BRINKLEY
C.W. BRINKLEY, INC. CONSTRUCTION

C. W. BRINKLEY, INC.
Agricultural Product Services Bid

Pre-Bid Addendum #01
Date: 9/24/2015

The Bid Date Remains Unchanged – 8/28 @ 3:00pm

Please find the following RFI's and their responses as it pertains to this bid:

Item 1 - Will the exterior doors be motor operated? Specifications plainly call for them to be motorized but the electrical drawings have omitted power provisions for the motor units (power plan and panel schedule)

Answer: The doors will be motorized. I am expecting a revised drawing either this afternoon or tomorrow morning.

Item 2 – Is door type 102 to be fire rated and motorized? There appears to be a fire rated partition at column line 8. If that door is to be fire rated will it be required to be tied into a fire alarm system as 08331-3.3 infers? Or will fusible link activation be acceptable?

Answer: This door will be motorized but not fire rated.

Item 3- Will the interior door #102 require the windload required per 1.4.A.1? Will it need to be insulated also?

Answer: No, it's an interior door.

Item 4 - Would the O/A consider using light gauge metal framing in lieu of the wood framing shown?

Answer: Light gauge metal framing is acceptable.

Item 5 – The drawings call for clear glass at the storefronts, whereas the specifications call for "Gray Light" by PPG. Which one are we to bid on?

Answer: Provide clear storefronts.

Item 6 – Are all of the overhead doors to be fire rated or just insulated?

Answer: Overhead doors only need to be insulated.

Item 7 - 16111. 2.01.B.2 Calls for 1" conduit for low voltage wiring. Is this correct?

Answer: The National Electrical Code Table 9 indicates that a single conductor in a conduit can be up to 53% of the cross sectional area of the conduit, two conductors can be up to a maximum of 31% and over two conductors up to 40% of the cross sectional area. Low voltage cable can be in different forms. If two small individual conductors are used, 0.5 inch conduit would meet the NEC. If the two conductors are twisted pair cable with a shield wire and PVC outer cable covering the 1 inch conduit may be necessary.

The conduit may be reduced in size if the NEC requirements are still met.

Item 8 - 16111.2.01.C.6 States In exposed locations and outdoors, use Galvanized thick wall rigid steel. Does this apply to exposed conduit above 10ft and conduit run to warehouse lighting in overhead?

Answer: Only outdoors. Any interior conduit can be EMT.

Item 9 – Please see the attached soils report for this project

REPORT OF
SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS
PROPOSED WAREHOUSE
PRETLOW STREET & PROGRESS PARKWAY
FRANKLIN, VIRGINIA

ECS PROJECT NO. 04:10194

For

SoilTech Consultants, Inc.
c/o Mr. Barton M. Schreiner, P.E.
101 Business Park Drive, Suite A
Ridgeland, MS 39110

May 20, 2015

ECS MID-ATLANTIC, LLC *"Setting the Standard for Service"*
Geotechnical • Construction Materials • Environmental • Facilities

May 20, 2015

SoilTech Consultants, Inc.
c/o Mr. Barton M. Schreiner, P.E.
101 Business Park Drive, Suite A
Ridgeland, MS 39110

ECS Job No. 04:10194

Reference: Report of Subsurface Exploration and
Geotechnical Engineering Analysis
Proposed Warehouse
Pretlow Street & Progress Parkway
Franklin, Virginia

Dear Mr. Schreiner,

ECS Mid-Atlantic, LLC (ECS) is pleased to provide you with this report of subsurface exploration and geotechnical engineering analysis for the proposed warehouse facility to be located at the intersection of Pretlow Street & Progress Parkway in Franklin, Virginia. This study has been completed in general accordance with our proposal No. 04:15444 dated May 5, 2015. Submitted herein are the results of our soil test borings, laboratory analysis and recommendations for geotechnical related design aspects for the proposed project.

We appreciate providing consulting services to SoilTech Consultants, Inc during the design phase of this project. If you should have any questions regarding the information and recommendations contained in the accompanying report or if we can be of further assistance, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC

MICHAEL J. GALLI
Lic. No. 030684

David M. Anderson, E.I.T.
Geotechnical Project Manager

Michael J. Galli, P.E.
VP, Chief Engineer

DMA/MJG/dma

Distribution: (1) Client via email

REPORT

Report of Subsurface Exploration and Geotechnical Engineering Analysis

PROJECT

Proposed Warehouse
Pretlow Street & Progress Parkway
Franklin, Virginia

CLIENT

SoilTech Consultants, Inc.
c/o Mr. Barton M. Schreiner, P.E.
101 Business Park Drive, Suite A
Ridgeland, MS 39110

PROJECT 04:10194

DATE May 20, 2015

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EXECUTIVE SUMMARY

This report contains the results of our subsurface exploration and geotechnical engineering analysis for the proposed warehouse facility, to be located at the intersection of Pretlow Street and Progress Parkway in Franklin, Virginia.

At the time of the subsurface exploration, the site was undeveloped land with site features consisting of agricultural land. Surface cover generally included tilled agricultural land with very loose topsoil. The site had a large drainage ditch at the rear.

Soil test borings conducted across the site indicated a soil profile generally consisting of upper SILTY SANDs (SM) with deeper deposits consisting of SAND WITH SILT (SP-SM). At the time of drilling, groundwater depths were observed at a depth 8.0 ft below ground surface.

Provided the subgrades are prepared as recommended herein and in the field during construction, the proposed structure can be supported on a shallow spread foundation system bearing on suitable undisturbed natural soils. The foundations can be dimensioned for a net allowable bearing pressure of 2,000 psf. The bearing pressure is based on assumed column and wall loads up to 200 kips and 5.0 klf, respectively. The bearing capacity at the final foundation elevation should be verified in the field by the Geotechnical Engineer during construction. The floor slabs may be designed as structurally reinforced slabs on grade for slab loading conditions along the order of 200 to 600 psf, more lightly loaded floor slab areas may not require reinforcing.

We have evaluated the seismic site coefficient in accordance with the 2012 International Building Code (IBC). Based on our experience with seismic testing in this geologic environment, we estimate the subsurface profile of this site to have Site-Class E.

California Bearing Ratio (CBR) tests were conducted to aide in the design of pavements. The laboratory test results were not available at the time of this report. Our design is based on conservative assumptions and our experience with local soil conditions. An updated version of this report will be issued upon completion of laboratory testing. Due to the generally sandy soil profile, we do not anticipate significant changes in our design recommendations.

Further information regarding the subsurface exploration procedures used; soil conditions encountered; foundation, floor slab, and pavement design; earthwork operations; and construction considerations are included in the text of this report. This report should be reviewed in its entirety by the appropriate design/construction professional before making any assumptions relating to geotechnical conditions.

1.0 PROJECT OVERVIEW

Our professional services for this project were performed in general accordance with your authorization of ECS Proposal No. 04:15444, dated May 5, 2015. The site information was obtained from the Preliminary Site Plan provided by the client.

1.1 Project Characteristics

The proposed project site is located at the southwest quadrant of the intersection of Pretlow Street and Progress Parkway in Franklin, VA. The project consists of the construction of a warehouse facility with associated pavements and structures.

The proposed construction will include multiple, one story steel framed warehouse structures. It is our understanding that the building structures will consist of structural steel framing with prefabricated steel panel walls and concrete slab-on-grade floors. Based on our assumptions and the site conditions observed, it is anticipated that the foundations will be designed for maximum wall loads of about 5.0 kips/foot with exterior and interior column loads no greater than 200 kips. Maximum floor slab loads are anticipated to be 200 to 600 psf. Final site grades are assumed to be within 2 feet of existing surface grades.

The site pavements are assumed to be subjected to maximum loading of 300,000 ESALs with an equivalent single axle loading of 18,000 pounds and a design life of 20 years. Traffic loading criteria is based on our experience with similar structures. If actual truck traffic volumes are known, ECS requests the opportunity to re-evaluate our assumptions and pavement design criteria for the subject facility.

1.2 Scope of Work

The conclusions and recommendations contained in this report are based upon the results of our field exploration and laboratory testing program. Our exploration consisted of a site visit by a geotechnical engineer and drilling of fourteen (14) soil test borings to depths up to 20 feet bgs. Laboratory testing performed on several representative samples obtained during the field exploration aided in the evaluation of the field data. Nine (9) soil test borings were drilled within the proposed building footprint areas to depths of 20 feet bgs and five (5) soil test borings were drilled within the proposed drive lanes and parking areas to depths of 6 feet bgs. Bulk soil samples were recovered at shallow depths from bore locations within the proposed pavement areas for laboratory Proctor and CBR tests to aid in pavement design.

The borings were located in the field by ECS personnel by measuring distances and estimating angles from existing sites features and based on the site plans provided. The approximate locations are shown on the Boring Location Diagram included in Appendix I. Laboratory testing was performed on representative samples obtained during the field exploration to aid in ascertaining pertinent soil properties.

The recommendations contained herein were developed from our interpretation of the subsurface data obtained from the soil test borings and subsequent laboratory testing. The borings indicate subsurface conditions at specific locations at the time of the exploration. If, during the course of construction variations in subsurface conditions appear evident, the Geotechnical Engineer should be informed so that the conditions can be addressed.

1.3 Purpose of Exploration

The purpose of this exploration was to explore the soil and groundwater conditions at the site in order to develop geotechnical engineering recommendations to aid in the design and construction of the project and help develop earthwork specifications. This purpose was accomplished by:

- Advancing borings to explore the subsurface soil conditions and ascertain the depth of ground water.

- Performing laboratory tests on representative soil samples obtained from the borings to evaluate pertinent engineering properties.

- Analyzing the field and laboratory data to develop appropriate geotechnical engineering recommendations to support the design of foundations, floor slabs, pavements, and develop earthwork specifications for the project.

2.0 EXPLORATION PROCEDURES

This section described the methods by which information was obtained during the subsurface exploration for the preparation of this report.

2.1 Subsurface Exploration Procedures

Soil test borings were performed with an ATV-Mounted drill rig which utilized mud rotary drilling techniques to advance the boreholes and prevent borehole collapse. Drilling services were provided by Fishburne Drilling, Inc. of Chesapeake, Virginia.

Representative samples were obtained from the soil borings by means of the split-barrel sampling procedure in accordance with ASTM Specification D 1586-99, (Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils). Samples were taken continuously to a depth of 10 feet, and at 5-foot intervals thereafter. In this procedure, a 2.25 inch O.D., split barrel sampler is driven into a soil a distance of 24 inches by a 140-pound hammer falling 30 inches. The first 6-inch depth increment is considered the seating interval. The number of blows required to drive the sampler through the next two 6-inch intervals is designated the standard penetration test or the “SPT N” value and is indicated for each sample on the boring logs. Individual Soil Boring Logs can be found in Appendix II, of this report. Copies of the “Unified Soil Classification System” and “Reference Notes for Boring Logs” are included in Appendix III of this report.

After recovery, representative portions of each sample were removed from the sampler and placed in sealed glass jars. The samples were taken to our laboratory for classification in accordance with ASTM D 2487 (United Soil Classification System) and laboratory testing.

2.2 Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to determine pertinent engineering properties. The laboratory testing program included visual classifications, moisture content, grain size analysis and Atterberg Limits tests. Additionally, CBR tests were performed to ascertain relevant soil properties for use in pavement design analysis. All data obtained from the laboratory tests will included on the laboratory test summary in Appendix IV as an updated form of this report. This report will be updated at a later date with laboratory test results, due to the clients requests.

An experienced Geotechnical Engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbol for each soil type is indicated in parentheses following the soil description on the boring logs. A brief explanation of the USCS is included with this report. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profile are approximate; in situ, the transitions may be gradual.

