



# Geotechnical Subsurface Data Report (GSDR)

SC 4 over South Edisto River

Wagener, Aiken County, South Carolina

SCDOT Project ID P040306

S&ME Project No. 207163

**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**

**January 25, 2021**



January 25, 2021

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

Attention: Mr. Trapp Harris, P.E.

Reference: **Geotechnical Subsurface Data Report (GSDR)**  
**SC 4 over South Edisto River**  
**SCDOT Project ID P040306**  
Wagener, Aiken County, South Carolina  
SCDOT Project ID P040306  
S&ME Project No. 207163

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 build projects. Our services were performed in general accordance with the Scope of Services provided in the *Work Order Request* by SCDOT, dated December 29, 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



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



Senior reviewed by J. Adam Browning, P.E.



# 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 Existing Roadway Coring .....2
  - 5.2 Cone Penetration Test (CPT) Soundings.....2
  - 5.3 Shear Wave Velocity Test by Surface Wave Method .....3
- 6.0 Closing .....4**

## Appendices

- Appendix I – Figures
- Appendix II – Tables
- Appendix III – CPT Sounding Records
- Appendix IV – Surface Shear Wave Velocity Test Results
- Appendix V – Electronic Data Files



## 1.0 Project Description

The proposed construction for this project includes emergency replacement of the existing SC 4/302 (Wagener Road) bridge over South Edisto River in Wagener, Aiken County, South Carolina, as shown in the *Site Location Plan*, attached as Figure 1 in Appendix I.

The following report and drawings for the project were reviewed:

- ◆ *Results of Soil Test Borings*, S&ME Project No. 1611-04-386, dated May 9, 2005, and
- ◆ *SC 4 Over Edisto River Existing Alignment*, prepared by SCDOT, dated January 21, 2021.

From our review of the provided information, we understand that the existing concrete, steel and timber bridge is to be demolished and replaced. The bridge is currently closed to traffic. Details regarding the design of the replacement bridge are not available 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 testing, to provide geotechnical data to be utilized for project design.

## 3.0 Scope of Work

As requested per the *Work Order Request*, representatives of S&ME were present for on-site field activities between January 14 and January 21, 2021, to conduct the following:

- Four (4) asphalt roadway cores
- Four (4) Piezocone Penetration Test (CPT) Soundings – C-1 through C-4
- One (1) Shear Wave Velocity Test using MAM/MASW Surface Methods
- As-built survey of test locations.

Testing was conducted at or near the proposed locations provided in the *Work Order Request*. Testing locations were modified as necessary due to utilities, terrain, and to facilitate safe working conditions.

## 4.0 Test Locations

The current test locations were initially established in the field by representatives of S&ME using our hand-held sub-meter GPS unit as well as field measurements from existing site features.

In addition, S&ME attempted to field locate previous boring and sounding locations performed during the 2005 exploration that were performed in the east and west embankments and end bents, and interior bents (bridge deck) of the existing South Edisto River Bridge (B-1 through B-29). S&ME was successful in visually locating 2005



borings B-6, and B-8 through B-23 performed in the existing bridge deck. The remainder of the 2005 borings could not be located due to re-paving operations since the 2005 exploration. The 2005 borings were marked with paint for later as-built survey.

An as-built survey of the current and previous testing locations was performed by Glenn Associates Surveying, Inc. The approximate testing locations are shown on the *Testing Location Plan*, included as Figure 2 in Appendix I. A summary of testing locations, including coordinates, elevation, alignment, station and offset, 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 Plane northing and easting coordinates.

## 5.0 Exploration Procedures

The subsurface exploration for this project to date has included asphalt coring, CPT soundings, and shear wave velocity testing by surface wave method. 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 – CPT Sounding Records
- ◆ Appendix IV – Shear Wave Velocity Test by Surface Wave Method Results
- ◆ Appendix V – Electronic Data Files

### 5.1 Existing Roadway Coring

Asphalt cores were performed by Advance Concrete Cutting and Coring on January 15, 2021 at sounding locations within the existing roadway. The cores were performed using a 3-inch outer diameter, diamond-tipped, core barrel. The cores were performed to provide a clean cut through the existing roadway to allow access to the underlying materials for sounding activities at the test locations.

### 5.2 Cone Penetration Test (CPT) Soundings

Four (4) cone penetration test (CPT) soundings (C-1 through C-4) were performed for this project on January 15, 2021 using a truck-mounted CPT rig. CPT soundings consist of a conical pointed penetrometer which is hydraulically pushed into the soil at a slow, measured rate to measure point stress, pore water pressure, and sleeve friction. Procedures for measurement of the tip resistance and side friction resistance to push generally follow those described by ASTM D5778, *Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils*.

The CPT data is used to determine soil stratigraphy and to estimate soil parameters such as, friction angle, and undrained shear strength. Soil types presented on CPT sounding logs are derived from Robertson's (1990) Soil Behavior Type (SBT) Index, as direct observation of recovered material, such as with ASTM D2487 or D2488 is not available. The soil type determined from the SBT index is more representative of soil behavior characteristics than traditional soil classification that is based on grain size and plasticity. The CPT sounding logs are included in Appendix III. The soundings were performed to cone termination and refusal depths ranging from roughly 50 to 55 feet below the existing ground surface. A summary of the CPT soundings performed during this exploration is provided in the following table:



**Table 5-1 – CPT Sounding Summary**

Boring No.	Depth (ft)	Purpose
C-1	50.0	West Embankment - Westbound
C-2	54.3	End Bent 1 - Westbound
C-3	54.7	End Bent 11 - Westbound
C-4	50.2	East Embankment - Westbound

Water level measurements were attempted in each sounding immediately after completion. Delayed water level measurements were then repeated after a period of 24 hours. Water level 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)*. Time of sounding water level readings ranged from roughly 13 to 14 feet below the existing ground surface as shown on the sounding logs in Appendix III. Ground water was not observed in the soundings during the delayed measurements, and the soundings were observed to be caved to depths ranging from roughly 13.1 to 13.8 feet below the existing ground surface.

Ground water levels are influenced by precipitation, long term climatic variations, and nearby construction. Ground water levels at the site are also likely influenced by fluctuations in the level of the adjacent South Edisto River. Measurements of ground water made at different times than our exploration may indicate ground water levels substantially different than reported herein .

After ground water measurements were complete, the soundings were backfilled with bentonite chips. The surface pavements at each sounding location were patched with commercially available bagged asphalt cold patch materials.

