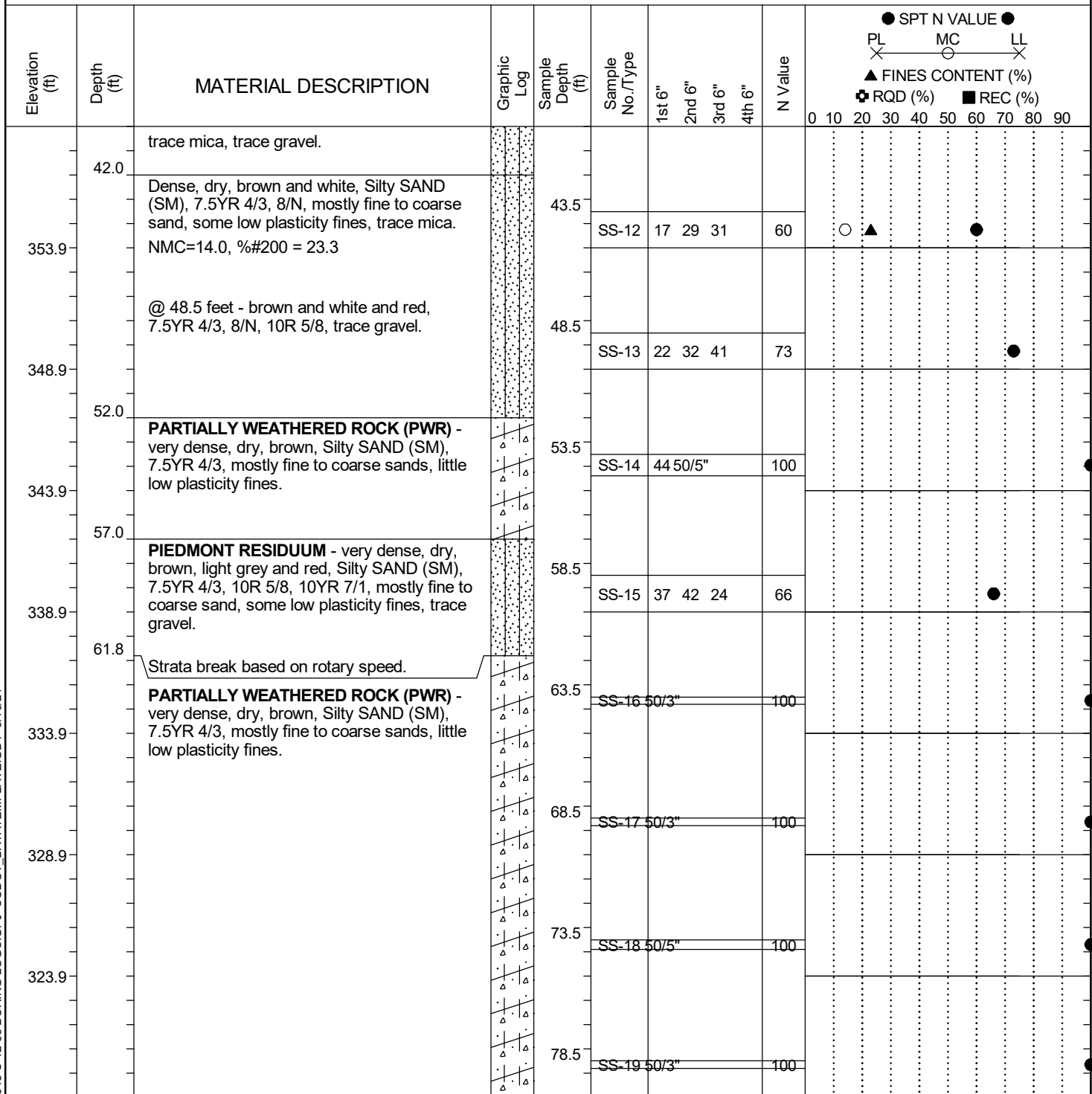
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SAMPLER TYPE		DRILLING METHOD	
SS	- Split Spoon	HSA	- Hollow Stem Auger
UD	- Undisturbed Sample	CFA	- Continuous Flight Augers
AWG	- Rock Core, 1-1/8"	DC	- Driving Casing
NQ	- Rock Core, 1-7/8"	RW	- Rotary Wash
CU	- Cuttings	RC	- Rock Core
CT	- Continuous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

SC.DOT 1361-20-048 S-12-58 BORING LOGS.GPJ SCDOT\_DATATEMPLATE.GDT 3/16/21

# SCDOT Soil Test Log

<b>Project ID:</b>	P038060	<b>County:</b>	Chester	<b>Boring No.:</b>	B-1
<b>Site Description:</b>	S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)			<b>Route:</b>	S-12-58
<b>Eng./Geo.:</b>	BK	<b>Boring Location:</b>	7.5' S of SEB	<b>Offset:</b>	7' E of CL
<b>Elev.:</b>	398.9 ft	<b>Latitude:</b>	34.5898164	<b>Longitude:</b>	-81.08206827
<b>Date Started:</b>	10/8/2020				
<b>Total Depth:</b>	98.5 ft	<b>Soil Depth:</b>	84.5 ft	<b>Core Depth:</b>	14 ft
<b>Date Completed:</b>	10/9/2020				
<b>Bore Hole Diameter (in):</b>	3 7/8	<b>Sampler Configuration</b>	<b>Liner Required:</b> Y (N)		<b>Liner Used:</b> Y (N)
<b>Drill Machine:</b>	CME550X	<b>Drill Method:</b>	RW / DC / RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	81.1%				
<b>Core Size:</b>	NQ	<b>Driller:</b>	J. Little	<b>Groundwater:</b>	TOB 7.7 ft
<b>24HR</b>	11.5 ft				



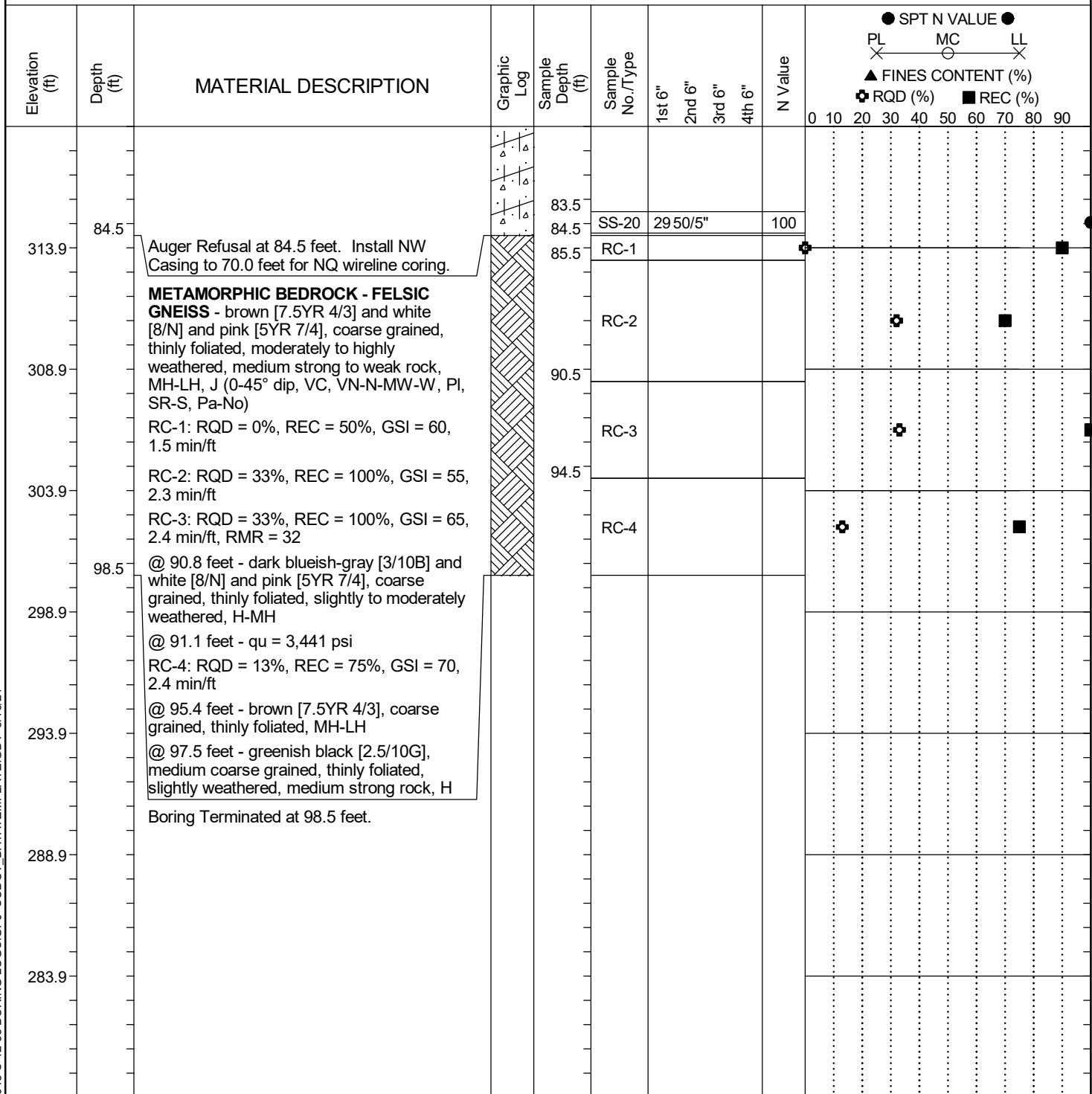
## LEGEND

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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	

# SCDOT Soil Test Log

<b>Project ID:</b>	P038060	<b>County:</b>	Chester	<b>Boring No.:</b>	B-1
<b>Site Description:</b>	S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)			<b>Route:</b>	S-12-58
<b>Eng./Geo.:</b>	BK	<b>Boring Location:</b>	7.5' S of SEB	<b>Offset:</b>	7' E of CL
<b>Elev.:</b>	398.9 ft	<b>Latitude:</b>	34.5898164	<b>Longitude:</b>	-81.08206827
<b>Date Started:</b>	10/8/2020				
<b>Total Depth:</b>	98.5 ft	<b>Soil Depth:</b>	84.5 ft	<b>Core Depth:</b>	14 ft
<b>Date Completed:</b>	10/9/2020				
<b>Bore Hole Diameter (in):</b>	3 7/8	<b>Sampler Configuration</b>	<b>Liner Required:</b> Y (N)		<b>Liner Used:</b> Y (N)
<b>Drill Machine:</b>	CME550X	<b>Drill Method:</b>	RW / DC / RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	81.1%				
<b>Core Size:</b>	NQ	<b>Driller:</b>	J. Little	<b>Groundwater:</b>	TOB 7.7 ft
<b>24HR</b>	11.5 ft				



## LEGEND

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	



## Rock Core Discontinuity Worksheet

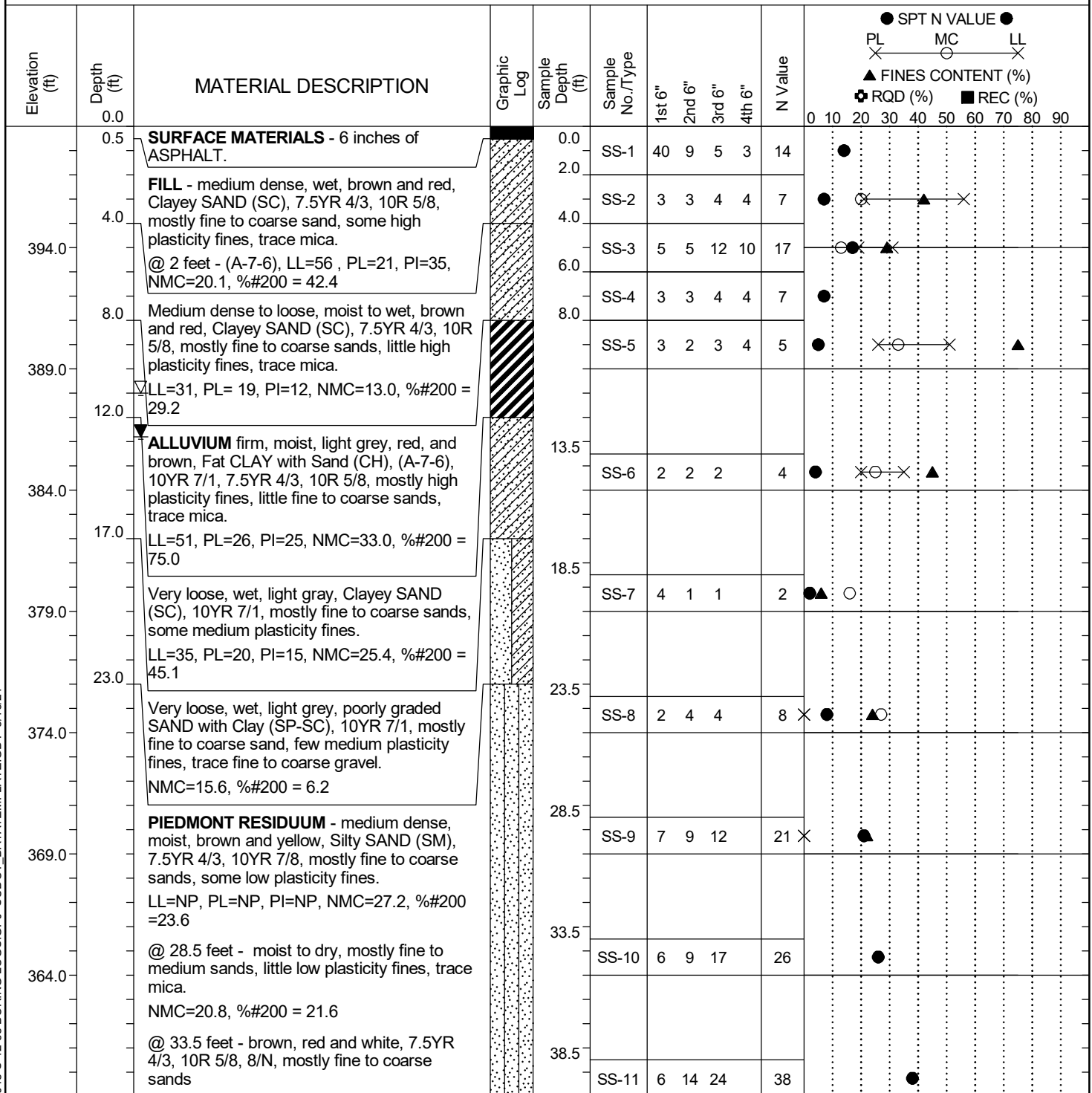
Project Name: S-12-58  
 Project Number: 1361-20-048  
 Driller (Company/Name): S&ME/Jay Little  
 Logged By: BRK  
 Date: 10/9/2020

Boring Number: B-1  
 Core Barrel Type: NQ  
 Core Barrel Length: 5.0'  
 Coring Technique: wireline  
 Number of Core Boxes: 2

Depth (ft)	Disc. No.	Disc. Type	Dip Angle (deg)	Disc. Width (mm)	Infill Amount	Infill Type	Surface Shape	Surface Roughness	Notes
84.7	1	J	45	MW	No	N/A	St	SR-S	
85	2	J	20	W	No	N/A	PI	SR-S	
85.5	3	J	N/A	MW-W	No	N/A	PI	SR-S	highly fractured 85.0'-85.5'
86	4	J	10	N	No	N/A	PI	SR-S	
86.1	5	J	60	N	No	N/A	PI	SR-S	
86.7	6	J	10	MW	No	N/A	PI	SR	
86.8	7	J	60	VN	No	N/A	PI	SR	
87.5	8	J	25	MW	Pa	CI	PI	SR-S	
87.8	9	J	60	MW-W	No	N/A	PI	SR-S	
90.5	10	J	N/A	MW-W	No-Pa	N/A-CI	PI	SR-S	
90.6	11	J	10	N	No	N/A	PI	SR	
91	12	J	30	VN	No	N/A	PI	SR-S	
91.1	13	J	30	VN	No	N/A	PI	SR	
91.8	14	J	45	N-MW	No	N/A	PI	SR-S	
92	15	J	45	N-MW	No	N/A	PI	SR-S	
92.4	16	J	45	N-MW	No	N/A	PI	SR-S	
92.5	17	J	N/A	MW-W	No	N/A	PI	SR-S	highly fractured 92.4'-92.5'
92.7	18	J	10	VN	No	N/A	PI	SR	
93.2	19	J	30	N	No	N/A	PI	SR	
93.3	20	J	30	MW	No	N/A	PI	SR-S	
93.7	21	J	10	VN	No	N/A	PI	SR	
94.1	22	J	15	MW	No	N/A	PI	SR-S	
94.5	23	J	N/A	MW-W	No	N/A	PI	SR-S	highly fractured 94.1'-94.5'
94.7	24	J	10	MW	No	N/A	PI	SR-S	
95.2	25	J	35	MW	No	N/A	PI	SR-S	
95.4	26	J	25	MW	No	N/A	PI	SR-S	
97.5	27	J	N/A	MW-W	No	N/A	PI	SR-S	highly fractured 95.4'-97.5'
98	28	J	5	VN	No	N/A	PI	SR	
98.2	29	J	10	VN	No	N/A	PI	SR	

