Report of Geotechnical Exploration
Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No. 22130193

PREPARED FOR:

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January 11, 2024

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Johnson, Laschober & Associates
701 East Bay Street, Suite 411
Charleston, South Carolina 29403

Attention: Mr. Herb Gillam, P.E.

Reference: **Report of Geotechnical Exploration**
Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No. 22130193

Dear Mr. Gilliam:

We have completed our geotechnical exploration for the referenced project. Our services have been provided pursuant to S&ME Proposal No. 22130193 dated July 14, 2022. The purpose of our geotechnical services was to explore the subsurface conditions at the site, evaluate those conditions, and provide recommendations for site preparation and foundation and pavement support. This report presents our understanding of the project, the site and subsurface conditions encountered, and our conclusions and recommendations.

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

Sincerely,

S&ME, Inc.

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 35390 AUSTIN A. COX

SOUTH CAROLINA S&ME, INC. C00473 CERTIFICATE OF AUTHORIZATION

Jan 11 2024 12:25 PM

Samuel W. Folmar, EIT
Staff Professional II

Austin A. Cox, PE
Senior Engineer

Senior Reviewed by: Gregory J. Canivan, P.E. – Technical Principal

Report at a Glance

Key geotechnical findings based on our current understanding of the proposed project are presented in the table below. These findings are presented as an overview and should not be used in place of the more detailed recommendations presented in the remainder of this report.

Category	Key Geotechnical Finding
Subsurface Conditions	• Existing asphalt pavement thickness ranges from approximately 3 to 5 in. • Topsoil thickness ranges from approximately 2 to 6 in. • Natural coastal plain deposits encountered below surficial soils/pavements, with most test locations encountering loose to medium dense sands to depths of approximately 7 to 10 ft, followed by soft to firm clay/silt with interbedded lenses of loose sand to depths or approximately 20 to 35 ft, underlain by dense to very dense sand to the deepest explored depth of 48 ft. • Subsurface water primarily encountered at depths ranging from 1 to 4 ft.
Site Development	• While not encountered during the exploration, portions of the site are previously developed, and existing fill or previously disturbed soils and debris may be present. • Near surface soils primarily consist of relatively clean (i.e., low silt and clay content) sands and silty sands, and significant undercutting or stabilization is not anticipated if moisture is managed.
Excavation Conditions	• Encountered soils can be excavated using typical earthmoving equipment/techniques. • Excavations deeper than 1 to 2 ft may encounter subsurface water and unstable excavation bottoms that require stabilization.
Pavements	• Pavements can be supported by existing subgrade soils provided they perform adequately under proofrolling, or on well-compacted imported controlled fill.
SHWT & Infiltration	• SHWT depth estimated at 1½ to 2 ft below existing ground surface. • Measured infiltration rates ranged from approximately 0.2 to 0.6 in./hr.
Seismic Considerations	• Seismic Site Class F • Saturated sands encountered to depths of approximately 30 ft appear liquefiable, which corresponds to a relatively high liquefaction hazard.
Foundation Type	• Shallow spread footings (provided liquefaction risk is accepted or mitigated).
Slab Support	• On-grade

Project Information

We understand renovations are planned for the US Forest Service's Buck Hall Recreation Area in Charleston County, South Carolina. Johnson, Laschober & Associates (JLA) is providing project management and design services.

The renovations and improvements planned as part of this project have gone through revisions since our proposal was submitted in July of 2022. The project features identified below and addressed herein are based on our most recent communications, including emails exchanged between Ms. Jillian Ready and Mr. Herb Gilliam of JLA and Mr. Austin Cox of S&ME between the dates of October 19 and November 8, 2023, and a phone call on October 23, 2023. Included in one of the emails on October 19 was a sketch of the latest site plan that identified the currently proposed structures/features and requested test locations. This sketch is overlaid on our *Test Location Plan* (Figure I-1) in Appendix I.

Based on our communication with you and the provided information, we understand the current plans include the following renovations/improvements:

- One new campground loop.
- Vehicular site circulation improvements with signage.
- New restroom, picnic shelter, event lawn, and walking paths in the day-use area.
- New bath houses (Loop A and B).
- New Concessionaire Building.
- New vault restroom building.
- New septic tank cluster.
- Improved overflow parking lot.
- New deceleration lane at the entrance on US-17.
- New kayak launch dock.
- New (replacement) bulkhead near the existing fishing pier located north of the existing boat ramp.

Specific structural information for the planned buildings was not provided at the time of this report, but we assume maximum column and wall loads to be 25 kips and 2 kips/ft, respectively. Grading plans were also not provided, but we assume site grading will require cut and fill heights of no more than 1 ft to reach final grades throughout the site.

Also included in your emails to us was a Septic Tank Plan and Cut Sheet (Sheet S100) that showed the dimensions of the planned septic tanks. We understand each tank will be approximately 6 ft wide, 13 ft long, and 6 ft tall, and weigh approximately 15,000 lb. We assume the tanks will be buried a few feet and bear approximately 7 to 8 ft below finished grade. Also included in this email was a link to a website related to the planned vault restroom building, which provided information on CXT buildings. The website indicated the restroom building will be approximately 15 ft long, 8½ ft wide, and 11½ ft tall, and weight approximately 28,600 lb. The underground vault portion will weigh approximately 17,400 lb, and bear approximately 4½ ft below finished grade.

One notable change to the project scope is that the existing seawall, which runs the entire length of the park's waterfront border, was originally planned to be replaced with another wall; however, we now understand most of the existing wall will be replaced with a sloped revetment. As noted above, the only portion of the existing seawall that will be replaced with a new bulkhead is near the existing fixed pier, which is located north of the existing boat ramp.

The project information and assumptions presented herein should be reviewed and confirmed by the appropriate team members. Modifications to our conclusions and recommendations may be required if the actual conditions vary substantially from the project information and assumptions stated herein.

♦ Methods of Exploration

Field Exploration

Our field exploration included a site reconnaissance by a geotechnical professional. Test locations were established in the field by S&ME personnel using a held-held GPS unit and by estimating distances and right angles from existing site features. Approximate test locations are shown on the *Test Location Plan* (Figure I-1) in Appendix I.

Our field exploration included the following:

- Ten cone penetration test (CPT) soundings at the proposed structures across the site to depths ranging from approximately 20 to 48 ft below the existing ground surface. Soundings C-1, C-2, and C-3 along the waterfront encountered refusal[1] within a very dense sand layer at depths ranging from approximately 37 to 48 ft.
- Kessler dynamic cone penetrometer (DCP) testing was performed at three locations: two within the planned deceleration lane off US17, and one at the Loop B bath house.
- To further evaluate the near surface soil conditions, we performed a 4-ft-deep hand-auger boring adjacent to each CPT sounding and DCP test location, and at seven locations within the parking and drive areas.
- A season-high water table (SHWT) evaluation and infiltration testing was performed at four locations. The SHWT was evaluated within a 4-ft deep hand-auger boring by noting the depth at which mottling or other hydric soil indicators first occur. Infiltration testing was performed at depths of approximately 2 to 3 ft using a cased bore-hole method, similar to those described in ASTM D6391.
- Existing pavements were cored at four locations to determine the existing asphalt thickness.
- We collected representative soils samples from hand-auger borings performed across the site for laboratory testing.

[1] In a CPT sounding, "refusal" occurs when the force required to advance the cone exceeds the maximum reaction force of the rig, or the material is dense enough that further advancement would likely result in damage to the cone. Refusal in a CPT sounding should not be taken as the top of rock as is often the case with a traditional soil test boring drill rig.

- Following completion of the borings and soundings, we noted the presence of subsurface water, backfilled the boreholes with the auger cuttings, and patched the pavement surface (when applicable).

A more detailed description of our field-testing procedures and the CPT sounding, hand-auger boring, and DCP logs are included in Appendix II.

Notable changes to our field exploration scope presented in our July 2022 proposal include:

- One additional CPT sounding.
- SHWT evaluation and infiltration testing at two additional locations.
- DCP testing at one additional location.
- Nine fewer hand-auger borings in parking and drive areas.
- Exclusion of four bulk soil samples.

Laboratory Testing

After field testing was complete, five soil samples were subjected to index property testing consisting of Atterberg limits, fines content testing (i.e., percent passing the No. 200 sieve), and natural moisture content testing to assist in classifying the soils and to use in concurrence with the infiltration test results. Additionally, two soil samples were subject to a series of corrosion potential testing. Laboratory testing was performed in general accordance with applicable ASTM standards. The index testing was performed by S&ME and the corrosion potential testing was performed by our subcontractor Project X Corrosion Engineering.

A summary of the laboratory testing results as well as the individual data sheets are included in Appendix III. Details pertaining to the procedures and applicable standards used during our laboratory testing activities are outlined in the *Summary of Laboratory Procedures* included in Appendix III.

♦ Site and Subsurface Conditions

Site Conditions

The project site is located in the US Forest Service's Buck Hall Recreational Area in McClellanville, South Carolina. The site is approximately 250-acres and accessed via Buck Hall Landing Road located to the east of Highway 17. The site is generally bound by undeveloped wooded areas to the northeast and southwest, Highway 17 to the northwest, and the Atlantic Intracoastal Waterway (ICW) to the southeast.

At the time of exploration, the southeastern portion of the site bordering the ICW was developed with camping areas, parking lots, roads and trails, a boat landing, and docks. A cleared overflow parking area is located northwest of the developed camping area. The remaining areas of the site were primarily undeveloped and wooded with pine trees or wetland areas. A powerline easement transects across the entirety of the site generally in a southeast/northeast direction.

Based on our visual observation, the site is relatively level. Standing water was observed in drainage ditches along Buck Hall Landing Road. Topographic information was not provided across the entire site; however, the

bathymetry survey data provided of the ICW indicates the existing ground surface elevation on the land side of the existing bulkhead ranges from approximately +5 to +7 ft (NAVD88). The site gently slopes and drains to the east towards the ICW.

Subsurface Conditions

Details of the subsurface conditions encountered by the soundings and hand auger borings are shown on the logs in Appendix II. The logs represent our interpretation of the subsurface conditions based upon field data. Stratification lines on the sounding logs represent approximate boundaries between soil behavior types[2]; however, the actual transition may be gradual. The general subsurface conditions and their pertinent characteristics are discussed in the following paragraphs.

Pavements

The existing pavement was cored at four locations, and the asphalt thickness was determined to generally range from approximately 3 to 5 in. as summarized in Table 1. The asphalt was underlain by aggregate base course at each location.

Table 1 - Asphalt Section

Test Location	Asphalt Thickness (in.)
P-1	4
P-2	4
P-3	5
P-4	3

Surficial Soils

Surface materials in the form of topsoil, root mat, and vegetative debris (leaves/pine straw) were encountered across most of the site and generally ranged from approximately 2 to 6 inches thick.

Coastal Plain Soils

Natural coastal plain soils were encountered beneath the surficial soils and pavements. The stratigraphy was relatively consistent in the soundings performed on the southeastern portion of the site (i.e., C-1 through C-9). These soundings generally encountered loose to medium dense sands and silty sands to depths of approximately 7 to 10 ft, underlain by soft to firm clay and silt with interbedded lenses of loose sand to depths ranging from

[2] Soil Behavior Type is calculated based on empirical correlations with tip resistance, sleeve friction, and pore pressure. A CPT may define a soil based on its behavior as one type while its grain size and plasticity, the traditional basis for soil classification, may define it as a different type.

approximately 20 to 35 ft. The soundings then primarily encountered dense to very dense sand that continued to the deepest explored depth of approximately 48 ft.

Sounding C-10, performed near the septic tank cluster, encountered thicker sand deposits starting at the existing ground surface that were primarily medium dense and extended to the termination depth of 20 ft. Table 2 summarizes the generalized subsurface conditions encountered on the southeastern part of the site, which does not reflect the conditions encountered at sounding C-10 in the upper 20 ft.

Table 2 – Generalized Subsurface Conditions

Approx. Depth Range (ft)	Description	Comments
0 to ½	Topsoil	-
½ to 8	Loose to M. Dense Sand & Silty Sand	Saturated sands are liquefiable
8 to 30	Soft to firm Clay & Silt with Lenses of Loose to M. Dense Sand & Silty Sand	Soft silts/clays are moderately compressible. Sands are liquefiable
30 to 48	Dense to V. Dense Sand	Deepest soundings encountered refusal within this layer

Subsurface Water

Subsurface water was measured upon completion of the soundings at depths ranging from approximately 1 to 4 ft below the existing ground surface. About half of the 4-ft deep hand-auger borings performed across the site encountered subsurface water, which was generally approximately 3 to 4 ft deep. The remaining hand-auger borings did not encounter subsurface water within about 4 ft of the ground surface. Subsurface water levels at the site will fluctuate during the year due to such things as seasonal, climatic, and tidal variations and the construction activity in the area. As discussed in more detail later, we estimated the SHWT depth on the southeastern part of the site to range from aproximately 1½ to 2 ft.

