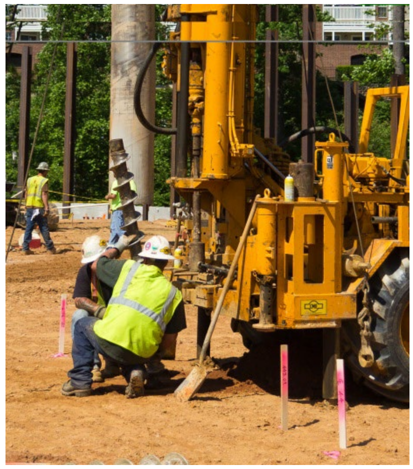

ECS Southeast, LLP

Geotechnical Engineering Report

3223 Battleground Avenue Site

3223 Battleground Avenue
Greensboro, North Carolina

ECS Project Number 09:29504

August 4, 2021

August 4, 2021

Mr. Stan Wingo
McAdams
2905 Meridian Parkway
Durham, NC 27713

ECS Project No. 09:29504

Reference: Geotechnical Engineering Report
3223 Battleground Avenue Site
3223 Battleground Avenue
Greensboro, North Carolina

Dear Mr. Wingo:

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 our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration conducted, and our geotechnical design and construction recommendations for the project.

It has been our pleasure to be of service to you 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 subsurface conditions assumed 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

NORTH CAROLINA PROFESSIONAL SEAL 034192 ENGINEER JOHN D. GODFREY, JR.
7-30-2021

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EXECUTIVE SUMMARY

This executive summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- Existing fill was encountered in a few of the borings. The existing fill should be evaluated at the time of construction by proofrolling, excavation of test pits, hand auger borings, and/or construction excavations. If the existing fill is very soft to soft and/or contains excessive inert debris or excessive organic materials, it should not be used to support foundations, floor slabs, or pavements, and should be undercut and replaced with compacted structural fill consisting of satisfactory materials.

- Based on the soil test borings, we anticipate undercutting of the existing fill soils may be necessary in localized areas of the site (upper 1.5 to 3 feet of Borings B-2 and B-3). If site earthwork is performed during the typically cooler, wetter months of the year, additional undercutting is anticipated due to excessively wet, poor soils.

- If excavations for mass grading, foundations, utilities, and the stormwater system are no deeper than the boring depths, ripping or blasting of partially weathered rock or rock is not anticipated based on the soil test borings.

- The planned building should be supported by conventional shallow foundations consisting of column and/or strip footings bearing on compacted structural fill or natural soils sized using a net allowable soil bearing pressure of 2,000 psf.

- Based on the N-values measured in the borings, a Seismic Site Class “D” designation is appropriate for seismic design of the proposed building.

- ECS should be retained to review the design documents for conformance with our recommendations.

- ECS should be retained for construction materials testing and special inspections to facilitate proper implementation of our recommendations.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of a building with associated pavements for McAdams. The recommendations developed for this report are based on project information supplied by Stan Wingo with McAdams.

Our services were provided in accordance with our Proposal No. 28015-P, dated February 11, 2021, as authorized by Stan Wingo with a notice to proceed on July 8, 2021.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A site location diagram and boring location diagram.
- Boring logs, laboratory test results, and a subsurface characterization.
- Recommendations for allowable soil bearing pressures for shallow foundations, slab-on-grade design and construction, and pavements.
- Recommendations for subgrade preparation and earthwork.
- Recommendations for additional testing and/or consultation that might be required to complete the geotechnical assessment and related engineering for this project.

2.0 PROJECT INFORMATION

This proposal is based on the following sources of information:

- Emails between Stan Wingo with McAdams and Nathan Nallainathan and Ertica Susanto with ECS on February 9, 2021.
- Site plan provided to us on February 9, 2021.
- Google Earth aerial photo dated December 21, 2019.
- Site and topographic information obtained from the Guilford County GIS website.

2.1 SITE INFORMATION

The site is located at 3223 Battleground Avenue in Greensboro, North Carolina, at the approximate location shown in the following figure.

Figure 2.1.1. Site Location Outlined In Red

We understand that previously there was an existing building at this site, which had been demolished. Based on our site visit, an existing concrete slab and pavement areas were present at the site.

