REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION

PROPOSED DEVELOPMENT
CHARLESTON HIGHWAY
WEST COLUMBIA, SOUTH CAROLINA

Prepared For:
Mr. Andy Fan
C/O ZZ Carolina Home Group
3430 Torrington Way, Suite 200
Charlotte, North Carolina 28277

BLE Project Number J21-16009-01

April 6, 2021

BLE | BUNNELL LAMMONS ENGINEERING
6004 Ponders Court | Greenville, SC 29615
☎ 864.288.1265 864.288.4330 info@blecorp.com
BLECORP.COM

BLE | BUNNELL LAMMONS ENGINEERING

April 6, 2021

Mr. Andy Fan
c/o ZZ Carolina Home Group
3430 Torrington Way, Suite 200
Charlotte, North Carolina 28277

Subject: **Report of Preliminary Geotechnical Exploration**
Proposed Development
Charleston Highway
West Columbia, South Carolina
BLE Project No. J21-16009-01

Dear Mr. Fan:

Bunnell-Lammons Engineering, Incorporated (BLE) is pleased to present this report of preliminary geotechnical exploration for the proposed development at Charleston Highway in West Columbia, South Carolina. This exploration was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P21-0375Rev.2 dated March 8, 2021. The exploration was authorized on March 11, 2021 by the signature of Mr. Fan on our Proposal Acceptance Sheet.

Sincerely,

BUNNELL LAMMONS ENGINEERING INC.

Jason C. Jansante, P.E.	Genevieve F. Sollenberger, P.E.
Project Engineer	Senior Engineer
Registered, South Carolina #34614	Registered, South Carolina #34936

4/6/2021
NO. 34614
JASON C. JANSANTE

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
BUNNELL-LAMMONS ENGINEERING, INC.
No. C01452

TABLE OF CONTENTS

Appendix

1.0 AUTHORIZATION

A preliminary geotechnical exploration for proposed development at Charleston Highway in West Columbia, South Carolina was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P21-0375Rev.2 dated March 8, 2021. The exploration was authorized on March 11, 2021 by the signature of Mr. Fan on our Proposal Acceptance Sheet.

2.0 SCOPE OF EXPLORATION

This report details the findings of the preliminary geotechnical exploration performed for the proposed development at Charleston Highway in West Columbia, South Carolina (reference Figure 1 in Appendix A). The intent of this exploration was to evaluate the subsurface soil and groundwater conditions at the site and provide geotechnical recommendations for design of the foundations, floor slabs and associated project elements. We have also included a discussion of secondary design considerations and provided geotechnical related construction recommendations.

3.0 PROJECT INFORMATION

The following project information was provided in a request for proposal (RFP) from Ms. Zhengzheng Wiley with ZZ Carolina Home Group to our Mr. Prescott May. Included with the RFP was an aerial map with preliminary locations of the proposed development as well as the requested boring locations.

We have been requested to complete a preliminary geotechnical investigation for a project north of the intersection of Charleston Highway and Kodak Court in West Columbia, South Carolina. At this preliminary stage, it is proposed that four buildings will be constructed within the approximately 44-acre property. Two buildings will be located within the western portion of the property and two buildings will be located at the northeastern portion of the property. Based on our review of available online aerial imagery and a site visit by our Mr. Bryan Howard, P.E., the site consists of moderate underbrush with small to medium trees.

Details regarding the development were not available at this time. However, we assume that the project site will be developed for either commercial or light industrial use. Based on the assumed development, we estimate maximum column and continuous wall loads of 150 kips and 3 kips per linear foot, respectively. At the time of this report, existing and proposed grading information were not available. For the purpose of this report, we are assuming less than 10 feet of cut and fill for construction.

4.0 FIELD EXPLORATION

The site was explored by drilling the seven requested soil test borings (ASTM D1586) at the approximate locations shown on the attached Boring Location Plan (reference Figure 2 in Appendix A). Boring Logs are presented as Appendix C. The borings were located in the field by our Mr. Jason Jansante by referencing the provided site plan and identifiable site landmarks. We note that borings B-1 and B-7 were offset from their requested locations were inaccessible due to standing water and soft soil conditions for the drill rig. The boring locations shown in Appendix A should be considered approximate. A description of our field procedures is also included as Appendix B.

5.0 SITE GEOLOGY

The site is located within the Atlantic Coastal Plain Physiographic Province of South Carolina. The soils in this province are generally interbedded silts, sands and clays that have been deposited during successive advances and retreats of the ocean over the past several million years. Along rivers the marine deposits have, in more recent times, been successively eroded and overlain by alluvial (water-deposited) soils.

Most formations within the Coastal Plain were laid down in a shallow sloping sea bottom, tilting gradually toward the sea at the rate of a few feet per mile. During periods of relatively low sea level, the old bottom deposits emerged, forming plains tilting toward the sea. These plains were subsequently eroded by coastal streams which formed shallow troughs in an otherwise uniform strata. During periods of relatively high sea level, the former troughs were inundated and filled with more recent sediments. Consequently, many of the formations in the Coastal Plain exist as fractional erosional remnants sandwiched within more continuous strata.

6.0 SUBSURFACE CONDITIONS

Beneath a surficial layer of approximately 4 to 6 inches of topsoil in each boring, the borings drilled for this exploration encountered coastal plain deposits. The costal plain soils were noted to consist generally of stiff to very stiff sandy silt (ML), loose to firm clayey sand (SC), firm to very firm silty sand (SM), loose to firm sand with clay (SP-SC), firm sand with silt (SP-SM) and firm to dense fine to medium sand (SP). The letters in parentheses represent a visual classification of the soils in accordance with the Unified Soil Classification System. A key to symbols and classification is included as Appendix D.

Groundwater was encountered in each boring at the time of boring as noted in the table below

Boring No.	Groundwater Depth (ft)
B-1	4
B-2	5
B-3	6
B-4	7
B-5	6
B-6	6
B-7	6

It should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall.

The above descriptions provide a general summary of the subsurface conditions encountered. The Boring Logs included as Appendix C contain information recorded at each boring location. The Boring Logs represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. It should be noted that the soil conditions will vary between boring locations.

7.0 PRELIMINARY ANALYSIS AND DESIGN RECOMMENDATIONS

The following recommendations are based on a limited preliminary geotechnical scope and limited project information. Once building location/orientation, finished floor elevations, foundation loads, etc. are finalized, supplemental geotechnical exploration will be required to develop detailed geotechnical recommendations for foundation design and site preparation specific to the planned project.

7.1 Foundations

The following preliminary foundation recommendations are based on the assumption that maximum individual column and continuous wall loads will not exceed 150 kips and 3 kips per linear foot, respectively. Furthermore, with regard to settlement, we have assumed that the sustained foundation loads will not exceed 80 percent of the maximum load.

Based on the boring data and our experience with similar soil conditions, the coastal plain deposits encountered in the borings are suitable for shallow foundation support of the proposed construction. Satisfactory performance of the shallow foundations is subject to the criteria and site preparation recommendations contained in this report.

