

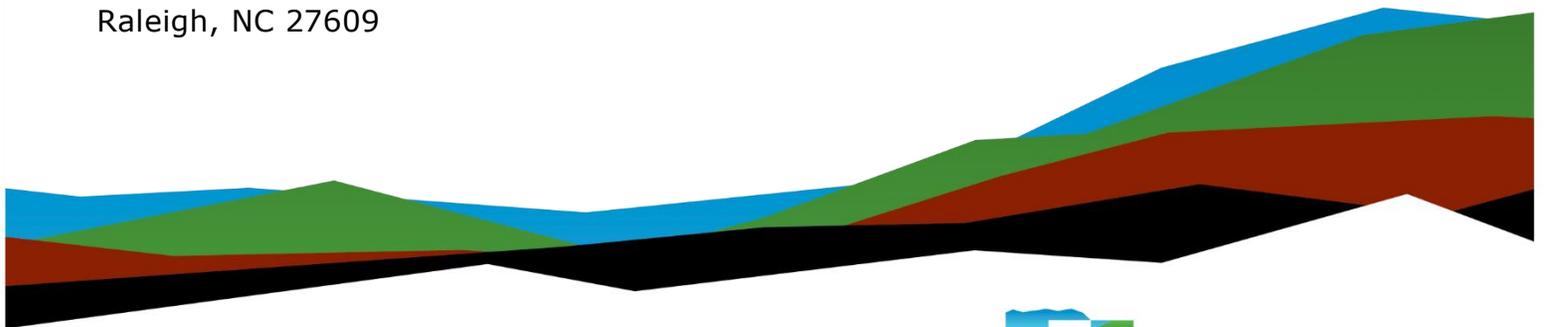
# S-23-40 (Pace Bridge Road) Bridge Replacement over South Saluda River Greenville County, SC

## Geotechnical Baseline Report

October 30, 2024 | SCDOT Project ID: P041160  
Terracon Project No.: 8623P180 Revision 1

### Prepared for:

HNTB Corporation  
343 E. Six Forks Road, Suite 200  
Raleigh, NC 27609



Nationwide  
[Terracon.com](https://www.terracon.com)

- Facilities
- Environmental
- Geotechnical
- Materials



72 Pointe Circle  
Greenville, SC 29615  
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October 30, 2024

HNTB Corporation  
343 E. Forks Road, Suite 200  
Raleigh, NC 27609

Attn: Mr. Spencer Franklin, PE, Senior Vice President  
P: 919-546-8997

Re: Geotechnical Baseline Report  
S-23-40 Bridge Replacement over South Saluda River  
Greenville County, South Carolina  
SCDOT Project ID.: P041160  
Terracon Project No.: 8623P180 Revision 1

Dear Mr. Franklin:

Terracon Consultants Inc. (Terracon) has completed the exploration, testing and limited engineering analysis services for the above-referenced project. The services were conducted in general accordance with our Task Order Number 001, dated May 25, 2023.

## **Introduction**

HNTB Corporation (HNTB) has contracted Terracon to perform subsurface exploration, laboratory testing and limited preliminary engineering recommendations for the replacement of the S-23-40 bridge over South Saluda River in Greenville County, South Carolina. This will be a complete bridge replacement within the project existing alignment. The results of subsurface exploration and laboratory testing have been separately presented in a Geotechnical Subsurface Data Report (GSDR). For convenience, those data are also provided here in this Geotechnical Baseline Report (GBR) along with a characterization of the subsurface conditions for the project. Limited preliminary geotechnical design and construction considerations associated with the requested scope of work are included in this GBR. This GBR was prepared in general accordance with the 2022 SCDOT Geotechnical Design Manual (GDM).

## **Project Description**

The project site is located at the S-23-40 (Pace Bridge Road) crossing over South Saluda River in Greenville County, South Carolina. Site location and exploration plans are presented

in Appendix A of this report. Based on the conceptual plans by HNTB dated 8/30/2024, the replacement bridge will be constructed on the same alignment as the current bridge. The current plan indicates the new bridge will be a 150-ft long two-span bridge constructed with AASHTO Type BIII-36 Box Beams for the 100-ft long span A and a prestressed concrete cored slab for the 50-ft long span B.

## Geotechnical Testing

The geotechnical exploration for this project was performed between August 20 and August 21, 2024. The results of our fieldwork and our associated laboratory testing are included in Appendices A and B.

### Field Exploration

Our field exploration consisted of the following:

- Three (3) Standard Penetration Test (SPT) Borings (S-23-40-1, S-23-40-2, and S-23-40-3)
- Two (2) offset borings near S-23-40-1 and S-23-40-3 for bulk sample collection

The tests were performed at the approximate locations as approved by SCDOT. A description of our testing methods and graphical logs outlining the soil conditions at each test location are presented in Appendix A. The test locations were established in the field by Terracon and surveyed by Thomas & Hutton, LLC after completion. Station and offset are based on the plans provided at the time the borings were performed.

### Laboratory Testing

The following laboratory tests were performed on the soil samples collected at the site.

- Twenty-four (24) Natural Moisture Content Tests
- Six (6) Atterberg Limits Tests
- Eight (8) Fines Content Tests
- Four (4) Grain Size Tests with Hydrometer
- One (1) Remolded, Consolidated-Undrained (CU) Triaxial Compression Test with Pore Pressure Readings
- One (1) Standard Proctor Test
- One (1) Corrosivity Suite (pH, chloride content, sulfate content, and resistivity tests)

The general scope of the laboratory testing frequency was determined by the SCDOT. The laboratory testing assignment was performed by our engineers. The laboratory procedures and results of the laboratory tests are presented in Appendix B.

## Subsurface Conditions

### Regional Geology

The bridge site is located on route S-23-40 on the outskirts of the town of Marietta in Greenville County, South Carolina. The site lies generally within the Piedmont Physiographic Complex. More specifically, the site is located within the Sixmile Thrust Sheet. According to regional geologic mapping and published geologic reports, the project area is mapped in an area with migmatitic granitoid gneiss. Migmatitic granitoid gneiss is mainly composed of quartz, feldspar, and mica. The bridge end bents and interior bent embankments contain existing fill above alluvial and/or residual soils, and very dense residual soils classified as Intermediate Geomaterials (IGM).

### Soil and Rock Stratification

Borings S-23-40-1 and S-23-40-3 encountered 6 to 10 inches of asphalt followed by 2 to 2.5 inches of gravel, followed by embankment fill soil consisting of loose to medium dense silty or clayey sand extending to about 6 to 8 feet below current site grade. Below the fill, a layer of alluvial soil consisting of very loose to medium dense silty sand or poorly graded sand or very soft sandy silt was encountered extending to depths of about 22 to 37 feet below the current ground surface. Underlying the alluvial soil, residual soils consisting of medium dense to dense silty sand were encountered to a depth of between 32 and 47 feet overlying very dense residual silty sand/IGM materials with blow counts exceeding 100 blows per foot (bpf) to the planned termination depth of 100 feet.

Boring S-23-40-2 was conducted through the existing bridge deck and encountered 5 inches of asphalt and 5 inches of concrete followed by an approximately 15-foot air gap to the bottom of the river where drilling started through casing 16 feet below the existing bridge deck. A layer of alluvial soil consisting of very loose to medium dense poorly graded sand and well graded sand was encountered extending to about 28 feet below the existing bridge deck. Below the alluvial soil, residual soils consisting of dense silty sand was encountered to a depth of about 42 feet below the bridge deck overlying very dense residual silty sand/IGM materials with blow counts exceeding 100 blows per foot (bpf) to the planned termination depth of 100 feet.

Materials identified as bedrock were not encountered to the depth explored in the borings.

Groundwater was encountered at a depth of 11.5 feet in boring S-23-40-1 after 24 hours, 14 feet (river level) in boring S-23-40-2, and 8.5 feet in boring S-23-40-3 at the termination of boring.

| Geology            | Approximate Elevation of Layer Bottom (ft, NAVD88) | USCS Soil Type          | Measured Field N Value | Plasticity Index      | Fines Content |
|--------------------|--|-------------------------|------------------------|-----------------------|---------------|
| Asphalt / Gravel   | 916  | --                      | --                     | --                    | --            |
| Asphalt / Concrete | 917  | --                      | --                     | --                    | --            |
| Fill <sup>3</sup>  | 909 to 911   | SM, SC                  | 4 to 11                | NP <sup>2</sup> to 15 | 27 to 43      |
| Alluvium           | 880 to 895   | SM, SP-SM, SP, SW-SM ML | 0 to 24                | 10 to 11              | 2 to 61       |
| Residuum           | PMDE <sup>1</sup>                                  | SM                      | 16 to 100+             | --                    | 14 to 32      |

1. PMDE = Present to Maximum Depth Explored

2. NP = non-plastic

3. Embankment fill present at Borings S-23-40-1 and S-23-40-3 only.

## Design and Construction Considerations

### Foundations

Steel H-piles driven to practical refusal within IGM materials (i.e., >20 blows per inch [bpi] with appropriately sized hammer) are expected to be feasible for the proposed bridge end abutments. Per 16.3.1 of the SCDOT GDM (2022):

*For driven piles bearing in rock with an RQD greater than 10 percent, the nominal resistance of the pile is typically limited by the structural capacity of the foundation element itself. This is especially true with prestressed concrete piles driven into rock, and why prestressed concrete piles typically have pile points when driven to bearing in rock. In many cases steel piles are fitted with “reinforced tips” to avoid damage to the foundation element. If the depth to rock with RQD greater than 10 percent is less than 10 feet, then the pile should be installed as a drilled pile. Therefore, piles should be driven to rock when the depth to top of rock is greater than 10 feet. For rock with RQD less than 10 percent and soils with 100 or more blows per foot of penetration, it has been the experience of SCDOT that piles can be driven into these materials. Penetrations typically range from 5 to 10 feet.*

Per the preliminary plans, the estimated bottom of pile cap is at about Elevation 915 feet, within about 2 feet of the existing grades along the alignment. The depth to very dense Residual soils/IGM is predicted to be between about 30 to 35 feet below the estimated bottom of abutment pile cap. Reinforced pile tips will be needed to minimize potential pile damage while penetrating through IGM. Per the excerpt above it is anticipated that the piles may be driven through the IGM perhaps maximum 10 feet before refusal. Pile drivability using the wave equation should be performed as part of subsequent detailed geotechnical evaluations.

Piles driven to practical refusal within the IGM can be designed to the factored structural capacity of the pile. The table below provides the maximum factored pile structural capacity assuming an AASHTO permitted factored pile capacity of  $0.5A_sF_y$ , using 50 ksi steel piles. An efficiency factor ( $\eta$ ) of 1.0 can be used if the pile spacing divided by the pile dimension is greater than 2.5 (Per Section 16.3.3 of the GDM).

| Pile Size                               | Area of Steel ( $A_s$ ) in <sup>2</sup> | Maximum Factored Pile Load (tons) <sup>1</sup> |
|---|---|--|
| HP14x73 (21.4 in <sup>2</sup> )         | 21.4                                    | 267  |
| HP14x89 (26.1 in <sup>2</sup> )         | 26.1                                    | 326  |
| 1. Max Load = $0.5 \cdot A_s \cdot F_y$ |   |  |

The nominal geotechnical resistance of the piles considering refusal in IGM is expected to be slightly higher than the maximum factored pile load above; however, as indicated above for piles driven to practical refusal in IGM, the pile design will be governed by the maximum factored structural capacity of the pile rather than geotechnical capacity.

According to the conceptual bridge plans by HNTB dated 8/30/2024, about 3 to 4 feet of fill is expected at the end bent embankments to support the approach slab, with excavation of the existing soil profile below the new bridge to establish a bench shelf and a relatively short 10-ft tall maximum rip rap lined end slope. Foundations should typically be installed after the approach embankment construction to reduce potential downdrag settlement issues. However, it is noted that piles driven to practical refusal in IGM are not considered sensitive to down drag settlement. The pile design should account for drag loads from the settling alluvium at the site; however, this additional drag load is not expected to control the pile design.

Drilled shafts are anticipated to be feasible for the proposed bridge interior Bent 2. Assuming redundant drilled shafts, Table 9-4 GDM 2022 allows using a resistance factor of 0.60 (both side resistance and end bearing) for a single redundant drilled shaft in rock. The shafts at Interior Bent No. 2 will probably be drilled through and bear within the very dense IGM. Per the GDM, shafts constructed through IGM and bearing in IGM should be designed using the Beta Method for side resistance in the IGM. The nominal end bearing resistance of the IGM ( $N_{60} > 100$  bpf) should be limited to not more than 30 tons per square foot (tsf) consistent with AASHTO/FHWA recommendations. Additional evaluation of the soil conditions should be performed at the planned Bent 2 location during subsequent evaluations.

We have observed variability in the depth and thickness of IGM, as seen in **Soil and Rock Stratification**. Therefore, we expect variability in tip elevations at each bent location. Resistance of piles driven to practical refusal in IGM or rock will be limited by their structural resistance. Therefore, likely reinforced pile tips will be required to penetrate to IGM and rock. Pile drivability using the wave equation should be performed along with estimating stresses

during driving and, in general, verifying the ability of the Contractor’s selected hammer to drive the piles to the desired penetration while preventing overstressing.

## Corrosion and Deterioration

Corrosion testing was performed on a composite sample obtained from split spoons in the upper 2 to 20 feet. Corrosion testing included pH, resistivity, chlorides, and sulfates content as summarized in Table below. Corrosion test results are included in Appendix B.

| Corrosion Test | Results<br>Bent 1, Boring S-23-40-1<br>Composite Sample from 2 to 20 feet | Indication of Corrosivity <sup>1</sup> |
|----------------|---|--|
| pH             | 5.9   | Less than 5.5                          |
| Resistivity    | 7,370 ohm-cm  | Less than 2,000 ohm-cm                 |
| Chloride       | 133 ppm   | Greater than 500 ppm                   |
| Sulfate        | 47 ppm  | Greater than 1,000 ppm                 |

1. AASHTO LRFD bridge design specifications, Ninth Edition 2020, Section 10.7.5.

Based on the criteria for electro-chemical properties in the GDM Section 7.18, the electro-chemical classification of the project site is non-aggressive. Interpretation of these data should be communicated with the project’s structural engineer.

## Embankment Construction

Based on the conceptual plans by HNTB, 3 to 4 feet of will be placed to support the bridge approach slabs with some cut excavation below the bridge to establish a bench and relatively short (less than 10 feet tall) 2H:1V rip rap lined fill slopes shown at the end abutment positions. Bulk samples were obtained from near Bent 1 and Bent 3 from the top 5 feet of existing embankment material. Per our scope, a bulk sample was tested for soil classification and was also remolded to about 95% of the Standard-effort Proctor prior to being tested for shear strength envelopes under CU Triaxial Compression with pore pressure readings. Test results are presented in Appendix B and summarized in the table below.

| Sample No.                     | Station         | Offset (ft) | Sample Depth (ft) | USCS Soil Type | Compaction           |                       | Shear Strength <sup>1</sup> |                      |
|--------------------------------|-----------------|-------------|-------------------|----------------|----------------------|-----------------------|-----------------------------|----------------------|
|                                |                 |             |                   |                | Optimum Moisture (%) | Max Dry Density (pcf) | Total                       | Effective            |
| S-23-40-1/3 Offset (Composite) | 30+90 and 32+56 | 4 L and 5 L | 0 – 5             | SM             | 15.4                 | 111.0                 | c=3.4 psi<br>φ=17°          | c'=1.2 psi<br>φ'=33° |

1. Based on a maximum deviator stress failure criterion

**Geotechnical Baseline Report**

S-23-40 BRO South Saluda River | Greenville County, SC

October 30, 2024 | Terracon Project No. 8623P180 R1 | SCDOT Project ID: P041160



## Closure

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or we may be of further service, please contact us.

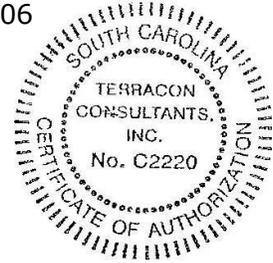
Sincerely,

**Terracon Consultants, Inc.**

A handwritten signature in black ink that reads "Maggie McKenney".

Maggie McKenney, EIT  
Senior Staff Engineer

Jonathan Ard, PE  
Manager Regional Services  
SC Registration No. 38806



## **Appendix A**

### **Field Exploration**

- Exhibit A-1 – Site Location Map
- Exhibit A-2 – Exploration Plans (2 Pages)
- Exhibit A-3 – Subsurface Profile
- Exhibit A-4 – Summary of Boring Data
- Exhibit A-5 – GeoScoping Form (2 Pages)
- Exhibit A-6 – Field Exploration Description (2 Pages)
- Exhibit A-7 – Soil Description Terms
- Exhibit A-8 – Soil/Rock Symbols
- Exhibit A-9 – Boring Logs (6 Pages)

Note: All exhibits are one page unless noted above

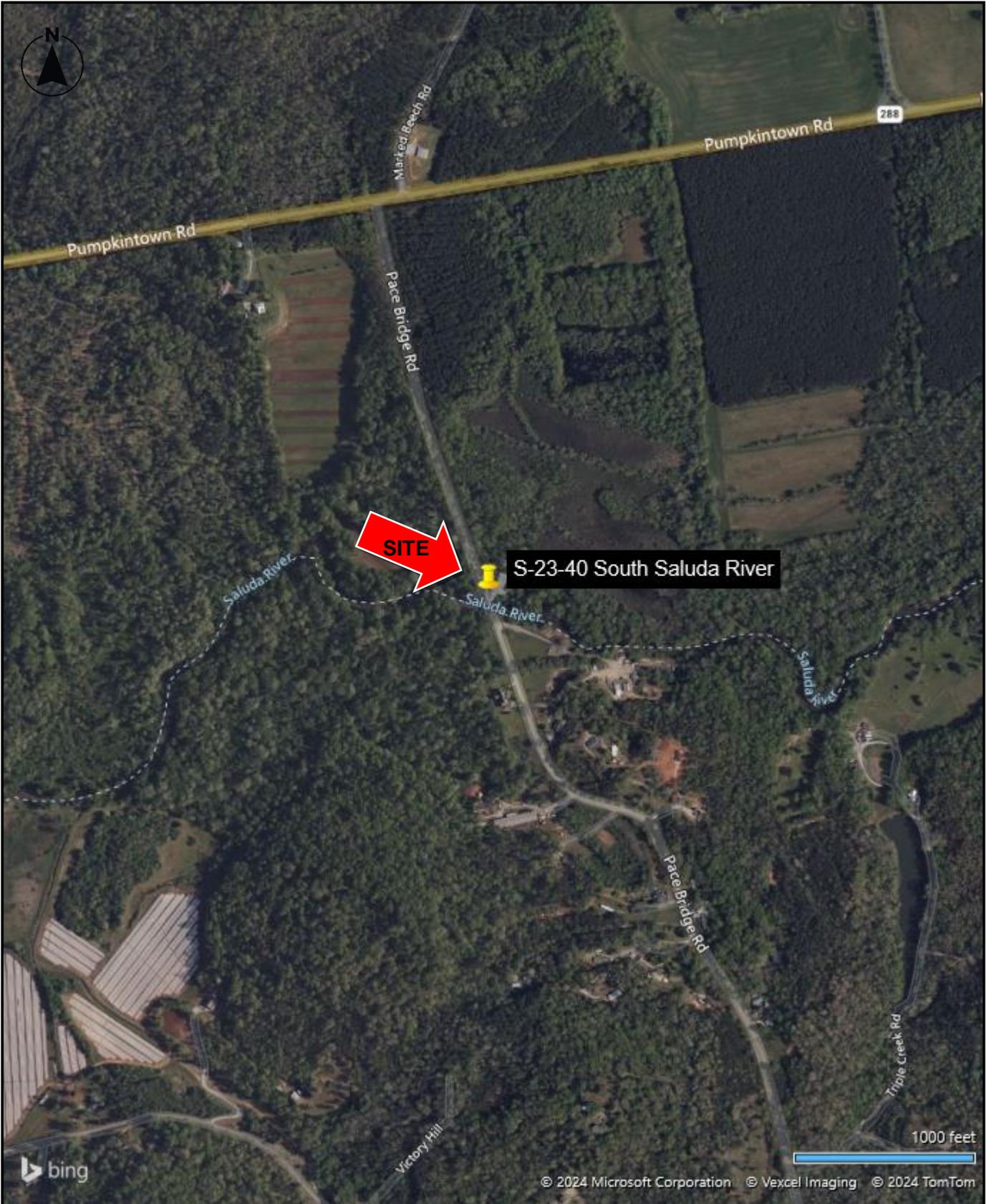


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

|                |           |
|----------------|-----------|
| Project Number | 8623P180  |
| Scale          | AS SHOWN  |
| Client         | HNTB      |
| Date           | 9/20/2024 |

**Terracon**  
 72 Pointe Cir  
 Greenville, South Carolina 29615

| SITE LOCATION   |  |
|---|--|
| S-23-40 BRO South Saluda River<br>Pace Bridge Road<br>Greenville County, SC |  |

|         |
|---------|
| Exhibit |
| A-1     |



SPT Boring Location

S-23-40-3

Pace Bridge Rd

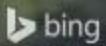
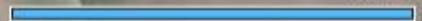
S-23-40-2

Pace Bridge Rd

Saluda River

S-23-40-1

50 feet



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DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

|                |           |
|----------------|-----------|
| Project Number | 8623P180  |
| Scale          | AS SHOWN  |
| Client         | HNTB      |
| Date           | 9/20/2024 |



72 Pointe Cir  
Greenville, South Carolina 29615

### EXPLORATION PLAN

S-23-40 BRO South Saluda River  
Pace Bridge Road  
Greenville County, SC

Exhibit

A-2

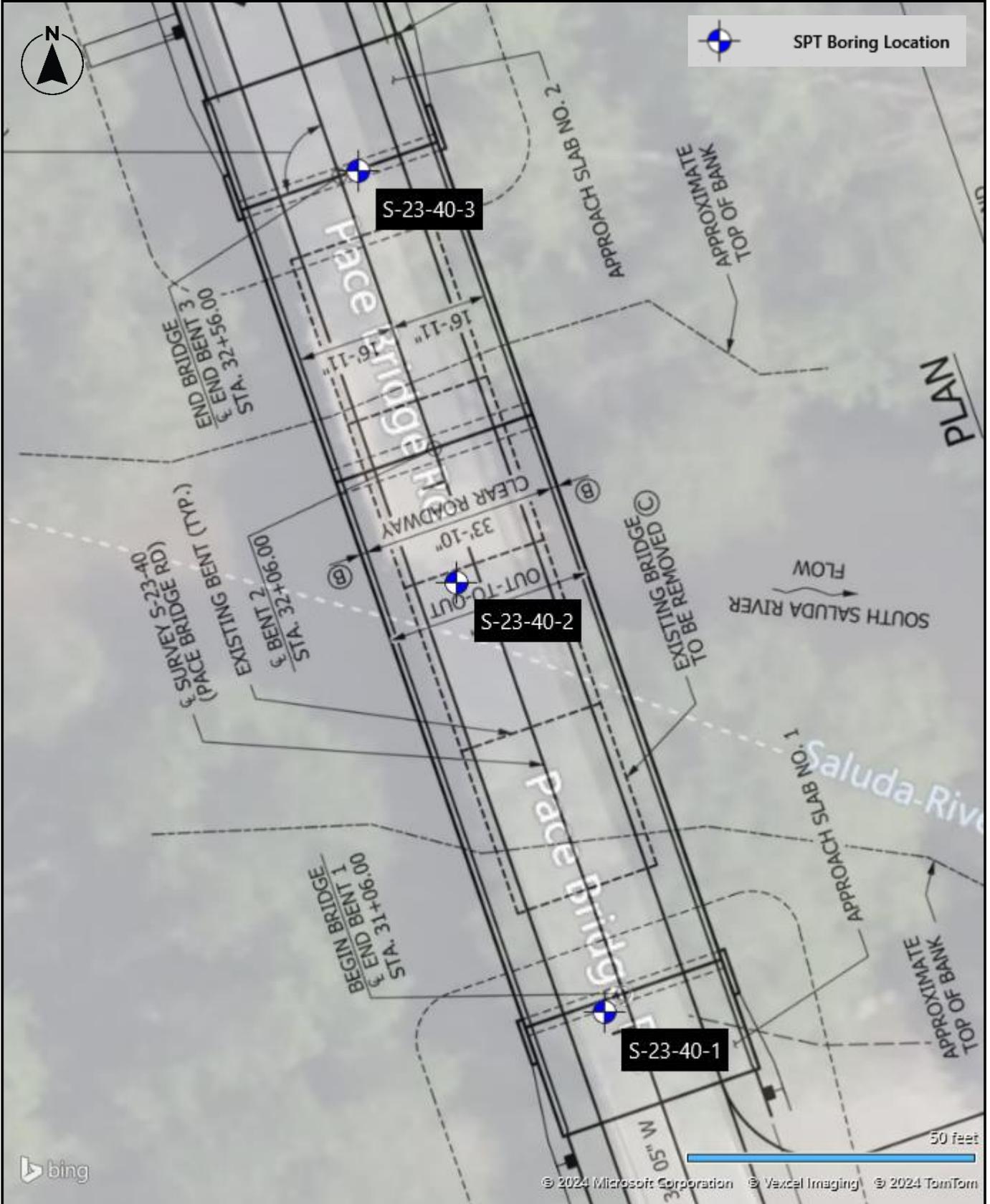


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

PRELIMINARY SITE PLAN PROVIDED BY HNTB

|                |           |
|----------------|-----------|
| Project Number | 8623P180  |
| Scale          | AS SHOWN  |
| Client         | HNTB      |
| Date           | 9/20/2024 |



