ECS Southeast, LLP

Geotechnical Engineering Report

Liberty Senior Living – Briar Chapel

9090 US-15/501 North
Pittsboro, Chatham County, North Carolina

ECS Project Number 06:20302-N1

January 16, 2018

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Mr. Bill Schoettelkotte
Liberty Senior Living
2334 S. 41st Street
Wilmington, North Carolina 28403

ECS Project No. 06:20302-N1

Reference: Geotechnical Engineering Report
Liberty Senior Living – Briar Chapel
9090 US-15/501 North
Pittsboro, Chatham County, North Carolina

Dear Mr. Schoettelkotte:

ECS Southeast, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with ECS Proposal No. 06:20526, dated November 2, 2017. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Liberty Senior Living during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLP

Brian W. McCarthy

Brian McCarthy, E.I.
Staff Project Manager
bmccarthy@ecslimited.com

Thomas M. Schipporeit

Tom Schipporeit, P.E.
Principal Engineer
tschipporeit@ecslimited.com

NORTH CAROLINA PROFESSIONAL SEAL 19331 1-16-18 ENGINEER THOMAS M. SCHIPPOREIT

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EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The geotechnical exploration performed for the planned development included 10 soil test boring drilled to depths between approximately 10 and 26 feet.

- Fill and possible fill soils were encountered in four borings to depths ranging from 3 to 8.5 feet below existing grades. The fill consisted of medium dense to very dense SAND (SP) and Silty SAND (SM).

- The borings encountered Piedmont residual soils to the boring termination depths. The soils were classified as Silty SAND (SM), SILT with SAND (ML), and SILT (ML). The silt soils were predominately very stiff to hard and granular soils were predominately medium dense to dense. Partially Weathered Rock (PWR) was encountered at depths of approximately 6 to 26 feet below the existing site grades in seven of the borings. Auger refusal was encountered in four borings at depths of approximately 11.5 to 26 feet.

- The planned Liberty Senior Living facility can be supported by conventional shallow foundations consisting of column or strip footings bearing on compacted structural fill and natural soils sized using a net allowable soil bearing pressure of 3000 psf. Details of the assumed foundation subgrade elevations are contained in the body of the report.

1 INTRODUCTION

1.1 GENERAL

The purpose of this study was to provide geotechnical information for the design of the building foundations, building floor slabs, and pavements for the proposed development. The project will include the development of a new Liberty Senior Living Center.

The recommendations developed for this report are based on project information supplied by Liberty Senior Living. This report contains the results of our subsurface explorations and laboratory testing programs, site characterization, engineering analyses, and recommendations for the design and construction of the building foundations, building floor slabs, and pavements.

1.2 SCOPE OF SERVICES

To obtain the necessary geotechnical information required for design of the project, 10 soil test borings were performed at locations selected by ECS. These borings were located at regular intervals in proposed building area, and in proposed pavement areas. A laboratory-testing program was also implemented to characterize the physical and engineering properties of the subsurface soils.

This report discusses our exploratory and testing procedures, presents our findings and evaluations and includes the following.

- Project description;
- Site conditions, including geology, and special site features;
- Field exploration and laboratory testing;
- Subsurface conditions;
- Shallow foundation recommendations;
    - Allowable bearing pressures;
    - Estimated settlement (total and differential);
- Site Seismic classification;
- Floor slab recommendations;
- Pavement recommendations;
- Permanent site slopes;
- Site development recommendations;
- Suitability of soils for use as fill material;
- Structural fill recommendations;
- Compaction recommendations;
- Special conditions encountered;
- Site vicinity map;
- Boring location plan;
- Soil test boring logs; and
- Summary of laboratory test results.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 06:20527, dated November 2, 2017, as authorized by Mr. Bill Schoettelkotte on November 6, 2017, and includes the Terms and Conditions of Service outlined with our proposal.

2 PROJECT INFORMATION

2.1 PROJECT LOCATION

The site consists of an approximate 23.6 acre developed parcel located at 9090 US 15/501 North in Pittsboro, Chatham County, North Carolina, as shown on Figure 1 in Appendix A. The property is further identified by the Chatham County Parcel Identification Number (PIN) 9774 00 29 1988.

2.2 PAST SITE HISTORY/USES

Based on Google Earth Aerial Imaging, it appears the site has remained undeveloped until 2016, when initial site clearing began for the property.

2.3 CURRENT SITE CONDITIONS

We understand that the site has currently been rough-graded as part of the mass grading to the entire parcel. We have received an electronic copy of the site survey showing existing ground surface contours. The site is relatively level. It was previously rough graded by excavating in the western portion of the site and by placing fill in the eastern portion of the site. A fill slope approximately 25 feet high at an angle of approximately 2.5H:1V to 2H:1V is located on the southeastern, eastern, and northeastern sides of the site.

ECS observed the fill placement at the site and performed field density testing on the fill placed at the site as part of the overall Briar Chapel Development by Newland Communities. The lower portion of the fill consists of ripped/hammered rock and includes fragments up to 16 inches in diameter and choke lifts of soil. This lower level of fill was observed full time by ECS field technicians. The upper 6 to 8 feet of fill consists of soil without boulder-sized rock fragments. Our test results indicated that the upper soil fill had been compacted to at least 95% of the material's standard Proctor maximum dry unit weight.

2.4 PROPOSED CONSTRUCTION

The project will consist of the construction of an approximately 100,000 square foot assisted living facility, with associated asphalt parking and landscaped areas. ECS understands that the site has been rough graded previously, and that the single-story structure will be wood framed with shallow concrete foundations. We have received preliminary architectural drawings for the building dated 9/18/2017. We have also received electronic copies of the proposed site and grading plans. In general, it appears that relatively little cut or fill will be needed to achieve the final design grades. However, the existing fill slope will be extended approximately 20 feet to the southeast to accommodate construction of the proposed access road and will be 2.5H:1V to 2.0H:1V.

Design loads for the proposed building have not been provided to us. Based on our experience with similar projects, we assume that unfactored foundation compression loads will be less than 50 kips for columns and less than 1 kip per foot for load-bearing walls.

3 FIELD EXPLORATION

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field and laboratory data to assist in the determination of geotechnical recommendations.

The subsurface conditions were explored by drilling 6 soil test borings within the structural building pad and 4 soil test borings in pavement areas. A truck-mounted drill rig was utilized to drill the soil test borings. Borings were generally advanced to depths of 10 to 27 feet below the current ground surface. Subsurface explorations were completed under the general supervision of an ECS geotechnical engineer or geologist.

Boring locations were identified in the field by ECS personnel using GPS techniques or by taping from existing features prior to mobilization of our drilling equipment. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A.

Standard penetration tests (SPTs) were conducted in the borings at regular intervals in general accordance with ASTM D 1586. Small representative samples were obtained during these tests and were used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility.

A bulk sample was taken from the upper 0 to 2 feet of subsurface soils from locations throughout the proposed pavement areas for subsequent laboratory testing.

4 LABORATORY TESTING

An experienced geotechnical professional visually classified each soil sample from the test borings on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS) and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). After classification, the geotechnical professional grouped the various soil types into the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual.

The laboratory testing performed by ECS for this project consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples obtained from the test borings in order to aid in classifying soils according to the Unified Soil Classification System and to quantify and correlate engineering properties. Standard Proctor compaction and California Bearing Ratio (CBR), consolidation were also performed. The laboratory test results are attached in Appendix C.

5 SUBSURFACE CONDITIONS

5.1 REGIONAL/SITE GEOLOGY

The referenced site is located within the Eastern Slate Belt in the Piedmont Physiographic Province of North Carolina. In the Piedmont Physiographic Province soils typically consist of residual materials that have formed in place from chemical and mechanical weathering of parent bedrock materials. Differential weathering of the parent rock is common with the degree of weathering influenced by the rock composition (mineralogy) and the presence of joints or dikes. The residual soils typically consist of clays or clayey silts (CH, CL, MH, ML) near the surface, where soil weathering is more advanced. The soil profile generally transitions with depth to silts or clays (ML, CL) or silty/clayey sands (SM, SC) in zones where soil weathering is less advanced. According to the Geologic Map of North Carolina (1985), the site is specifically located within an area mapped as intrusive "Metamorphosed Granitic Rock (CZg)."