# SCDOT Soil Test Log

Project ID: P038060				County: Chester		Boring No.: B-2		
Site Description:		S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)					Route: S-12-58	
Eng./Geo.: BK		Boring Location: 7.5' N of NEB		Offset: 7' E of CL		Alignment: Existing		
Elev.: 399.0 ft		Latitude: 34.59013132		Longitude: -81.08196232		Date Started: 10/12/2020		
Total Depth: 80.5 ft		Soil Depth: 70.5 ft		Core Depth: 10.0 ft		Date Completed: 10/13/2020		
Bore Hole Diameter (in): 3 7/8		Sampler Configuration		Liner Required: Y (N)		Liner Used: Y (N)		
Drill Machine: CME550X		Drill Method: RW / DC / RC		Hammer Type: Automatic		Energy Ratio: 81.1%		
Core Size: NQ		Driller: J. Little		Groundwater: TOB 11 ft		24HR 12.8 ft		



## LEGEND

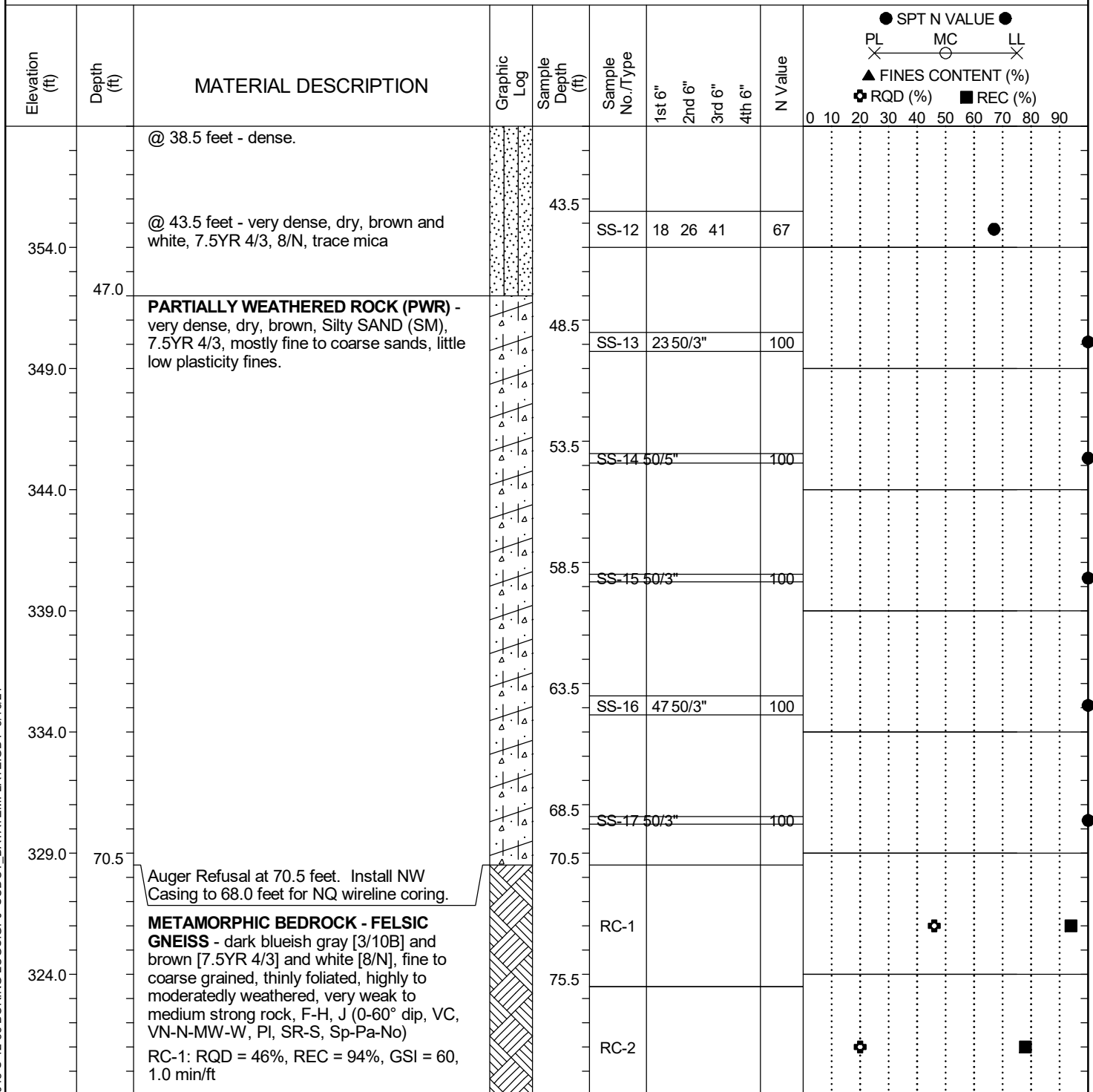
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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
UD - Undisturbed Sample	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving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

SC.DOT 1361-20-048 S-12-58 BORING LOGS.GPJ SCDOT\_DATATEMPLATE.GDT 3/16/21

# SCDOT Soil Test Log

<b>Project ID:</b>	P038060	<b>County:</b>	Chester	<b>Boring No.:</b>	B-2
<b>Site Description:</b>	S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)			<b>Route:</b>	S-12-58
<b>Eng./Geo.:</b>	BK	<b>Boring Location:</b>	7.5' N of NEB	<b>Offset:</b>	7' E of CL
<b>Elev.:</b>	399.0 ft	<b>Latitude:</b>	34.59013132	<b>Longitude:</b>	-81.08196232
<b>Date Started:</b>	10/12/2020				
<b>Total Depth:</b>	80.5 ft	<b>Soil Depth:</b>	70.5 ft	<b>Core Depth:</b>	10.0 ft
<b>Date Completed:</b>	10/13/2020				
<b>Bore Hole Diameter (in):</b>	3 7/8	<b>Sampler Configuration</b>	<b>Liner Required:</b> Y (N)		<b>Liner Used:</b> Y (N)
<b>Drill Machine:</b>	CME550X	<b>Drill Method:</b>	RW / DC / RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	81.1%				
<b>Core Size:</b>	NQ	<b>Driller:</b>	J. Little	<b>Groundwater:</b>	TOB 11 ft
<b>24HR:</b>	12.8 ft				



## LEGEND

Continued Next Page

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

<b>Project ID:</b>	P038060	<b>County:</b>	Chester	<b>Boring No.:</b>	B-2
<b>Site Description:</b>	S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)			<b>Route:</b>	S-12-58
<b>Eng./Geo.:</b>	BK	<b>Boring Location:</b>	7.5' N of NEB	<b>Offset:</b>	7' E of CL
<b>Elev.:</b>	399.0 ft	<b>Latitude:</b>	34.59013132	<b>Longitude:</b>	-81.08196232
<b>Date Started:</b>	10/12/2020				
<b>Total Depth:</b>	80.5 ft	<b>Soil Depth:</b>	70.5 ft	<b>Core Depth:</b>	10.0 ft
<b>Date Completed:</b>	10/13/2020				
<b>Bore Hole Diameter (in):</b>	3 7/8	<b>Sampler Configuration</b>	<b>Liner Required:</b> Y (N)		<b>Liner Used:</b> Y (N)
<b>Drill Machine:</b>	CME550X	<b>Drill Method:</b>	RW / DC / RC	<b>Hammer Type:</b>	Automatic
<b>Energy Ratio:</b>	81.1%				
<b>Core Size:</b>	NQ	<b>Driller:</b>	J. Little	<b>Groundwater:</b>	TOB 11 ft
<b>24HR:</b>	12.8 ft				

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	4th 6"	N Value	● SPT N VALUE ● PL X — MC — LL X ▲ FINES CONTENT (%) + RQD (%) ■ REC (%)
80.5		RC-2: RQD = 20%, REC = 78%, GSI = 60, 1.0 min/ft Boring Terminated at 80.5 feet.									0 10 20 30 40 50 60 70 80 90
314.0											
309.0											
304.0											
299.0											
294.0											
289.0											
284.0											

## LEGEND

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	



## Rock Core Discontinuity Worksheet

Project Name: S-12-58  
 Project Number: 1361-20-048  
 Driller (Company/Name): S&ME/Jay Little  
 Logged By: AR  
 Date: 10/13/2020

Boring Number: B-2  
 Core Barrel Type: NQ  
 Core Barrel Length: 5.0'  
 Coring Technique: wireline  
 Number of Core Boxes: 1

Depth (ft)	Disc. No.	Disc. Type	Dip Angle (deg)	Disc. Width (mm)	Infill Amount	Infill Type	Surface Shape	Surface Roughness	Notes
70.6	1	J	10	MW	No	N/A	PI	SR	
71.3	2	J	60	MW	No	N/A	PI	SR	
71.6	3	J	60	MW	No	N/A	PI	SR	
71.9	4	J	30	VN	No	N/A	PI	SR-S	
72.3	5	J	45	MW	Sp	Sd	PI	SR-S	
72.9	6	J	10	W	Sp	Sd	PI	SR	
73.4	7	J	30	W	No	N/A	PI	SR	
73.9	8	J	45	N	No	N/A	PI	SR	
74.1	9	J	30	N	No	N/A	PI	SR	
74.2	10	J	45	N	No	N/A	PI	SR	
74.8	11	J	45	MW	No	N/A	PI	SR-S	
75.5	12	J	N/A	MW-N	No	N/A	PI	SR-S	highly fractured 74.8'-75.5'
75.9	13	J	10	N	No	N/A	PI	SR-S	
76	14	J	25	W	No	N/A	PI	SR-S	
76.6	15	J	N/A	W	No	N/A	PI	SR-S	
76.8	16	J	60	W	Pa	Sd	PI	SR	
78.2	17	J	N/A	N-MW	No	N/A	PI	SR-S	highly fractured 76.8'-78.2'
78.8	18	J	N/A	W	No	N/A	PI	SR-S	
79.2	19	J	60	VN	No	N/A	PI	SR	
80.5	20	J	N/A	VN-W	No	N/A	PI	SR-S	highly fractured 79.2'-80.5'

### Rock Core Photo Log

Boring: B-1	Box: 1 of 2	Date: 10/9/2020	Driller: J. Little	Geologist: B. Kebea
Run: RC-1	Length: 1.0	Depth Int: 84.5-85.5	Recovery: 90%	RQD: 0%
Run: RC-2	Length: 5.0	Depth Int: 85.5-90.5	Recovery: 70%	RQD: 32%
Run: RC-3	Length: 4.0	Depth Int: 90.5-94.5	Recovery: 100%	RQD: 33%



Boring: B-1	Box: 2 of 2	Date: 10/9/2020	Driller: J. Little	Geologist: B. Kebea
Run: RC-4	Length: 4.0	Depth Int: 94.5-98.5	Recovery: 75%	RQD: 13%



### Rock Core Photo Log

Boring: B-2	Box: 1 of 1	Date: 10/13/2020	Driller: J. Little	Geologist: A. Rodriguez
Run: RC-1	Length: 5.0	Depth Int: 70.5-75.5	Recovery: 94%	RQD: 46%
Run: RC-2	Length: 5.0	Depth Int: 75.5-80.5	Recovery: 78%	RQD: 20%