72 Pointe Cir  
Greenville, South Carolina 29615

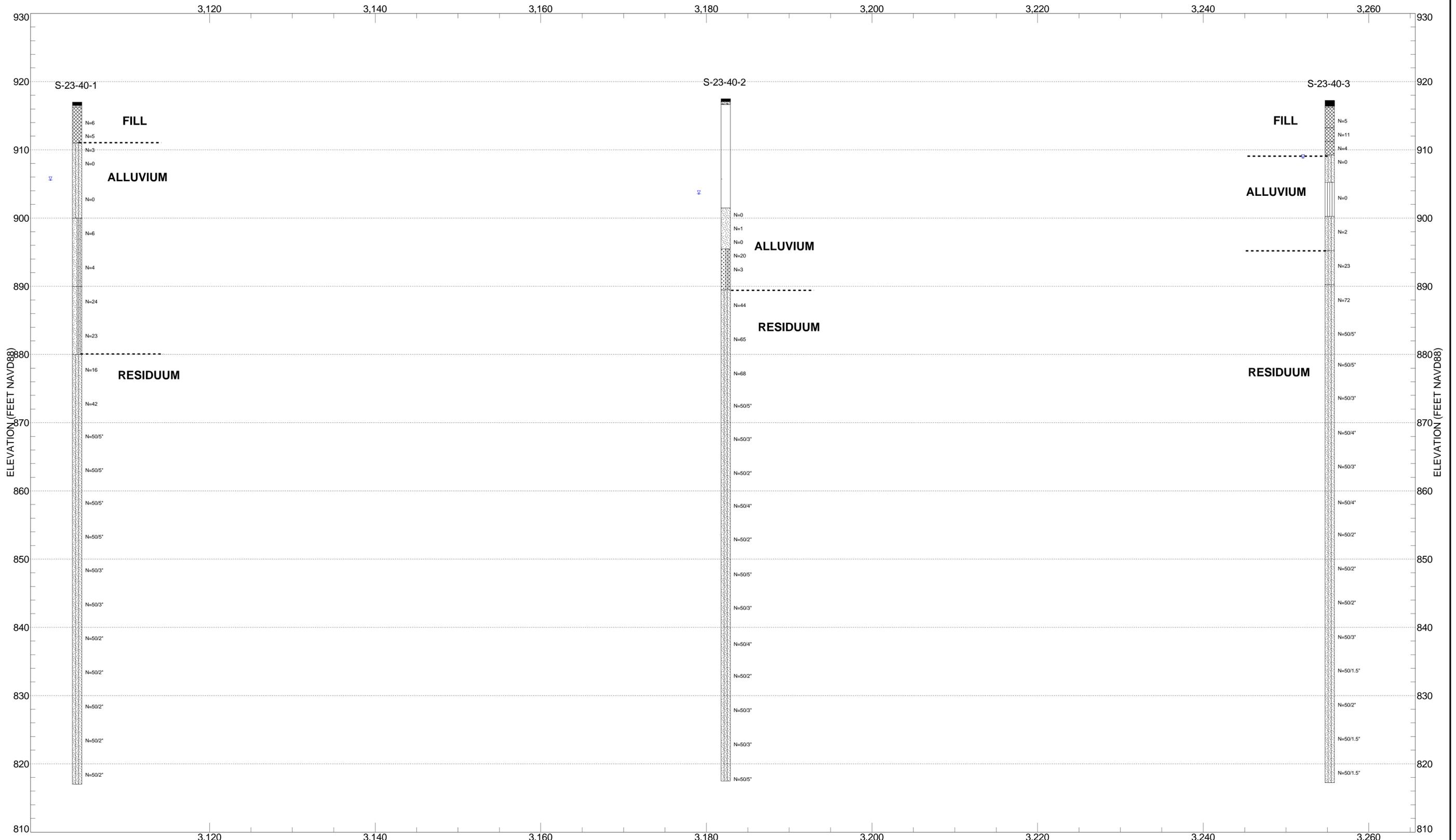
**EXPLORATION PLAN**

S-23-40 BRO South Saluda River  
Pace Bridge Road  
Greenville County, SC

Exhibit

**A-2**

APPROXIMATE STATIONING (FEET)



APPROXIMATE STATIONING (FEET)

Legend for USCS Classification Graphic Symbols

|               |             |                |
|---------------|-------------|----------------|
| SCDOT-ASPHALT | SCDOT-GP    | SCDOT-FILL     |
| SCDOT-SM      | SCDOT-SP-SM | SCDOT-CONCRETE |
| SCDOT-SP      | SCDOT-SW-SM | SCDOT-ML       |

NOTES:  
 See Exhibit for orientation of soil profile.  
 See General Notes in Appendix A for symbols and soil classifications.  
 Soils profile provided for illustration purposes only.  
 Soils between borings may differ.  
 For presentation purposes, some locations are offset to allow display of both borings and CPTs.  
 BT - Boring Termination (Ft)

▽ Water Level Reading at time of drilling.  
 ▼ Water Level Reading after drilling.

|                      |                       |  |   |                        |
|----------------------|-----------------------|--|---|------------------------|
| Project Manager: DJC | Project No.: 6623P180 | <p>72 Pointe Cir<br/>Greenville, SC<br/>PH: 864-292-2901 FAX: 864-292-4361</p> | <p><b>SUBSURFACE PROFILE</b></p> <p>SECTION ALONG PACE BRIDGE ROAD<br/>                 S-23-40 (PACE BRIDGE ROAD) BRO SOUTH SALUDA RIVER<br/>                 SCDOT PROJECT ID: P041160<br/>                 GREENVILLE COUNTY, SC</p> | <p>EXHIBIT<br/>A-3</p> |
| Drawn by: MEM        | Scale: N.T.S.         |  |   |                        |
| Approved by: JNA     | File Name:            |  |   |                        |
| Date: 10/30/2024     |                       |  |   |                        |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT, BAK FENCE CPT, STB FENCE AT 1823P180 SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER, INTERNAL.GPJ TERRACON, DATATEMPLATE.GDT 10/30/24

## Summary of Boring Data – Exhibit A-4

S-23-40 Bridge Replacement over South Saluda River | Greenville County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



### Summary of Boring Data

| Boring No.               | Ground Elevation (ft) | Test Depth (ft) | Northing (ft) | Easting (ft) | Latitude (°) | Longitude (°) | Station (ft) <sup>1</sup> | Offset (ft) <sup>1</sup> |
|--------------------------|-----------------------|-----------------|---------------|--------------|--------------|---------------|---------------------------|--------------------------|
| S-23-40-1 <sup>2,3</sup> | 917                   | 100             | 1160199.42    | 1529669.78   | 35.012103    | -82.570559    | 31+04                     | 4 L                      |
| S-23-40-2                | 917.5                 | 100             | 1160273.90    | 1529645.30   | 35.012307    | -82.570645    | 31+83                     | 4 L                      |
| S-23-40-3 <sup>2</sup>   | 917.2                 | 100             | 1160345.21    | 1529629.35   | 35.012502    | -82.570702    | 32+56                     | 4 R                      |

1. Plans were provided by HNTB after the field exploration and survey. Station and offset values are estimated based on overlay in Google Earth <sup>TM</sup>.
2. A composite bulk sample was collected about 14 feet south of S-23-40-1 and 8.5 feet west of S-23-40-3.
3. Boring S-23-40-1 was not surveyed due to a dirt mound being placed at the boring location after testing was completed. Testing location values are based on field measurements taken at the time of drilling.
4. Station and offset are based on the plans provided at the time the tests were performed.

# GeoScoping Form

| PROJECT INFORMATION |             |               |                  |
|---------------------|-------------|---------------|------------------|
| Project ID:         | P041160     | Date of Trip: | 8/21/2024        |
| County:             | Greenville  | Location:     | Marietta         |
| Rd/ Route:          | S-23-40     | Local Name:   | Pace Bridge Road |
| Attendees:          | M. McKenney |               |                  |

| EXISTING BRIDGE INFORMATION  |                              |  |                          |
|--|------------------------------|--|--------------------------|
| Bridge Length:   | 120 ft                       | Bridge Width:                            | 26 ft                    |
| Superstructure Type:   | Concrete framing and decking | Substructure Type:                       | Timber and Steel H-Piles |
| Begin Bridge Sta <sup>1</sup> :  | 31+06                        | End Bridge Sta <sup>1</sup> :            | 32+56                    |
| Begin Bridge Embankment Sta <sup>1</sup> :   | 30+06                        | End Bridge Embankment Sta <sup>1</sup> : | 33+56                    |
| Structure Number:  | 02540                        | Posted Weight Limit:                     | 11 tons                  |
| Crossing:  | South Saluda River           | Skew:                                    | N/A                      |
| Latitude:  | 35.01233°                    | Longitude:                               | -82.57065°               |
| Existing Fill Height:  | approx. 8 ft                 | Approx Existing Slope Angle:             | 2H:1V                    |
| 1. Begin & End Bridge Embankment 100 ft down Sta. or up Sta., respectively. Sta. estimated from overlay of bridge plan provided by HNTB. |                              |  |                          |

| EXISTING ROADWAY EMBANKMENT INFORMATION |   |                              |          |
|---|---|------------------------------|----------|
| Begin Project Sta:                      | 29+60   | Begin Bridge Embankment Sta: | 30+06    |
| Accessibility Issues:                   | Dirt mounds                                     |                              |          |
| Ground Cover:                           | Asphalt pavement and vegetation along shoulders |                              |          |
| Existing Fill Height:                   | 8 feet, sloping                                 | Approx Existing Slope Angle: | 2H:1V    |
| Local Development:                      | developed - residential                         |                              |          |
| Topography:                             | slope to river                                  |                              |          |
| Traffic Control Necessary:              | No  |                              |          |
| Surface Soils:                          | silty sand / clayey sand                        | Muck:                        | No       |
| Exposed Rock in Stream Bed:             | No  | Exposed Rock in banks:       | No       |
| Wetlands on Site:                       | Yes   | Wetland Adjacent:            | Yes      |
| Depth FG to Water:                      | 14 ft   | Water Depth:                 | 2 ft     |
| Depth to Existing Ground:               | approx. 16 ft at center of bridge               |                              |          |
| Scour Condition at EB:                  | Critical  | Scour Condition at IB:       | Critical |

|                             |   |                              |          |
|-----------------------------|---|------------------------------|----------|
| End Bridge Embankment Sta:  | 33+56   | End Project Sta:             | 33+56    |
| Accessibility Issues:       | Dirt mounds                                     |                              |          |
| Ground Cover:               | Asphalt pavement and vegetation along shoulders |                              |          |
| Existing Fill Height:       | 8 feet, sloping                                 | Approx Existing Slope Angle: | 2H:1V    |
| Local Development:          | developed - residential                         |                              |          |
| Topography:                 | slope to river                                  |                              |          |
| Traffic Control Necessary:  | No  |                              |          |
| Surface Soils:              | silty sand / clayey sand                        | Muck:                        | No       |
| Exposed Rock in Stream Bed: | No  | Exposed Rock in banks:       | No       |
| Wetlands on Site:           | Yes   | Wetland Adjacent:            | Yes      |
| Depth FG to Water:          | 14 ft   | Water Depth:                 | 2 ft     |
| Depth to Existing Ground:   | approx. 16 ft at center of bridge               |                              |          |
| Scour Condition at EB:      | Critical  | Scour Condition at IB:       | Critical |

# GeoScoping Form

| UTILITIES INFORMATION |   |
|-----------------------|---|
| Attached:             | N/A   |
| Above Ground:         | Overhead power was observed along the west side of the road |
| Underground:          | N/A   |

| Comments:                                |
|--|
| <br><br><br><br><br><br><br><br><br><br> |

## Field Exploration Description

### Overview

The testing locations were proposed to and approved by SCDOT and located in the field by Terracon using measurements from existing structures shown on the provided drawings. The borings were surveyed by Thomas and Hutton, LLC after testing and drilling was complete. Boring S-23-40-1 was not surveyed due to a dirt mound being placed at the boring location prior to the survey being completed. The locations as shown in the Exploration Plan are shown to the scale indicated.

A field log of each test location was prepared by our engineer. The final boring logs included with this report represent the engineer's description of the encountered conditions modified as necessary based on laboratory test results of the individual samples.

### Soil Test Borings (STB)

All boring and sampling operations were conducted in general accordance with the following procedures:

- SCDOT Geotechnical Design Manual 2022
- Preconstruction Design Memorandum (PCDM) 11 - Supplemental Design Criteria for Low Volume Bridge Replacement Projects
- ASTM D5783, "Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geo-environmental Exploration"
- ASTM D6151, "Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling"
- ASTM D1586 "Test Method for Penetration Test and Split-Barrel Sampling of Soils"
- ASTM D4220 "Standard Practices for Preserving and Transporting Soil"

Each soil test boring was advanced using rotary wash drilling techniques. The initial sampling program is summarized in the following table:

| Test ID               | Total Depth | Interval of Continuous Sampling |
|-----------------------|-------------|---------------------------------|
| S-23-40-1             | 100 feet    | 2 to 10 feet                    |
| S-23-40-2             | 100 feet    | 16 to 26 feet                   |
| S-23-40-3             | 100 feet    | 2 to 10 feet                    |
| S-23-40-1/3<br>Offset | 5 feet      | Bulk Sample <sup>1</sup>        |

1. Bulk sample was obtained with 2 ¼-inch Hollow Stem Auger (HSA).

Soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler, also known as a standard split-spoon. The sampler is advanced into the soil a total of 18 to 24 inches by striking the drill rod using a 140-pound automatic hammer falling 30 inches.

#### Exhibit A-6 – Field Exploration Description

S-23-40 BRO South Saluda River | Greenville County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



The number of blows required to advance the sampler for each of three to four, 6-inch increments is recorded. The sum of the number of blows for the second and third increments is called the "Standard Penetration Value", or N-value ( $N_{meas}$ , blows per foot). The N-value, when properly evaluated, is an index to the soil strength.

Soil classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply his experience to current situations. In our exploration, samples obtained during drilling operations are examined and visually classified by a geotechnical engineer using the procedures outlined in ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Laboratory testing was also performed on select split-spoon samples to evaluate index properties for further classification. The soils are described according to color, texture, and relative density or consistency (based on standard penetration resistance). The designations shown on the logs are described in the 2022 SCDOT Geotechnical Design Manual, Chapter 6.

The borings were advanced to the planned drilling depth at which they were terminated. As practical, groundwater readings were collected from each of the soil test borings after 24 hours. These water levels are indicated on the boring logs. The borings were advanced using mud rotary drilling techniques. As the drilling method introduces water into the borehole, time-of-drilling water levels may not be reliable.

At the conclusion of the work, the boreholes were backfilled with the drill cuttings and clean sand. The upper 20 feet of those in the embankments were grouted with a cement bentonite grout and capped with cold-patch asphalt.

## SOIL DESCRIPTION TERMS

### Relative Density/Consistency Terms

| <u>Relative Density</u> <sup>1</sup> |                  |                | <u>Consistency</u> <sup>2</sup> |   |                |
|--------------------------------------|------------------|----------------|---------------------------------|---|----------------|
| Descriptive Term                     | Relative Density | SPT Blow Count | Descriptive Term                | Unconfined Compression Strength (q <sub>u</sub> ) (tsf) | SPT Blow Count |
| Very Loose                           | 0 to 15%         | 4 and less     | Very Soft                       | 0.25 and less   | 2 and less     |
| Loose                                | 16 to 35%        | 5 to 10        | Soft                            | 0.26 to 0.50  | 3 to 4         |
| Medium Dense                         | 36 to 65%        | 11 to 30       | Firm                            | 0.51 to 1.00  | 5 to 8         |
| Dense                                | 66 to 85%        | 31 to 50       | Stiff                           | 1.01 to 2.00  | 9 to 15        |
| Very Dense                           | 86 to 100%       | 51 and more    | Very Stiff                      | 2.01 to 4.00  | 16 to 30       |
|                                      |                  |                | Hard                            | 4.01 and more   | 31 and more    |

### Moisture Condition

| <u>Descriptive Term</u> | <u>Criteria</u>   |
|-------------------------|---|
| Dry                     | Absence of moisture, dusty, dry to the touch                              |
| Moist                   | Damp but no visible water   |
| Wet                     | Visible free water, usually in coarse-grained soils below the water table |

### Color

Describe the sample color while sample is still moist.

### Angularity<sup>1</sup>

| <u>Descriptive Term</u> | <u>Criteria</u>   |
|-------------------------|---|
| Angular                 | Particles have sharp edges and relatively plane sides with unpolished surfaces. |
| Subangular              | Particles are similar to angular description but have rounded edges.            |
| Subrounded              | Particles have nearly plane sides but have well-rounded corners and edges.      |
| Rounded                 | Particles have smoothly curved sides and no edges.                              |

### HCl Reaction<sup>3</sup>

| <u>Descriptive Term</u> | <u>Criteria</u>                                    |
|-------------------------|--|
| None Reactive           | No visible reaction                                |
| Weakly Reactive         | Some reaction, with bubbles forming slowly         |
| Strongly Reactive       | Violent reaction, with bubbles forming immediately |

### Cementation<sup>3</sup>

| <u>Descriptive Term</u> | <u>Criteria</u>   |
|-------------------------|---|
| Weakly Cemented         | Crumbles or breaks with handling or little finger pressure Moderately |
| Cemented                | Crumbles or breaks with considerable finger pressure                  |
| Strongly Cemented       | Will not crumble or break with finger pressure                        |

### Particle-Size Range<sup>1</sup>

| <u>Gravel</u> | Diameter, mm | Sieve Size       | <u>Sand</u> | Diameter, mm  | Sieve Size  |
|---------------|--------------|------------------|-------------|---------------|-------------|
| Fine          | 4.76 to 19.1 | #4 to ¾ inch     | Fine        | 0.074 to 0.42 | #200 to #40 |
| Coarse        | 19.1 to 76.2 | ¾ inch to 3 inch | Medium      | 0.42 to 2.00  | #40 to #10  |
|               |              |                  | Coarse      | 4.00 to 4.76  | #10 to #4   |

### Primary Soil Type<sup>1, 2</sup>

The primary soil type will be shown in all capital letters.

### USCS Soil Designation

Indicate USCS soil designation as defined in ASTM D-2487 and D-2488

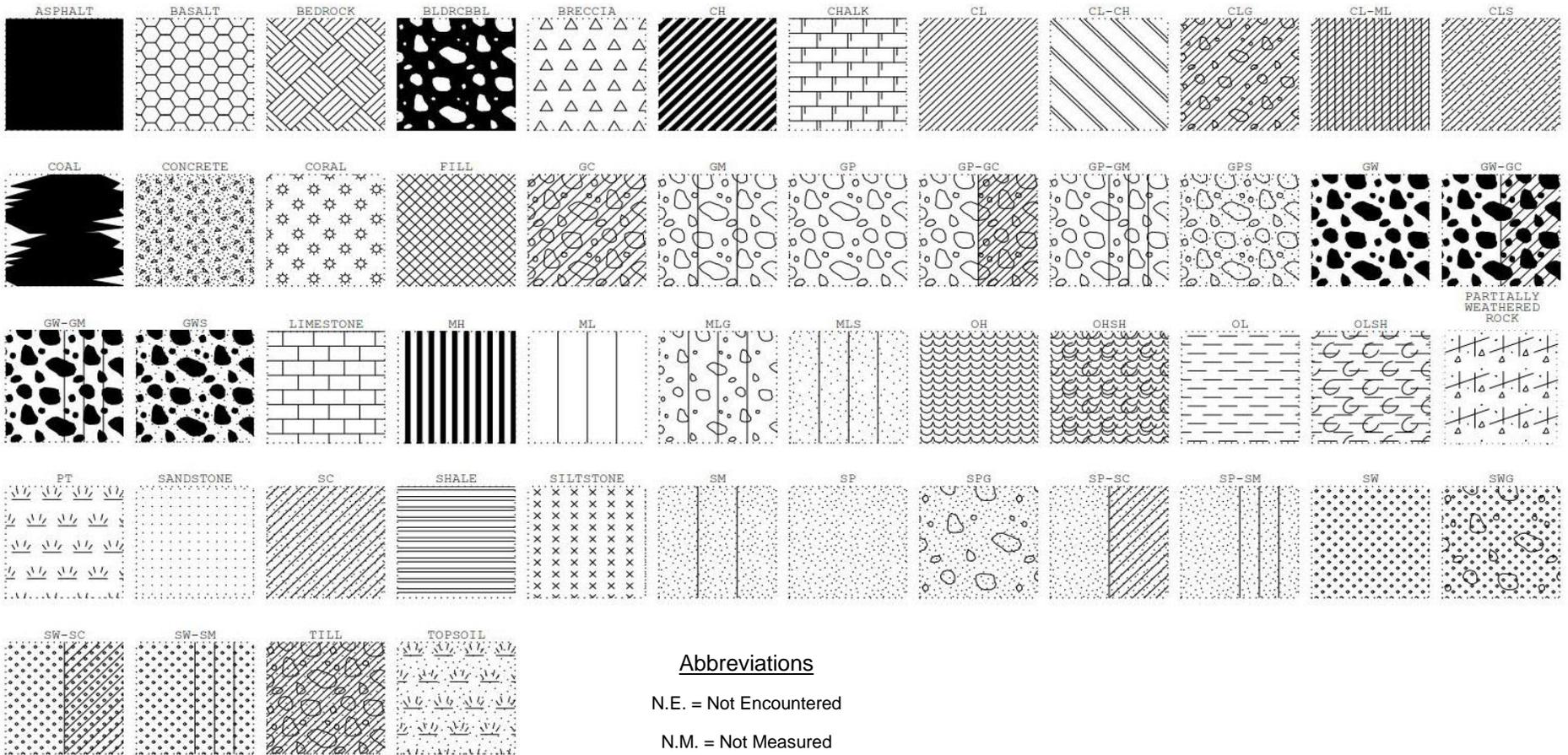
### AASHTO Soil Designation

Indicate AASHTO soil designation as defined in AASHTO M-145 and ASTM D-3282

<sup>1</sup>Applies to coarse-grained soils (major portion retained on No. 200 sieve)

<sup>2</sup>Applies to fine-grained soils (major portion passing No. 200 sieve)

<sup>3</sup>Use as required



Abbreviations

N.E. = Not Encountered

N.M. = Not Measured

Project Manager:  
MEM  
Drawn by:  
KJZ  
Checked by:  
SG  
Approved by:  
DJC

Project No.  
8623P180  
Scale:  
N.T.S.  
File Name:  
Soil - Rock - Log  
Date:  
Jul 2023

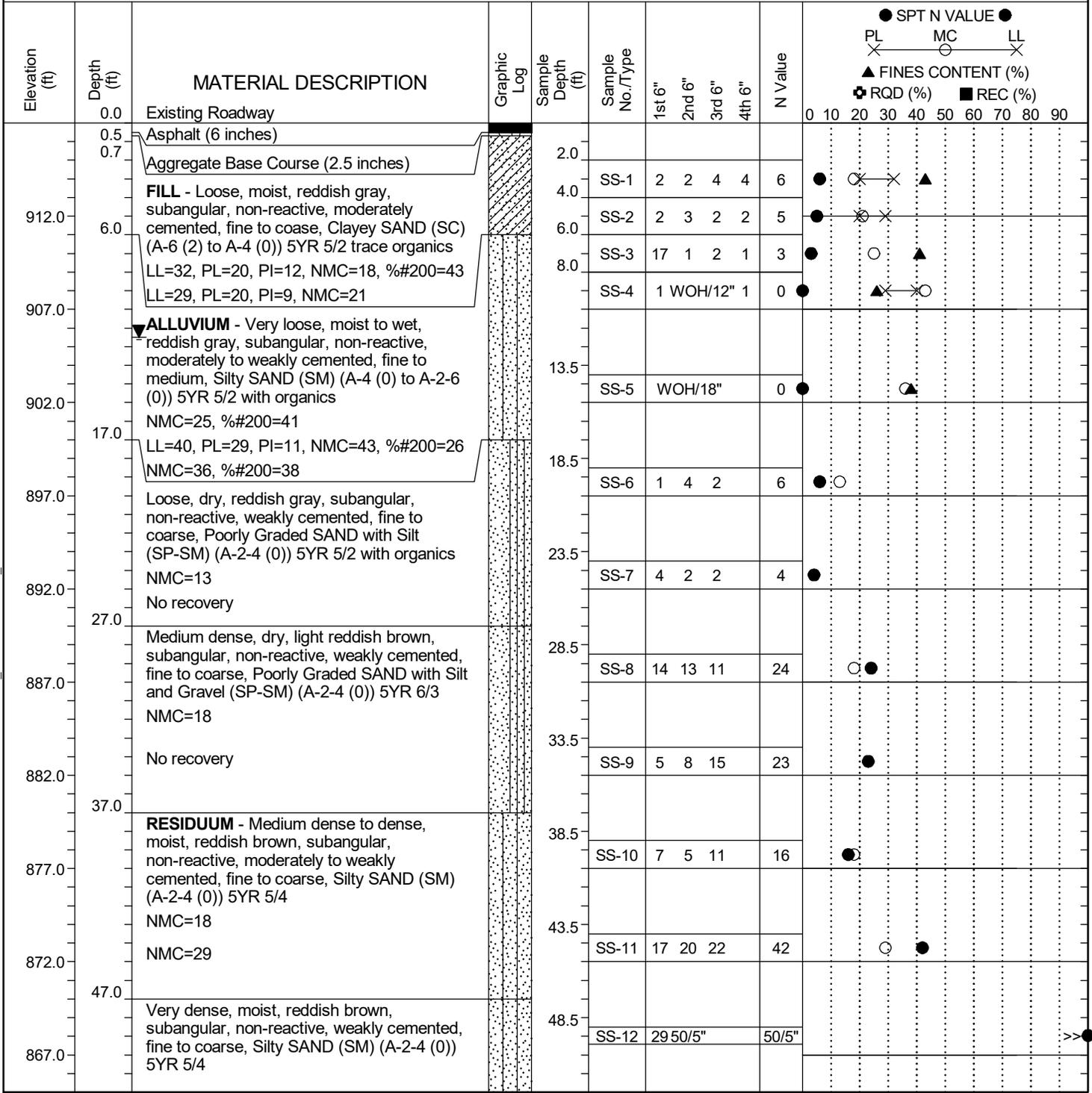


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SOIL AND ROCK SYMBOLS

# SCDOT Soil Test Log

|   |                                |                                  |
|---|--------------------------------|----------------------------------|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville      | <b>Boring No.:</b> S-23-40-1     |
| <b>Site Description:</b> S-23-40 BRO South Saluda River |                                | <b>Route:</b> S-23-40            |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 31+04  | <b>Offset:</b> 4 L               |
| <b>Alignment:</b> Existing                              | <b>Date Started:</b> 8/20/2024 | <b>Date Completed:</b> 8/20/2024 |
| <b>Elev.:</b> 917.0 ft                                  | <b>Latitude:</b> 35.0121       | <b>Longitude:</b> -82.57056      |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft      | <b>Core Depth:</b> 0 ft          |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)     |
| <b>Liner Used:</b> Y (N)                                | <b>Drill Machine:</b> DR#554   | <b>Drill Method:</b> RW          |
| <b>Hammer Type:</b> Automatic                           | <b>Energy Ratio:</b> 88.5%     | <b>Groundwater:</b> TOB N.M.     |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> G. Robinson    | <b>24HR:</b> 11.5 ft             |