3.0 EXPLORATION RESULTS

This section incorporates the site and subsurface conditions observed during our site reconnaissance and field exploration.

3.1 Site Conditions

At the time of the subsurface exploration, the site was undeveloped land with site features consisting of agricultural land. Surface cover generally included tilled agricultural land with very loose topsoil. The site had a large drainage ditch at the rear and is generally flat.

3.2 Regional Geology

The subject property is located on the eastern margin of the Coastal Plain Physiographic Province. The Coastal Plain Physiographic Province extends from the Fall Zone at the eastern edge of the Piedmont Province eastward to the Atlantic Ocean. The topography of the Coastal Plain is a terraced landscape that stair-steps down to the coast and to the major rivers. The terrace risers (scarps) are former shorelines and the treads are emergent bay and river bottoms. The higher, older plains in the western part of the Coastal Plain are more dissected by stream erosion than the lower, younger terrace treads. This landscape was formed over the last few million years as sea level rose and fell in response to the repeated melting and growth of large continental glaciers and as the Coastal Plain slowly uplifted.

The Coastal Plain is underlain by a thick wedge of sediments that increases in thickness from a featheredge near the Fall Zone to more than 4,000 meters under the continental shelf. These sediments rest on an eroded surface of Precambrian to early Mesozoic Era rock. Two-thirds of this wedge are comprised of late Jurassic and Cretaceous clay, sand, and gravel, which were stripped from the Appalachian mountains, carried eastward by rivers, sorted by shoreline, bay, and estuary hydraulics, and deposited primarily in submerged environments. A sequence of deeply bedded, fossiliferous marine sands and Clays of Tertiary period (late Miocene and Pliocene Epochs) overlies similar older strata. These formed at the bottom of shallow seas and are pre-consolidated deposits, having once been buried hundreds of feet below the surface but now being nearly exposed by erosion. Later Tertiary and Quaternary Period sand, silt, and clay, which cover much of the Coastal Plain surface, were deposited during subsequent interglacial highstands of the sea over the past 1.5 million years under shallow water conditions similar to those that exist in the modern Chesapeake Bay and its tidal tributaries.

The shallowest fossiliferous marine sands and clays are known as the Yorktown Formation. The Yorktown Formation soils are a marine deposit that is generally considered to be of late Miocene and early Pliocene age. The surface of the Yorktown in the tidewater area is about El 20 near the Suffolk Scarp (which extends north-south through Suffolk) but can be as high as El 60 further inland. The formation surface, excluding deep eroded zones, slopes gently eastward to about El -20 near the present ocean front. The Yorktown formation is 150 to 200 ft thick in the vicinity of the Suffolk Scarp and over 500 ft thick in eastern tidewater. Since deposition, the Yorktown Formation has experienced numerous cycles of erosion, desiccation, and additional deposition. The ocean level has varied from about El 125 during deposition of the Yorktown Formation to as low as El -180 during the Wisconsin Glacial period which peaked about 20,000 years ago. The effect of this extended period of low ocean level was non-uniform erosion and desiccation of the Yorktown surface. Yorktown soils are thus consolidated in excess of existing overburden pressure. ("Coastal Plain Province: The geology of Virginia", by Chad Roberts).

3.3 Subsurface Conditions

Borings were conducted across the agricultural areas of the site and indicated approximately 6 to 14 inches of Topsoil. Underlying the surface cover, we generally encountered two (2) distinct soil strata:

Stratum I: The near surface soils from the bottom of the surface cover to depths of approximately 6 feet bgs consisted of natural deposits of brown, SILTY SAND (SM). The N-values of the sandy soil deposit varied from 4 to 20 bpf, with an approximate average value of 8 bpf within 0 to 6 feet bgs. These N-values are indicative of a density range of very loose to medium dense.

Stratum II: Underlying the stratum I soils from depths of 6 feet and extending to boring termination depths of approximately 20 feet bgs consisted of deposits of light tan to dark brown, SAND WITH SILT (SP-SM). The N-values of the Sandy soil deposit were observed to be 4 to 21 bpf. These N-values are indicative of a density range of very loose to medium dense.

3.4 Groundwater Observations

The groundwater table (GWT) was encountered at a depth of approximately 8.0 feet bgs at the time of drilling. Static groundwater elevations were not observed as part of our scope of services. In the event that precise groundwater elevations are desired for the design of stormwater management facilities, it is recommended that groundwater observation wells be installed and observed over an extended period of time. It is not expected that the GWT will be encountered by foundation excavations for the building. However, if the GWT is encountered in utility or other deeper excavations, well-pointing will likely be required to achieve dewatering as well as an excavation plan.

The location of the groundwater table can vary as a result of seasonal fluctuations in precipitation, evaporation, surface water runoff, local topography, and other factors not immediately apparent at the time of this exploration. Normally, the highest groundwater levels occur in the late winter and spring and lowest levels occur in the late summer and fall. The contractor should determine actual groundwater conditions prior to construction to evaluate their impact on the work. Seasonal high groundwater elevations are generally anticipated to fluctuate as much as 2 feet. Static groundwater observations over a period of two to three months are most accurate for defining reliable groundwater elevations.

4.0 ANALYSIS AND RECOMMENDATIONS

The data developed during this study indicate that the subsoil and groundwater conditions at the site are generally adaptable for the construction of the proposed building and parking areas provided the recommendations in this report are followed. Shallow foundations are considered suitable for support of the proposed structure.

4.1 Site Preparation and Earthwork Operations

Prior to the start of construction, the site should be cleared of unsuitable materials such as: surface vegetation and topsoil materials within the expanded building and pavement limits. It is recommended that the clearing operations extend laterally at least five (5) feet beyond the proposed building limits and two (2) feet beyond the proposed pavement limits and toe of fill slopes.

Much of the project site was formerly used for agricultural purposes. As such we encountered up to 12 inches of topsoil. However, the cultivation zone could extend to depths of 18 to 24 inches below existing grades. After stripping and removal of all unsuitable materials and cutting to the desired grade, and prior to Engineered Fill placement, subgrades should be observed by the Geotechnical Engineer. Proofrolling using a 10-ton drum roller or a loaded tandem axle dump truck having an axle weight of at least 10 tons should be used at this time to aid in identifying localized soft or unsuitable material. Any soft or unsuitable materials encountered during proofrolling should be removed and replaced with an approved backfill (Engineered Fill material) or scarified and recompacted as recommended by the Geotechnical Engineer.

Loose/soft and organic surficial soil conditions were encountered across the site and will likely render poor subgrade soil conditions during the winter/wetter months. In the event that site work extends through winter months, soil stabilization and/or extensive undercutting may be required to stabilize the site. Soil stabilization required may include calciment stabilization, geotextiles, aeration and/or extensive undercutting, depending on soil conditions at the time of construction.

After stripping and prior to Engineered Fill placement, all subgrades to a depth of at least 8 inches should be moisture conditioned to within +/- 2 percentage points of the soil’s optimum moisture content and be compacted to a dry density of at least 95% of maximum dry density as determined by the Standard Proctor (ASTM D-698). Engineered Fill should be placed and compacted in loose lifts not exceeding 8 inches to a dry density of at least 95% of the maximum dry density as determined by the Standard Proctor (ASTM D-698). Compaction should be accomplished with a large sheepsfoot roller for predominately Clayey soil materials and/or a heavy vibratory drum roller for Sandy soil materials (or equivalent compacting equipment). Field density testing of all subgrades and subsequent lifts of Engineered Fill should be performed at a rate of no less than one (1) test per 2,000 square feet in the building areas and one (1) test per 5,000 square feet in the pavement areas, but not less than one (1) test per lift.

The Engineered Fill should extend at least 5 feet beyond the building limits and 2 feet beyond the edges of the pavement before being sloped. Fill and cut slopes should not be constructed steeper than 3H:1V.

On-site soils which are free of organic material and deleterious debris and which meet the criteria for On-Site Borrow Engineered Fill provided below may be considered suitable for use as Engineered Fill for building and pavement support provided these soils are tested to verify their suitability prior to use and are moisture conditioned, as required. If off-site borrow soils are needed, they should consist of material satisfying the criteria for Imported Engineered Fill, as described below.

The ease by which on-site soils can be reused as Engineered Fill will depend upon their moisture content at the time of construction. At the time this report was prepared, some natural moistures, determined through laboratory testing, indicated that the on-site soils possess higher than optimum moistures. Therefore, scarifying and drying of the on-site soils may be required before recommended compaction can be achieved. Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, we recommend earthwork be performed during the warmer, drier times of the year. Proper drainage should be maintained during the earthwork phases of construction to prevent prolonged periods of standing water which has a tendency to degrade soil subgrades. Materials identified as “unsuitable” should be limited to landscaped areas and other areas without any significant loading.

The following fill types are recommended for use on this project:

On-Site Borrow Engineered Fill: Granular soil material classified as Sand (SM, SC, SP, SW or better) which is free of organics, debris, rubble greater than 4 inches in diameter, and other unsuitable material. Soils classified as Clay (CL and CH) or Silt (ML and MH) or soils containing excessive organic materials are not suitable for reuse as Engineered Fill below the building or within 2 vertical feet of pavement subgrades.

Imported Engineered Fill: Granular soil material classified as Sand (SM, SP, SW or better) with a maximum 20% passing the No. 200 Sieve (Silt or Clay) and free of organics, debris, rubble, and other unsuitable material. Imported Engineered Fill shall posses a minimum CBR quality of 15.

Porous Fill below Slabs: Poorly Graded Sand (SP or SP-SM) with no more than 12% passing the No. 200 Sieve placed in a minimum 6-inch layer or Aggregate Base Material Type I Size 21-A placed in a minimum 6-inch layer. The porous fill material is to serve as a capillary break only.

Foundation Undercut Backfill: VDOT Size No. 57 Stone or Flowable Fill with a minimum compressive strength of 200 psi at 28 days. No. 57 Stone should be used for backfilling foundation excavations under wet or submerged conditions.

It is recommended that all materials to be used for Engineered Fill be analyzed and approved by ECS prior to their use on the site.

4.2 Foundations

Based on the results of our exploration and considering the maximum anticipated foundation loads previously described, we recommend that the proposed building be supported on shallow spread foundation systems. Foundations should be supported on suitable undisturbed natural soils or on properly compacted Engineered Fill. Foundations can be designed for a net allowable bearing pressure of 2,000 psf. The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. This bearing pressure provides a factor of safety of at least 3.0 against general shear failure. Temporary increases in soil bearing pressure up to 3,000 psf may also be considered for wind loading conditions.

Minimum foundation widths of 24 and 36 inches should be maintained for wall and column foundations, respectively, for general shear considerations. The bottoms of all foundations should be placed at a depth of at least 18 inches below finished ground surface in order to develop the allowable bearing pressure and provide the necessary frost protection.

The foundations should be designed as structurally independent of the floor slabs-on-grade. This is to allow for some differential movement between the slabs and the foundations and walls and columns supported by the foundations. In addition, all continuous (strip type) foundations should be adequately reinforced with steel reinforcement in order to better distribute the foundation structural loading and to span soft zones or other inconsistencies in the subgrade bearing soils. New foundations should be positioned so as to avoid bearing above or in close proximity to any deep utilities or storm drains.

The bearing capacity at the final foundation elevation should be verified in the field by the Geotechnical Engineer or their qualified representative to assure that the in-situ bearing capacity at the bottom of each foundation excavation is adequate for support of the design loads. Where foundation excavations are undercut, the bottom of foundation elevation should be reestablished by backfilling with Foundation Undercut Backfill.