## Drill Rig Photo Log

Bridge: S-12-58

Boring: B-1

Date: 10/8/2020

Driller: J. Little

Geologist: B. Kebea





## Drill Rig Photo Log

Bridge: S-12-58

Boring: B-2

Date: 10/12/2020

Driller: J. Little

Geologist: B. Kebea



## **Appendix IV – Laboratory Test Results – Split-Spoon Samples**



# INDEX PROPERTIES VERSUS DEPTH

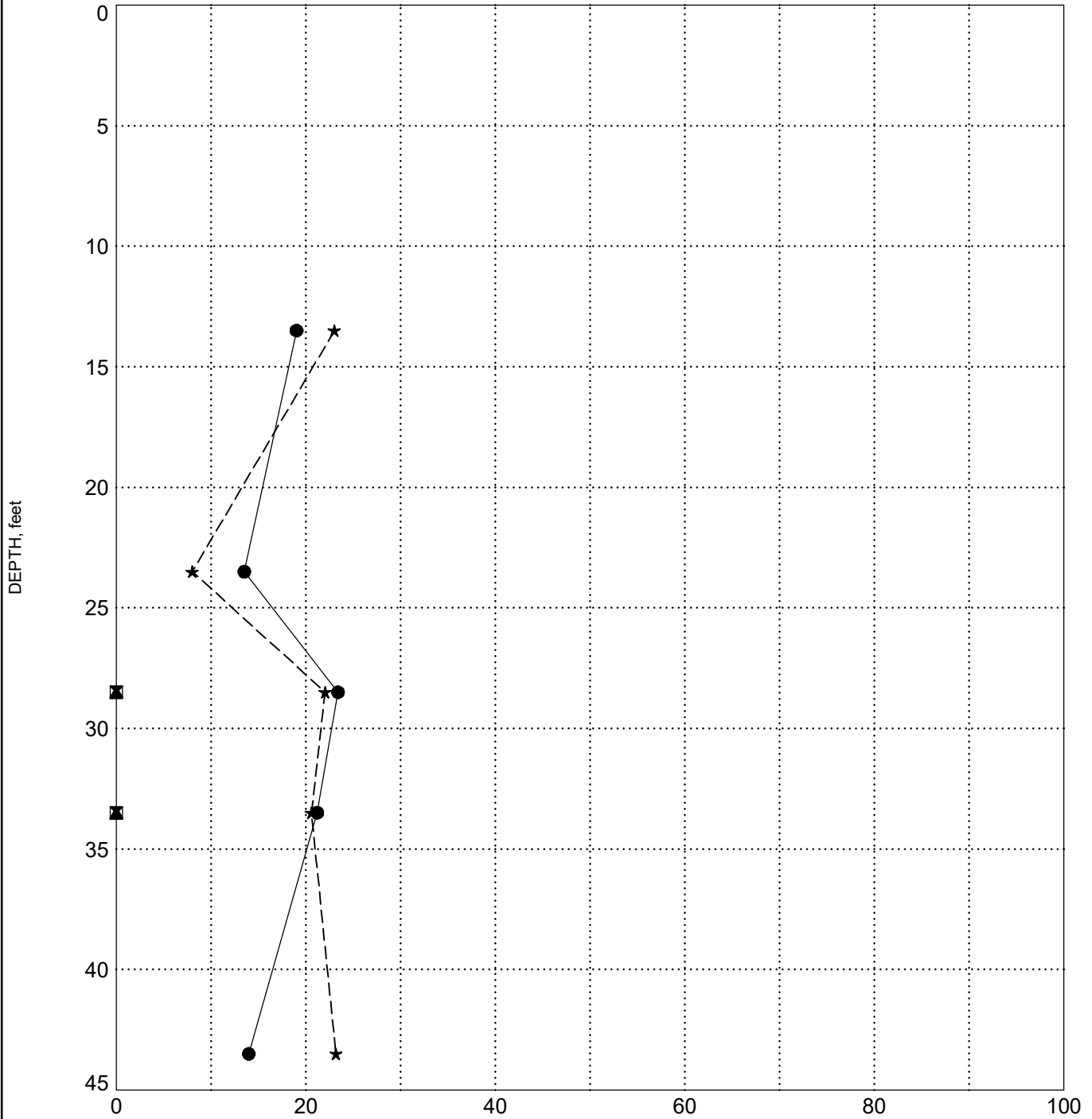
PROJECT ID P038060

PROJECT NAME S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

PROJECT COUNTY Chester

SURFACE ELEVATION: 398.9

## BORING B-1



LEGEND	
●	Water Content
■	Plastic Limit
▲	Liquid Limit
★	Fines



# INDEX PROPERTIES VERSUS DEPTH

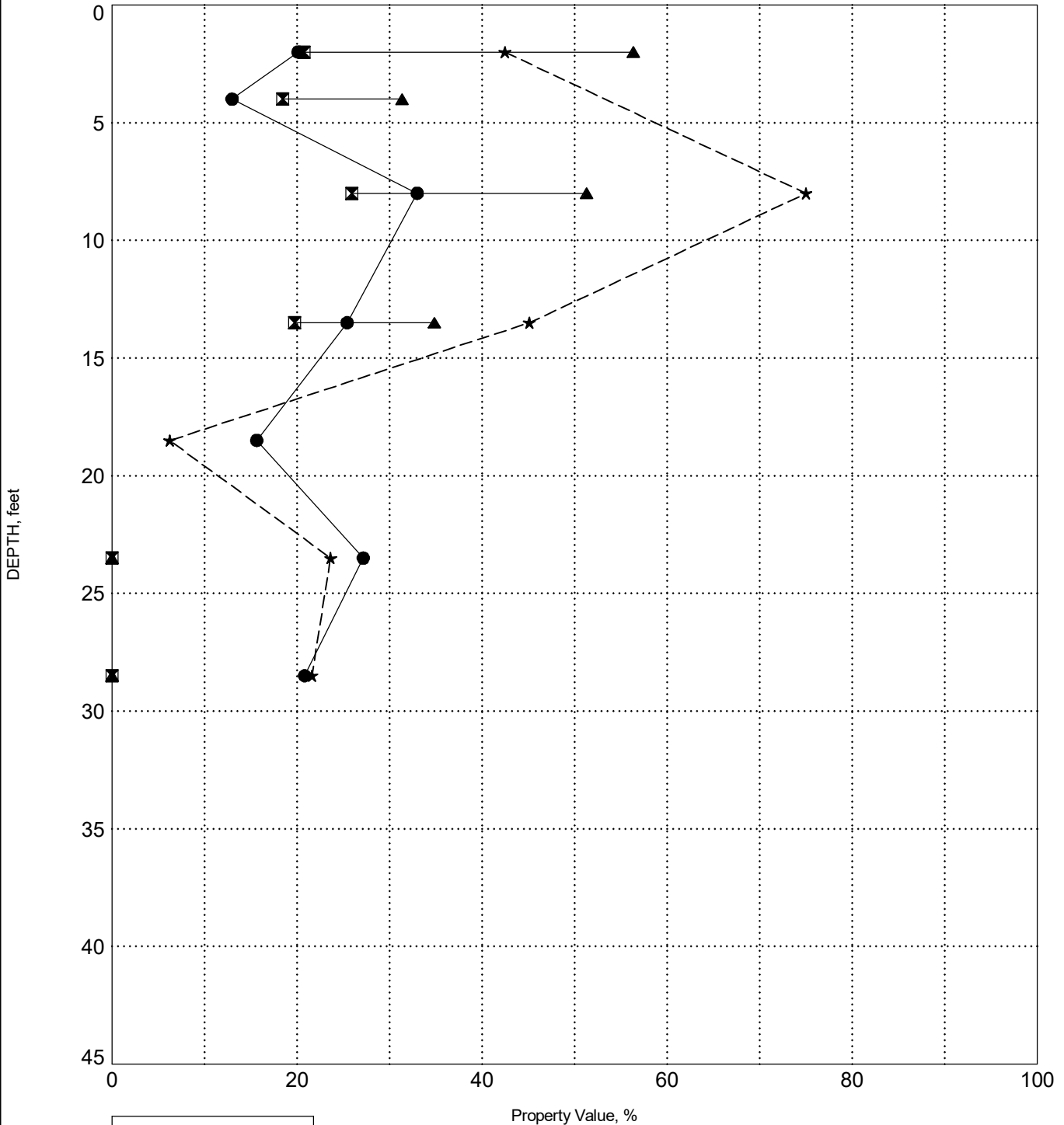
PROJECT ID P038060

PROJECT NAME S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

PROJECT COUNTY Chester

SURFACE ELEVATION: 399.0

## BORING B-2



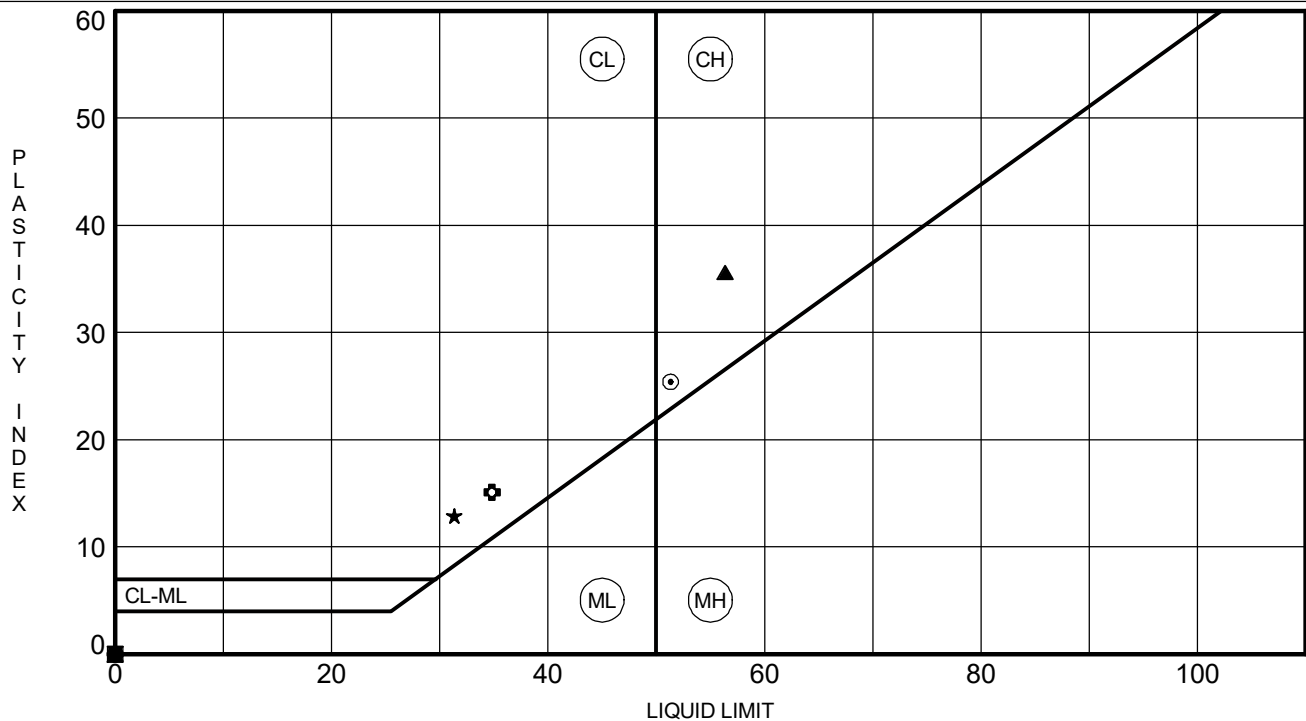
LEGEND	
●	Water Content
☒	Plastic Limit
▲	Liquid Limit
★	Fines

## ATTERBERG LIMITS' RESULTS

**PROJECT ID** P038060

**PROJECT NAME** S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

**PROJECT COUNTY** Chester

[illegible]

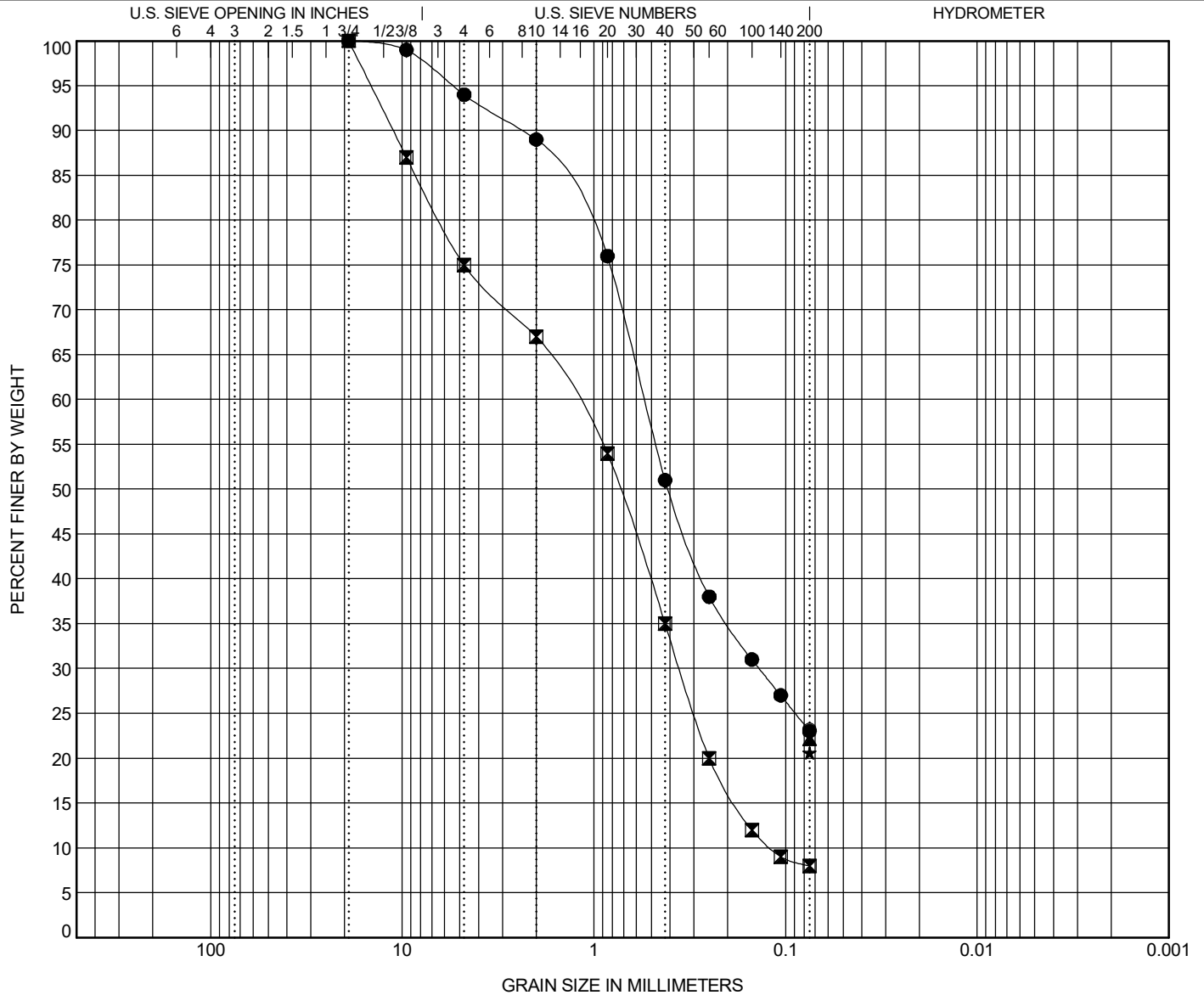


# GRAIN SIZE DISTRIBUTION

PROJECT ID P038060

PROJECT NAME S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

PROJECT COUNTY Chester



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-1	13.5	CLAYEY SAND (SC)									
■ B-1	23.5	WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)								0.84	10.60
▲ B-1	28.5	SILTY SAND (SM)					NP	NP	NP		
★ B-1	33.5	SILTY SAND (SM)					NP	NP	NP		
◎ B-1	43.5	SILTY SAND (SM)									
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-1	13.5	19.05	0.545	0.138		6.0	71.0	23.0			
■ B-1	23.5	19.05	1.262	0.356	0.119	25.0	67.0	8.0			
▲ B-1	28.5	0.075						22.0			
★ B-1	33.5	0.075						20.6			
◎ B-1	43.5	0.075						23.2			

GRAIN SIZE 1361-20-048 S-12-58 BORING LOGS.GPJ SCDOT DATA TEMPLATE\_01\_30\_2015.GDT 2/8/21

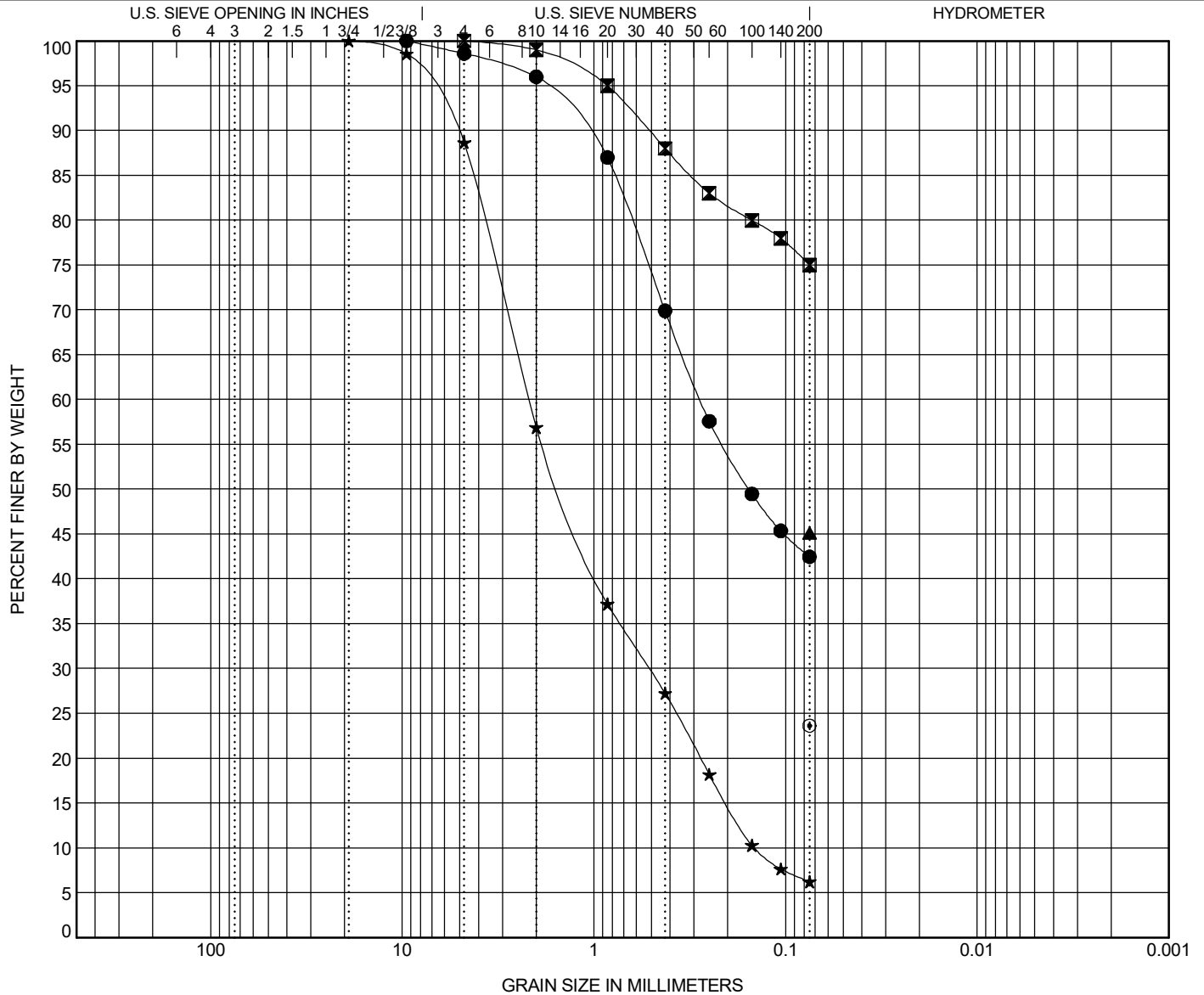


# GRAIN SIZE DISTRIBUTION

PROJECT ID P038060

PROJECT NAME S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

PROJECT COUNTY Chester



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-2	2.0	CLAYEY SAND (SC)					56	21	35		
■ B-2	8.0	FAT CLAY WITH SAND (CH)					51	26	25		
▲ B-2	13.5	CLAYEY SAND (SC)					35	20	15		
★ B-2	18.5	POORLY GRADED SAND WITH CLAY (SP-SC)								0.84	15.06
⊙ B-2	23.5	SILTY SAND (SM)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-2	2.0	9.5	0.278			1.4	56.1	42.4			
■ B-2	8.0	4.75				0.0	25.0	75.0			
▲ B-2	13.5	0.075						45.1			
★ B-2	18.5	19	2.177	0.515	0.145	11.3	82.5	6.2			
⊙ B-2	23.5	0.075						23.6			