5.2 SUBSURFACE CHARACTERIZATION

Existing fill and possible fill consisting of Silty SAND (SC), SAND (SP), and SILT (ML) was encountered at the surface and extended to approximate depths of 3 to 8.5 feet below existing grades at Borings B-7 through B-10. The SPT N-values within the fill and possible soils ranged from 11 to 58 blows-per-foot (bpf). Rock fragments were observed in the recovered fill and possible fill soils. It is important to note that some of the N-values obtained in these samples were possibly influenced by these inclusions and are not an accurate indicator of their density or consistency. Borings B-7 and B-8 were terminated at a depth of 8.5 feet in possible rock fill.

The natural soils encountered at the surface and/or below the fill and possible fill soils generally consisted of Silty SAND (SM), SILT (ML), and SILT with SAND (ML). The SPT N-values within these soils ranged from 4 to 62 bpf, indicating fine-grained soils with a consistency varying between very stiff to very hard, and granular soils with a relative density of medium dense to dense.

Partially Weathered Rock (PWR), which is classified as material with SPT blow counts greater than 50 blows per 6 inches of penetration, was encountered at Borings B-1 through B-6 and B-10 at depths ranging from approximately 6 to 26 feet below existing grades. Auger refusal was encountered at depths approximately 11.5 to 26 feet below existing grades in Borings B-2 through B-4 and B-6. Auger refusal indicates the presence of material such as rock with sufficient hardness to permit no further advancement of the drilling.

5.3 GROUNDWATER OBSERVATIONS

Groundwater seepage into the borings was not observed during our exploration at the depths explored. We did observe borehole caving at depths of 7 to 20 ft which may be an indicator of groundwater presence.

Water levels should be expected to vary depending on seasonal fluctuations in precipitation, evaporation, surface water absorption characteristics, construction activities, nearby surface water bodies, and other factors, and may be present at higher elevations in the future. Also, perched water conditions should be anticipated on top of low permeability soil layers. Perched water may also be present in areas of coarse-grained soils, existing fill soils, and partially weathered rock. Consequently, the designer and contractor should be aware of this possibility while designing and constructing this project. Extended monitoring of the groundwater using wells would be required to determine the fluctuation of the groundwater level over time.

6 DESIGN RECOMMENDATIONS

6.1 BUILDING DESIGN

6.1.1 Foundations

Provided subgrades and structural fills are prepared as discussed herein, the proposed building can be supported by conventional shallow foundations consisting of individual column footings and continuous wall footings. The design of the foundation should utilize the following parameters:

Foundation Design

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure[1]	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Medium Dense/Stiff Natural Low Plasticity Soils or Structural Fill	Medium Dense/Stiff Natural Low Plasticity Soils or Structural Fill
Minimum Width	24 inches	16 inches
Minimum Footing Embedment Depth (below slab or finished grade)	12 inches	12 inches
Estimated Total Settlement	1 inch	1 inch
Estimated Differential Settlement	Less than 0.5 inches between columns	Less than 0.5 inches over 50 feet

1. Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

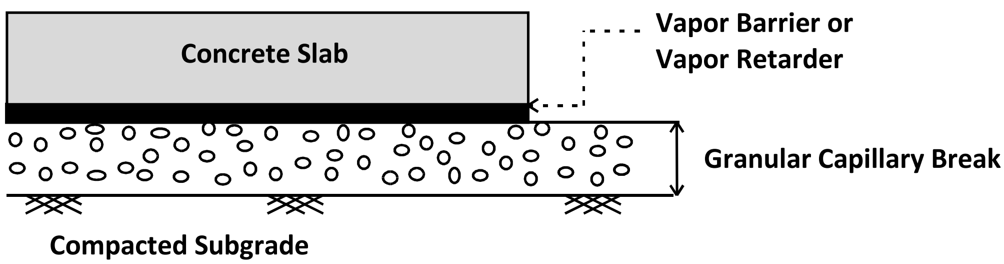
It should be noted that our estimates do not include settlement from stress overlap associated with closely spaced footings or fill induced settlement. Our estimates should be provided to the structural engineer for review, and we should be provided with a foundation plan and loads to allow finalized settlement analyses to be performed before finalizing design.

Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. If very loose, very soft to soft, or otherwise unsuitable soils are observed at the footing bearing elevations, they should be undercut and removed. Any undercut excavation should be backfilled with compacted structural fill, No. 57 stone wrapped in filter fabric, flowable fill, or lean concrete ($f'_c \geq 1{,}000$ psi at 28 days) up to the original design bottom of footing elevation. The original footing should be constructed on top of the compacted structural fill, No. 57 stone wrapped in filter fabric, hardened flowable fill, hardened lean concrete.

6.1.2 Floor Slabs

The on-site lower plasticity natural soils and any new engineered fill are considered suitable for support of the lowest floor slabs, although moisture control during earthwork operations, including the use of discing or appropriate drying equipment, may be necessary. If elastic silt (MH) or fat clay (CH) soils are encountered during construction, a minimum separation of 2 feet should be maintained between the floor slab subgrade elevation and these soils.

Slabs At or Above Finish Exterior Grades: At the time of this report, a grading plan was not available showing the lowest finished floor elevations. We assume the lowest level floor slab will bear on structural fill or natural soils. These materials are likely suitable for the support of a slab-on-grade, however, there may be areas of soft or yielding soils that should be removed and replaced with compacted structural fill in accordance with the recommendations included in this report. The following graphic depicts our soil-supported slab recommendations:



Floor Slab Section

1. Capillary Break Layer Thickness: 4 inches
2. Capillary Break Layer Material: GRAVEL (GP, GW, GP-SM, GW-SM), SAND (SP, SW, SP-SM, SW-SM). Material should have less than 12 percent fines, and can consist of No. 57 stone, ABC, or processed fill.
3. Subgrade compacted to **98%** maximum dry density per ASTM D698
4. Vapor Barrier or Vapor Retarder – Refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction and ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs for recommendations on this issue. Additionally, any environmental vapor intrusions considerations should be taken into account by the floor slab/vapor barrier/vapor retarder material selection and design.

Subgrade Modulus: Provided the placement of structural fill and capillary break layer per the recommendations discussed herein, the slabs may be designed assuming a modulus of subgrade reaction, k_1 of 170 pci (lbs/cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test.

Slab Isolation: Ground-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab. Maximum differential settlement of soils supporting interior slabs is anticipated to be less than ½ inch in 40 feet.

Vapor Retarder/Barrier: Based on the results of our exploration, it appears unlikely that the floor slabs will be subjected to hydrostatic pressure from groundwater. However, water vapor transmission through the slabs 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. Further, health and environmental considerations with respect to any potentially harmful vapor transmission are also outside of our scope of services for this project.

6.1.3 Seismic Design Considerations

Seismic Site Classification: The 2012 North Carolina Building Code requires site classification for seismic design based on the upper 100 feet of a soil profile. Three methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the unconfined compressive strength (s_u) method; and the Standard Penetration Resistance (N-value) method. The N-value method was used for this project.

The seismic site class definitions for the weighted average of shear wave velocity or SPT N-value in the upper 100 feet of the soil profile are shown in the following table:

Seismic Site Classification

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N value (bpf)
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60
E	Soft Soil Profile	Vs < 600 fps	<15

The 2012 North Carolina Building Code (2009 International Building Code with North Carolina Amendments) requires that a Site Class be assigned for the seismic design of new structures. The Site Class for the site was determined by calculating a weighted average SPT N-Value for the top 100 feet of the subsurface profile. Based on the conditions encountered in the borings, we recommend that a Site Class "C," as defined in the NCSBC, 2012, be used for the proposed buildings.

Our experience indicates that evaluation of seismic site class in North Carolina using N-values can be overly conservative. If it is determined that significant advantage could be gained with an improved Site Class, additional site testing could be performed to measure actual shear wave velocities using ReMi test methods and possibly a site specific seismic analysis. ECS can provide a proposal for these services upon request.

Ground Motion Parameters: In addition to the seismic site classification noted above, ECS has determined the design spectral response acceleration parameters in accordance with the 2012 North Carolina Building Code, which is based on the 2009 International Building Code (IBC) methodology. The Mapped Reponses were estimated from the free [Java Ground Motion Parameter Calculator](http://earthquake.usgs.gov/designmaps/us/application.php) available from the USGS website (http://earthquake.usgs.gov/designmaps/us/application.php). The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far right end of the following table.

Ground Motion Parameters *(IBC 2009 Method)*

Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
Reference	Figures 1613.5 (1) & (2)		Tables 1613.5.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.215	F_a	1.6	$S_{MS}=F_aS_s$	0.344	$S_{DS}=2/3\ S_{MS}$	**0.229**
1.0	S_1	0.083	F_v	2.4	$S_{M1}=F_vS_1$	0.199	$S_{D1}=2/3\ S_{M1}$	**0.132**

The Site Class definition should not be confused with the Seismic Design Category designation, which the Structural Engineer typically assesses.