2.2 PROPOSED CONSTRUCTION

The project involves the development of a single-story building with associated driveways and parking spaces.

We assume that the proposed building will be a 1-story, steel- or wood-framed structure with masonry load bearing walls and a slab-on-grade ground floor. Design foundation loads have not been provided to us. We assume the maximum unfactored foundation loads will be:

- Maximum Column Load = 50 kips
- Maximum Wall Loads= 2 kips per foot
- Maximum Ground Floor Slab Load = 50 pounds per square foot (psf)

The structural engineer should verify these assumptions and notify ECS if the actual unfactored foundation design loads exceed or are significantly less than these assumed values.

Design grades have not been provided to us. Based on existing site grades, the site plan provided to us, and our experience with similar projects, we assume that fill and cut depths will be less than 3 feet for general site grading.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedures. Our scope of work included drilling five (5) borings. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil strata. Please refer to the boring logs in Appendix B.

The site is located within the Piedmont physiographic province. The Piedmont is characterized by residual overburden soils weathered in place from the underlying igneous and metamorphic rock. The topography and relief of the Piedmont uplands have developed from differential weathering of the bedrock. Because of the continued chemical and physical weathering, the bedrock in the Piedmont is now generally covered with a mantle of soil that has weathered in place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically finer grained and has higher clay content near the surface because of the advanced weathering. Similarly, the soils typically become coarser grained with increasing depth because of decreased weathering. As the degree of weathering decreases, the residual soils generally retain the overall appearance, texture, gradation and foliations of the parent rock. The boundary between soil and rock in the Piedmont is not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying the parent bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with Standard Penetration Resistances (N-values) exceeding 100 blows per foot. The transition between hard/dense residual soils and partially weathered rock occurs at irregular depths due to variations in degree of weathering. Also, it is not unusual to find lenses and boulders of hard rock and/or zones of partially weathered rock within the soil mantel well above the general bedrock level.

The general subsurface strata are summarized in the following table:

Subsurface Stratigraphy

Approximate Average Depth (ft)	Stratum	Description	Ranges of SPT[(1)] N-values (bpf)[(1)]
0 – 0.6	n/a	**Surficial Material:** Topsoil, gravel, or concrete (2 to 7.25 inches) Notes: - Borings B-1, B-4, and B-5 encountered concrete with approximate thickness of 5.5 to 7.25 inches. - Boring B-2 encountered gravel with approximate thickness of 2 inches. - Boring B-3 encountered topsoil with approximate thickness of 2 inches.	N/A

Approximate Average Depth (ft)	Stratum	Description	Ranges of SPT(1) N-values (bpf)(1)
0.2 – 15	I	**Existing Fill and Residuum:** Elastic SILT (MH) and Sandy SILT (ML) Notes: - Boring B-2 and B-3 encountered existing fill classified as Sandy SILT with some debris in the upper 3 and 1.5 feet, respectively. - Boring B-1 encountered moderately plastic Elastic SILT (MH) materials in the upper 3 feet.	6 to 27

Note: (1) Standard Penetration Testing; bpf = blows per foot

The depths given in the previous table are average depths. The actual strata depths may vary significantly at specific boring locations.

A graphical presentation of the subsurface conditions is shown on the Subsurface Cross Section included in Appendix A. As shown, the strata thicknesses are variable across the site.

Please note that the ground surface elevations shown on the boring logs and cross sections were not surveyed by a licensed surveyor. These elevations were interpolated using topographic information obtained from Google Earth. They should be considered approximate and accurate to +/- several feet.

3.2 GROUNDWATER OBSERVATIONS

Groundwater seepage into the borings was not observed during our exploration at the depths explored. However, borehole caving which may be an indicator of groundwater presence were encountered in the borings at approximate depths ranging from 3.8 to 9.4 feet below the existing grades. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.3 LABORATORY TESTING

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols. After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. Laboratory tests performed on selected samples included percent finer than No. 200 sieve test (ASTM D 1140), moisture content tests (ASTM D 2216), and Atterberg limit test (ASTM D 4318). Please refer to the laboratory testing summary in Appendix C.