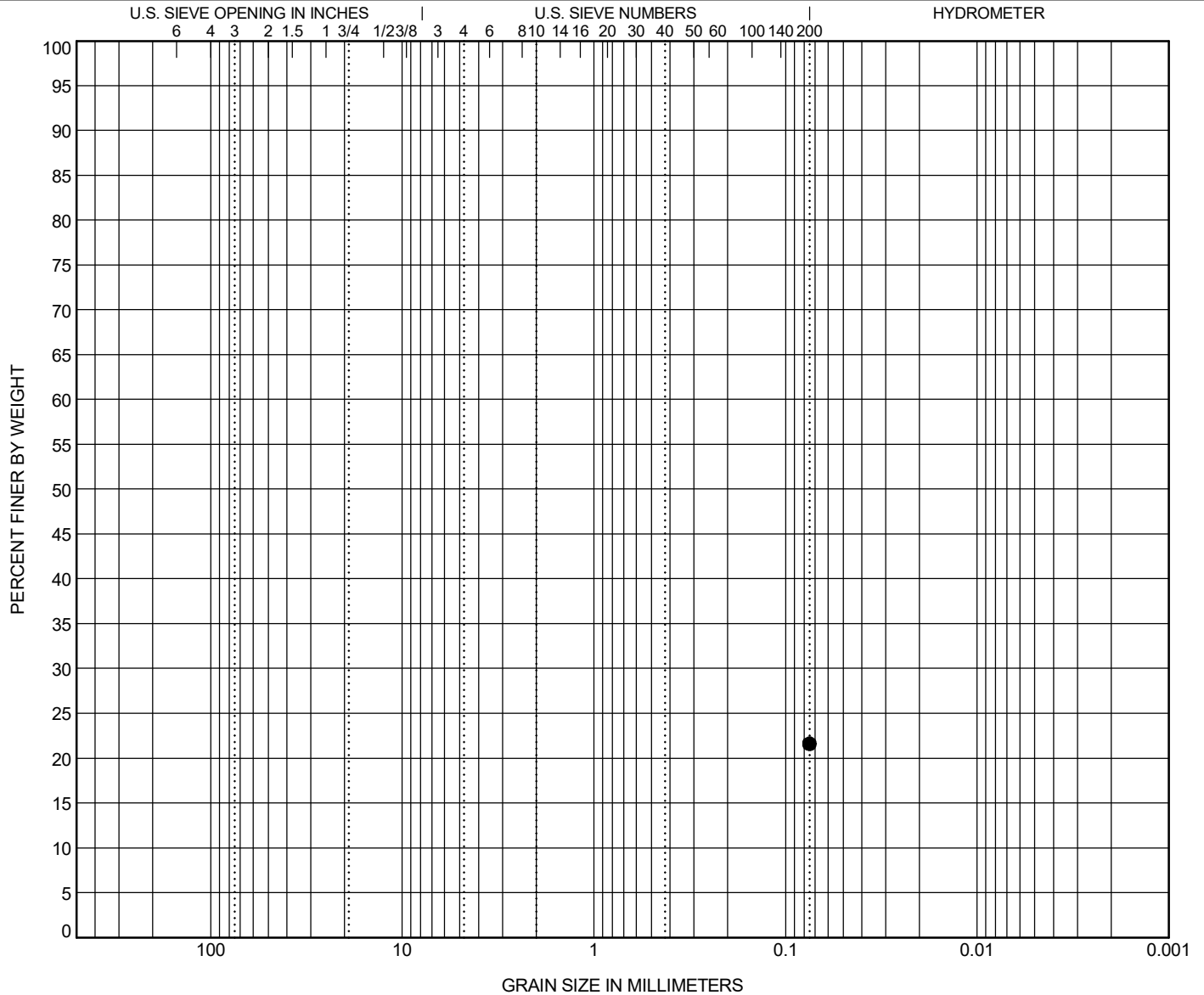


# GRAIN SIZE DISTRIBUTION

PROJECT ID P038060

PROJECT NAME S-12-58 BRO Little Rocky Creek (S&ME Project 1361-20-048)

PROJECT COUNTY Chester



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-2	28.5	SILTY SAND (SM)					NP	NP	NP		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-2	28.5	0.075						21.6			

## **Appendix V – Laboratory Test Data Sheets – Corrosion Series Testing**



# **Results Only Soil Testing for SCDOT Bridge Package 2021-01 DB Prep**

**December 8, 2020**

**Prepared for:  
Matthew F. Cooke  
S&ME, Inc.  
134 Suber Road  
Columbia, SC 29210  
mcooke@smeinc.com**

**Project X Job#: S201125D  
Client Job or PO#: 1361-20-48**

Respectfully Submitted,

Eduardo Hernandez, M.Sc., P.E.  
Sr. Corrosion Consultant  
NACE Corrosion Technologist #16592  
Professional Engineer  
California No. M37102  
[ehernandez@projectxcorrosion.com](mailto:ehernandez@projectxcorrosion.com)





## Soil Analysis Lab Results

Client: S&ME, Inc.  
Job Name: SCDOTBridge Package 2021-01 DB Prep  
Client Job Number: 1361-20-48  
Project X Job Number: S201125D  
December 8, 2020

	Method	AASHTO T290		AASHTO T291		AASHTO T288		AASHTO T289
Bore# / Description	Depth	Sulfates SO <sub>4</sub> <sup>2-</sup>		Chlorides Cl <sup>-</sup>		Resistivity As Rec'd   Minimum		pH
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)	
SS-7 B-2; S-11-97 Bridge	18.5-20.0	34.8	0.0035	8.2	0.0008	31,490	26,800	6.7
SS-6/SS-7 B-2; S-11-119 Bridge	8.2-14.4	8.7	0.0009	21.4	0.0021	13,400	8,710	6.7
SS-5 B-2; S-11-265 Bridge	8.5-10.0	35.6	0.0036	109.9	0.0110	2,881	2,345	6.4
SS-4 B-1; S-12-58 Bridge	6.0-8.0	31.1	0.0031	23.9	0.0024	25,460	18,760	6.4
SS-4/SS-5 B-2; S-12-300 (2310) Bridge	6.0-10.0	19.3	0.0019	103.7	0.0104	3,283	2,479	6.5
SS-6 B-1; S-12-300 (2490) Bridge	13.5-15.0	36.1	0.0036	21.0	0.0021	9,380	8,040	6.7
SS-7/SS-8 B-2; S-20-214 Bridge	18.5-25.0	9.9	0.0010	7.4	0.0007	49,580	23,450	7.1
SS-6 B-1; S-29-97 Bridge	13.4-14.90	4.6	0.0005	1.9	0.0002	10,050	6,700	7.1
SS-4/SS-5 B-2; S-44-87 Bridge	7.0-11.0	45.9	0.0046	15.3	0.0015	16,080	15,410	6.2

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography  
mg/kg = milligrams per kilogram (parts per million) of dry soil weight  
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown  
Chemical Analysis performed on 1:3 Soil-To-Water extract



Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

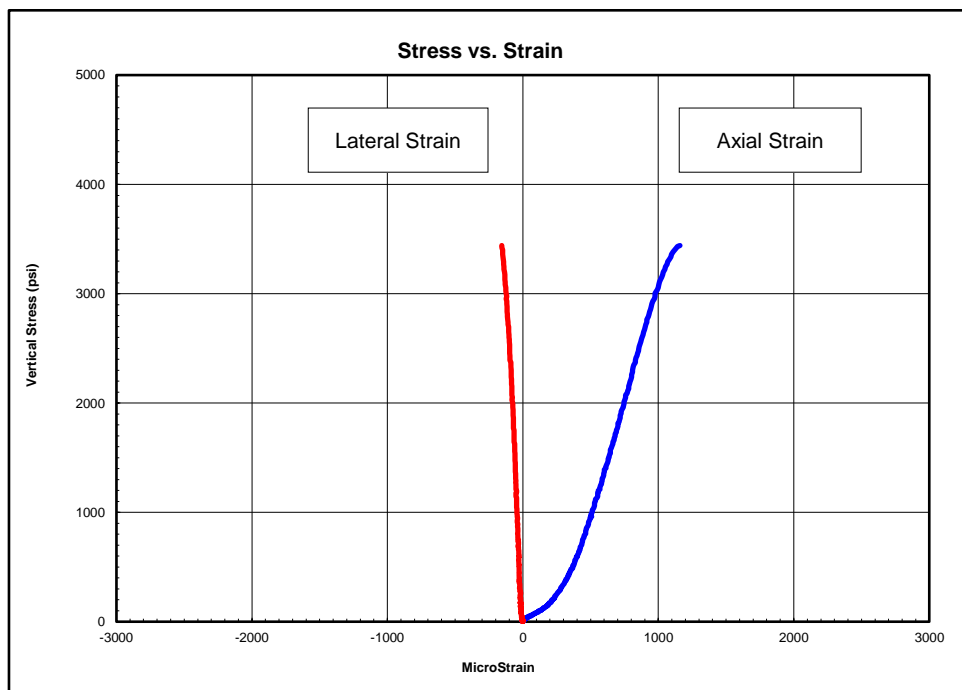
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## **Appendix VI – Laboratory Test Data Sheets – Rock Cores**



Client:	S&ME, Inc.
Project Name:	SCDOT Bridge Package 2021-1
Project Location:	South Carolina
GTX #:	313047
Test Date:	1/18/2021
Tested By:	cmh
Checked By:	jsc
Boring ID:	S-12-58, B-1
Sample ID:	RS-2
Depth, ft:	91.1-91.5
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

## Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 3,441 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
300-1300	3,320,000	0.10
1300-2200	4,360,000	0.16
2200-3100	4,150,000	0.22

**Notes:** Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.  
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.  
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.  
Calculations assume samples are isotropic, which is not necessarily the case.

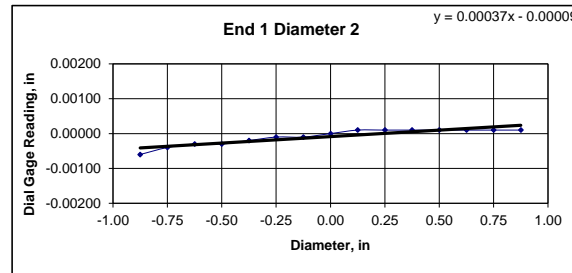
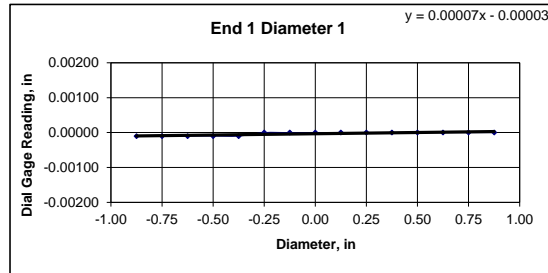


Client:	S&ME, Inc.	Test Date:	1/14/2021
Project Name:	SCDOT Bridge Package 2021-1	Tested By:	cmh
Project Location:	South Carolina	Checked By:	smd
GTX #:	313047		
Boring ID:	S-12-58, B-1		
Sample ID:	RS-2		
Depth:	91.1-91.5 ft		
Visual Description:	See photographs		

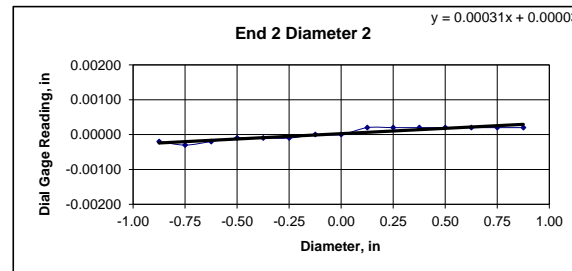
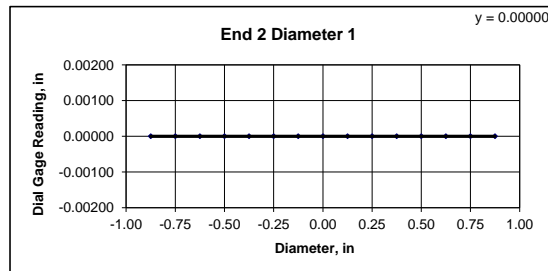
## UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.? YES	
Specimen Length, in:	4.93	4.93	4.93	Maximum difference must be $<$ 0.020 in. <b>Straightness Tolerance Met? YES</b>	
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	708.71				
Bulk Density, lb/ft <sup>3</sup>	176				
Length to Diameter Ratio:	2.5	<b>Minimum Diameter Tolerance Met? YES</b>	<b>Length to Diameter Ratio Tolerance Met? YES</b>		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00060	-0.00040	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Difference between max and min readings, in: 0° = 0.00010      90° = 0.00070															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00020	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
Difference between max and min readings, in: 0° = 0      90° = 0.0005 Maximum difference must be < 0.0020 in.      Difference = ± 0.00035 Flatness Tolerance Met? YES															



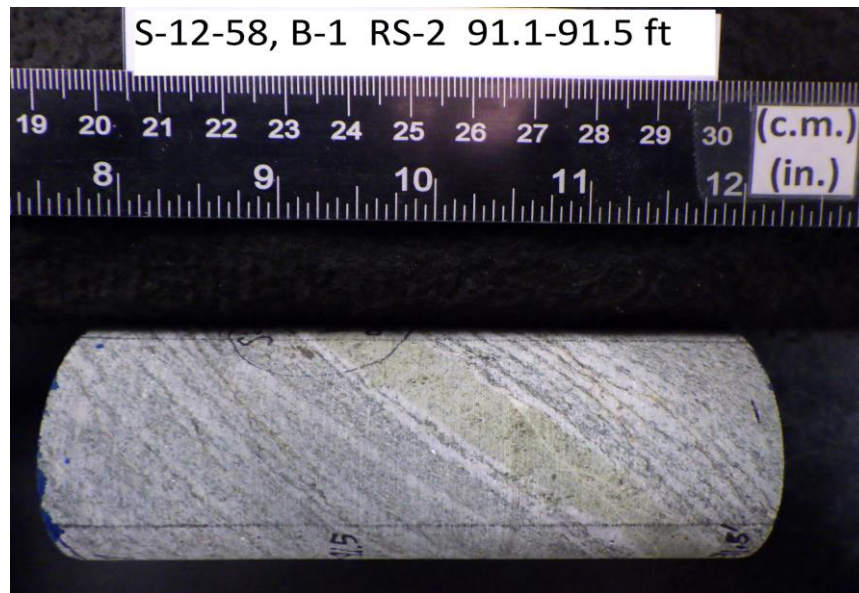
DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00409
End 2:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
Maximum Angular Difference:	0.00409
<b>Parallelism Tolerance Met? Spherically Seated</b>	<b>YES</b>



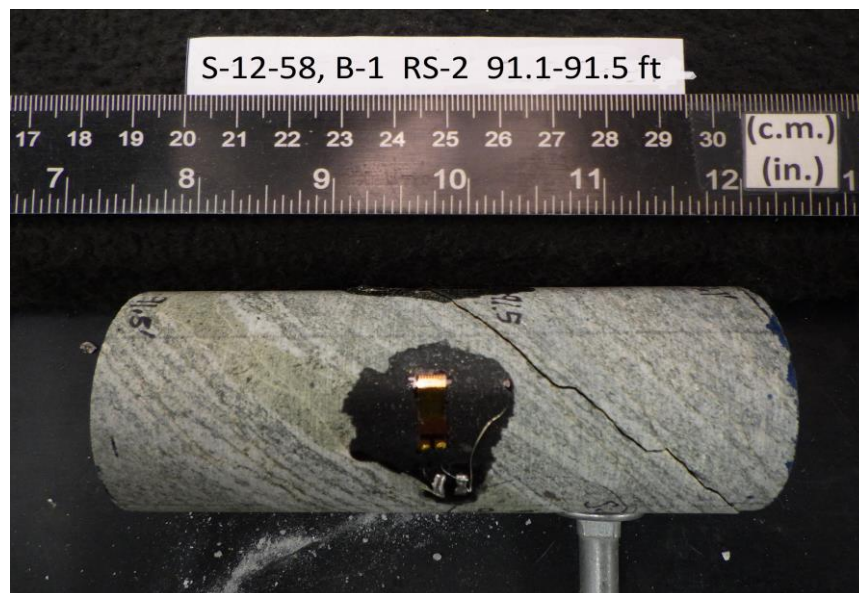
DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00037
Angle of Best Fit Line:	0.02128
End 2:	
Slope of Best Fit Line	0.00031
Angle of Best Fit Line:	0.01752
Maximum Angular Difference:	0.00377
<b>Parallelism Tolerance Met? Spherically Seated</b>	<b>YES</b>

PERPENDICULARITY (Procedure P1)					(Calculated from End Flatness and Parallelism measurements above)	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES	<b>Perpendicularity Tolerance Met? YES</b>
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES	
END 2						
Diameter 1, in	0.00000	1.990	0.00000	0.000	YES	
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	

Client:	S&ME, Inc.
Project Name:	SCDOT Bridge Package 2021-1
Project Location:	South Carolina
GTX #:	313047
Test Date:	1/18/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	S-12-58, B-1
Sample ID:	RS-2
Depth, ft:	91.1-91.5



After cutting and grinding



After break

## **Appendix VII – SPT Hammer Energy Measurements**



Report of SPT Energy Measurements  
S&ME CME-550X ATV (Serial No. 290593)  
Rutherfordton, North Carolina  
S&ME Project No. 1535-20-200

**PREPARED FOR:**

**North Carolina Department of Transportation  
Geotechnical Engineering Unit  
1589 Mail Service Center  
Raleigh, North Carolina 27699**

**PREPARED BY:**

**S&ME, Inc.  
9751 Southern Pine Boulevard  
Charlotte, North Carolina 28273**

**June 4, 2020**



June 4, 2020

North Carolina Department of Transportation  
Geotechnical Engineering Unit  
1589 Mail Service Center  
Raleigh, North Carolina 27699

Attention: Dr. Shunyi (Chris) Chen, Ph.D., P.E.