Provided our recommendations outlined herein are followed, total foundation settlement is expected to be less than 1.0 inch for the new addition. Differential settlement between similarly loaded foundations is not expected to exceed ½ inch across the new addition. These settlements will occur more or less immediately during construction. The structural design and specification of architectural finishes should consider the potential aesthetic impact of these settlements. This evaluation is based on our engineering experience of the soil conditions and the anticipated structural loading and is to guide the structural engineer with the design.

4.3 Seismic Classification

The 2012 Edition of the International Building Code (IBC) requires that a seismic Site Class be assigned for new structures. The Seismic Site Class may be determined by calculating a weighted average of the N-values of subsurface materials encountered through a depth of 100 feet or to a depth of consistent values as determined by Standard Penetration Test methods. Alternatively, engineering judgment based on local experience may be applied.

We have evaluated the seismic site coefficient in accordance with the IBC. Based on our experience with seismic testing in this geologic environment, we estimate the subsurface profile of this site to have Site-Class E.

4.4 Floor Slab Design

Floor slabs may be supported on suitable natural soils and/or properly placed and compacted Engineered Fill, or approved subgrade material. Slab subgrades should be re-worked to a depth of 8 inches and re-compacted to a dry density of at least 95% the maximum dry density as determined by the Standard Proctor Method (ASTM D 698), as previously discussed.

An effective modulus of subgrade reaction, k_s, of 200 pci may be used to design the floor slab. Floor slab subgrades should be proofrolled by the Geotechnical Engineer or their qualified representative during the time of construction to aid in locating any soft or unsuitable materials. Fill placed for support of floor slabs should satisfy the criteria outlined in this report.

We recommend that the floor slab be isolated from the shallow foundations so differential settlement of the structure will not induce shear stresses in the floor slab. Also, in order to minimize the crack width of any shrinkage cracks that may develop near the surface of the slab, we recommend mesh reinforcement be included in the design of the floor slab. The mesh should be within the top half of the slab to be effective. Based on the slab loading conditions of 200 to 600 psf, we recommend that the project structural engineer evaluate floor slabs and provide a structurally reinforced slab, as necessary.

The floor slab should be directly supported by a Porous Fill layer consisting of a minimum of 6 inches of Poorly Graded Sand (SP, SP-SM). This Porous Fill layer will facilitate the fine grading of the building pad, provide more uniform bearing conditions and help prevent the rise of water to the bottom of the slab (capillary action). As an alternate to protect slab subgrades during adverse seasonal conditions, a 6-inch layer of Aggregate Base Material, VDOT Type I, Size 21A can be employed beneath the slabs. A suitable vapor barrier consisting of at least a 6 mil polyethylene sheet should be placed on top of the Porous Fill prior to the placement of concrete, with an overlap of at least 6 inches. Seams and penetrations in the vapor barrier should be taped. Floor slab subgrades should be recompacted immediately before placing the Porous Fill to repair any disturbance that may have occurred due to construction operations.

4.5 Site Drainage

Positive drainage should be provided around the perimeter of the building to reduce moisture infiltration into the foundation and/or subgrade soils. We recommend landscaped areas adjacent to these structures be provided with a fall of at least 6 inches for the first 10 feet outward from the structures. The parking lot, sidewalks, and any other paved areas should be sloped away from the proposed building.

To reduce contractor costs associated with unnecessary undercutting of soft, wet soils during construction, it is essential that positive drainage be maintained. Building and pavement subgrades frequently require undercutting as a result of wet surficial soils, standing water, and poor drainage. Temporary construction roads can be employed to minimize subgrade deterioration during wet seasonal conditions.

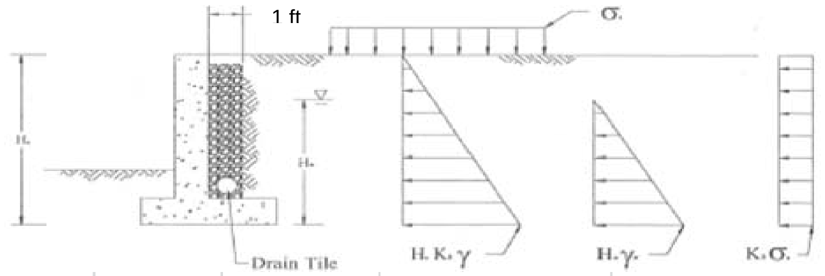
In order to enhance pavement performance and help protect subgrades, we recommend that ditches and/or subdrains be employed around the perimeter of pavements as discussed in Section 4.7. We do not anticipate the groundwater table will be encountered during general earthwork operations. However, seasonally perched water may be encountered. Temporary dewatering measures such as trenching and/or pumping from sumps should be sufficient to control perched water.

4.6 Below Grade/Loading Dock Wall Structure Design

The building loading dock walls should be structurally designed to resist the forces imposed by the lateral earth pressures, hydrostatic water pressure, and surcharge loads (if any). Drainage behind the walls is recommended to limit the build-up of hydrostatic forces on the wall face. As such, only a free draining clean sandy soil or crushed stone material should be used as backfill within 1 foot behind below grade walls. Backfill placed behind the wall shall be placed and compacted as recommended below. Suitable man-made drainage materials may be used in lieu of the granular backfill, adjacent to the below-grade walls. Examples of suitable materials include Enka Mat, Mira-drain, or Geotec drains. These materials should be covered with a nonwoven filter fabric having an apparent opening size (AOS) consistent with the size of the soil to be retained. The material should be placed in accordance with the manufacturer's recommendations and connected to either the perimeter drain system or the underslab drainage system, which in turn should be properly drained. The lateral earth pressures presented below are applicable for either granular backfill or the manufactured drainage medium.

For walls where no movement is allowed such as these loading dock walls, we recommend that the walls be designed to resist "at rest" K_o lateral earth pressures. The at-rest earth pressure assumes no movement of the wall facing is allowed. If the wall is free to rotate, the active earth pressure, K_a may be used to design the wall. To aid in evaluating the various forces imposed on the walls, the following table is presented which outlines soils parameters for the fine and/or medium-grained soils observed in the test boring. The soils encountered in our explanation were mixed deposits of fine- and medium-grained soils. We recommend utilizing the following soil parameters on the next page to design the walls:

Table 1: Earth Pressure Coefficients



Soil Strength Parameters for On Site Soils and Imported Engineered Fill

	On Site Subgrade Soils (SM)	Imported Engineered Fill (SP or SM)
Cohesion, c (psf)	0	0
Angle of Internal Friction, ϕ	30	32
At-Rest Lateral Earth Pressure Coefficient, Ko	0.5	0.47
Active Lateral Earth Pressure Coefficient, Ka	0.33	0.31
Passive Lateral Earth Pressure Coefficient, Kp	3	3.26
Moist Unit Weight, γ (pcf)	120	125
Coefficient of Sliding, u	0.25	0.25
Modulus of Subgrade Reaction, Ks (pci)	200	250

The value of H in the expressions above is defined as the height of the wall in units of feet against which the retained earth is placed. It should be noted that because the frictional and passive earth pressure resistances are based on limit strength conditions, appropriate factors of safety of at least 1.5 should be applied to the designs considering these resistances.

The design criteria presented above for evaluation of horizontal earth pressures on below-grade walls are based on the assumption of level backfill conditions and the absence of free water within the wall backfill materials. Lateral pressures induced by sloping backfills and/or by any surcharge loadings adjacent to walls will also need to be considered in the wall designs. Surcharge loads should be considered within a 45-degree slope from the base of the wall. We recommend that any below grade walls be provided with a drainage system. The system may consist of a 4-inch perforated pipe or drain tiles located around the perimeter of the lowest level, outside the walls, slightly below the lowest floor level. These drain pipes should be surrounded by a minimum of 6 inches of free-draining granular filter material having a gradation compatible with the size of the openings utilized in the drain lines and surrounding soils to be retained, such as VDOT Size No. 57 stone. The drainage material should be wrapped with a suitable, non-woven, geotextile filter fabric geotextile fabric. The drains should be installed such to remove the excess water from the foundation area.

For backfilling below grade walls we recommend utilizing a select granular fill (SAND) classified as SM, SP-SM, SP or better containing less than 20% by weight material passing a No. 200 sieve, and compacted to at least 95% of the material's maximum dry density as determined by the Standard Proctor method (ASTM D-698). An alternative to backfilling with controlled fill would be to backfill with an angular crushed stone (VDOT No. 57 Stone). This crushed stone can be readily placed with minimal compactive effort and will be less susceptible to deterioration from moisture intrusion.

4.7 Pavements

For the construction of new pavements, we recommend that any soft, unstable and/or unsuitable materials be removed from design subgrade elevations in the pavement areas. The exposed surface should be proofrolled and carefully observed at the time of construction in order to aid in identifying any localized soft or unsuitable materials. This material where encountered, should be closely evaluated during construction and should be removed from below the pavement or moisture conditioned and compacted as required and/or considered necessary by the Geotechnical Engineer. Subgrades to a depth of 8 inches should be scarified, moisture conditioned, and compacted as recommended herein. In the event that large areas of unstable and unsuitable subgrade are encountered, stabilization utilizing geotextile, geogrid, moderate undercutting, admixture stabilization or a combination of these remedial type measures, could be considered under the advisement of the Geotechnical Engineer.

Soils expected to be exposed at design pavement subgrade elevations consist of SILTY SAND (SM). The CBR test results were not available at the time of this report, and will be made available at the time of completion. Based on our local experience, we recommend a design CBR value of 8.0 be utilized for pavement design. In the event that the CBR results differ substantially, we will revise our pavement design with the issuance of the updated report. The following pavement sections are based on assumed equivalent 18 kip axle load:

LIGHT DUTY PAVEMENT
(Parking Stalls)

Asphalt Surface: 2.0 inches Asphalt Surface Material Type SM-9.5A
Aggregate Base: 8.0 inches Aggregate Base Material Type I Size 21A
Subgrade: Stable and compacted to a dry density of at least 95% of the soil’s Standard Proctor maximum dry density (ASTM D698) to a depth of at least 8 inches.

HEAVY DUTY PAVEMENT
(Entrance Drives and Drive Lanes)

Asphalt Surface: 2.0 inches Asphalt Surface Material Type SM-9.5A
Asphalt Base Course: 3.0 inches Asphalt Base Material Type BM-25.0
Aggregate Base: 8.0 inches Aggregate Base Material Type I Size 21A
Subgrade: Stable and compacted to a dry density of at least 95% of the soil's Standard Proctor maximum dry density (ASTM D698) to a depth of at least 8 inches.

CONCRETE PAVEMENTS
(Entrance Drives and Drive Lanes)

Surface: 7.0 inches air entrained Portland Cement concrete with a minimum flexural strength of 650 psi and minimum 28-day compressive strength of 4,000 psi
Aggregate Base: 8.0 inches Aggregate Base Material Type I Size 21A
Subgrade: Stable and compacted to a dry density of at least 95% of the soil's Standard Proctor maximum dry density (ASTM D698) to a depth of at least 8 inches.

It should be noted that pavement sections recommended herein are considered to be minimums with regard to standard design practices, and any reductions could result in long term maintenance and periodic repair. The Civil Engineer should review actual traffic patterns to assure they are compatible with these minimum sections.

A rigid pavement should be used beneath dumpster pads (including the area the collection truck will be on while emptying the dumpster). These concrete pads should be comprised of a minimum of 6 inches of Portland Cement concrete with a minimum flexural strength of 650 psi and minimum 28-day compressive strength of 4,000 psi. The concrete should be air entrained and should be reinforced with welded wire mesh-type reinforcement. Construction joints or sawcut joints should be provided at a maximum spacing of 12 feet. Six (6) inches of untreated aggregate base material, Type I - Size 21A, is recommended beneath exterior concrete pavements.