Depending on the location on the site, foundations bearing in the coastal plain deposits may be preliminarily sized for an allowable bearing pressure of 3,000 pounds per square foot (psf). Foundations bearing on new engineered fill compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698), as recommended later in this report, may also be preliminarily sized for an allowable bearing pressure of 3,000 psf.

We recommend that the minimum widths for individual column and continuous wall footings be 24 and 18 inches, respectively. The minimum widths will provide a margin of safety against a local or punching shear failure of the foundation soils. Footings should bear at least 12 inches below final grade to provide frost protection and protective embedment. We recommend that walls be provided with movement joints to accommodate some possible differential settlement.

Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain open for long periods of time. Therefore, we recommend that once each foundation excavation is extended to final grade, the foundation be constructed as soon as possible to minimize the potential damage to bearing soils. The foundation bearing area should be level or benched and free of loose soil, ponded water and debris. Foundation concrete should not be placed on soils that have been disturbed by seepage. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom prior to placement of concrete. If the excavation must remain open overnight or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 2 to 4-inch thick "mud-mat" of "lean" (2,000 psi) concrete be placed on the bearing soils for protection before the placement of reinforcing steel.

To verify that the soils encountered in footing excavations are similar to those encountered by the soil test borings, we recommend that foundation excavations be examined. Part of this examination should include checking the bearing soils with a dynamic cone penetrometer performed by an experienced engineering technician working under the direction of the geotechnical engineer.

7.2 Settlement

We conducted preliminary settlement estimates assuming conventional shallow foundations were used to support the structure(s). The settlement estimates are based on a sustained load equal to 80 percent of the assumed maximum column load of 150 kips and maximum wall loads of 3 kips per linear foot. Assuming foundations are designed and constructed in accordance with the preliminary recommendations presented in the report, we estimate the total foundation settlement to be approximately 1 inch. Maximum differential settlement between adjacent similarly loaded foundations is estimated to be approximately half to three-quarters of the total settlement.

It should be noted that the actual settlement will depend on the site grading operations, building location/orientation, sustained foundation loads and other factors that have not been developed at this preliminary stage of the project. The settlement estimates presented above are provided to demonstrate that shallow foundations can be expected to perform within normally accepted standards for allowable settlement for the foundation loads estimated for this project.

7.3 Lateral Earth Pressure

Retaining walls must be capable of resisting the lateral earth pressures that will be imposed on them. Walls which will be permitted to rotate at the top, such as cantilever retaining walls, may be designed to resist the active earth pressure. The active earth pressure coefficient is designated as Ka. Typically, a top rotation of about 1 inch per 10 feet height of wall is sufficient to develop active pressure conditions in soils similar to those encountered at the site. We recommend a Ka value of 0.33 for the soils encountered at this site when placed in accordance with the requirements for engineered fill.

Walls which will be prevented from rotating such as laterally braced retaining walls should be designed to resist the at-rest lateral earth pressure. The at-rest earth pressure coefficient is designated as Ko. We recommend a Ko value of 0.5 for the soils encountered at this site when placed in accordance with the requirements for engineered fill.

The passive earth pressure may be considered as the pressure exerted on the side of a foundation which aids in resisting sliding of the foundation. The passive earth pressure coefficient is designated as Kp. Friction resistance along the base of the foundation may also be used to resist sliding. The coefficient of frictional resistance is designated as fs. We recommend a fs value of 0.4 and a Kp value of 3.0 for the soils encountered at this site. Consideration should be given to dividing the passive earth pressure coefficient by a safety factor of 2 to limit the amount of lateral deformation required to mobilize the passive resistance. Published documentation[1] indicates that very little horizontal compression (approximately 0.5% relative to wall height) is required to develop one-half of the available passive resistance, hence the suggested safety factor of 2. However, depending on soil type and relative density it may take 2 to 15% horizontal compression to develop the full passive resistance.

The values presented above assume that the ground surface is level. Sloping backfill (or sloping soil surfaces in front of a footing when considering passive resistance) will dramatically influence the earth pressure coefficients. Bunnell-Lammons Engineering should be consulted concerning applicable earth pressure coefficients where sloping soil surfaces may be present.

---

[1] *Soil Mechanics* by T. William Lambe and Robert V. Whitman; Massachusetts Institute of Technology; 1969; p.165.

The compacted mass unit weight of the backfill soil, which we estimate to be approximately 125 pcf, should be used with the earth pressure coefficients to calculate lateral earth pressures. Lateral pressure arising from surcharge loading, earthquake loading, and groundwater should be added to the above soil earth pressures to determine the total lateral pressures which the walls must resist. Where practical, we recommend that retaining walls and other below grade walls incorporate filtered gravity drainage systems to prevent the buildup of excess hydrostatic pressures behind the walls. In addition, transient loads imposed on the walls by construction equipment during backfilling should be taken into consideration during design and construction. Excessively heavy grading equipment should not be allowed within about 5 feet horizontally of the walls.

7.4 Grade Slabs

The grade slab may be soil supported assuming that the site is prepared in accordance with the recommendations in this report. The grade slab should be jointed around columns and along footing supported walls so that the slab and foundations can settle differentially without damage. This jointing is not required when slabs and foundations are cast as a single unit (i.e. thickened edge foundations). If slab thickness permits, joints containing dowels or keys may be used in the slab to permit movement between parts of the slab without cracking or sharp vertical displacements.

Floor slabs supported on grade which will be carpeted, tiled, painted or receive some other covering or sealant should incorporate a vapor barrier. The vapor barrier should be installed in accordance with the manufacturer’s recommendations.

7.5 Pavement

A site-specific pavement design requires detailed information about projected traffic frequency and intensity, acceptable service limits, life expectancy and other factors which are not currently available. It also requires site specific laboratory testing which was not part of the scope of this exploration. However, presented below are recommended pavement sections based on our experience on similar projects in this region. These pavement sections have demonstrated acceptable performance with subsurface conditions similar to this site. Assuming the site is prepared in accordance with the recommendations of this report, the pavement sections presented below could be expected to provide adequate performance considering a 15 to 20-year service life. For the purpose of this report, light duty pavement is considered to be subject to automobile traffic, such as a car parking lot. Medium duty pavement is considered to be subject to a heavy concentration of automobiles and occasional loaded trucks, such as streets and drive lanes.

Pavement Type	Layers	Material	Thickness (Inches)	
			Light Duty	Medium Duty
Flexible	a.	Asphaltic concrete surface course	2	3
	b.	Aggregate base course	6	8
Rigid	a.	Concrete	6	6

The asphaltic concrete should conform to the South Carolina Department of Transportation Supplemental Technical Specification for Hot-Mix Asphalt Material Properties (SCDOT Designation: SC-M-402) Type C HMA Surface Course. The stone base course should meet the requirements of Section 305 of SCDOT Standard Specifications for Macadam base. The base course should be compacted to 100 percent of the modified Proctor (ASTM D1557) maximum dry density.