If a higher site classification is beneficial to the project, ECS would be pleased to discuss additional testing capabilities in this regard.

6.2 SITE DESIGN CONSIDERATIONS

6.2.1 Cut and Fill Slopes

The permanent fill slope should be constructed using engineered fill at a slope of 2H:1V or flatter. The surface of all cut and fill slopes should be adequately compacted. Piedmont SILT (ML) and Silty SAND (SM) on fill slopes steeper than 3H:1V is subject wetting, erosion, subsurface piping, and sloughing, especially if surface drainage is not properly controlled. All permanent slopes should be protected using vegetation and other permanent erosion control measures. Please note that slopes steeper than 3H:1V, as planned, may be difficult to establish vegetation, mow safely, and maintain.
Where fill materials will be placed to extend the existing slope, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. New fill material should be placed and compacted in horizontal lifts. To aid in obtaining proper compaction on the slope face, the fill slopes should be overbuilt with properly compacted structural fill and then excavated back to the proposed grades.

The edges of pavements placed near slopes should be located at least 3 feet horizontally from tops the slopes. Structures placed at the tops of slopes should be placed a distance equal to at least the smaller of 40 feet or 1/3 of the height of the slope behind the crest of the slope, per Figure 1808.7.1 of the 2012 North Carolina Building Code. Structures near the bottoms of slopes should be located at least the smaller of 15 feet or ½ of the height of the slope from the toe of the slope, per Figure 1808.7.1. Slopes with structures located closer than these limits should be specifically evaluated by the geotechnical engineer and may require approval from the building code official.

Appropriately sized ditches should run above and parallel to the crest of all permanent slopes to divert surface runoff away from the slope face. Slope drain pipes should be installed, if necessary, to prevent drainage from flowing down the slope face.

6.2.2 New Pavement Sections

Subgrade Characteristics: Based on the results of our soil test borings, it appears that the soils that will be exposed as pavement subgrades, exposed in cuts and placed as fill, will consist mainly of Silty SAND (SM). This soil demonstrated a laboratory CBR value of 15.8, which is relatively high for Piedmont Silty SAND (SM). A design CBR value of 7 and a design modulus of subgrade reaction of 170 psi/in are recommended for this project. Laboratory testing, consisting of Standard Proctor and California Bearing Ratio (CBR) tests are still being processed. An addendum will be issued following this report confirming the recommendations of this report. The pavement design assumes subgrades consist of suitable materials evaluated by ECS and placed and compacted to at least 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D 698) in accordance with the project specifications.

Rigid Concrete Pavements: For heavy-duty traffic areas, such as loading docks, truck turn-around areas, dumpster or container storage yards, and unloading zones for deliveries, the Portland cement concrete pavement section should consist of air-entrained Portland cement concrete having a minimum 28-day compressive strength of 4,000 psi. The rigid pavement section should be provided with construction joints at appropriate intervals per PCA requirements. The construction joints should be reinforced with dowels to transfer loads across the joints.

Drainage: An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the aggregate base course layer, softening of the subgrades and other problems related to the deterioration of the pavement can be expected. This is particularly important at the site due to the moisture sensitive near-surface soils. Furthermore, good drainage should help reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

Design Traffic Loading: Detailed traffic loading information for proposed project is not available at this time. We assume that design traffic loads will be limited to cars and light trucks in light-duty areas (less than 10,000 ESALs in 20 years), in addition to occasional delivery, garbage, and recycling trucks in medium-duty areas (less than 50,000 ESALs in 20 years).

Minimum Material Thicknesses: Pavements for the project are expected to consist of light duty parking areas and medium duty pavements in truck traffic areas. We recommend the following minimum pavement sections for the project. Please note that these sections are considered minimum required thicknesses and do not represent a pavement design.

Pavement Section Recommendations

Pavement Type	Material Designation	Light Duty Pavement	Medium Duty Pavement
Flexible	Asphalt Surface Course (SF9.5A)	2inches	2.5 inches
	Aggregate Base Course	6 inches	8 inches
Rigid	Portland Cement Concrete	5 inches	6 inches
	Aggregate Base Course	4 inches	6 inches

The aggregate base course materials beneath pavements should be compacted to at least 98 percent of their modified Proctor maximum dry density (ASTM D 1557).

ECS should be allowed to review these recommendations and make appropriate revisions based upon the formulation of the final traffic design criteria for the project. It is important to note that the design sections do not account for construction traffic loading.

It should be noted that these design recommendations may not satisfy the North Carolina Department of Transportation traffic guidelines. Any roadways constructed for public use and to be dedicated to the State for repair and maintenance must be designed in accordance with the State requirements.

7 SITE CONSTRUCTION RECOMMENDATIONS

7.1 EARTHWORK OPERATIONS

7.1.1 Excavation Considerations

Excavation Safety: All excavations and slopes should be made and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing and constructing stable, temporary excavations and slopes and should shore, slope, or bench the sides of the excavations and slopes as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Excavatibility: Based on the assumed excavation depths for footings and utilities, in addition to the depth at which partially weathered rock and possible rock fill was encountered in the borings, we anticipate that the majority of the materials to be excavated will be previously placed engineered fill or residual soils, which can be removed with conventional earth excavation equipment such as track-mounted backhoes, loaders, or bulldozers.

7.1.2 Structural fill Materials

Product Submittals: Prior to placement of structural fill, representative bulk samples (about 50 pounds) of onsite and/or imported borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Satisfactory Structural fill Materials: Materials satisfactory for use as structural fill should consist of inorganic soils classified as CL, ML, SM, SC, SW, SP, GW, GP, GM and GC, or a combination of these group symbols, per ASTM D 2487. In order to achieve the design CBR value of 7, any additional fill placed within the upper 2 feet of pavement subgrades should classify as SM, SC, SW, SP, GW, GP, GM and GC, or a combination of these group symbols, per ASTM D 2487. The materials should be free of organic matter and debris, and should contain no particle sizes greater than 3 inches in the largest dimension. The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by a Standard Proctor compaction test (ASTM D 698). Open graded materials, such as gravels (GW and GP), which contain void space in their mass, should not be used in structural fills unless properly encapsulated with filter fabric.

Unsuitable Materials: Unsuitable fill materials include materials which do not satisfy the requirements for suitable materials, such as topsoil, organic materials, debris, debris-laden fill, Elastic SILT (MH), and Fat CLAY (CH).

Onsite Borrow Suitability: The on-site soils meeting the classifications for recommended satisfactory structural fill, plus meeting the restrictions on organic content and debris, may be used as structural fill. We anticipate that of the majority of the soils encountered in the borings within the anticipated excavation depths will be satisfactory for use as compacted structural fill backfill.
On-site soils used as structural fill will require careful moisture control in order to achieve compaction and stability. Any soils excavated from below the water table will require significant drying to achieve the recommended moisture content and minimum compaction. Soils above the water table may also be relatively dry at the time of construction and require wetting to achieve the recommended moisture content and minimum compaction.

7.1.3 Compaction

Structural fill Compaction: Structural fill within the expanded pavements, hardscapes, slopes, or other structural limits should be placed in maximum 8-inch loose lifts and moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content. Structural fill should be compacted with suitable equipment to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D698) more than 12 inches below the finish subgrade elevation and to a least 98% in the upper 12 inches. ECS should be called on to document that proper fill compaction has been achieved.

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified representative of the construction testing laboratory to determine that the minimum compaction requirements are being achieved. Field density testing of fills will be performed at the frequencies shown the following table, but not less than 1 test per lift.

Frequency of Compaction Tests in Fill Areas

Location	Frequency of Tests
Pavement Areas	1 test per 2,500 sq. ft. per lift
Utility Trenches	1 test per 100 linear ft. per lift
All Other Non-Critical Areas	1 test per 10,000 sq. ft. per lift

Compaction Equipment: Compaction equipment used to compact the subgrades and fill materials should be suitable to the soil type being compacted. Sheepsfoot compaction equipment should be suitable for the fine-grained soils (Clays and Silts). A vibratory smooth-drum roller should be used for compaction of coarse-grained soils (Sands) as well as for sealing compacted surfaces.

Fill Placement Considerations: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and all frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

At the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils. Alternatively, if these soils cannot be stabilized by conventional methods as previously discussed, additional modifications to the subgrade soils such as lime or cement stabilization may be utilized to adjust the moisture content. If lime or cement are utilized to control moisture contents and/or for stabilization, Quick Lime, Calciment® or regular Type 1 cement can be used. The construction testing laboratory should evaluate proposed lime or cement soil modification procedures, such as quantity of additive and mixing and curing procedures, before implementation. The contractor should be required to minimize dusting or implement dust control measures, as required.