An important consideration with regard to the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials becoming saturated over a long period of time. Based upon the results of the soil test borings, groundwater should not significantly affect the performance of pavements; however, surface runoff water that is trapped during construction on the exposed subgrade soils could create localized deterioration of the soil's bearing capacity. Standing water that may develop on the surface of the pavement may be controlled by adequate design (surface graded to control runoff to desired locations - catch basins, drain inlets, gutters, etc.), adequate compaction of each lift of pavement section component material (to reduce localized settlements that result in ponding) and accurate grading of each lift of pavement section component material (to achieve the desired design grades). Standing water that may develop within the base course layer may be removed by installing temporary weep holes in drainage structures, construction of drainage swales and diversion ditches, and proper backfill and grading behind curbs to minimize water intrusion from behind the curbs.

Pavement subdrains or drainage ditches should be provided behind curbs in cut areas where the grades slope down towards the pavements. The invert grade of swales should be at least 1 ft below the pavement subgrade level. Pavement subdrains should be daylighted or connected to a storm sewer.

4.8 Construction Considerations

It has been our experience that newly exposed subgrades will deteriorate more rapidly upon demolition of overlying surface cover. The shallow soil materials on this site consist of Silty Sands that are expected to be sensitive to moisture and disturbance once they are exposed. Because of this, care should be taken by the contractor to protect the existing subgrades once they are exposed. These materials should be carefully observed and tested to verify that they are suitable for supporting pavements, floor slabs, and building foundations in accordance with the report recommendations.

Exposure to the environment may weaken the soils at the foundation 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. 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.

All Engineered Fill materials should be placed, compacted and tested in accordance with the recommendations contained in this report. We recommend that all cut and fill operations be observed on a full-time basis by the Geotechnical Engineer or their qualified representative to determine if minimum earthwork and compaction requirements are being met.

In a dry and undisturbed state, the subgrade soils at the site should provide suitable subgrade support for Engineered Fill placement and construction operations. However, when wet, soils will degrade quickly either with or without disturbance from contractor operations. Therefore, positive site drainage should be maintained during earthwork operations so as to help maintain the stability of the soil. We recommend that the design depths of stone be placed in the pavement areas early in the construction so as to help protect these subgrades. Any subgrades left exposed to precipitation will quickly degrade, regardless of the construction traffic exposure. Attempting site work during adverse seasonal conditions will have significant effect on the site work budget as substantially more undercutting will be required. Ideally, earthwork should be performed during the summer or early fall (typically drier and warmer months).

If shallow perched water is encountered, we expect that dewatering in shallow trenches could be accomplished by pumping from sumps adjacent to the construction excavations. However, for deeper excavations below the groundwater table, additional measures may require temporary dewatering systems such as well-pointing to permit stable excavations to be made. The specifications should alert the contractor to the potential presence of subsurface water, and it should be incumbent on the contractor to provide the means by which to satisfactorily dewater the site.

5.0 CLOSING

This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties. The use of this report by any undesignated third party or parties will be at the sole risk of the third party or parties and ECS Mid-Atlantic, LLC disclaims liability for any such third party use or reliance. Our conclusions and recommendations have been rendered in a manner consistent with the level and skill ordinarily exercised by members of the geotechnical engineering profession in the Commonwealth of Virginia.

Our conclusions and recommendations are based on design information furnished to us and our experience. They do not necessarily reflect variations in the subsurface conditions, which likely exist intermediate of our borings and in unexplored areas of the site due to inherent variability of the subsurface conditions in this geologic region, as well as past land use. Should such variations become apparent during construction, it will be necessary to reevaluate our conclusions and recommendations based upon on-site observations of the conditions.

If changes are made in the overall design or location of the building and other structures or if our assumptions differ significantly from the actual design, the recommendations presented in this report must not be considered valid unless the changes are reviewed by ECS Mid-Atlantic, LLC and our recommendations are modified or verified in writing. We request the opportunity to review the foundation plan, grading plan and applicable portions of the project specifications when the design is finalized. This review will allow us to check whether these documents are consistent with the intent of our recommendations.

Field observations, monitoring and quality assurance testing during earthwork and foundation installation are an extension of the geotechnical design. We recommend that the owner retain these services and we be allowed to continue our involvement throughout these phases of construction. ECS Mid-Atlantic, LLC is not responsible for the conclusions, opinions or recommendations of others based on the data in this report.

APPENDICES

APPENDIX I

Site Location Map
Boring Location Diagram

APPENDIX II

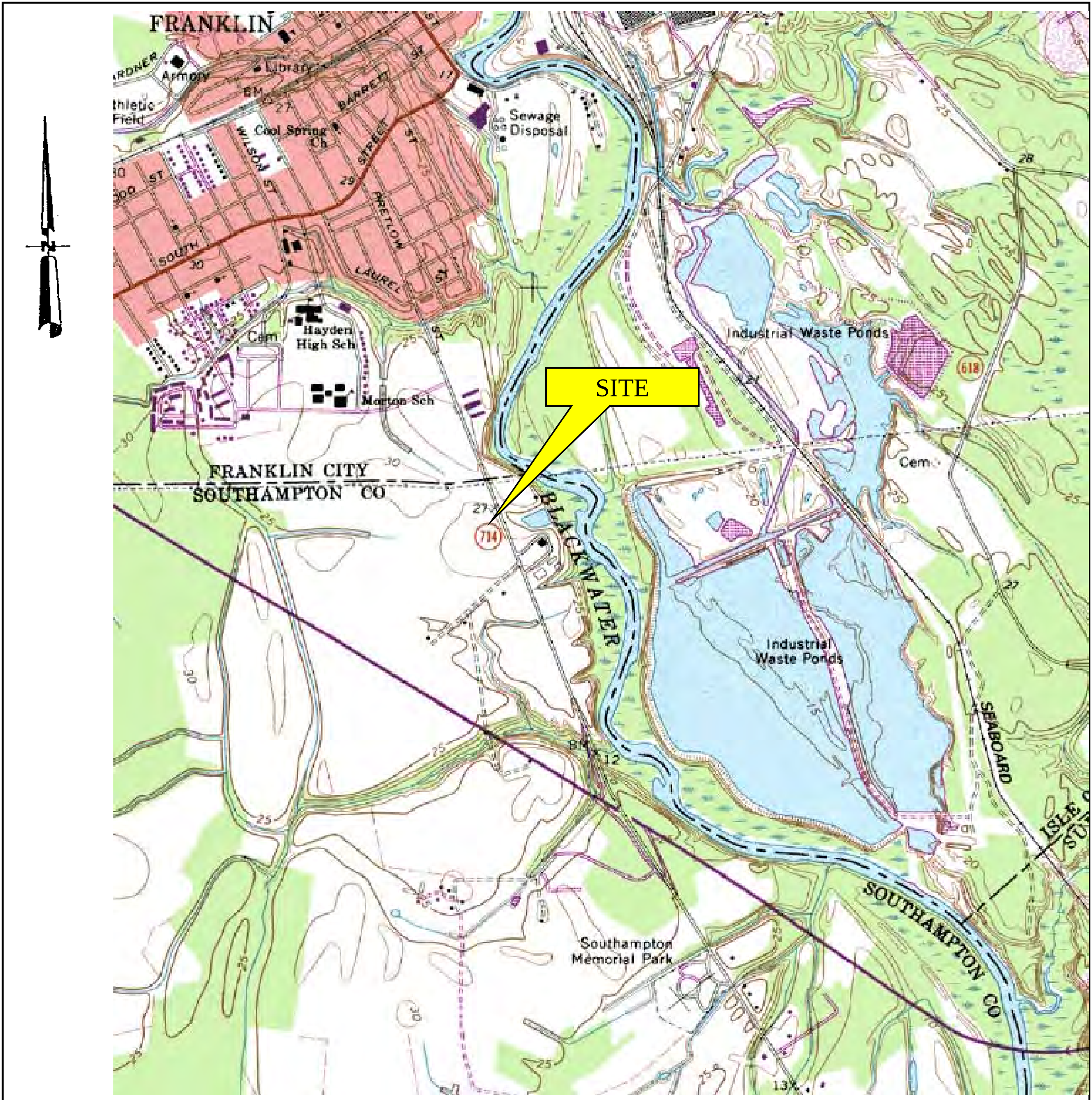
Generalized Soil Profile
Soil Boring Logs