The concrete for rigid pavement should be air-entrained and have a minimum flexural strength (third point loading) of 550 psi which could likely be achieved by a concrete mix having a compressive strength of at least 4,000 psi at 28 days. Recommended air contents from the Portland Cement Association (PCA) are as follows:

Maximum Aggregate Size	Percent Air
1½ inches	5 percent plus or minus 1½ percent
¾ to 1-inch	6 percent plus or minus 1½ percent

In addition, we recommend a maximum slump of 4 inches for plastic concrete.

Joint spacing for this concrete thickness should be on the order of 12 to 15 feet. Control joints should be sawed as soon as the cut can be made, without raveling (aggregate pulling out of the concrete matrix) or cracks forming ahead of the saw blade. Joints should be sawed consecutively so that the joints commence working together. The American Association of State Highway and Transportation Officials (AASHTO) suggests that transverse contraction joints should be one quarter of the slab thickness and longitudinal joints should be one third of the slab thickness. All joints should be filled with flexible joint filler.

Curing of the concrete slab should begin as soon as the slab has been finished and the joints sawed. Moist curing by fog spray nozzles or wet burlap is the most dependable curing procedure. Other methods of curing could consist of spray applied curing compounds or covering the slab with waterproof paper or heavy plastic. If paper or plastic is used for curing, the edges of the cover should be anchored and joints between sheets should be taped or sealed.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

7.6 Secondary Design Considerations

The following items are presented for your consideration. These items are known to generally enhance performance of structural and pavement systems.

- Roof drainage should be collected by a system of gutters and downspouts and directed away from all structures.
- Sidewalks should be sloped so that water drains away from the structures.
- Site grading and paving should result in positive drainage away from the structures. Water should not be allowed to pond around the structures or in such locations that would lead to saturation of pavement subgrade materials. A minimum slope of approximately ¼ to ½-inch per foot should provide adequate drainage.
- Backfill for utility lines should be placed in accordance with the requirements for engineered fill to minimize the potential for differential settlement.

8.0 PRELIMINARY CONSTRUCTION RECOMMENDATIONS

8.1 Clearing and Grubbing

All existing topsoil, vegetation, disturbed soils, limbs, stumps and surface soils containing organic matter or other deleterious materials should be stripped from within the proposed building and any paved areas. Topsoil and organic soils may be stockpiled for later use in areas to be landscaped. Stumps and other deleterious material should be disposed of offsite or in areas of the site that will not be developed. Future construction of buildings or pavement in areas containing limbs or stumps, organic soils, burn pit residue or other deleterious materials will first require that these materials be removed.

8.2 Drainage

Groundwater was encountered within each boring at depths ranging from 4 feet to 7 feet below the ground surface. If final grades do not result in lowering the site elevation, shallow groundwater is not anticipated to be encountered within shallow excavation depths. However, it should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall. The contractor should be prepared to promptly remove any surface water or groundwater from the construction area. This has been done effectively on past jobs by means of gravity ditches and pumping from filtered sumps.

8.3 Proofrolling

After stripping and rough excavation grading, we recommend that areas to provide support for the foundations, floor slab, engineered fill and pavement be carefully inspected for soft surficial soils and proofrolled with a 25 to 35-ton, four-wheeled, rubber-tired roller or similar approved equipment. The proofroller should make at least four passes over each location, with the last two passes perpendicular to the first two where practical.

Any areas which wave, rut or deflect excessively and continue to do so after several passes of the proofroller should be excavated to firmer soils. The excavated areas should be backfilled in thin lifts with engineered fill. The proofrolling and excavating operations should be carefully monitored by an experienced engineering technician working under the direction of the geotechnical engineer. Proofrolling should not be performed when the ground is frozen or wet from recent precipitation.

8.4 Engineered Fill

All fill used for raising site grade or for replacement of material that is undercut should be uniformly compacted in thin lifts to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). In addition, at least the upper 12 inches of subgrade fill beneath pavements and floor slabs should be compacted to at least 98 percent of the maximum dry density. We recommend that the fill be placed and compacted at a moisture content within three percent of the standard Proctor optimum moisture content.

Based on our visual examination and experience with similar soil types, the on-site soil appears to be generally suitable for use as engineered fill with proper moisture adjustment. In general, soils having a Plasticity Index (PI) greater than 30 (less than 15 is preferable) should not be used for fill. Soils used for engineered fill should be reasonably free from organics (less than 3% organics by weight) and should exhibit a standard Proctor maximum dry density greater than 90 pcf.

Before filling operations begin, representative samples of each proposed fill material should be collected and tested to determine the compaction and classification characteristics. The maximum dry density and optimum moisture content should be determined. Once compaction begins, a sufficient number of density tests should be performed by an experienced engineering technician working under the direction of the geotechnical engineer to measure the degree of compaction being obtained. Existing slopes steeper than 6:1

(horizontal:vertical) should be benched prior to placement of engineered fill such that the fill is placed in horizontal layers and keyed into the existing slopes.

The edge of engineered fill extending above surrounding grade should extend horizontally beyond the outside edge of the building foundations at least 10 feet or a distance equivalent to the height of fill to be placed, whichever is greater, before sloping. Fill slope surfaces should be protected from erosion by grassing or some other means.

The surface of compacted subgrade soils can deteriorate and lose its support capabilities when exposed to environmental changes and construction activity. Deterioration can occur in the form of freezing, formation of erosion gullies, extreme drying, exposure for a long period of time or rutting by construction traffic. We recommend that the surfaces of floor slab and pavement subgrades that have deteriorated or softened be recompacted prior to construction of the floor slab or pavement. Additionally, any excavations through the subgrade soils (such as utility trenches) should be properly backfilled in compacted lifts. Recompaction of subgrade surfaces and compaction of backfill should be checked with a sufficient number of density tests to determine if adequate compaction is being achieved.