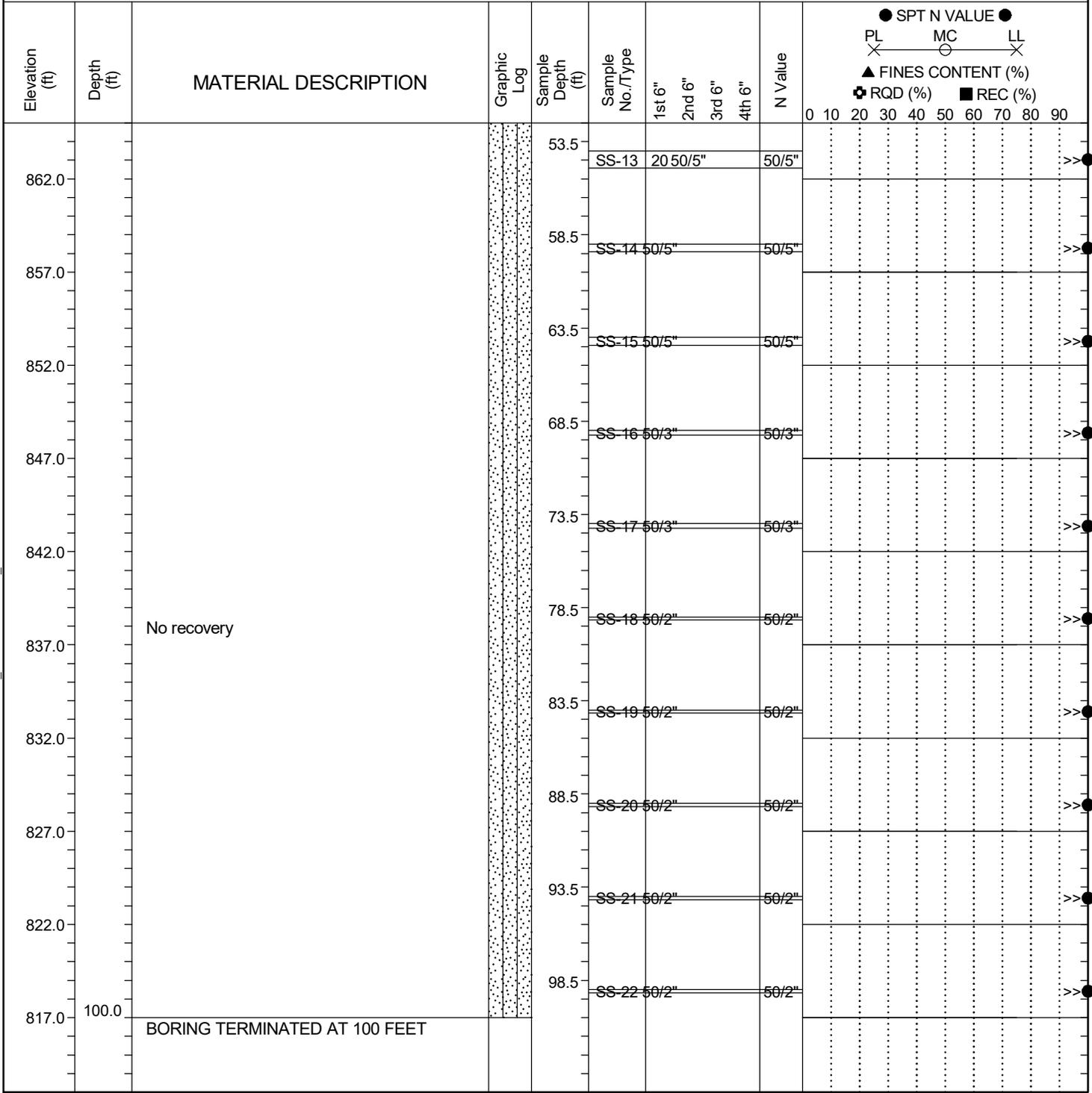
LEGEND Continued Next Page

| 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            |                  |

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

# SCDOT Soil Test Log

|   |                               |                               |
|---|-------------------------------|-------------------------------|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville     | <b>Boring No.:</b> S-23-40-1  |
| <b>Site Description:</b> S-23-40 BRO South Saluda River |                               | <b>Route:</b> S-23-40         |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 31+04 | <b>Offset:</b> 4 L            |
| <b>Alignment:</b> Existing                              |                               |                               |
| <b>Elev.:</b> 917.0 ft                                  | <b>Latitude:</b> 35.0121      | <b>Longitude:</b> -82.57056   |
| <b>Date Started:</b> 8/20/2024                          |                               |                               |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft     | <b>Core Depth:</b> 0 ft       |
| <b>Date Completed:</b> 8/20/2024                        |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                |                               |                               |
| <b>Drill Machine:</b> DR#554                            | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 88.5%                              |                               |                               |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> G. Robinson   | <b>Groundwater:</b> TOB N.M.  |
| <b>24HR:</b> 11.5 ft                                    |                               |                               |



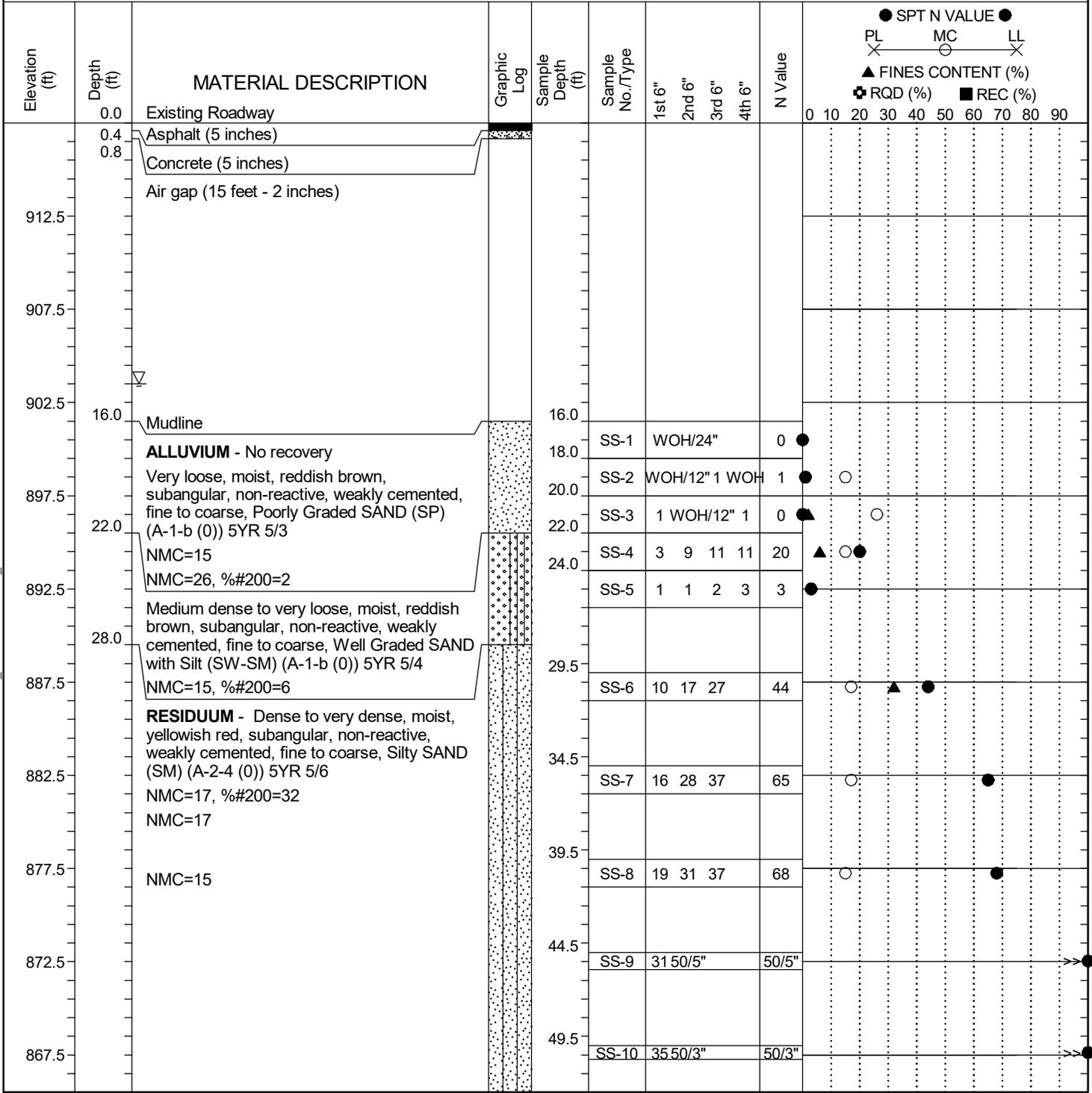
### LEGEND

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

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

# SCDOT Soil Test Log

|   |                                |                               |
|---|--------------------------------|-------------------------------|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville      | <b>Boring No.:</b> S-23-40-2  |
| <b>Site Description:</b> S-23-40 BRO South Saluda River |                                | <b>Route:</b> S-23-40         |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 31+83  | <b>Offset:</b> 4 L            |
| <b>Alignment:</b> Existing                              | <b>Date Started:</b> 8/20/2024 |                               |
| <b>Elev.:</b> 917.5 ft                                  | <b>Latitude:</b> 35.01231      | <b>Longitude:</b> -82.57065   |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft      | <b>Core Depth:</b> 0 ft       |
| <b>Date Completed:</b> 8/21/2024                        |                                |                               |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>   | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                |                                |                               |
| <b>Drill Machine:</b> DR#1327                           | <b>Drill Method:</b> RW        | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 92.6%                              |                                |                               |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> B. Burnette    | <b>Groundwater:</b> TOB 14 ft |
|   |                                | <b>24HR:</b> N.M.             |



### LEGEND

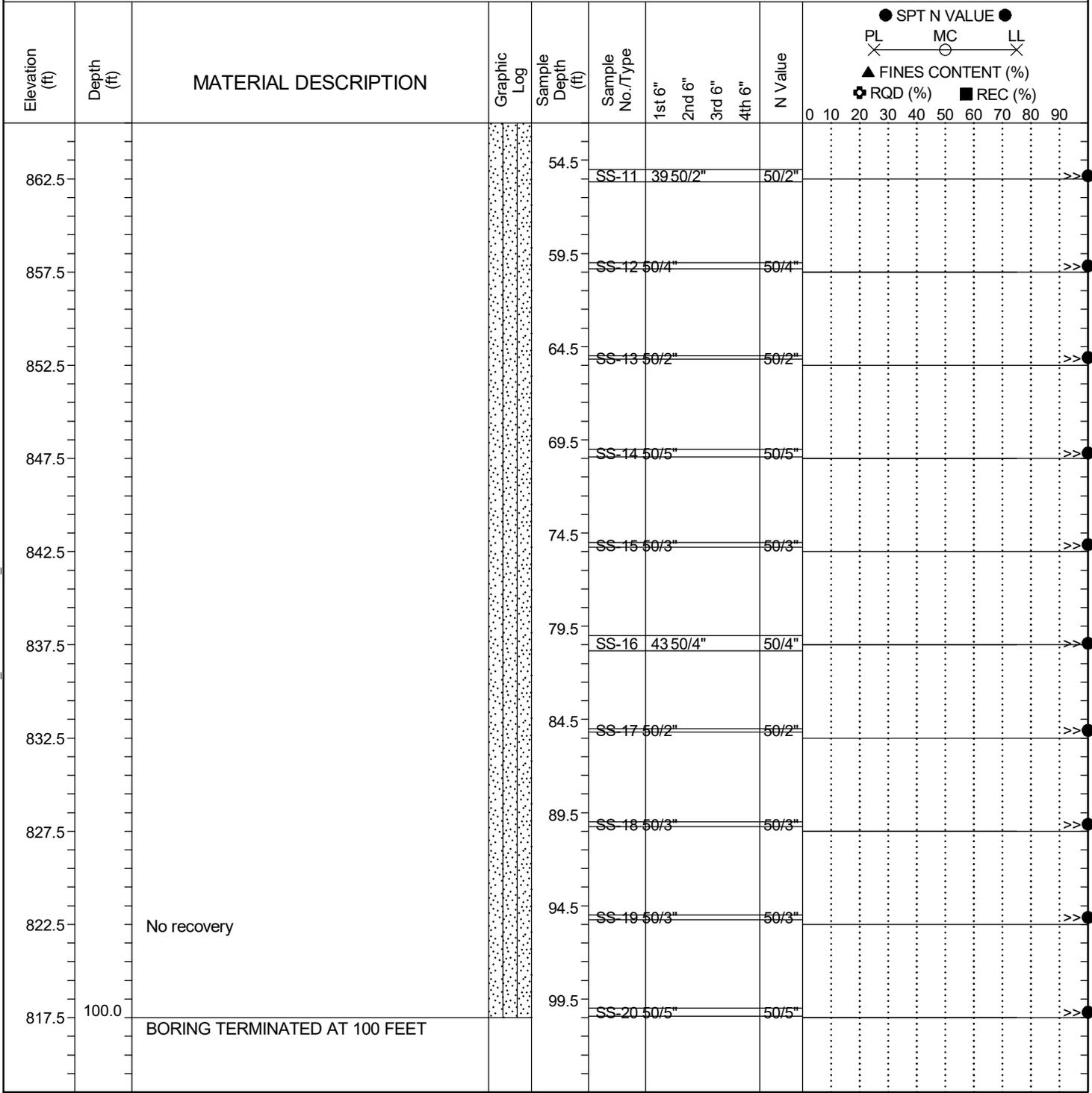
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| SAMPLER TYPE            |                        | DRILLING METHOD                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| SS - Split Spoon        | NQ - Rock 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 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER.DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

# SCDOT Soil Test Log

|   |                               |                               |
|---|-------------------------------|-------------------------------|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville     | <b>Boring No.:</b> S-23-40-2  |
| <b>Site Description:</b> S-23-40 BRO South Saluda River | <b>Route:</b> S-23-40         |                               |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 31+83 | <b>Offset:</b> 4 L            |
| <b>Alignment:</b> Existing                              |                               |                               |
| <b>Elev.:</b> 917.5 ft                                  | <b>Latitude:</b> 35.01231     | <b>Longitude:</b> -82.57065   |
| <b>Date Started:</b> 8/20/2024                          |                               |                               |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft     | <b>Core Depth:</b> 0 ft       |
| <b>Date Completed:</b> 8/21/2024                        |                               |                               |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)  |
| <b>Liner Used:</b> Y (N)                                |                               |                               |
| <b>Drill Machine:</b> DR#1327                           | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic |
| <b>Energy Ratio:</b> 92.6%                              |                               |                               |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> B. Burnette   | <b>Groundwater:</b> TOB 14 ft |
|   |                               | <b>24HR:</b> N.M.             |



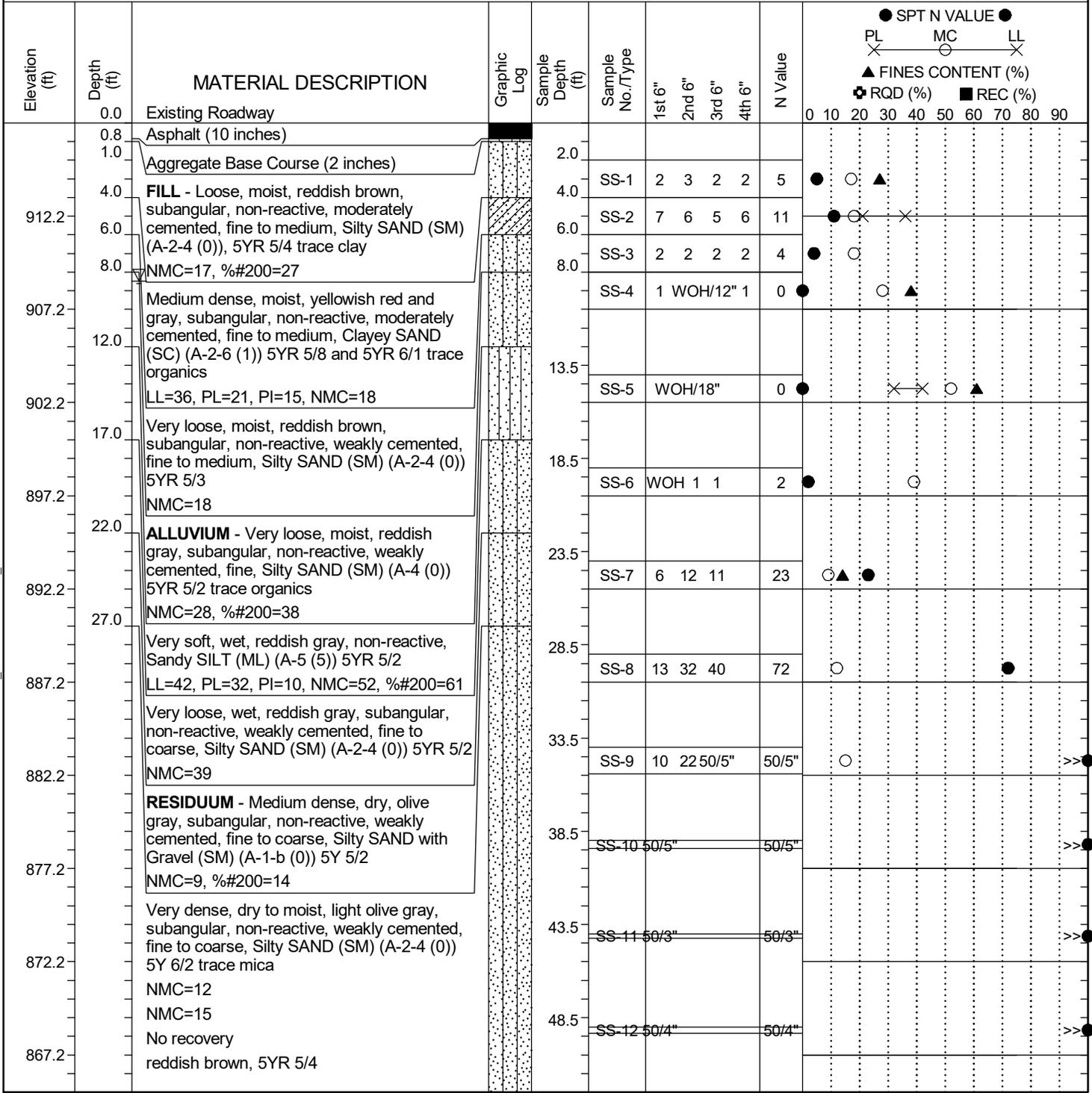
### LEGEND

| 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            |                  |

SC.DOT 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

# SCDOT Soil Test Log

|   |                               |   |
|---|-------------------------------|---|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville     | <b>Boring No.:</b> S-23-40-3                      |
| <b>Site Description:</b> S-23-40 BRO South Saluda River |                               | <b>Route:</b> S-23-40                             |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 32+56 | <b>Offset:</b> 4 R                                |
| <b>Alignment:</b> Existing                              |                               |   |
| <b>Elev.:</b> 917.2 ft                                  | <b>Latitude:</b> 35.0125      | <b>Longitude:</b> -82.5707                        |
| <b>Date Started:</b> 8/21/2024                          |                               |   |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft     | <b>Core Depth:</b> 0 ft                           |
| <b>Date Completed:</b> 8/21/2024                        |                               |   |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)                      |
| <b>Liner Used:</b> Y (N)                                |                               |   |
| <b>Drill Machine:</b> DR#554                            | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic                     |
| <b>Energy Ratio:</b> 88.5%                              |                               |   |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> G. Robinson   | <b>Groundwater:</b> TOB 8.5 (After 1hr) 24HR N.M. |



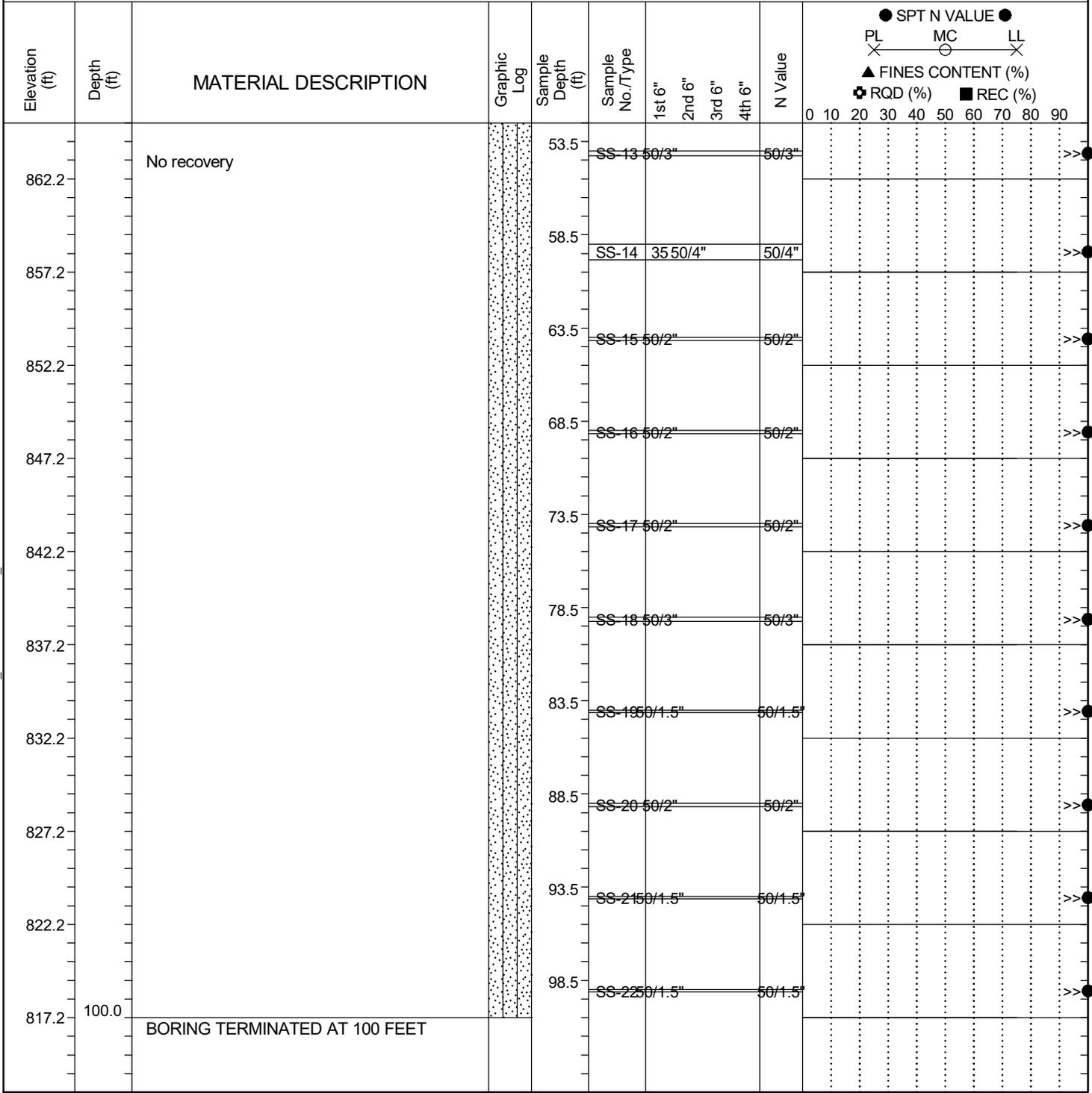
LEGEND Continued Next Page

|                         |                        |                                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| 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 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

# SCDOT Soil Test Log

|   |                               |   |
|---|-------------------------------|---|
| <b>Project ID:</b> P041160                              | <b>County:</b> Greenville     | <b>Boring No.:</b> S-23-40-3                      |
| <b>Site Description:</b> S-23-40 BRO South Saluda River | <b>Route:</b> S-23-40         |   |
| <b>Eng./Geo.:</b> S. Greaber                            | <b>Boring Location:</b> 32+56 | <b>Offset:</b> 4 R                                |
| <b>Alignment:</b> Existing                              |                               |   |
| <b>Elev.:</b> 917.2 ft                                  | <b>Latitude:</b> 35.0125      | <b>Longitude:</b> -82.5707                        |
| <b>Date Started:</b> 8/21/2024                          |                               |   |
| <b>Total Depth:</b> 100 ft                              | <b>Soil Depth:</b> 100 ft     | <b>Core Depth:</b> 0 ft                           |
| <b>Date Completed:</b> 8/21/2024                        |                               |   |
| <b>Bore Hole Diameter (in):</b> 4                       | <b>Sampler Configuration</b>  | <b>Liner Required:</b> Y (N)                      |
| <b>Liner Used:</b> Y (N)                                |                               |   |
| <b>Drill Machine:</b> DR#554                            | <b>Drill Method:</b> RW       | <b>Hammer Type:</b> Automatic                     |
| <b>Energy Ratio:</b> 88.5%                              |                               |   |
| <b>Core Size:</b> N/A                                   | <b>Driller:</b> G. Robinson   | <b>Groundwater:</b> TOB 8.5 (After 1hr) 24HR N.M. |



### LEGEND

|                         |                        |                                |                  |
|-------------------------|------------------------|--------------------------------|------------------|
| <b>SAMPLER TYPE</b>     |                        | <b>DRILLING METHOD</b>         |                  |
| 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 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT\_DATATEMPLATE.GDT 9/30/24

**Appendix B – Laboratory Testing**

S-23-40 BRO South Saluda River | Greenville County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



## **Appendix B**

### **Laboratory Testing**

Exhibit B-1 – Laboratory Testing Description  
Summary of Laboratory Data (2 Pages)  
Laboratory Data Sheets (12 Pages)

Note: All exhibits are one page unless noted above.

**Exhibit B-1 – Laboratory Testing Description**

S-23-40 BRO South Saluda River | Greenville County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



**Laboratory Testing Description**

The samples collected during the field exploration were taken to our laboratory for additional testing. The laboratory testing scope was developed by the SCDOT and laboratory assignment was performed by Terracon. The laboratory tests were conducted on selected soil samples from the borings and the bulk sample locations. The test results are presented in this appendix.