APPENDIX III

Unified Soil Classification System and
Reference Notes for Boring Logs

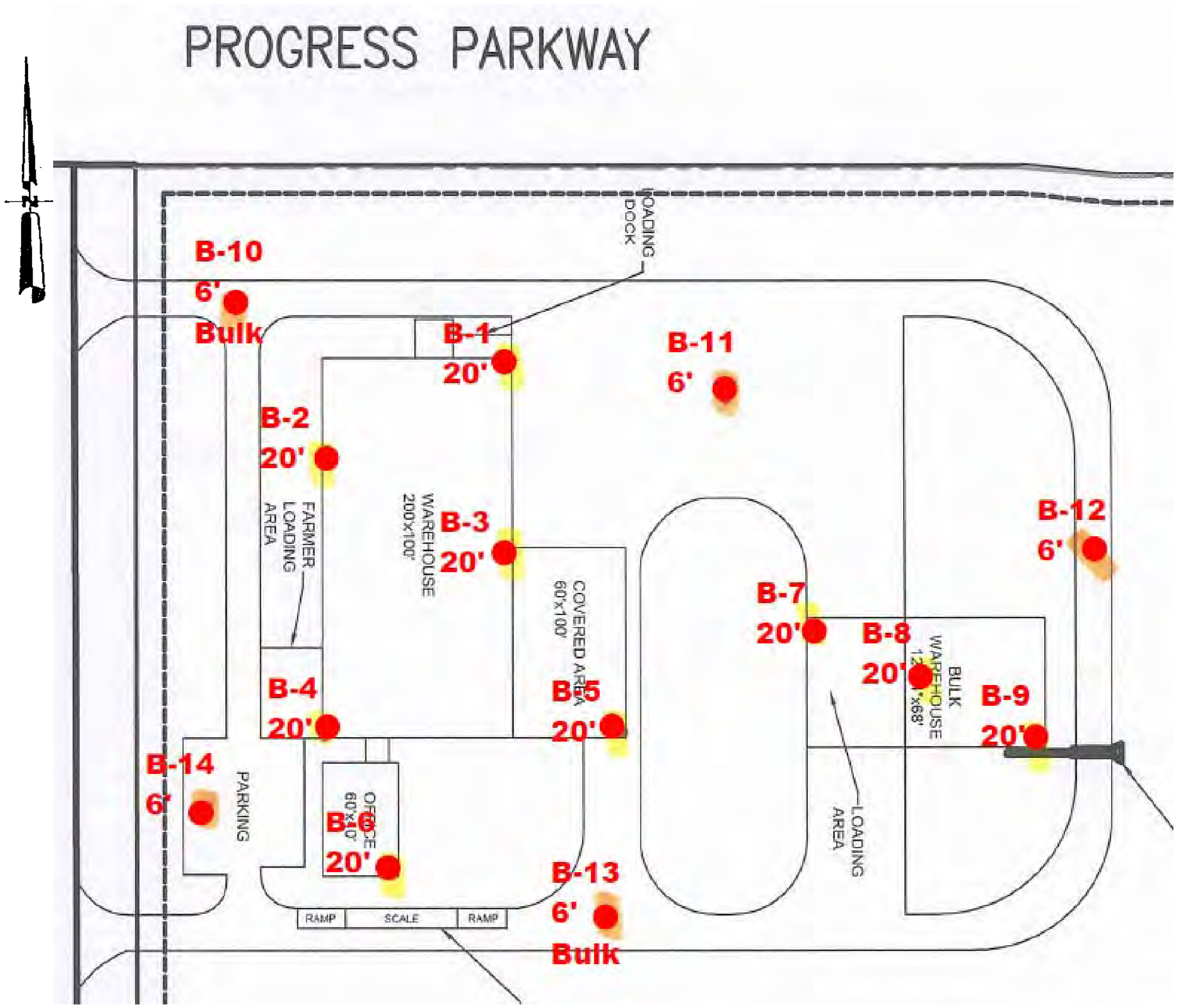
APPENDIX I

Site Location Map
Boring Location Diagram



PROJECT:	PROPOSED WAREHOUSE FRANKLIN, VIRGINIA
	PROJECT NUMBER: 04:10194 DATE: MAY 2015

SITE LOCATION MAP



PROJECT: PROPOSED WAREHOUSE
FRANKLIN, VIRGINIA

PROJECT NUMBER: 04:10194
DATE: MAY 2015

ECS™

BORING LOCATION DIAGRAM

APPENDIX II

Generalized Soil Profiles
Soil Boring Logs

SOIL CLASSIFICATION LEGEND

ST - SHELBY TUBE
RC - ROCK CORE
PM - PRESSURE METER

- FILL - FILL (POSS/PROB) OF ALL TYPES.
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- CH - HIGH PLASTICITY CLAY
- OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
- OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
- PT - PEAT
- WR - WEATHERED ROCK
- PWR - PARTIALLY WEATHERED ROCK
- HWR - HIGHLY WEATHERED ROCK
- DR - DECOMPOSED ROCK

SURFACE MATERIALS

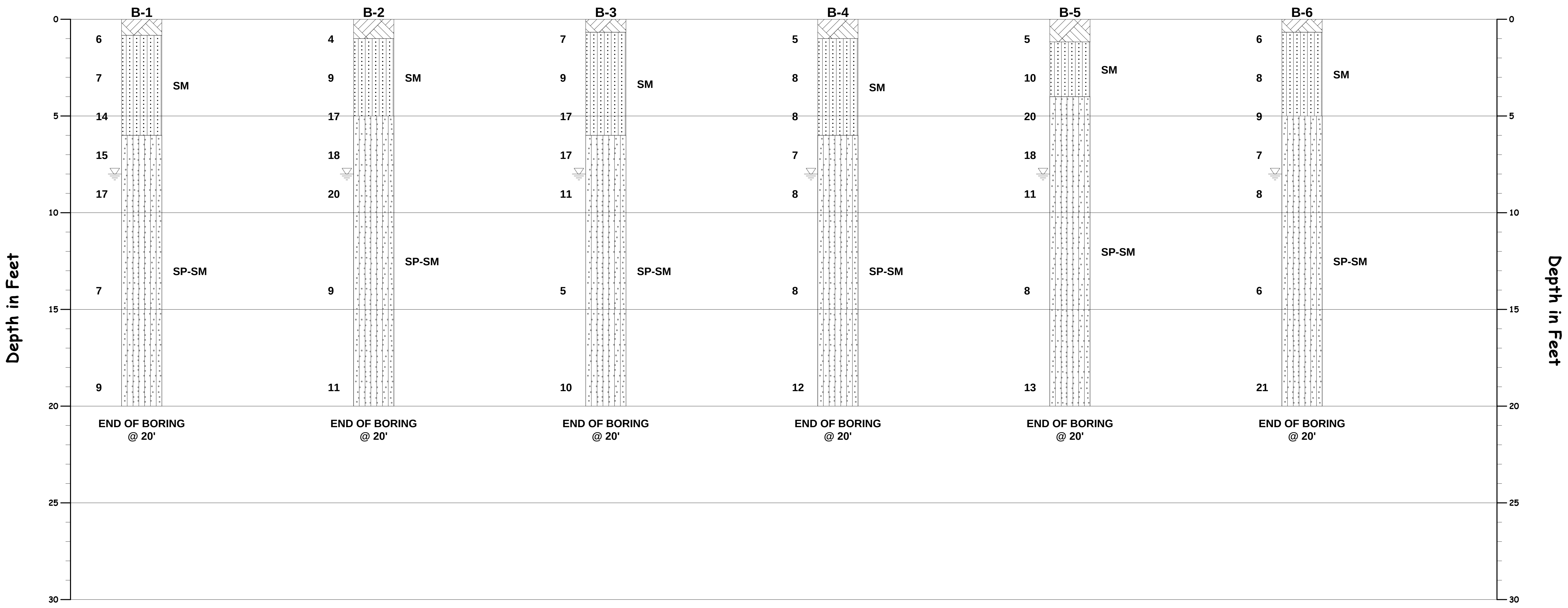
- TOPSOIL
- ASPHALT
- GRAVEL
- CONCRETE
- VOID

ROCK TYPES

- IGNEOUS
- METAMORPHIC
- SEDIMENTARY

SYMBOL LEGEND

- ▽ WATER LEVEL - DURING DRILLING/SAMPLING
- ▽ WATER LEVEL - BEFORE CASING REMOVAL
- ▼ WATER LEVEL - AFTER CASING REMOVAL
- ▽ WATER LEVEL - AFTER 24 HOURS



NOTES:
1 SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.
2 PENETRATION TEST RESISTANCE IN BLOWS PER FOOT (ASTM D1586).
3 HORIZONTAL DISTANCES ARE NOT TO SCALE.

ECS

GENERALIZED SUBSURFACE SOIL PROFILE

Proposed Warehouse
SoilTech Consultants, Inc.
Pretlow Street & Progress Parkway, Franklin, VA

PROJECT NO.: 04:10194 | DATE: 5/20/2015 | VERTICAL SCALE: 1"=5'

SOIL CLASSIFICATION LEGEND

ST - SHELBY TUBE
RC - ROCK CORE
PM - PRESSURE METER

FILL - FILL (POSS/PROB) OF ALL TYPES.
GW - WELL GRADED GRAVEL
GM - SILTY GRAVEL
GP - POORLY GRADED GRAVEL
GC - CLAYEY GRAVEL
SW - WELL GRADED SAND
ML - LOW PLASTICITY SILT
CL - LOW PLASTICITY CLAY
MH - HIGH PLASTICITY SILT
SM - SILTY SAND
SP - POORLY GRADED SAND
SC - CLAYEY SAND
CH - HIGH PLASTICITY CLAY
OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
PT - PEAT
WR - WEATHERED ROCK
PWR - PARTIALLY WEATHERED ROCK
HWR - HIGHLY WEATHERED ROCK
DR - DECOMPOSED ROCK

SURFACE MATERIALS

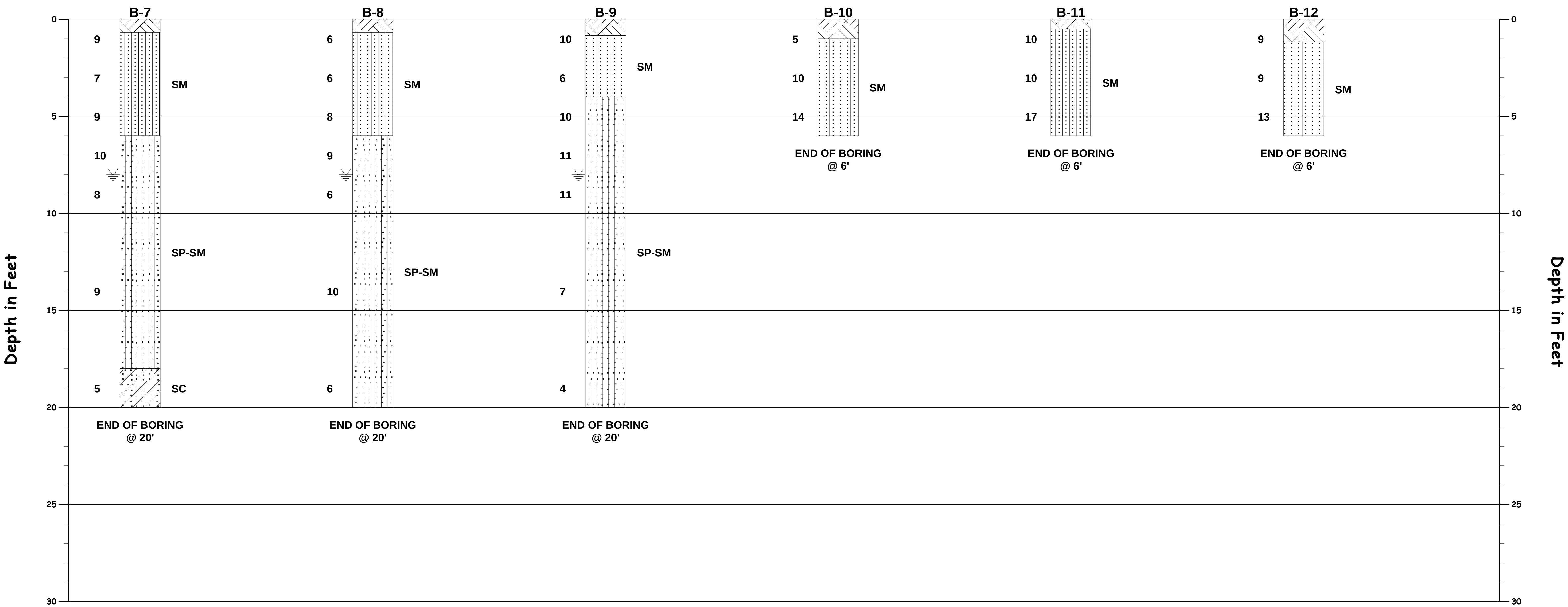
TOPSOIL
ASPHALT
GRAVEL
CONCRETE
VOID

ROCK TYPES

IGNEOUS
METAMORPHIC
SEDIMENTARY

SYMBOL LEGEND

▽ WATER LEVEL - DURING DRILLING/SAMPLING
▽ WATER LEVEL - BEFORE CASING REMOVAL
▼ WATER LEVEL - AFTER CASING REMOVAL
▽ WATER LEVEL - AFTER 24 HOURS



NOTES:
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ECS™

GENERALIZED SUBSURFACE SOIL PROFILE

Proposed Warehouse
SoilTech Consultants, Inc.
Pretlow Street & Progress Parkway, Franklin, VA

PROJECT NO.: 04:10194 | DATE: 5/20/2015 | VERTICAL SCALE: 1"=5'

CLIENT
SoilTech Consultants, Inc.