4.0 DESIGN RECOMMENDATIONS

4.1 BUILDING/STRUCTURE DESIGN

4.1.1 Foundations

Provided subgrades and structural fills are prepared as discussed herein, and based on the assumed design foundation loads, the proposed structure can be supported by conventional shallow spread footing foundations. These include individual column footings and continuous wall footings. The design of the shallow foundations should utilize the following parameters:

Foundation Design

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure(1)	2,000 psf	2,000 psf
Acceptable Bearing Soil Material	Stiff Low Plasticity Silts/Clays, Medium Dense Sands, or Compacted Structural Fill	
Minimum Width	24 inches	16 inches
Minimum Footing Embedment Depth (below slab or finished grade) (2)	18 inches2	18 inches2
Estimated Total Settlement (3)	Less than 1 inch	Less than 1 inch
Estimated Differential Settlement (4)	Less than 0.5 inches between columns	Less than 0.5 inches over 50 feet

Notes:
(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) For bearing considerations and frost penetration requirements.
(3) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(4) Based on anticipated range of column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

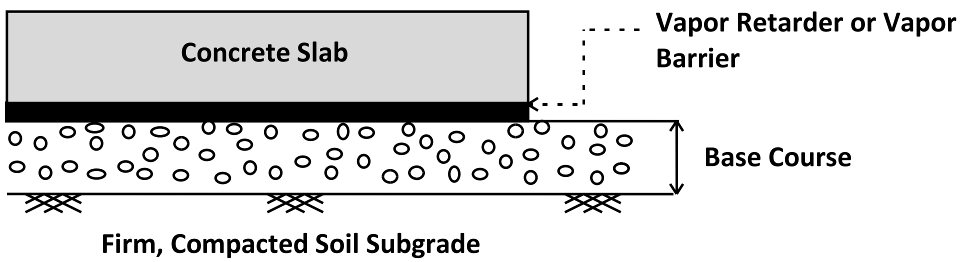
We recommend that where the existing fill is observed to be very soft to soft and/or contains excessive inert debris or excessive organic materials, the foundations should extend through the existing fill and bear on stiff native soils.

4.1.2 Floor Slabs Above Exterior Grades

The on-site lower plasticity natural soils and new engineered fill are considered adequate for support of the ground floor slabs, although moisture control during earthwork operations, including the use of disking or appropriate drying equipment, may be necessary. Low to moderately plastic Elastic SILT (MH) soils were encountered in Boring B-1 at the site. Even though the on-site Elastic SILT (MH) is not considered to be expansive, they are very moisture sensitive and can be relatively weak and compressible.

We assume that the ground floor slabs-on-grade will be at or above finish exterior grades around the entire building footprints. For this case, the 2018 North Carolina Building Code does not require damproofing or waterproofing of the slab. However, depending on floor coverings and building use, a capillary break layer and vapor retarder should be installed to reduce excessive moisture from coming in contact with the concrete floor slab from the soils below.

The following graphic depicts our soil-supported slab recommendations:



Floor Slab Section

1. Base Course Layer Thickness: 4 inches
2. Base Course Layer Material: A compactable granular fill that will remain steady and support construction traffic. At least 10% to 30% of the material should pass a No. 100 sieve with a maximum aggregate size of ¼ inch. Satisfactory materials are GRAVEL (ABC, GW, GW-SM), SAND (SP-SM, SW-SM), and SILTY SAND (SM) with less than 30% fines.
3. Base Course Layer Material should be compacted to at least 98% maximum dry density per ASTM D698.
4. Undisturbed natural subgrade should proofroll as firm and steady. Upper 1 foot of structural fill subgrade should be compacted to at least **98%** maximum dry density per ASTM D698
5. Vapor Barrier or Vapor Retarder – Refer to ACI 302.1R-04 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, environmental vapor intrusions considerations should be taken into account by the vapor barrier/vapor retarder material selection and design.

Provided a base course break layer is implemented in the slab section, the slabs may be designed using a modulus of subgrade reaction of 100 psi/in. This value is applicable for design of slabs subject to point loads, and should be reduced based on loaded area for uniform sustained distributed loads.

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 reduces the use of a free-floating slab, the slab should be designed with adequate reinforcement and load transfer devices to preclude overstressing of the slab.

4.1.3 Seismic Design

The 2018 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 50
E	Soft Soil Profile	Vs < 600 fps	<15

The 2018 North Carolina Building 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 "D" be used for design of the proposed building.