The laboratory test results were used to confirm the soil descriptions presented on the boring logs in Appendix A. Laboratory tests were performed in general accordance with the applicable ASTM, AASHTO, SCDOT or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Moisture Content AASHTO T265/(ASTM D2216)
- Atterberg Limits AASHTO T89/T90(ASTM D4318)
- Wash 200 AASHTO T11/(ASTM D1140)
- Proctor (Standard effort) AASHTO T99/ (ASTM D698)
- Triaxial Shear CU w/ PP AASHTO T297/(ASTM D4767)
- Grain Size Distribution ASTM D6913
- Hydrometer ASTM D7928
- Corrosion Series AASHTO D422  
AASHTO T289/ASTM G51  
AASHTO T290/ASTM C1580  
AASHTO T291

## Summary of Laboratory Results

| Boring ID | Depth (Ft.) | Soil Classification<br>USCS &<br>AASHTO         | Liquid<br>Limit | Plastic<br>Limit | Plasticity<br>Index | % Gravel | % Sand | % Fines | % Silt | % Clay | Water<br>Content<br>(%) | Proctor<br>Dry Density<br>(pcf)/Opt.<br>Moisture<br>(%) |
|-----------|-------------|---|-----------------|------------------|---------------------|----------|--------|---------|--------|--------|-------------------------|---|
| S-23-40-1 | 2-4         | CLAYEY SAND(SC) / A-6 (2)                       | 32              | 20               | 12                  | 3.1      | 54.3   | 42.6    |        |        | 18.3                    |   |
| S-23-40-1 | 4-6         | CLAYEY SAND(SC) / A-4 (0)                       | 29              | 20               | 9                   |          |        |         |        |        | 20.9                    |   |
| S-23-40-1 | 6-8         | SILTY SAND(SM) / A-4 (0)                        |                 |                  |                     | 0.6      | 58.9   | 40.5    |        |        | 25.2                    |   |
| S-23-40-1 | 8-10        | SILTY SAND(SM) / A-2-6 (0)                      | 40              | 29               | 11                  | 1.1      | 72.9   | 26.0    | 20.5   | 5.5    | 42.9                    |   |
| S-23-40-1 | 13.5-15     | SILTY SAND(SM) / A-4 (0)                        |                 |                  |                     | 0.1      | 62.2   | 37.7    | 26.7   | 11.0   | 35.9                    |   |
| S-23-40-1 | 18.5-20     | POORLY GRADED SAND with SILT(SP-SM) / A-2-4 (0) |                 |                  |                     |          |        |         |        |        | 12.8                    |   |
| S-23-40-1 | 28.5-30     | POORLY GRADED SAND with SILT(SP-SM) / A-2-4 (0) |                 |                  |                     |          |        |         |        |        | 17.6                    |   |
| S-23-40-1 | 38.5-40     | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     |          |        |         |        |        | 18.1                    |   |
| S-23-40-1 | 43.5-45     | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     |          |        |         |        |        | 28.5                    |   |
| S-23-40-2 | 18-20       | POORLY GRADED SAND(SP) / A-1-b (0)              |                 |                  |                     |          |        |         |        |        | 14.6                    |   |
| S-23-40-2 | 20-22       | POORLY GRADED SAND(SP) / A-1-b (0)              |                 |                  |                     | 0.8      | 97.4   | 1.7     | 0.9    | 0.9    | 26.1                    |   |
| S-23-40-2 | 22-24       | WELL GRADED SAND with SILT(SW-SM) / A-1-b (0)   |                 |                  |                     | 5.0      | 88.6   | 6.4     |        |        | 14.6                    |   |
| S-23-40-2 | 29.5-31     | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     | 0.5      | 68.0   | 31.5    |        |        | 17.1                    |   |
| S-23-40-2 | 34.5-36     | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     |          |        |         |        |        | 16.6                    |   |
| S-23-40-2 | 39.5-41     | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     |          |        |         |        |        | 14.6                    |   |
| S-23-40-3 | 2-4         | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     | 3.1      | 70.0   | 26.8    |        |        | 16.6                    |   |
| S-23-40-3 | 4-6         | CLAYEY SAND(SC) / A-2-6 (1)                     | 36              | 21               | 15                  |          |        |         |        |        | 18.1                    |   |
| S-23-40-3 | 6-8         | SILTY SAND(SM) / A-2-4 (0)                      |                 |                  |                     |          |        |         |        |        | 17.8                    |   |
| S-23-40-3 | 8-10        | SILTY SAND(SM) / A-4 (0)                        |                 |                  |                     | 0.5      | 61.3   | 38.2    |        |        | 28.4                    |   |

## Summary of Laboratory Results

| Boring ID          | Depth (Ft.) | Soil Classification USCS & AASHTO      | Liquid Limit | Plastic Limit | Plasticity Index | % Gravel | % Sand | % Fines | % Silt | % Clay | Water Content (%) | Proctor Dry Density (pcf)/Opt. Moisture (%) |
|--------------------|-------------|--|--------------|---------------|------------------|----------|--------|---------|--------|--------|-------------------|---|
| S-23-40-3          | 13.5-15     | SANDY SILT(ML) / A-5 (5)               | 42           | 32            | 10               | 0.0      | 39.1   | 60.9    | 44.2   | 16.7   | 51.6              |   |
| S-23-40-3          | 18.5-20     | SILTY SAND(SM) / A-2-4 (0)             |              |               |                  |          |        |         |        |        | 38.9              |   |
| S-23-40-3          | 23.5-25     | SILTY SAND with GRAVEL(SM) / A-1-b (0) |              |               |                  | 34.5     | 51.7   | 13.9    |        |        | 9.4               |   |
| S-23-40-3          | 28.5-30     | SILTY SAND(SM) / A-2-4 (0)             |              |               |                  |          |        |         |        |        | 12.0              |   |
| S-23-40-3          | 33.5-34.96  | SILTY SAND(SM) / A-2-4 (0)             |              |               |                  |          |        |         |        |        | 15.3              |   |
| S-23-40-1/3 Offset | 0-5         | SILTY SAND(SM) / A-4 (0)               | NP           | NP            | NP               | 4.4      | 52.3   | 43.3    |        |        |                   | 111.0 / 15.4                                |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |
|                    |             |  |              |               |                  |          |        |         |        |        |                   |   |



# INDEX PROPERTIES VERSUS DEPTH

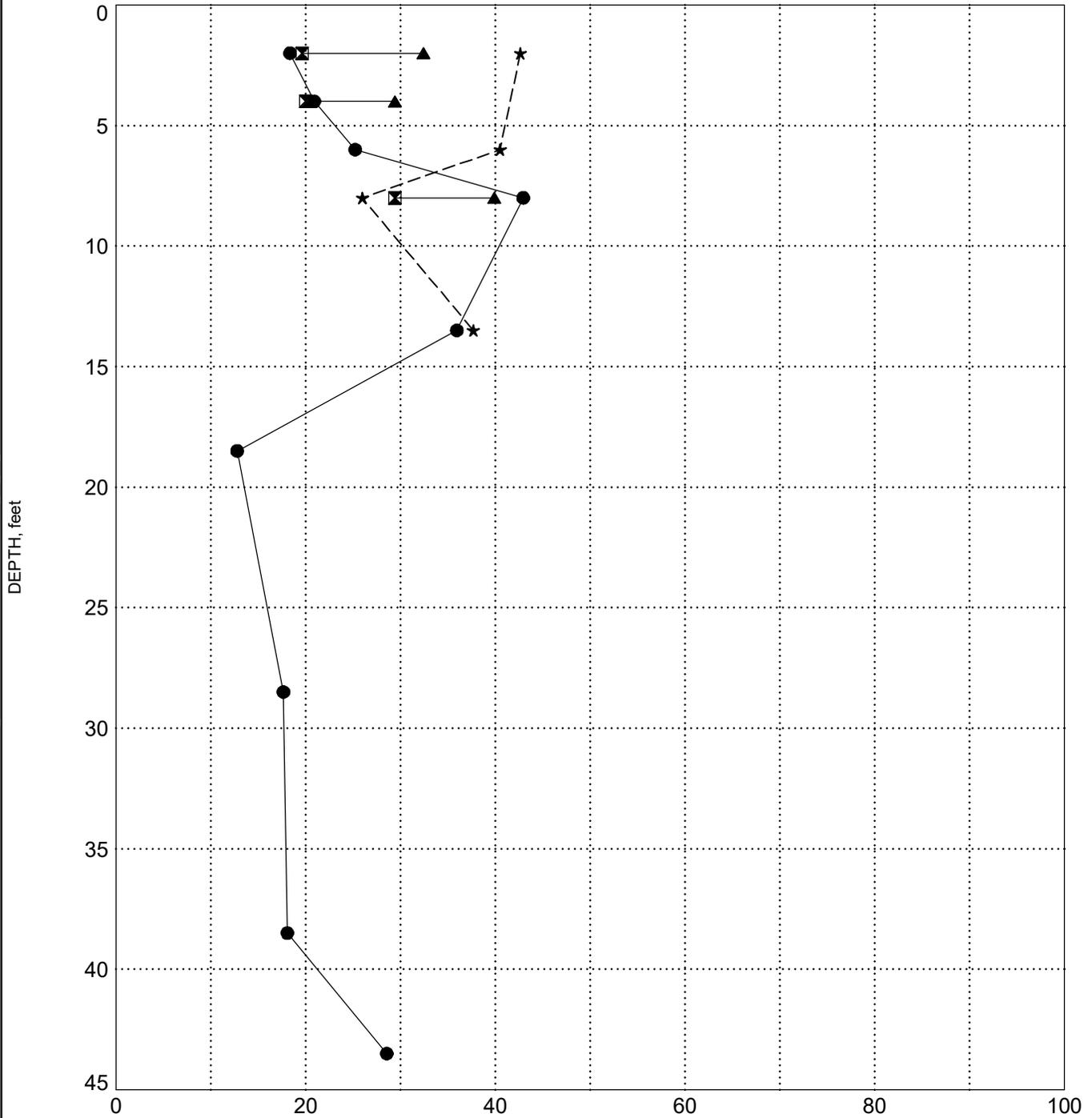
PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

## BORING S-23-40-1

SURFACE ELEVATION: 917.0



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

INDEX PROPS 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT DATA TEMPLATE\_01\_30\_2015.GDT 9/30/24



# INDEX PROPERTIES VERSUS DEPTH

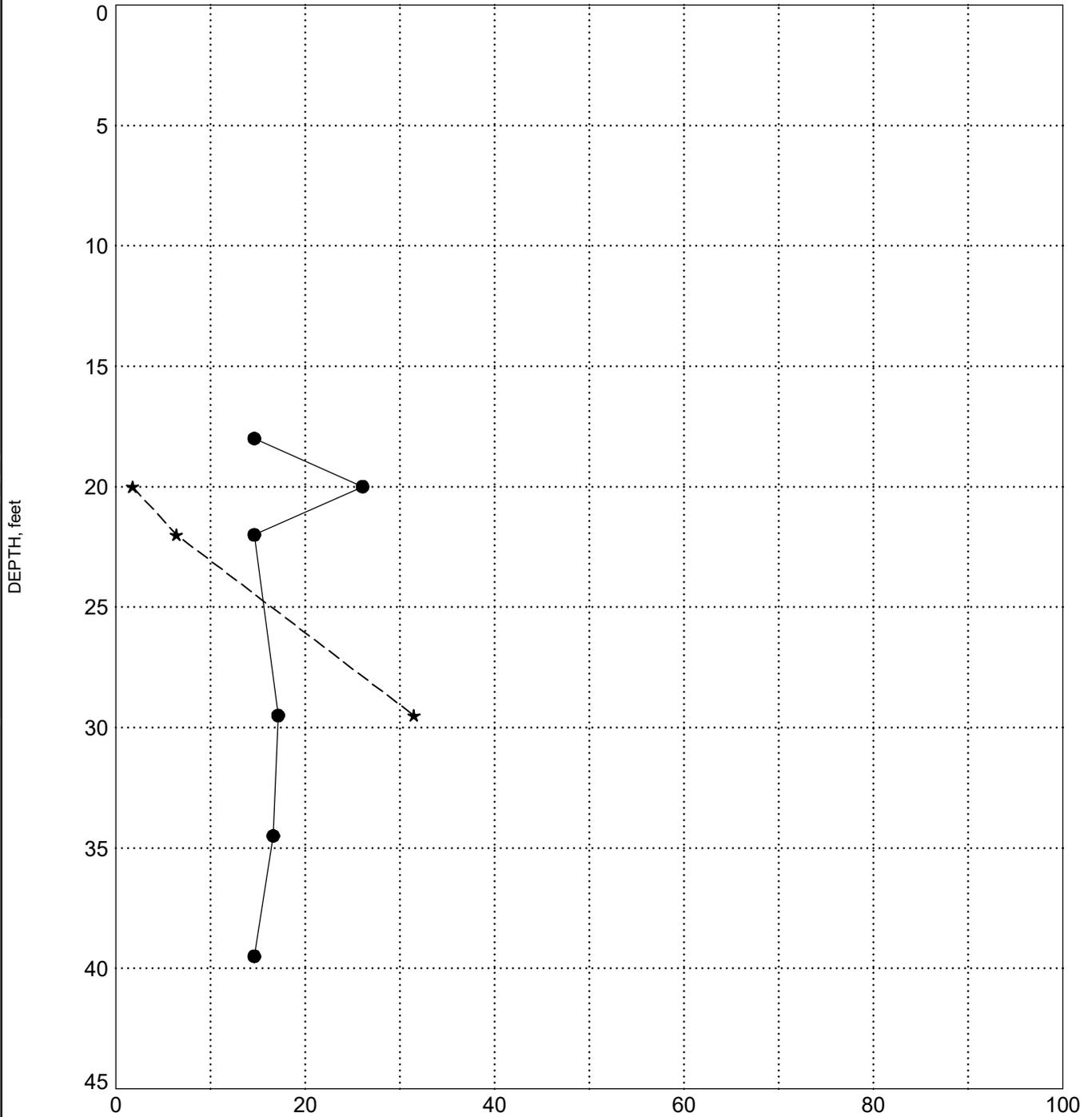
PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

SURFACE ELEVATION: 917.5

## BORING S-23-40-2



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

INDEX PROPS 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT DATA TEMPLATE\_01\_30\_2015.GDT 9/30/24



# INDEX PROPERTIES VERSUS DEPTH

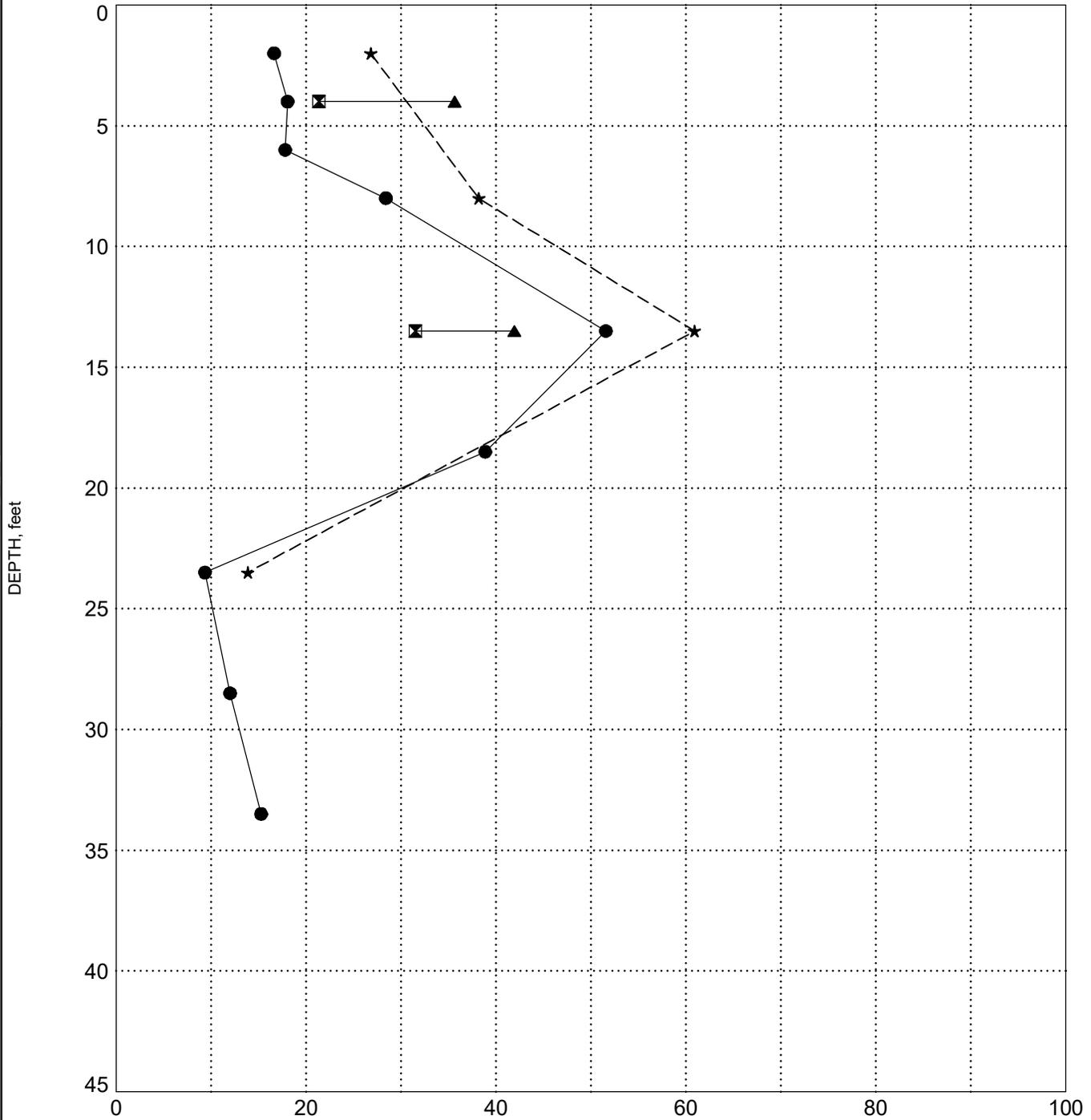
PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

SURFACE ELEVATION: 917.2

## BORING S-23-40-3



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

INDEX PROPS 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT DATA TEMPLATE\_01\_30\_2015.GDT 9/30/24



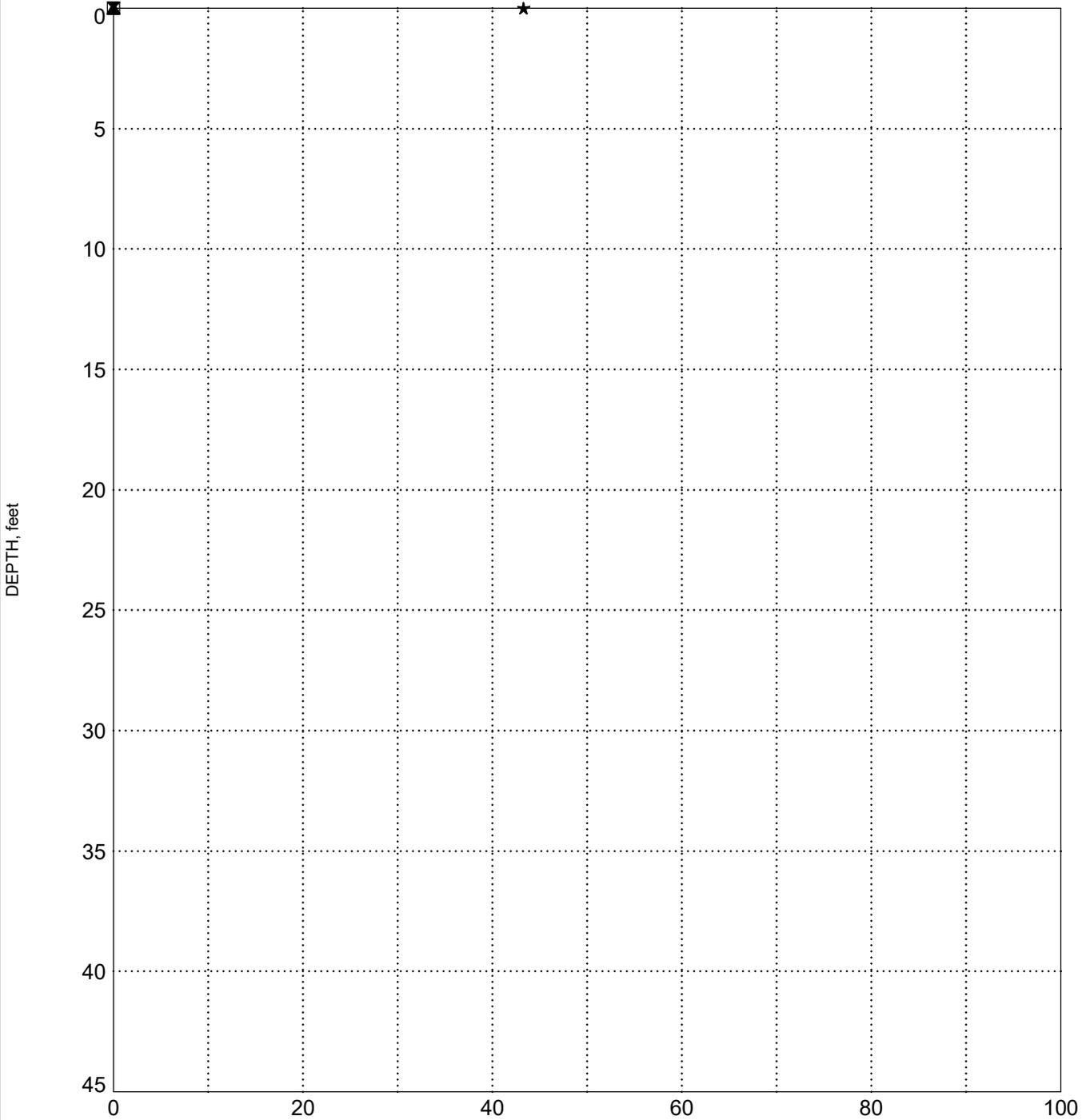
# INDEX PROPERTIES VERSUS DEPTH

PROJECT ID P041160

PROJECT NAME S-23-40 BRO South Saluda River

PROJECT COUNTY Greenville

## BORING S-23-40-1/3 Offset



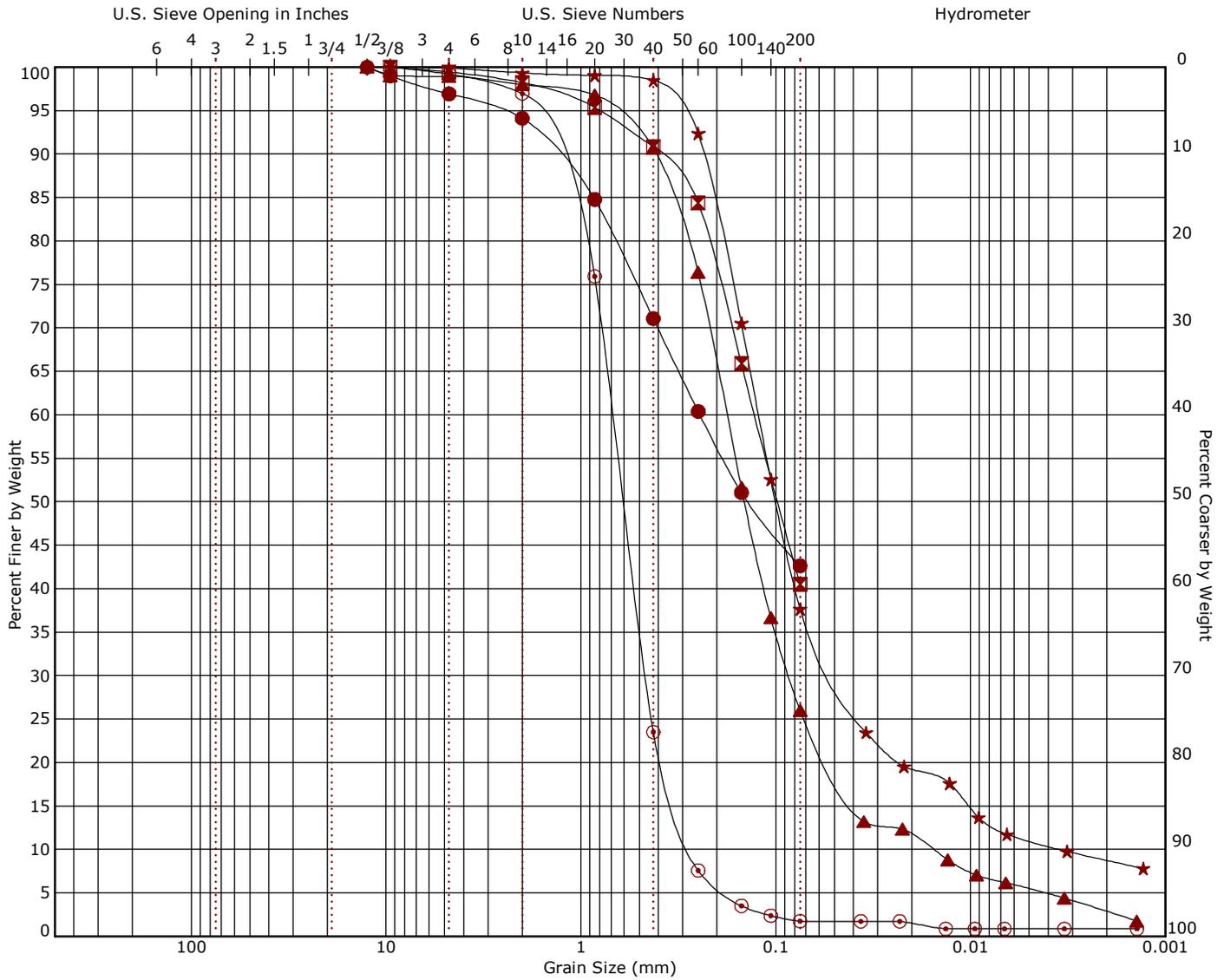
| LEGEND |               |
|--------|---------------|
| ●      | Water Content |
| ☒      | Plastic Limit |
| ▲      | Liquid Limit  |
| ★      | Fines         |

INDEX PROPS 8623P180T SCDOT BRIDGE PACK 19 S-23-40 OVER SOUTH SALUDA RIVER-DOT\_JNA.GPJ SCDOT DATA TEMPLATE\_01\_30\_2015.GDT 9/30/24