Cc: Ms. Cheryl A. Youngblood, L.G.  
Ms. Christina M. Bruinsma, L.G.

Reference: **Report of SPT Energy Measurements**  
**S&ME CME-550X ATV (Serial No. 290593)**  
Rutherfordton, North Carolina  
S&ME Project No. 1535-20-200  
NC PE Firm License No. F-0176

Dear Dr. Chen:

We have completed the Standard Penetration Test (SPT) energy measurements on the automatic hammer used with our CME-550X ATV-mounted drill rig (Serial No. 290593). This service was performed by Mr. Joseph Williamson, P.E. of our firm on May 5, 2020, in general accordance with ASTM D4633 and the most recent revision of the North Carolina Department of Transportation (NCDOT) Geotechnical Engineering Unit's requirements. Review of the data quality and analyses was performed by Mr. Gregory Canivan, P.E. of our firm. Copies of the Certificates of Proficiency issued by Pile Dynamics based on the Dynamic Measurement and Analysis Proficiency Test for Mr. Williamson and Mr. Canivan are included in Appendix I. The testing procedures, equipment used during testing, and detailed results are presented in this report.

## 1.0 Dynamic Testing Methodology

Testing was performed using a model PAX (Serial No. 3733L) Pile Driving Analyzer™ (PDA) manufactured by Pile Dynamics, Inc. The PDA was used to record and interpret data from two piezoresistive accelerometers (Serial Nos. K5641 and K10181) bolted to a 2.0-foot long AWJ drill rod (Serial No. 203) internally instrumented with two strain transducers. Calibration sheets for the accelerometers and the instrumented rod are included in Appendix II. The instrumented AWJ drill rod has a cross-sectional area of 1.19 square inches and an outside diameter of approximately 1.75 inches. Therefore, we calculate the inside diameter to be approximately 1.25 inches at the gauge location. The accelerometers and strain gauges, which are diametrically opposed near the middle of the instrumented rod, monitor acceleration and strain for each hammer blow. The analyzer converts the data to velocities and forces and computes the maximum transferred hammer energies with the "EFV" method described in ASTM D4633. Preliminary results are recorded and displayed in real time for each blow.



## 2.0 Testing and Observations

S&ME personnel were on site May 5, 2020, to observe and perform high-strain dynamic testing during SPT sampling on the CME-550X ATV-mounted drill rig operated by Fred Johnson of S&ME. The measurements were taken during drilling and sampling of a soil test boring for an NCDOT project (R-2233BA boring L3\_121) in Rutherfordton, North Carolina. SPT energy measurements were recorded during six sampling intervals at depths of approximately 28.5, 33.5, 38.5, 43.5, 48.5 and 53.5 ft below the ground surface. The 48.5 and 53.5 ft sample intervals did not meet the NCDOT blow count requirements and were not included in the data analysis. The information presented in the tables below summarizes the equipment and tooling used during the SPT energy measurements. The SPT Energy Evaluation Form and Boring L3\_121 Soil Boring Log are included in Appendix III.

**Table 2-1: Drill Rig Information**

<b>Manufacturer</b>	CME
<b>Model</b>	550X
<b>Serial Number</b>	290593
<b>Operator</b>	F. Johnson
<b>Carrier</b>	ATV

**Table 2-2: Hammer Information**

<b>Model / Type</b>	CME / Auto
<b>Serial Number</b>	290593
<b>Anvil Height (inches)</b>	12
<b>Anvil Diameter (inches)</b>	2.5
<b>Typical Drop Height (inches)</b>	30
<b>Typical Ram Weight (pounds)</b>	140
<b>Ram Serial Number</b>	N/A

**Table 2-3: Drilling and Instrumented Rod Information**

<b>Drill Rod Type</b>	AWJ
<b>OD (inches)</b>	1.75
<b>ID (inches)</b>	1.25
<b>Cross-Sectional Area (in<sup>2</sup>)</b>	1.19
<b>Typical Lengths (feet)</b>	5
<b>Instrumented Rod Type</b>	AWJ (Serial No. 203)
<b>OD (inches)</b>	1.75
<b>ID (inches)</b>	1.25
<b>Cross-Sectional Area (in<sup>2</sup>)</b>	1.19
<b>Total Instrumented Rod Length (feet)</b>	2.0
<b>Length Below Gages (feet)</b>	0.8
<b>Split-Spoon Length (feet)</b>	2.85



### 3.0 Dynamic Testing Results

The total rod length from the instrumentation to the tip of the split-spoon sampler was determined by adding 3.65 ft to the drill rod length at each sample depth. The SPT Energy Measurement Data Summary tables in Appendix IV present the test data from every hammer blow at each sampling interval, along with representative force and velocity traces for each test interval. Per ASTM D4633, only the blows from the final foot of each sample interval (i.e. the blows that determine the N-value) are considered when computing the average measurement values of each test interval.

The reported blow counts obtained by the drill rig personnel, a summary of the test data, and average computed hammer energy and transfer ratio values are provided in Table 3-1. Based on the test data, the automatic hammer on the CME-550X operated at an average rate of about 51 blows per minute (bpm) during dynamic testing. The measured average transferred hammer energy (EFV) of the four sample intervals tested ranged from 263 to 292 ft-lbs, which corresponds to Energy Transfer Ratio (ETR) values of 75.2 to 83.4%, respectively. Plots and tables of the following are also included in the Appendix and present the test data with depth for each test interval:

- Penetration vs. BLC<sup>1</sup>
- Penetration vs. CSX<sup>4</sup>
- ETR vs. Rod Length
- Penetration vs. FMX<sup>2</sup>
- Penetration vs. VMX<sup>5</sup>
- Average ETR vs. Rod Length
- Penetration vs. EFV<sup>3</sup>
- Penetration vs. ETR<sup>6</sup>

**Table 3-1: Summary of Dynamic Testing Results**

Data Set ID	Sample Depth (ft)	Drill Rod Length (ft)	Instrumentation to Sampler Tip Length (ft)	Blows per 6" Increment / N-value	Soil Sample Description (Piedmont Residual)	Avg. BPM	Avg. EFV (ft-lbs)	Avg. ETR (%)
1	28.5 – 30.0	30.0	33.65	7-9-11 / 20	SILTY SAND	43.3	263	75.2
2	33.5 – 35.0	35.0	38.65	7-11-14 / 25	SILTY SAND	53.2	289	82.6
3	38.5 – 40.0	40.0	43.65	9-10-12 / 22	SILTY SAND	53.2	289	82.6
4	43.5 – 45.0	45.0	48.65	10-10-11 / 21	SILTY SAND	53.3	292	83.4
Overall Average						<b>51.0</b>	<b>284</b>	<b>81.1</b>

The overall average transferred hammer energy for the automatic hammer on the CME-550X ATV-mounted drill rig was 284 foot-pounds, with an average ETR of 81.1%.

<sup>1</sup> BLC - Blow Count per 6-in. increment

<sup>2</sup> FMX - Maximum Compressive Force

<sup>3</sup> EFV - Maximum Transferred Energy

<sup>4</sup> CSX - Maximum Compressive Stress

<sup>5</sup> VMX - Maximum Velocity

<sup>6</sup> ETR - Energy Transfer Ratio - Ratio of Calculated Energy to Theoretical Energy of 140 lb hammer falling 30 inches



## 4.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report were based on the applicable standards of our profession in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

## 5.0 Closing

S&ME appreciates the opportunity to provide this report to the North Carolina Department of Transportation, Geotechnical Engineering Unit. Please let us know if you have any questions concerning this report.

Sincerely,

**S&ME, Inc.**

A handwritten signature in blue ink that reads "Joseph Williamson".

Joseph R. Williamson, P.E.  
Geotechnical Group Leader



Gregory J. Canivan, P.E.  
Technical Principal  
N.C. Registration No. 028593

### Appendices:

- Appendix I - Certificates of Proficiency
- Appendix II - Instrumented Rod and Accelerometer Calibration Sheets
- Appendix III - SPT Energy Evaluation Form (Field Log) & Boring L3\_121 Soil Boring Log
- Appendix IV - CME-550X ATV (SN 290593) SPT Energy Measurements Summary Plots and Tables

## **Appendices**

## **Appendices**

## **Appendix I**



This documents that

**Joseph Williamson  
S&ME**

has on October 31, 2017 achieved the rank of


**INTERMEDIATE**

**on the Dynamic Measurement and Analysis Proficiency Test.**

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended that Individuals at the Intermediate level seek Advanced, Master or Expert levels through additional study within four years of the date of this document.***

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate. This certificate can be verified at [www.PDAproficiencytest.com](http://www.PDAproficiencytest.com).

  
Steven A. Hall, Executive Director  
Pile Driving Contractors Association

  
Garland Likins, Senior Partner  
Pile Dynamics, Inc.

No. 2426





This documents that

**Greg Canivan  
S&ME Inc.**

has on October 8, 2014 achieved the rank of

**MASTER**


**on the Dynamic Measurement and Analysis Proficiency Test.**

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended that individuals at the Master level seek to attain Expert level through additional study within five years of the date of this document***

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate. This certificate can be verified at [www.PDAproficiencytest.com](http://www.PDAproficiencytest.com).

  
Steven A. Hall, Executive Director  
Pile Driving Contractors Association



  
Garland Likins, President  
Pile Dynamics, Inc

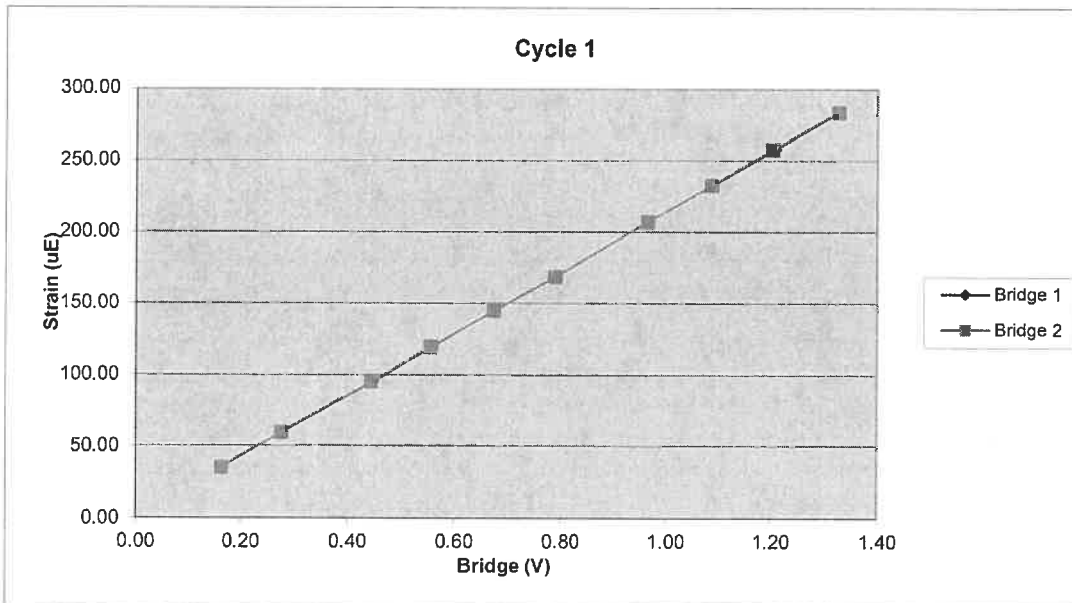
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## **Appendix II**

203AWJ		Cycle 1		
Sample	Force (lb)	Strain ( $\mu$ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	1238.45	35.09	0.16	0.16
3	2101.82	59.39	0.28	0.28
4	3386.54	94.77	0.44	0.44
5	4235.08	119.35	0.56	0.56
6	5136.73	144.58	0.67	0.67
7	6021.00	168.91	0.79	0.79
8	7359.61	207.34	0.97	0.97
9	8298.94	232.84	1.09	1.09
10	9187.31	257.76	1.21	1.20
11	10120.00	284.12	1.33	1.33

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7630.77	Force Calibration (lb/V)	7630.97
Offset	-7.83	Offset	-3.17
Correlation	1.000000	Correlation	0.999999
Strain Calibration ( $\mu$ E/V)	213.97	Strain Calibration ( $\mu$ E/V)	213.98
Offset	0.12	Offset	0.25
Correlation	0.999992	Correlation	0.999995

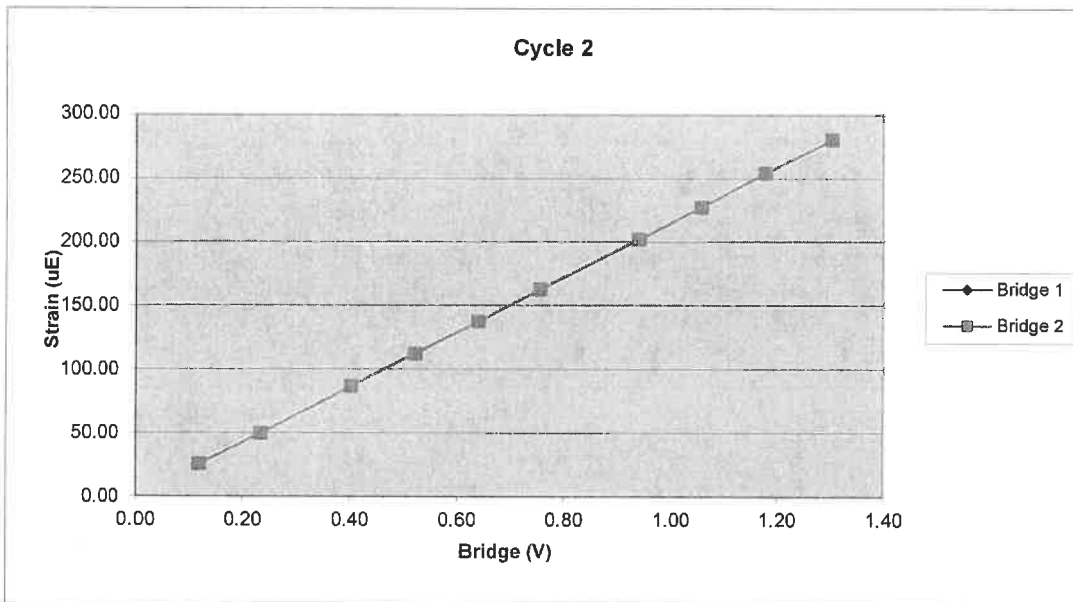
Force Strain Calibration	
EA (Kips)	35662.28
Offset	-12.17
Correlation	0.999993



203AWJ		Cycle 2		
Sample	Force (lb)	Strain ( $\mu\text{E}$ )	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	883.29	25.21	0.12	0.12
3	1765.61	49.65	0.23	0.23
4	3049.75	86.59	0.40	0.40
5	3958.42	112.20	0.52	0.52
6	4857.33	137.43	0.64	0.64
7	5743.75	162.78	0.76	0.76
8	7145.42	202.15	0.94	0.94
9	8044.14	227.44	1.06	1.06
10	8969.22	253.99	1.18	1.18
11	9924.95	280.34	1.30	1.30

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7617.86	Force Calibration (lb/V)	7627.07
Offset	-11.91	Offset	-18.36
Correlation	0.999998	Correlation	1.000000
Strain Calibration ( $\mu\text{E/V}$ )	215.30	Strain Calibration ( $\mu\text{E/V}$ )	215.56
Offset	-0.14	Offset	-0.33
Correlation	0.999995	Correlation	0.999996