Where fill materials will be placed up against sloping ground, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 4 inches to 6 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

7.2 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made or shortly thereafter. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. It will be important to have the geotechnical engineer of record observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated. If soft or unsuitable soils are observed at the footing bearing elevations, the unsuitable soils should be undercut and removed. Any undercut should be backfilled with compacted aggregate base course (ABC), No. 57 stone wrapped in woven filter fabric, or lean concrete ($f'_c \geq$ 1,000 psi at 28 days) up to the original design bottom of footing elevation; the original footing shall be constructed on top of the compacted ABC, fabric-wrapped No. 57 stone, or hardened lean concrete.

Slab Subgrade Verification: A representative of ECS should be called on to observe exposed subgrades within the proposed building limits prior to structural fill placement to assure that adequate subgrade preparation has been achieved. Proofrolling using a drum roller or loaded dump truck should be performed in their presence at that time. Once subgrades have been determined to be firm and stable, new structural fill can be placed. Existing subgrades to a depth of at least 10 inches and all structural fill should be moisture conditioned to within -3/+3 percentage points of optimum moisture content then be compacted to the required density. If there will be a significant time lag between the site grading work and final grading of concrete slab areas prior to the placement of the capillary break material and concrete, a representative of ECS should be called on to evaluate the condition of the prepared subgrade. Prior to final slab construction, the subgrade may require scarification, moisture conditioning, and re-compaction to restore stable conditions.

7.3 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes. The pipe subgrade should be observed and probed for stability by ECS to evaluate the suitability of the materials encountered. Any loose or unsuitable materials encountered at the utility pipe subgrade elevation should be removed and replaced with suitable compacted structural fill or pipe bedding material.

Utility Backfilling: The granular bedding material should be at least 4 inches thick, but not less than that specified by the project drawings and specifications. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill given in this report. Compacted backfill should be free of topsoil, roots, ice, or any other material designated by ECS as unsuitable. The backfill should be moisture conditioned, placed, and compacted in accordance with the recommendations of this report.

Utility Excavation Dewatering: It is possible that perched water may be encountered by utility excavations which extend below existing grades. It is expected that removal of perched water which seeps into excavations could be accomplished by pumping from sumps excavated in the trench bottom and which are backfilled with No. 57 stone or open graded bedding material.

8 CLOSING

ECS has prepared this report of findings, evaluations, and recommendations to guide geotechnical-related design and construction aspects of the project.

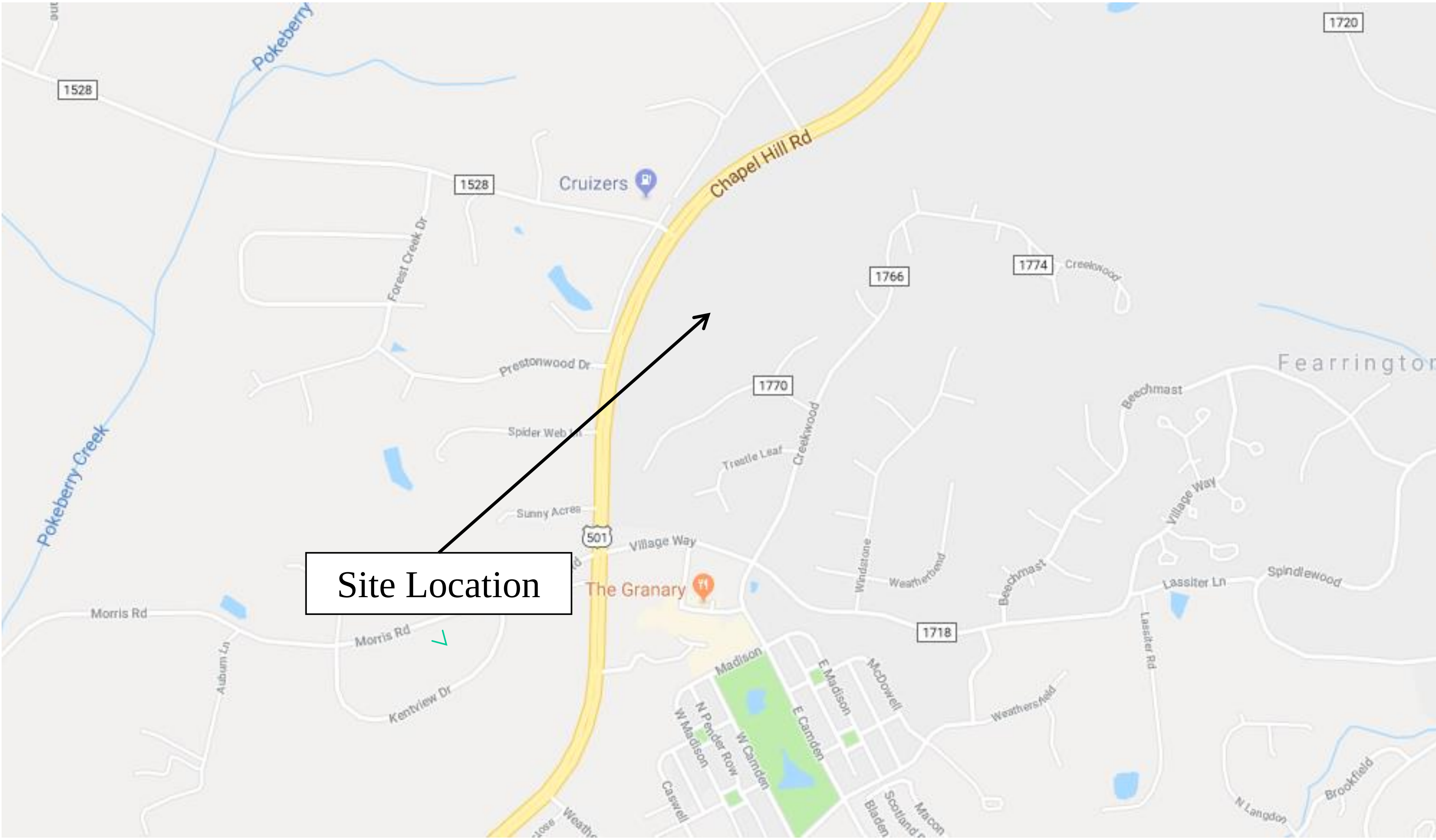
The description of the proposed project is based on information provided to ECS. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately in order that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend that ECS be allowed to review the project's plans and specifications pertaining to our work so that we may ascertain consistency of those plans/specifications with the intent of the geotechnical report.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