### **5.3 Shear Wave Velocity Test by Surface Wave Method**

S&ME performed MASW and MAM measurements near sounding location C-1 on January 14, 2021. Performing both surveys generally provide greater penetration depth using low frequency surface waves (MAM) without sacrificing resolution at shallower depths by using higher frequency surface waves (MASW). The MASW survey consisted of recording varying frequency surface waves generated from an active energy source (sledgehammer striking a metal plate) traveling across a linear array using a Geometrics seismograph equipped with twenty-four (24) 4.5 Hz vertical geophones at set spacing of 5 feet. The MAM survey consisted of recording varying frequency surface waves generated from a passive energy source (e.g., background noise, vehicles, etc.) traveling across a linear array using a Geometrics seismograph equipped with eleven (11) 4.5 Hz vertical geophones at a set spacing of 30 feet. Data analysis was conducted using the Geogiga Technology Corp. Seismic Pro™ software (SURFACE PLUS module).

The results of the active and passive sources were combined to produce a single shear wave velocity profile at the test location. The location of the MASW/MAM array is shown in the *Testing Location Plan* attached as Figure 2 in Appendix I. A composite shear wave velocity versus depth profile for SW-1 is provided in Appendix IV.

## Geotechnical Subsurface Data Report (GSDR)

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SCDOT Project ID P040306

S&ME Project No. 207163



The geophysical methods used for this survey have inherent limitations and active site activity (e.g. vehicles, etc.) can cause noise/interference in the data sets. Depth restrictions are also associated with the MASW/MAM methods and the energy source. Depth of penetration using surface wave methods is mainly controlled by the shear properties of the subsurface materials and frequency range of site surface waves (generated active or ambient passive). Generally, penetration depth is greater for stiffer profiles as the signal does not attenuate as rapidly. However, because very small strain is required to determine the shear properties, sometimes velocities of very stiff materials are difficult to obtain using traditional active or ambient sources. Regardless of the thoroughness of a geophysical study, there is always a possibility that actual conditions may not match the interpretations. The results should be considered accurate only to the degree implied by the methods used and the method's limitations and data coverage.

## 6.0 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**

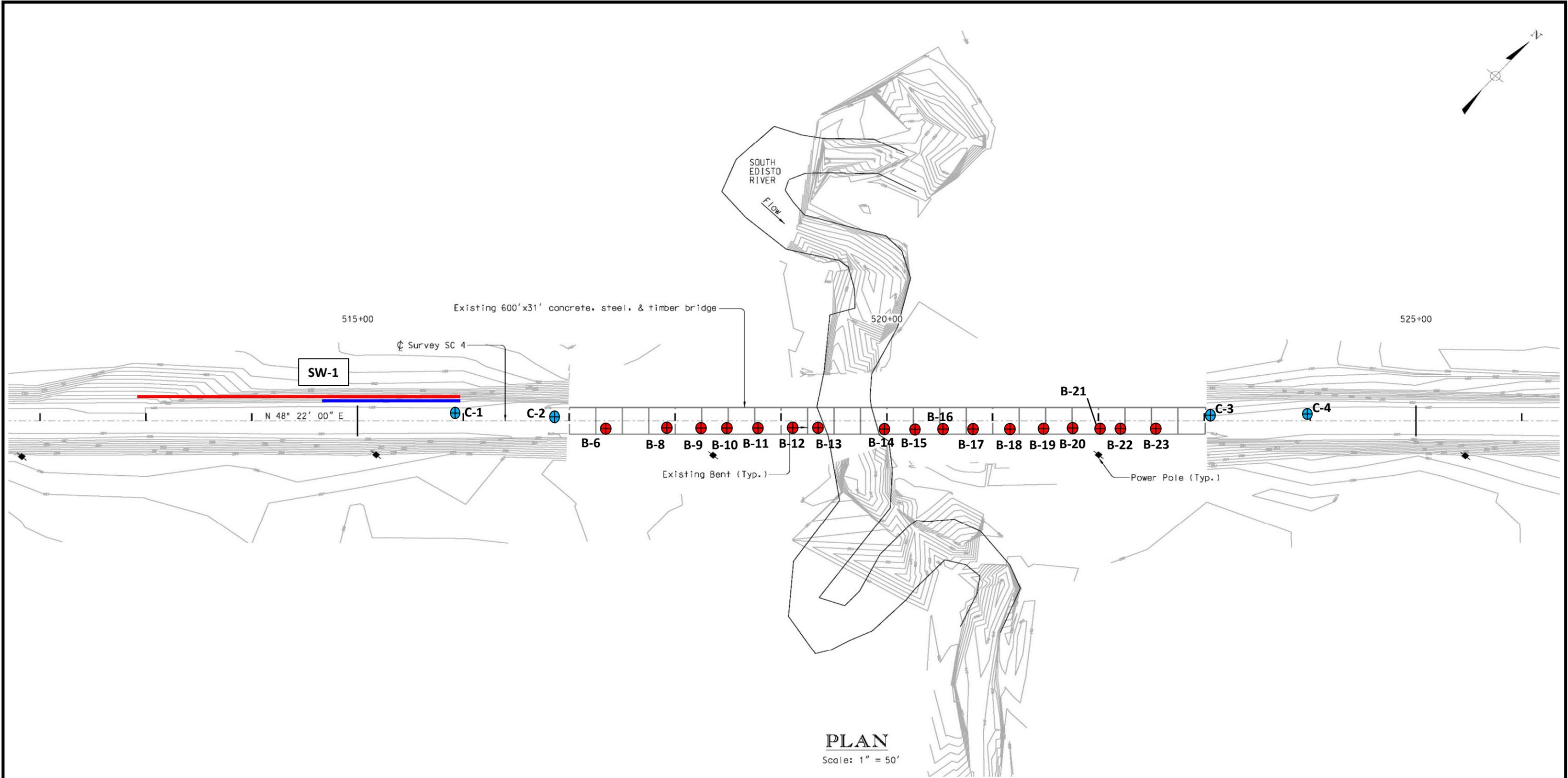
## **Appendix I – Figures**



SOURCE: Aiken County General Highway System Map, produced by SCDOT, dated 4/2016



<b>SITE LOCATION PLAN</b>		FIGURE NO.
<b>JOB NAME:</b>	SC 4 over South Edisto River	<b>1</b>
<b>LOCATION:</b>	SC 4/302 (Wagener Road)	
<b>CITY, STATE:</b>	Wagener, Aiken County, South Carolina	
<b>PROJECT NO:</b>	207163	
<b>SCALE:</b>	NTS	<b>CHECKED BY:</b> MFC
<b>DATE:</b>	1/22/2021	<b>DRAWN BY:</b> JPL