## Grain Size Distribution

### ASTM D422 / ASTM C136

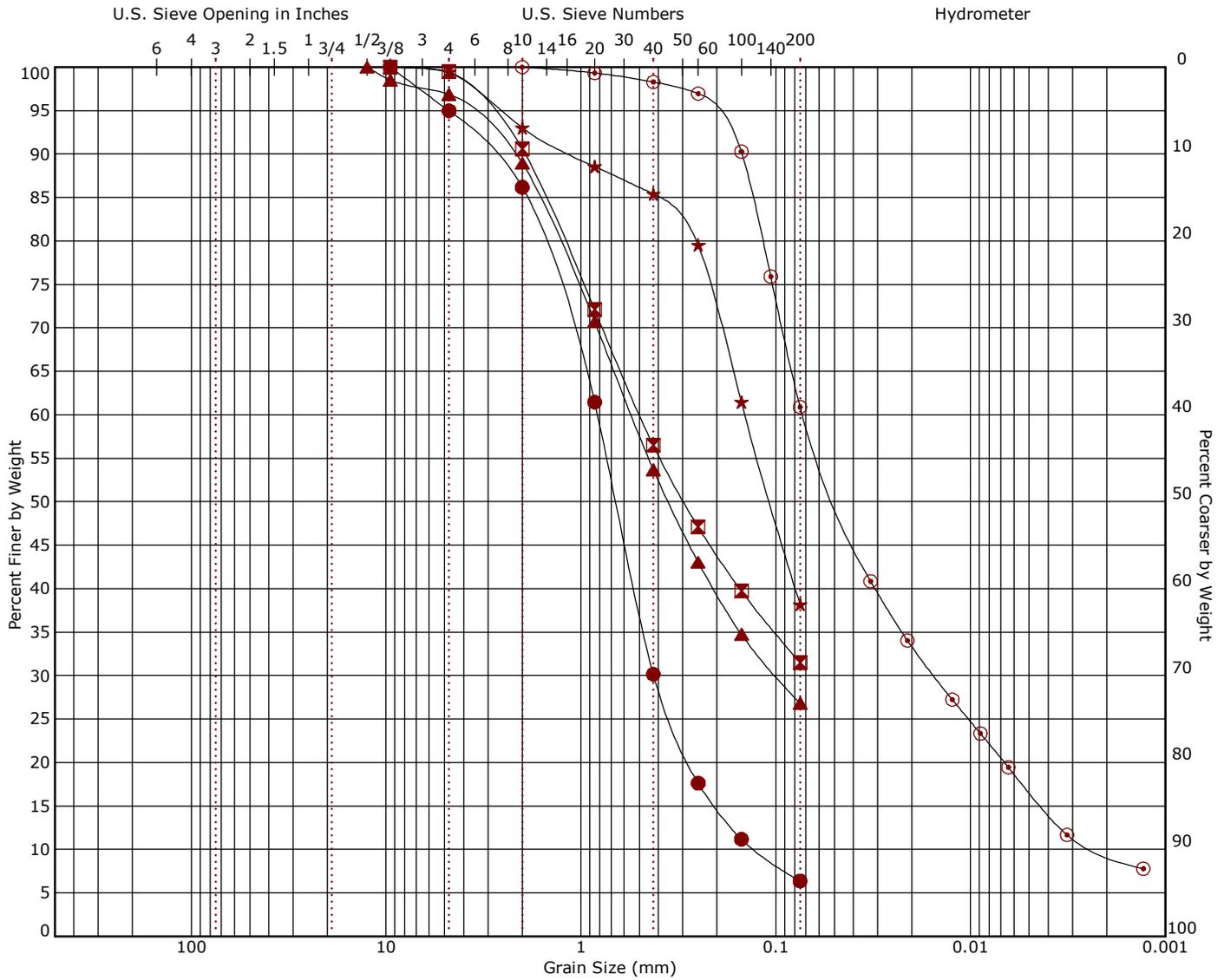


| Boring ID   | Depth (Ft) | USCS Classification | USCS | AASHTO    | LL | PL | PI | Cc   | Cu    |
|-------------|------------|---------------------|------|-----------|----|----|----|------|-------|
| ● S-23-40-1 | 2 - 4      | CLAYEY SAND         | SC   | A-6 (2)   | 32 | 20 | 12 |      |       |
| ■ S-23-40-1 | 6 - 8      | SILTY SAND          | SM   | A-4 (0)   |    |    |    |      |       |
| ▲ S-23-40-1 | 8 - 10     | SILTY SAND          | SM   | A-2-6 (0) | 40 | 29 | 11 | 2.60 | 11.34 |
| ★ S-23-40-1 | 13.5 - 15  | SILTY SAND          | SM   | A-4 (0)   |    |    |    | 5.70 | 35.21 |
| ⊙ S-23-40-2 | 20 - 22    | POORLY GRADED SAND  | SP   | A-1-b (0) |    |    |    | 1.15 | 2.54  |

| Boring ID   | Depth (Ft) | D <sub>100</sub> | D <sub>60</sub> | D <sub>30</sub> | D <sub>10</sub> | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
|-------------|------------|------------------|-----------------|-----------------|-----------------|----------|---------|-------|--------|-------|-------|
| ● S-23-40-1 | 2 - 4      | 12.5             | 0.245           |                 |                 | 0.0      | 3.1     | 54.3  | 42.6   |       |       |
| ■ S-23-40-1 | 6 - 8      | 9.5              | 0.128           |                 |                 | 0.0      | 0.6     | 58.9  | 40.5   |       |       |
| ▲ S-23-40-1 | 8 - 10     | 12.5             | 0.178           | 0.085           | 0.016           | 0.0      | 1.1     | 72.9  |        | 20.5  | 5.5   |
| ★ S-23-40-1 | 13.5 - 15  | 9.5              | 0.122           | 0.049           | 0.003           | 0.0      | 0.1     | 62.2  |        | 26.7  | 11.0  |
| ⊙ S-23-40-2 | 20 - 22    | 9.5              | 0.689           | 0.463           | 0.271           | 0.0      | 0.8     | 97.4  |        | 0.9   | 0.9   |

## Grain Size Distribution

### ASTM D422 / ASTM C136



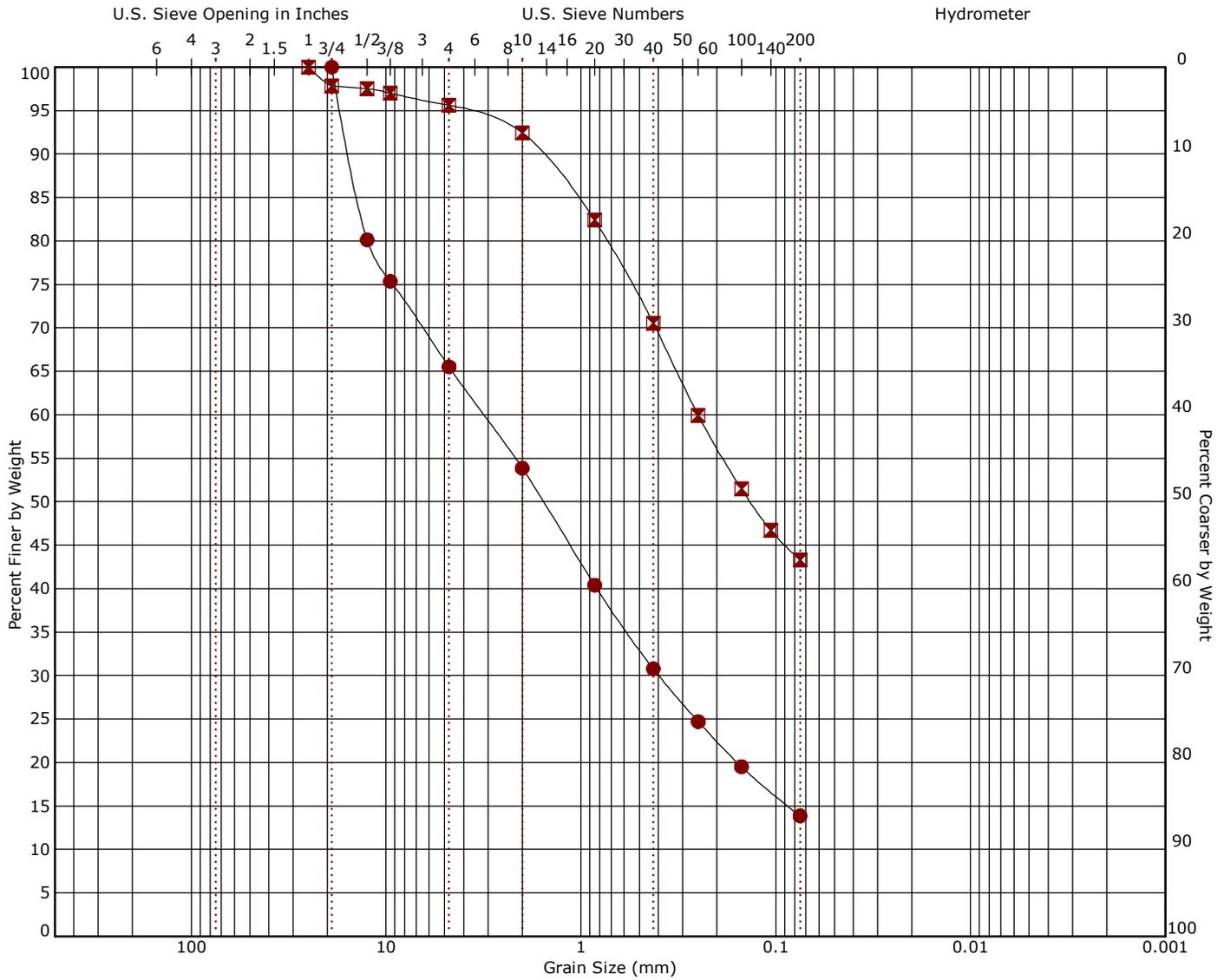
| Boring ID   | Depth (Ft) | USCS Classification        | USCS  | AASHTO    | LL | PL | PI | Cc   | Cu    |
|-------------|------------|----------------------------|-------|-----------|----|----|----|------|-------|
| ● S-23-40-2 | 22 - 24    | WELL GRADED SAND with SILT | SW-SM | A-1-b (0) |    |    |    | 1.71 | 6.50  |
| ■ S-23-40-2 | 29.5 - 31  | SILTY SAND                 | SM    | A-2-4 (0) |    |    |    |      |       |
| ▲ S-23-40-3 | 2 - 4      | SILTY SAND                 | SM    | A-2-4 (0) |    |    |    |      |       |
| ★ S-23-40-3 | 8 - 10     | SILTY SAND                 | SM    | A-4 (0)   |    |    |    |      |       |
| ⊙ S-23-40-3 | 13.5 - 15  | SANDY SILT                 | ML    | A-5 (5)   | 42 | 32 | 10 | 1.51 | 33.26 |

| Boring ID   | Depth (Ft) | D <sub>100</sub> | D <sub>60</sub> | D <sub>30</sub> | D <sub>10</sub> | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
|-------------|------------|------------------|-----------------|-----------------|-----------------|----------|---------|-------|--------|-------|-------|
| ● S-23-40-2 | 22 - 24    | 9.5              | 0.823           | 0.422           | 0.127           | 0.0      | 5.0     | 88.6  | 6.4    |       |       |
| ■ S-23-40-2 | 29.5 - 31  | 9.5              | 0.497           |                 |                 | 0.0      | 0.5     | 68.0  | 31.5   |       |       |
| ▲ S-23-40-3 | 2 - 4      | 12.5             | 0.549           | 0.099           |                 | 0.0      | 3.1     | 70.0  | 26.8   |       |       |
| ★ S-23-40-3 | 8 - 10     | 9.5              | 0.144           |                 |                 | 0.0      | 0.5     | 61.3  | 38.2   |       |       |
| ⊙ S-23-40-3 | 13.5 - 15  | 2                | 0.072           | 0.015           | 0.002           | 0.0      | 0.0     | 39.1  |        | 44.2  | 16.7  |

## Grain Size Distribution

### ASTM D422 / ASTM C136



Cobbles | 
 Gravel | 
 Sand | 
 Silt or Clay

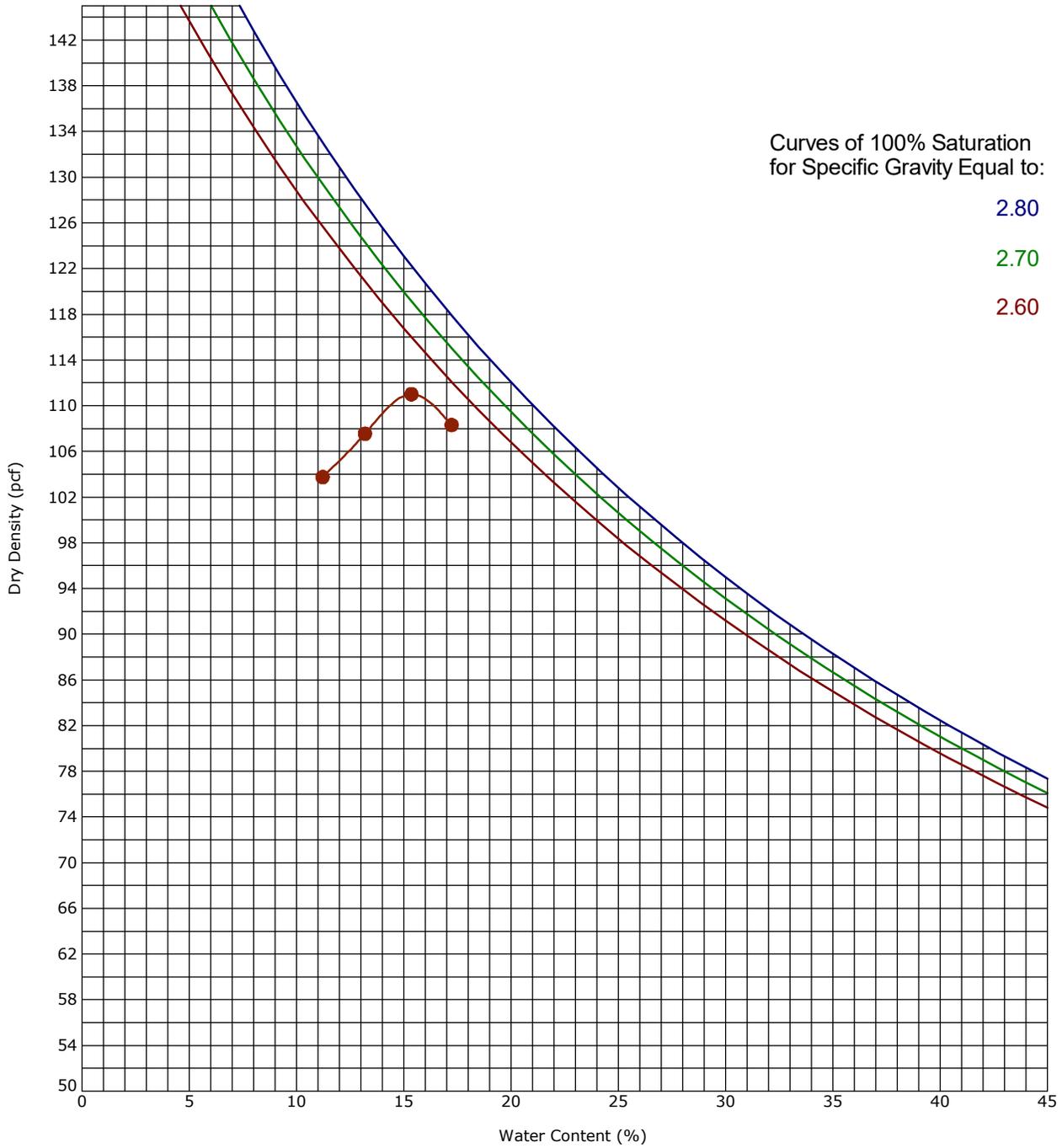
coarse | fine | coarse | medium | fine

| Boring ID               | Depth (Ft) | USCS Classification    | USCS | AASHTO    | LL | PL | PI | Cc | Cu |
|-------------------------|------------|------------------------|------|-----------|----|----|----|----|----|
| ● S-23-40-3             | 23.5 - 25  | SILTY SAND with GRAVEL | SM   | A-1-b (0) |    |    |    |    |    |
| ☒ S-23-40-1/3<br>Offset | 0 - 5      | SILTY SAND             | SM   | A-4 (0)   | NP | NP | NP |    |    |

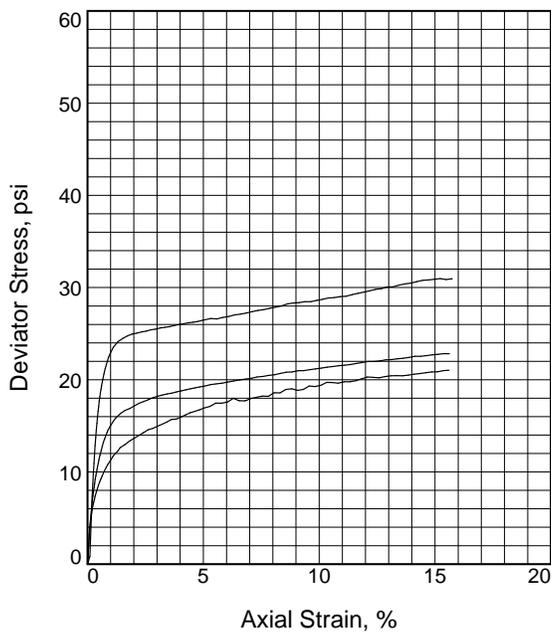
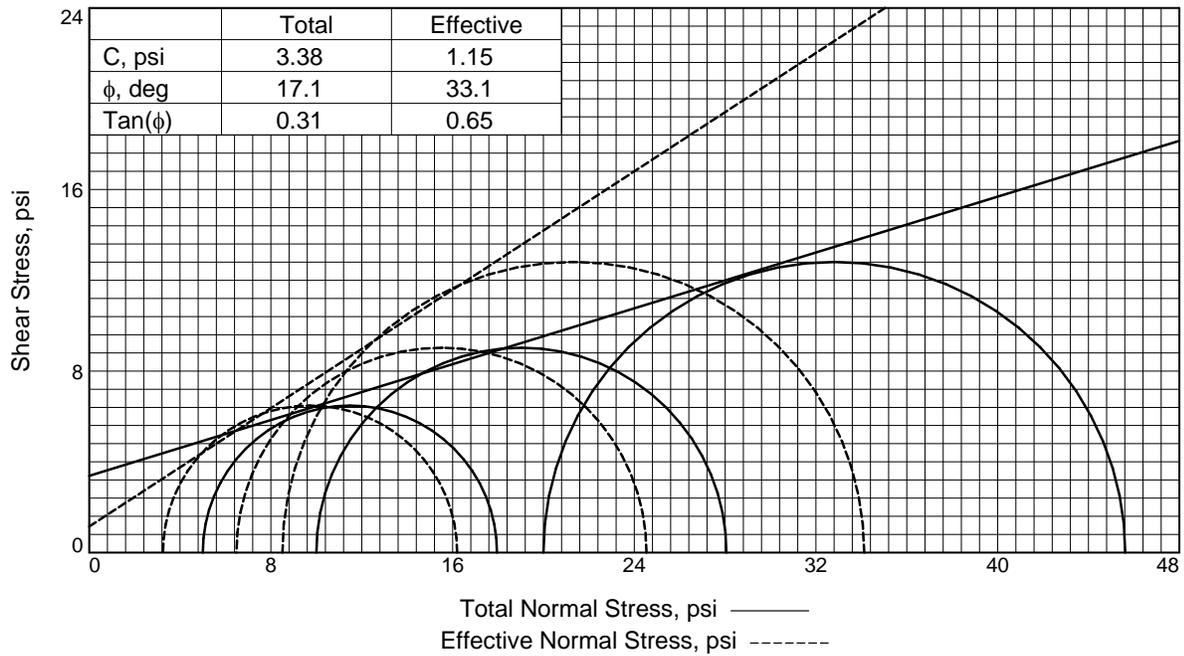
| Boring ID               | Depth (Ft) | D <sub>100</sub> | D <sub>60</sub> | D <sub>30</sub> | D <sub>10</sub> | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
|-------------------------|------------|------------------|-----------------|-----------------|-----------------|----------|---------|-------|--------|-------|-------|
| ● S-23-40-3             | 23.5 - 25  | 19               | 3.153           | 0.397           |                 | 0.0      | 34.5    | 51.7  | 13.9   |       |       |
| ☒ S-23-40-1/3<br>Offset | 0 - 5      | 25               | 0.251           |                 |                 | 0.0      | 4.4     | 52.3  | 43.3   |       |       |

## Moisture-Density Relationship

### ASTM D698-Method B



| Boring ID          |                    | Depth (Ft) |    | Description of Materials |                    |                           |                           |  |
|--------------------|--------------------|------------|----|--------------------------|--------------------|---------------------------|---------------------------|--|
| S-23-40-1/3 Offset |                    | 0 - 5      |    | SILTY SAND(SM)           |                    |                           |                           |  |
| Fines (%)          | Fraction > mm size | LL         | PL | PI                       | Test Method        | Maximum Dry Density (pcf) | Optimum Water Content (%) |  |
| 43                 | 0.0                | NP         | NP | NP                       | ASTM D698-Method B | 111.0                     | 15.4                      |  |



| Sample No.                    | 1                | 2      | 3      |        |
|-------------------------------|------------------|--------|--------|--------|
| Initial                       | Water Content, % | 15.4   | 15.7   | 15.5   |
|                               | Dry Density, pcf | 105.5  | 105.6  | 105.6  |
|                               | Saturation, %    | 69.4   | 71.0   | 70.1   |
|                               | Void Ratio       | 0.5971 | 0.5964 | 0.5955 |
|                               | Diameter, in.    | 2.80   | 2.80   | 2.80   |
|                               | Height, in.      | 5.62   | 5.62   | 5.62   |
| At Test                       | Water Content, % | 20.2   | 20.8   | 19.4   |
|                               | Dry Density, pcf | 109.0  | 108.0  | 110.7  |
|                               | Saturation, %    | 100.0  | 100.0  | 100.0  |
|                               | Void Ratio       | 0.5467 | 0.5604 | 0.5227 |
|                               | Diameter, in.    | 2.76   | 2.77   | 2.75   |
|                               | Height, in.      | 5.58   | 5.58   | 5.54   |
| Strain rate, in./min.         | 0.001            | 0.001  | 0.001  |        |
| Back Pressure, psi            | 50.0             | 50.0   | 50.0   |        |
| Cell Pressure, psi            | 55.0             | 60.0   | 70.0   |        |
| Fail. Stress, psi             | 13.0             | 18.1   | 25.6   |        |
| Excess Pore Pr., psi          | 1.8              | 3.5    | 11.5   |        |
| Ult. Stress, psi              | 20.9             | 22.8   | 30.9   |        |
| Excess Pore Pr., psi          | -2.2             | 1.2    | 9.4    |        |
| $\bar{\sigma}_1$ Failure, psi | 16.2             | 24.5   | 34.1   |        |
| $\bar{\sigma}_3$ Failure, psi | 3.2              | 6.5    | 8.5    |        |

**Type of Test:**

CU with Pore Pressures

**Sample Type:** Remolded

**Description:** Silty Sand (SM)

LL= NV

PI= NP

**Specific Gravity=** 2.7

**Remarks:** Specimens were remolded to approximately 95% MDD at optimum water content.

**Figure** \_\_\_\_\_

**Client:** HNTB North Carolina PC

**Project:** S-23-40 BRO South Saluda River

**Source of Sample:** S-23-40-1/3 Offset **Depth:** 0-5'

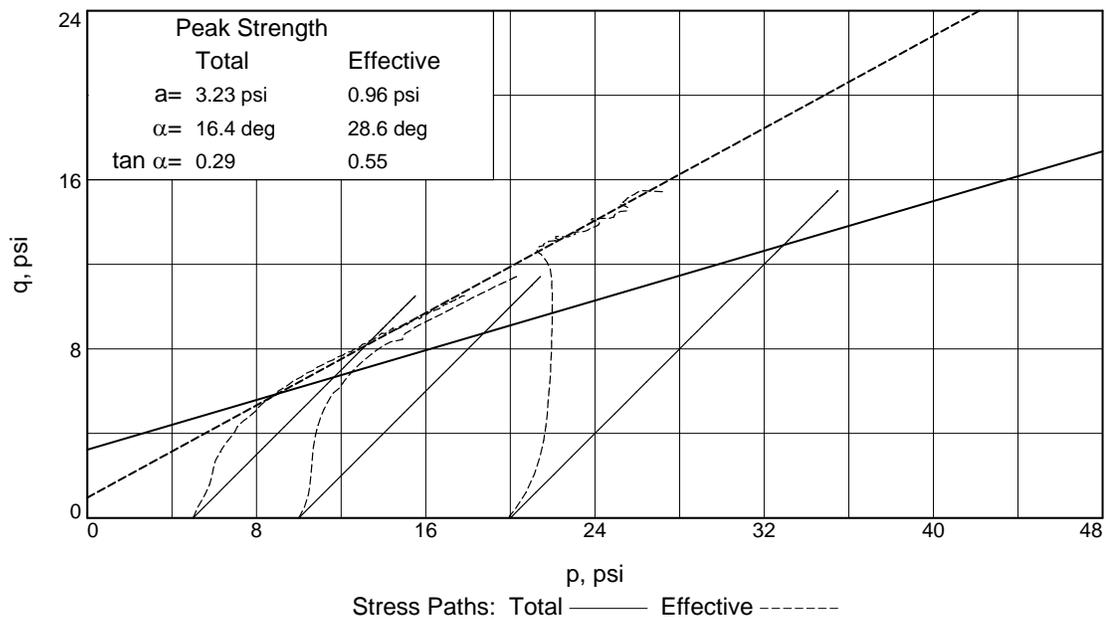
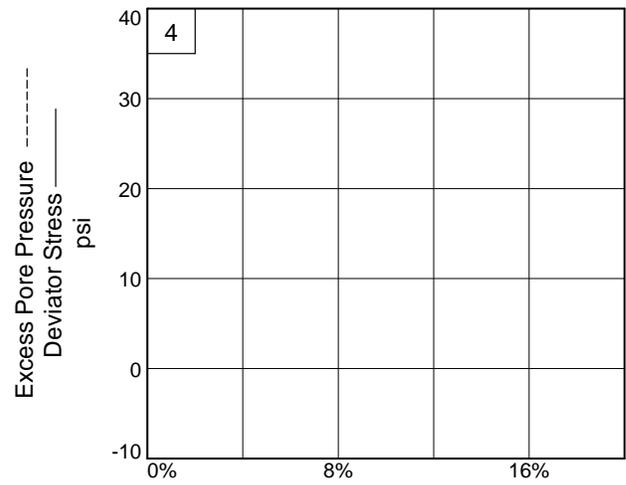
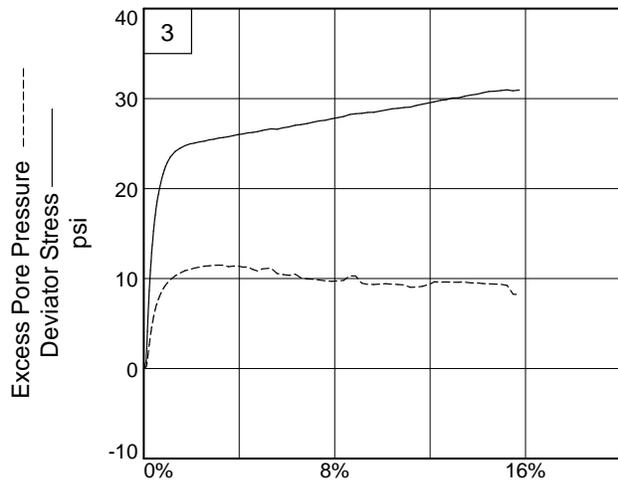
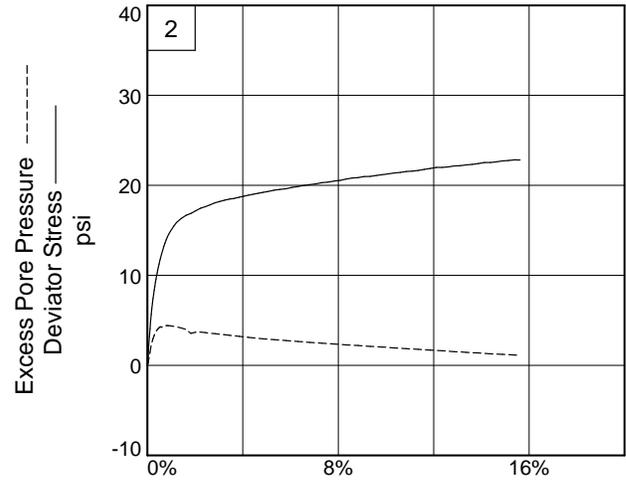
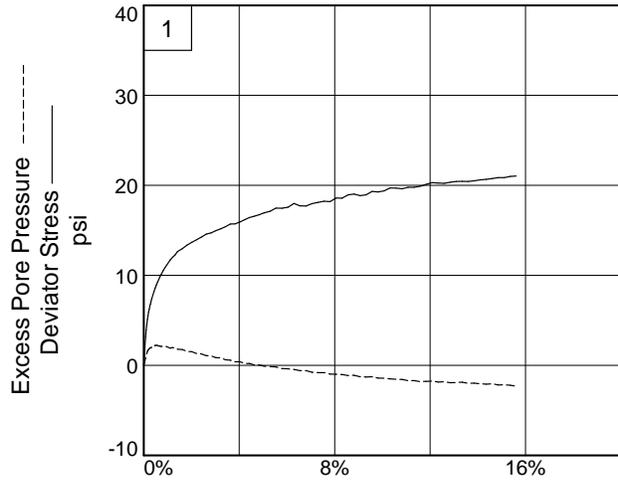
**Proj. No.:** 8623P180

**Date Sampled:** N/A

TRIAXIAL SHEAR TEST REPORT

Terracon Consultants, Inc.