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 at the site. ECS can provide a proposal for these services upon request.

4.2 SITE DESIGN CONSIDERATIONS

4.2.1 Pavements

Design Traffic Loading: Design traffic loading information for the pavements has not been provided to us. Based on our experience with similar projects, we assume that the proposed private pavements will be subjected to the average daily traffic, as given in the following table. This table also provides our estimates for 20-year 18-kip Equivalent Single Axle Loads (ESALS) for the assumed vehicle types and average daily traffic.

Assumed Average Daily Traffic Loading

Vehicle	Days Per Week	Light Duty Pavement	Medium Duty Pavement
Passenger Cars	7	100	200
Pickups, Vans, SUVs	7	100	200
Dual Axle Trucks (NCDOT)	7	2	4
Garbage & Recycling Trucks	1	2	4
HS20, 80,000-lb, 18-wheel Tractor-Trailer Truck with tandem axles	7	0	2
20-year ESALs		**11,000**	**56,000**

The civil engineer, developer, owner, and/or user should verify these assumptions and notify ECS if the actual pavement design traffic loading conditions exceed or are significantly less than these assumed values. If the project will include public pavements (NCDOT or local municipality), we need the projected average daily traffic, % dual axle trucks, and % tractor trailer trucks in order to provide recommended pavement sections for the public pavements.

Subgrade Characteristics: Pavement subgrades soils should consist of firm, compacted low plasticity soil. Based on our experience with similar soils, a design CBR value of 3 is recommended for this project. The pavement design assumes subgrades consist of adequate 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).

Minimum Material Thicknesses: The following minimum pavement sections may be used by the civil engineer to develop the pavement design drawings for the project, provided the civil engineer is in agreement with ECS' design traffic loading assumptions and estimates. The contractor should bid and construct the project in accordance with the civil design drawings, not the recommendations given in this report. These recommendations are not contract drawings nor specifications.

Asphalt Pavement Section Recommendations

Pavement Type	Material Designation	Light Duty Pavement (in.)	Heavy Duty Pavement (in)
Flexible	Asphalt Surface Course (S9.5B)	2.5	3
	Aggregate Base Course	6	8

Concrete Pavement Section Recommendations

Pavement Type	Material Designation	Heavy Duty Concrete Pavement (in.)
Rigid	Portland Cement Concrete (4000 psi, air-entrained)	5
	Aggregate Base Course	5

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.

Concrete Pavements: Front-loading trash dumpsters frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of bituminous pavements and ultimately pavement failures and costly repairs. Therefore, we suggest that the pavements in trash pickup area utilize the aforementioned Portland Cement Concrete (PCC) pavement section. It may be prudent to use rigid pavement sections in the areas planned for heavy truck traffic.

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 and saw-cut control joints at appropriate intervals per Portland Cement Association (PCA) requirements. The construction joints should be reinforced with dowels to transfer loads across the joints. Wire mesh should be included to control shrinkage cracking of the concrete.

We used a Load Transfer Coefficient, J, of 4.2 to determine the recommended concrete pavement thicknesses given in the preceding table. The concrete pavement section thicknesses are for plain jointed concrete pavement with reinforcement dowels only at construction joints.

Construction Traffic: It is important to note that the design sections do not account for construction traffic loading. An incomplete pavement section without the final 1 inch of surface course asphalt can be used for temporary construction traffic, such as concrete trucks and tractor trailer material delivery trucks. Please note, however, that damage to the asphalt already placed is likely to occur in localized areas, and it should be repaired by removal and replacement with new asphalt at or near the end of construction, prior to placement of the surface course.

Alternatively, heavy construction vehicles and traffic should be limited to a temporary pavement section consisting of 12 inches of compacted ABC overlying a high-strength woven geotextile (Tencate Mirafi HP270 or equivalent). The temporary pavement section could then be graded and covered with asphalt to achieve the final design heavy duty pavement section.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Previous Site Development

When reviewing our recommendations, please note that there was previously a building on the site and currently, a large part of the site is developed with concrete slab and/or pavement. Hence, previous grading activities have likely occurred on this site. Our experience with previously graded sites indicates that unexpected conditions can exist that were not encountered by the soil test borings. Unexpected conditions could include areas of soft or loose fill, debris-laden fill, and other obstructions or conditions. These conditions should be addressed by on-site engineering evaluation by ECS during construction.