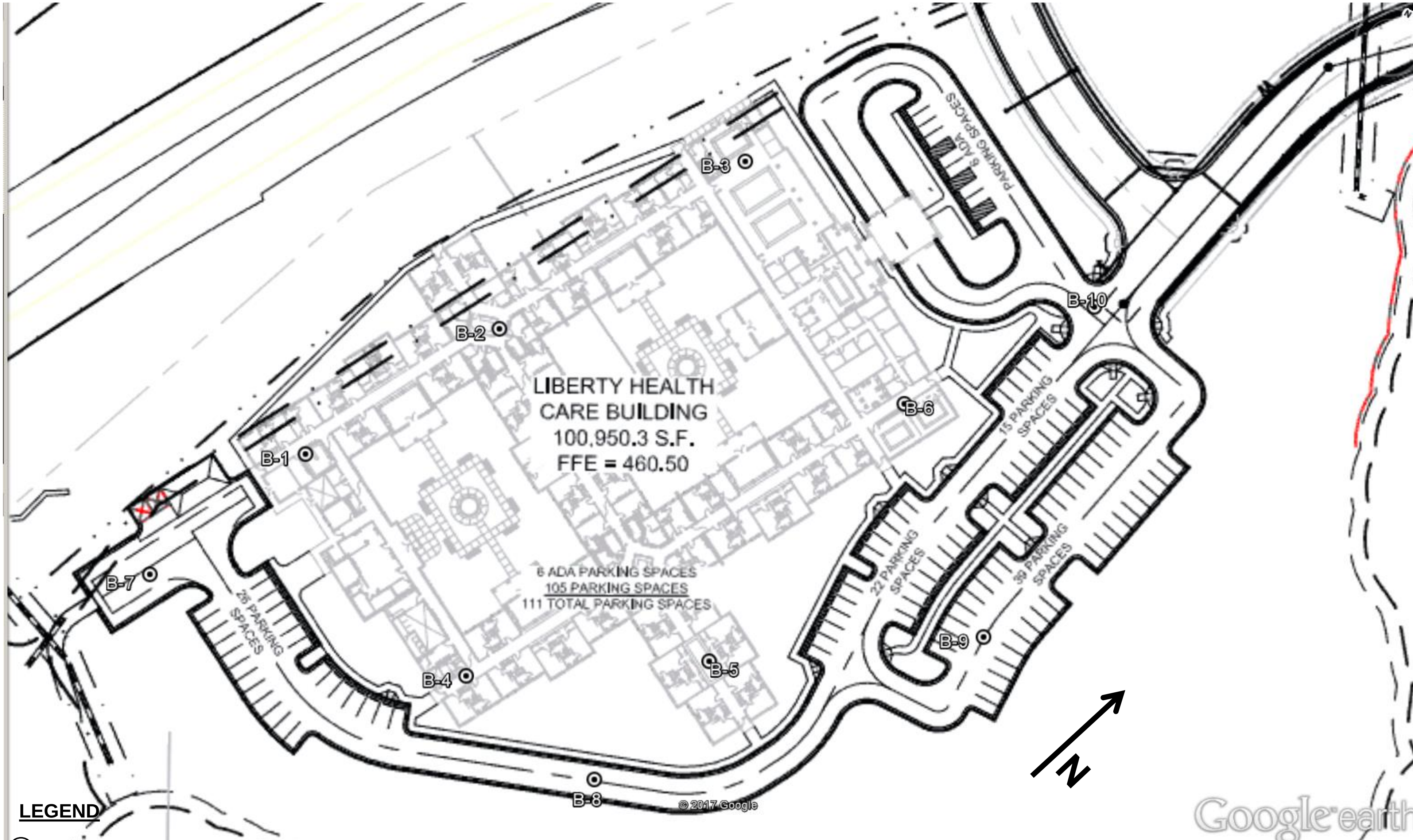
APPENDIX A – Drawings & Reports

Site Location Diagram
Boring Location Diagram



SITE LOCATION Liberty Senior Living 9090 NC HWY 15/501 North Pittsboro, North Carolina	PROJECT NO. 06:20302-N1	FIGURE NO. 1
	DRAWN BY BWM	CHECKED BY TMS
	SCALE NTS	DATE 01-08-18

SOURCE: Google Maps - 2017



LEGEND

ECS Soil Test Borings Drilled 12/05/17 and 12/07/17

N

BORING LOCATION PLAN Liberty Senior Living 9090 NC HWY 15/501 North Pittsboro, North Carolina	PROJECT NO. 06:20302-N1	FIGURE NO. 2
	DRAWN BY BWM	CHECKED BY TMS
	SCALE NTS	DATE 01-08-18

SOURCE: Conceptual Site Plan for the Liberty Senior Living Site and Google Earth

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Boring Logs B-1 through B-10

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

ASPHALT		
CONCRETE		
GRAVEL		
TOPSOIL		
VOID		
BRICK		
AGGREGATE BASE COURSE		
FILL[3]	MAN-PLACED SOILS	
GW	WELL-GRADED GRAVEL	gravel-sand mixtures, little or no fines
GP	POORLY-GRADED GRAVEL	gravel-sand mixtures, little or no fines
GM	SILTY GRAVEL	gravel-sand-silt mixtures
GC	CLAYEY GRAVEL	gravel-sand-clay mixtures
SW	WELL-GRADED SAND	gravelly sand, little or no fines
SP	POORLY-GRADED SAND	gravelly sand, little or no fines
SM	SILTY SAND	sand-silt mixtures
SC	CLAYEY SAND	sand-clay mixtures
ML	SILT	non-plastic to medium plasticity
MH	ELASTIC SILT	high plasticity
CL	LEAN CLAY	low to medium plasticity
CH	FAT CLAY	high plasticity
OL	ORGANIC SILT or CLAY	non-plastic to low plasticity
OH	ORGANIC SILT or CLAY	high plasticity
PT	PEAT	highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

Designation		Particle Sizes
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

Unconfined Compressive Strength, Q_P[4]	SPT[5] (BPF)	Consistency[7] (Cohesive)
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

Relative Amount[7]	Coarse Grained (%)[8]	Fine Grained (%)[8]
Trace	≤5	≤5
Dual Symbol *(ex: SW-SM)*	10	10
With	15 - 20	15 - 25
Adjective *(ex: "Silty")*	≥25	≥30

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	Density
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

WL	Water Level (WS)(WD)
	(WS) While Sampling
	(WD) While Drilling
SHW	Seasonal High WT
ACR	After Casing Removal
SWT	Stabilized Water Table
DCI	Dry Cave-In
WCI	Wet Cave-In

[1] *Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

[2] *To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

[3] *Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

[4] *Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

[5] *Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

[6] *The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

[7] *Minor deviation from ASTM D 2488-09 Note 16.*

[8] *Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-1	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY — RQD% — REC%

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%

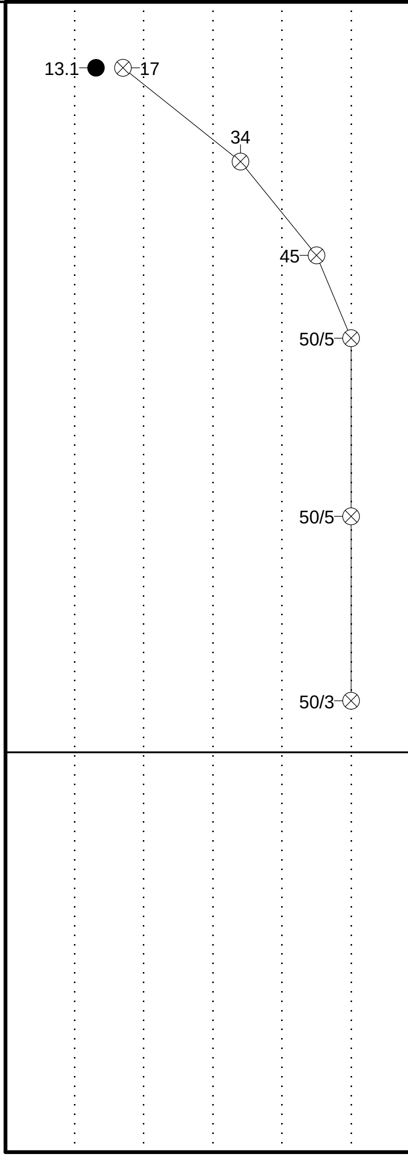
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM) SILTY COARSE SAND, contains rock fragments and roots, orangish brown, moist, medium dense to dense			
	S-1	SS	18	18				8 8 9
	S-2	SS	18	18				13 15 19
5								
	S-3	SS	18	18				16 21 24
	S-4	SS	11	8	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY COARSE SAND, contains rock fragments, orangish brown, moist			31 50/5
10								
	S-5	SS	5	5				50/5
15								
	S-6	SS	3	3				50/3
20					END OF BORING AT 18.8'			
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ — WD ☒	BORING STARTED 12/05/17	CAVE IN DEPTH
WL(SHW) — WL(ACR) Dry	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 — FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Liberty Senior Living - Briar Chapel	

SITE LOCATION
67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

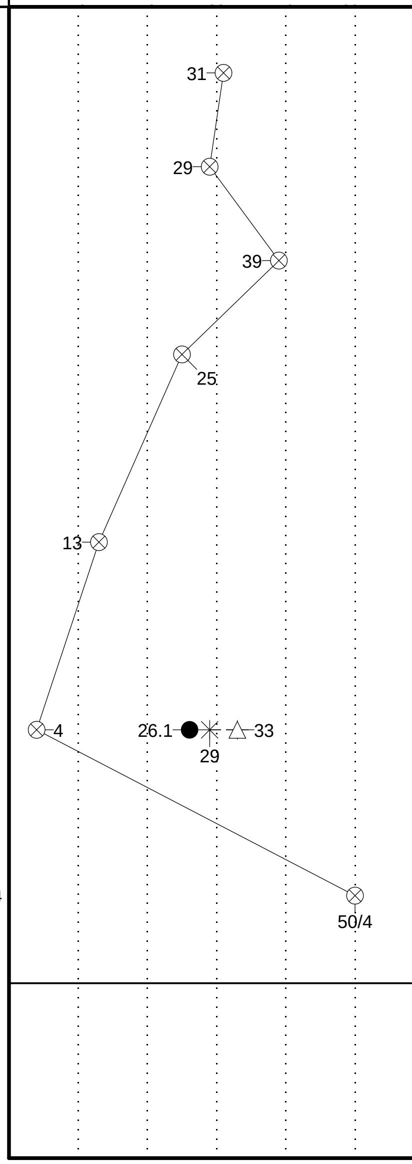
ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION (100%)
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM) SILTY COARSE SAND, contains rock fragments and roots, orangish brown, moist, dense			
	S-1	SS	18	18				10 13 18
	S-2	SS	18	18				13 14 15
5					(SM) SILTY SAND, contains rock fragments and mica, orangish brown orangish brown to gray, moist to wet, dense dense to very loose			
	S-3	SS	18	18				8 21 18
	S-4	SS	18	18				17 14 11
10								
	S-5	SS	18	18				7 6 7
15								
	S-6	SS	18	18				3 3 1
20								
	S-7	SS	4	4	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, gray, wet			50/4
25								
					AUGER REFUSAL AT 26'			
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/05/17	CAVE IN DEPTH @ 8'
WL(SHW) WL(ACR)	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-3	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