♦ Conclusions and Recommendations

The exploration indicates the site is adaptable for the proposed construction. The proposed structures may be supported on conventional shallow foundations provided our site preparation and controlled fill recommendations are followed and the risks associated with liquefaction[3] are accepted or mitigated. The primary geotechnical considerations will be site preparation and subgrade and foundation evaluation during construction.

The following presents our geotechnical recommendations regarding site grading and structural and pavement support. During review of these recommendations, it should be kept in mind that with any previously developed site, subsurface conditions will vary between our test locations. Unexpected subsurface conditions such as deeper, and/or poorly-compacted fill deposits and buried debris may be encountered. These variable conditions can normally be handled during construction by field engineering.

Drainage Improvements

Prior to mass clearing and grading in the wooded areas, drainage improvements should be made to lower subsurface water levels, and handle rainfall runoff during construction. This will be very important in maintaining stable subgrades during the early stages of site preparation. Site drainage can be established by excavating gravity-drained ditches to divert water flow away from construction areas. Ditches should be excavated as deep as practical and as far ahead of general site work as possible. Existing ditches may be used. If enough fall is not available, ditches should be tied to sumps and pumped. Even during dry weather conditions, ditches and drainage improvements should be in place to handle any heavy rainfall that might occur during construction.

Site Preparation

Site preparation in structure and pavement areas should start with the removal of existing pavements, clearing and grubbing vegetation and roots, stripping organic-laden topsoil, and removal of unsuitable surface materials, large root systems, buried structures, debris, and subsurface utilities to be abandoned. The voids created should be cleaned and backfilled with well-compacted controlled fill. The exploration indicates the organic-laden topsoil thickness ranges from approximately 2 to 6 in. which will vary in unexplored areas.

The initial phases of the site preparation within the wooded areas will disturb the near-surface subgrade soils. The disturbed subgrade should be densified as needed. The exposed subgrade should be evaluated by proofrolling with a heavily loaded, tandem-axle dump truck or similar rubber-tired equipment under the observation of the Geotechnical Engineer. Proofrolling will expose unstable subgrade areas. Areas that pump or rut excessively should be stabilized in place or undercut and replaced with controlled fill as recommended by the Geotechnical Engineer. All undercutting should be observed by the Geotechnical Engineer to determine that all unsuitable materials are removed and to prevent removal of suitable materials.

The near-surface soils primarily consist of relatively clean (i.e., low silt and clay content) sands and silty sands , and widespread undercutting and replacement is not anticipated if moisture is controlled. However, while not encountered during our exploration, portions of the site have been previously developed and uncontrolled fill, previously disturbed soils, and/or debris may be present. As such, thorough subgrade evaluations will be important during construction to identify unsuitable subgrade soils, and some undercutting and replacement of existing soils may be required.

The extent and depth of undercutting or stabilization will be dependent on the final grades, the climatic conditions during construction, the aggressiveness of the earthwork schedule, site drainage, and the grading

[3] Liquefaction, the loss of a soil's shear strength due to the increase in porewater pressure resulting from seismic vibrations, is always a potential concern in coastal South Carolina.

contractor's means and methods. The stabilization measures used are best determined in the field at the time of construction with joint consultation between the Grading Contractor and the Geotechnical Engineer.

Controlled Fill

Off-site borrow material should be cohesionless soil containing no more than 15% fines (material passing the No. 200 sieve) by weight and having a maximum dry density of at least 100 pcf as determined by a laboratory modified Proctor compaction test (ASTM D 1557). The soil should be relatively free of organics, deleterious matter, and elongated or flat particles susceptible to degradation.

Based on our understanding of the proposed construction, there are no large-scale excavations planned that will result in significant amounts of spoils. Regardless, the hand-auger borings performed across the site primarily encountered silty sand and relatively clean sand to depths of approximately 4 ft, which appear generally suitable for use as controlled fill with moisture adjustment.

All fill should be placed in uniform lifts of 10 in. or less (loose measure) and compacted to at least 95% of the modified Proctor maximum dry density. Fill placement should be observed by a qualified engineering technician working under the direction of the Geotechnical Engineer. In addition to this visual evaluation, the technician should perform a sufficient number of in-place field density tests to confirm the contractor's equipment and methods are capable of achieving the required degree of compaction.

Excavations and Dewatering

Subsurface water was encountered at a depth of approximately 1 to 4 ft below the existing ground surface, but primarily at depths of 2 ft or greater at most of our test locations. Depending on conditions at the time of construction, excavations within this depth range will likely encounter subsurface water.

If encountered, water levels should be maintained at least 1 ft below excavations to help maintain bottom stability. Water can probably be controlled at the site by pumping from sumps located within the excavation. The contractor should be responsible for determining groundwater control measures based on the site conditions encountered during construction, and the contractor is responsible for evaluating the effects of lowering groundwater levels.

The exploration indicates that excavations below the existing ground surface will encounter low to moderate consistency soils. These soils can be excavated using typical earthmoving equipment and techniques, and we do not anticipate difficult to excavate materials will be encountered. Excavations below the groundwater table may encounter loose soils and/or unstable excavation bottoms. Unstable bottoms can be stabilized with placement of a non-woven geotextile and/or 12 to 18 in. of crushed stone. This will aid in dewatering and provide a stable working platform and bedding layer.

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service, and under no circumstances should S&ME be assumed to be responsible for construction site safety.

Pavement Recommendations

We have evaluated new flexible (asphalt) using the South Carolina Asphalt Pavement Association's (SCAPA) *Asphalt-Pavement Design Guide for Low-Volume Roads and Parking Lots – Third Edition*[4] *(SCAPA Design Guide)* and associated literature. Traffic loading data was not provided. Based on our experience with similar projects, we assume light-duty pavement will be subjected primarily to passenger cars and heavy-duty pavements will be subjected to light truck traffic. We recommend using a rigid pavement section in areas subjected to repeated lateral loading (turning, stopping, starting) and loading areas.

Based on the measured data and our experience with sites that have similar soils, a CBR value of 10% is appropriate for design provided the subgrade is properly prepared and passes proofroll inspection as described above, and any new fill required meets the controlled fill recommendations provided herein. Therefore, we assumed Good subgrade conditions per the SCAPA Design Guide. CBR values should be confirmed during grading by engineering evaluation and field and laboratory testing.

Based on our understanding of the proposed development, we have assumed Class 1 and 2 Traffic Class designations, as defined in the SCAPA Design Guide, for standard and heavy-duty scenarios, respectively. Traffic Class designations should be confirmed by others. The minimum recommended pavement sections should be reevaluated if the assumed Traffic Class designations are incorrect.

Based on our understanding of the proposed development, our evaluation, and our experience in the Charleston area, the minimum recommended asphalt pavement sections are presented in Table 3.

Table 3 - Minimum Recommended Pavement Sections

Material	Flexible Pavement		Rigid Pavement	
	Heavy Duty	Standard Duty	Heavy Duty	Standard Duty
Asphaltic Concrete Surface Course (SCDOT Type C)	3 in.	2 in.	-	-
Portland Cement Concrete (f'c=4000psi)	-	-	6 in.	5 in.
Graded Aggregate Base Course	8 in.	6 in.	6 in.	6 in.

Based on our experience, this should be adequate for the assumed traffic and a typical 15-year pavement life. Construction traffic has not been included in our analysis, and construction traffic should be restricted from prepared subgrades and new pavements. If pavements must support construction traffic, stage construction or a thicker asphalt section will be required.

[4] https://www.scasphalt.org/uploads/5/6/3/8/56382339/scapa_design_guide_3rd_edition__6-30-20_.pdf

All materials and workmanship should be in accordance with the South Carolina Department of Transportation's *Standard Specifications for Highway Construction*, 2007 Edition.

A stable subgrade is very important to pavement performance. Immediately prior to paving, the subgrade should be proofrolled, and any unstable areas should be repaired. The base course should be compacted to at least 100% of the maximum dry density as determined by SCDOT Test Procedure SC-T-140. In-place field density tests should be performed by a qualified Materials Technician, and the area should be methodically proofrolled under their evaluation to confirm that the base course has been uniformly compacted. The thickness should not be deficient in any area by more than ½ in. The asphalt pavement thickness should not be deficient by more than ¼ in. in any area.

The performance of asphalt and rigid concrete pavements will be dependent upon several factors including subgrade conditions at the time of paving, drainage, and traffic. The geometric design should provide positive drainage for the pavement surface and subgrades.

Pavement design typically has relatively low factors of safety; therefore, it will be very important that the specifications are followed closely during pavement construction. The recommended sections should typically be suitable for a 15-year design life; however, some isolated areas could require repair in a shorter period.

Seasonal-High Water Table and Infiltration Testing

Soil Survey Data

We reviewed the United States Department of Agriculture (USDA) *Soil Survey of Charleston County* to determine the mapped near-surface soil types at the project site. The USDA Soil Surveys provide helpful information about the near surface soils. The soil survey maps soil within 6 to 7 ft of the ground surface and provides general information. The data is not intended to replace geotechnical evaluations and testing, but it can help identify trends.

Based on the soil survey, the shallow subsurface conditions in the areas where we performed SHWT evaluations and infiltration testing consist of soils from the Chipley loamy fine sand (Cm) series. The relevant survey data for this soil series is presented in Table 4. The USDA Soil Survey is shown on the *Soil Survey Map* (Figure 2) in Appendix I.

We emphasize that the soil survey data is qualitative in nature and that the evaluations are based solely on the characteristics of the shallow (<7 ft deep) soil stratigraphy. The soil survey evaluations do not consider deeper soil conditions which can control a structure's design.

Table 4 – Summary of USDS Soil Survey Data

SCS Classification	Classification		Drainage Class	SHWT Depth (ft)	Saturated Hydraulic Conductivity (in./hr)
	USCS	AASHTO			
Chipley loamy fine sand (Cm)	SC-SM, SM, SW-SM	A-2-4	Moderately-well drained	½ - 3	6 - 20

Seasonal-High Water Table Evaluation

The SHWT evaluation was conducted by advancing a hand auger boring to a depth of 4 ft below the existing ground surface and evaluating the extracted soil for hydromorphic indicators. The hand-auger borings generally encountered relatively clean sands and silty sands. At the time of our SHWT evaluation, subsurface water was encountered at depths ranging from approximately 3 to 3½ ft.

In general, the soils encountered during our exploration appear to be natural and generally consistent with the mapped soil types. The soils encountered in the hand auger borings exhibited signs of mottling at depths as shallow as 1½ to 2 ft. Based on these observations, it is our opinion that the SHWT ranges from approximately 1½ to 2 ft below the existing ground surface at our test locations.

Infiltration Test Results

The bore-hole infiltration testing was performed at depths ranging from approximately 2 to 3 ft below the existing ground surface. The infiltration tests indicate field-measured infiltration rates (k_m) ranging from approximately 0.2 to 0.6 in/hr. Table 5 summarizes the measured infiltration rates and observed SHWT at each test location. We recommend a factor of safety of 2 be used with field measured infiltration rates.

Table 5 - Infiltration and Test Results

Test Location	Observed Subsurface Water Depth[a] (ft)	SHWT Depth[a] (ft)	Infiltration Test Depth[a] Range (ft)	Field Measured Infiltration Rate, k_m (in./hr)
I-1	3	2	2½ - 3	0.6
I-2	3	1½	2 – 2½	0.5
I-3	3¼	1½	2 – 2½	0.4
I-4	3½	2	2½ - 3	0.2

[a] Depth references the depth below the existing ground surface at the time of our 2023 exploration.

Seismic Considerations

Based on the measured CPT data, the subsurface soils appear consistent with the stiff soil designation for determining Seismic Site Class based on Table 20.3-1 in ASCE 7-16. However, before assigning a site class, the 2021 edition of the International Building Code (IBC 2021) requires consideration of liquefiable soils, which could

result in a Site Class F designation. Based on the measured data and our experience the saturated sands encountered to depths of approximately 30 ft at the site appear liquefiable, which triggers a Seismic Site Class F designation. The CPT data suggests a relatively high liquefaction hazard associated with surface manifestation and possible foundation damage.

Shallow Foundation Recommendations

The proposed structures may be supported on conventional shallow foundations designed for a maximum allowable soil bearing pressure of 2,500 psf, provided our site preparation and fill placement and compaction recommendations are completed as recommended and the risks associated with liquefaction are accepted or mitigated. Foundations should bear at least 12 in. below finished grade, and wall and column footings should be a minimum of 18 and 24 in. wide, respectively.