Chattanooga, TN



**Client:** HNTB North Carolina PC

**Project:** S-23-40 BRO South Saluda River

**Source of Sample:** S-23-40-1/3 Offset **Depth:** 0-5'

**Project No.:** 8623P180

**Figure** \_\_\_\_\_

**Terracon Consultants, Inc.**

750 Pilot Road, Suite F  
Las Vegas, Nevada 89119  
(702) 597-9393



**Client**

HNTB North Carolina PC

**Project**

S-23-40 BRO South Saluda River

**Sample Submitted By:** Terracon (86)

**Date Received:** 8/29/2024

**Lab No.:** 24-0289

**Results of Corrosion Analysis**

|  |           |
|--|-----------|
| <b>Sample Number</b>                                 | S-23-40-1 |
| <b>Sample Location</b>                               | --        |
| <b>Sample Depth (ft.)</b>                            | 2.0-20.0  |
| pH Analysis, AASHTO T289                             | 5.94      |
| Water Soluble Sulfate (SO4), AASHTO T290 (mg/kg)     | 47        |
| Chlorides, AASHTO T291, (mg/kg)                      | 133       |
| Saturated Minimum Resistivity, AASHTO T288, (ohm-cm) | 7370      |

A handwritten signature in black ink, appearing to read 'N. Campo'.

**Analyzed By** \_\_\_\_\_

Nathan Campo  
Laboratory Coordinator

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

**Appendix C – Supporting Documents**

S-23-40 BRO South Saluda River | Greenville County, SC  
Terracon Project No. 8623P180 | SCDOT Project ID: P041160



## **Appendix C**

### **Supporting Documents**

Rig Calibration Report – DR#554 (5 Pages)

Rig Calibration Report – DR#1327 (8 Pages)

Note: All exhibits are one page unless noted above.

# For Borings S-23-40-1 and S-23-40-3

## SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: GeoProbe 3126

Drill Rig Serial Number: 3126TTS52010006

Asset Number: DR#554

August 21, 2023



July 19, 2023

Terracon  
72 Pointe Circle  
Greenville, South Carolina 29607

Attn: Maggie McKenney  
E: m.mckenney@terracon.com

**Re:** SPT Automatic Hammer Energy Measurement Report  
Rig Serial Number: 3126TTS52010006  
Terracon Project Number: DYX0500

Dear Ms. McKenney:

This report provides the Energy Transfer Ratio (ETR) for the Standard Penetration Testing (SPT) automatic hammer as summarized below:

**Table 1: Hammer Efficiency Summary**

| Drill Rig Make/Model | Drill Rig Serial Number | Drill Rig Year | Asset Number | Energy Transfer Ratio (ETR) | Hammer Efficiency Correction (Ce) |
|----------------------|-------------------------|----------------|--------------|-----------------------------|-----------------------------------|
| GeoProbe 3126        | 3126TTS52010006         | 2021           | GP#554       | 88.5% ± 4.2%                | 1.48                              |

If you have any questions concerning this summary, or if we may be of further service, please contact us.

*Jim Smith*

James P. Smith  
National Manager of Equipment & Training

*Rob Kramer*

Rob Kramer  
Group Manager Geophysics

Attachments:

- Exhibit A: PDA SPT Analyzer Results
- Exhibit B: PDA Equipment Calibration

Prepared for:

Terracon  
Greenville-Spartanburg, South Carolina



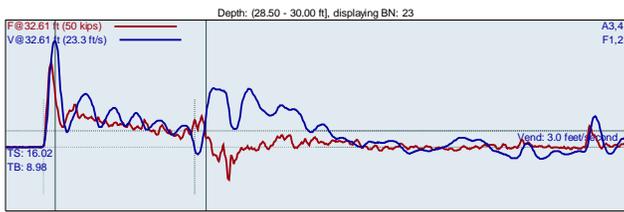
### MEASUREMENT SUMMARY

| ITEM                          | DESCRIPTION   |
|-------------------------------|---|
| Drill Rig Owner               | Terracon Greenville-Spartanburg – Greenville, SC  |
| Drill Rig Operator            | Brett Burnett; Terracon Exploration Services  |
| Testing Date                  | 08/21/2023  |
| Testing Location              | Spartanburg, SC   |
| Boring Identification         | B-1   |
| Hammer Type                   | 140 pounds (automatic)  |
| Boring Method                 | Hollow Stem Auger   |
| Drill Rods                    | <ul style="list-style-type: none"> <li>AWJ</li> <li>1-3/4" outside diameter</li> <li>3/16" wall thickness</li> </ul>  |
| Calibration Testing Equipment | <ul style="list-style-type: none"> <li>2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers</li> <li>Model SPT Analyzer™ (PDA)</li> </ul>  |
| ASTM Methods Used             | <p><b>ASTM D1586</b>, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils</p> <p><b>ASTM D4633-16</b>, Standard Method for Energy Measurement for Dynamic Penetrometers</p> |
| SPT Calibration Personnel     | Jim Smith, National Manager of Equipment and Training   |

### Exhibit A

### PDA SPT Analyzer Results

GP554-3126 28.530  
JIM SMITH Interval start: 8/21/2023  
TB-1  
AR: 1.20 in/2 SP: 0.492 k/ft3  
LE: 32.61 ft EM: 30000 ksi  
WS: 16807.9 fts



F1 : [648AWJ1] 226.21 PDICAL (1) FF1 A3 (PR): [K4483] 410.187 mv/6.4w5000g (1) VF1  
F2 : [648AWJ2] 225.58 PDICAL (1) FF1 A4 (PR): [K10491] 421.907 mv/6.4w5000g (1) VF1

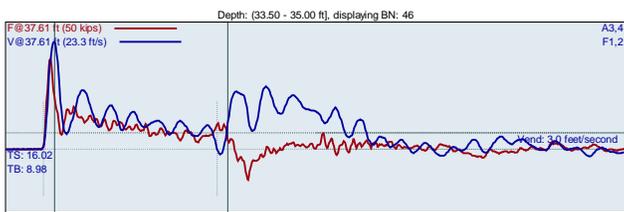
FMX: Maximum Force EFV: Maximum Energy  
VMX: Maximum Velocity ETR: Energy Transfer Ratio - Rated  
BPM: Blows/Minute

| BL# | BC /6" | FMX kips | VMX fts | BPM bpm | EFV ft-lb | ETR % |
|-----|--------|----------|---------|---------|-----------|-------|
| 1   | 6      | 40       | 19.4    | 1.9     | 234       | 84.1  |
| 2   | 6      | 39       | 19.2    | 51.9    | 232       | 83.4  |
| 3   | 6      | 25       | 16.9    | 52.7    | 274       | 78.2  |
| 4   | 6      | 28       | 17.9    | 52.4    | 273       | 77.9  |
| 5   | 6      | 32       | 19.6    | 52.6    | 294       | 83.9  |
| 6   | 6      | 27       | 17.3    | 53.1    | 269       | 79.5  |
| 7   | 8      | 38       | 19.0    | 52.7    | 289       | 82.5  |
| 8   | 8      | 39       | 19.6    | 52.4    | 305       | 87.2  |
| 9   | 8      | 36       | 19.2    | 52.7    | 290       | 82.8  |
| 10  | 8      | 28       | 18.2    | 52.5    | 292       | 83.4  |
| 11  | 8      | 38       | 19.0    | 53.0    | 293       | 83.8  |
| 12  | 8      | 35       | 19.4    | 52.6    | 282       | 80.4  |
| 13  | 8      | 36       | 19.1    | 52.9    | 299       | 85.3  |
| 14  | 8      | 34       | 19.8    | 52.8    | 307       | 87.7  |
| 15  | 11     | 34       | 19.5    | 52.7    | 307       | 87.6  |
| 16  | 11     | 33       | 19.5    | 52.9    | 299       | 85.6  |
| 17  | 11     | 36       | 19.4    | 52.7    | 308       | 88.1  |
| 18  | 11     | 37       | 18.5    | 52.8    | 320       | 91.4  |
| 19  | 11     | 32       | 19.6    | 52.9    | 301       | 86.1  |
| 20  | 11     | 39       | 18.7    | 52.9    | 301       | 85.9  |
| 21  | 11     | 26       | 17.5    | 52.8    | 277       | 79.1  |
| 22  | 11     | 30       | 19.1    | 52.6    | 306       | 87.4  |
| 23  | 11     | 33       | 19.5    | 52.7    | 298       | 85.1  |
| 24  | 11     | 35       | 19.9    | 52.4    | 303       | 86.5  |
| 25  | 11     | 36       | 19.4    | 53.1    | 313       | 89.6  |

| Average     | 34 | 19.2 | 52.8 | 299 | 85.6 |
|-------------|----|------|------|-----|------|
| Std Dev     | 3  | 0.6  | 0.2  | 10  | 3.0  |
| Maximum     | 39 | 19.9 | 53.1 | 320 | 91.4 |
| Minimum     | 26 | 17.5 | 52.4 | 277 | 79.1 |
| N-value: 19 |    |      |      |     |      |

Sample Interval Time: 27.36 seconds.

GP554-3126 28.530  
JIM SMITH Interval start: 8/21/2023  
TB-1  
AR: 1.20 in/2 SP: 0.492 k/ft3  
LE: 37.61 ft EM: 30000 ksi  
WS: 16807.9 fts



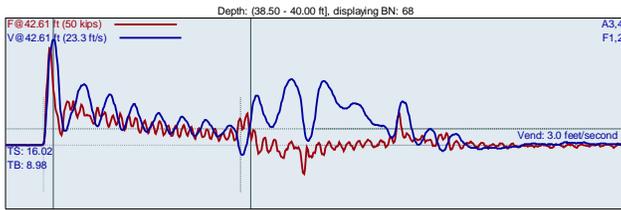
F1 : [648AWJ1] 226.21 PDICAL (1) FF1 A3 (PR): [K4483] 410.187 mv/6.4w5000g (1) VF1  
F2 : [648AWJ2] 225.58 PDICAL (1) FF1 A4 (PR): [K10491] 421.907 mv/6.4w5000g (1) VF1

FMX: Maximum Force EFV: Maximum Energy  
VMX: Maximum Velocity ETR: Energy Transfer Ratio - Rated  
BPM: Blows/Minute

| BL#         | BC /6" | FMX kips | VMX fts | BPM bpm | EFV ft-lb | ETR % |
|-------------|--------|----------|---------|---------|-----------|-------|
| 26          | 5      | 38       | 19.1    | 1.9     | 302       | 86.4  |
| 27          | 5      | 35       | 18.9    | 52.0    | 301       | 86.1  |
| 28          | 5      | 29       | 18.8    | 52.0    | 299       | 85.5  |
| 29          | 5      | 35       | 19.2    | 52.7    | 299       | 85.5  |
| 30          | 5      | 37       | 19.4    | 52.5    | 297       | 84.8  |
| 31          | 8      | 37       | 19.5    | 52.4    | 307       | 87.7  |
| 32          | 8      | 26       | 16.4    | 52.7    | 282       | 80.5  |
| 33          | 8      | 34       | 19.5    | 52.4    | 307       | 87.6  |
| 34          | 8      | 40       | 19.1    | 52.2    | 307       | 87.6  |
| 35          | 8      | 37       | 19.4    | 52.6    | 299       | 85.5  |
| 36          | 8      | 40       | 20.6    | 52.4    | 321       | 91.7  |
| 37          | 8      | 41       | 19.6    | 52.8    | 308       | 87.9  |
| 38          | 8      | 40       | 19.8    | 52.7    | 313       | 89.5  |
| 39          | 10     | 34       | 20.2    | 52.2    | 323       | 92.2  |
| 40          | 10     | 32       | 19.4    | 52.8    | 297       | 84.9  |
| 41          | 10     | 36       | 19.8    | 52.6    | 311       | 88.8  |
| 42          | 10     | 37       | 19.7    | 52.5    | 317       | 90.7  |
| 43          | 10     | 35       | 20.0    | 52.6    | 324       | 92.6  |
| 44          | 10     | 38       | 19.5    | 52.7    | 308       | 88.1  |
| 45          | 10     | 34       | 20.1    | 52.4    | 322       | 92.0  |
| 46          | 10     | 35       | 19.7    | 52.4    | 322       | 92.0  |
| 47          | 10     | 37       | 19.9    | 52.6    | 314       | 89.7  |
| 48          | 10     | 37       | 19.8    | 52.7    | 332       | 94.8  |
| Average     |        |          |         |         |           |       |
|             |        | 36       | 19.6    | 52.6    | 312       | 89.1  |
| Std Dev     |        |          |         |         |           |       |
|             |        | 3        | 0.8     | 0.2     | 12        | 3.3   |
| Maximum     |        |          |         |         |           |       |
|             |        | 41       | 20.6    | 52.8    | 332       | 94.8  |
| Minimum     |        |          |         |         |           |       |
|             |        | 26       | 16.4    | 52.2    | 282       | 80.5  |
| N-value: 18 |        |          |         |         |           |       |

Sample Interval Time: 25.16 seconds.

GP554-3126 28.5-30  
JIM SMITH Interval start: 8/21/2023  
TB-1 SP: 0.492 k/ft  
AR: 1.20 in/2 EM: 30000 ksi  
LE: 42.61 ft  
WS: 16807.9 ft/s



F1 : [648AWJ1] 226.21 PDICAL (1) FF1 A3 (PR): [K4483] 410.187 mv/6.4w/5000g (1) VF1  
F2 : [648AWJ2] 225.58 PDICAL (1) FF1 A4 (PR): [K10491] 421.907 mv/6.4w/5000g (1) VF1

| BL#         | BC /6" | FMX kips | VMX ft/s | BPM bpm | EFV ft-lb | ETR % |
|-------------|--------|----------|----------|---------|-----------|-------|
| 49          | 5      | 34       | 19.6     | 1.9     | 307       | 87.6  |
| 50          | 5      | 34       | 19.3     | 52.0    | 301       | 86.1  |
| 51          | 5      | 27       | 16.5     | 52.7    | 279       | 79.4  |
| 52          | 5      | 33       | 19.9     | 52.5    | 310       | 88.6  |
| 53          | 5      | 29       | 17.7     | 52.7    | 288       | 82.2  |
| 54          | 8      | 29       | 18.6     | 52.5    | 295       | 84.2  |
| 55          | 8      | 23       | 15.6     | 52.9    | 287       | 82.0  |
| 56          | 8      | 34       | 20.1     | 52.6    | 323       | 92.2  |
| 57          | 8      | 28       | 18.1     | 52.8    | 295       | 84.3  |
| 58          | 8      | 38       | 18.8     | 53.1    | 312       | 89.1  |
| 59          | 8      | 35       | 19.2     | 52.6    | 329       | 94.0  |
| 60          | 8      | 36       | 19.3     | 52.9    | 327       | 93.3  |
| 61          | 8      | 40       | 19.7     | 52.8    | 323       | 92.4  |
| 62          | 9      | 35       | 18.8     | 53.0    | 320       | 91.3  |
| 63          | 9      | 37       | 19.1     | 52.7    | 320       | 91.3  |
| 64          | 9      | 35       | 19.9     | 52.9    | 327       | 93.4  |
| 65          | 9      | 29       | 18.8     | 52.7    | 314       | 89.7  |
| 66          | 9      | 35       | 19.7     | 53.0    | 342       | 97.8  |
| 67          | 9      | 36       | 19.9     | 52.8    | 331       | 94.5  |
| 68          | 9      | 38       | 19.3     | 52.8    | 335       | 95.8  |
| 69          | 9      | 36       | 19.9     | 52.5    | 325       | 92.9  |
| 70          | 9      | 39       | 19.5     | 52.9    | 329       | 94.0  |
| Average     |        | 34       | 19.1     | 52.8    | 320       | 91.3  |
| Std Dev     |        | 4        | 1.0      | 0.2     | 15        | 4.1   |
| Maximum     |        | 40       | 20.1     | 53.1    | 342       | 97.8  |
| Minimum     |        | 23       | 15.6     | 52.5    | 287       | 82.0  |
| N-value: 17 |        |          |          |         |           |       |

Sample Interval Time: 23.91 seconds.

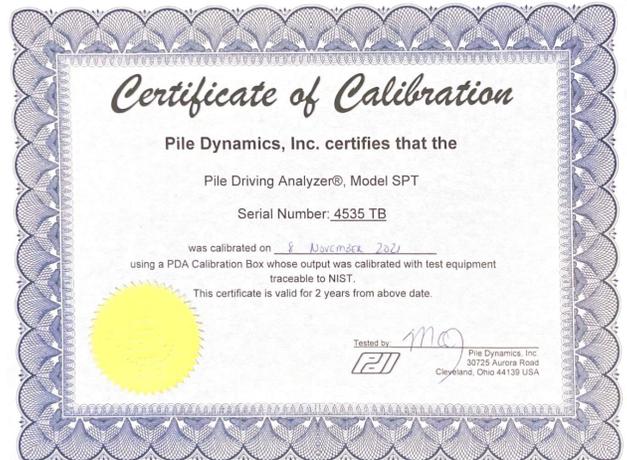
Summary of SPT Test Results

Project: GP554-3126, Test Date: 8/21/2023

| Blow/Minute             | Force   | N     | N60   | Average FMX | Average VMX | Average BPM | Average EFV | Average ETR |
|-------------------------|---------|-------|-------|-------------|-------------|-------------|-------------|-------------|
| Length                  | Applied | Value | Value | kips        | ft/s        | bpm         | ft-lb       | %           |
| ft                      | /ft     |       |       |             |             |             |             |             |
| 32.61                   | 6-8-11  | 19    | 28    | 34          | 19.2        | 52.8        | 299         | 85.6        |
| 37.61                   | 5-8-10  | 18    | 26    | 36          | 19.6        | 52.6        | 312         | 89.1        |
| 42.61                   | 5-9-9   | 17    | 25    | 34          | 19.1        | 52.8        | 320         | 91.3        |
| Overall Average Values: |         |       |       | 35          | 19.3        | 52.7        | 310         | 88.5        |
| Standard Deviation:     |         |       |       | 4           | 0.8         | 0.2         | 15          | 4.2         |
| Overall Maximum Value:  |         |       |       | 41          | 20.6        | 53.1        | 342         | 97.8        |
| Overall Minimum Value:  |         |       |       | 23          | 15.6        | 52.2        | 277         | 79.1        |



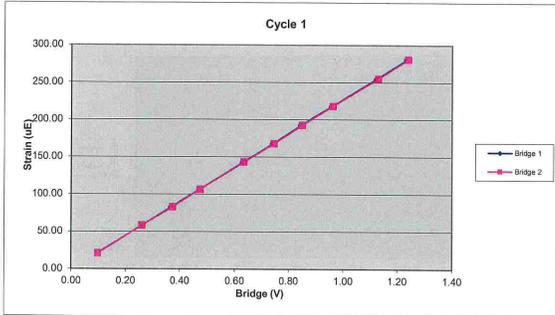
**Exhibit B**  
**PDA Equipment Calibration**



| 648AWJ |            | Cycle 1     |              |              |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1      | 0.00       | 0.00        | 0.00         | 0.00         |
| 2      | 799.99     | 21.12       | 0.10         | 0.10         |
| 3      | 2111.63    | 58.22       | 0.26         | 0.26         |
| 4      | 2997.39    | 82.70       | 0.37         | 0.37         |
| 5      | 3848.07    | 106.26      | 0.47         | 0.47         |
| 6      | 5131.83    | 143.07      | 0.63         | 0.63         |
| 7      | 6017.79    | 167.81      | 0.74         | 0.75         |
| 8      | 6872.07    | 192.74      | 0.85         | 0.85         |
| 9      | 7783.57    | 218.15      | 0.96         | 0.96         |
| 10     | 9136.93    | 255.02      | 1.12         | 1.13         |
| 11     | 10026.70   | 280.73      | 1.24         | 1.24         |

| Bridge 1                  |          | Bridge 2                  |          |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V)  | 8120.30  | Force Calibration (lb/V)  | 8089.75  |
| Offset                    | -4.24    | Offset                    | -2.24    |
| Correlation               | 0.999998 | Correlation               | 0.999995 |
| Strain Calibration (µE/V) | 228.56   | Strain Calibration (µE/V) | 227.70   |
| Offset                    | -1.57    | Offset                    | -1.51    |
| Correlation               | 0.999991 | Correlation               | 0.999983 |

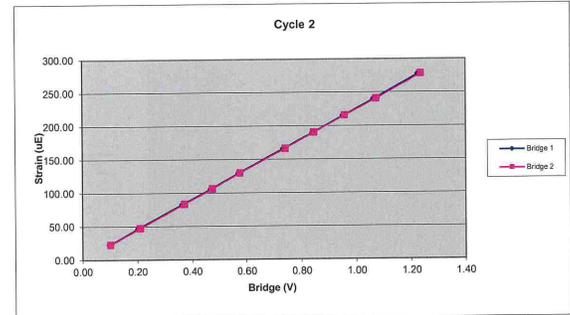
| Force Strain Calibration |          |
|--------------------------|----------|
| EA (Kips)                | 35527.98 |
| Offset                   | 51.69    |
| Correlation              | 0.999986 |



| 648AWJ |            | Cycle 2     |              |              |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1      | 0.00       | 0.00        | 0.00         | 0.00         |
| 2      | 805.54     | 22.23       | 0.10         | 0.10         |
| 3      | 1679.81    | 47.04       | 0.20         | 0.21         |
| 4      | 2989.11    | 83.03       | 0.37         | 0.37         |
| 5      | 3830.62    | 105.81      | 0.47         | 0.47         |
| 6      | 4658.00    | 129.50      | 0.57         | 0.58         |
| 7      | 5984.74    | 165.81      | 0.74         | 0.74         |
| 8      | 6848.87    | 189.76      | 0.84         | 0.84         |
| 9      | 7747.90    | 215.15      | 0.95         | 0.96         |
| 10     | 8674.21    | 240.08      | 1.07         | 1.07         |
| 11     | 9994.82    | 277.48      | 1.23         | 1.24         |

| Bridge 1                  |          | Bridge 2                  |          |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V)  | 8127.14  | Force Calibration (lb/V)  | 8103.79  |
| Offset                    | 10.37    | Offset                    | -14.59   |
| Correlation               | 0.999997 | Correlation               | 0.999997 |
| Strain Calibration (µE/V) | 225.29   | Strain Calibration (µE/V) | 224.64   |
| Offset                    | 0.36     | Offset                    | -0.33    |
| Correlation               | 0.999990 | Correlation               | 0.999992 |

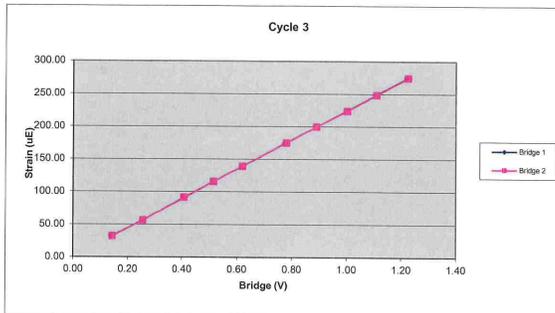
| Force Strain Calibration |          |
|--------------------------|----------|
| EA (Kips)                | 36073.41 |
| Offset                   | -2.66    |
| Correlation              | 0.999993 |



| 648AWJ |            | Cycle 3     |              |              |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1      | 0.00       | 0.00        | 0.00         | 0.00         |
| 2      | 1153.24    | 31.90       | 0.14         | 0.14         |
| 3      | 2056.55    | 56.28       | 0.26         | 0.26         |
| 4      | 3310.19    | 91.18       | 0.41         | 0.41         |
| 5      | 4155.51    | 115.51      | 0.51         | 0.51         |
| 6      | 5035.81    | 139.16      | 0.62         | 0.62         |
| 7      | 6303.78    | 175.10      | 0.78         | 0.78         |
| 8      | 7221.91    | 199.87      | 0.89         | 0.89         |
| 9      | 8120.94    | 223.92      | 1.00         | 1.00         |
| 10     | 9001.15    | 248.68      | 1.11         | 1.11         |
| 11     | 9931.66    | 274.33      | 1.22         | 1.23         |

| Bridge 1                  |          | Bridge 2                  |          |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V)  | 8132.32  | Force Calibration (lb/V)  | 8118.57  |
| Offset                    | -20.37   | Offset                    | -15.36   |
| Correlation               | 0.999998 | Correlation               | 0.999997 |
| Strain Calibration (µE/V) | 224.79   | Strain Calibration (µE/V) | 224.41   |
| Offset                    | -0.57    | Offset                    | -0.43    |
| Correlation               | 0.999984 | Correlation               | 0.999985 |

| Force Strain Calibration |          |
|--------------------------|----------|
| EA (Kips)                | 36175.62 |
| Offset                   | 0.42     |
| Correlation              | 0.999984 |



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

| Calibration Factors | 648AWJ   | Bridge 2 (µE/V)         | 225.58 |
|---------------------|----------|-------------------------|--------|
| Bridge 1 (µE/V)     | 226.21   | Area (in <sup>2</sup> ) | 1.20   |
| EA Factor (Kips)    | 35925.67 |                         |        |

Calibrated by: *Aht*  
Calibrated Date: 3/3/2022

Pile Dynamics Inc  
30725 Aurora Rd  
Solon, OH 44139

Traceable to N.I.S.T.

