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PRELIMINARY GEOTECHNICAL REPORT
PROPOSED BUCKWALTER PLACE DEVELOPMENT
PROGRESSIVE STREET
BLUFFTON, SC

PREPARED FOR

GEL ENGINEERING OF NC, INC.

SCI PROJECT 190110
SEPTEMBER 27, 2019

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September 27, 2019

GEL Engineering of NC, Inc.
55 Shiloh Road, Suite 6
Asheville, NC 28803

Attention: Mr. Reggie Reeves

SCI Project 190110

Dear Mr. Reeves:

Soil Consultants, Inc. submits this report to provide results of the preliminary geotechnical services provided for the proposed Buckwalter Place development located at a property on Progressive Street in Bluffton, SC. Our services were performed in accordance with SCI Proposal No. 14-19-124, dated July 24, 2019. This report provides a discussion of the proposed development, exploration procedures used, subsurface conditions encountered, seismic analysis, and preliminary recommendations for site preparation and foundation design. We appreciate the opportunity to be of service to you during the preliminary design phase of this project. Please notify us when the final building layout and approximate structural loading information is determined, so that we may provide assistance with the final geotechnical investigation.

Analyses by:

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 29039 ALVIN TALBOT HENDERSON III

9/27/2019

A. Talbot Henderson, III, P.E.

Reviewed by:

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 17234 RONALD R. AUSTIN

9/27/2019

Ronald R. Austin, P.E.

SOUTH CAROLINA SOIL CONSULTANTS, INC. No. 124 CERTIFICATE OF AUTHORIZATION

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INTRODUCTION

Soil Consultants, Inc. (SCI) presents this report to document geotechnical findings and preliminary recommendations for the proposed Buckwalter Place development located on Progressive Street in Bluffton, SC. Geotechnical services were performed in accordance with SCI Proposal No. 14-19-124, dated July 24, 2019. Our services were authorized via a subconsultant master services agreement with GEL and an email message with notice to proceed from Mr. Reggie Reeves on July 30, 2019.

SCOPE OF PROJECT

We understand the project consists of a preliminary investigation for a proposed future development. We have been provided a conceptual plan drawing (Conceptual Plan A) which shows two new buildings and new paved parking and driveway areas at the site. The drawing also indicates that the buildings are one-story structures with footprint areas of approximately 11,500 square feet and 12,000 square feet. No additional information regarding the proposed development was provided. For the purposes of this report, we assume the proposed development may include timber, metal, or masonry-framed buildings with concrete floor slabs supported at grade. In addition, we assume the proposed development will include asphalt and concrete pavements.

Structural loading information was not provided. However, based on previous experience with similar projects, we anticipate that maximum column loads will be in the range of 25 to 50 kips, and maximum wall loads will be in the range of 2 to 3 kips per linear foot. In addition, we assume floor loading will be 100 pounds per square foot (psf) or less.

Based on observations of the existing topography at the site, we assume that no more than 2 feet of fill material will be required for grading the proposed structure locations during construction. Fill heights refer to the net fill heights above the existing ground surface elevations at the time of our subsurface exploration neglecting any fill that is placed where existing soils (such as topsoil) will be removed.

SITE DESCRIPTION

The site of the proposed development is adjacent to the Bluffton Police station and is bound by Innovation Drive to the east, by Progressive Street to the south, by wooded undeveloped property to the west, and by an existing stormwater detention pond to the north. At the time of our investigation, the property was partially wooded and partially cleared and several of the cleared areas were being used for vehicle parking. The ground surfaces in the cleared areas were generally covered with grass and weeds, and the areas traveled by the drilling equipment were noted to be relatively firm.

Topographic information was not provided. However, based on observations at the site, the ground surface appears to be generally flat. In addition, the ground surface elevations generally appeared similar to the adjacent properties and roadways, with the exception of the existing detention pond to the north.

The FEMA flood zone was not provided. For the purposes of this report, we assume the property is not located in a V or VE flood zone or within an area of moderate to severe flooding.

FIELD EXPLORATION

On August 19 and 20, 2019, we performed four soil borings, designated B-1 through B-4, using mud-rotary drilling procedures at the site. Because the investigation is preliminary, the borings were widely spaced across the property to obtain general soil conditions at the site. Borings B-2 and B-4 are located in or near proposed structure locations. Approximate boring locations are shown on Figure 1, *Boring Location Plan,* attached to this report.