Our analysis indicates post-construction, static (not seismically-induced) settlement due to the assumed building loads (i.e. 25 kip columns and 2 kips/ft walls) and up to 1 ft of permanent fill will be approximately 1 in. or less. Differential settlement is typically assumed to be about half of the total settlement. If actual structural loads will be greater than those assumed in this report or more than 1 ft of fill will be required for grading, we should be provided with this information so that we can reevaluate settlement. This is important because higher structural loads or more fill will cause additional settlement.

Based on the provided information, we anticipate the new vault restroom building and septic tanks will bear approximately 7 to 8 ft and 4 to 5 ft below finished grade, respectively. Considering the weight of the structures and the weight of the in-situ soils that will be excavated during installation, we anticipate the net stress change at the bearing depths will be small and that any settlement (if any) will be within an acceptable range.

All foundation excavation bottoms must be evaluated by a representative of the Geotechnical Engineer prior to steel and concrete placement. This evaluation may include probing, hand-auger borings, and dynamic cone penetrometer (DCP) testing, as deemed appropriate. This evaluation will help determine if individual footings are directly underlain by suitable bearing material and is considered part of the geotechnical design. Any loose or soft material should be properly compacted or undercut and replaced with well-compacted controlled fill, crushed aggregate such as No. 57 stone, or crushed concrete meeting SCDOT gradation requirements. If practical, concrete placement should be completed the same day as the footing excavation. Slag is not recommended as backfill due to its potentially expansive nature.

Floor Slabs

Floor slabs may be soil-supported provided our site preparation and fill placement and compaction recommendations are followed. A subgrade modulus (k) of 180 pci is available for design. This recommended modulus is representative of a 30-in. diameter plate load test and is only applicable for light point loads. This modulus must be reduced for wide-area loads.

Based on the results of our exploration, the floor slab will not be subjected to hydrostatic pressure from groundwater. However, water vapor transmission through the slab is still a design consideration. Evaluating the need for and design of a vapor retarder or vapor barrier for moisture control is outside our scope of services and

should be determined by the project architect/structural engineer based on the planned floor coverings and the corresponding design constraints, as outlined in ACI 302.1R-04 Guide for Concrete Floor and Slab Construction.

Soil Parameters for Bulkhead and Dock Design

Tables 6 and 7 present soil parameters based on the CPT data that can be used to design the new replacement bulkhead and kayak launch dock, respectively. The parameters are based on published correlations and our local experience in similar soils. The soil parameters are representative of those soils encountered in the CPT soundings and no factor of safety or similar reduction in the parameters has been considered.

The new bulkhead will need to resist lateral earth pressures that will be imposed on it. To determine the total lateral pressure, the design should consider the development of hydrostatic pressure behind the retaining structure and lateral earth pressures arising from surcharge loading (i.e., soil surcharge, construction equipment, traffic, etc.) or any slopes above the structure.

Table 6 - Soil Parameters for Bulkhead Design (C-4)

Approx. Depth[a] Interval (ft)	Approx. El. Interval (ft-NAVD88)	Soil Description	Unit Weight (pcf)	Undrained Shear Strength, Su (psf)	Effective Friction Angle, ϕ′ (deg)	Wall Adhesion (psf)	Wall Friction Angle (deg)
0 to 8	+6 to -2	Loose to M. Dense Sand	110	0	34	0	17
8 to 12	-2 to -6	V. Soft to Soft Clay/Silt	95	400	0	200	0
12 to 22	-6 to -16	Soft to Firm Clay/Silt	100	1,000	0	500	0
22 to 30	-16 to -24	Loose to M. Dense Sand	110	0	34	0	17
30 to 45	-24 to -39	Dense to V. Dense Sand	120	0	36	0	18

[a] Depth references the existing ground surface at the time of our 2023 exploration.

Table 7 - Soil Parameters for Kayak Launch Dock Design (C-3)

Approx. Depth[a] Interval (ft)	Approx. El. Interval (ft-NAVD88)	Soil Description	Unit Weight (pcf)	Undrained Shear Strength, Su (psf)	Effective Friction Angle, ϕ′ (deg)
0 to 8	+6 to 2	Loose to M. Dense Sand	110	0	34
8 to 12	-2 to -6	V. Soft to Soft Clay/Silt	95	400	0
12 to 22	-6 to -16	Soft to Firm Clay/Silt	100	1,000	0
22 to 25	-16 to -19	Dense to V. Dense Sand	120	0	36
25 to 29	-19 to -23	Firm Clay/Silt	105	1,000	0
29 to 48	-23 to -42	Dense to V. Dense Sand	120	0	36

[a] Depth references the existing ground surface at the time of our 2023 exploration.

♦ Limitations of Report

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

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

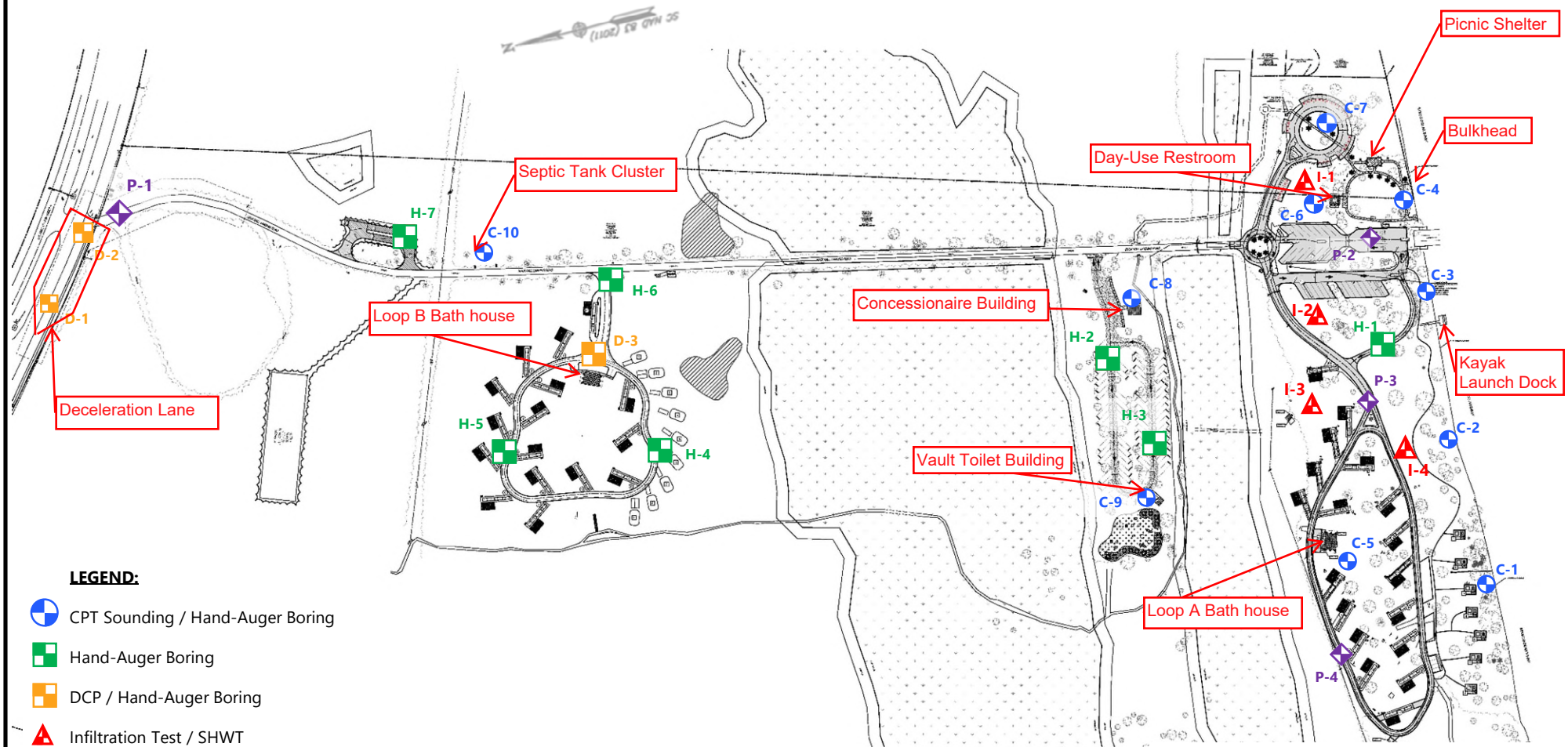
Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed.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

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by observation and monitoring of earthwork and foundation construction activities.

Appendix I - Figures

Test Location Plan – Figure I-1

Soil Survey Map – Figure I-2



LEGEND:

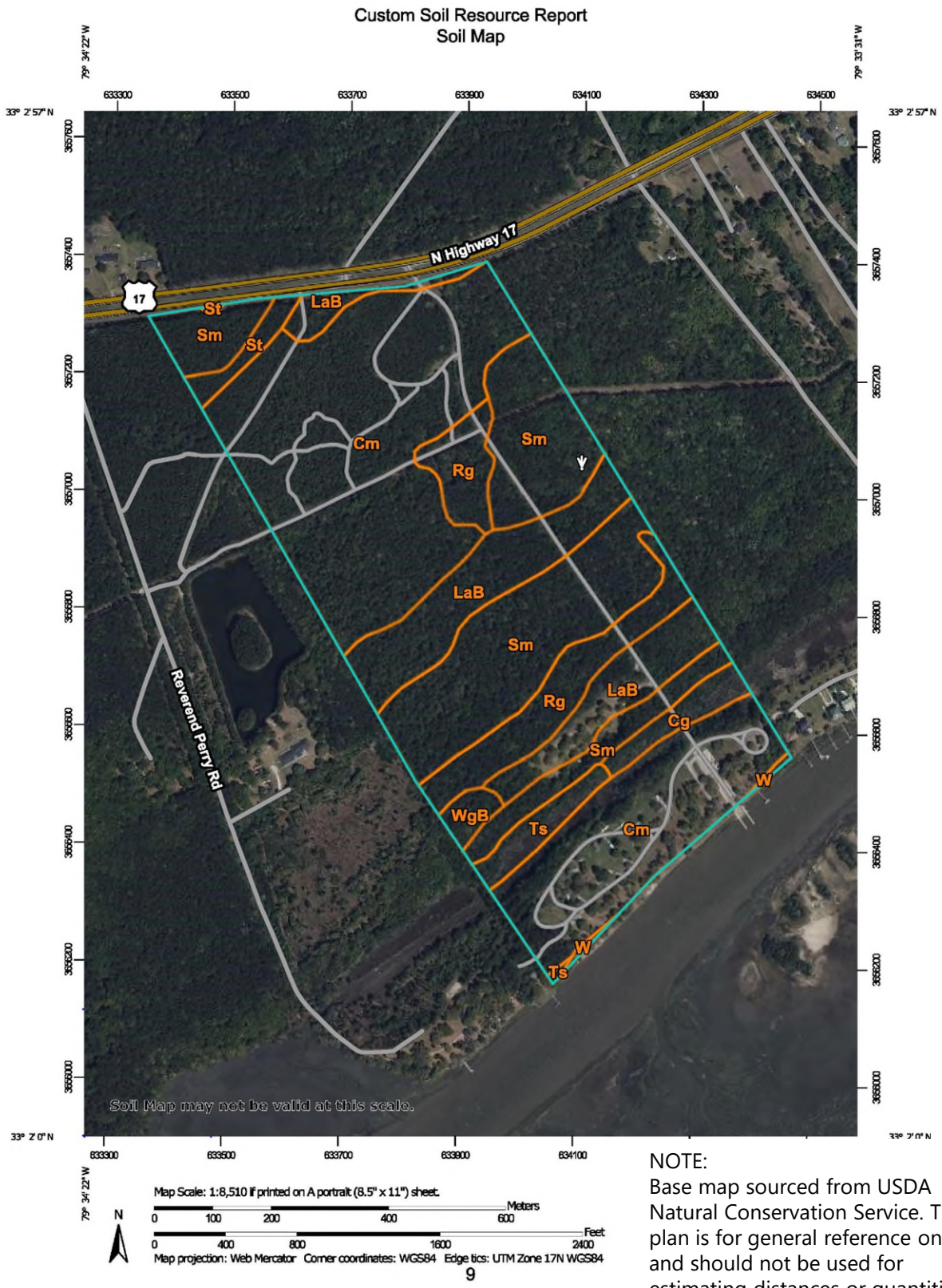
- CPT Sounding / Hand-Auger Boring
- Hand-Auger Boring
- DCP / Hand-Auger Boring
- Infiltration Test / SHWT
- Pavement Core

NOTE:
This conceptual site plan was provided by Johnson, Laschober & Associates and adapted by S&ME. The test Locations shown are considered approximate. This Test Location Plan is for reference only and should not be used for estimating distances or quantities.