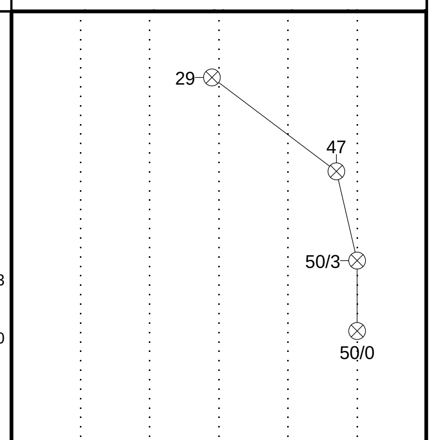
ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM) SILTY COARSE SAND, contains rock fragments and roots, tan, moist, medium dense to dense			
	S-1	SS	18	18				11 12 17
	S-2	SS	18	18				13 23 24
5								
	S-3	SS	15	15				17 23 50/3
					PARTIALLY WEATHERED ROCK SAMPLED AS SILTY COARSE SAND, contains rock fragments, tan, moist			
	S-4	SS	0	0				50/0
10								
					AUGER REFUSAL at 11.5'			
15								
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/07/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/07/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-4	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING: | EASTING: | STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

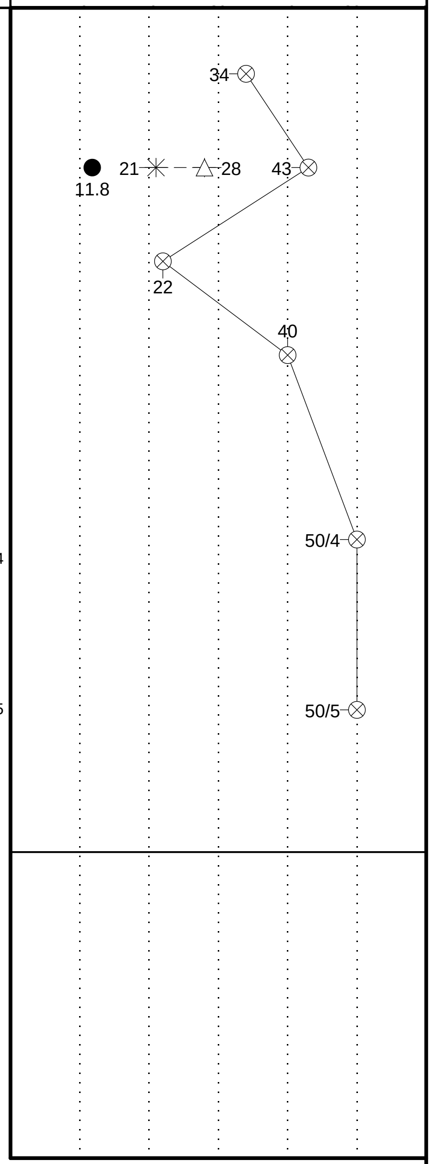
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(ML) SILT WITH SAND, contains rock fragments, tan, moist, very stiff			
	S-1	SS	18	18				11 18 16
	S-2	SS	18	18	(SM) SILTY SAND, contains rock fragments, tan, moist, hard			10 23 20
5	S-3	SS	18	18				4 10 12
	S-4	SS	18	18	(SM) SILTY COARSE SAND, contains rock fragments, tan to gray, moist, dense			13 18 22
10								
	S-5	SS	16	16				24 36 50/4
15					PARTIALLY WEATHERED ROCK SAMPLED AS SILTY COARSE SAND, contains rock fragments, gray, moist			
	S-6	SS	5	5				50/5
20					AUGER REFUSAL at 22.5'			
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/07/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/07/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-5	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING: | EASTING: | STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% × — WATER CONTENT% ● — LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					(SM) SILTY SAND, contains rock fragments and roots, tan, moist, medium dense to dense				
	S-1	SS	18	18				7 10 11	21
	S-2	SS	18	18				4 7 11	18
5									
	S-3	SS	18	18				14 13 17	30
	S-4	SS	18	18				14 16 19	35
10									
	S-5	SS	11	8	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, contains rock fragments, tan, moist			31 50/5	50/5
15									
	S-6	SS	3	3				50/3	50/3
20					END OF BORING at 18.8'				
25									
30									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ — WD ☒	BORING STARTED 12/05/17	CAVE IN DEPTH
WL(SHW) — WL(ACR) Dry	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 — FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Liberty Senior Living - Briar Chapel	

SITE LOCATION
67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING	EASTING	STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

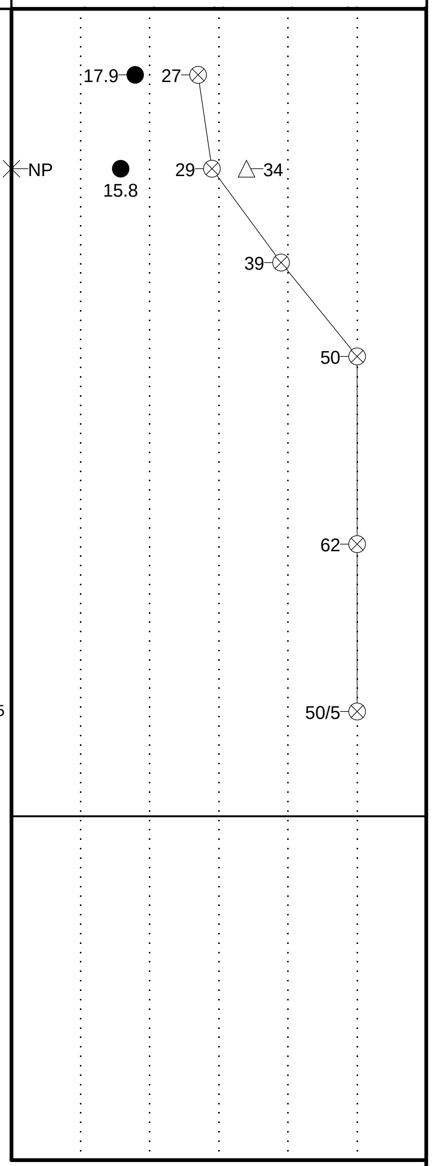
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM) SILTY FINE SAND, contains rock fragments, tan, moist, medium dense to dense			
	S-1	SS	18	18				7 11 16
	S-2	SS	18	18				5 13 16
5								
	S-3	SS	18	18				6 16 23
	S-4	SS	18	18				20 24 26
10								
	S-5	SS	18	18				24 32 30
15								
	S-6	SS	5	5	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE SAND, contains rock fragments, tan, moist			50/5
20								
					AUGER REFUSAL at 21.5'			
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/05/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-7	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING | EASTING | STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

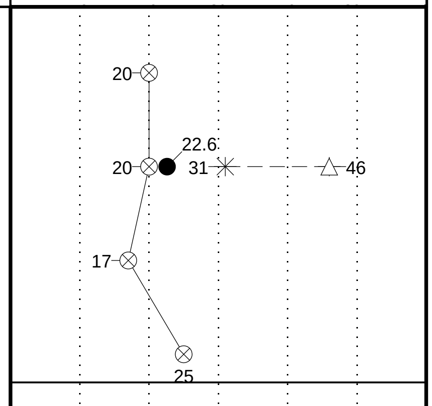
ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% × —— WATER CONTENT% ● —— LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM FILL) SILTY COARSE SAND, contains rock fragments, tan, moist, medium dense			
	S-1	SS	18	18				7 8 12
					(ML) SILT, yellowish tan, moist, very stiff			
	S-2	SS	18	18				6 10 10
5								
	S-3	SS	18	18				6 8 9
	S-4	SS	18	18				9 11 14
10					END OF BORING at 10'			
15								
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/05/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-8	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Liberty Senior Living - Briar Chapel	