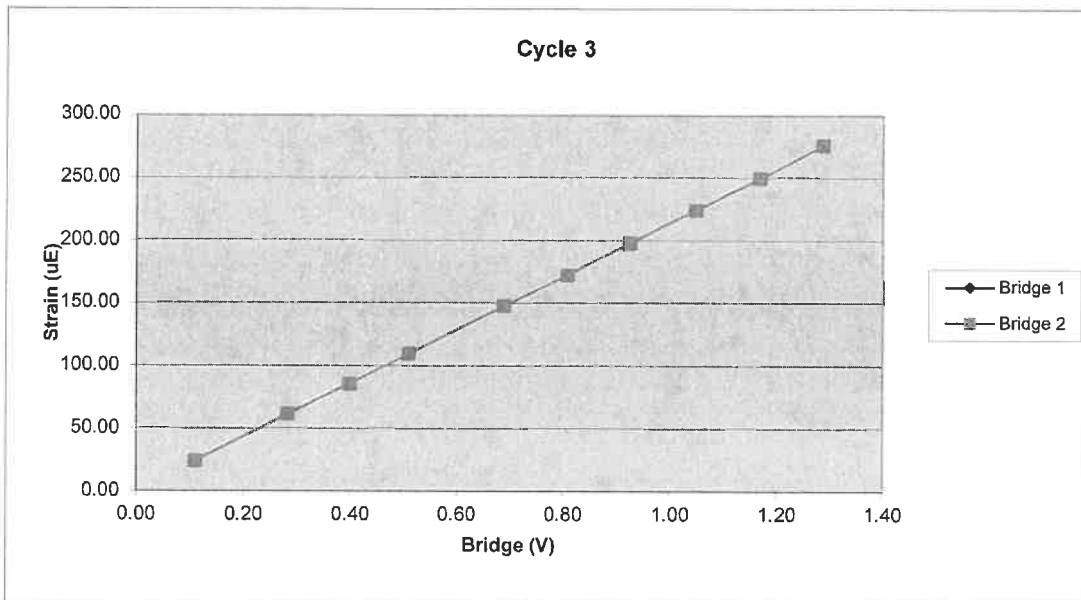
Force Strain Calibration	
EA (Kips)	35381.61
Offset	-6.76
Correlation	0.999996



203AWJ		Cycle 3		
Sample	Force (lb)	Strain ( $\mu$ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	843.85	23.93	0.11	0.11
3	2145.36	61.00	0.28	0.28
4	3029.63	85.25	0.40	0.40
5	3880.71	109.47	0.51	0.51
6	5241.19	147.71	0.69	0.69
7	6147.33	172.47	0.81	0.81
8	7034.72	198.06	0.92	0.92
9	7979.71	224.33	1.05	1.05
10	8906.15	249.58	1.17	1.17
11	9817.56	275.86	1.29	1.29

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7623.93	Force Calibration (lb/V)	7629.88
Offset	-3.49	Offset	-9.59
Correlation	0.999999	Correlation	0.999999
Strain Calibration ( $\mu$ E/V)	213.65	Strain Calibration ( $\mu$ E/V)	213.81
Offset	0.47	Offset	0.30
Correlation	0.999992	Correlation	0.999991

Force Strain Calibration	
EA (Kips)	35684.19
Offset	-20.08
Correlation	0.999992




Bridge Excitation (V) 5  
Shunt Resistor (ohm) 60.4k

Calibration Factors	203AWJ		
Bridge 1 ( $\mu\text{E/V}$ )	214.31	Bridge 2 ( $\mu\text{E/V}$ )	214.45
EA Factor (Kips)	35576.02	Area ( $\text{in}^2$ )	1.19

Calibrated by:

Calibrated Date:

  
2/26/2019

Pile Dynamics Inc  
30725 Aurora Rd  
Solon, OH 44139

Traceable to N.I.S.T.

QBTA: ON [ALT-F1/BB=60]

File Dynamics, Inc.

TG F2 DPF

File Dynamics  
2019-05-21 10:07FS —  
10BN 3743  
SL 1513/ 3440/ 2PJ:  
PN: HOPBARA 4 -- US  
F 2 3.3LE 17.0 ft  
AR 1.7 in2  
EM 30000 Ksi  
SP 0.492 K/ft3  
WS 16815 ft/s  
WC 7312 ft/sJC 0.40  
FM 1.00  
UM 1.00EA/C 30.3 Ks/ft  
UN KIPS\*0.1  
FR 20000 MB 90DL -42  
UT -1 IP 0.00  
PK 1 TM-PEAKF1/2 500/ 213  
F3/4 213/ 213  
A1/2 999/ 999  
A3/4 999/ 378TS 12 E B PD: K5641 LP 0.00 ft  
TB 8.0 T1 9.6 2L/C 4.7 UA 1000 UE 1024 LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

ACCEPT

UMX= 4.1 FMX= 65 AMX= 139  
EMX= 0.2 MEX= 127 FVP= 1.00

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K5641

CALIBRATION FACTOR: .0756 MV/g

PAK (\*5000): 378 DATE: 21 MAY 19

PDA OPERATOR: [Signature]

&lt;-AT:PIEZORESISTIVE

OP: LAINE [ver:5.011]

AT:PIEZOELECTRIC-&gt;

Smart Sensor

Programmed By: [Signature]

CRC Value F648

QBTA: ON [ALT-F1/BB=60]

Pile Dynamics, Inc.

TG F2 DPF

Pile Dynamics  
2020-02-28 11:23FS —  
10BN 5034/15033  
SL 1255/ 3440/ 99PJ:  
PN: HOPBARA 4 -- US  
F 2 3.3LE 39.6 ft  
AR 1.7 in2  
EM 30000 Ksi  
SP 0.492 K/ft3  
WS 16815 ft/s  
WC 16851 ft/sJC 0.40  
FM 1.00  
UM 1.00EA/C 30.3 Ks/ft  
UN KIPS\*0.1  
FR 20000 MB 90DL -27  
UT -1 IP 0.00  
PK 1 TM-PEAKF1/2 500/ 213  
F3/4 213/ 213  
A1/2 999/ 999  
A3/4 999/ 385TS 12  
TB 8.0E B PD: K10181  
T1 9.6 2L/C 4.7

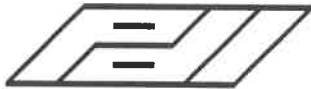
VA 1000

UE 1024

LP 0.00 ft  
LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

ACCEPT

VMX= 4.1 FMX= 64 AMX= 149  
EMX= 0.2 MEX= 125 FVP= 0.99

ACCELEROMETER CALIBRATION

N.I.S.T. Traceable

SERIAL NUMBER: K10181

CALIBRATION FACTOR: .077 mV/g

PAK (\*5000): 385

DATE: 28 Feb 20

PDA OPERATOR: Jase

&lt;-AT:PIEZORESISTIVE

OP: LAINE [ver:5.01]

AT:PIEZOELECTRIC-&gt;

Smart Sensor

Programmed By: J.W.

CRC Value 1108

## **Appendix III**



## SPT Energy Evaluation Form

**Project:** RUTHERFORDTON / US-221 RELOCATION  
**Project No.:** 6235-20-004 / R-2233BA  
**Boring No.:** L3\_121

**Date:** 5/5/2020  
**Weather:** CLEAR / 70s  
**Drill Rod Type:** 5' LONG AWJ

### On-site Personnel

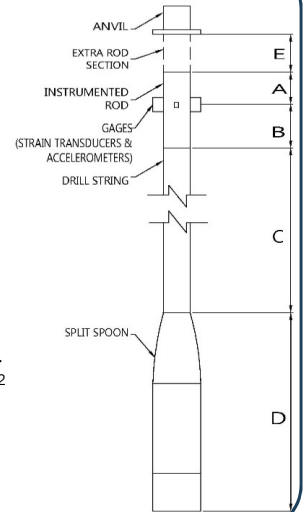
Drilling Company: S&ME, INC.  
Rig Operator: F. JOHNSON  
Engr/Geologist: B. KEBEA  
Client Rep.: N/A  
Analyzer Oper.: J. WILLIAMSON

### Rig/Hammer Info

Drill Rig Make/Model: CME-550X  
Carrier Type: ATV  
Rig Serial No.: 290593  
Hammer Type/Model: CME-550X  
Hammer Serial No.: N/A - BUILT IN  
Hammer Drop System: AUTOMATIC  
Lubrication Condition: PER MANUFACTURER  
Manufacturer Recommended  
Operation Rate (bpm): 50  
Typical Drop Height (in.): 30  
Typical Hammer Weight (lbs): 140  
Anvil Dimension (in.): 12  
Drilling Method: MUD ROTARY - 2-15/16" TRICONE

### Rod Info

(A + E) Impact Surface to Gages Length: 1.2 ft  
(B) Instr. Rod Length below Gages: 0.8 ft  
(A) + (B) Instr. Rod Length: 2.0 ft  
(D) Spoon Length: 2.85 ft  
(E) Rod Length Above Instr. Rod (if applicable): N/A ft  
Instr. Rod S/N: 203AWJ  
Instr. Rod Outside Dia.: 1.75 in.  
Instr. Rod Area: 1.19 in<sup>2</sup>  
PDA Make/Model: PDI/PAX  
PDA Serial No.: 3733L  
Calib. Pulse Test (y/n): Y



### Gage Info

Gage		Serial No.	Calibration No.
Accel.	A3	K5641	378.0
	A4	K10181	385.0
Strain	F3	203AWJ-1	214.31
	F4	203AWJ-2	214.45

Date of Test	Test Depth Increment (ft to ft)	Test Time Start / Stop (military)	Length of Drill String (ft) (C)	(LE) Length below Gages (ft) (B) + (C) + (D)	Avg. Meas. Hammer Rate (BPM)	SPT Blow Counts				Drop Height in Tolerance (y/n)	
						6"	12"	18"	N-Value		
5/5/2020	28.5 - 30.0	9:52	30	33.65	43	7	9	11	20	Y	A-2-4
	33.5 - 35.0	10:02	35	38.65	53	7	11	14	25	Y	A-2-4
	38.5 - 40.0	10:14	40	43.65	53	9	10	12	22	Y	A-2-4
	43.5 - 45.0	10:23	45	48.65	53	10	10	11	21	Y	A-2-4
	48.5 - 50.0	10:36	50	53.65	53	12	18	35	53	Y	A-2-4
	53.5 - 55.0	10:48	55	58.65	53	25	58	42/0.2'	100/0.7'	Y	WR

Notes:

NOTE: (1) Note any unusual hammer operating conditions that affect the hammer performance, or changes in operating conditions (e.g. veritcality, weather, or lubrication between trials). (2) Note any changes in rod diameter along drill string and record locations of short rod sections.

Joseph Williamson  
Prepare By (print/signature)

5/5/2020  
Date

# GEOTECHNICAL BORING REPORT

## BORE LOG

SHEET 1

WBS 34400.1.4			TIP R-2233BA			COUNTY RUTHERFORD			GEOLOGIST B. Kebea						
SITE DESCRIPTION Rutherfordton Bypass									GROUND WTR (ft)						
BORING NO. L3_121			STATION 5915+47			OFFSET 90 ft RT			ALIGNMENT -L3-			0 HR.	N/A		
COLLAR ELEV. N/A			TOTAL DEPTH 83.5 ft			NORTHING 591,547			EASTING 1,122,032			24 HR.	49.0		
DRILL RIG/HAMMER EFF./DATE SME0593 CME-550X 86% 05/01/2019						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER F. Johnson			START DATE 05/05/20			COMP. DATE 05/05/20			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)
		0.0	3	5	5										GROUND SURFACE 0.0
		3.5	6	5	7										TOPSOIL 0.3
		8.5	4	4	5										RESIDUAL LOOSE TO VERY DENSE RED BROWN BLACK SILTY FINE TO COARSE SAND (A-2-4), TRACE MICA, TRACE ANGULAR MANGANESE OXIDE
		13.5	7	5	11										
		18.5	5	7	7										
		23.5	11	12	13										
		28.5	7	9	11										
		33.5	7	11	14										
		38.5	9	10	12										
		43.5	10	10	11										
		48.5	12	18	35										
		53.5	25	58	42/0.2										
		58.5	12	13	26										WEATHERED ROCK MIGMATITIC GRANITIC GNEISS
		63.5	12	18	29										
		68.5	8	10	14										RESIDUAL DENSE TO MEDIUM DENSE GRAY BROWN BLACK SILTY FINE TO COARSE SAND (A-2-4), TRACE MICA, TRACE GRAVEL, TRACE ANGULAR MANGANESE OXIDE
		73.5	5	6	8										
		78.5	8	13	19										

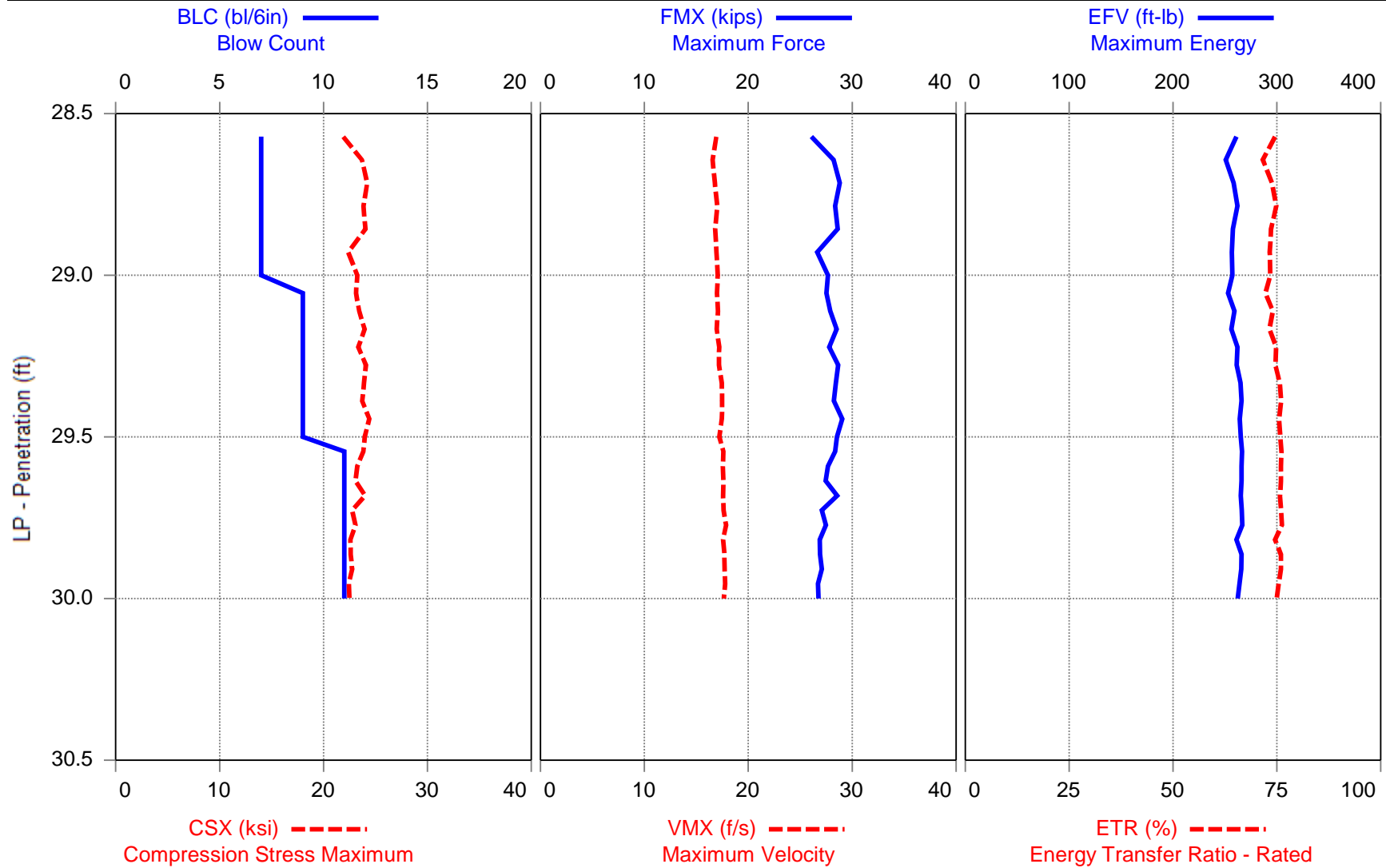
NCDOT BORE SINGLE L3\_116 BORING LOG.GPJ NC\_DOT.GDT 5/7/20

## **Appendix IV**



## CME-550X (SN 290593) - 28.5-30.0 FEET

L3\_121



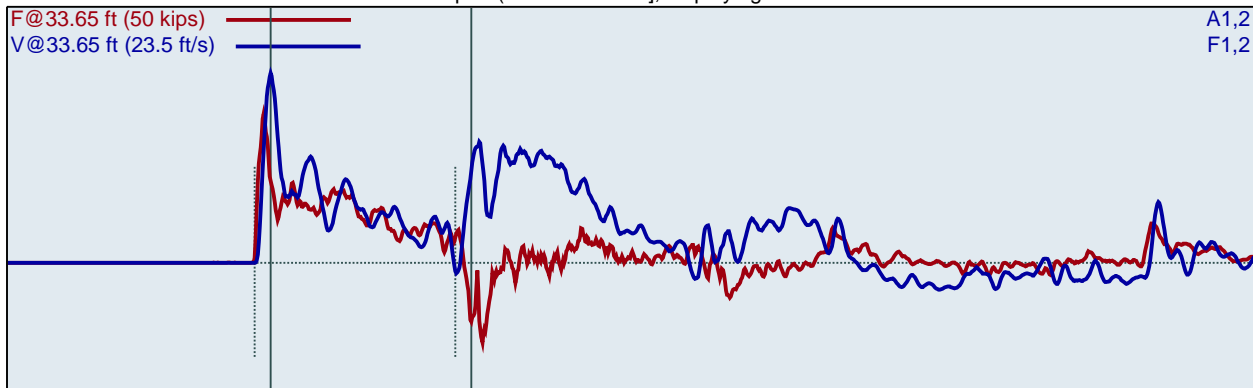
CME-550X (SN 290593)  
JRW  
L3\_121

Annual Calibration  
Test date: 5/5/2020

AR: 1.19 in<sup>2</sup>  
LE: 33.65 ft  
WS: 16807.9 ft/s

SP: 0.492 k/ft<sup>3</sup>  
EM: 30000 ksi

Depth: (28.50 - 30.00 ft), displaying BN: 15



F1 : [203 AWJ-1] 214.31 PDICAL (1) FF1  
F2 : [203 AWJ-2] 214.45 PDICAL (1) FF1

A1 (PR): [K5641] 378 mv/6.4v/5000g (1) VF1  
A2 (PR): [K10181] 385 mv/6.4v/5000g (1) VF1