TEST LOCATION PLAN

Buck Hall Renovations
McClellanville,, South Carolina

SCALE:	FIGURE NO.
Not to Scale	I-1
DATE: 12/1/23	
PROJECT NUMBER: 22130193	



NOTE:
Base map sourced from USDA Natural Conservation Service. This plan is for general reference only and should not be used for estimating distances or quantities

	Soil Survey Map	SCALE: Not to Scale	FIGURE NO.
	Buck Hall Renovations McClellanville, South Carolina	DATE: 1/3/2023 PROJECT NUMBER 23130193	**I-2**

Appendix II – Field Data

CPT Soundings

Hand-Auger Boring Logs

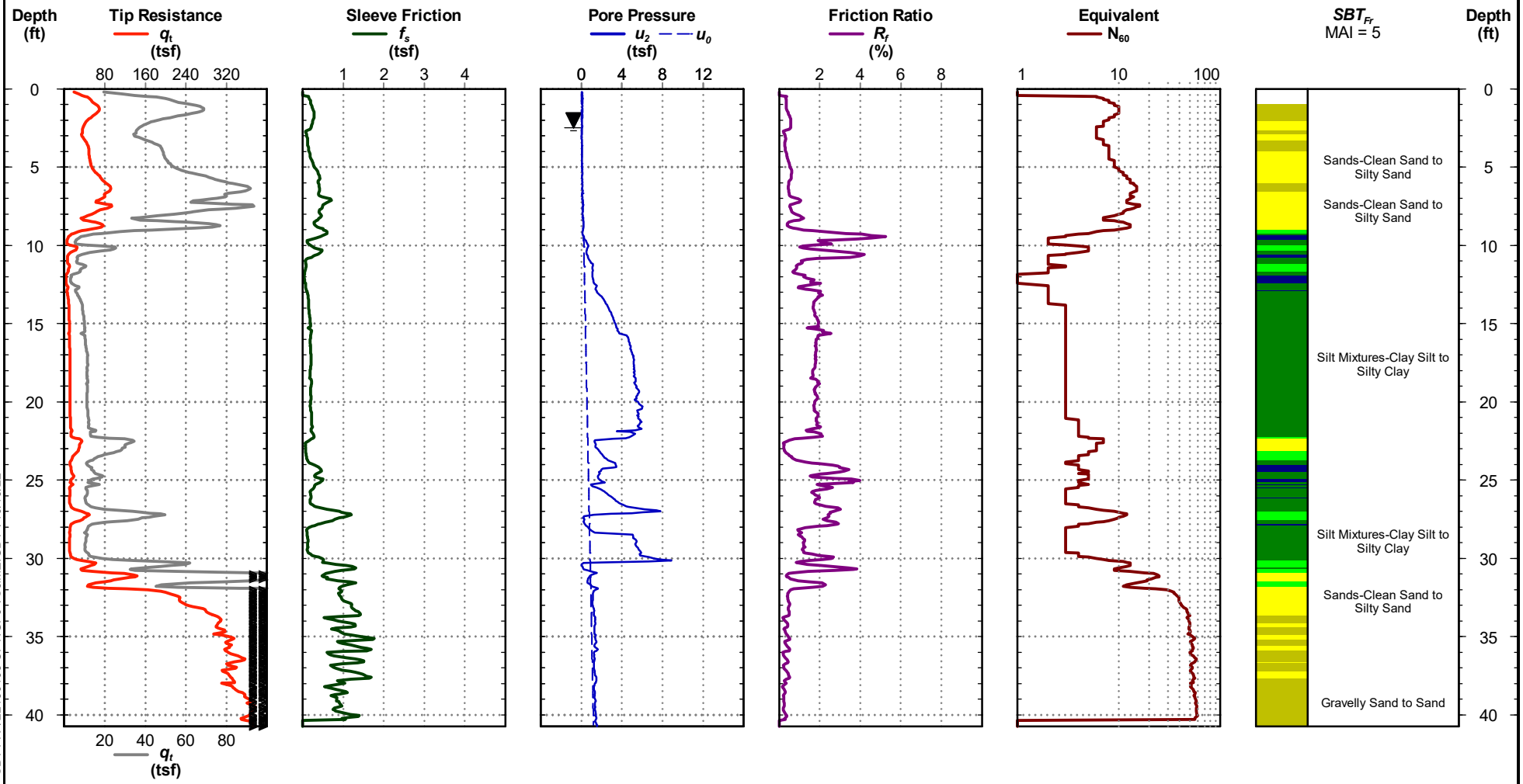
DCP Logs

Test Methods and Procedures

Sounding ID: C-01

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	40.8 ft
Estimated Water Depth:	2.5 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

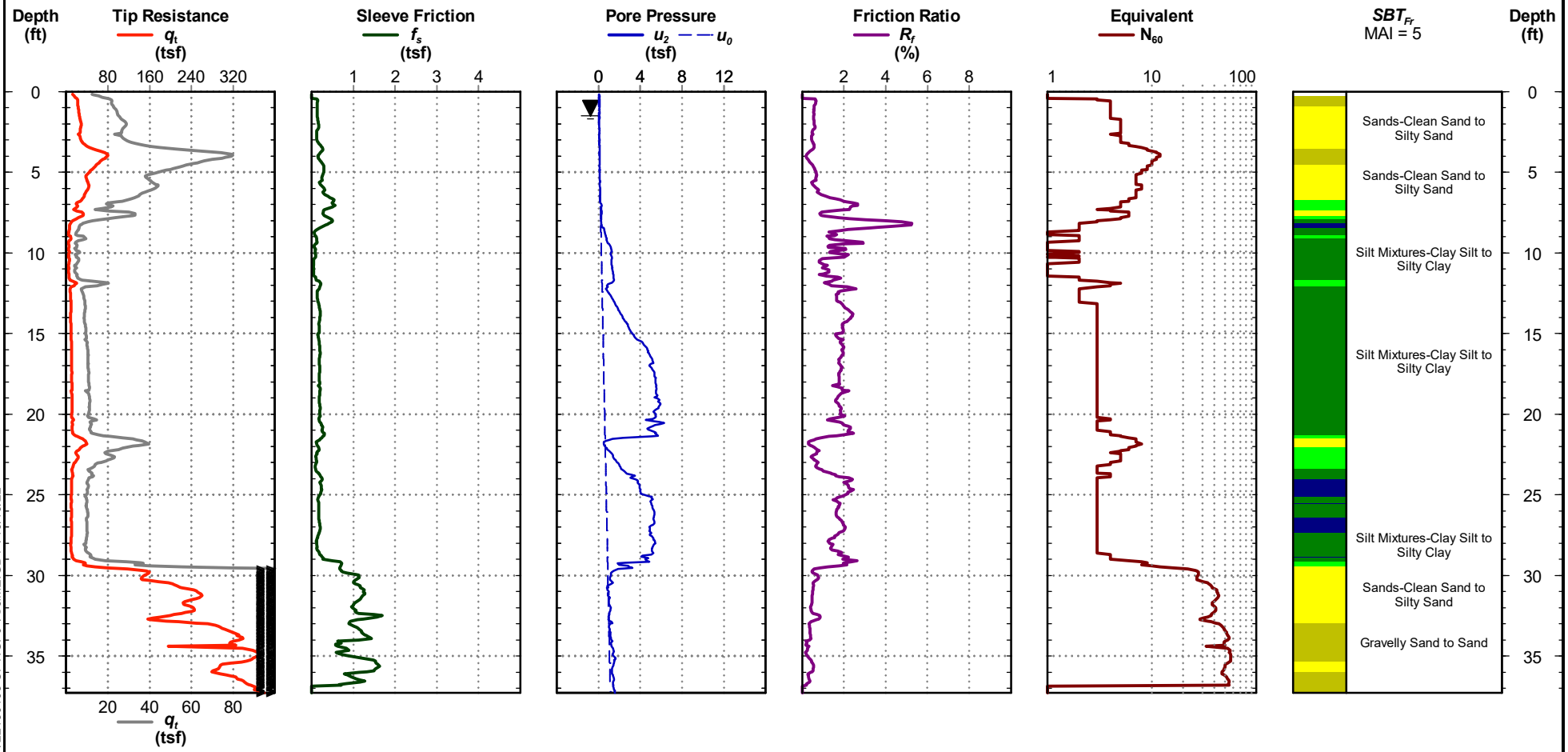
Electronic Filename: C-01.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-02

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	37.3 ft
Estimated Water Depth:	1.5 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

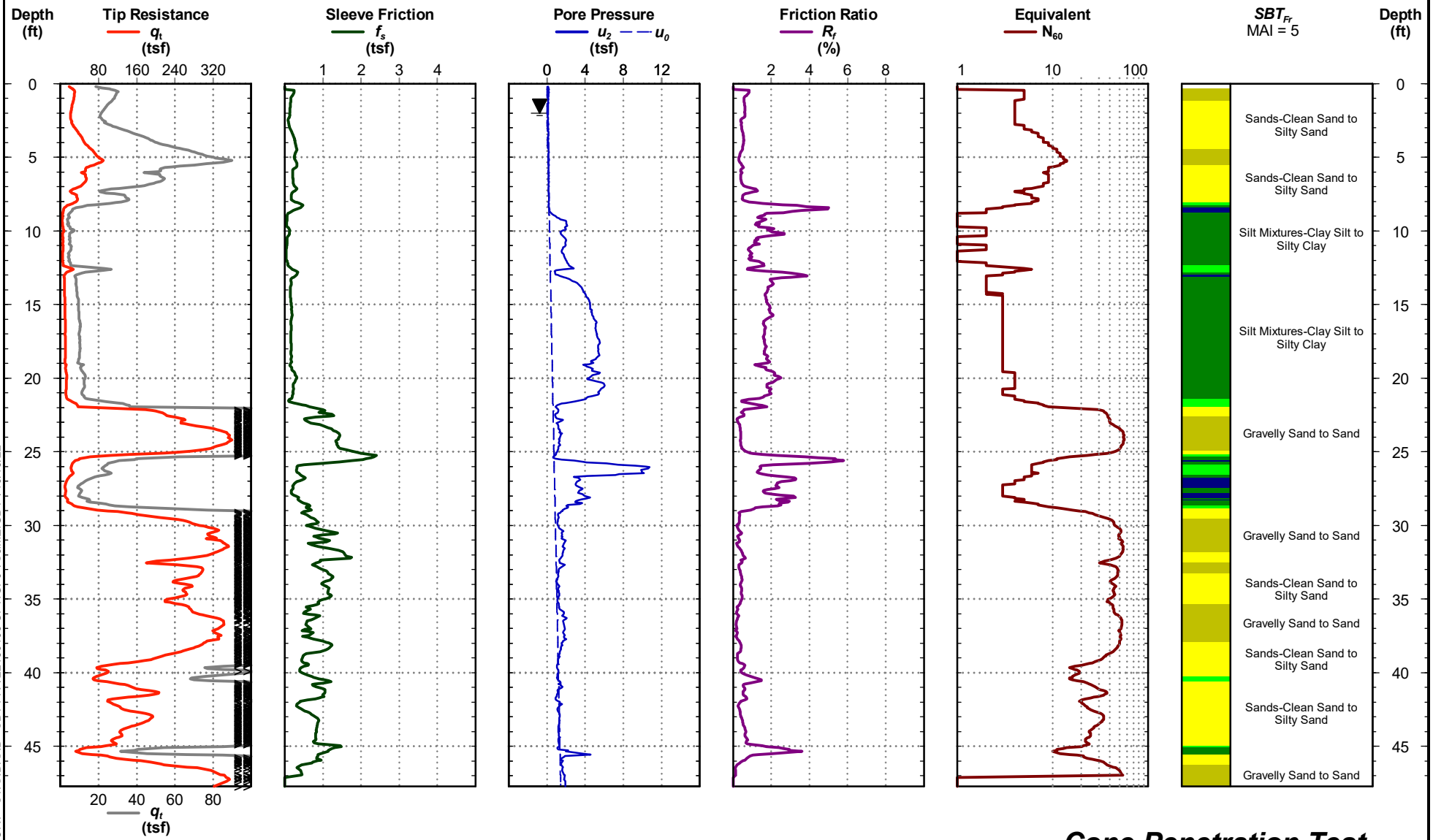
Electronic Filename: C-02.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-03

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	47.7 ft
Estimated Water Depth:	2 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