SOURCE: Existing Alignment Plan, provided by SCDOT, dated 1/22/2021



- ⊕ Approximate Cone Penetration Test Sounding Location
- MASW Geophysical Survey
- MAM Geophysical Survey
- Approximate 2005 Boring Location

TESTING LOCATION PLAN			
<b>JOB NAME:</b>	SC 4 over South Edisto River	FIGURE NO.	
<b>LOCATION:</b>	SC 4/302 (Wagener Road)	2	
<b>CITY, STATE:</b>	Wagener, Aiken County, South Carolina		
<b>PROJECT NO:</b>	207163		
SCALE:	NTS	CHECKED BY:	MFC
DATE:	1/25/2021	DRAWN BY:	JPL

## **Appendix II – Tables**



**Table 1: Test Location Summary**

Test ID	Test/SampleType(s)						SC State Plane Northing (ft.)	SC State Plane Easting (ft.)	Latitude (degrees)	Longitude (degrees)	Elevation (ft-msl)	Alignment	Station	Offset (ft)
	SPT	CPT	DMT	Seismic	Bulk	UD								
C-1		X					634448.2	1842393.7	33.57604	-81.51753	268.7	Existing	515+86.19	3.41 L
C-2		X					634513.3	1842467.8	33.57594	-81.51729	268.9	Existing	516+84.82	2.83 L
C-3		X					634925.0	1842933.1	33.57736	-81.51577	269.3	Existing	523+06.13	1.38 L
C-4		X					634989.6	1843007.2	33.57754	-81.51553	269.2	Existing	524+04.39	0.44 L
MASW/MAM - Start				X			634459.5	1842392.4	33.57607	-81.50087	268.6	Existing	515+92.74	12.70 L
MASW - End				X			634383.0	1842306.2	33.57586	-81.50115	268.5	Existing	514+77.44	12.82 L
MAM - End				X			634260.9	1842167.8	33.57552	-81.50161	268.3	Existing	512+92.82	13.46 L
<b>2005 Locations (S&amp;ME Report 1611-04-386)</b>														
B-6	X						634534.2	1842510.9	33.57628	-81.51715	268.98	Existing	517+30.89	10.14 R
B-8	X						634575.1	1842555.0	33.57639	-81.51701	269.17	Existing	517+91.02	8.97 R
B-9	X						634595.7	1842578.7	33.57645	-81.51693	269.10	Existing	518+22.45	9.25 R
B-10	X						634614.3	1842598.2	33.57650	-81.51686	269.14	Existing	518+49.38	8.3 R
B-11	X						634633.98	1842621.26	33.57655	-81.51679	268.93	Existing	518+79.66	8.95 R
B-12	X						634653.41	1842644.74	33.57661	-81.51671	269.00	Existing	519+10.12	10.03 R
B-13	X						634672.86	1842665.04	33.57666	-81.51665	269.01	Existing	519+38.22	8.98 R
B-14	X						634713.21	1842710.06	33.57677	-81.51650	268.89	Existing	519+98.68	8.73 R
B-15	X						634732.90	1842732.79	33.57683	-81.51642	269.00	Existing	520+28.74	9.12 R
B-16	X						634752.69	1842754.93	33.57688	-81.51635	269.15	Existing	520+58.45	9.03 R
B-17	X						634772.72	1842777.50	33.57694	-81.51628	269.50	Existing	520+88.62	9.06 R
B-18	X						634791.89	1842799.15	33.57699	-81.51621	269.38	Existing	521+17.53	9.11 R
B-19	X						634813.35	1842822.97	33.57705	-81.51613	268.99	Existing	521+49.60	8.9 R
B-20	X						634832.25	1842844.14	33.57710	-81.51606	269.53	Existing	521+77.97	8.84 R
B-21	X	X					634852.50	1842866.75	33.57716	-81.51599	268.88	Existing	522+08.32	8.72 R
B-22	X						634872.02	1842888.64	33.57721	-81.51592	268.92	Existing	522+37.66	8.67 R
B-23	X						634891.75	1842911.48	33.57727	-81.51584	269.45	Existing	522+67.83	9.1 R

Notes: As-built coordinates, elevation, alignment, station, and offset, provided by Glenn Associates Surveying, Inc.

## **Appendix III – CPT Sounding Records**

## CPT Soil Classification Legend

Zone	Color	Q <sub>t</sub> /N	Description
1	<span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span>	2	Sensitive, Fine Grained
2	<span style="display: inline-block; width: 15px; height: 15px; background-color: orange; border: 1px solid black;"></span>	1	Organic Soils-Peats
3	<span style="display: inline-block; width: 15px; height: 15px; background-color: blue; border: 1px solid black;"></span>	1.5	Clays-Clay to Silty Clay
4	<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span>	2	Silt Mixtures-Clayey Silt to Silty Clay
5	<span style="display: inline-block; width: 15px; height: 15px; background-color: lightgreen; border: 1px solid black;"></span>	3	Sand Mixtures-Silty Sand to Sandy Silt
6	<span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span>	4.5	Sands-Clean Sand to Silty Sand
7	<span style="display: inline-block; width: 15px; height: 15px; background-color: olive; border: 1px solid black;"></span>	6	Gravelly Sand to Sand
8	<span style="display: inline-block; width: 15px; height: 15px; background-color: lightgrey; border: 1px solid black;"></span>	1	Very Stiff Clay to Clayey Sand*
9	<span style="display: inline-block; width: 15px; height: 15px; background-color: grey; border: 1px solid black;"></span>	2	Very Stiff, Fine Grained*

(\*) Heavily Overconsolidated or Cemented

Robertson's Soil Behavior Type (SBT), 1990			
Group #	Description	I <sub>c</sub>	
		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