Boring locations were staked at the site by a representative of our firm estimating distances and angles with reference to existing site features using the provided Conceptual Plan A drawing. Before mobilization of the drilling equipment, SCI contacted SC811 to locate any known underground utilities at the site.

Borings B-1 through B-3 were advanced to depths of 20 feet below the existing ground surface, and Boring B-4 was advanced to a depth of 60 feet. The borings were performed using track-mounted drilling equipment. During drilling, split-spoon sampling and Standard Penetration Testing (SPT) was performed at selected intervals. Our experienced drilling personnel visually classified the recovered samples and placed portions into sealed sample containers for transport to our laboratory.

Soil samples from this exploration will be retained for a period of three months from the date of this report. Unless other arrangements are made, they will be disposed of following this period.

BORING LOGS

SCI's geotechnical engineer developed the final log for each boring using SPT data and visual descriptions recorded during the field exploration and visual classification of the recovered materials after return to the SCI laboratory. The boring logs attached to this report represent SCI's interpretation of stratigraphy and groundwater conditions at the explored locations based on visual classification of recovered samples. Transition boundaries between soil types noted on the boring logs are approximate.

SUBSURFACE CONDITIONS

Generalized stratigraphy and groundwater are discussed in the following paragraphs. The subsurface and groundwater conditions are based on conditions encountered at the boring locations and to the depths explored. All references to depth are approximate and are made with respect to the existing ground surface at the time the borings were performed.

Stratigraphy

Subsurface conditions encountered in the borings were generally similar.

Below a surficial layer of topsoil and roots, visually estimated to be approximately ½ to 1 foot thick, the borings generally encountered interbedded layers of coarse-grained and fine-grained soils typical of Coastal Plain sediments to termination of the borings at depths of 21½ feet and 61½ feet. The coarse-grained soils consisted of very loose to dense, fine-grained sands with varying amounts of silt and clay. SPT resistance (N) values obtained in the sands ranged from 0 to 50 blows per foot (bpf). The fine-grained soils consisted of soft to hard clays with N values ranging from 3 to 38 bpf.

The soil borings encountered root content to depths of approximately 6 inches. Although this data is an indication of the depths of root content at the site, it should be noted that the depth of roots and organic material can be expected to vary across the site and will likely be more significant within more heavily vegetated portions or low lying areas of the site. The actual depth to which roots of significant size and quantity will be encountered will best be determined by visual inspection during site stripping operations.

Groundwater

The depths to groundwater were measured in Borings B-3 and B-4 approximately 24 hours after completion of drilling and sampling to allow drilling fluids to dissipate and groundwater levels to somewhat stabilize. Groundwater depth measurements in Borings B-1 and B-2 were made as late as possible on the date of drilling. The measured groundwater depths ranged from ¼ foot to 6½ feet. Because the groundwater measurements in Borings B-1 and B-2 were made on the same day of drilling, we believe the deeper groundwater depths observed in Borings B-3 and B-4 would be more-representative of the existing groundwater conditions at this site.

Fluctuations in the level of groundwater may occur due to variations in ground elevation, rainfall, drainage, types of soil encountered, temperature, and other factors not evident at the time the measurements were made. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities, and construction planning should be based on such assumptions of variation. If excavation is required below groundwater during construction, dewatering should be anticipated.

SEISMIC CONSIDERATIONS

Seismic analysis is required in accordance with the International Building Code, 2015 Edition (IBC). The IBC references the American Society of Civil Engineers (ASCE) 7-10, *Minimum Design Loads for Buildings and Other Structures*. Therefore, the procedures described in ASCE 7-10 were used.

Seismic considerations include liquefaction of relatively clean, submerged loose sands due to shaking as well as subsequent ground movements associated with shearing or consolidation of the liquefied soils. In addition, when potentially liquefiable soils exist near the ground surface, surface disruptions such as sand boils are possible. Such disruptions beneath structures supported at grade or on shallow foundations could result in a bearing capacity failure.

Liquefaction Potential

To evaluate the potential for liquefaction, initial determination of site class is needed. The IBC requires soil information to a depth of 100 feet be used in site classification. However, ASCE 7-10, Section 20.1 states “Where site-specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soil investigation report based on known geologic conditions.” SCI used weighted average N values, with extrapolated soil conditions between the 61½-foot boring termination depth and 100 feet as permitted by ASTM 7-10, to determine the site class. Based on the weighted average N values, the site may be initially considered as Site Class D.