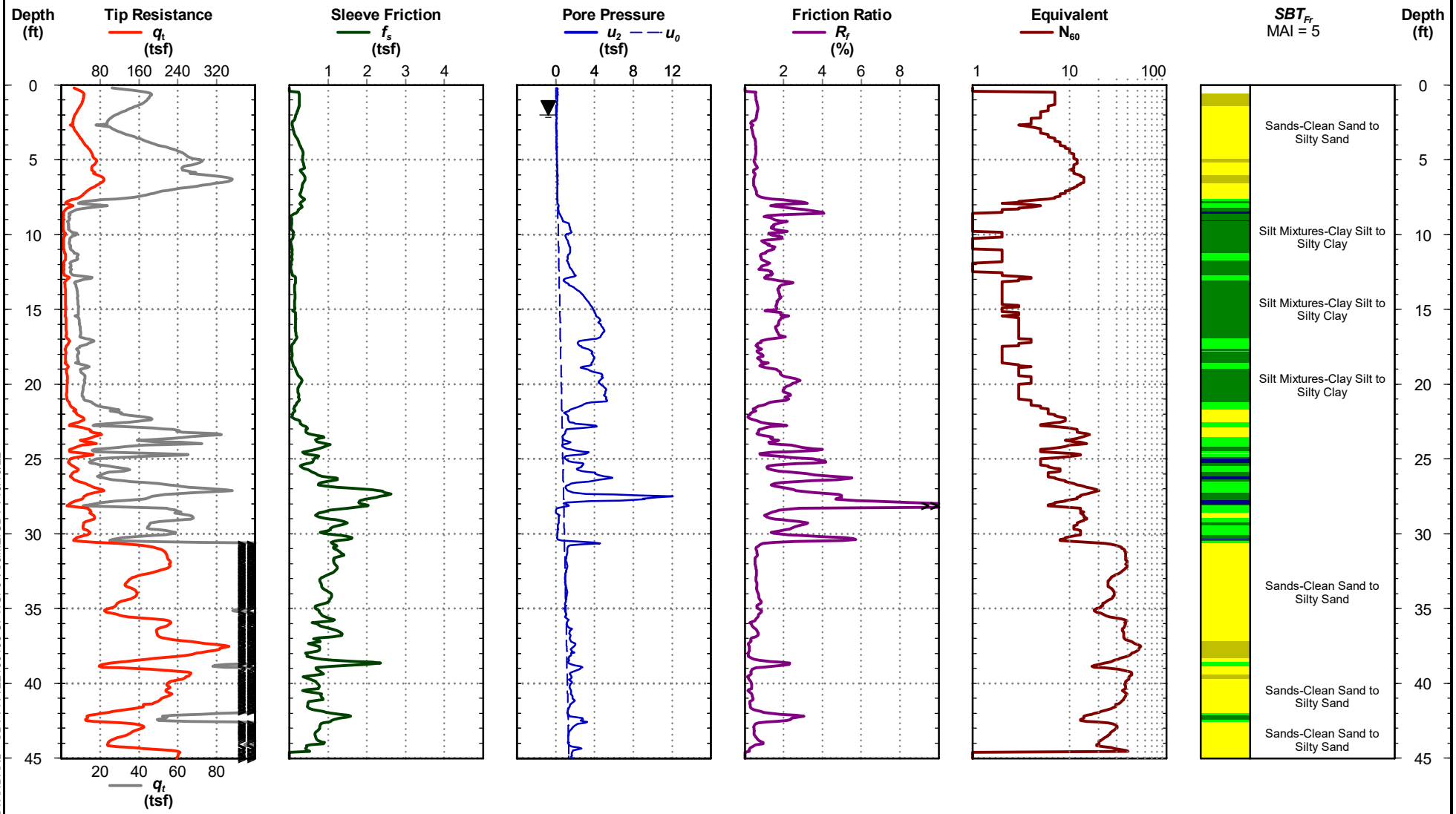
Cone Penetration Test

Electronic Filename: C-03.DAT

Sounding ID: C-04

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	45.0 ft
Estimated Water Depth:	2 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

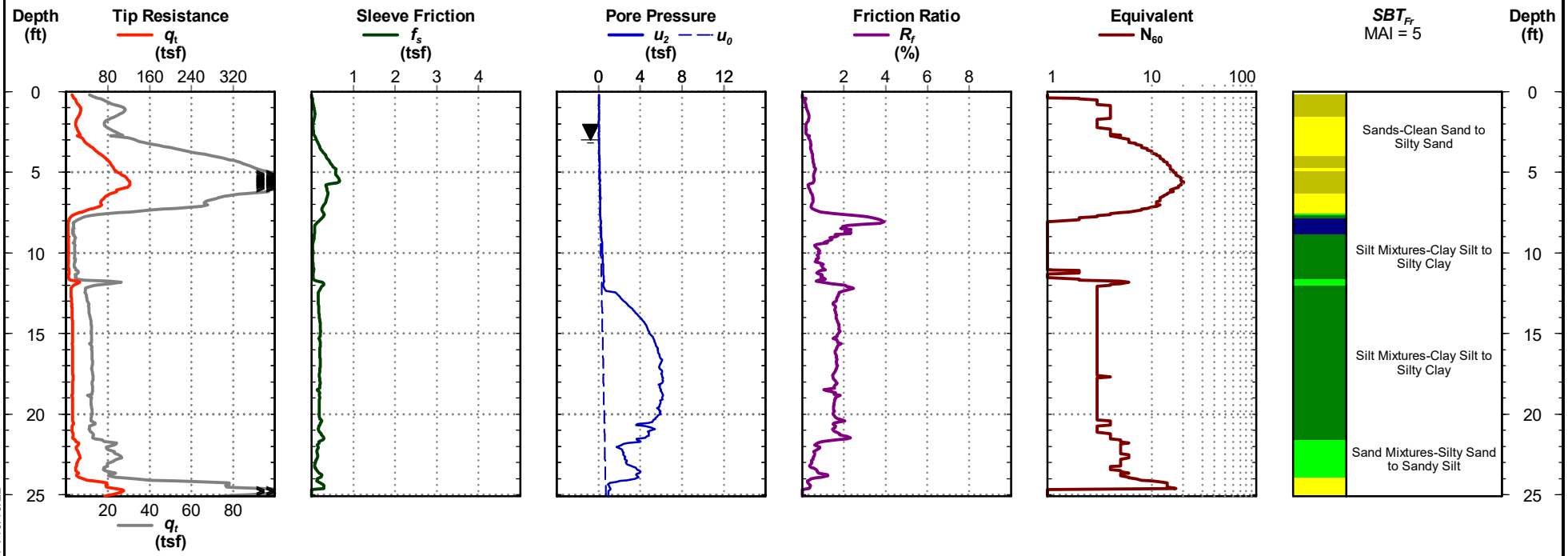
Electronic Filename: C-04.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-05

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	25.1 ft
Estimated Water Depth:	3 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

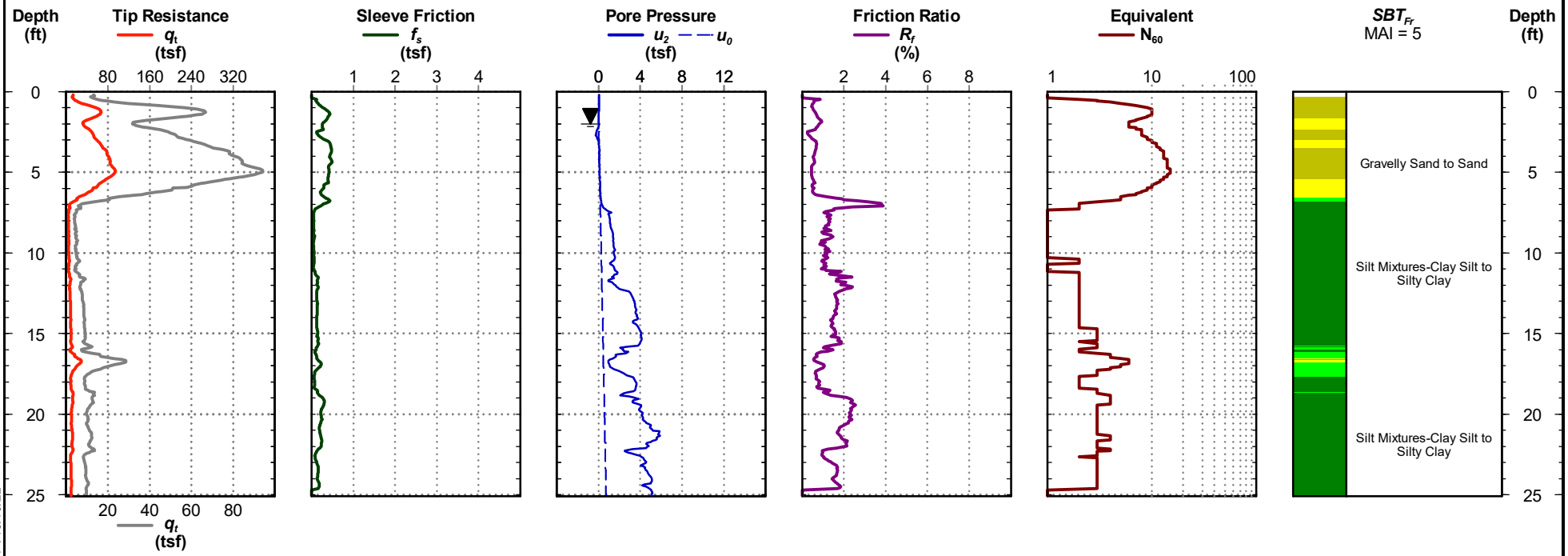
Electronic Filename: C-05.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-06

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	25.1 ft
Estimated Water Depth:	2 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

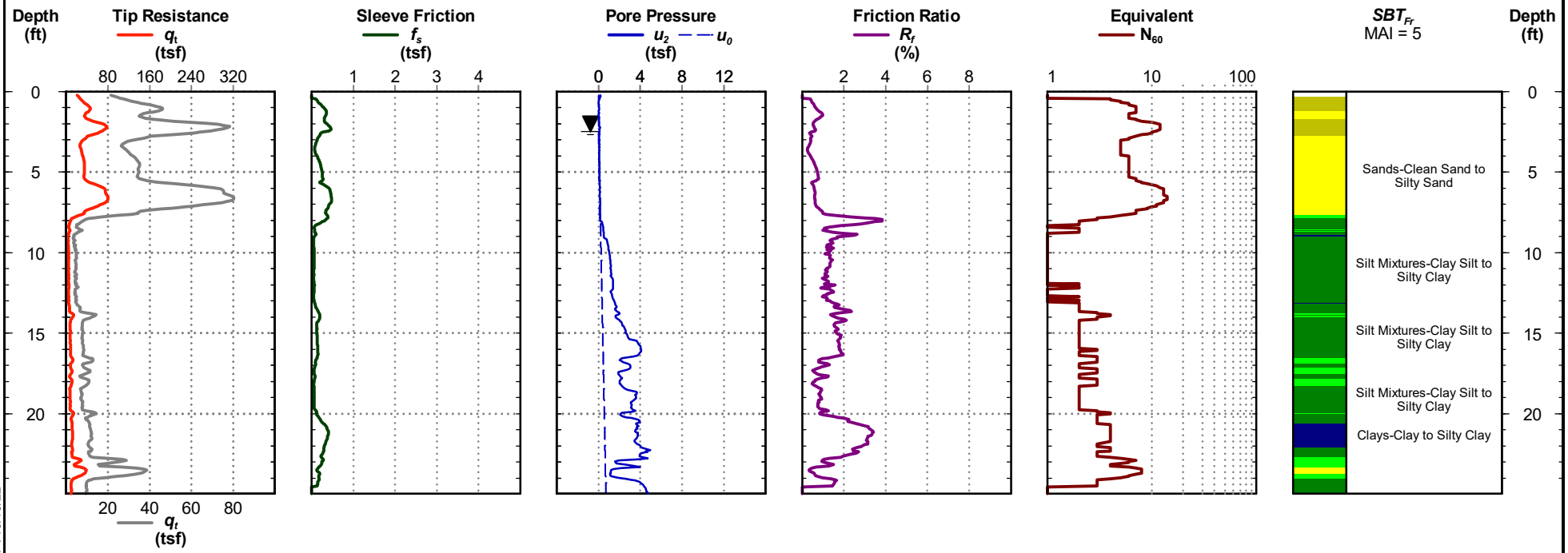
Electronic Filename: C-06.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-07

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Oct. 11, 2022	**Total Depth:**	25.0 ft
Estimated Water Depth:	2.5 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/MW | TW	**Cone Size:**	1.75