**Accelerometer Calibration Certificate**  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on 26Oct2021

Serial No: K4483      Temperature: 22.1 °C  
Model: PR      Humidity: 45%  
Calibrated on: Channel 3 on 8G 5161 LE

**PDA CALIBRATION FACTOR**  
410.2 mv/5000g  
(62.0 µv/g)  
R<sup>2</sup>: 0.999973 [Chip programmed]

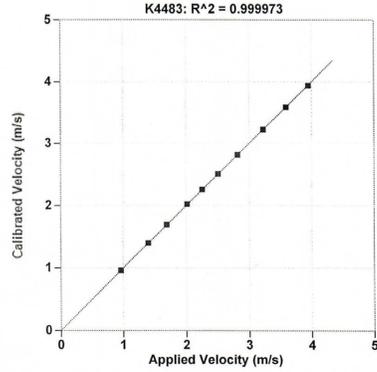
Operator: William Johnson

*William Johnson*  
Signed

Ref Acc 1: 690961      Cal on: 27Jan2021  
978 g's/volt

Ref Acc 2: 691321      Cal on: 09Feb2021  
960 g's/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



| Reference Velocity m/s | S/N K4483 Velocity m/s |
|------------------------|------------------------|
| 0.964                  | 0.962                  |
| 1.399                  | 1.401                  |
| 1.691                  | 1.700                  |
| 2.014                  | 2.022                  |
| 2.254                  | 2.257                  |
| 2.507                  | 2.508                  |
| 2.815                  | 2.814                  |
| 3.226                  | 3.220                  |
| 3.590                  | 3.591                  |
| 3.947                  | 3.941                  |

Maximum Acceleration: 874 g's

Date printed: 26Oct2021, version: 2020.30.170 0.57

**Accelerometer Calibration Certificate**  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on 25Jan2022

Serial No: K10491      Temperature: 19.3 °C  
Model: PR      Humidity: 30%  
Calibrated on: Channel 3 on 8G 5161 LE

**PDA CALIBRATION FACTOR**  
421.9 mv/5000g  
(84.4 µv/g)  
R<sup>2</sup>: 0.999915 [Chip programmed]

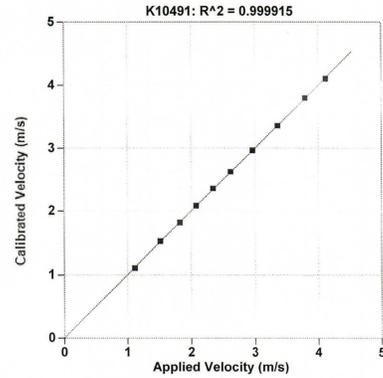
Operator: William Johnson

*William Johnson*  
Signed

Ref Acc 1: 691321      Cal on: 09Feb2021  
960 g's/volt

Ref Acc 2: 690961      Cal on: 27Jan2021  
978 g's/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



| Reference Velocity m/s | S/N K10491 Velocity m/s |
|------------------------|-------------------------|
| 1.117                  | 1.106                   |
| 1.518                  | 1.521                   |
| 1.823                  | 1.818                   |
| 2.078                  | 2.084                   |
| 2.344                  | 2.355                   |
| 2.616                  | 2.623                   |
| 2.963                  | 2.969                   |
| 3.360                  | 3.357                   |
| 3.794                  | 3.801                   |
| 4.121                  | 4.104                   |

Maximum Acceleration: 916 g's

Date printed: 25Jan2022, version: 2020.30.170 0.05

# For Boring S-23-40-2

## SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: Geoprobe 3126GT

Drill Rig Serial Number: 3126S5V224106

Asset Number: DR#1327

September 13, 2024

September 13, 2024

Terracon Consultants Inc.  
72 Pointe Circle  
Greenville, SC 29615

Attn: Nitin Dudani  
E: nitin.dudani@terracon.com

Re: SPT Automatic Hammer Energy Measurement Report  
Rig No: 1327  
Terracon Project Number: 73245115

Dear Mr. Dudani:

This report provides the Energy Transfer Ratio (ETR) for the Standard Penetration Testing (SPT) automatic hammer as summarized below:

Table 1: Hammer Efficiency Summary

| Drill Rig Make/Model | Drill Rig Serial Number | Drill Rig Year | Asset Number | Energy Transfer Ratio (ETR) | Hammer Efficiency Correction (C <sub>e</sub> ) |
|----------------------|-------------------------|----------------|--------------|-----------------------------|--|
| Geoprobe             | 3126S5V224106           | 2024           | DR#1327      | 92.6% ± 1.75%               | 1.54   |

\*Please Note: according to ASTM standard, a minimum of three recordings should be collected at five-foot intervals no shallower than twenty feet below current ground surface (bgs). The sample intervals were obtained between 30 and 50 feet bgs.

If you have any questions concerning this summary, or if we may be of further service, please contact us.

Ryan C. Wakeford, P.E.  
Geotechnical Engineer

Susheel R. Kolwalkar, Ph.D., P.E.  
Regional Services Manager

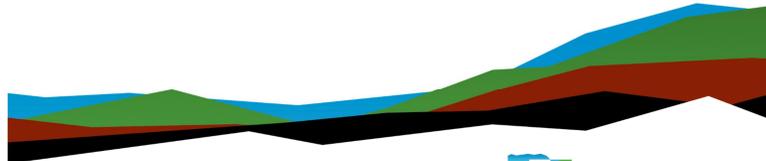


Micah Hatch, P.E.  
Geotechnical Department Manager



Attachments:

- Exhibit A: SPT Representative Blow
- Exhibit B: SPT Analyzer Literature and Equipment Calibrations
- Exhibit C: SPT Analyzer Results
- Exhibit D: Field Log
- Exhibit E: Copy of Certificate of Proficiency



Prepared for:

Terracon Consultants, Inc.  
Greenville, South Carolina



### 1.0 MEASUREMENT SUMMARY

| ITEM                          | DESCRIPTION   |
|-------------------------------|---|
| Drill Rig Owner               | Terracon Consultant, Inc. – Greenville, SC  |
| Drill Rig Operator            | Brett Burnett: Terracon Exploration   |
| Testing Date                  | 9/5/2024  |
| Testing Location              | Sumter County, SC   |
| Boring Identification         | B-3   |
| Energy Measurement Depths     | 30 ft, 40 ft, 45 ft, 50 ft  |
| Subsurface Soils              | Poorly graded sands (SP) to clayey sands (SC)   |
| Hammer Type/Height            | 140 pounds (automatic) with 2.5-foot drop height  |
| Boring Method                 | Mud rotary  |
| Drill Rods                    | <ul style="list-style-type: none"> <li>AWJ</li> <li>1-3/4" outside diameter</li> <li>1-1/4" inside diameter</li> <li>1.15 in<sup>2</sup> cross sectional area</li> <li>1/4" wall thickness</li> </ul>                                 |
| Calibration Testing Equipment | <ul style="list-style-type: none"> <li>2-foot AWJ rod instrumented w/ two strain gauges and two accelerometers manufactured by Pile Dynamics Inc. (PDI)</li> <li>SN: 746AWJ</li> <li>Model SPT Analyzer™ (PDA) SN: 4621 TB</li> </ul> |
| ASTM Methods Used             | <p>ASTM D1586, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils</p> <p>ASTM D4633-16, Standard Method for Energy Measurement for Dynamic Penetrometers</p>                                       |
| SPT Calibration Personnel     | Ryan Wakeford – Intermediate PDA Proficiency, Terracon Consultants, Inc.  |

### 2.0 PURPOSE AND SCOPE OF WORK

The North Charleston office of Terracon Consultants, Inc. conducted SPT energy measurements in accordance with ASTM D4633-16 at a site off Panola Road in Sumter County, South Carolina. Energy measurements on the rig were taken during eight samples events.

### 3.0 TEST RESULTS

Table 2: SPT Hammer Energy Calibration Testing Summary

| Boring | Start Depth <sup>1</sup> (ft) | Rod Length <sup>2</sup> (ft) | Rod Sections <sup>3</sup> |      |       |                        | Measured Blow Counts (blows/6 inches) |                        |                        |    | SPT N <sub>meas</sub> (bpf) | Soil Type <sup>4</sup> |
|--------|-------------------------------|------------------------------|---------------------------|------|-------|------------------------|---------------------------------------|------------------------|------------------------|----|-----------------------------|------------------------|
|        |                               |                              | 2 ft                      | 5 ft | 10 ft | 1 <sup>st</sup> 1 inc. | 2 <sup>nd</sup> 1 inc.                | 3 <sup>rd</sup> 1 inc. | 4 <sup>th</sup> 1 inc. |    |                             |                        |
| B-3    | 28.5                          | 33.7                         | 0                         | 6    | 0     | 4                      | 5                                     | 6                      | -                      | 11 | SP                          |                        |
|        | 38.5                          | 43.7                         | 0                         | 8    | 0     | 7                      | 10                                    | 10                     | -                      | 20 | SP                          |                        |
|        | 43.5                          | 48.7                         | 0                         | 9    | 0     | 4                      | 5                                     | 7                      | -                      | 12 | SP                          |                        |
|        | 48.5                          | 53.7                         | 0                         | 10   | 0     | 4                      | 4                                     | 7                      | -                      | 11 | SP                          |                        |

- Depth from existing ground surface to start of SPT
- Total rod length from instrumentation to bottom of sampler
- Two-foot section is instrumented and is located at top of drill rods
- Soil type visually classified by Terracon

Table 3: Energy Measurement and Analysis Summary

| Boring   | Start Depth <sup>1</sup> (ft) | SPT N <sub>m</sub> (bpf) | No. of Blows <sup>2</sup> | EMX <sup>3</sup> (ft-lbs) |      |      | ETR <sup>3</sup> (%) |      |           |
|----------|-------------------------------|--------------------------|---------------------------|---------------------------|------|------|----------------------|------|-----------|
|          |                               |                          |                           | Max.                      | Min. | Ave. | Std. Dev.            | Ave. | Std. Dev. |
| B-3      | 28.5                          | 11                       | 11                        | 340                       | 313  | 327  | 8.8                  | 93.4 | 2.5       |
|          | 38.5                          | 20                       | 20                        | 334                       | 309  | 318  | 5.6                  | 90.9 | 1.6       |
|          | 43.5                          | 12                       | 12                        | 330                       | 309  | 323  | 5.5                  | 92.4 | 1.6       |
|          | 48.5                          | 11                       | 11                        | 334                       | 320  | 328  | 4.5                  | 93.7 | 1.3       |
| Average: |                               |                          |                           | 335                       | 313  | 334  | 6.1                  | 92.6 | 1.75      |

- Boring ID and depth from existing ground surface to start of SPT
- Number of blows used in energy calibration analysis; limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the first increment if refusal were encountered
- EMX = Maximum Transferred Energy, ETR = Energy Transfer Ratio.

Table 4: Hammer Blow Rate Summary

| Boring   | Start Depth <sup>1</sup><br>(ft) | SPT<br>N <sub>meas</sub><br>(bpf) | No.<br>of<br>Blows <sup>2</sup> | BPM <sup>3</sup> |      |      |           |
|----------|----------------------------------|-----------------------------------|---------------------------------|------------------|------|------|-----------|
|          |                                  |                                   |                                 | Max.             | Min. | Ave. | Std. Dev. |
| B-3      | 28.5                             | 11                                | 11                              | 53.8             | 53.1 | 53.5 | 0.2       |
|          | 38.5                             | 20                                | 20                              | 53.7             | 53.0 | 53.4 | 0.1       |
|          | 43.5                             | 12                                | 12                              | 53.6             | 53.2 | 53.4 | 0.1       |
|          | 48.5                             | 11                                | 11                              | 53.8             | 53.1 | 53.4 | 0.2       |
| Average: |                                  |                                   |                                 | 53.7             | 53.1 | 53.4 | 0.2       |

- Boring ID and depth from existing ground surface to start of SPT.
- Number of blows used in energy calibration analysis. Limited to measurements recorded during the second and third 6-inch sampling intervals at each depth or during the 1st increment if refusal conditions were encountered.
- BPM = Blows per minute

Exhibit A

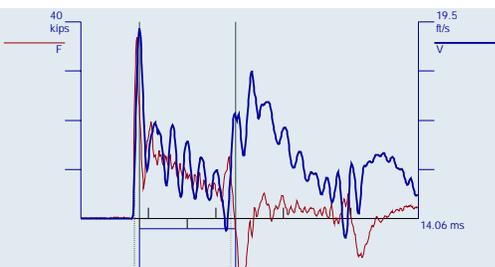
SPT Representative Blow

GRL Engineers, Inc.  
 GEOPROBE 3126GT  
 28.5-30  
 B3  
 PDA Operator: RW

Pile Driving Analyzer ® (PDA)  
 Version: 2022.35.2

GRL Engineers, Inc.  
 GEOPROBE 3126GT  
 38.5-40  
 B3  
 PDA Operator: RW

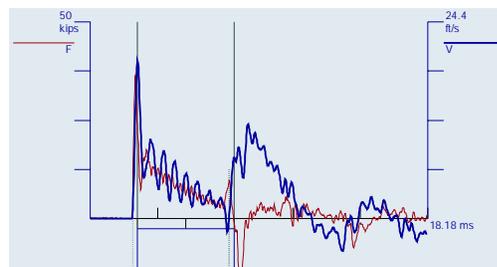
Pile Driving Analyzer ® (PDA)  
 Version: 2022.35.2



BN 13  
 05Sep2024 10:07:23 AM

|     |                         |
|-----|-------------------------|
| CSX | 32.1 ksi                |
| DMX | 1.11 in                 |
| EFV | 331 ft-lb               |
| ETR | 94.7 %                  |
| BPM | 53.8 bpm                |
| RAT | 1.0                     |
| VMX | 18.9 ft/s               |
| FMX | 37 kips                 |
| DFN | 1.00 in                 |
| MEX | 1070 µE                 |
| AMX | 3001 g/s                |
| FVP | 0.6                     |
| LE  | 33.70 ft                |
| AR  | 1.15 in <sup>2</sup>    |
| EM  | 30000 ksi               |
| SP  | 0.492 k-ft <sup>3</sup> |
| WS  | 16807.9 ft/s            |
| WC  | 16766.2 ft/s            |
| JC  | 0.90                    |
| JF  | 1.00                    |

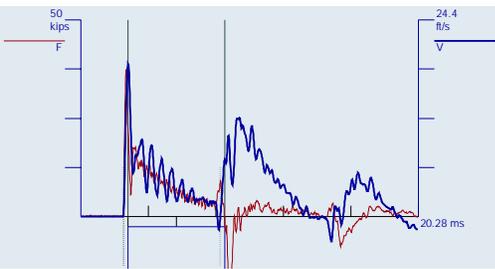
F1: [746AWJ1] 222.05 PDICAL (1) FF1  
 F2: [746AWJ2] 222.19 PDICAL (1) FF1  
 A3 (PR): [K14007] 407.233 mv/6.4v/5000g (1) VF1  
 A4 (PR): [K14006] 375.226 mv/6.4v/5000g (1) VF1



BN 25  
 05Sep2024 10:24:35 AM

|     |                         |
|-----|-------------------------|
| CSX | 31.7 ksi                |
| DMX | 0.66 in                 |
| EFV | 324 ft-lb               |
| ETR | 92.6 %                  |
| BPM | 53.4 bpm                |
| RAT | 1.1                     |
| VMX | 19.6 ft/s               |
| FMX | 36 kips                 |
| DFN | 0.60 in                 |
| MEX | 1056 µE                 |
| AMX | 3358 g/s                |
| LE  | 43.70 ft                |
| AR  | 1.15 in <sup>2</sup>    |
| EM  | 30000 ksi               |
| SP  | 0.492 k-ft <sup>3</sup> |
| WS  | 16807.9 ft/s            |
| WC  | 16807.7 ft/s            |
| JC  | 0.90                    |
| JF  | 1.00                    |

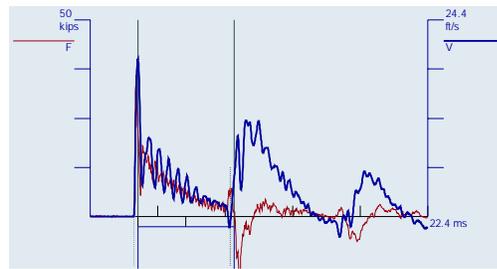
F1: [746AWJ1] 222.05 PDICAL (1) FF1  
 F2: [746AWJ2] 222.19 PDICAL (1) FF1  
 A3 (PR): [K14007] 407.233 mv/6.4v/5000g (1) VF1  
 A4 (PR): [K14006] 375.226 mv/6.4v/5000g (1) VF1



BN 14  
05Sep2024 10:32:57 AM

|     |                         |
|-----|-------------------------|
| CSX | 32.6 ksi                |
| DMX | 0.91 in                 |
| EFV | 325 ft-lb               |
| ETR | 92.8 %                  |
| BPM | 53.4 bpm                |
| RAT | 1.0                     |
| VMX | 19.0 ft/s               |
| FMX | 37 kips                 |
| DFN | 0.86 in                 |
| MEX | 1086 µE                 |
| AMX | 3426 g's                |
| LE  | 48.70 ft                |
| AR  | 1.15 m <sup>2</sup>     |
| EM  | 30000 ksi               |
| SP  | 0.492 k-ft <sup>3</sup> |
| WS  | 16807.9 ft/s            |
| WC  | 16793.1 ft/s            |
| JC  | 0.90                    |
| JF  | 1.00                    |

F1: [746AWJ1] 222.05 PDICAL (1) FF1  
 F2: [746AWJ2] 222.19 PDICAL (1) FF1  
 A3 (PR): [K14007] 407.233 mv/6.4v/5000g (1) VF1  
 A4 (PR): [K14006] 375.226 mv/6.4v/5000g (1) VF1



BN 13  
05Sep2024 10:42:13 AM

|     |                         |
|-----|-------------------------|
| CSX | 31.5 ksi                |
| DMX | 1.01 in                 |
| EFV | 320 ft-lb               |
| ETR | 91.4 %                  |
| BPM | 53.7 bpm                |
| RAT | 1.1                     |
| VMX | 19.6 ft/s               |
| FMX | 36 kips                 |
| DFN | 0.86 in                 |
| MEX | 1049 µE                 |
| AMX | 4077 g's                |
| LE  | 53.70 ft                |
| AR  | 1.15 m <sup>2</sup>     |
| EM  | 30000 ksi               |
| SP  | 0.492 k-ft <sup>3</sup> |
| WS  | 16807.9 ft/s            |
| WC  | 16781.3 ft/s            |
| JC  | 0.90                    |
| JF  | 1.00                    |

F1: [746AWJ1] 222.05 PDICAL (1) FF1  
 F2: [746AWJ2] 222.19 PDICAL (1) FF1  
 A3 (PR): [K14007] 407.233 mv/6.4v/5000g (1) VF1  
 A4 (PR): [K14006] 375.226 mv/6.4v/5000g (1) VF1

Exhibit B

SPT Analyzer Literature and Equipment Calibrations



# PI SPT Analyzer

## SPT Analyzer

Measures the energy transferred into an instrumented SPT rod during a Standard Penetration Test (SPT)

### Reliable. Simplified. Rugged.

The SPT Analyzer determines the energy transferred by SPT hammers using force and velocity measurements, for improved reliability of SPT N-values.

### What is SPT?

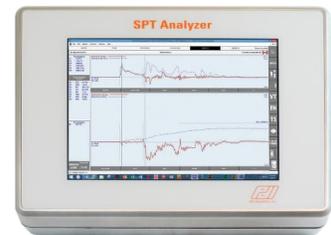
The Standard Penetration Test (SPT) is a widely-employed soil exploration tool that involves using an SPT hammer to drive a split sampler at the bottom of a drill string to obtain soil samples. The number of blows required to penetrate the last 300mm (1ft) is the "N value" which is related to soil strength.

### Why measure the energy transferred by the SPT hammer?

Several different types of SPT hammers are used to conduct Standard Penetration Tests. Their varying efficiencies influence the N value. The measured N value is normalized by multiplying it by the ratio of the measured energy transferred to the rod to 60% of the theoretical potential energy. The normalization compensates for the variability of the efficiencies of different SPT hammer types, and improves the reliability of soil strength estimates used in geotechnical applications.

The SPT Analyzer is furnished with a 0.6m sub assembly (or section) of an SPT rod (AW, NW or other type) instrumented with two strain gage bridges, and calibrated by Pile Dynamics. Once in the field, two accelerometers are bolted to the rod section. The instrumented section is inserted at the top of the drill string between the hammer and the existing sampling rod. The sensors on the rod are connected to the SPT Analyzer.

Smart Sensor technology allows the SPT Analyzer to read the rod instrumentation, obtaining the sensor calibration and rod cross sectional area.



- Calculates energy transferred by SPT hammers using force and velocity measurements
- Determines N value to help improve reliability of soil strength estimates
- Offers simplified reporting and analysis option to speed testing results
- Operates in English, SI, or Metric units



**EN ISO 22486-3:2005/ASTM Compliant**

The SPT Analyzer is compliant with EN ISO 22476-3:2005. ASTM D1586 recommends normalizing results from any SPT test using energy measurements. When these tests are performed to determine the liquefaction potential of sands, ASTM D6066 not only recommends but mandates the normalization. ASTM D4633 states that the only acceptable method of determining energy for normalization of N values is by force and velocity measurements.

These quantities are input to the SPT Analyzer automatically. This significantly simplifies the initial test setup.

The strain gages and accelerometers obtain the force and velocity signals necessary for the calculation of transferred energy to the drill string for each hammer blow. The energy is displayed in real time on the SPT Analyzer screen.

**Output**

SPT Analyzer data is stored and transferred to a computer via USB memory stick. The software furnished with the SPT Analyzer has a Report Creation Option that makes it quick and easy to summarize results and create output graphs of Force, Velocity, Energy and Displacement versus Time, as well as numerical, statistical, and graphical results for each data set. The software is fully customizable.



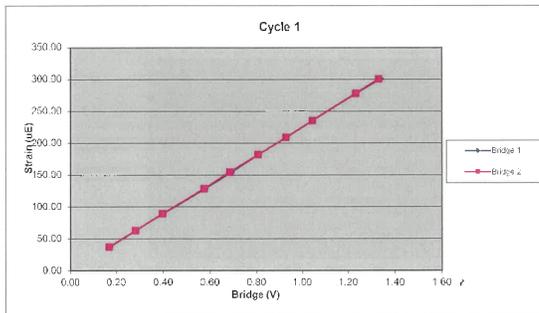
**Pile Dynamics, Inc. (PDI)** is the world leader in developing, manufacturing and supplying state of the art QA/QC products and systems for the deep foundations industry. The company is headquartered in Cleveland, Ohio, USA, with offices and representatives worldwide. For additional information visit us at [www.pile.com](http://www.pile.com) or contact [info@pile.com](mailto:info@pile.com).