Liquefaction analyses were performed using Seed's simplified procedure, as updated and documented by Youd et al (2001), considering the material types and depths to groundwater encountered in the borings and a design earthquake with a magnitude of 6.1 having a 2%

probability of exceedance in a 50-year period as required by IBC 2015. The Maximum Considered Earthquake Geometric Mean (MCEG) peak ground acceleration adjusted for site class effects (PGA_M) used in liquefaction analyses was 0.29g. We used the USGS Earthquake Hazards program to determine PGA_M based on Site Class D.

Results of the liquefaction analysis indicate that potentially liquefiable sand layers exist at various depths below the groundwater table and extend to a depth of 19½ feet. Calculations indicate that approximately 1 to 2 inches of liquefaction-induced total settlement could occur at this site as a result of the design seismic event. Because of the potential for liquefaction, the site is characterized as Site Class F.

However, IBC 2015 through ASCE 7-10 (Section 20.3.1) allows the design spectral response accelerations for a site to be determined without regard to liquefaction provided structures have a fundamental period of less than or equal to 0.5 seconds and the risks of liquefaction are considered in structure design. If the proposed structures meet the requirements of the exception, as determined by the structural engineer, and liquefaction risks are considered in the design, Site Class D would be applicable.

Seismic Design Parameters

Seismic design parameters based on Site Class D are presented in Table 1.

Table 1
Seismic Design Parameters

Seismic Design Parameter		Design Value
Short-period site coefficient (at 0.2 s period)	F_a	1.491
Long-period site coefficient (at 1.0 s period)	F_v	2.241
Mapped MCER, 5 percent damped, spectral response acceleration parameter at short periods	S_S	0.386g
Mapped MCER, 5 percent damped, spectral response acceleration parameter at a period of 1 s	S_1	0.140g
Design, 5% damped, spectral response acceleration parameter at short periods	S_{DS}	0.384g
Design, 5 % damped, spectral response acceleration parameter at a period of 1 s	S_{D1}	0.209g
Based on Site Class D Assumes exception for fundamental period applies otherwise Site Class F will apply requiring a site response analysis.		

Methods to Reduce Liquefaction

Based on our experience with past projects, 2 inches of liquefaction settlement is within the range that is generally considered acceptable for similar projects. However, the magnitude of liquefaction-induced settlement should be evaluated by the project structural engineer considering the settlement tolerance of the proposed structures. If the anticipated liquefaction settlement is not acceptable for this project, liquefaction settlement could be mitigated by installing earthquake drains or supporting the proposed structures on deep foundations extending below the liquefiable zone. Please contact us if liquefaction settlement mitigation recommendations are desired.

PRELIMINARY FOUNDATION DESIGN AND CONSTRUCTION CONSIDERATIONS

As mentioned earlier in this report, this is a preliminary subsurface exploration based on assumed structural loadings and fewer soil borings than would normally be recommended for a project of this size. In addition, the borings were widely spaced across the site to provide general coverage. Therefore, the following comments and recommendations should be construed as preliminary in nature. When better information is known about the planned structures and the exact building locations are decided, additional subsurface investigation and engineering analysis should be performed prior to development of the site to assess subsurface soil conditions in specific locations and to evaluate soil bearing capacities and the anticipated settlements based on the actual structural loading. General site preparation and foundation considerations are discussed below.

Foundation Considerations

Soft to very soft clays and very loose clayey sands were encountered at various depths between 9½ feet and 17 feet in all of the borings. These soft soils are expected to be compressible under load. Based on preliminary calculations, we expect that very lightly-loaded structures may be supported on conventional shallow foundations if less than 1 foot of fill is required to raise the grade in the structure areas. However, settlement mitigation will likely be required for heavier structures or if more than 1 foot of fill will be used for grading.

The three most common alternatives for settlement mitigation are surcharging, ground modification, and deep foundations. Surcharging would likely consist of placing the fill required for grading plus additional fill to mimic the loading of the structures, and the fill should be allowed to remain for a period of time to allow for settlement to occur prior to construction of the structures. The surcharging period is expected to be on the order of 3 to 9 months. Ground modification would likely consist of the installation of aggregate piers or stone columns installed to depths below 17 feet. The most economical deep foundation alternative is expected to be driven timber piles which would likely be driven into the denser sands encountered in Borings B-2 and B-4 at depths below 17 feet.