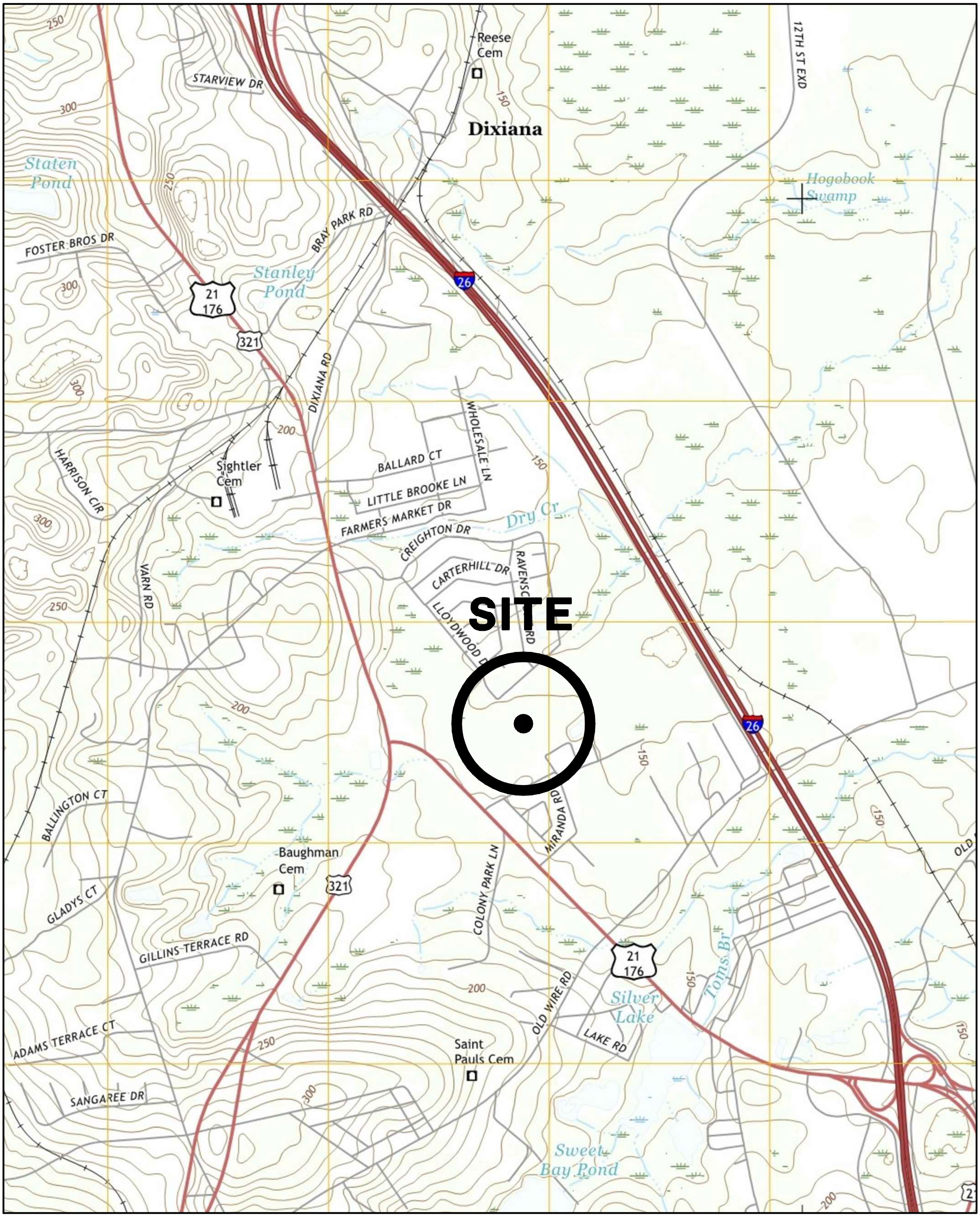
8.5 Slopes

Confined temporary excavations such as for utility installation or below-grade wall construction should conform to OSHA regulations. For permanent slopes which are not confined, our experience suggests that excavation side slopes through the existing soil overburden at the site should be laid back at a 2H:1V (horizontal to vertical) slope or flatter. Permanent fill slopes placed on a suitable foundation should be constructed at 2.5:1, or flatter. Fill slopes should be adequately compacted. Cut and fill slope surfaces should be protected from erosion by grassing or other means. Permanent slopes of 3:1 or flatter may be desirable for mowing.

9.0 BASIS OF RECOMMENDATIONS

Our preliminary evaluation of foundation support conditions has been based on our understanding of the project information and data obtained in our exploration as well as our experience on similar projects. The general subsurface conditions utilized in our foundation evaluation have been based on interpolation of the subsurface data between the widely spaced borings. Subsurface conditions between the borings may differ. Once the project details concerning building(s) location, orientation, foundation loads and finished floor elevation are finalized, BLE should be contacted to evaluate the continued applicability of the recommendations presented in this report. We could then also determine whether additional exploration will be required prior to developing detailed geotechnical recommendations for final design and construction. The discovery of any site or subsurface conditions during construction which deviate from the data obtained in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions for presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this exploration. Soil cuttings used as backfill in boreholes will settle over time resulting in a depression at the surface. It is beyond the scope of our services to return to the site to repair boreholes that have exhibited settlement of the backfill soils.

APPENDIX A
Figures



REFERENCE:
USGS TOPOGRAPHIC MAP, 7.5 MINUTE SERIES,
SOUTHWEST COLUMBIA, S.C. QUADRANGLE, 2017.

DRAWN: ACE	DATE: 04-05-21	BUNNELL LAMMONS ENGINEERING 6004 Ponders Court, Greenville, SC 29615 Phone: (864) 288-1265 Fax: (864) 288-4430	SITE LOCATION MAP CHARLESTON HIGHWAY SITE WEST COLUMBIA, SOUTH CAROLINA
CHECKED: JCJ	CAD: CHASHIGHWAY-SLM		FIGURE 1
APPROVED: WAM	JOB NO: J21-16009-01		

LEGEND

● APPROXIMATE LOCATION OF SOIL TEST BORING

REFERENCE:
GOOGLE EARTH IMAGE DATED 12-4-2019.

DRAWN: ACE
CHECKED: JCJ
APPROVED: WAM

DATE: 04-05-21
CAD: CHASHWYSITE-BLP
JOB NO: J21-16009-01

BLE | BUNNELL LAMMONS ENGINEERING
6004 Ponders Court, Greenville, SC 29615
Phone: (864) 288-1265 **Fax:** (864) 288-4430

BORING LOCATION PLAN
PROPOPSED DEVELOPMENT
CHARLESTON HIGHWAY
WEST COLUMBIA, SOUTH CAROLINA

FIGURE
2

APPENDIX B
Field Exploration Procedures

BUNNELL
LAMMONS
ENGINEERING

Field Exploration Procedures

The borings were made by mechanically twisting a continuous flight steel auger into the soil. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586. At assigned intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and is designated the "standard penetration resistance." The penetration resistance, when properly evaluated, is an index to the strength of the soil and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined by a geotechnical engineer to verify the field classifications of the driller. Boring Logs are attached, showing the soil descriptions and penetration resistance.