[www.pile.com](http://www.pile.com) | +1 (216) 831-6131 | [info@pile.com](mailto:info@pile.com)

| 746AWJ |            | Cycle 1     |              |              |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1      | 0.00       | 0.00        | 0.00         | 0.00         |
| 2      | 1296.93    | 37.22       | 0.17         | 0.17         |
| 3      | 2135.32    | 62.74       | 0.28         | 0.28         |
| 4      | 3028.79    | 89.39       | 0.40         | 0.40         |
| 5      | 4377.09    | 128.61      | 0.58         | 0.57         |
| 6      | 5243.07    | 154.57      | 0.69         | 0.68         |
| 7      | 6143.17    | 181.90      | 0.81         | 0.81         |
| 8      | 7067.95    | 208.93      | 0.93         | 0.93         |
| 9      | 7958.18    | 238.42      | 1.04         | 1.05         |
| 10     | 9380.66    | 278.02      | 1.23         | 1.23         |
| 11     | 10161.74   | 300.76      | 1.34         | 1.33         |

| Bridge 1                  |          | Bridge 2                  |          |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V)  | 7605.07  | Force Calibration (lb/V)  | 7606.74  |
| Offset                    | -0.16    | Offset                    | 12.66    |
| Correlation               | 0.999997 | Correlation               | 0.999999 |
| Strain Calibration (µE/V) | 225.99   | Strain Calibration (µE/V) | 226.04   |
| Offset                    | -1.01    | Offset                    | -8.33    |
| Correlation               | 0.999989 | Correlation               | 0.999992 |

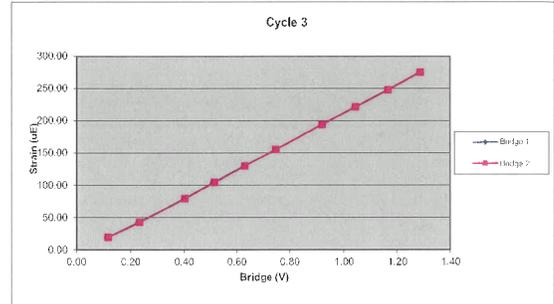
| Force Strain Calibration |          |
|--------------------------|----------|
| EA (Kips)                | 33651.50 |
| Offset                   | 33.98    |
| Correlation              | 0.999994 |



| 746AWJ |            | Cycle 3     |              |              |
|--------|------------|-------------|--------------|--------------|
| Sample | Force (lb) | Strain (µE) | Bridge 1 (V) | Bridge 2 (V) |
| 1      | 0.00       | 0.00        | 0.00         | 0.00         |
| 2      | 838.16     | 19.27       | 0.11         | 0.12         |
| 3      | 1786.75    | 42.28       | 0.23         | 0.23         |
| 4      | 3083.67    | 79.12       | 0.40         | 0.40         |
| 5      | 3943.80    | 104.13      | 0.51         | 0.51         |
| 6      | 4839.52    | 129.87      | 0.63         | 0.63         |
| 7      | 5750.14    | 155.24      | 0.75         | 0.75         |
| 8      | 7079.92    | 194.22      | 0.92         | 0.92         |
| 9      | 8007.70    | 221.43      | 1.04         | 1.05         |
| 10     | 8943.28    | 247.95      | 1.17         | 1.17         |
| 11     | 9871.55    | 275.44      | 1.29         | 1.29         |

| Bridge 1                  |          | Bridge 2                  |          |
|---------------------------|----------|---------------------------|----------|
| Force Calibration (lb/V)  | 7659.96  | Force Calibration (lb/V)  | 7667.39  |
| Offset                    | 13.76    | Offset                    | -1.59    |
| Correlation               | 0.999999 | Correlation               | 0.999998 |
| Strain Calibration (µE/V) | 219.43   | Strain Calibration (µE/V) | 219.64   |
| Offset                    | -7.95    | Offset                    | -8.39    |
| Correlation               | 0.999934 | Correlation               | 0.999939 |

| Force Strain Calibration |          |
|--------------------------|----------|
| EA (Kips)                | 34904.41 |
| Offset                   | 291.93   |
| Correlation              | 0.999935 |



**Accelerometer Calibration Certificate**  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on **MAY 16 2024**

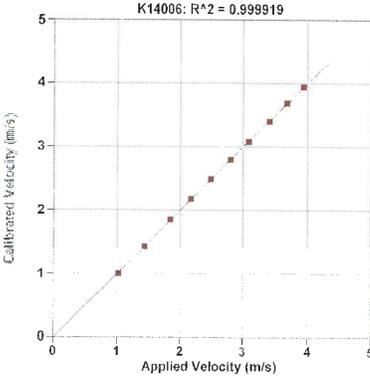
Serial No: K14006 Temperature: 24.0 °C  
Model: PR Humidity: 42%  
Calibrated on: Channel 3 on 8G 5161 LE

**PDA CALIBRATION FACTOR**  
375.2 mv/5000g  
(75.0 μv/g)  
R²: 0.999919 [Chip programmed]

Operator: William Johnson  
  
Signed

Ref Acc 1: 78268! Cal on: 11Jan2024  
986 g/s/volt  
Ref Acc 2: 78270! Cal on: 11Jan2024  
971 g/s/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



| Reference Velocity | S/N K14006 Velocity |
|--------------------|---------------------|
| m/s                | m/s                 |
| 1.015              | 1.001               |
| 1.426              | 1.425               |
| 1.839              | 1.850               |
| 2.171              | 2.177               |
| 2.489              | 2.491               |
| 2.930              | 2.796               |
| 3.087              | 3.078               |
| 3.408              | 3.397               |
| 3.681              | 3.688               |
| 3.938              | 3.946               |

Maximum Acceleration: 848 gs

Version: 2023-09-17 4: 17

**Accelerometer Calibration Certificate**  
Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.  
Calibration performed on **MAY 16 2024**

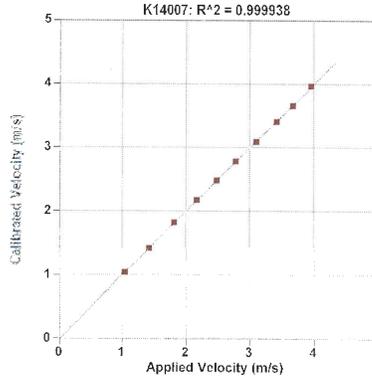
Serial No: K14007 Temperature: 23.8 °C  
Model: PR Humidity: 42%  
Calibrated on: Channel 4 on 8G 5161 LE

**PDA CALIBRATION FACTOR**  
407.2 mv/5000g  
(81.4 μv/g)  
R²: 0.999938 [Chip programmed]

Operator: William Johnson  
  
Signed

Ref Acc 1: 78268! Cal on: 11Jan2024  
986 g/s/volt  
Ref Acc 2: 78270! Cal on: 11Jan2024  
971 g/s/volt

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



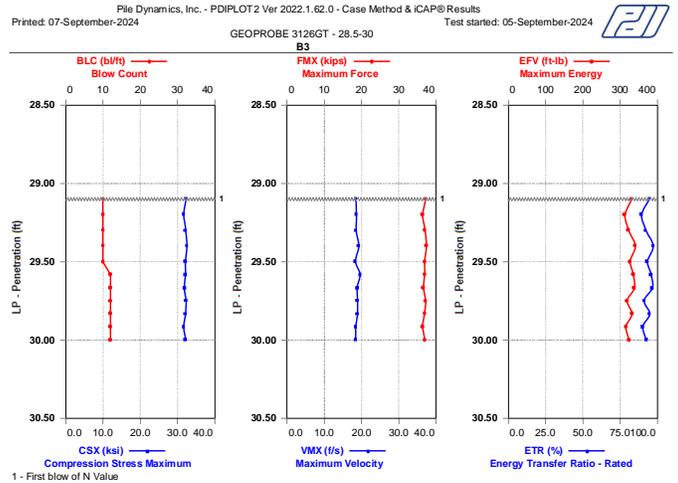
| Reference Velocity | S/N K14007 Velocity |
|--------------------|---------------------|
| m/s                | m/s                 |
| 1.042              | 1.032               |
| 1.417              | 1.411               |
| 1.812              | 1.817               |
| 2.168              | 2.173               |
| 2.476              | 2.483               |
| 2.777              | 2.783               |
| 3.098              | 3.090               |
| 3.411              | 3.406               |
| 3.666              | 3.657               |
| 3.955              | 3.967               |

Maximum Acceleration: 852 gs

Version: 2023-09-17 4: 24



Exhibit C  
SPT Analyzer Results





GEOPROBE 3126GT - 28.5-30

Case Method & iCAP® Results

Date: 05-September-2024

OP: RW  
AR: 1.15 in<sup>2</sup> SP: 0.492 klf<sup>2</sup>  
LE: 33.70 ft EM: 30,000 ksi  
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force  
VMX: Maximum Velocity  
EMX: Maximum Energy  
EFV: Maximum Energy  
ETR: Energy Transfer Ratio - Rated

BPM: Blows/Minute  
DMX: Maximum Displacement  
DFN: Final Displacement  
CSX: Compression Stress Maximum

| BL#       | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|----------|----------|----------|---------|-----------|-----------|---------|---------|--------|--------|---------|
| 5         | 29.10    | 10       | 37       | 18.4    | 331.0     | 331.0     | 94.6    | 53.1    | 1.58   | 1.20   | 32.3    |
| 6         | 29.20    | 10       | 36       | 18.7    | 312.7     | 312.7     | 89.3    | 53.4    | 1.47   | 1.20   | 31.7    |
| 7         | 29.30    | 10       | 37       | 18.5    | 323.0     | 323.0     | 92.3    | 53.6    | 1.54   | 1.20   | 32.2    |
| 8         | 29.40    | 10       | 37       | 19.2    | 340.4     | 340.4     | 97.3    | 53.4    | 1.57   | 1.20   | 32.5    |
| 9         | 29.50    | 10       | 37       | 18.4    | 326.6     | 326.6     | 93.3    | 53.5    | 1.48   | 1.20   | 32.1    |
| 10        | 29.58    | 12       | 37       | 19.6    | 335.5     | 335.5     | 95.9    | 53.3    | 1.41   | 1.00   | 32.1    |
| 11        | 29.67    | 12       | 37       | 18.8    | 338.0     | 338.0     | 96.6    | 53.7    | 1.58   | 1.00   | 31.8    |
| 12        | 29.75    | 12       | 37       | 18.9    | 318.3     | 318.3     | 90.9    | 53.5    | 1.37   | 1.00   | 32.3    |
| 13        | 29.83    | 12       | 37       | 18.9    | 331.4     | 331.4     | 94.7    | 53.8    | 1.11   | 1.00   | 32.1    |
| 14        | 29.92    | 12       | 36       | 18.5    | 315.2     | 315.2     | 90.1    | 53.8    | 1.09   | 1.00   | 31.7    |
| 15        | 30.00    | 12       | 37       | 18.4    | 324.1     | 324.1     | 92.6    | 53.6    | 1.07   | 1.00   | 32.1    |
| Average   |          |          | 37       | 18.8    | 326.9     | 326.9     | 93.4    | 53.5    | 1.39   | 1.09   | 32.1    |
| Std. Dev. |          |          | 0        | 0.4     | 8.8       | 8.8       | 2.5     | 0.2     | 0.19   | 0.10   | 0.3     |
| Maximum   |          |          | 37       | 19.6    | 340.4     | 340.4     | 97.3    | 53.8    | 1.58   | 1.20   | 32.5    |
| Minimum   |          |          | 36       | 18.4    | 312.7     | 312.7     | 89.3    | 53.1    | 1.07   | 1.00   | 31.7    |

Total number of blows analyzed: 11

BL# Sensors

5-15 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00); A4: [K14006] 375.2 (1.00)

BL# Comments

5 First blow of N Value

Time Summary

Drive 15 seconds 10:07 AM - 10:07 AM BN 1 - 15



GEOPROBE 3126GT - 38.5-40

Case Method & iCAP® Results

Date: 05-September-2024

OP: RW  
AR: 1.15 in<sup>2</sup> SP: 0.492 klf<sup>2</sup>  
LE: 43.70 ft EM: 30,000 ksi  
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force  
VMX: Maximum Velocity  
EMX: Maximum Energy  
EFV: Maximum Energy  
ETR: Energy Transfer Ratio - Rated

BPM: Blows/Minute  
DMX: Maximum Displacement  
DFN: Final Displacement  
CSX: Compression Stress Maximum

| BL#       | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|----------|----------|----------|---------|-----------|-----------|---------|---------|--------|--------|---------|
| 7         | 39.05    | 20       | 36       | 18.7    | 320.4     | 320.4     | 91.5    | 53.3    | 0.91   | 0.60   | 31.6    |
| 8         | 39.10    | 20       | 36       | 18.5    | 313.6     | 313.6     | 89.6    | 53.2    | 0.65   | 0.60   | 31.6    |
| 9         | 39.15    | 20       | 37       | 18.9    | 318.4     | 318.4     | 91.0    | 53.4    | 0.66   | 0.60   | 32.1    |
| 10        | 39.20    | 20       | 37       | 18.9    | 309.8     | 309.8     | 88.5    | 53.5    | 0.64   | 0.60   | 31.9    |
| 11        | 39.25    | 20       | 37       | 19.1    | 321.4     | 321.4     | 91.8    | 53.2    | 0.93   | 0.60   | 31.9    |
| 12        | 39.30    | 20       | 36       | 18.5    | 309.3     | 309.3     | 88.4    | 53.5    | 0.64   | 0.60   | 31.5    |
| 13        | 39.35    | 20       | 37       | 19.5    | 320.6     | 320.6     | 91.6    | 53.0    | 0.69   | 0.60   | 31.9    |
| 14        | 39.40    | 20       | 36       | 18.4    | 314.3     | 314.3     | 89.8    | 53.3    | 0.80   | 0.60   | 30.9    |
| 15        | 39.45    | 20       | 37       | 19.5    | 326.5     | 326.5     | 93.3    | 53.5    | 0.92   | 0.60   | 32.0    |
| 16        | 39.50    | 20       | 36       | 18.6    | 320.6     | 320.6     | 91.6    | 53.5    | 1.02   | 0.60   | 31.7    |
| 17        | 39.55    | 20       | 37       | 19.1    | 316.4     | 316.4     | 90.4    | 53.7    | 0.68   | 0.60   | 31.8    |
| 18        | 39.60    | 20       | 36       | 19.0    | 312.4     | 312.4     | 89.2    | 53.3    | 0.66   | 0.60   | 31.7    |
| 19        | 39.65    | 20       | 36       | 18.8    | 315.8     | 315.8     | 90.2    | 53.5    | 0.70   | 0.60   | 31.1    |
| 20        | 39.70    | 20       | 36       | 19.2    | 320.1     | 320.1     | 91.5    | 53.4    | 0.78   | 0.60   | 31.1    |
| 21        | 39.75    | 20       | 36       | 19.5    | 320.9     | 320.9     | 91.7    | 53.3    | 0.63   | 0.60   | 31.0    |
| 22        | 39.80    | 20       | 37       | 19.2    | 317.1     | 317.1     | 90.6    | 53.5    | 0.74   | 0.60   | 31.7    |
| 23        | 39.85    | 20       | 36       | 18.8    | 315.1     | 315.1     | 90.0    | 53.5    | 0.61   | 0.60   | 31.1    |
| 24        | 39.90    | 20       | 36       | 19.7    | 333.6     | 333.6     | 95.3    | 53.5    | 0.83   | 0.60   | 31.3    |
| 25        | 39.95    | 20       | 36       | 19.6    | 323.9     | 323.9     | 92.6    | 53.4    | 0.66   | 0.60   | 31.7    |
| 26        | 40.00    | 20       | 35       | 18.9    | 313.5     | 313.5     | 89.6    | 53.5    | 0.60   | 0.60   | 30.6    |
| Average   |          |          | 36       | 19.0    | 318.2     | 318.2     | 90.9    | 53.4    | 0.74   | 0.60   | 31.5    |
| Std. Dev. |          |          | 0        | 0.4     | 5.6       | 5.6       | 1.6     | 0.1     | 0.12   | 0.00   | 0.4     |
| Maximum   |          |          | 37       | 19.7    | 333.6     | 333.6     | 95.3    | 53.7    | 1.02   | 0.60   | 32.1    |
| Minimum   |          |          | 35       | 18.4    | 309.3     | 309.3     | 88.4    | 53.0    | 0.60   | 0.60   | 30.6    |

Total number of blows analyzed: 20

BL# Sensors

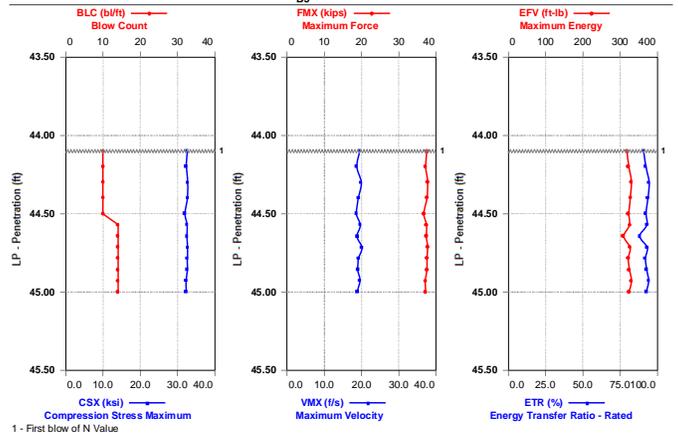
7-26 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00); A4: [K14006] 375.2 (1.00)

BL# Comments

7 First blow of N Value

Time Summary

Drive 28 seconds 10:24 AM - 10:24 AM BN 1 - 26



1 - First blow of N Value



GEOPROBE 3126GT - 43.5-45

Case Method & iCAP® Results

B3

OP: RW Date: 05-September-2024  
AR: 1.15 in<sup>2</sup> SP: 0.492 klf/ft  
LE: 48.70 ft EM: 30,000 ksi  
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force BPM: Blows/Minute  
VMX: Maximum Velocity DMX: Maximum Displacement  
EMX: Maximum Energy DFN: Final Displacement  
EFV: Maximum Energy CSX: Compression Stress Maximum

ETR: Energy Transfer Ratio - Rated

| BL#       | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|----------|----------|----------|---------|-----------|-----------|---------|---------|--------|--------|---------|
| 5         | 44.10    | 10       | 37       | 19.5    | 317.4     | 317.4     | 90.7    | 53.2    | 1.23   | 1.19   | 32.6    |
| 6         | 44.20    | 10       | 37       | 18.7    | 322.7     | 322.7     | 92.2    | 53.3    | 1.22   | 1.20   | 32.4    |
| 7         | 44.30    | 10       | 38       | 19.9    | 330.1     | 330.1     | 94.3    | 53.4    | 1.30   | 1.20   | 32.8    |
| 8         | 44.40    | 10       | 38       | 19.2    | 327.2     | 327.2     | 93.5    | 53.5    | 1.22   | 1.20   | 32.6    |
| 9         | 44.50    | 10       | 37       | 18.6    | 323.0     | 323.0     | 92.3    | 53.5    | 1.21   | 1.20   | 32.0    |
| 10        | 44.57    | 14       | 37       | 19.7    | 325.2     | 325.2     | 92.9    | 53.4    | 0.95   | 0.85   | 32.6    |
| 11        | 44.64    | 14       | 37       | 18.8    | 309.1     | 309.1     | 88.3    | 53.6    | 0.90   | 0.85   | 32.5    |
| 12        | 44.71    | 14       | 38       | 20.1    | 326.0     | 326.0     | 93.2    | 53.5    | 1.06   | 0.86   | 32.8    |
| 13        | 44.79    | 14       | 37       | 19.2    | 321.1     | 321.1     | 91.8    | 53.4    | 1.05   | 0.86   | 32.6    |
| 14        | 44.86    | 14       | 37       | 19.0    | 324.7     | 324.7     | 92.8    | 53.4    | 0.91   | 0.86   | 32.6    |
| 15        | 44.93    | 14       | 37       | 19.5    | 329.6     | 329.6     | 94.2    | 53.5    | 0.99   | 0.86   | 32.3    |
| 16        | 45.00    | 14       | 37       | 18.8    | 323.5     | 323.5     | 92.4    | 53.4    | 0.89   | 0.86   | 32.3    |
| Average   |          |          | 37       | 19.3    | 323.3     | 323.3     | 92.4    | 53.4    | 1.08   | 1.00   | 32.5    |
| Std. Dev. |          |          | 0        | 0.5     | 5.5       | 5.5       | 1.6     | 0.1     | 0.15   | 0.17   | 0.2     |
| Maximum   |          |          | 38       | 20.1    | 330.1     | 330.1     | 94.3    | 53.6    | 1.30   | 1.20   | 32.8    |
| Minimum   |          |          | 37       | 18.6    | 309.1     | 309.1     | 88.3    | 53.2    | 0.89   | 0.85   | 32.0    |

Total number of blows analyzed: 12

BL# Sensors

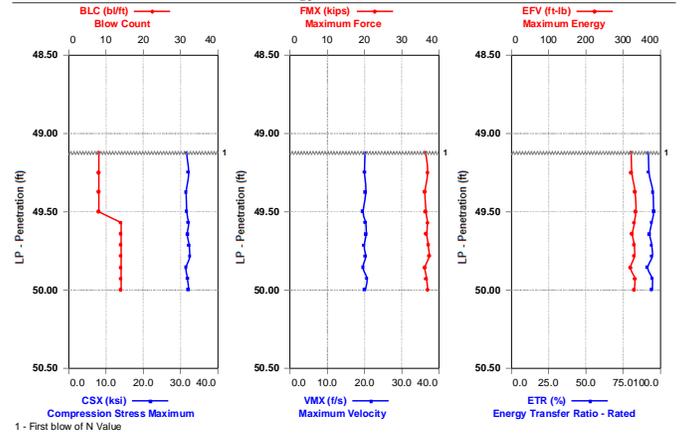
5-16 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);  
A4: [K14006] 375.2 (1.00)

BL# Comments

5 First blow of N Value

Time Summary

Drive 16 seconds 10:32 AM - 10:33 AM BN 1 - 16



GEOPROBE 3126GT - 48.5-50

Case Method & iCAP® Results

B3

OP: RW Date: 05-September-2024  
AR: 1.15 in<sup>2</sup> SP: 0.492 klf/ft  
LE: 53.70 ft EM: 30,000 ksi  
WS: 16,807.9 f/s JC: 0.00

FMX: Maximum Force BPM: Blows/Minute  
VMX: Maximum Velocity DMX: Maximum Displacement  
EMX: Maximum Energy DFN: Final Displacement  
EFV: Maximum Energy CSX: Compression Stress Maximum

ETR: Energy Transfer Ratio - Rated

| BL#       | Depth ft | BLC b/ft | FMX kips | VMX f/s | EMX ft-lb | EFV ft-lb | ETR (%) | BPM bpm | DMX in | DFN in | CSX ksi |
|-----------|----------|----------|----------|---------|-----------|-----------|---------|---------|--------|--------|---------|
| 5         | 49.13    | 8        | 36       | 20.1    | 321.6     | 321.6     | 91.9    | 53.3    | 1.81   | 1.50   | 31.6    |
| 6         | 49.25    | 8        | 37       | 20.1    | 323.0     | 323.0     | 92.3    | 53.4    | 1.81   | 1.50   | 32.1    |
| 7         | 49.38    | 8        | 36       | 20.3    | 332.2     | 332.2     | 94.9    | 53.5    | 1.50   | 1.50   | 31.5    |
| 8         | 49.50    | 8        | 36       | 19.6    | 334.0     | 334.0     | 95.4    | 53.3    | 1.50   | 1.50   | 31.7    |
| 9         | 49.57    | 14       | 37       | 20.3    | 329.3     | 329.3     | 94.1    | 53.8    | 0.87   | 0.86   | 32.1    |
| 10        | 49.64    | 14       | 37       | 20.4    | 324.8     | 324.8     | 92.8    | 53.4    | 1.00   | 0.86   | 31.9    |
| 11        | 49.71    | 14       | 37       | 19.9    | 329.7     | 329.7     | 94.2    | 53.2    | 0.89   | 0.86   | 32.2    |
| 12        | 49.79    | 14       | 37       | 20.2    | 330.1     | 330.1     | 94.3    | 53.7    | 0.89   | 0.86   | 32.4    |
| 13        | 49.86    | 14       | 36       | 19.6    | 319.8     | 319.8     | 91.4    | 53.7    | 1.01   | 0.86   | 31.5    |
| 14        | 49.93    | 14       | 37       | 20.7    | 331.0     | 331.0     | 94.6    | 53.1    | 0.91   | 0.86   | 31.9    |
| 15        | 50.00    | 14       | 37       | 20.1    | 330.2     | 330.2     | 94.4    | 53.2    | 1.03   | 0.86   | 32.1    |
| Average   |          |          | 37       | 20.1    | 327.8     | 327.8     | 93.7    | 53.4    | 1.20   | 1.09   | 31.9    |
| Std. Dev. |          |          | 0        | 0.3     | 4.5       | 4.5       | 1.3     | 0.2     | 0.36   | 0.31   | 0.3     |
| Maximum   |          |          | 37       | 20.7    | 334.0     | 334.0     | 95.4    | 53.8    | 1.81   | 1.50   | 32.4    |
| Minimum   |          |          | 36       | 19.6    | 319.8     | 319.8     | 91.4    | 53.1    | 0.87   | 0.86   | 31.5    |

Total number of blows analyzed: 11

BL# Sensors

5-15 F1: [746AWJ1] 222.1 (1.00); F2: [746AWJ2] 222.2 (1.00); A3: [K14007] 407.2 (1.00);  
A4: [K14006] 375.2 (1.00)

BL# Comments

5 First blow of N Value

Time Summary

Drive 15 seconds 10:42 AM - 10:42 AM BN 1 - 15

Exhibit D  
Field Log





SPT HAMMER CALIBRATION FIELD WORKSHEET

PROJECT NAME: 7324515
PROJECT NO.: Terracon Assets Site
BORING NO.: 8-3
CLIENT:

ARRIVAL TIME:
DEPART TIME:
TOTAL TRAVEL:
TOTAL TIME:
CLIENT REP:
MILEAGE:
DATE: 9/5/24
TERRACON REP: (N)
PDA MODEL/SN: SPT 4021 TR
TERRACON RIG #: 1307

DRILL RIG DATA
Type/Transport: Fork
Manufacturer: Geopole
Model No.: 3126 GS
Serial No.: 7126550224106
Year Built: 2024
Modifications: N/A
Maint. Schedule: 50 hrs

SPT HAMMER DATA
Type: A10
Manufacturer: Geopole
Lifting Mechanism: Claw
Model No.: AD1131
Serial No.: 10001
Hammer Weight: 140
Hammer Operator(s): B. R. MEAT

PDA INPUT DATA
Operator: OP (N)
Project No./Location: PJ 7324515/
Rig Mode & SN: PN Geopole/3126 GS
Hammer Type, LM, Rods: PD A10/AWJ
Drill Rod Area (in^2): AR 115
Elastic Modulus (ksi): EM 3000
Specific Weight (kips/ft^3): SP 0.492
Wave Speed (ft/sect): WS 16808
Increment Length (ft): LI 0.5
Sampling Freq (kHz): FR 50

TRANSDUCER INFORMATION
Gage SN Calibration
F1/F3: 746 AWJ1 222.05
F2/F4: 746 AWJ2 222.19
A1/A3: K14002 402.23
A2/A4: K14006 375.83
NOTES: 286.25 + 1.875 = 288.125
34.38 + 25 + 10.25 = 69.63
SPLIT SPOON SAMPLER LENGTH: 38K + 0.88 = 38.88
LE is measured from the center of the Strain Gauges to the bottom of Split Spoon Sampler

SPT TESTING INFORMATION table with columns: Start Time, Soil, Stick Up Length (ft), Depth (ft), LE (ft), Rods & Lengths, PDA Blows, SPT Blows.

Individual pairs of F or V signals versus time shall be very similar for good quality data.
If you see Force goes negative before 2L/C after impact, drill rod joints should be carefully tightened for good quality data.

PICTURE NUMBERS AND INFO:
Take Photo of Each Rigs, Boring Locations at the Site

Terracon SPT Rig Calibration Worksheet.xlsx



This documents that
Susheel R. Kolwalker
Terracon Consultants
has on March 11, 2016 achieved the rank of
EXPERT

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.

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.

Steven A. Hall, Executive Director
Pile Driving Contractors Association

Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2005



Exhibit E

Copy of Certificate of Proficiency

Certificate of Proficiency for Ryan Wakeford, Terracon Consultants, Inc. on the Dynamic Measurement and Analysis Proficiency Test. Includes PDCA and PI logos, signatures of Frank T. Peters and Garland Likins, and a gold seal.