SITE LOCATION	
67 Andrews Store Road, Pittsboro, Chatham, NC	

NORTHING	EASTING	STATION

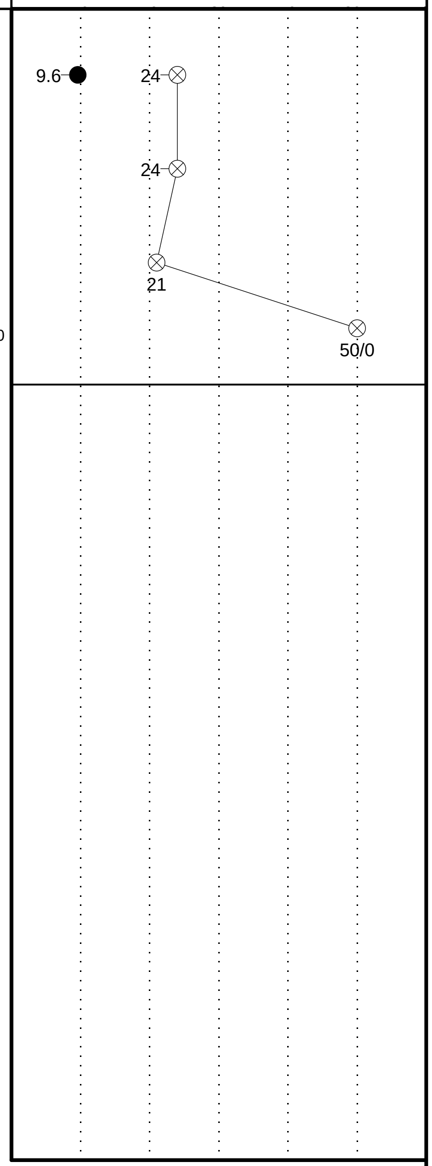
-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

⊗ STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS) BOTTOM OF CASING / LOSS OF CIRCULATION / SURFACE ELEVATION	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SP POSSIBLE FILL) COARSE SAND, contains rock fragments, orangish brown, moist, medium dense			
	S-1	SS	18	18				5 8 16
	S-2	SS	18	18				7 14 10
5								
	S-3	SS	18	18				6 9 12
	S-4	SS	0	0	(NO RECOVERY)			50/0
10					END OF BORING at 8.5'			
15								
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☒	BORING STARTED 12/05/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/05/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-9	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING | EASTING | STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					(SM FILL) SILTY COARSE SAND, contains rock fragments, tan, moist				
	S-1	SS	18	18				7 9 13	22
	S-2	SS	18	18	(ML Possible Fill) SILT, contains rock fragments, tan, moist, stiff to very stiff			11 4 7	11
5									
	S-3	SS	18	18				10 12 13	25
	S-4	SS	0	0	(NO RECOVERY)			50/0	
10					END OF BORING at 8.5'				
15									
20									
25									
30									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/07/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/07/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

CLIENT	Job #:	BORING #	SHEET
Liberty Healthcare Properties of Chatham	06:20302-N1	B-10	1 OF 1

PROJECT NAME: Liberty Senior Living - Briar Chapel

ARCHITECT-ENGINEER:

SITE LOCATION: 67 Andrews Store Road, Pittsboro, Chatham, NC

NORTHING: | EASTING: | STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% × — WATER CONTENT% ● — LIQUID LIMIT% △

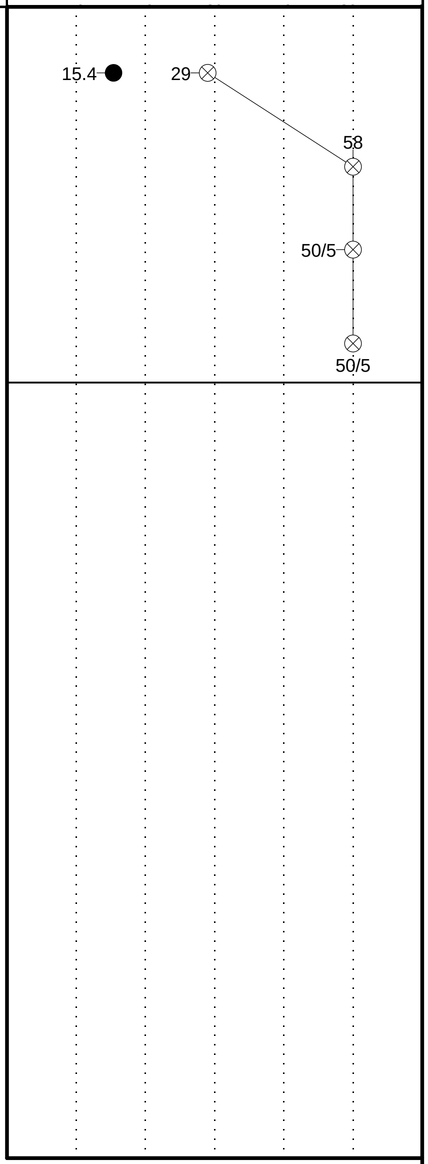
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					(SM Possible Fill) SILTY FINE SAND, contains rock fragments, orangish brown to tan, moist, medium dense to very dense			
	S-1	SS	18	18				11 13 16
	S-2	SS	18	18				12 20 38
5								
	S-3	SS	11	11	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE SAND, contains rock fragments, orangish brown to tan, moist			28 50/5
	S-4	SS	11	11				29 50/5
10					END OF BORING at 10'			



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☒	BORING STARTED 12/07/17	CAVE IN DEPTH
WL(SHW) WL(ACR) Dry	BORING COMPLETED 12/07/17	HAMMER TYPE Manual
WL	RIG CME 550 FOREMAN Higgins	DRILLING METHOD 2.25"I.D.HSA

APPENDIX C – Laboratory Testing

Laboratory Test Results Summary
Moisture-Density Relationship Curves
CBR Test Results

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3] LL	PL	PI	Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5] Maximum Density (pcf)	Optimum Moisture (%)	CBR Value[6]	Other
B-1												
	S-1	1.00 - 2.50	13.1									
B-2												
	S-6	18.50 - 20.00	26.1	SM	33	29	4	22.1				
B-4												
	S-2	3.50 - 5.00	11.8	SM	28	21	7	39.2				
B-6												
	S-1	1.00 - 2.50	17.9									
	S-2	3.50 - 5.00	15.8	SM	34	NP	NP	30.7				
B-7												
	S-2	3.50 - 5.00	22.6	SM	46	31	15	46.5				
B-8												
	S-1	1.00 - 2.50	9.6									
B-10												
	S-1	1.00 - 2.50	15.4									
Parking Area												
	D4S-52	0.00 - 2.00	16.6	SM	34	26	8	32.0	110.7	15.5	18.2	