Site Preparation in Structure Areas

Performance of grade-supported features will be directly affected by the quality of site preparation. Recommendations for site preparation within the building footprints are presented herein.

Unexpected Conditions. Unexpected conditions may occur on previously developed sites. These conditions may include, but not be limited to, active or abandoned utility lines, foundations or remnants of foundations from previous structures, areas of poorly compacted fill, subsurface and debris. Unexpected conditions, if encountered, are best handled by on-site engineering evaluations.

Clearing and Stripping. The proposed construction areas should be fully cleared and stripped of any topsoil, trees, stumps, or other organic debris that may be present within the proposed construction footprints. Topsoil and organic material encountered within the project limits should be removed from the site or stored on site away from controlled fill if reuse for non-structural fill is desired. Stripping and undercutting should extend at least 5 feet beyond the proposed structure footprints.

Compaction of Stripped Subgrade. After organic material and soft soils have been stripped and before placement of fill material, the remaining surface soils within the proposed structure footprints should be thoroughly and uniformly compacted using a 5-ton (minimum) steel drum vibratory roller.

Proofrolling. Following compaction, the proposed structure areas should be proofrolled with a fully-loaded tandem axle dump truck. SCI's geotechnical engineer or an SCI representative should monitor the proofrolling operations. Areas that pump, rut, or perform poorly during the proofrolling operations should be undercut and replaced with controlled backfill. After proofrolling and subsequent repairs, controlled fill should be placed to achieve the desired grade.

Backfill and Controlled Fill Material Criteria. Backfill and controlled fill should be non-plastic and granular in nature with a maximum of 15% passing the No. 200 sieve. Backfill and controlled fill soils should be as approved by the project geotechnical engineer and should generally consist of sands classified as SP, SP-SC, SC, SP-SM, or SM soils according to the Unified Soil Classification System. In addition, backfill and controlled fill should be free of roots, organics, and debris.

Suitability of Onsite Soils for Use as Structural Fill. As previously discussed in the Subsurface Conditions section of this report, the borings encountered sandy soils, classified as SP-SM, beneath the topsoil to a depth of only 2 feet to 4½ feet below the existing ground surface, and the sandy soils were underlain by clayey soils, classified as SC and CH. The near surface sandy soils would be considered suitable for use as fill within roadway and building footprint areas. However, the clayey soils are generally not recommended for use as structural fill due to the difficulty in achieving proper compaction and due to the poor drainage characteristics of clayey soils. The amount of suitable near-surface sands in the areas of Borings B-1 through B-3 is expected to be minimal.

Backfill and Controlled Fill Placement Criteria. Backfill and controlled fill should be placed in thin successive layers 8 to 10 inches thick loose measurement, and each layer should be compacted to at least 95% of its maximum laboratory dry density, within ± 2% of its optimum moisture content determined in accordance with ASTM D1557 (Modified Proctor). However, large vibrating compaction equipment should not be used immediately adjacent to existing or recently constructed facilities or structures. Hand operated compaction equipment may be used to compact soils in these areas. If hand-operated compaction equipment is used, the layer thickness should be reduced to approximately 6 inches thick loose measure.

Verification of In-Place Moisture and Density. In-place field density tests should be performed as backfill or controlled fill is being placed and compacted to ensure that required density and moisture conditions are being achieved. The IBC requires continuous inspection of structural fill within building footprints during its placement. Since these testing services are within the scope of services we routinely provide for our clients, we urge that SCI be retained to provide testing services during the earthwork phase.

Wet Conditions During Construction. If standing water is noted in the bottom of excavations or stability of wet soils becomes a problem during compaction, a layer of thoroughly compacted granite aggregate meeting the requirements of ASTM C33, Size No. 57 or 67, could be used to establish a stable working mat. The aggregate layer would be covered with a layer of geotextile filter fabric, such as Mirafi® 140NL or equivalent, and then the soil backfill would be placed. If the amount of backfill is small, thoroughly compacted granite aggregate could be used entirely in lieu of soil backfill. Slag should not be used due to its potentially expansive nature.