Cone Penetration Test

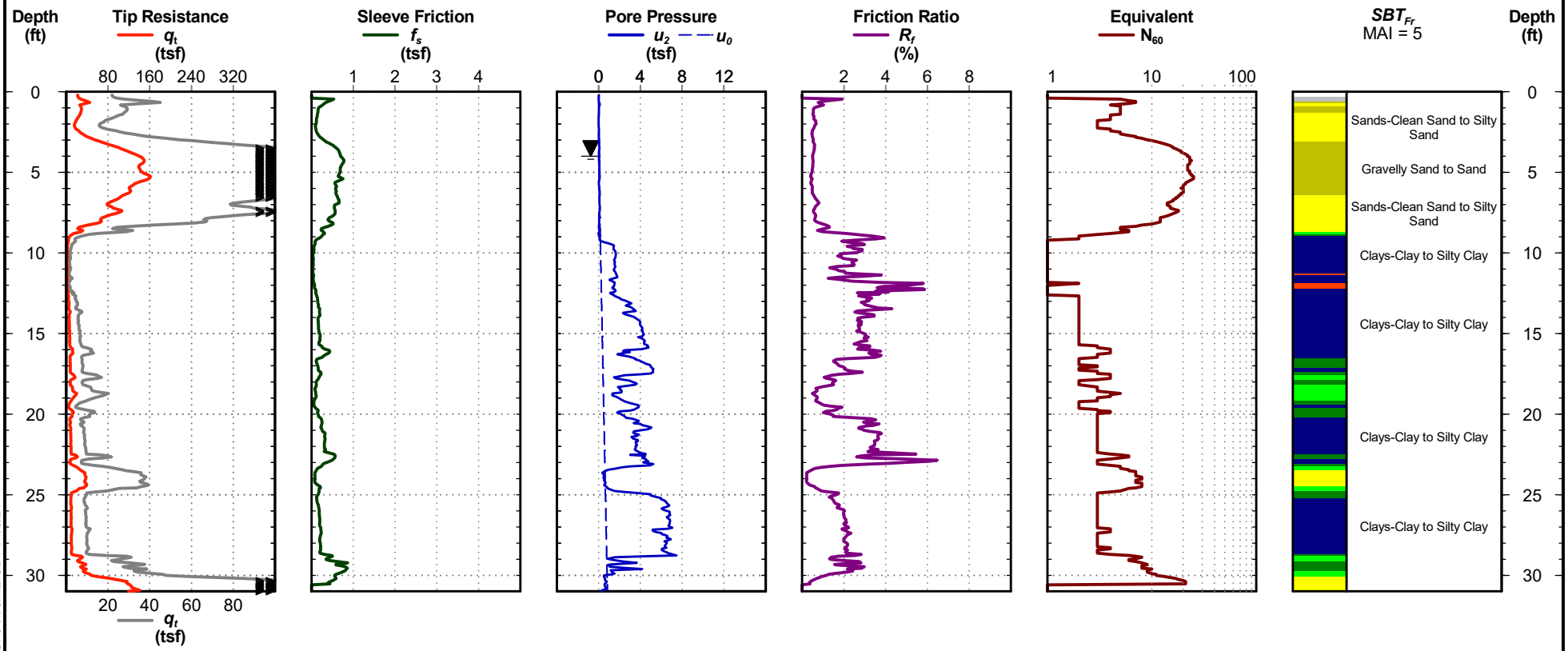
Electronic Filename: C-07.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 10/16/22

Sounding ID: C-08

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Dec. 7, 2023	**Total Depth:**	31.0 ft
Estimated Water Depth:	4 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/BJones | LGreene	**Cone Size:**	1.75



Cone Penetration Test

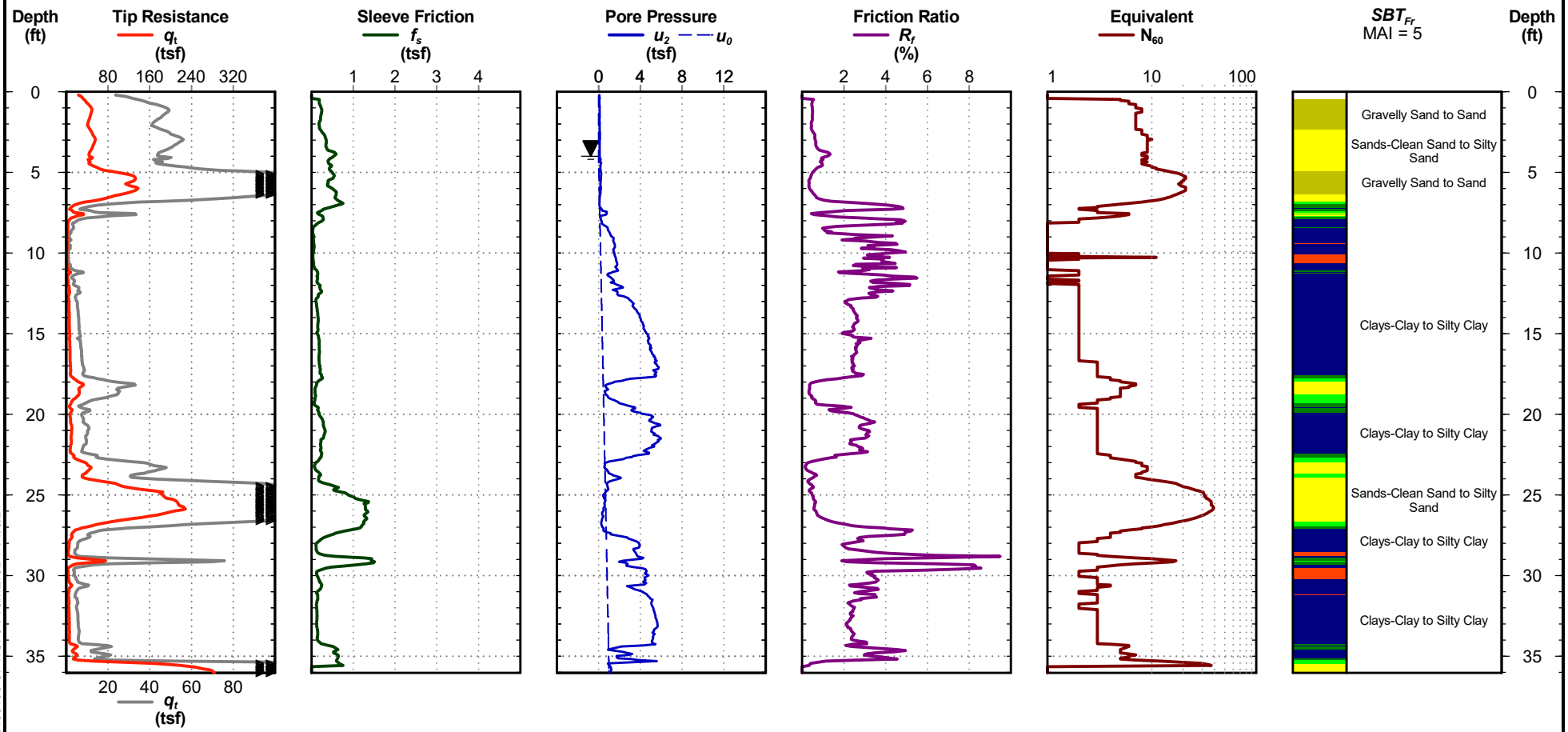
Electronic Filename: C-08 (mod).DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 1/3/24

Sounding ID: C-09

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Dec. 7, 2023	**Total Depth:**	36.0 ft
Estimated Water Depth:	4 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/BJones | LGreene	**Cone Size:**	1.75



Cone Penetration Test

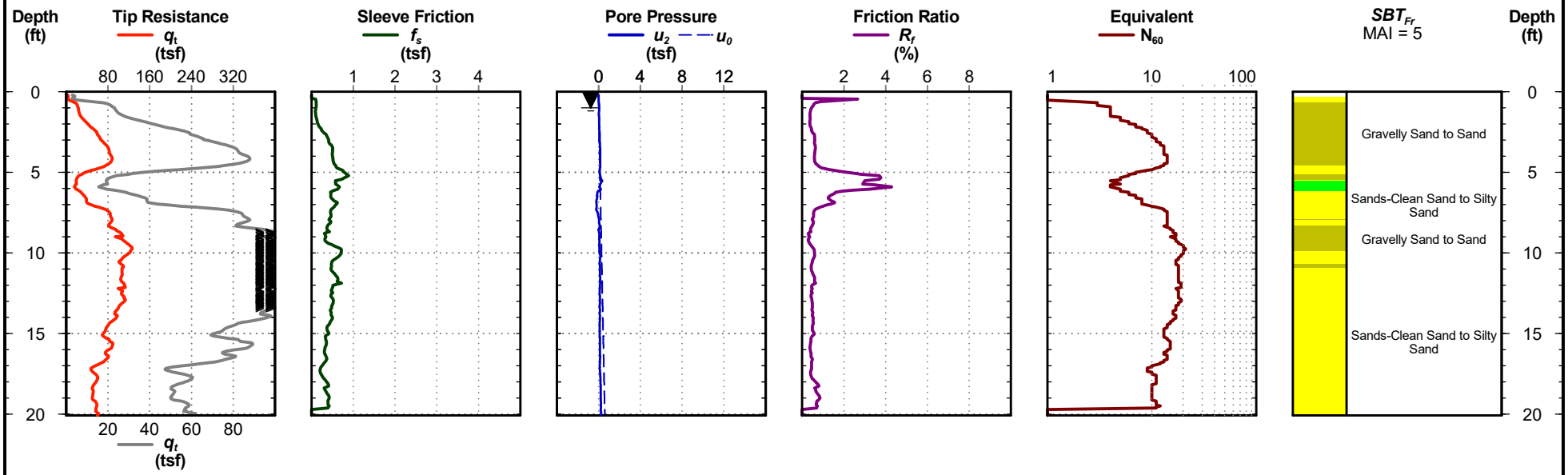
Electronic Filename: C-09.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 1/3/24

Sounding ID: C-10

Buck Hall Renovations
McClellanville, South Carolina
S&ME Project No: 22130193

Date:	Dec. 7, 2023	**Total Depth:**	20.1 ft
Estimated Water Depth:	1 ft	**Termination Criteria:**	Target Depth
Rig/Operator:	Skid Steer/BJones | LGreene	**Cone Size:**	1.75



Cone Penetration Test

Electronic Filename: C-10.DAT

CPT REPORT - STANDARD - SBT FR \ 22130193 CPT.GPJ \ S&ME.GDT \ 1/3/24

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-1 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.036742 **LONGITUDE:** -79.563142
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			POORLY GRADED SAND WITH SILT (SP-SM), orange and tan, fine to medium grained, moist			
1.5					POORLY GRADED SAND (SP), tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-2 *Sheet 1 of 1*

DATE:	11/13/2023	ELEVATION:	NOTES:
EQUIPMENT:	Hand Auger	DATUM: NGVD29	
OPERATOR:	Samuel Folmar	DEPTH: 4.0 ft	
HAMMER TYPE:	n/a	CLOSURE: Cuttings	
DRILLING METHOD:		LOGGED BY: Samuel Folmar	LATITUDE: 33.037525 LONGITUDE: -79.562269
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, gray, fine to medium grained, moist			
1.0		Coastal Plain			POORLY GRADED SAND (SP), trace fines, tan to orange, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-3 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.038202 **LONGITUDE:** -79.561391
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			SILTY SAND (SM), little silt, tan and brown, fine to medium grained, moist			
1.5					POORLY GRADED SAND (SP), trace fines, tan to orange brown, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-4 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.038720 LONGITUDE: -79.560721
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3		Coastal Plain			SILTY SAND (SM), little silt, tan and brown, fine to medium grained, moist			
2.0					POORLY GRADED SAND (SP), trace fines, tan to orange brown, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-5 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.037696 **LONGITUDE:** -79.563641
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, dark gray, fine grained, dry			
1.0					POORLY GRADED SAND WITH SILT (SP-SM), brown, fine to medium grained, moist			
1.5					POORLY GRADED SAND (SP), tan, fine to medium grained, moist			
		Coastal Plain						
▽ 4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.8	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-6 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.039310 **LONGITUDE:** -79.561185
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.5		Coastal Plain			POORLY GRADED SAND WITH SILT (SP-SM), orange and tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.8	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-7 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.039478 LONGITUDE: -79.560529
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3		Coastal Plain			SILTY SAND (SM), little silt, gray, fine to medium grained, moist			
1.5					POORLY GRADED SAND (SP), trace fines, tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING

LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-8 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.039989 LONGITUDE: -79.562706
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3		Coastal Plain			SILTY SAND (SM), some silt, dark brown, fine to medium grained, moist			
					little silt			
2.5					POORLY GRADED SAND (SP), trace fines, tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-9 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.039108 LONGITUDE: -79.564077
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, brown, fine to medium grained, moist			
2.0		Coastal Plain			POORLY GRADED SAND WITH CLAY (SP-SC), orange, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023	3.8	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: C-10 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.044039 **LONGITUDE:** -79.565285
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			SILTY SAND (SM), brown to tan, fine to medium grained, moist to wet			
					some fines			
					little fines			
					few fines			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: D-1 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.046512 LONGITUDE: -79.567580
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			POORLY GRADED SAND WITH SILT (SP-SM), brown to green, fine to medium grained, moist			
2.0					POORLY GRADED SAND WITH CLAY (SP-SC), orange and tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: D-2 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.046561 **LONGITUDE:** -79.567143
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			POORLY GRADED SAND WITH SILT (SP-SM), brown to green, fine to medium grained, moist			
2.0					POORLY GRADED SAND WITH CLAY (SP-SC), orange and tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: D-3 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.042972 **LONGITUDE:** -79.565708
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			SILTY SAND (SM), some silt, dark brown, fine to medium grained, moist			
1.0					POORLY GRADED SAND WITH SILT (SP-SM), brown to tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-1 *Sheet 1 of 1*

DATE:	11/13/2023	ELEVATION:	NOTES:
EQUIPMENT:	Hand Auger	DATUM: NGVD29	
OPERATOR:	Samuel Folmar	DEPTH: 4.0 ft	
HAMMER TYPE:	n/a	CLOSURE: Cuttings	
DRILLING METHOD:		LOGGED BY: Samuel Folmar	LATITUDE: 33.038321 LONGITUDE: -79.561916
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
					SILTY SAND (SM), little silt, gray and brown, fine grained, dry			
1.5								
		Coastal Plain			POORLY GRADED SAND (SP), trace fines, tan to orange, fine to medium grained, moist to wet			
4.0								
					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023	4.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-2 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.039857 LONGITUDE: -79.563318
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0		Coastal Plain			SILTY SAND (SM), little silt, gray and brown, fine to medium grained, moist			0
3.0					POORLY GRADED SAND WITH CLAY (SP-SC), orange and tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023	3.8	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING

LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-3 *Sheet 1 of 1*

DATE:	11/13/2023	ELEVATION:	NOTES:
EQUIPMENT:	Hand Auger	DATUM: NGVD29	
OPERATOR:	Samuel Folmar	DEPTH: 4.0 ft	
HAMMER TYPE:	n/a	CLOSURE: Cuttings	
DRILLING METHOD:		LOGGED BY: Samuel Folmar	LATITUDE: 33.039300 LONGITUDE: -79.563698
SAMPLING METHOD:		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0		Coastal Plain			SILTY SAND (SM), little silt, gray and brown, fine to medium grained, moist			0
3.0					CLAYEY SAND (SC), little fines, orange, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING

LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-4 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.042303 **LONGITUDE:** -79.566000
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0		Coastal Plain			SILTY SAND (SM), little silt, dark brown brown, fine to medium grained, moist			0
1.0					POORLY GRADED SAND WITH SILT (SP-SM), brown to tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-5 *Sheet 1 of 1*

DATE: 11/13/2023	ELEVATION:		NOTES:
EQUIPMENT: Hand Auger		DATUM: NGVD29	
OPERATOR: Samuel Folmar	DEPTH: 4.0 ft		
HAMMER TYPE: n/a	CLOSURE: Cuttings		
DRILLING METHOD:	LOGGED BY: Samuel Folmar		LATITUDE: 33.043191 LONGITUDE: -79.566690
SAMPLING METHOD: Grab		PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.5		Coastal Plain			SILTY SAND (SM), some silt, dark brown brown, fine to medium grained, moist			
2.0					POORLY GRADED SAND WITH SILT (SP-SM), brown to tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-6 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.044628 **LONGITUDE:** -79.565538
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					POORLY GRADED SAND WITH SILT (SP-SM), brown to tan, fine to medium grained, moist			0
1.5		Coastal Plain			POORLY GRADED SAND (SP), trace fines, tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: H-7 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.044628 **LONGITUDE:** -79.565538
SAMPLING METHOD:		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0								0
0.2					TOPSOIL			
		Coastal Plain			SILTY SAND (SM), some silt, dark brown, fine to medium grained, moist			
1.5					POORLY GRADED SAND (SP), trace fines, tan, fine to medium grained, moist			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/13/2023	3.8	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: I-1 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.039386 **LONGITUDE:** -79.561101
SAMPLING METHOD: Grab		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, gray, fine to medium grained, moist			
0.8					POORLY GRADED SAND WITH SILT (SP-SM), tan to orange, fine to medium grained, moist			
					very pale brown (10YR 7/3)			
		Coastal Plain			*brownish yellow (10YR 6/8) and brown (10YR 5/3)*			
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: I-2 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.038839 **LONGITUDE:** -79.561974
SAMPLING METHOD: Grab		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, gray, fine to medium grained, moist			
0.5					POORLY GRADED SAND WITH CLAY (SP-SC), tan to orange, fine to medium grained, moist			
					gray (10YR 6/1)			
					very pale brown (10YR 7/3)			
					brownish yellow (10YR 6/6)		△ ○	
		Coastal Plain						
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: I-3 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.038491 **LONGITUDE:** -79.562684
SAMPLING METHOD: Grab		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, gray, fine to medium grained, moist			
1.0					POORLY GRADED SAND WITH SILT (SP-SM), tan to orange, fine to medium grained, moist *very pale brown (10YR 7/3)*			
		Coastal Plain			*yellow (10YR 7/8)*		△	
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.2	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

PROJECT:	Buck Hall Renovations McClellanville S&ME Project No. 22130193	HAND AUGER LOG: I-4 *Sheet 1 of 1*

DATE: 11/13/2023	**ELEVATION:**		**NOTES:**
EQUIPMENT: Hand Auger		**DATUM:** NGVD29	
OPERATOR: Samuel Folmar	**DEPTH:** 4.0 ft		
HAMMER TYPE: n/a	**CLOSURE:** Cuttings		
DRILLING METHOD:	**LOGGED BY:** Samuel Folmar		**LATITUDE:** 33.037858 **LONGITUDE:** -79.562451
SAMPLING METHOD: Grab		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane South Carolina FIPS 3900 Feet	

Depth (feet)	NOTES	DEPOSITIONAL ENVIRONMENT	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	DCP BLOW COUNTS	△ % Fines ○ NMC ⊢ PL---LL (20 40 60 80)	ELEVATION
0					TOPSOIL			0
0.3					SILTY SAND (SM), little silt, gray, fine to medium grained, moist *gray (10YR 6/1)*			
0.8		Coastal Plain			POORLY GRADED SAND (SP), tan, fine to medium grained, moist *very pale brown 7/3*			
2.8					POORLY GRADED SAND WITH CLAY (SP-SC), tan to orange, fine to medium grained, moist *brownish yellow (10YR 6/6*		△ ○	
4.0					Bore Hole terminated at 4.0 feet.			
5								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/10/2023	3.5	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf)

Kessler DCP Test Results

ASTM D6951/ACOE GL-92-3/ACOE GL-94-17

Project: Buck Hall Renovations
Date: 11/13/2023
Project Number: 22130193
Personel: SWF
Test Location: D-1

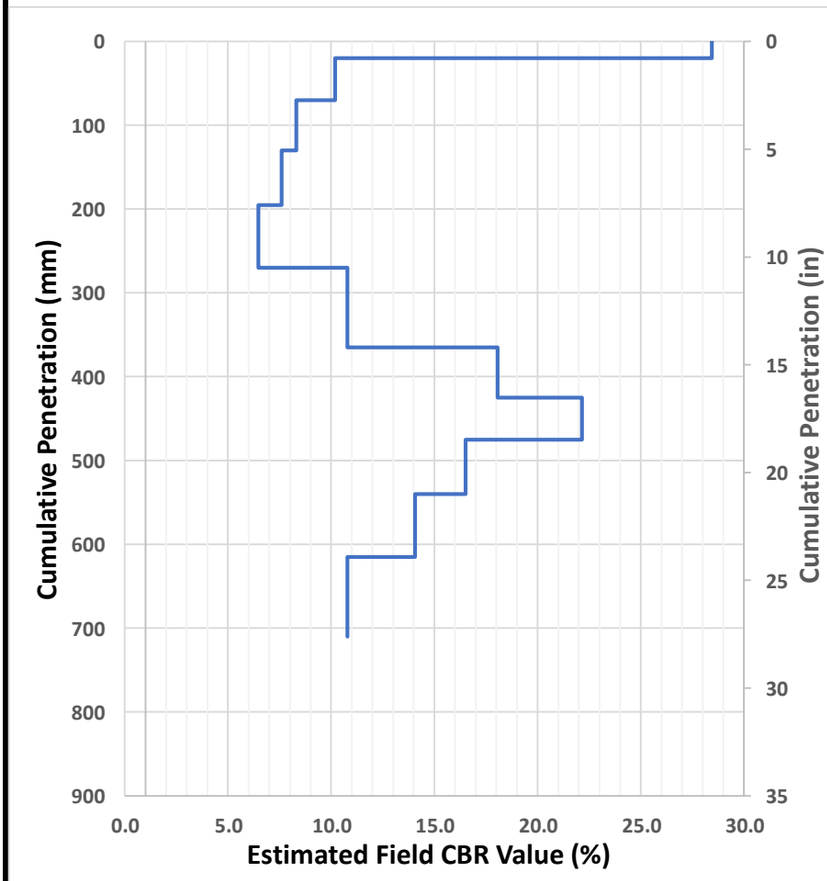
Soil Type
- (●) All Other Soils
- ( ) CH
- ( ) CL (estimated CBR <10)

Hammer Type
- ( ) Dual 17.6 lb
- (●) Single 10.1 lb

Test Data

Number of Blows	Cumulative Penetration (mm)	Cumulative Penetration (in)	Hammer Type
0	0	0	2
5	20	0.79	2
5	70	2.76	2
5	130	5.12	2
5	195	7.68	2
5	270	10.63	2
10	365	14.37	2
10	425	16.73	2
10	475	18.70	2
10	540	21.26	2
10	615	24.21	2
10	710	27.95	2

Subgrade	
No. of Values:	11
Average CBR:	13.9
Max CBR:	28.4
Min CBR:	6.5



References:

1) ASTM D6951 *Standard Test Method for Use of Dynamic Cone Penetrometer in Shallow Pavement Applications*

2) ACOE Instruction Report GL-92-3 *Description and Application of Dual Mass Dynamic Cone Penetrometer*

3) ACOE Technical Report GL-94-17 *Force Protection Site Evaluation Using the Electronic Cone Penetrometer (ECP) and the Dynamic Cone Penetrometer (DCP)*

Kessler DCP Test Results

ASTM D6951/ACOE GL-92-3/ACOE GL-94-17

Project: Buck Hall Renovations
Date: 11/13/2023
Project Number: 22130193
Personel: SWF
Test Location: D-2

Soil Type
- (●) All Other Soils
- ( ) CH
- ( ) CL (estimated CBR <10)

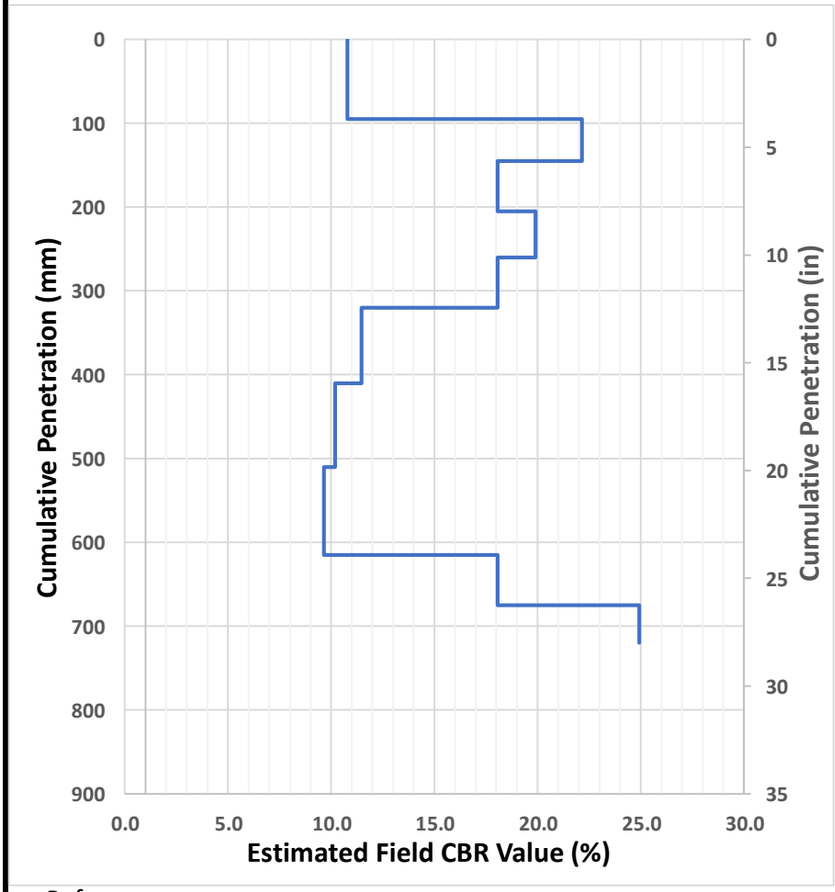
Hammer Type
- ( ) Dual 17.6 lb
- (●) Single 10.1 lb