JOB #
04:10194

BORING #
B-1

SHEET
1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

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

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

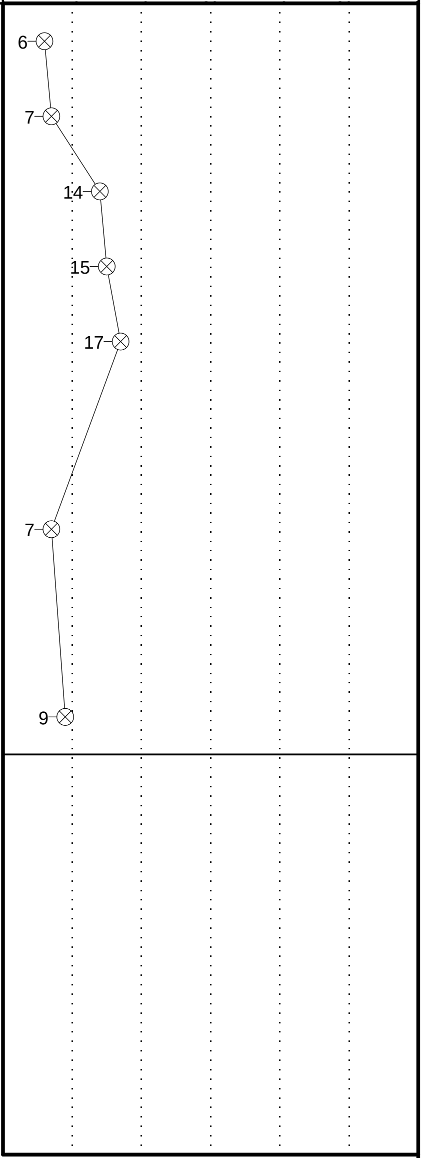
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [10"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose to Medium Dense		25	2 3 3 4
	S-2	SS	24	24				3 3 4 4
5	S-3	SS	24	24				5 6 8 9
	S-4	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Brown, Moist to Wet, Medium Dense to Loose		20	5 7 8 9
	S-5	SS	24	24		▽		7 8 9 7
10							15	
	S-6	SS	24	24				3 3 4 5
15							10	
	S-7	SS	24	24				4 4 5 7
20					END OF BORING @ 20'		5	
25							0	
30								



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

▽ WL 8   WS ☐   WD ☐
BORING STARTED 05/14/15
CAVE IN DEPTH

▽ WL(BCR)   ▼ WL(ACR)
BORING COMPLETED 05/14/15
HAMMER TYPE Auto

▽ WL
RIG 550 ATV   FOREMAN Fishburne
DRILLING METHOD Mud Rotary

CLIENT
SoilTech Consultants, Inc.

JOB #
04:10194

BORING #
B-2

SHEET
1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

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

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

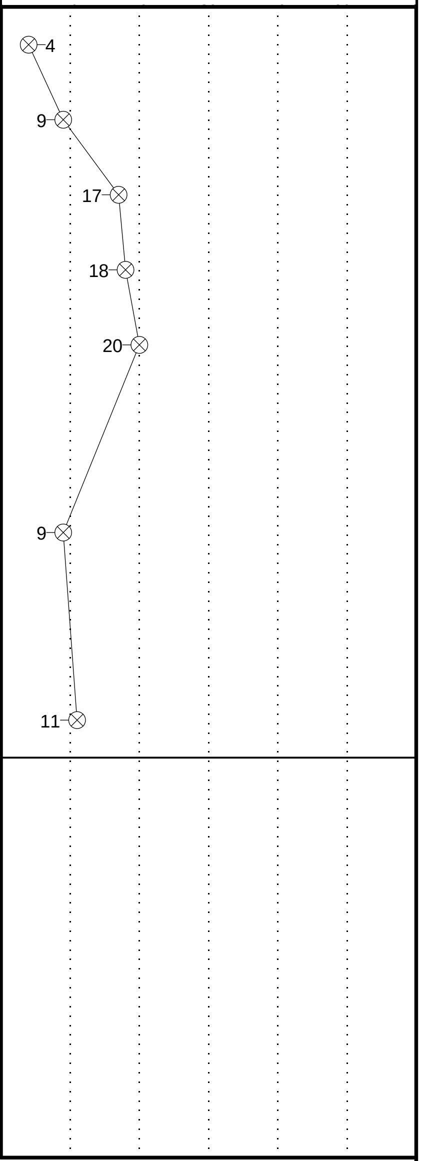
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 26

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					Topsoil Depth [12"]				
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Very Loose to Medium Dense		25	2 2 2 2	4
	S-2	SS	24	24				3 4 5 6	9
5	S-3	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Brown, Moist to Wet, Medium Dense to Loose			6 8 9 10	17
							20		
	S-4	SS	24	24				6 8 10 11	18
						▽			
	S-5	SS	24	24				8 9 11 7	20
10									
							15		
	S-6	SS	24	24				3 4 5 6	9
15									
							10		
	S-7	SS	24	24				4 5 6 8	11
20					END OF BORING @ 20'				
							5		
25									
							0		
30									



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT SoilTech Consultants, Inc.	JOB # 04:10194	BORING # B-3	SHEET 1 OF 1	
PROJECT NAME Proposed Warehouse	ARCHITECT-ENGINEER			
SITE LOCATION Pretlow Street & Progress Parkway, Franklin, VA				
NORTHING	EASTING	STATION		

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – — –   REC% ———

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

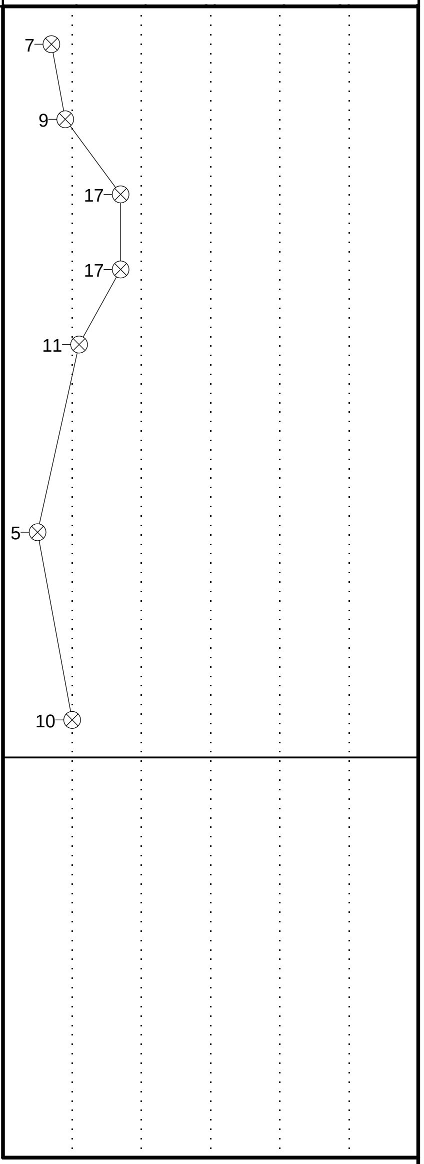
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [8"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose to Medium Dense		25	3 4 3 3
	S-2	SS	24	24				4 4 5 6
5	S-3	SS	24	24				6 8 9 11
							20	
	S-4	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Medium Dense to Loose			7 8 9 9
						▽		
	S-5	SS	24	24				6 5 6 6
10								
							15	
	S-6	SS	24	24				3 3 2 2
15								
							10	
	S-7	SS	24	24				3 4 6 4
20					END OF BORING @ 20'			
							5	
25								
							0	
30								



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-4	1 OF 1

PROJECT NAME: Proposed Warehouse

ARCHITECT-ENGINEER:

SITE LOCATION: Pretlow Street & Progress Parkway, Franklin, VA

NORTHING:

EASTING:

STATION:

–○– CALIBRATED PENETROMETER TONS/FT^2

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

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

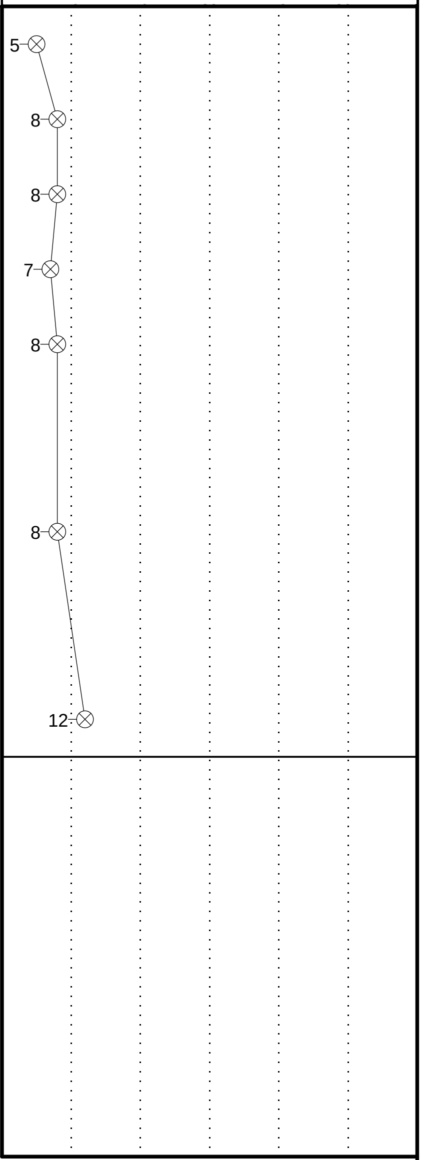
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 26

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					Topsoil Depth [12"]				
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose		25	3 2 3 4	5
	S-2	SS	24	24				3 4 4 5	8
5	S-3	SS	24	24				4 4 4 5	8
					(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Loose to Medium Dense		20		
	S-4	SS	24	24				3 4 3 4	7
						▽			
	S-5	SS	24	24				4 4 4 4	8
10									
							15		
	S-6	SS	24	24				3 4 4 5	8
15									
							10		
	S-7	SS	24	24				3 5 7 2	12
20					END OF BORING @ 20'				
							5		
25									
							0		
30									



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT
SoilTech Consultants, Inc.

JOB # 04:10194

BORING # B-5

SHEET 1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

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

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

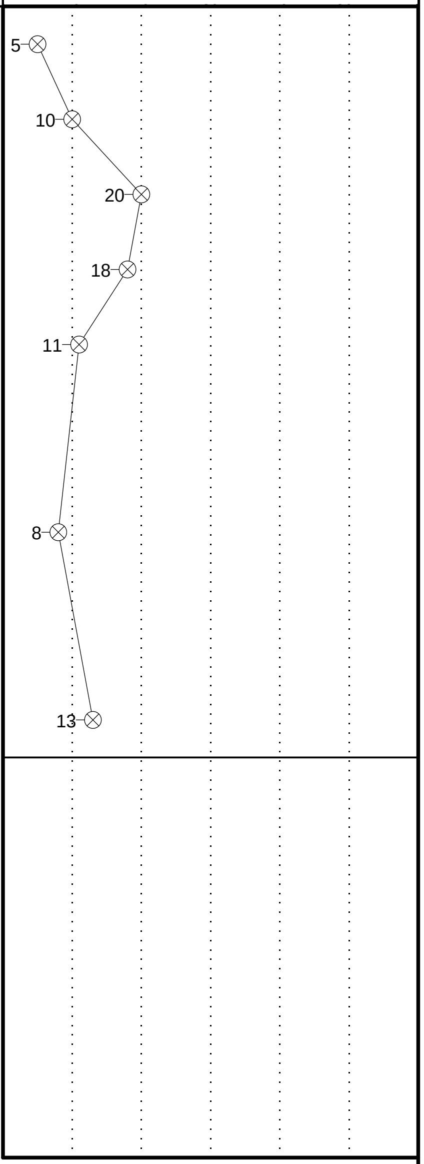
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [14"]			
	S-1	SS	24	24	(SM) SILTY SAND, Light Brown, Moist, Loose		25	3 3 2 3
	S-2	SS	24	24				3 4 6 7
5	S-3	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Loose to Medium Dense			7 10 10 11
	S-4	SS	24	24			20	8 10 8 9
	S-5	SS	24	24		▽		7 6 5 5
10							15	
	S-6	SS	24	24				5 5 3 2
15							10	
	S-7	SS	24	24				3 5 8 5
20					END OF BORING @ 20'		5	
25							0	
30								



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT
SoilTech Consultants, Inc.