Grading and Drainage. The presence of near-surface fine-grained soils at the site may lead to "perched" water conditions. A perched condition occurs when water cannot drain quickly through the lower-permeability fine-grained soils. Subsequently, the trapped water moves laterally across the site to pond in low areas before it slowly descends to the true groundwater level or evaporates.

Before site work begins, the installation of additional or temporary drainage ditches will help control shallow water conditions. If site work takes place during extended periods of dry weather, the need for extensive drainage improvements may be less critical. However, if site work takes place during wet weather conditions, more extensive drainage improvements may be required. Even during dry weather conditions, ditches and drainage improvements should be in place to handle any heavy rainfall that might occur during construction.

Groundwater was encountered at depths ranging from ¼ foot to 6½ feet below the existing ground surface. While excavating below the groundwater, dewatering should be anticipated. Safety precautions must be taken to maintain the side slopes and bottoms of deeper excavations.

Temporary and permanent site drainage should be established to facilitate drainage away from the proposed structures and pavement areas. This will prevent soils beneath floor slabs, foundation elements, and pavements from becoming saturated and reduce fluctuations in moisture contents. Positive site drainage is one of the most important factors influencing the long term performance of structural foundation elements and pavements.

Pavement Considerations

Initially, site grading for roadway and pavement areas should be performed in accordance with construction drawings for the project, and site preparation should be performed as previously described herein. Near-surface soils encountered in the borings predominantly consisted of sands (classified as SP-SM). Sandy soils are considered good to excellent for use as pavement subgrade.

If the proposed pavements will be constructed at or very near existing grades or above existing grades on controlled fill, then the existing soils should be suitable, and we expect that significant undercutting would not be necessary. However, if proposed pavements will be constructed below the existing grades or if soil conditions encountered during construction are less stable than those encountered during the subsurface exploration, undercutting may be required in some areas, and the extent of undercutting can best be determined by on-site evaluations during construction. Additional borings performed within proposed pavement areas after the proposed development layout has been finalized would help assess the amount of undercutting that may be required during construction.

LIMITATIONS OF REPORT

This report was prepared as an instrument of service exclusively for GEL Engineering of NC, Inc. and the project design team in preparation of the foundation design, construction drawings, and construction specifications for the proposed Buckwalter Place development in Bluffton, SC. Recommendations and comments given in this report are based on the results of the soil borings, combined with interpolation of the subsurface conditions between borings, and the provided and assumed design data. If any changes occur in the design concept or if conditions are encountered during construction that appear to be different from those represented, the conclusions and recommendations contained in this report shall not be considered valid until the changes are reviewed by SCI and our findings and conclusions are verified in writing.

SCI should be given the opportunity to review the design and construction documents. The purpose of this review is to verify that our recommendations are properly incorporated into the project plans and specifications. Review of design and construction documents is not within the scope of authorized services outlined in our proposal; therefore, additional fees would apply.

SCI's report has been prepared in accordance with generally accepted geotechnical engineering practice with a degree of care and skill ordinarily exercised by reputable geotechnical engineers practicing in this area and the area of the site. Verification of subsurface conditions for the purpose of determining the difficulty of excavation, dewatering, and other construction issues is the responsibility of others specializing in those areas.

FIGURES

Reference: Base map obtained from GoogleMaps.com
Note: Boring locations are approximate.

Legend: Test Boring Location

BORING LOCATION PLAN

Preliminary Geotechnical Exploration
Proposed Buckwalter Place Development
Bluffton, SC

Scale	Not to scale	Project No. 190110
Date	9/27/2019	Figure 1

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ATTACHMENTS

LOG OF BORING B-1

Project:	Preliminary Geotechnical Exploration, Proposed Buckwalter Place Development, Progressive Street, Bluffton, SC	**SCI Project:**	190110
		Date Drilled:	8/20/2019
Location:	See Boring Plan	**Drill Rig:**	CME 45C (Track)
Total Depth:	21.5 ft	**Driller:**	Grimball
Datum:	Ground Surface	**Drilling Method:**	Mud Rotary (4-in. diameter)
Elevation:	Not known to SCI	**Water Level:**	1.7 ft (day of drilling)