APPENDIX C
Boring Logs

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-1

PROJECT: Proposed Development

PROJECT NO.: J21-16009-01

CLIENT: Mr. Andy Fan

START: 3-24-21 END: 3-24-21

LOCATION: Charleston Highway, West Columbia, South Carolina

ELEVATION:

DRILLER: Metro Drill, Inc., C. Simmons

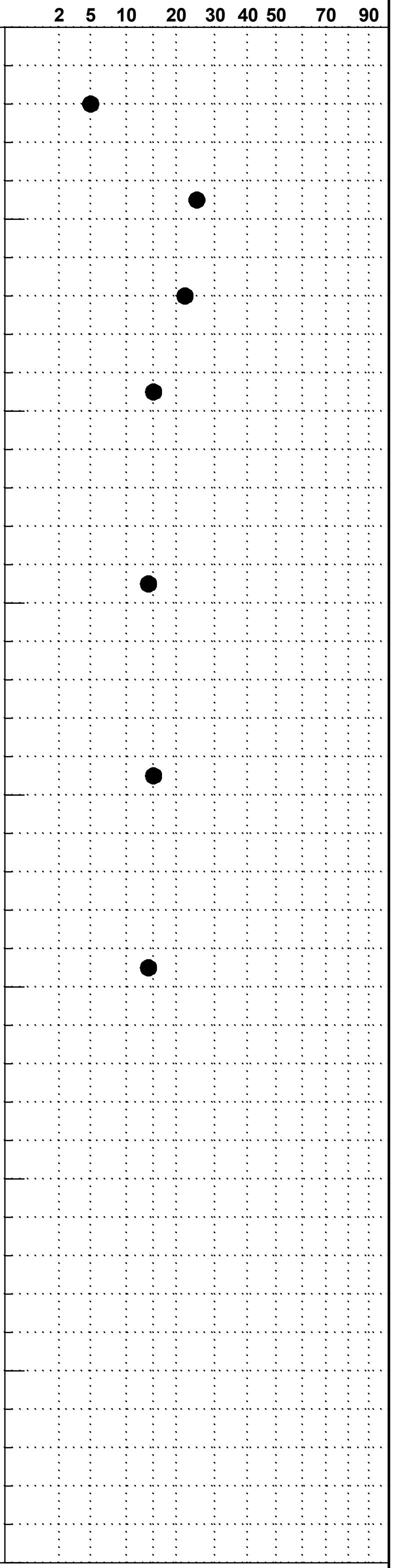
LOGGED BY: J. Jansante

DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ 4 AFTER 24 HOURS: ▼ CAVING>

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	SAMPLES (blows)
	5-inches of TOPSOIL	
	Loose, brown and dark brown, fine to medium SAND with clay - (coastal plain)	2 2 3
▽ 5	Very firm to firm, tan and gray, fine to medium SAND	7 11 14
		7 10 12
10		7 7 8
15	Firm, gray and white, fine to medium SAND with silt	7 7 7
20	Firm, brown and tan, fine to medium SAND	5 7 8
25		6 8 6
	Boring terminated at 25.0 feet. Groundwater encountered at 4 feet at time of drilling.	
30		
35		

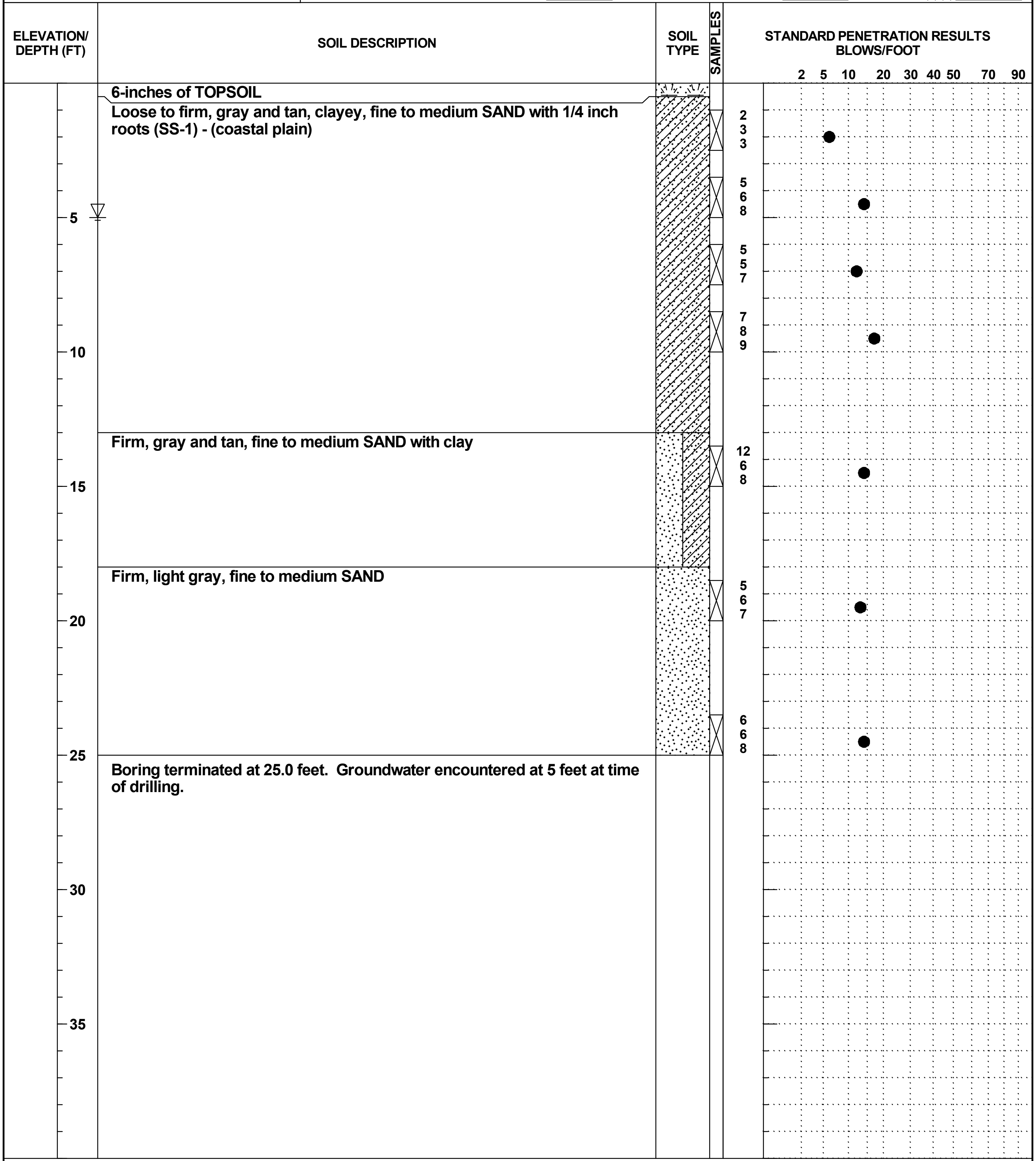
STANDARD PENETRATION RESULTS BLOWS/FOOT



BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-2

PROJECT: Proposed Development
PROJECT NO.: J21-16009-01
CLIENT: Mr. Andy Fan
START: 3-24-21 END: 3-24-21
LOCATION: Charleston Highway, West Columbia, South Carolina
ELEVATION:
DRILLER: Metro Drill, Inc., C. Simmons
LOGGED BY: J. Jansante
DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ 5 AFTER 24 HOURS: ▼ CAVING>



6-inches of TOPSOIL

Loose to firm, gray and tan, clayey, fine to medium SAND with 1/4 inch roots (SS-1) - (coastal plain)