BPM: Blows/Minute

FMX: Maximum Force

VMX: Maximum Velocity

DMX: Maximum Displacement

CSX: Compression Stress Maximum

DFN: Final Displacement

EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated

BL#	LP ft	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
1	28.57	7	1.9	26	16.9	1.29	21.9	0.86	261	74.6
2	28.64	7	31.6	28	16.6	1.10	23.7	0.86	251	71.6
3	28.71	7	41.8	29	16.8	1.03	24.2	0.86	258	73.8
4	28.79	7	43.3	28	17.0	0.96	23.8	0.86	262	74.9
5	28.86	7	43.0	29	16.8	0.91	24.0	0.86	257	73.6
6	28.93	7	43.2	27	16.9	0.91	22.4	0.86	257	73.3
7	29.00	7	43.4	28	17.0	0.90	23.2	0.86	257	73.4
8	29.06	9	43.0	28	17.0	0.84	23.1	0.67	253	72.2
9	29.11	9	43.1	28	17.1	0.86	23.4	0.67	259	74.0
10	29.17	9	43.2	28	17.0	0.81	23.9	0.67	256	73.2
11	29.22	9	43.3	28	17.2	0.80	23.4	0.67	262	74.8
12	29.28	9	43.3	29	17.2	0.76	24.1	0.67	261	74.6
13	29.33	9	43.2	28	17.5	0.72	23.9	0.67	265	75.7
14	29.39	9	43.2	28	17.5	0.71	23.7	0.67	266	76.0
15	29.44	9	43.2	29	17.5	0.70	24.4	0.67	264	75.5
16	29.50	9	43.3	29	17.2	0.69	24.0	0.67	265	75.8
17	29.55	11	43.3	28	17.6	0.66	23.8	0.55	266	76.1
18	29.59	11	43.2	28	17.6	0.66	23.2	0.55	266	76.0
19	29.64	11	43.3	27	17.6	0.65	23.1	0.55	266	76.0
20	29.68	11	43.4	29	17.6	0.64	24.0	0.55	265	75.7
21	29.73	11	43.3	27	17.6	0.62	22.8	0.55	266	76.0
22	29.77	11	43.3	27	17.9	0.61	23.1	0.55	267	76.2
23	29.82	11	43.2	27	17.6	0.60	22.6	0.55	261	74.6
24	29.86	11	43.4	27	17.7	0.60	22.6	0.55	266	76.0
25	29.91	11	43.4	27	17.7	0.58	22.7	0.55	266	75.9
26	29.95	11	43.4	27	17.8	0.55	22.4	0.55	264	75.4
27	30.00	11	43.5	27	17.6	0.55	22.5	0.55	262	75.0

Average	43.3	28	17.5	0.68	23.3	0.60	263	75.2
Std Dev	0.1	1	0.3	0.09	0.6	0.06	4	1.0
Maximum	43.5	29	17.9	0.86	24.4	0.67	267	76.2
Minimum	43.0	27	17.0	0.55	22.4	0.55	253	72.2

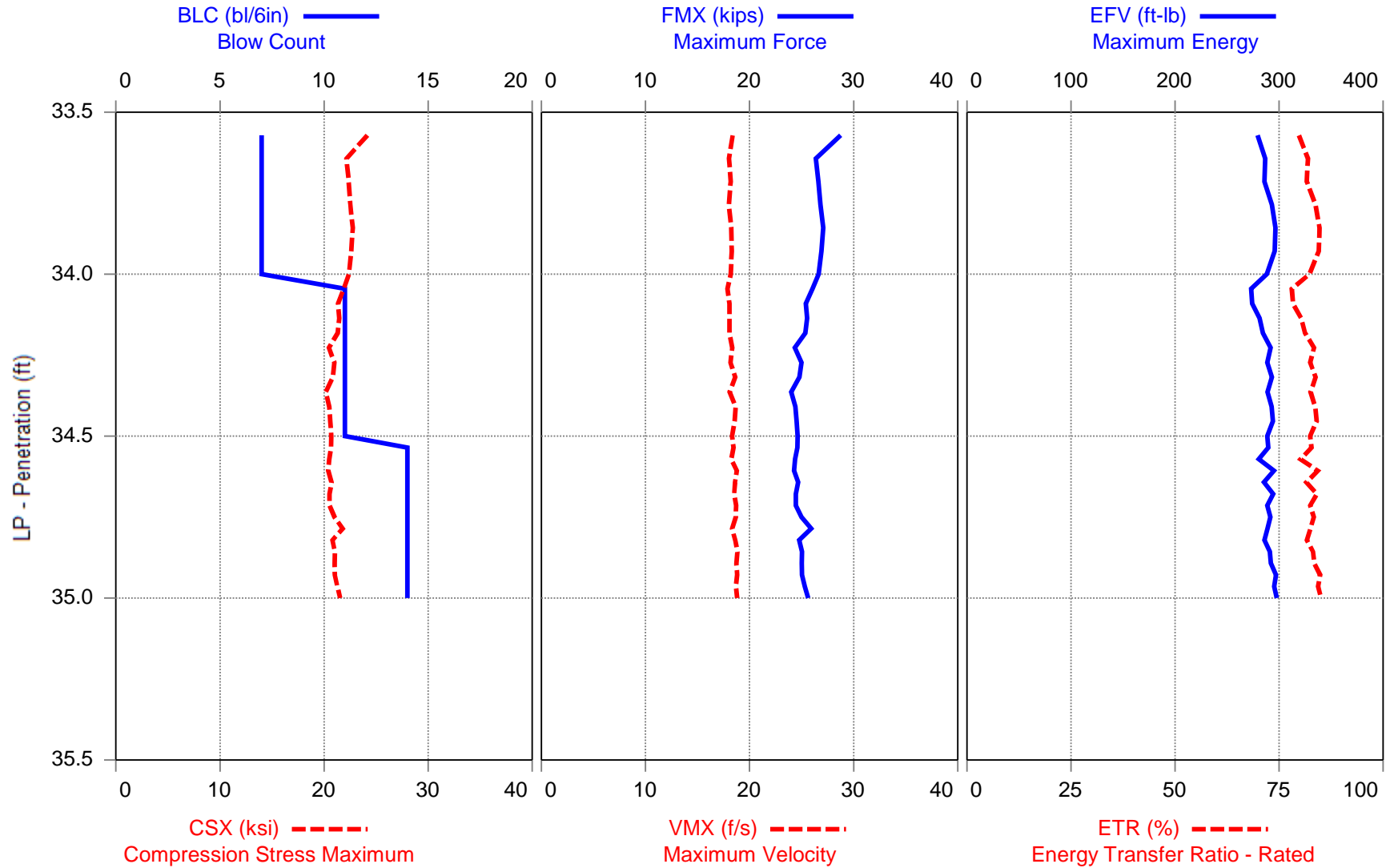
N-value: 20

Sample Interval Time: 36.56 seconds.



## CME-550X (SN 290593) - 33.5-35.0 FEET

L3\_121



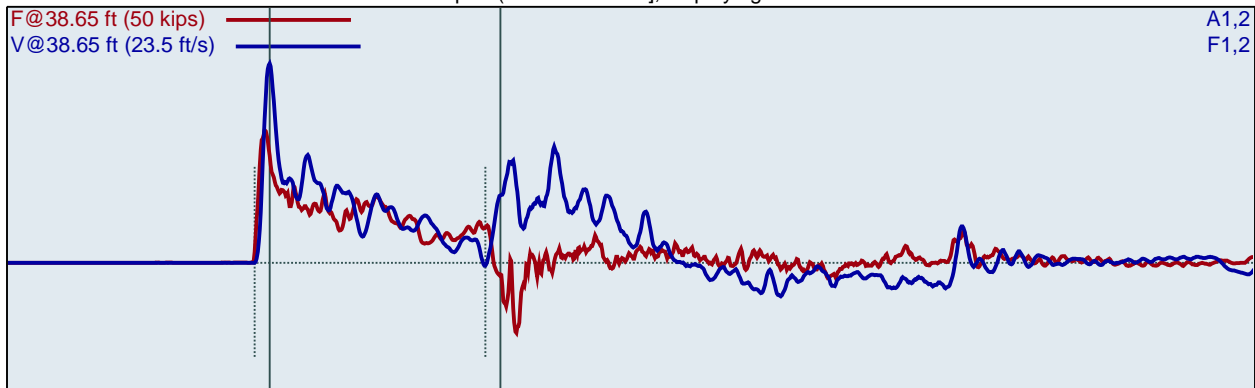
CME-550X (SN 290593)  
JRW  
L3\_121

Annual Calibration  
Test date: 5/5/2020

AR: 1.19 in<sup>2</sup>  
LE: 38.65 ft  
WS: 16807.9 ft/s

SP: 0.492 k/ft<sup>3</sup>  
EM: 30000 ksi

Depth: (33.50 - 35.00 ft), displaying BN: 26



F1 : [203 AWJ-1] 214.31 PDICAL (1) FF1  
F2 : [203 AWJ-2] 214.45 PDICAL (1) FF1

A1 (PR): [K5641] 378 mv/6.4v/5000g (1) VF1  
A2 (PR): [K10181] 385 mv/6.4v/5000g (1) VF1

BL#	LP ft	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
1	33.57	7	1.9	29	18.4	1.07	24.2	0.86	279	79.8
2	33.64	7	52.6	26	18.0	1.00	22.1	0.86	287	81.9
3	33.71	7	52.9	27	18.2	0.91	22.4	0.86	286	81.7
4	33.79	7	53.4	27	18.0	0.90	22.5	0.86	293	83.8
5	33.86	7	53.4	27	18.2	0.92	22.8	0.86	296	84.7
6	33.93	7	53.2	27	18.3	0.91	22.6	0.86	296	84.5
7	34.00	7	53.3	27	18.2	0.86	22.4	0.86	288	82.3
8	34.05	11	53.3	26	17.9	0.74	21.9	0.54	273	78.0
9	34.09	11	53.1	25	18.1	0.70	21.3	0.54	274	78.3
10	34.14	11	53.1	26	18.1	0.69	21.4	0.54	281	80.3
11	34.18	11	53.4	25	18.1	0.69	21.3	0.54	284	81.2
12	34.23	11	53.0	24	18.3	0.68	20.5	0.54	292	83.4
13	34.27	11	53.4	25	18.2	0.59	21.0	0.54	289	82.5
14	34.32	11	53.4	25	18.6	0.55	20.8	0.54	293	83.8
15	34.36	11	53.3	24	18.1	0.54	20.2	0.54	289	82.5
16	34.41	11	53.0	24	18.7	0.54	20.5	0.54	293	83.7
17	34.45	11	53.4	25	18.6	0.54	20.6	0.54	294	84.0
18	34.50	11	53.2	25	18.3	0.54	20.7	0.54	289	82.4
19	34.54	14	53.4	25	18.5	0.52	20.7	0.43	290	82.8
20	34.57	14	53.1	24	18.2	0.51	20.5	0.43	281	80.1
21	34.61	14	53.1	24	18.8	0.53	20.4	0.43	295	84.3
22	34.64	14	53.2	25	18.6	0.51	20.7	0.43	285	81.5
23	34.68	14	53.3	24	18.5	0.55	20.5	0.43	294	84.1
24	34.71	14	53.1	24	18.7	0.51	20.5	0.43	289	82.5
25	34.75	14	53.1	25	18.7	0.51	21.0	0.42	292	83.3
26	34.79	14	53.3	26	18.3	0.50	21.8	0.43	289	82.6
27	34.82	14	53.1	25	18.6	0.50	20.8	0.43	286	81.7
28	34.86	14	53.1	25	18.8	0.50	21.0	0.43	291	83.1
29	34.89	14	53.5	25	18.7	0.50	21.0	0.43	292	83.4
30	34.93	14	52.8	25	18.8	0.51	21.0	0.43	297	84.8
31	34.96	14	53.3	25	18.7	0.50	21.3	0.43	295	84.3

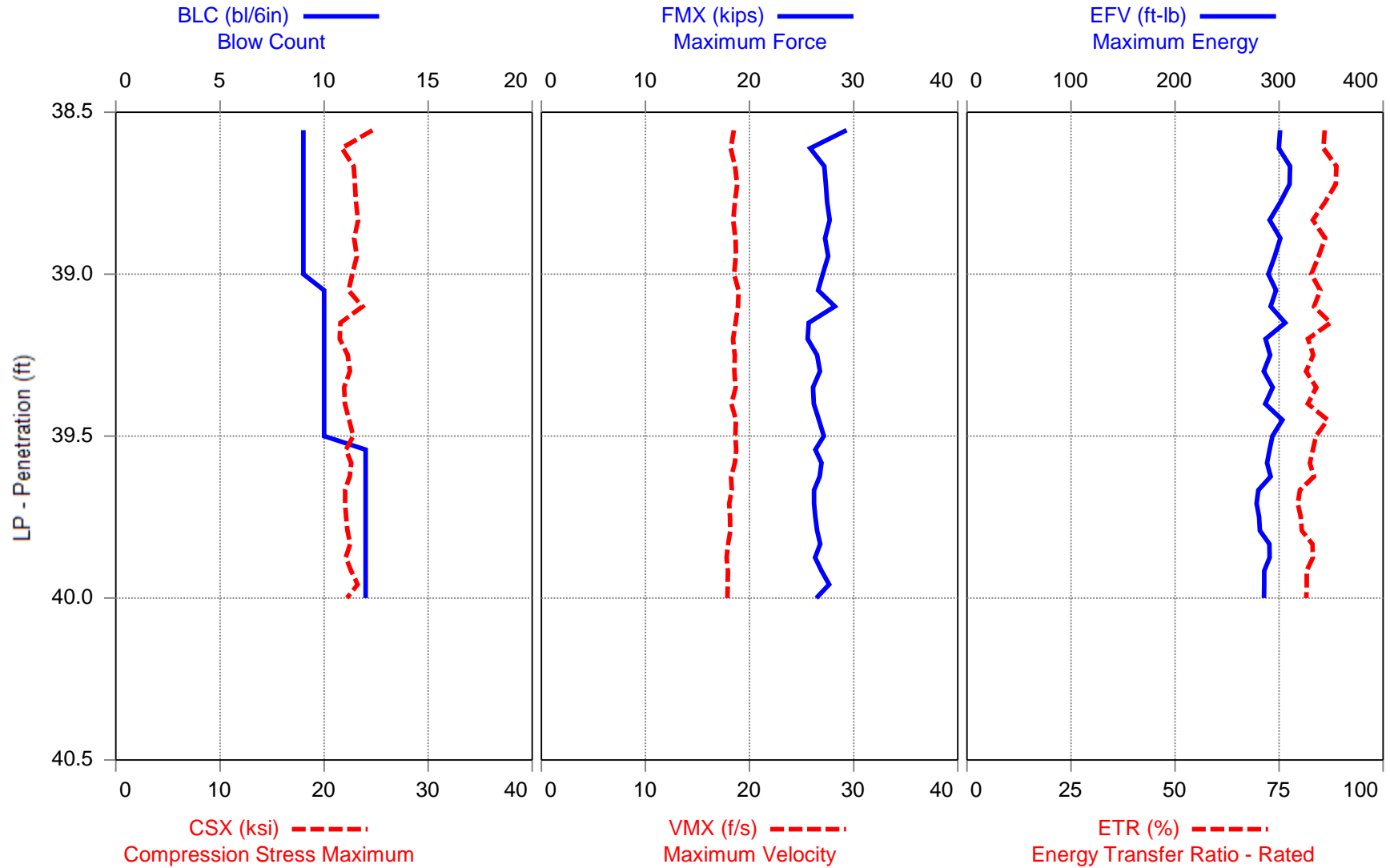
32	35.00	14	52.7	26	18.8	0.50	21.5	0.43	298	85.1
		Average	53.2	25	18.5	0.56	20.9	0.48	289	82.6
		Std Dev	0.2	1	0.3	0.07	0.4	0.06	6	1.8
		Maximum	53.5	26	18.8	0.74	21.9	0.54	298	85.1
		Minimum	52.7	24	17.9	0.50	20.2	0.42	273	78.0
N-value: 25										

Sample Interval Time: 34.93 seconds.