Depth (ft)	Material Description	Bottom of Layer (ft)	Sample Number	Actual Blows (6-in. interval)	Corrected N Value (Clays to N_{60} and Sands to $(N_1)_{60}$)
0	POORLY GRADED SAND WITH SILT (SP-SM): loose, light brown, fine to medium, moist	2.0	1	2-1-3	8
2.0	FAT CLAY WITH SAND (CH): stiff, light brown, moist to saturated	7.0	2	4-5-5	11
			3	3-4-5	10
7.0	CLAYEY SAND (SC): loose, light brown, fine to medium, saturated	9.5	4	1-2-2	6
9.5	FAT CLAY WITH SAND (CH): soft, gray, saturated	12.0	5	1-1-1	3
12.0	POORLY GRADED SAND WITH SILT (SP-SM): very loose, gray, fine to medium, saturated	14.5	6	1-1-1	4
14.5	CLAYEY SAND (SC): loose, gray, fine to medium, saturated	17.0	7	1-1-3	6
17.0	POORLY GRADED SAND WITH SILT (SP-SM): medium dense, gray, fine to medium, saturated	21.5	8	5-4-4	15
			9	6-5-7	22

Boring terminated at 21.5 feet below referenced grade.

Remarks:
Boring encountered topsoil and roots to a depth of approximately 6 inches.
The Soil Consultants, Inc. Key to Boring Log Symbols and Terms contains explanations about symbols and terms used on the boring log.

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LOG OF BORING B-2

Project:	Preliminary Geotechnical Exploration, Proposed Buckwalter Place Development, Progressive Street, Bluffton, SC	**SCI Project:**	190110
		Date Drilled:	8/20/2019
Location:	See Boring Plan	**Drill Rig:**	CME 45C (Track)
Total Depth:	21.5 ft	**Driller:**	Grimball
Datum:	Ground Surface	**Drilling Method:**	Mud Rotary (4-in. diameter)
Elevation:	Not known to SCI	**Water Level:**	0.3 ft (day of drilling)

Depth (ft)	Material Description	Sample Depth	Sample Number	Actual Blows (6-in. interval)	Corrected N Value (Clays to N_{60} and Sands to $(N_1)_{60}$)
0.0–2.0	POORLY GRADED SAND WITH SILT (SP-SM): medium dense, light brown, fine to medium, moist		1	1-2-4	12
2.0–9.5	FAT CLAY WITH SAND (CH): firm, light brown, moist to saturated		2	1-2-5	8
		5	3	1-3-4	8
	- color changed to gray at 7 feet		4	2-2-3	6
9.5–12.0	LEAN CLAY WITH SAND (CL): soft, gray, saturated	10	5	2-1-2	4
12.0–14.5	POORLY GRADED SAND WITH SILT (SP-SM): loose, gray, fine to medium, saturated		6	2-2-2	7
14.5–17.0	CLAYEY SAND (SC): very loose, gray, fine to medium, saturated	15	7	1-1-1	3
17.0–21.5	POORLY GRADED SAND WITH SILT (SP-SM): dense, gray, fine to medium, saturated		8	5-7-11	35
		20	9	7-9-12	39

Boring terminated at 21.5 feet below referenced grade.

Remarks:
Boring encountered topsoil and roots to a depth of approximately 6 inches.
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2018-08 PRIMARY / 190110 LOGS.GPJ/2018-08 TEMPLATE.GDT / 9/27/19

LOG OF BORING B-3

Project:	Preliminary Geotechnical Exploration, Proposed Buckwalter Place Development, Progressive Street, Bluffton, SC	**SCI Project:**	190110
		Date Drilled:	8/19/2019
Location:	See Boring Plan	**Drill Rig:**	CME 45C (Track)
Total Depth:	21.5 ft	**Driller:**	Grimball
Datum:	Ground Surface	**Drilling Method:**	Mud Rotary (4-in. diameter)
Elevation:	Not known to SCI	**Water Level:**	6.4 ft (24-hour)