Firm, gray and tan, fine to medium SAND with clay

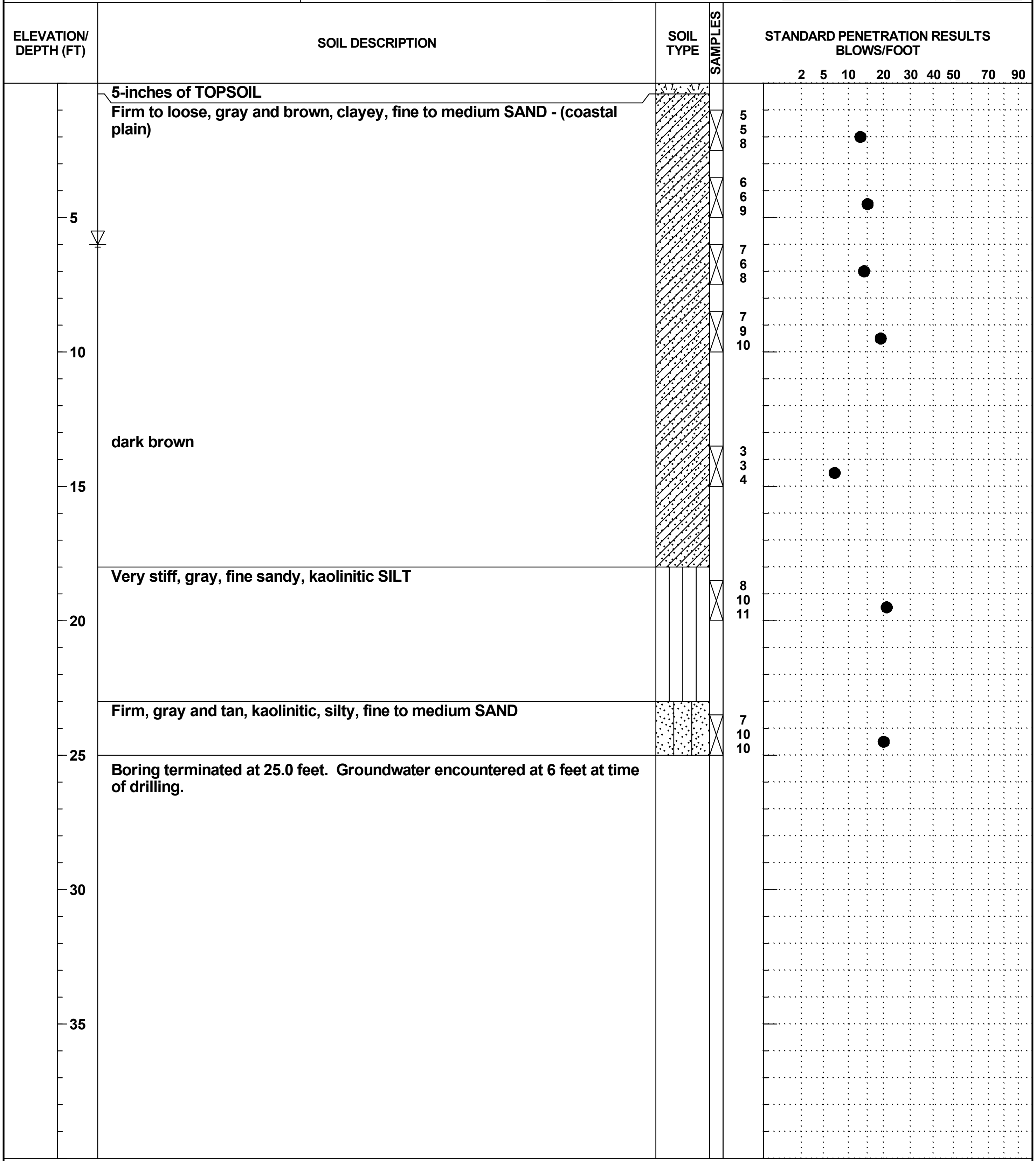
Firm, light gray, fine to medium SAND

Boring terminated at 25.0 feet. Groundwater encountered at 5 feet at time of drilling.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-3

PROJECT: Proposed Development
PROJECT NO.: J21-16009-01
CLIENT: Mr. Andy Fan
START: 3-24-21 END: 3-24-21
LOCATION: Charleston Highway, West Columbia, South Carolina
ELEVATION:
DRILLER: Metro Drill, Inc., C. Simmons
LOGGED BY: J. Jansante
DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger
DEPTH TO - WATER> INITIAL: ∇ 6 AFTER 24 HOURS: ▼ CAVING>



5-inches of TOPSOIL

Firm to loose, gray and brown, clayey, fine to medium SAND - (coastal plain)

dark brown

Very stiff, gray, fine sandy, kaolinitic SILT

Firm, gray and tan, kaolinitic, silty, fine to medium SAND

Boring terminated at 25.0 feet. Groundwater encountered at 6 feet at time of drilling.

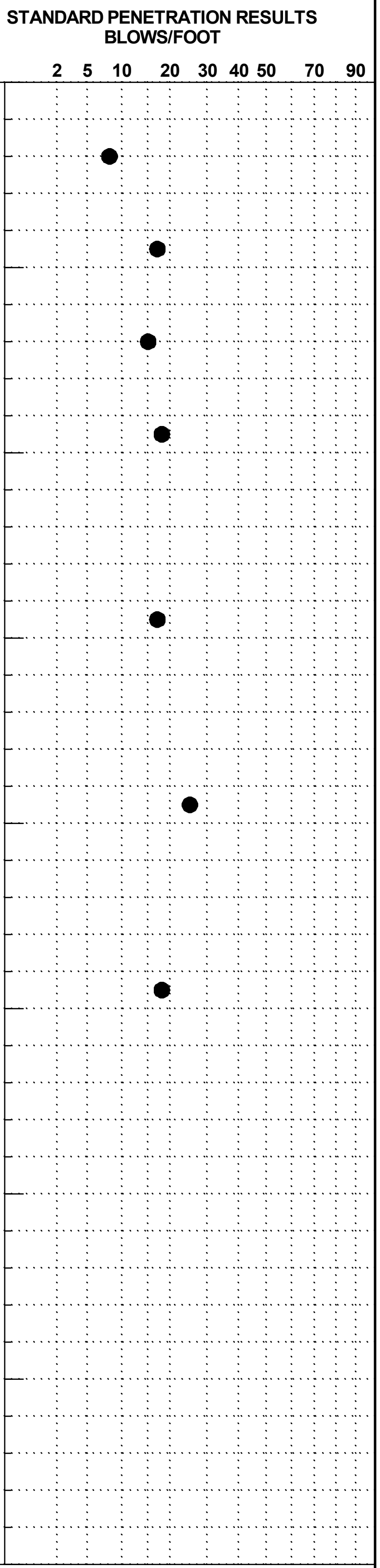
SOIL TEST BORING NO. B-3
Sheet 1 of 1

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-4

PROJECT: Proposed Development
PROJECT NO.: J21-16009-01
CLIENT: Mr. Andy Fan
START: 3-24-21 END: 3-24-21
LOCATION: Charleston Highway, West Columbia, South Carolina
ELEVATION:
DRILLER: Metro Drill, Inc., C. Simmons
LOGGED BY: J. Jansante
DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ 7 AFTER 24 HOURS: ▼ CAVING>