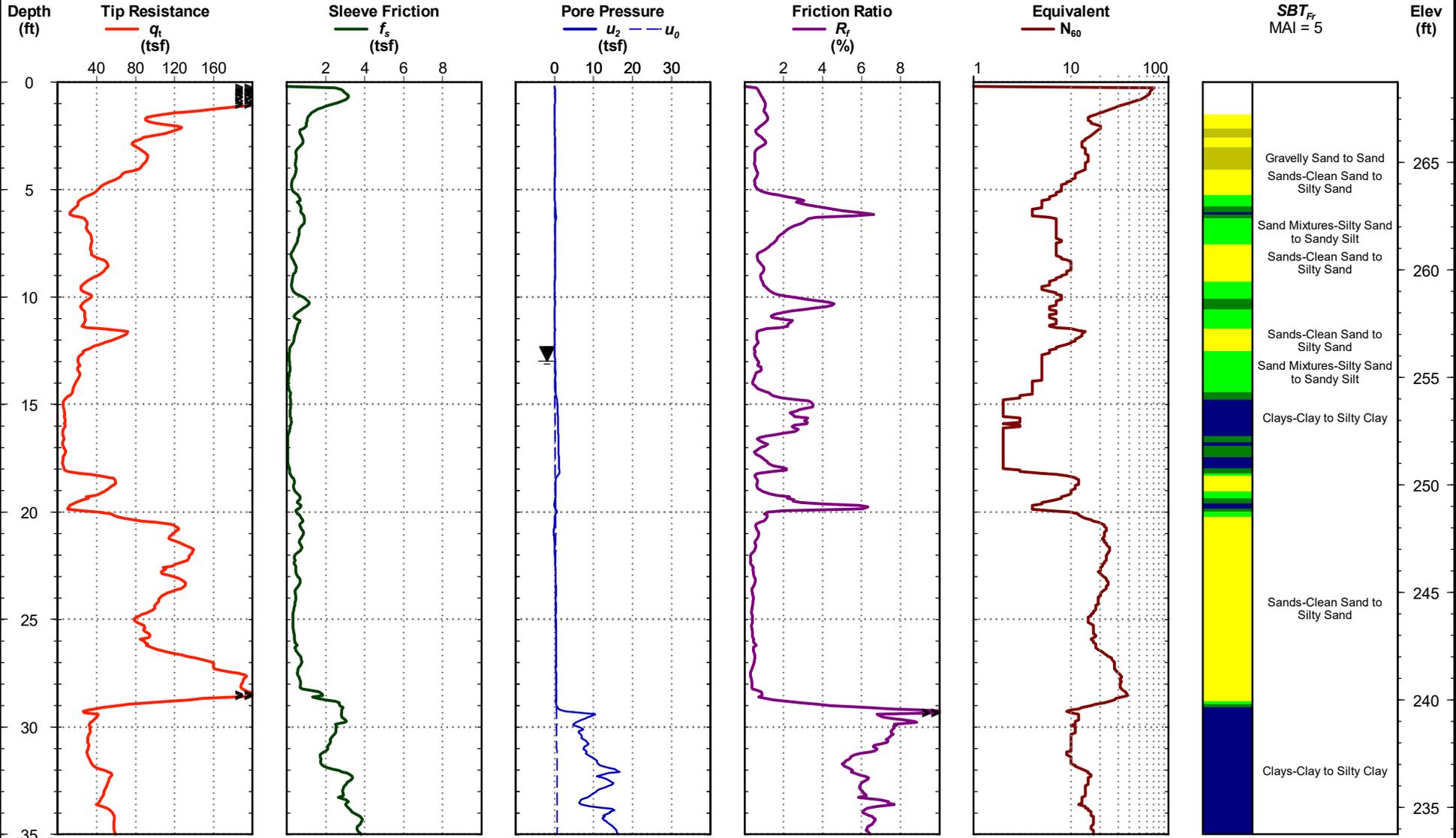


**SC 4 over South Edisto River (P040306)**  
**Wagener, SC**  
**S&ME Project No: 207163**

Station: 515+86.19  
 Offset: -3.41  
 Elevation: 268.74 ft  
 Date: Jan. 15, 2021  
 Estimated Water Depth: 13 ft  
 Rig/Operator: Truck Rig

**Sounding ID: C-1**

Total Depth: 50.0 ft  
 Termination Criteria: Target Depth  
 Cone Size: 1.75



**Cone Penetration Test**

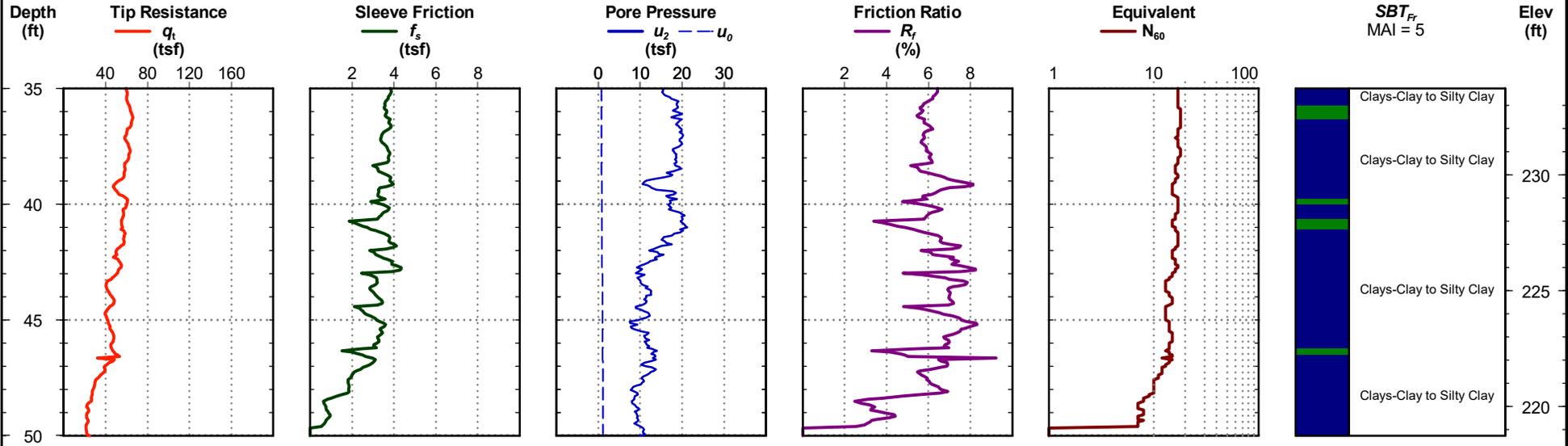


SC 4 over South Edisto River (P040306)  
Wagener, SC  
S&ME Project No: 207163

Station: 515+86.19  
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Termination Criteria: Target Depth  
Cone Size: 1.75