Depth (ft)	Material Description	Bottom of Layer (ft)	Sample Depth	Sample Number	Actual Blows (6-in. interval)	Corrected N Value (Clays to N_{60} and Sands to $(N_1)_{60}$)
	POORLY GRADED SAND WITH SILT (SP-SM): medium dense, light brown, fine to medium, moist	2.0		1	2-5-6	21
	FAT CLAY WITH SAND (CH): stiff, light brown, moist	4.5		2	1-4-5	10
5	CLAYEY SAND (SC): medium dense, light brown, fine to medium, moist to saturated	7.0	5	3	3-4-7	16
	POORLY GRADED SAND WITH SILT (SP-SM): loose, light brown, fine to medium, saturated	9.5		4	2-3-2	9
10	CLAYEY SAND (SC): loose, gray, fine to medium, saturated, with shells	12.0	10	5	1-2-2	6
	LEAN CLAY WITH SAND (CL): soft, gray, saturated, with shells	14.5		6	2-1-1	3
15	CLAYEY SAND (SC): loose, gray, fine to medium, saturated, with shells	17.0	15	7	3-1-3	6
	POORLY GRADED SAND WITH SILT (SP-SM): medium dense, gray, fine to medium, saturated, with shells	19.5		8	2-3-3	11
20	FAT CLAY WITH SAND (CH): firm, gray, moist to saturated	21.5	20	9	2-2-3	7

Boring terminated at 21.5 feet below referenced grade.

Remarks:
Boring encountered topsoil and roots to a depth of approximately 6 inches.
The Soil Consultants, Inc. Key to Boring Log Symbols and Terms contains explanations about symbols and terms used on the boring log.

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LOG OF BORING B-4

Project:	Preliminary Geotechnical Exploration, Proposed Buckwalter Place Development, Progressive Street, Bluffton, SC	**SCI Project:**	190110
		Date Drilled:	8/19/2019
Location:	See Boring Plan	**Drill Rig:**	CME 45C (Track)
Total Depth:	61.5 ft	**Driller:**	Grimball
Datum:	Ground Surface	**Drilling Method:**	Mud Rotary (4-in. diameter)
Elevation:	Not known to SCI	**Water Level:**	4.3 ft (24-hour)

Depth (ft)	Material Description	Sample Number	Actual Blows (6-in. interval)	Corrected N Value (Clays to N_{60} and Sands to $(N_1)_{60}$)
0	POORLY GRADED SAND WITH SILT (SP-SM): medium dense, light brown, fine to medium, moist	1	4-6-6	23
		2	2-5-4	17
4.5	FAT CLAY WITH SAND (CH): soft to stiff, light brown, saturated	3	3-4-7	13
	- color changed to gray at 7 feet	4	1-1-3	5
10		5	1-2-1	4
		6	1-1-1	3
14.5	CLAYEY SAND (SC): very loose, light brown, fine to medium, saturated	7	WOH/18"	0
17.0	POORLY GRADED SAND WITH SILT (SP-SM): medium dense to dense, gray, fine to medium, saturated	8	3-2-5	13
20		9	3-8-12	37
	- color changed to greenish gray at 23 feet			
25		10	5-10-18	50
28.0	FAT CLAY WITH SAND (CH): stiff to hard, greenish gray, saturated			
30		11	3-3-5	12
35				9

Remarks:
Boring encountered topsoil and roots to a depth of approximately 6 inches. WOH = weight of SPT hammer
The Soil Consultants, Inc. Key to Boring Log Symbols and Terms contains explanations about symbols and terms used on the boring log.

SCI SOIL CONSULTANTS, INC.
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Construction Materials Geotechnical Nondestructive Special Inspections

LOG OF BORING B-4

Project:	Preliminary Geotechnical Exploration, Proposed Buckwalter Place Development, Progressive Street, Bluffton, SC	**SCI Project:**	190110
		Date Drilled:	8/19/2019
Location:	See Boring Plan	**Drill Rig:**	CME 45C (Track)
Total Depth:	61.5 ft	**Driller:**	Grimball
Datum:	Ground Surface	**Drilling Method:**	Mud Rotary (4-in. diameter)
Elevation:	Not known to SCI	**Water Level:**	4.3 ft (24-hour)

Depth (ft)	Material Description	Material Graphic	Sample Depth	Sample Type	Sample Number	Actual Blows (6-in. interval)	Corrected N Value (Clays to N_{60} and Sands to $(N_1)_{60}$)
	FAT CLAY WITH SAND (CH): stiff to hard, greenish gray, saturated *(continued)*				12	1-3-3	9
40			40		13	3-4-6	15
45			45		14	5-7-11	27
	- color changed to gray at 48 feet						
50			50		15	7-10-15	38
55			55		16	5-9-14	35
60			60		17	6-10-15	38
61.5							

Boring terminated at 61.5 feet below referenced grade.