Test Data

Number of Blows	Cumulative Penetration (mm)	Cumulative Penetration (in)	Hammer Type
0	0	0	2
10	95	3.74	2
10	145	5.71	2
10	205	8.07	2
10	260	10.24	2
10	320	12.60	2
10	410	16.14	2
10	510	20.08	2
10	615	24.21	2
10	675	26.57	2
10	720	28.35	2

Subgrade

No. of Values:	10
Average CBR:	16.3
Max CBR:	24.9
Min CBR:	9.6



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2) ACOE Instruction Report GL-92-3 *Description and Application of Dual Mass Dynamic Cone Penetrometer*

3) ACOE Technical Report GL-94-17 *Force Protection Site Evaluation Using the Electronic Cone Penetrometer (ECP) and the Dynamic Cone Penetrometer (DCP)*

Kessler DCP Test Results

ASTM D6951/ACOE GL-92-3/ACOE GL-94-17

Project: Buck Hall Renovations
Date: 11/13/2023
Project Number: 22130193
Personel: SWF
Test Location: D-3

Soil Type
- (●) All Other Soils
- ( ) CH
- ( ) CL (estimated CBR <10)

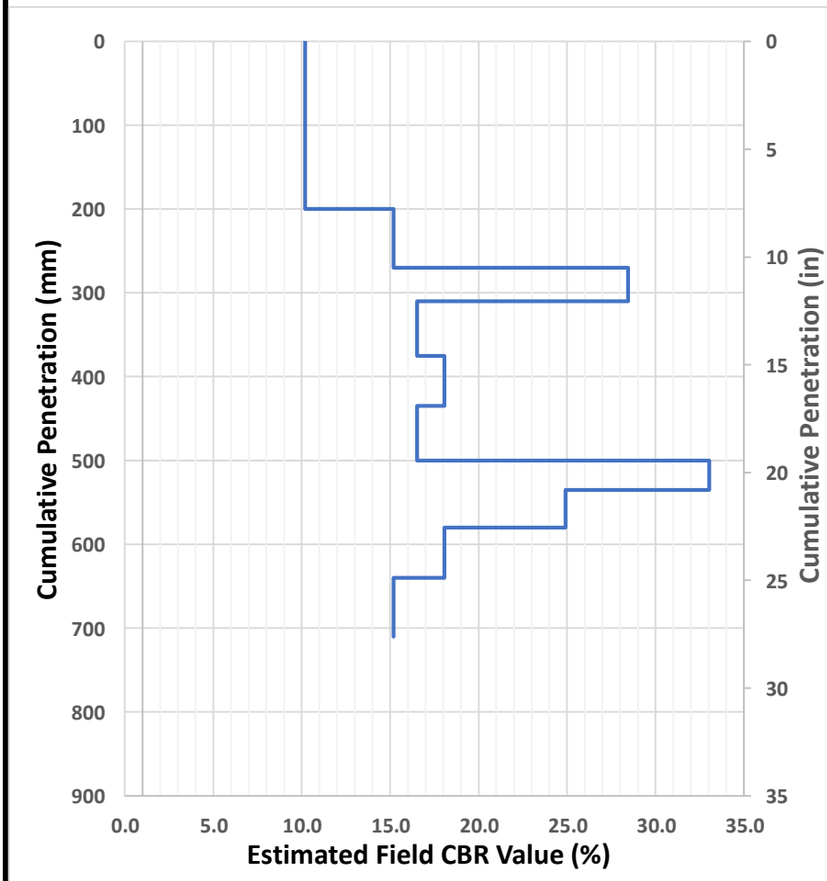
Hammer Type
- ( ) Dual 17.6 lb
- (●) Single 10.1 lb

Test Data

Number of Blows	Cumulative Penetration (mm)	Cumulative Penetration (in)	Hammer Type
0	0	0	2
10	100	3.94	2
10	200	7.87	2
10	270	10.63	2
10	310	12.20	2
10	375	14.76	2
10	435	17.13	2
10	500	19.69	2
10	535	21.06	2
10	580	22.83	2
10	640	25.20	2
10	710	27.95	2

Subgrade

No. of Values:	11
Average CBR:	18.8
Max CBR:	33.0
Min CBR:	10.2



References:

1) ASTM D6951 *Standard Test Method for Use of Dynamic Cone Penetrometer in Shallow Pavement Applications*

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Field Testing Procedures

CPT Soil Classification Legend

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

(*) Heavily Overconsolidated or Cemented

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

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

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

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

Cone Penetrometer Test (CPT) Sounding

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

Dynamic Cone Penetrometer (DCP USACE)

The DCP test involves driving a conical-shaped tip into the ground by use of a 10.1-pound hammer free-falling through a drop of 22.6 inches. The number of hammer blows required to drive the tip through successive increments of 2 to 6 inches is defined as the penetration index. Softer/looser soils will yield a higher Penetration Index than more dense/stiff soils. Penetration Indices can be correlated to CBR values based on extensive US Army Corps of Engineers research data.

Appendix III – Laboratory Test Data

Laboratory Test Results

Summary of Laboratory Test Procedures

Form No: TR-D1140-3
Revision No. 1
Revision Date: 8/2/17

MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

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

Project #:	22130193	Report Date:	12/18/23
Project Name:	Buck Hal Renovations	Test Date(s):	12/13-18/23
Client Name:	Johnson, Laschober & Associates		
Client Address:	701 East Bay Street Suite 411, Charleston, SC		
Sample by:	S. Folmar	Sample Dates:	11/13/23
Sampling Method:		Drill Rig :	

Method: **A** ☐ **B** ☑ Soaked ☑ Soak Time 2 hrs

Sample Identification	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
I-1 (2'-3')	51.09	208.00	199.37	190.83	8.63	**5.8%**	**5.8%**
I-2 (0.5'-2.5')	50.60	212.86	180.57	170.67	32.29	**24.8%**	**7.6%**
I-3 (2'-3')	50.21	201.07	189.91	177.35	11.16	**8.0%**	**9.0%**
I-4 (2.75'-3')	49.66	287.90	243.87	228.89	44.03	**22.7%**	**7.7%**
H-5 (0-2')	49.54	224.14	195.64	173.64	28.50	**19.5%**	**15.1%**

Balance ID. *06796* *Calibration Date:* *1/3/23* *#200 Sieve* *10661* *Calibration Date:* *11/15/23*

Notes / Deviations / References: ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um)) Sieve

Marc D. Cerino		Senior Engineer	12/18/23
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

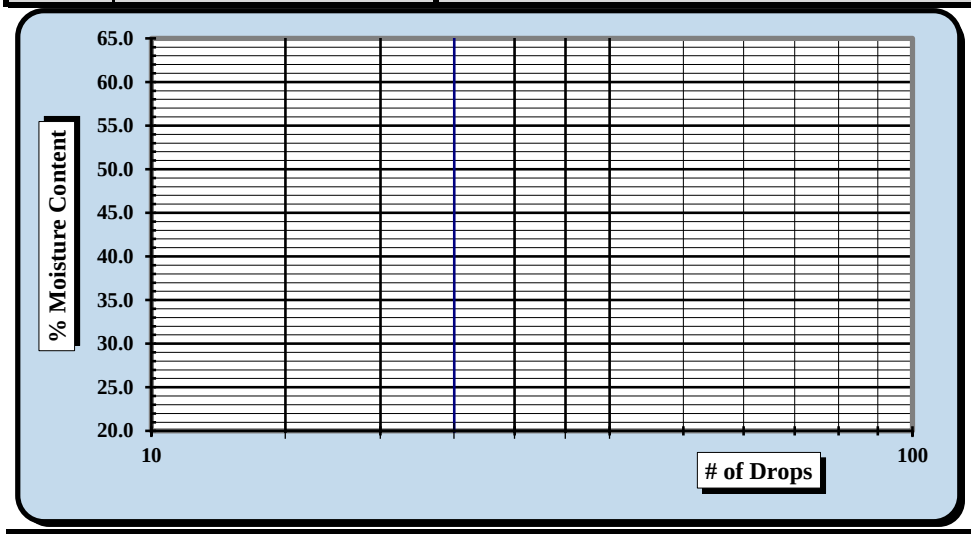
S&ME, Inc. - Charleston: 620 Wando Park Boulevard, Mt. Pleasant, SC 29464

Project #:	22130193	Report Date:	12/18/23
Project Name:	Buck Hall Renovations	Test Date(s)	12/13-18/23
Client Name:	Johnson, Laschober & Associates		
Client Address:	701 East Bay Street, Suite 411, Charleston, SC		

Boring #:	H-5	Sample #:	n/a	Sample Date:	11/13/23
Location:	n/a	Offset:	n/a	Elevation:	0-2
Sample Description:	Dark Brown Silty Sand (SM)				

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	06976	1/3/2023	Grooving tool	36037	8/17/2023
LL Apparatus	06238	7/31/2023	Grooving tool	36038	8/17/2023
Oven	13796	7/31/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:									
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit

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

NP, Non-Plastic ☒

Liquid Limit	
Plastic Limit	
Plastic Index	
Group Symbol	

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☑ Dry Preparation ☐ Air Dried ☐

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Marc D. Cerino
Technical Responsibility

12/18/23
Date

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Results Only Soil Testing for Buck Hall Renovations

December 18, 2023

Prepared for:

Austin Cox
S&ME, Inc.
620 Wando Park Blvd
Mount Pleasant, SC 29464
acox@smeinc.com

Project X Job#: S231215D
Client Job or PO#: 22130193

Respectfully Submitted,

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

REGISTERED PROFESSIONAL ENGINEER
EDUARDO HERNANDEZ
No. M37102
MECHANICAL
STATE OF CALIFORNIA

Soil Analysis Lab Results

Client: S&ME, Inc.
Job Name: Buck Hall Renovations
Client Job Number: 22130193
Project X Job Number: S231215D
December 18, 2023

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{--}	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
D-3	0-4	13.8	0.0014	13.7	0.0014	180,900	30,820	7.4	131	0.1	55.8	3.7	ND	15.0	2.9	8.4	56.3	2.6	6.0
H-2	0-4	12.1	0.0012	5.7	0.0006	174,200	61,640	8.1	142	0.1	0.7	5.6	ND	8.1	1.4	7.3	48.5	3.7	12.1

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

Note: Sometimes a bad sulfate hit is a contaminated spot. Typical fertilizers are Potassium chloride, ammonium sulfate or ammonium sulfate nitrate (ASN). So this is another reason why testing full corrosion series is good because we then have the data to see if those other ingredients are present meaning the soil sample is just fertilizer-contaminated soil. This can happen often when the soil samples collected are simply surface scoops which is why it's best to dig in a foot, throw away the top and test the deeper stuff. Dairy farms are also notorious for these items.

Summary of Laboratory Procedures

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means.

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means. Other samples were tested in the laboratory to determine their strength or consolidation properties.

♦ Laboratory Tests of Soil

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*. Albert Atterberg originally defined "limits of consistency" of fine grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the liquid limit of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The plastic limit defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The plasticity index (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine grained Group A, B, C, or D samples were prepared using the wet method described in Section 10.1 of ASTM D4318. The liquid limit of each sample was determined using the multipoint method (Method A) described in Section 11. The liquid limit is by definition the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced

combinations of N versus moisture content. When plotted on semilog paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D2216.

Percent Fines Determination

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D1140, Standard Test Method for Amount of Material Finer Than the No. 200 Sieve. Method A, using water to wash the sample through the sieve without soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the “percent fines” or percent clay and silt fraction