5.1.2 Demolition

Site demolition should include the removal of existing asphalt, concrete pavement, concrete slabs, concrete curb and gutter, underground utilities, underground stormwater structures and pipes, buried structures, and foundations from the proposed construction areas. Underground utilities that may exist within the proposed building areas should be relocated, and those within proposed pavement areas should be evaluated by the design team and relocated or filled with grout, if necessary. The crushed stone on the ground surface in the existing pavement areas should be left in place in areas to be filled, or can be excavated and re-used as compacted structural fill. Excavations or cavities resulting from demolition should be backfilled with compacted structural backfill.

The existing concrete pavements and slabs at the site could be re-used as compacted structural fill, provided the concrete is first crushed to less than 1-1/2 inch in maximum particle size and is well-graded. Reinforcing steel should be removed from the crushed concrete. Properly crushed concrete may also be used as a subgrade stabilization material in building and pavement areas and as backfill where foundation undercut is required to remove inadequate materials. It may also be used as new aggregate base course (ABC) in private pavement areas, provided it meets the NCDOT standard specifications for ABC gradation.

5.1.3 Stripping and Grubbing

The subgrade preparation should consist of stripping the concrete, asphalt, existing inadequate fill materials, vegetation, rootmat, topsoil, and other soft or inadequate materials from the proposed construction areas. Some of the borings encountered approximately 2 inches of topsoil and up to 7¼ inches of concrete. Deeper topsoil or organic laden soils are likely present in wet, low-lying, and poorly drained areas. The topsoil encountered in the borings was not analyzed for its suitability for reuse in landscaping areas. ECS should be called on to verify that topsoil and inadequate surficial materials have been completely removed prior to the placement of structural fill or construction of structures and pavements.

We anticipate average stripping depths of 6 inches to remove topsoil and rootmat from areas that are currently grass-, weed- or brush-covered. We recommend that these average stripping depths be used for quantity approximations for earthwork design and construction cost estimating.

5.1.4 Proofrolling

After removing inadequate surface materials, cutting to the proposed grade, and prior to the placement of structural fill or other construction materials, the exposed subgrade should be examined by the geotechnical engineer or authorized representative. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons (e.g. fully loaded tandem-axle dump truck). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the geotechnical engineer or authorized representative. This procedure is intended to assist in identifying localized yielding materials.

In the event that unsteady or “pumping” subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of subsequent structural fill or other

construction materials. Methods of repair of unsteady subgrade, such as undercutting or moisture conditioning or chemical stabilization, should be discussed with the geotechnical engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits and/or hand auger borings may be excavated to explore the shallow subsurface materials in the area of the instability to help in determining the cause of the observed unsteady materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

Undercut excavations should be backfilled with properly placed and compacted structural fill. Use of geotextiles and select granular fill may be recommended by ECS during construction to reduce the required undercut depths and/or aid in stabilization of subgrades.

5.2 EARTHWORK OPERATIONS

5.2.1 Existing Fill

As we have not been provided fill placement construction field testing reports, we interpret the existing fill to also be undocumented. Undocumented existing fill were encountered in the upper 1.5 to 3 feet in Borings B-2 and B-3.

Uncontrolled and/or undocumented fill poses risks associated with under-compacted soil, undetected deleterious inclusions within the fill, and/or deleterious materials at the virgin ground-fill interface that are covered by the fill. ECS does not recommend supporting building foundations, floor slabs, and pavements on under-compacted existing fill or existing fill with excessive organics or excessive inert debris. Therefore, we recommend that these conditions be addressed by on-site engineering evaluation by ECS during construction, including proofrolling and test pits, if recommended. Undercutting and replacement of existing fill should be anticipated for this project and could be addressed contractually through allowances and unit prices.

5.2.2 Expansive Soil

Elastic SILT (MH) soils were encountered in Boring B-1. This is potentially expansive soil per the current North Carolina Building Code and local practice. However, based on the laboratory test result for the selected samples and our experience, this soil has a low to medium potential for expansion (i.e., shrink-swell). We estimate that the potential heave of footings, floor slabs, and pavements due to potential wetting and settlement due to drying of potentially expansive soils will be less than ½ inch. As such, no specific mitigation measures for footings, floor slabs, or pavements due to potentially expansive soils are recommended.