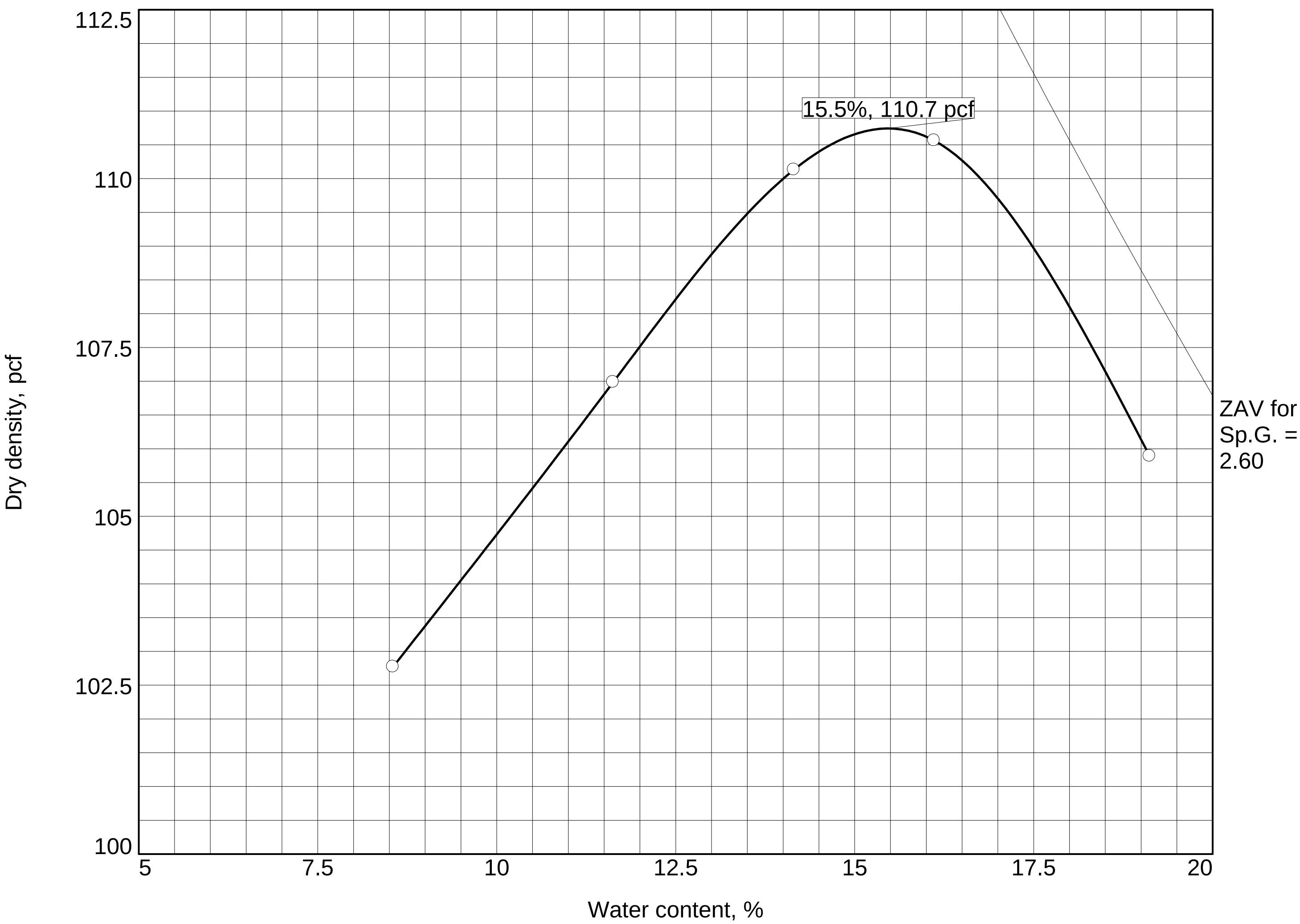
Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 06:20302-N1
Project Name: Liberty Senior Living - Briar Chapel
PM: Brian W. McCarthy
PE: Tom Schipporeit
Printed On: Tuesday, January 16, 2018

ECS SOUTHEAST, LLP
9001 Glenwood Avenue
Raleigh, NC 27617
Phone: (919) 861-9910
Fax: (919) 861-9911

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0-2	SM		16.6	2.6	34	8	1.1	32.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.7 pcf Optimum moisture = 15.5 %	Orangish Brown Silty Coarse Sand

Project No. 20302-N1 **Client:** Liberty Healthcare Properties of Chatham

Project: Liberty Senior Living - Briar Chapel

Source of Sample: Parking Area **Sample Number:** D4S-52

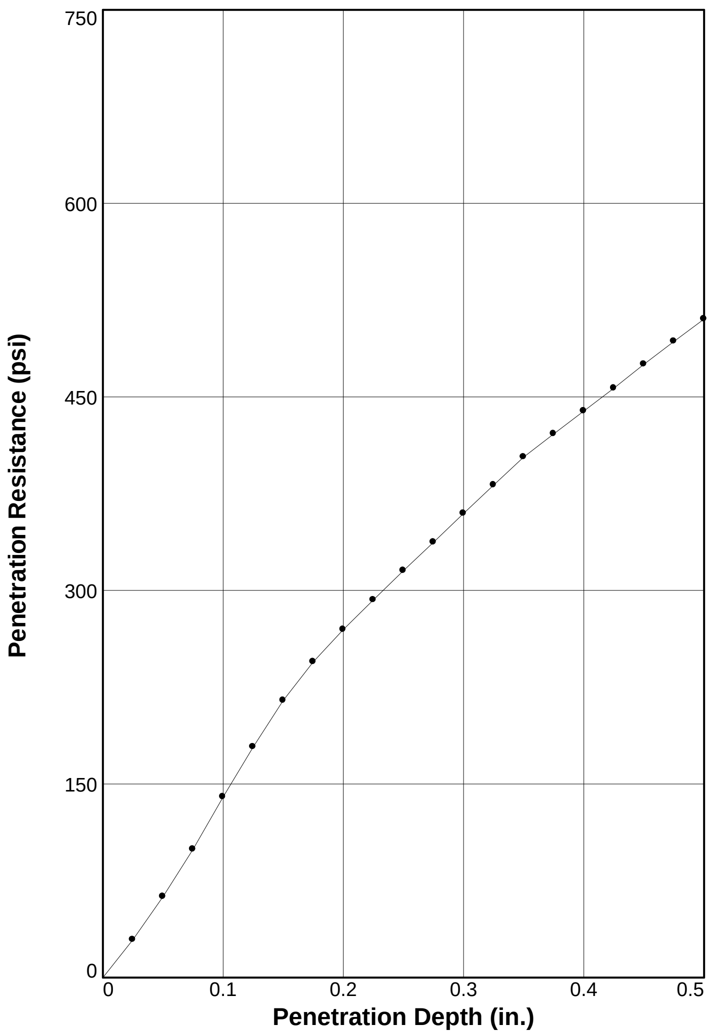
Remarks:

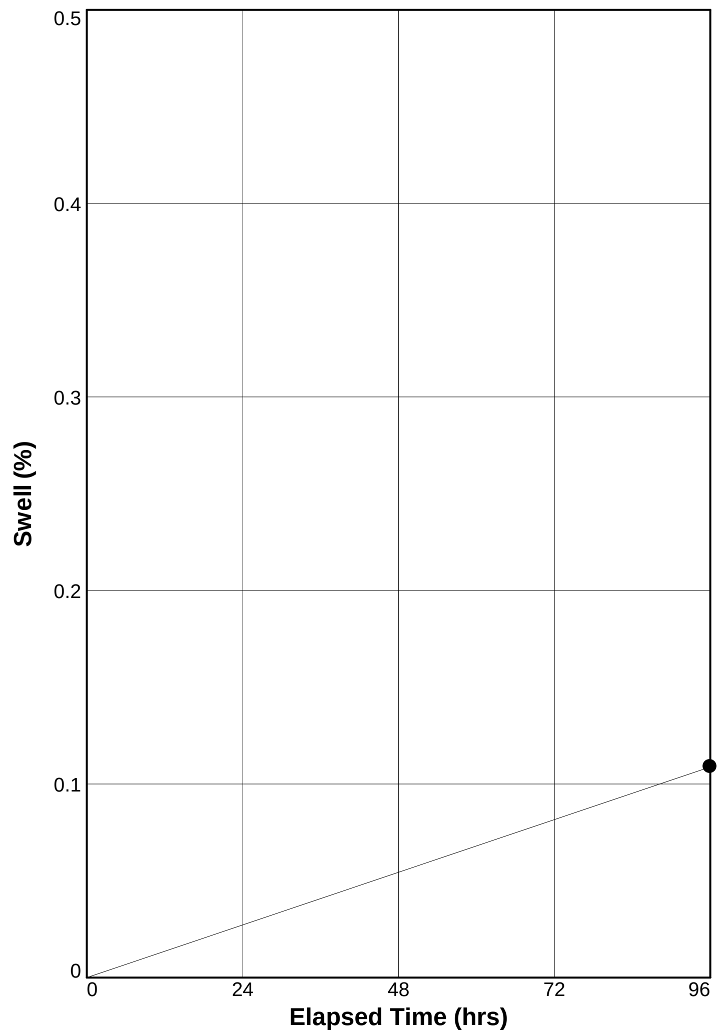
ECS SOUTHEAST, LLP
9001 Glenwood Avenue
Raleigh, NC 27617
Phone: (919) 861-9910
Fax: (919) 861-9911

Figure

Tested By: MB

BEARING RATIO TEST REPORT
ASTM D1883-16





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	108.2	97.7	15.5	108.1	97.7	17.6	14.7	18.2	0.004	10	0.1
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Orangish Brown Silty Coarse Sand	SM	110.7	15.5	34	8

Project No: 20302-N1

Project: Liberty Senior Living - Briar Chapel

Source of Sample: Parking Area **Depth:** 0-2

Sample Number: D4S-52

Date: 12/15/2017

ECS SOUTHEAST, LLP
9001 Glenwood Avenue
Raleigh, NC 27617
Phone: (919) 861-9910
Fax: (919) 861-9911

Test Description/Remarks:

Figure ________