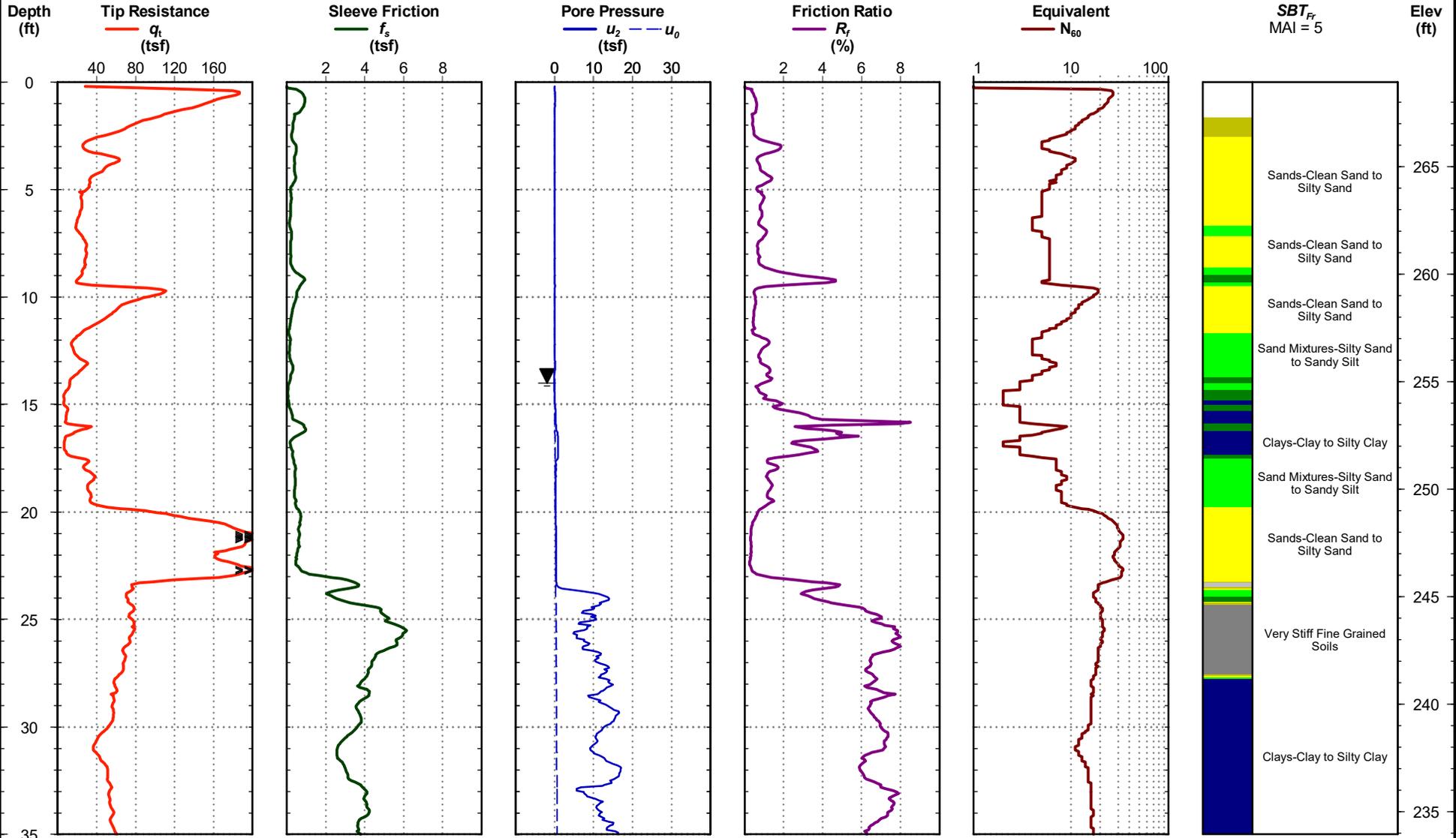


**SC 4 over South Edisto River (P040306)**  
**Wagener, SC**  
**S&ME Project No: 207163**

Station: 516+84.82  
 Offset: -2.83  
 Elevation: 268.95 ft  
 Date: Jan. 15, 2021  
 Estimated Water Depth: 14 ft  
 Rig/Operator: Truck Rig

**Sounding ID: C-2**

Total Depth: 54.3 ft  
 Termination Criteria: Maximum Reaction Force  
 Cone Size: 1.75



**Cone Penetration Test**

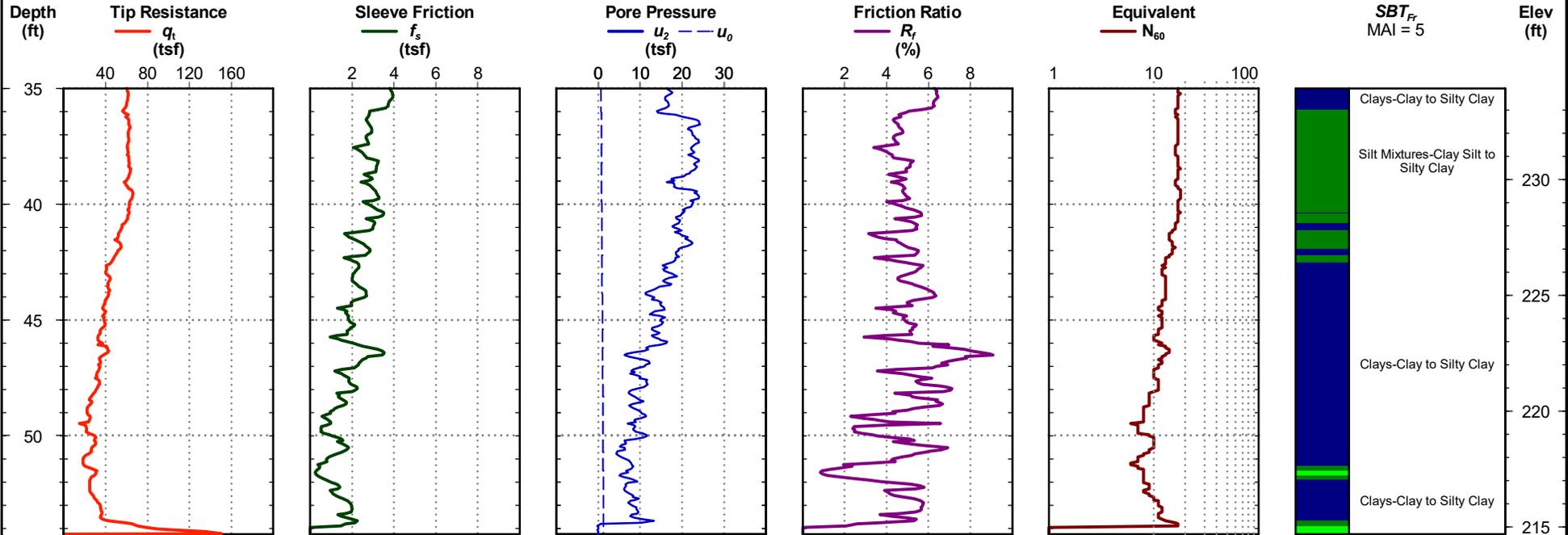


SC 4 over South Edisto River (P040306)  
Wagener, SC  
S&ME Project No: 207163

Station: 516+84.82  
Offset: -2.83  
Elevation: 268.95 ft  
Date: Jan. 15, 2021  
Estimated Water Depth: 14 ft  
Rig/Operator: Truck Rig