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	
	5-inches of TOPSOIL	
	Loose to firm, dark brown, clayey, fine to medium SAND - (coastal plain)	3 3 5
	gray and tan	7 8 9
5		
▽		6 6 9
	Firm, yellow and tan, fine to medium SAND	8 8 10
10		
	Firm to very firm, gray and light gray, kaolinitic, silty, fine to medium SAND	6 8 9
15		
		7 11 14
20		
	Firm, tan and gray, fine to medium SAND	8 8 10
25	Boring terminated at 25.0 feet. Groundwater encountered at 7 feet at time of drilling.	
30		
35		



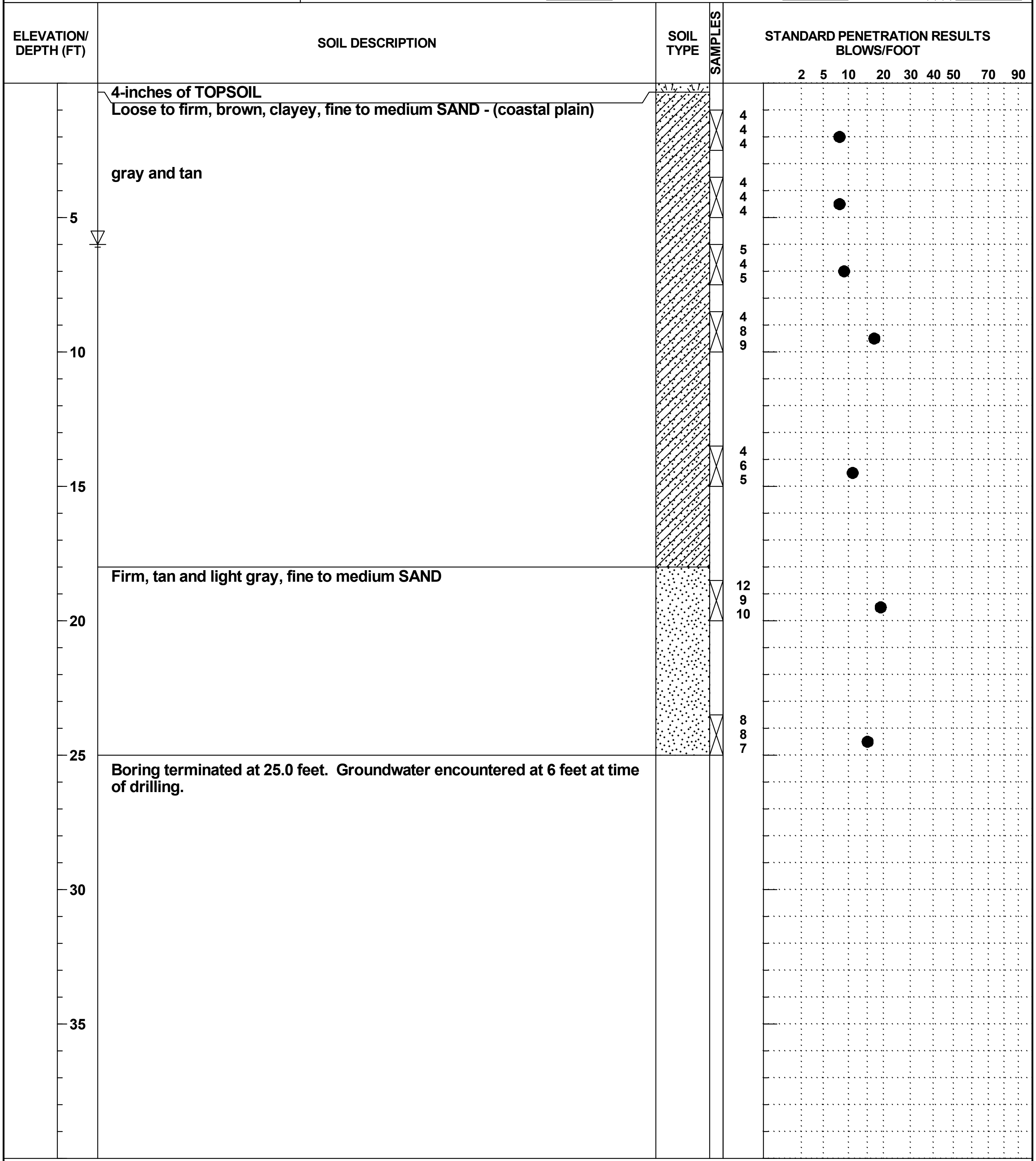
BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-5

PROJECT: Proposed Development
PROJECT NO.: J21-16009-01
CLIENT: Mr. Andy Fan
START: 3-24-21 END: 3-24-21
LOCATION: Charleston Highway, West Columbia, South Carolina
ELEVATION:
DRILLER: Metro Drill, Inc., C. Simmons
LOGGED BY: J. Jansante
DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger
DEPTH TO - WATER> INITIAL: ∇ 6 AFTER 24 HOURS: ▼ CAVING> ▨



4-inches of TOPSOIL

Loose to firm, brown, clayey, fine to medium SAND - (coastal plain)

gray and tan

Firm, tan and light gray, fine to medium SAND

Boring terminated at 25.0 feet. Groundwater encountered at 6 feet at time of drilling.

BLE INC.

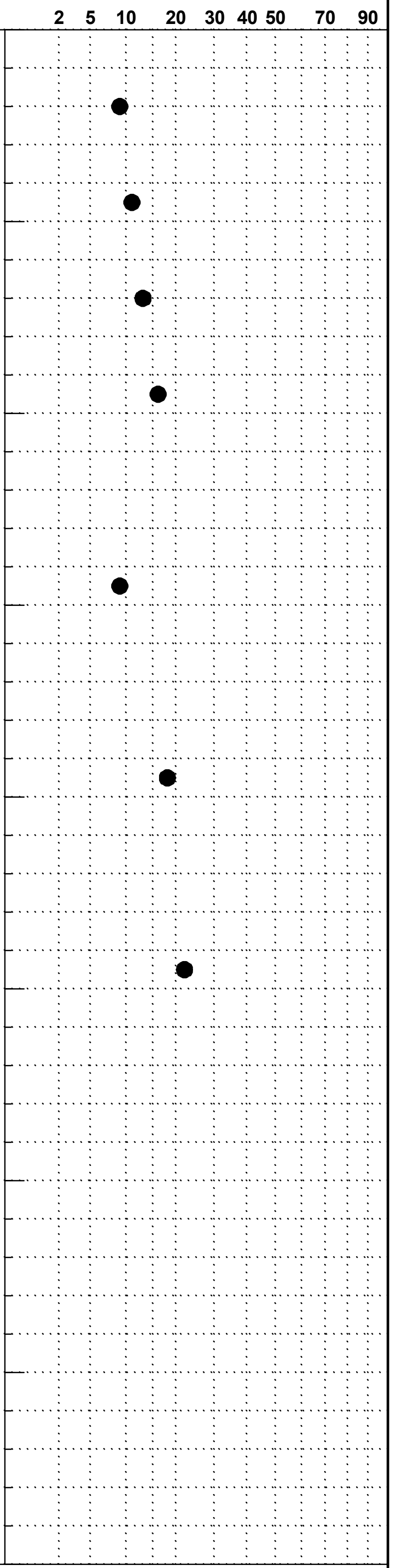
BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-6