JOB #
04:10194

BORING #
B-6

SHEET
1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

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

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

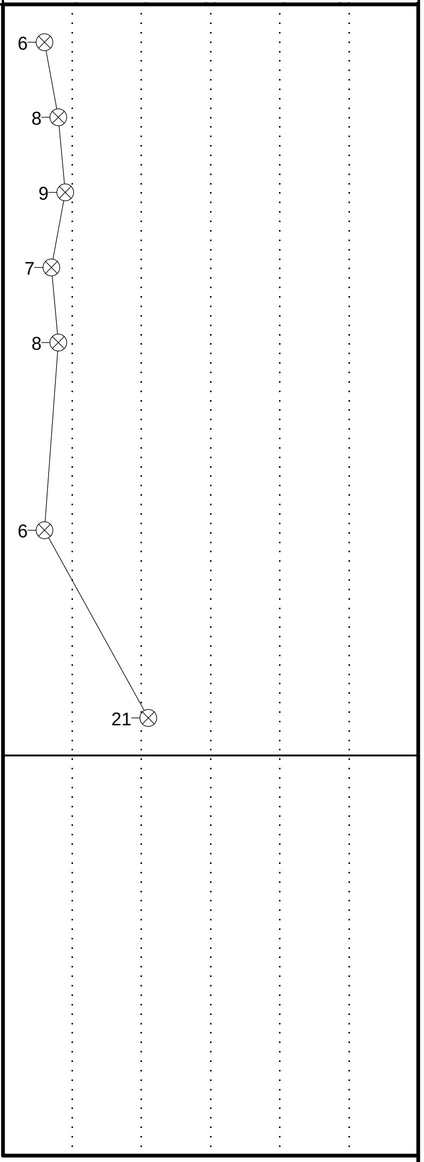
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [8"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose		25	3 3 3 2
	S-2	SS	24	24				3 3 5 5
5	S-3	SS	24	24				3 4 5 5
					(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Loose to Medium Dense		20	
	S-4	SS	24	24				4 3 4 4
						▽		
	S-5	SS	24	24				3 4 4 5
10							15	
	S-6	SS	24	24				3 3 3 5
15							10	
	S-7	SS	24	24				4 11 10 3
20					END OF BORING @ 20'		5	
25							0	
30								



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▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-7	1 OF 1

PROJECT NAME: Proposed Warehouse

ARCHITECT-ENGINEER:

SITE LOCATION: Pretlow Street & Progress Parkway, Franklin, VA

NORTHING:

EASTING:

STATION:

-○- CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – – – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

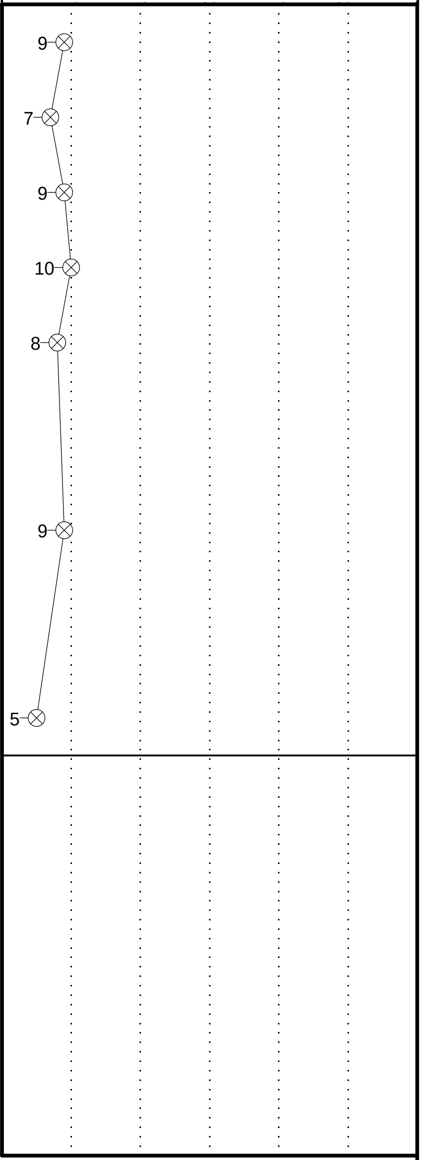
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [8"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose		25	3 4 5 4
	S-2	SS	24	24				2 3 4 5
5	S-3	SS	24	24				4 4 5 5
	S-4	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Brown, Moist to Wet, Loose		20	5 5 5 6
	S-5	SS	24	24		▽		4 4 4 5
10								
							15	
	S-6	SS	24	24				4 4 5 4
15								
							10	
	S-7	SS	24	24	(SC) CLAYEY SAND, Dark Brown Mottled Orange, Wet, Loose			2 3 2 2
20					END OF BORING @ 20'			
							5	
25								
							0	
30								



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-8	1 OF 1

PROJECT NAME: Proposed Warehouse

ARCHITECT-ENGINEER:

SITE LOCATION: Pretlow Street & Progress Parkway, Franklin, VA

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT²

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

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

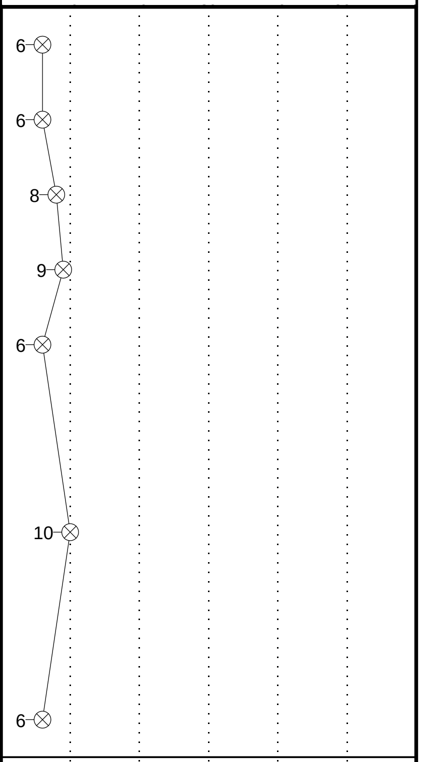
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [8"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Dry to Moist, Loose		25	3 3 3 3
	S-2	SS	24	24				3 3 3 4
5	S-3	SS	24	24				3 4 4 5
					(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Loose		20	
	S-4	SS	24	24				4 4 5 5
						▽		
	S-5	SS	24	24				2 3 3 5
10								
							15	
	S-6	SS	24	24				5 5 5 5
15								
							10	
	S-7	SS	24	24				2 2 4 2
20					END OF BORING @ 20'			
							5	
25								
							0	
30								



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▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT SoilTech Consultants, Inc.
JOB # 04:10194
BORING # B-9
SHEET 1 OF 1
PROJECT NAME Proposed Warehouse
ARCHITECT-ENGINEER
SITE LOCATION Pretlow Street & Progress Parkway, Franklin, VA
NORTHING
EASTING
STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

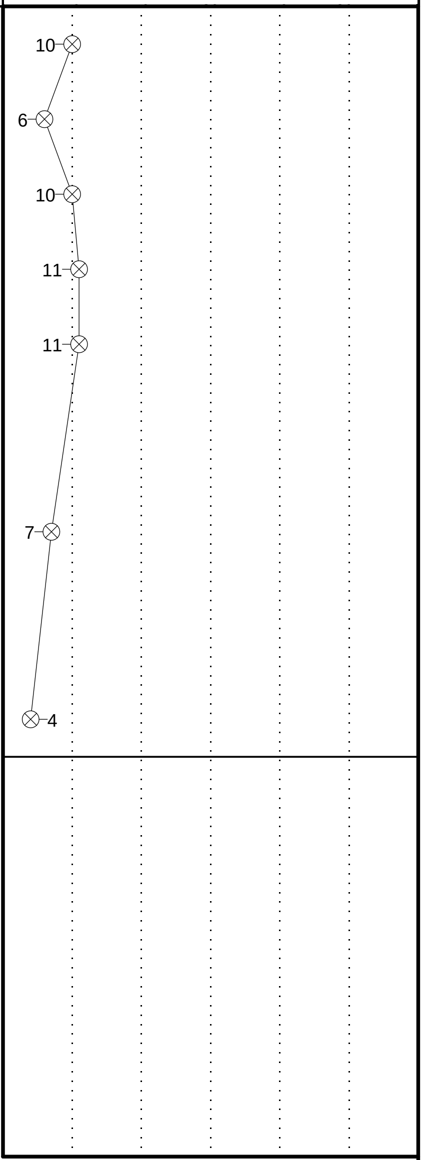
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING
LOSS OF CIRCULATION
SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [10"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown, Moist, Loose		25	4 5 5 4
	S-2	SS	24	24				3 3 3 5
5	S-3	SS	24	24	(SP-SM) SAND WITH SILT, Light Tan to Dark Brown, Moist to Wet, Loose to Medium Dense to Very Loose			3 5 5 7
							20	
	S-4	SS	24	24				5 5 6 6
						▽		
	S-5	SS	24	24				6 5 6 7
10								
							15	
	S-6	SS	24	24				3 3 4 4
15								
							10	
	S-7	SS	24	24				5 2 2 1
20					END OF BORING @ 20'			
							5	
25								
							0	
30								



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

▽ WL 8 WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
▽ WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-10	1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING
EASTING
STATION

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION

SURFACE ELEVATION 26

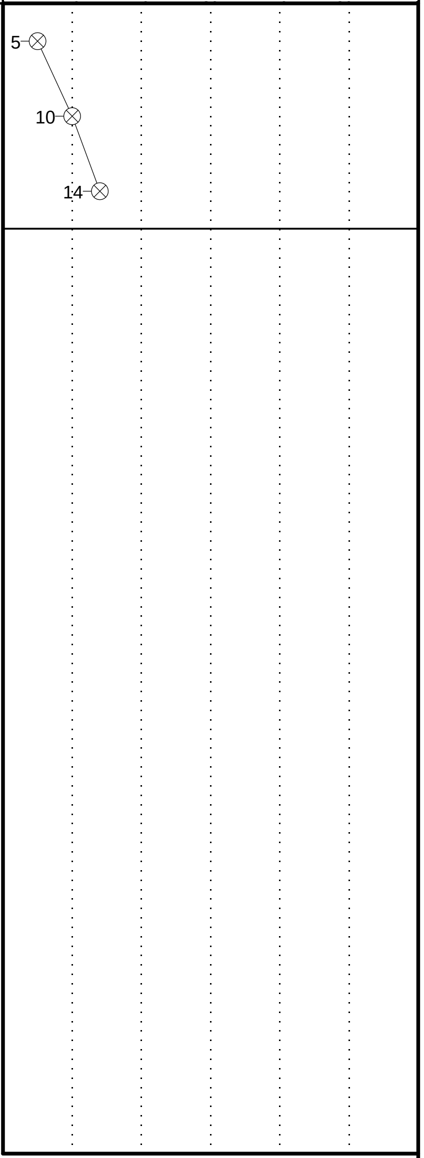
-○- CALIBRATED PENETROMETER TONS/FT²

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	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]			
	S-1	SS	24	24	(SM) SILTY SAND, Brown Mottled Orange, Moist, Loose to Medium Dense		25	3 3 2 3
	S-2	SS	24	24				4 5 5 8
5	S-3	SS	24	24				7 6 8 10
					END OF BORING @ 6'		20	
10							15	
15							10	
20							5	
25							0	
30								



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

WL WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
WL(BCR) WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-11	1 OF 1

PROJECT NAME: Proposed Warehouse

ARCHITECT-ENGINEER:

SITE LOCATION: Pretlow Street & Progress Parkway, Franklin, VA

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

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

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

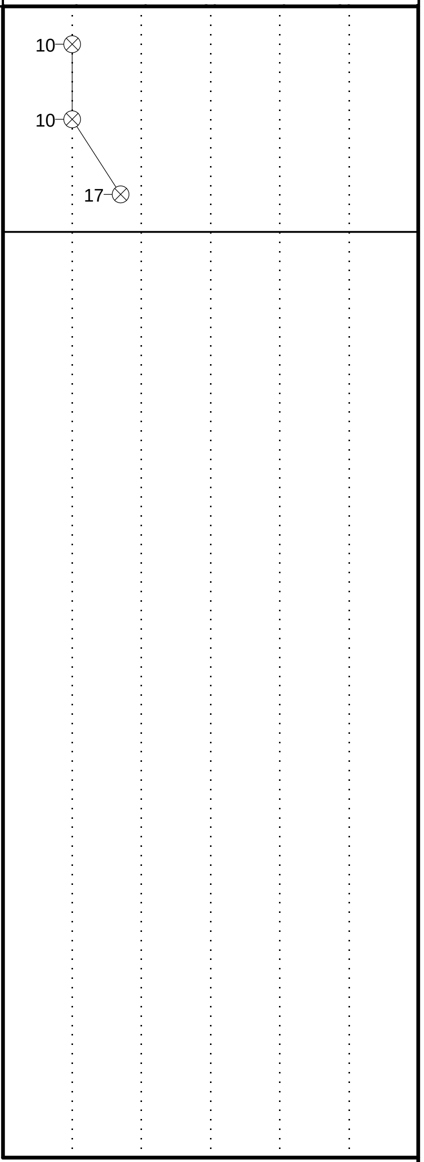
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [6"]			
	S-1	SS	24	24	(SM) SILTY SAND, Gray Mottled Orange, Moist, Loose to Medium Dense		25	5 6 4 4
	S-2	SS	24	24				4 4 6 7
5	S-3	SS	24	24				5 8 9 11
					END OF BORING @ 6'		20	
10							15	
15							10	
20							5	
25							0	
30								



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

WL WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
WL(BCR) WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
SoilTech Consultants, Inc.	04:10194	B-12	1 OF 1

PROJECT NAME: Proposed Warehouse

ARCHITECT-ENGINEER:

SITE LOCATION: Pretlow Street & Progress Parkway, Franklin, VA

NORTHING:

EASTING:

STATION:

-○- CALIBRATED PENETROMETER TONS/FT²

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

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

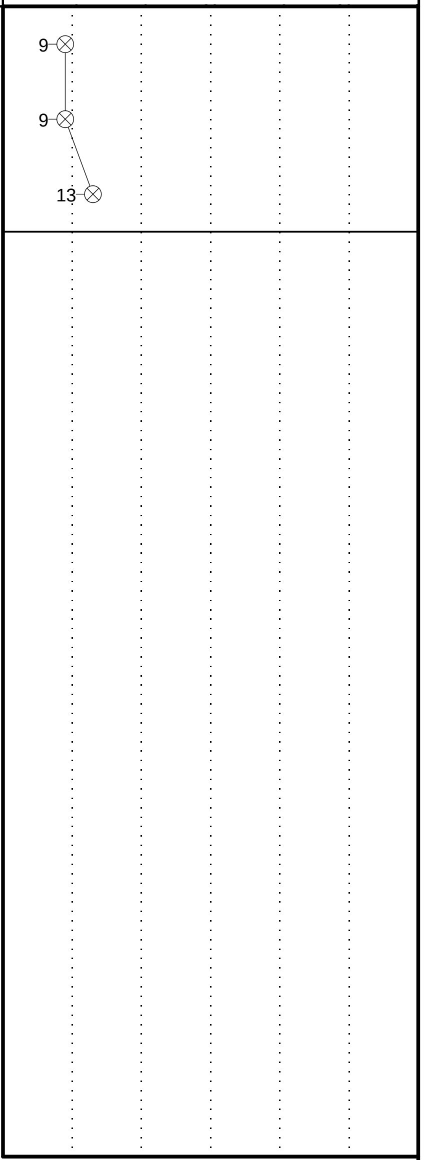
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [14"]			
	S-1	SS	24	24	(SM) SILTY SAND, Orangish- Brown, Moist, Loose to Medium Dense		25	3 4 5 3
	S-2	SS	24	24				3 4 5 7
5	S-3	SS	24	24				5 7 6 7
					END OF BORING @ 6'		20	
10							15	
15							10	
20							5	
25							0	
30								



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

WL WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
WL(BCR) WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT
SoilTech Consultants, Inc.

JOB #
04:10194

BORING #
B-13

SHEET
1 OF 1

PROJECT NAME
Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION
Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

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

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

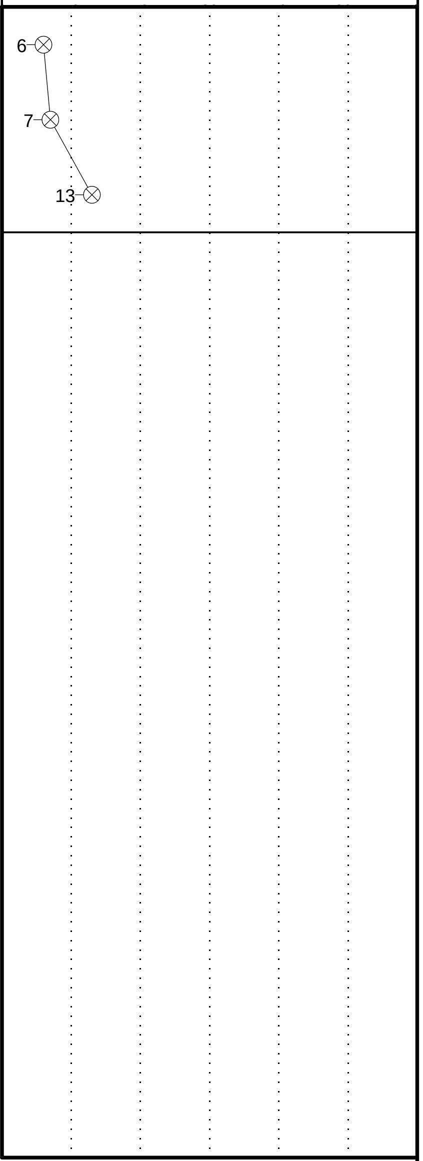
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]			2 3
	S-1	SS	24	24	(SM) SILTY SAND, Gray Mottled Orange, Moist, Loose to Medium Dense		25	3 3
	S-2	SS	24	24				2 3 4 5
5	S-3	SS	24	24				5 5 8 10
					END OF BORING @ 6'		20	
10								
							15	
15								
							10	
20								
							5	
25								
							0	
30								



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

WL WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
WL(BCR) WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

CLIENT SoilTech Consultants, Inc.

JOB # 04:10194

BORING # B-14

SHEET 1 OF 1

PROJECT NAME Proposed Warehouse

ARCHITECT-ENGINEER

SITE LOCATION Pretlow Street & Progress Parkway, Franklin, VA

NORTHING

EASTING

STATION

—○— CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – – –   REC% ———

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

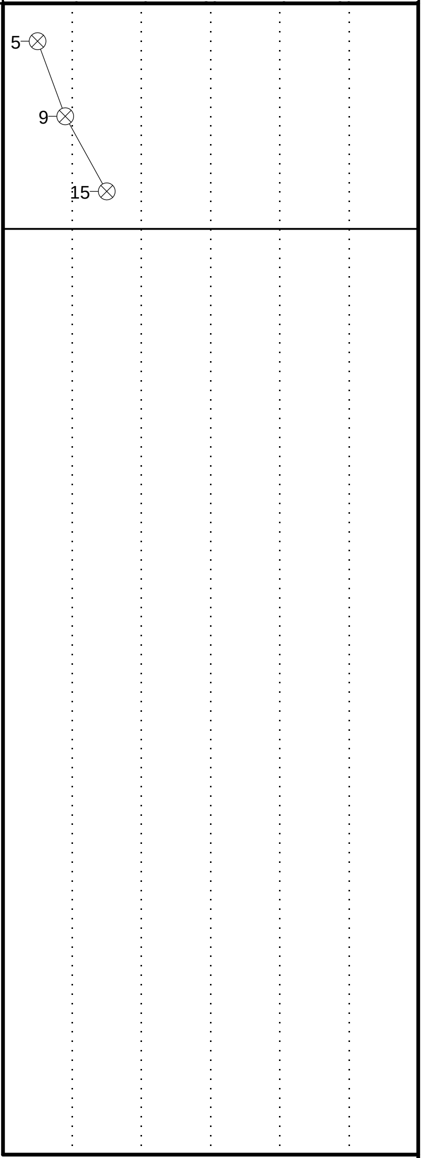
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 26

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	24	24	Topsoil Depth [14"] (SM) SILTY SAND, Brown, Moist, Loose to Medium Dense		25	3 3 2 2
	S-2	SS	24	24				3 4 5 5
5	S-3	SS	24	24				6 7 8 7
					END OF BORING @ 6'		20	
10								
							15	
15								
							10	
20								
							5	
25								
							0	
30								



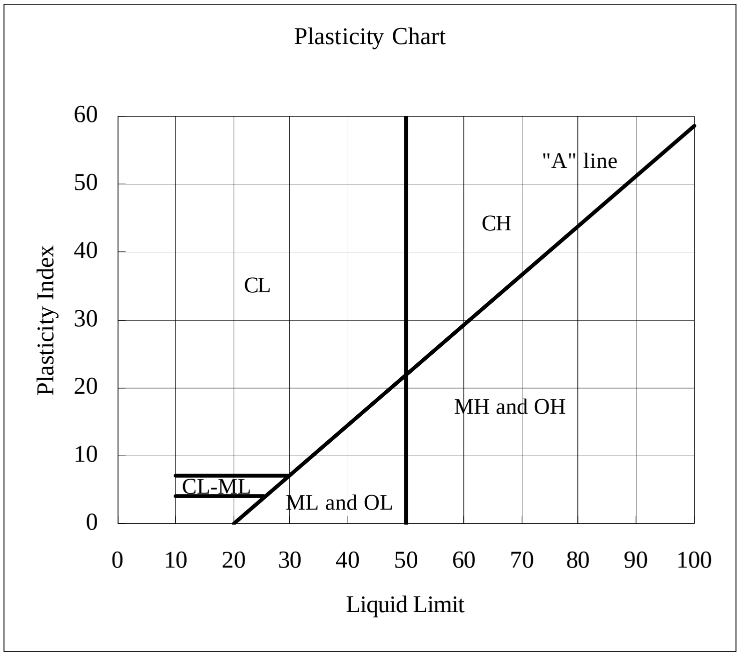
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 05/14/15	CAVE IN DEPTH
WL(BCR) WL(ACR)	BORING COMPLETED 05/14/15	HAMMER TYPE Auto
WL	RIG 550 ATV FOREMAN Fishburne	DRILLING METHOD Mud Rotary

APPENDIX III

Unified Soil Classification System and Reference Notes for Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentage of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Border 4 line cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10}\text{x}D_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10}\text{x}D_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount o fines)	SM[a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt		Peat and other highly organic soils			

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC,well-graded gravel-sand mixture with clay binder. (From Winterkorn and Fang. 1975)

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HAS	Hollow Stem Auger	WS	Wash sample

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

A. Non-Cohesive Soils (Silt, Sand Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
4 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
2 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
Over 30	Hard	Over 4.00		

III. Water Level Measurement Symbols:

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Existing Groundwater Level	▼	Est. Seasonal High GWT

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 a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.