# CME-550X (SN 290593) - 38.5-40.0 FEET

L3\_121



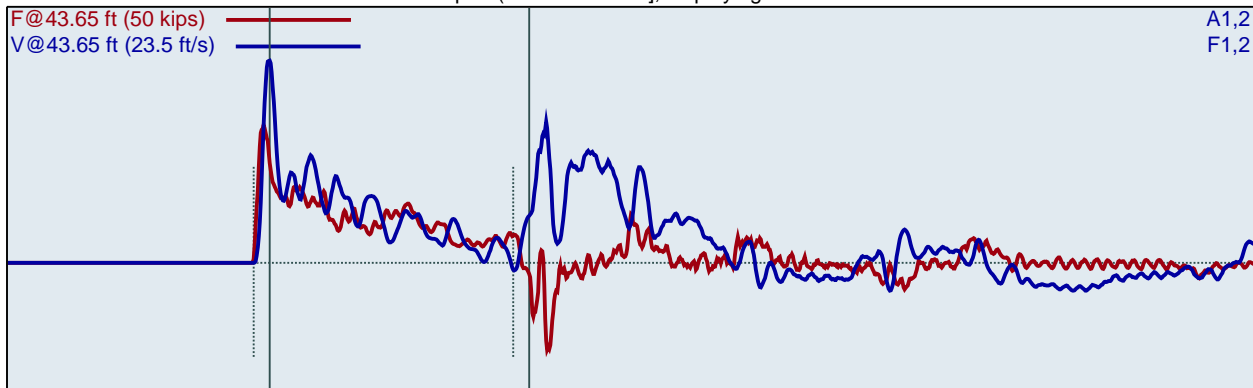
CME-550X (SN 290593)  
JRW  
L3\_121

Annual Calibration  
Test date: 5/5/2020

AR: 1.19 in<sup>2</sup>  
LE: 43.65 ft  
WS: 16807.9 ft/s

SP: 0.492 k/ft<sup>3</sup>  
EM: 30000 ksi

Depth: (38.50 - 40.00 ft), displaying BN: 21



F1 : [203 AWJ-1] 214.31 PDICAL (1) FF1  
F2 : [203 AWJ-2] 214.45 PDICAL (1) FF1

A1 (PR): [K5641] 378 mv/6.4v/5000g (1) VF1  
A2 (PR): [K10181] 385 mv/6.4v/5000g (1) VF1

BL#	LP ft	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
1	38.56	9	1.9	29	18.5	1.03	24.6	0.67	301	85.9
2	38.61	9	52.8	26	18.2	0.78	21.7	0.67	300	85.6
3	38.67	9	52.7	27	18.6	0.72	22.8	0.67	311	88.8
4	38.72	9	53.2	27	18.8	0.74	23.0	0.67	310	88.6
5	38.78	9	53.1	27	18.6	0.72	23.1	0.67	301	86.0
6	38.83	9	53.2	28	18.4	0.70	23.3	0.67	291	83.1
7	38.89	9	53.2	27	18.6	0.78	22.9	0.67	301	86.1
8	38.94	9	53.5	28	18.7	0.75	23.1	0.67	296	84.5
9	39.00	9	53.0	27	18.5	0.75	22.7	0.66	290	82.7
10	39.05	10	53.5	27	18.9	0.74	22.3	0.60	297	84.9
11	39.10	10	53.2	28	18.9	0.72	23.7	0.60	292	83.4
12	39.15	10	53.2	26	18.7	0.85	21.6	0.60	306	87.4
13	39.20	10	53.4	26	18.4	0.74	21.5	0.60	287	81.9
14	39.25	10	53.0	26	18.6	0.71	22.3	0.60	291	83.2
15	39.30	10	53.2	27	18.5	0.63	22.5	0.60	285	81.5
16	39.35	10	53.1	26	18.7	0.62	21.9	0.60	294	83.9
17	39.40	10	53.0	26	18.3	0.61	22.0	0.60	287	81.9
18	39.45	10	53.4	27	18.7	0.64	22.4	0.60	303	86.6
19	39.50	10	53.2	27	18.6	0.60	22.8	0.60	294	83.9
20	39.54	12	53.3	26	18.7	0.58	22.1	0.50	291	83.1
21	39.58	12	53.2	27	18.6	0.58	22.6	0.50	288	82.4
22	39.63	12	52.9	27	18.2	0.69	22.5	0.50	292	83.4
23	39.67	12	53.3	26	18.3	0.57	22.0	0.50	280	80.0
24	39.71	12	53.2	26	18.1	0.57	22.0	0.50	278	79.5
25	39.75	12	53.1	26	18.1	0.56	22.1	0.50	281	80.2
26	39.79	12	53.1	26	18.2	0.56	22.3	0.50	281	80.4
27	39.83	12	53.1	27	17.9	0.58	22.5	0.50	291	83.0
28	39.88	12	53.1	26	17.8	0.64	22.1	0.50	291	83.1
29	39.92	12	53.5	27	17.9	0.56	22.6	0.50	286	81.6
30	39.96	12	53.0	28	17.9	0.56	23.2	0.50	286	81.6
31	40.00	12	52.9	26	17.9	0.58	22.2	0.50	285	81.5

Average	53.2	27	18.4	0.63	22.3	0.54	289	82.6
Std Dev	0.2	1	0.3	0.08	0.5	0.05	7	1.9
Maximum	53.5	28	18.9	0.85	23.7	0.60	306	87.4
Minimum	52.9	26	17.8	0.56	21.5	0.50	278	79.5

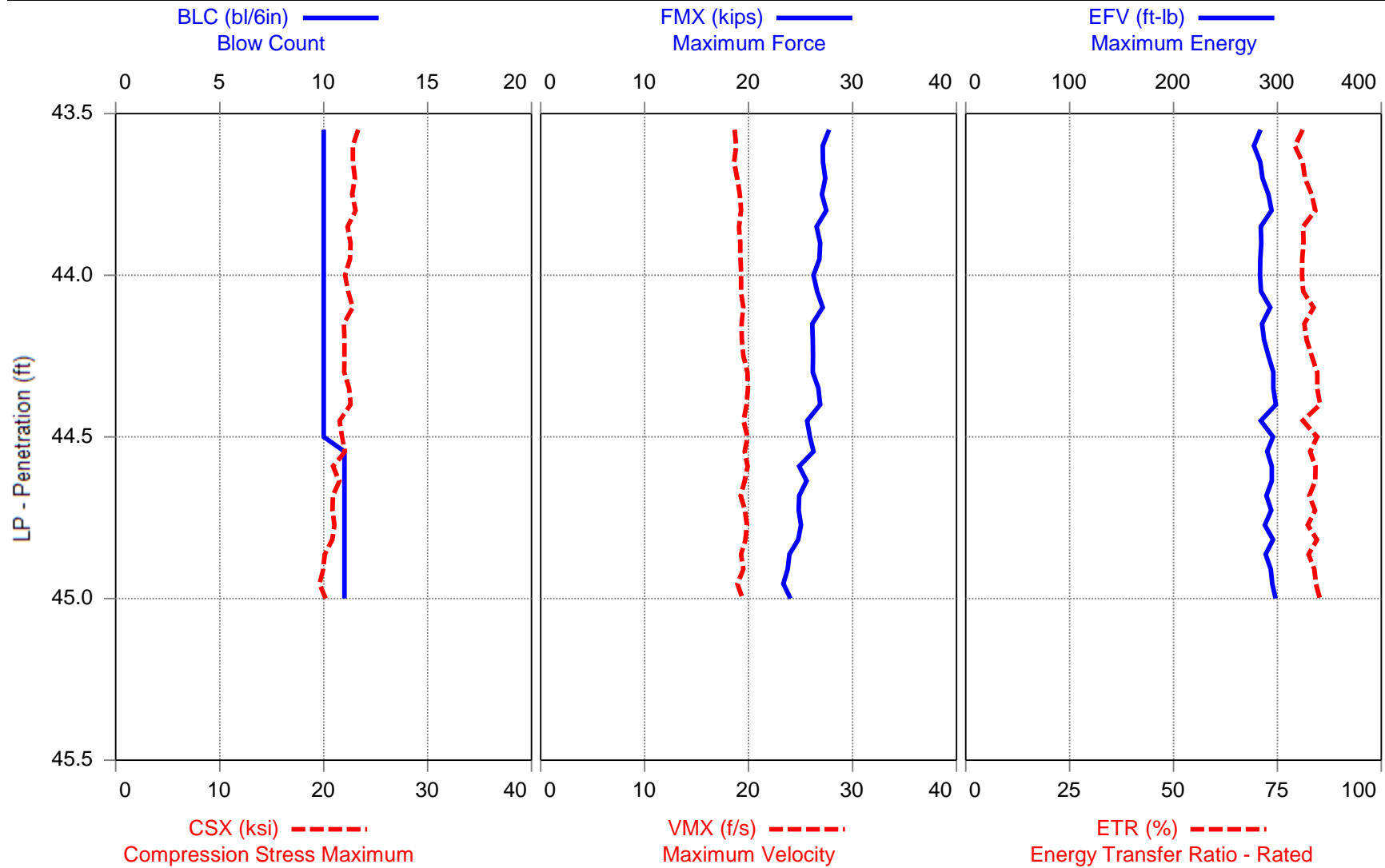
N-value: 22

Sample Interval Time: 33.81 seconds.



## CME-550X (SN 290593) - 43.5-45.0 FEET

L3\_121

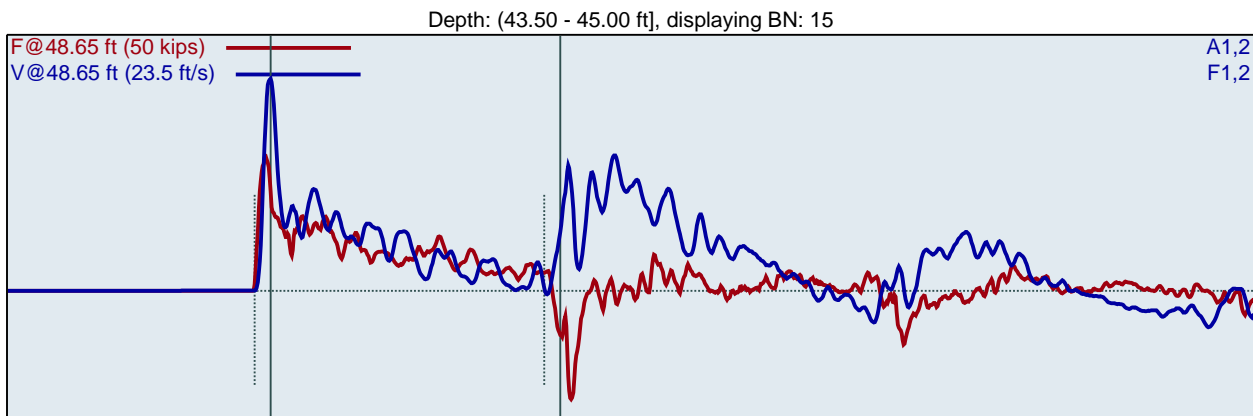


CME-550X (SN 290593)  
JRW  
L3\_121

Annual Calibration  
Test date: 5/5/2020

AR: 1.19 in<sup>2</sup>  
LE: 48.65 ft  
WS: 16807.9 ft/s

SP: 0.492 k/ft<sup>3</sup>  
EM: 30000 ksi



F1 : [203 AWJ-1] 214.31 PDICAL (1) FF1  
F2 : [203 AWJ-2] 214.45 PDICAL (1) FF1

A1 (PR): [K5641] 378 mv/6.4v/5000g (1) VF1  
A2 (PR): [K10181] 385 mv/6.4v/5000g (1) VF1

BL#	LP ft	BC /6"	BPM bpm	FMX kips	VMX ft/s	DMX in	CSX ksi	DFN in	EFV ft-lb	ETR %
1	43.55	10	1.9	28	18.7	0.78	23.3	0.60	284	81.1
2	43.60	10	52.3	27	18.8	0.63	22.8	0.60	277	79.2
3	43.65	10	54.0	27	18.6	0.63	22.8	0.60	284	81.0
4	43.70	10	52.9	27	18.9	0.64	23.0	0.60	286	81.6
5	43.75	10	53.5	27	19.2	0.64	22.7	0.60	291	83.2
6	43.80	10	53.5	27	19.3	0.66	23.1	0.60	294	84.1
7	43.85	10	53.2	27	19.1	0.68	22.3	0.60	284	81.2
8	43.90	10	53.4	27	19.2	0.69	22.6	0.60	284	81.2
9	43.95	10	53.3	27	19.2	0.70	22.5	0.60	283	81.0
10	44.00	10	53.5	26	19.3	0.70	22.1	0.60	283	80.9
11	44.05	10	53.1	27	19.3	0.70	22.4	0.60	284	81.2
12	44.10	10	53.3	27	19.5	0.71	22.8	0.60	293	83.7
13	44.15	10	53.5	26	19.3	0.72	21.9	0.60	285	81.4
14	44.20	10	53.5	26	19.3	0.74	22.0	0.60	287	82.0
15	44.25	10	53.3	26	19.5	0.75	22.0	0.60	291	83.2
16	44.30	10	53.3	26	19.9	0.74	22.0	0.60	296	84.6
17	44.35	10	53.3	27	19.9	0.70	22.5	0.60	296	84.6
18	44.40	10	53.2	27	19.8	0.69	22.6	0.60	298	85.3
19	44.45	10	53.5	26	19.5	0.68	21.5	0.60	284	81.1
20	44.50	10	53.0	26	19.9	0.68	21.8	0.60	296	84.5
21	44.55	11	53.2	26	19.6	0.64	22.0	0.54	290	82.9
22	44.59	11	53.1	25	19.9	0.64	20.9	0.54	295	84.1
23	44.64	11	53.2	26	19.6	0.61	21.5	0.54	294	84.1
24	44.68	11	53.1	25	19.2	0.61	20.9	0.54	289	82.6
25	44.73	11	53.5	25	19.7	0.61	20.8	0.54	294	84.0
26	44.77	11	53.3	25	19.8	0.57	21.0	0.54	288	82.3
27	44.82	11	53.2	25	19.7	0.59	20.8	0.54	296	84.5
28	44.86	11	53.2	24	19.3	0.58	20.1	0.54	289	82.5
29	44.91	11	53.2	24	19.5	0.56	20.0	0.54	293	83.8
30	44.95	11	53.4	23	18.9	0.58	19.6	0.54	295	84.3
31	45.00	11	53.2	24	19.4	0.58	20.2	0.54	298	85.2

Pile Dynamics, Inc.  
SPT Analyzer Results

Page 2 of 2  
PDA-S Ver. 2018.30 - Printed: 6/4/2020

Average	53.3	25	19.6	0.65	21.4	0.57	292	83.4
Std Dev	0.1	1	0.3	0.06	0.9	0.03	4	1.3
Maximum	53.5	27	19.9	0.75	22.8	0.60	298	85.3
Minimum	53.0	23	18.9	0.56	19.6	0.54	284	81.1
N-value: 21								

Sample Interval Time: 33.74 seconds.

**Summary of SPT Test Results**

Project: CME-550X (SN 290593), Test Date: 5/5/2020

BPM: Blows/Minute											CSX: Compression Stress Maximum		
FMX: Maximum Force											DFN: Final Displacement		
VMX: Maximum Velocity											EFV: Maximum Energy		
DMX: Maximum Displacement											ETR: Energy Transfer Ratio - Rated		
Instr. Length ft	Start Depth ft	Final Depth ft	Blows Applied /6"	N Value	N60 Value	Average BPM bpm	Average FMX kips	Average VMX ft/s	Average DMX in	Average CSX ksi	Average DFN in	Average EFV ft-lb	Average ETR %
33.65	28.50	30.00	7-9-11	20	27	43.3	28	17.5	0.68	23.3	0.60	263	75.2
38.65	33.50	35.00	7-11-14	25	33	53.2	25	18.5	0.56	20.9	0.48	289	82.6
43.65	38.50	40.00	9-10-12	22	29	53.2	27	18.4	0.63	22.3	0.54	289	82.6
48.65	43.50	45.00	10-10-11	21	28	53.3	25	19.6	0.65	21.4	0.57	292	83.4
Overall Average Values:						51.0	26	18.5	0.63	21.9	0.54	284	81.1
Standard Deviation:						4.2	1	0.8	0.09	1.1	0.07	13	3.6
Overall Maximum Value:						53.5	29	19.9	0.86	24.4	0.67	306	87.4
Overall Minimum Value:						43.0	23	17.0	0.50	19.6	0.42	253	72.2