PROJECT: Proposed Development
PROJECT NO.: J21-16009-01
CLIENT: Mr. Andy Fan
START: 3-24-21 END: 3-24-21
LOCATION: Charleston Highway, West Columbia, South Carolina
ELEVATION:
DRILLER: Metro Drill, Inc., C. Simmons
LOGGED BY: J. Jansante
DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ 6 AFTER 24 HOURS: ▼ CAVING>

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	SOIL TYPE	SAMPLES
	6-inches of TOPSOIL		
5 ▽	Loose to firm, brown, tan and red, clayey, fine to medium SAND - (coastal plain)		3 4 5 5 5 6 4 7 6
10 15	Very stiff to stiff, brown SILT with trace fine sand		5 8 8 5 4 5
20	Firm to very firm, tan and light gray, fine to medium SAND		9 9 9 8 10 12
25 30 35	Boring terminated at 25.0 feet. Groundwater encountered at 6 feet at time of drilling.		

STANDARD PENETRATION RESULTS BLOWS/FOOT



BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

SOIL TEST BORING NO. B-7

PROJECT: Proposed Development

CLIENT: Mr. Andy Fan

LOCATION: Charleston Highway, West Columbia, South Carolina

DRILLER: Metro Drill, Inc., C. Simmons

DRILLING METHOD: Acker Soil Sentry; 2-1/4 inch hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ 6 AFTER 24 HOURS: ▼ CAVING>

PROJECT NO.: J21-16009-01

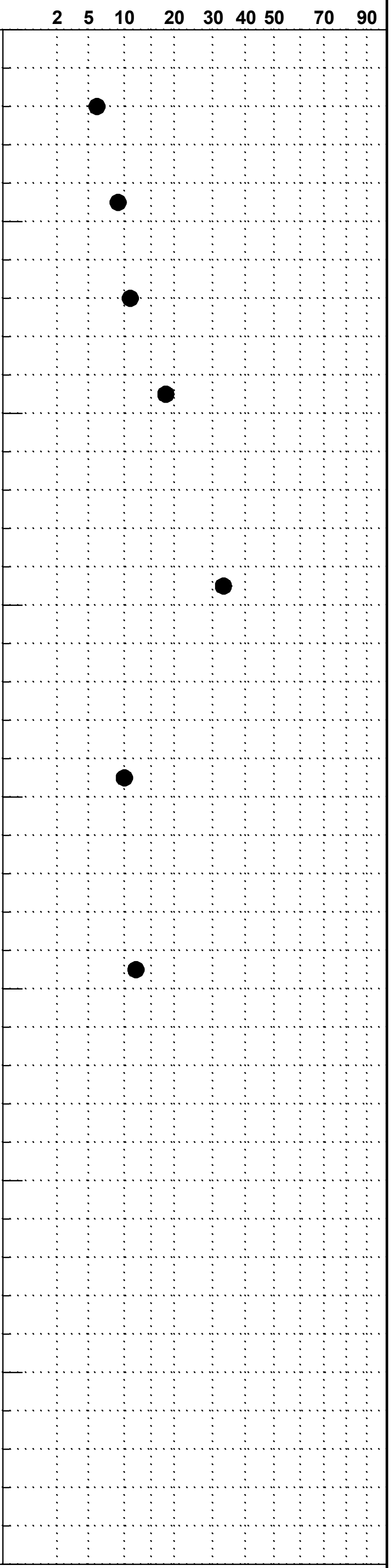
START: 3-24-21 END: 3-24-21

ELEVATION:

LOGGED BY: J. Jansante

ELEVATION/ DEPTH (FT)	SOIL DESCRIPTION	SAMPLES
	6-inches of TOPSOIL	
	Loose, brown and gray, clayey, fine to medium SAND - (coastal plain)	2 3 3
		4 5 4
5 ▽	Firm, gray and tan, fine to medium SAND with clay	5 5 6
	Firm to dense, tan and light gray, fine to medium SAND	7 8 10
10		
		14 16 17
15		
	Stiff, gray and brown, fine sandy, kaolinitic SILT	5 4 6
20		
		6 5 7
25	Boring terminated at 25.0 feet. Groundwater encountered at 6 feet at time of drilling.	
30		
35		

STANDARD PENETRATION RESULTS BLOWS/FOOT



APPENDIX D
A Key to Soil Classification

KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

BUNNELL-LAMMONS ENGINEERING, INC.
GREENVILLE, SOUTH CAROLINA

SANDS

Penetration Resistance* Blows per Foot	Relative Density
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

SILTS and CLAYS

Penetration Resistance* Blows per Foot	Consistency
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

*ASTM D 1586

Particle Size Identification

Boulder: Greater than 300 mm
Cobble: 75 to 300 mm
Gravel:
  Coarse - 19 to 75 mm
  Fine - 4.75 to 19 mm
Sand:
  Coarse - 2 to 4.75 mm
  Medium - 0.425 to 2 mm
  Fine - 0.075 to 0.425 mm
Silt & Clay: Less than 0.075 mm

KEY TO DRILLING SYMBOLS

✋	Grab Sample
☒	Split Spoon Sample
■	Undisturbed Sample

NR = No reaction to HCL
NA = Not applicable
NS = No sample

▽	Groundwater Table at Time of Drilling
▼	Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

●	Well-graded Gravel	GW
▨	Low Plasticity Clay	CL
▥	Clayey Silt	MH
░	Silty Sand	SM
○	Poorly-graded Gravel	GP
▨	Sandy Clay	CLS
░	Sandy Silt	MLS
░	Topsoil	TOPSOIL
■	Partially Weathered Rock	BLDRCBBL
▥	Silty Clay	CL-ML
░	Sand	SW
≈	Liquid Sludge	SLUDGE
▨	High Plasticity Clay	CH
▥	Silt	ML
▨	Clayey Sand	SC
▩	Fill	FILL
░	Poorly Graded Sand	SP
▩	Bedrock	BEDROCK
●	Waste	WOOD