Remarks:
Boring encountered topsoil and roots to a depth of approximately 6 inches. WOH = weight of SPT hammer
The Soil Consultants, Inc. Key to Boring Log Symbols and Terms contains explanations about symbols and terms used on the boring log.

KEY TO BORING LOG SYMBOLS AND TERMS

Soil Consultants, Inc.'s geotechnical engineer reviewed recovered samples, field data, and laboratory data to develop each boring log. Each log represents our interpretation of general soil and water conditions at the boring location. Soil classifications presented on the boring log are based on the Unified Soil Classification System (USCS) as outlined in ASTM D2487. The system is used to classify coarse-grained materials (boulders, cobbles, gravel, and sand) and fine-grained materials (silt and clay). Descriptors are added to describe additional constituents based on percentages of these constituents. In the absence of laboratory data required to classify soils in complete accordance with ASTM D2487, visual descriptions of the materials are provided with their interpreted USCS group name.

Subsurface conditions at the explored location(s) may not be indicative of subsurface conditions at other locations or at other times. Strata lines on the log may be transitional and are approximate in nature.

USCS MATERIAL TYPES AND SYMBOLS

- Well-Graded Gravel (GW)
- Well-Graded Gravel with Sand (GW-GM)
- Well-Graded Gravel with Clay (GW-GC)
- Poorly-Graded Gravel (GP)
- Poorly-Graded Gravel with Sand (GP-GM)
- Poorly-Graded Gravel with Clay (GP-GC)
- Silty Gravel (GM)
- Clayey Gravel (GC)
- Well-Graded Sand (SW)
- Well-Graded Sand with Silt (SW-SM)
- Well-Graded Sand with Clay (SW-SC)
- Poorly-Graded Sand (SP)
- Poorly-Graded Sand with Silt (SP-SM)
- Poorly-Graded Sand with Clay (SP-SC)
- Silty Sand (SM)
- Clayey Sand (SC)
- Fat Clay (CH)
- Sandy Fat Clay (CH)
- Lean Clay (CL)
- Sandy Lean Clay (CL)
- Silty Clay (CL-ML)
- Elastic Silt (MH)
- Sandy Elastic Silt (MH)
- Silt (ML)
- Sandy Silt (ML)
- Organic Clay (OH)
- Organic Silt (OH)
- Organic Clay (OL)
- Organic Silt (OL)
- Peat (PT)

LOCAL MATERIAL TYPES AND SYMBOLS

- Concrete
- Asphalt
- Base
- Wood
- Hard Layer

SAMPLER SYMBOLS

- Auger Sample
- Thin-walled tube
- Split barrel
- Core
- No Recovery

STANDARD PENETRATION TEST (SPT)

Within a desired sampling interval, the SPT test includes seating the split-barrel sampler to 6-in. depth with blows from a 140-lb hammer. The sampler is advanced through two additional 6-in. deep intervals with blow counts recorded for each interval. The "N" value is the sum of the blows for the final 12 in. of the 18-inch penetration.

WOR	The sampler penetrated the full 18-in. test depth under the weight of the drill rod.
WOH	The sampler penetrated the full 18-in. test depth under the weight of the hammer.
1/18"	The sampler was driven the full 18-in. test depth by 1 blow of the 140-lb hammer.
50/3"	50 blow limit was recorded with 3 in. penetration of the sampler.
$N_{corrected}$	Standard Penetration Resistance Value (N value) corrected to N_{60} for clays and to $(N_1)_{60}$ for sands.

RELATIVE DENSITY AND CONSISTENCY

DENSITY OF COARSE-GRAINED SOILS
(More than 50% retained on the No. 200 Sieve)
Gravels and Sands
Density determined by Standard Penetration Resistance.

Relative Density	SPT N Value
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

CONSISTENCY OF FINE-GRAINED SOILS
(50% or more passing the No. 200 Sieve)
Silts and Clays
Consistency determined by laboratory strength testing, standard penetration resistance, or field visual-manual procedures.

Unconfined Compressive Strength, tsf	Consistency	SPT N Value
< 0.25	Very Soft	0 - 2
0.25 to 0.50	Soft	3 - 4
0.50 to 1.00	Medium (Firm)	5 - 8
1.00 to 2.00	Stiff	9 - 15
2.00 - 4.00	Very Stiff	16 - 30
> 4.00	Hard	> 30

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