Sounding ID: C-2

Total Depth: 54.3 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size: 1.75



CPT REPORT - STANDARD - SBT FR 1 207163 CPT LOGS.GPJ \ S&ME.GDT 1/22/21

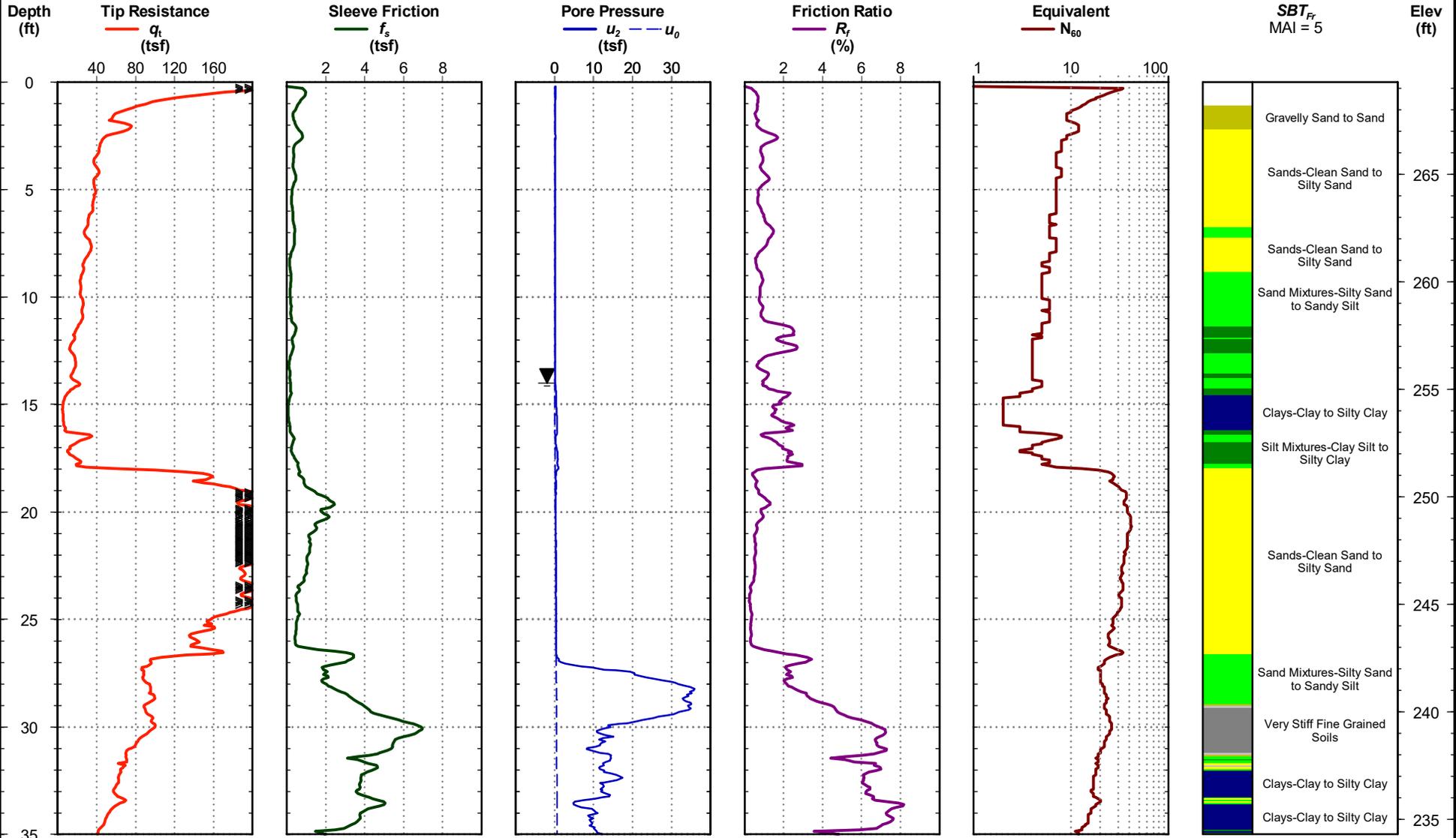


SC 4 over South Edisto River (P040306)  
Wagener, SC  
S&ME Project No: 207163

Station: 523+06.13  
Offset: -1.38  
Elevation: 269.3 ft  
Date: Jan. 15, 2021  
Estimated Water Depth: 14 ft  
Rig/Operator: Truck Rig

Sounding ID: C-3

Total Depth: 54.7 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size: 1.75



Cone Penetration Test

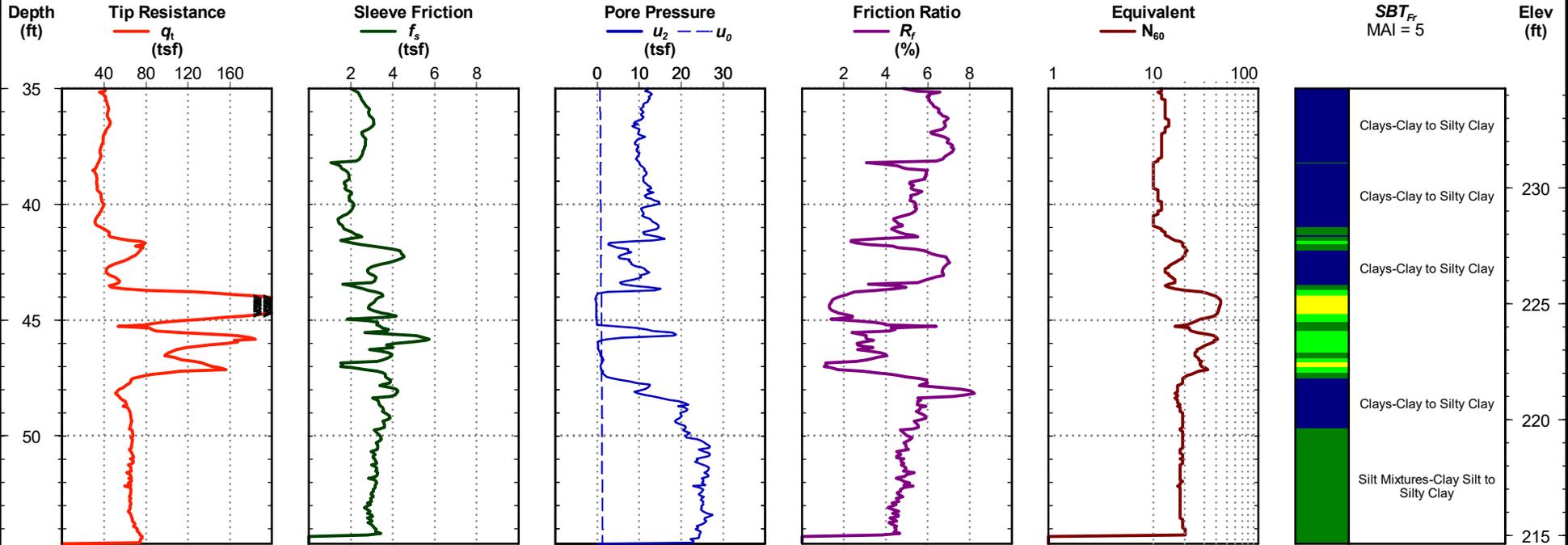


SC 4 over South Edisto River (P040306)  
Wagener, SC  
S&ME Project No: 207163

Station: 523+06.13  
Offset: -1.38  
Elevation: 269.3 ft  
Date: Jan. 15, 2021  
Estimated Water Depth: 14 ft  
Rig/Operator: Truck Rig

Sounding ID: C-3

Total Depth: 54.7 ft  
Termination Criteria: Maximum Reaction Force  
Cone Size: 1.75



CPT REPORT - STANDARD - SBT FR \ 207163\_CPT\_LOGS.GPJ \ S&ME\_GDT \ 1/22/21

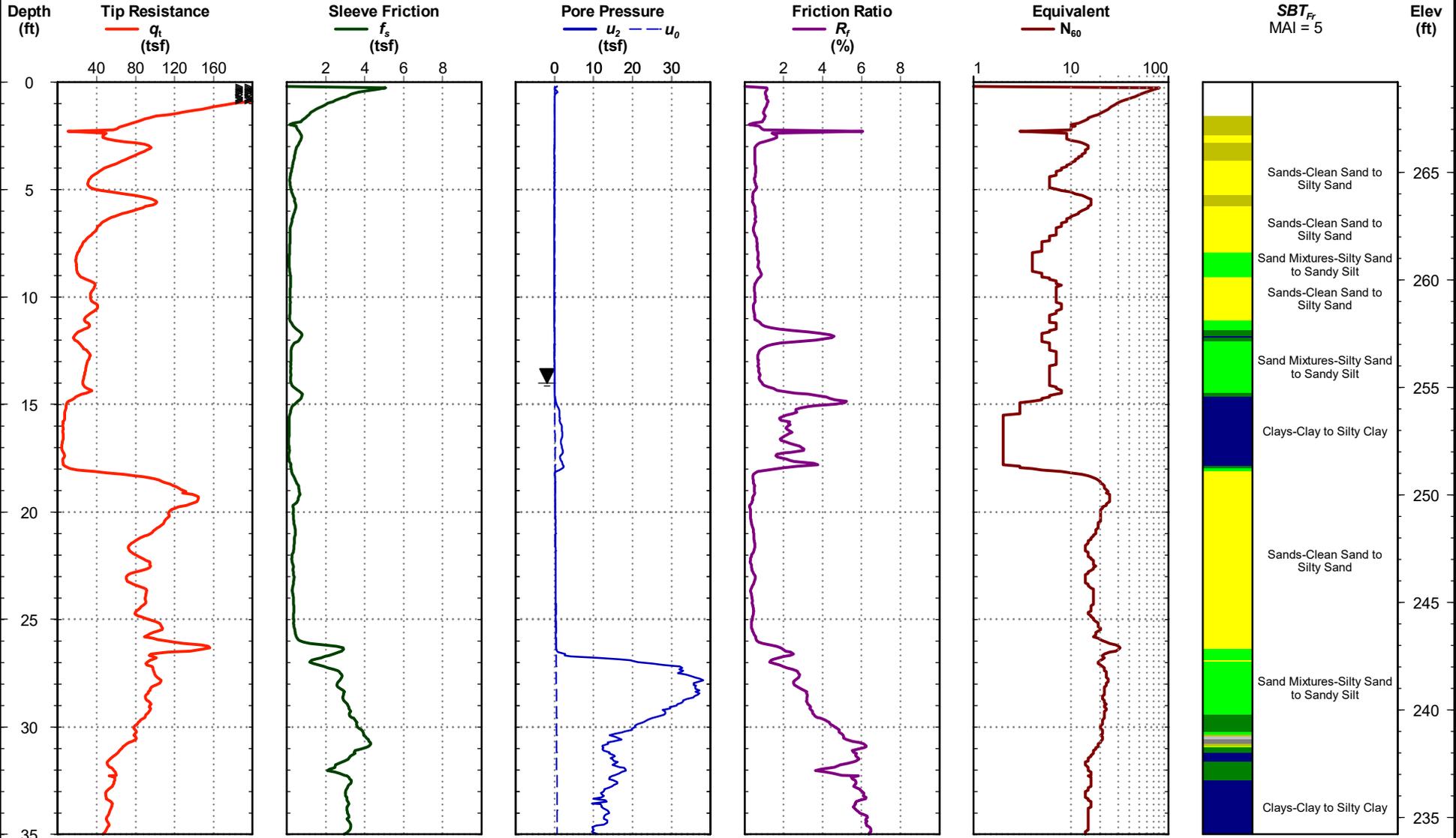


**SC 4 over South Edisto River (P040306)**  
**Wagener, SC**  
**S&ME Project No: 207163**

Station: 524+04.39  
 Offset: -44  
 Elevation: 269.22 ft  
 Date: Jan. 15, 2021  
 Estimated Water Depth: 14 ft  
 Rig/Operator: Truck Rig

**Sounding ID: C-4**

Total Depth: 50.2 ft  
 Termination Criteria: Target Depth  
 Cone Size: 1.75



**Cone Penetration Test**

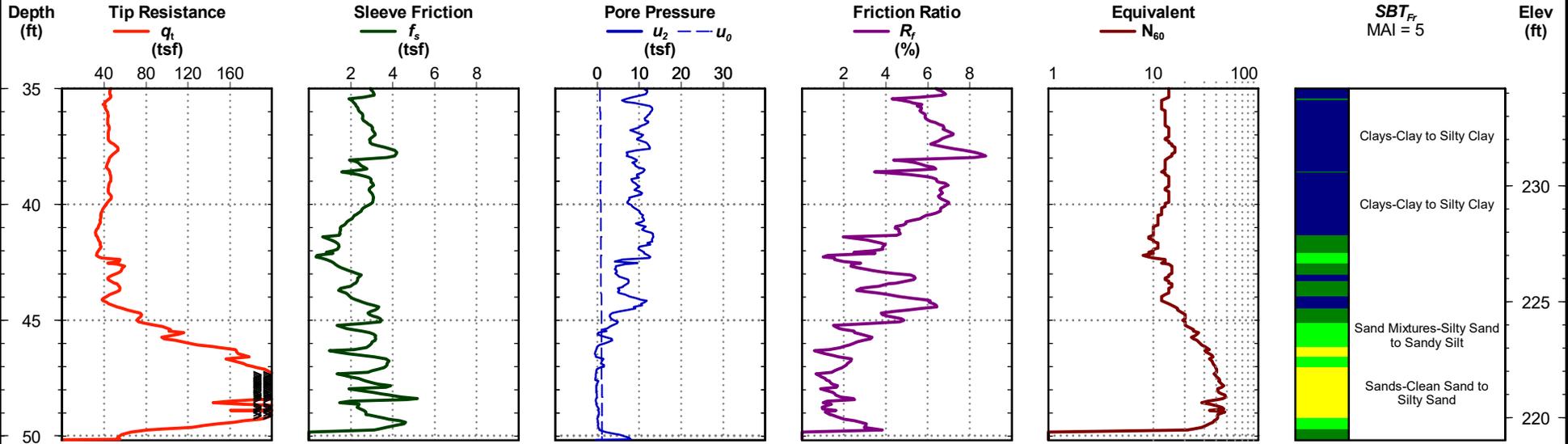


**SC 4 over South Edisto River (P040306)**  
**Wagener, SC**  
**S&ME Project No: 207163**

Station: 524+04.39  
 Offset: -44  
 Elevation: 269.22 ft  
 Date: Jan. 15, 2021  
 Estimated Water Depth: 14 ft  
 Rig/Operator: Truck Rig

**Sounding ID: C-4**

Total Depth: 50.2 ft  
 Termination Criteria: Target Depth  
 Cone Size: 1.75

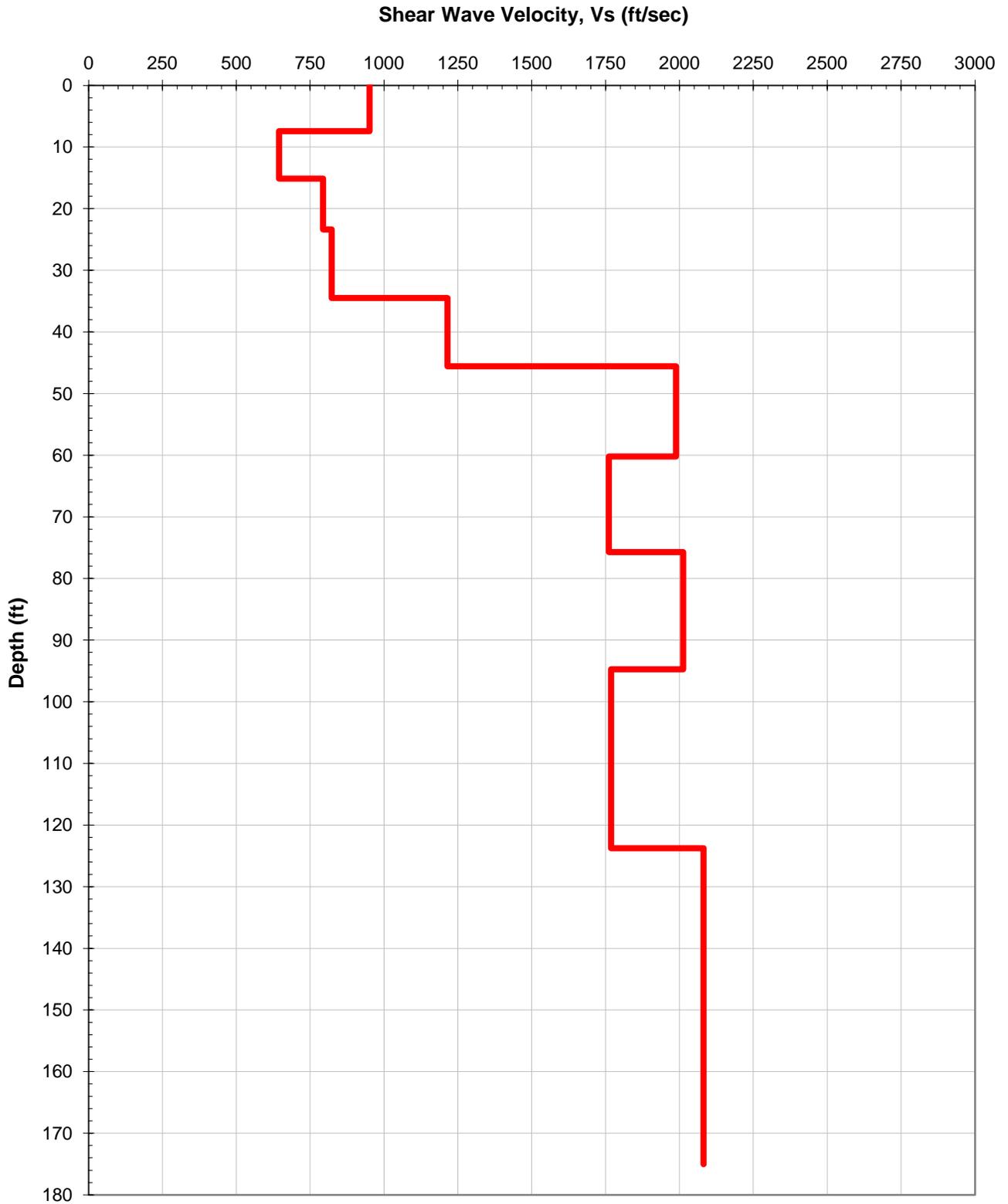


**Cone Penetration Test**

## **Appendix IV – Surface Shear Wave Velocity Test Results**



Shear Wave Velocity Profile SW-1  
SC-4 BRO South Edisto River  
Aiken, South Carolina  
S&ME Project: 207163



## **Appendix V – Electronic Data Files**

gINT® Project File

Excel® Surface Shear Wave Velocity Test Results File