Even though the on-site Elastic SILT (MH) is not considered to be expansive, it is very moisture sensitive and can be relatively weak and compressible. The moisture contents will require careful control and must be within +/- 3% of the soil's standard Proctor maximum dry density to provide stability and to reduce excessive swell heave, shrinkage settlement, or collapse settlement.

5.2.3 Excavation Considerations

Excavation Safety: Excavations and slopes should be made and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing and constructing firm, 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.

Construction Dewatering: Based on the borings, our experience with groundwater fluctuations on similar sites, and anticipated design grades, most of the temporary excavations are unlikely to encounter groundwater. The contractor should be prepared to remove precipitation or groundwater that may seep into temporary construction excavations using open pumping. Open pumping utilizes submersible sump pumps in pits or trenches dug below the bottom of the excavation and backfilled with No. 57 stone.

Excavatibility: Based on the assumed excavation depths for mass grading, footings and utilities, we anticipate that the majority of the materials to be excavated will be existing fill and natural soils, which can be removed with conventional earth excavation equipment such as track-mounted backhoes, loaders, or bulldozers. However, the weathering process in the Piedmont can be erratic and significant variations of the depths of the more dense materials can occur in relatively short distances. In some cases, isolated boulders or thin rock seams may be present in the soil matrix.

5.2.4 Structural Fill Materials

Product Submittals: At least one week prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and/or off-site 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, GM and GC, or a combination of these group symbols, per ASTM D 2487. The materials should be free of organic matter and debris. 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). Since the on-site Elastic SILT (MH) has a low expansion potential, it may be placed as structural fill for mass grading. Rock fragments should generally be less than 3 inches in maximum dimension and should be blended with soil.

Unsatisfactory Materials: Unsatisfactory fill materials include materials which do not satisfy the requirements for satisfactory materials, such as topsoil, organic materials, debris, and debris-laden fill.

On-Site Borrow Suitability: The on-site soils meeting the classifications for recommended satisfactory structural fill, plus meeting the restrictions on separation distances, organic content, and debris, may be used as structural fill. We anticipate that most of the soils encountered in the borings within the anticipated excavation depths will be satisfactory for use as compacted structural fill.

The on-site Elastic SILT (MH) may be used as structural fill for mass grading. Please note that these soils are very moisture sensitive, can be relatively weak and compressible, and may be difficult to properly moisture condition and compact.

On-site soils used as structural fill will require careful moisture control in order to achieve compaction and stability. 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.

The gradation of partially weathered rock and rock removed by ripping or blasting will probably be quite varied. Crushing of boulder-sized rock fragments may be required to meet the maximum particle sizes given in the previous table if ripped or blasted rock is to be used as structural fill.

5.2.5 Compaction

Fill Compaction: Structural fill should be placed in maximum 8-inch loose 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.

Structural fill should be moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content. Moisture conditioning options include spraying and mixing in water to excessively dry soils, scarifying and drying of excessively wet soils, and adding lime to excessively wet soils.

Structural fill should be compacted with adequate 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 retained to observe and test the placement and compaction of structural fill.

Fill Placement Considerations: Proper drainage should be maintained during the earthwork phases of construction to reduce the likelihood of ponding of water which will degrade the subgrade soils. Exposed soil subgrades should be protected at the end of each working day by sloping to drain and sealing with a smooth-drum roller to limit infiltration of precipitation and surface water. Where fill materials will be placed to widen existing embankment fills, or 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.

Moisture Conditioning: The on-site soils are moisture sensitive and can be difficult to work. Problems include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the inability to adequately dry and compact wet soil.

Drying and compaction of wet soils is typically difficult during typically cooler, wetter months of the year (typically November through March). During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives,

such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, removal and replacement with drier, off-site materials may be necessary.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate and cover haul roads and construction staging areas to limit the areas of disturbance and to reduce construction traffic from excessively degrading subgrade soils. Haul roads and construction staging areas should be covered with ABC to protect those subgrades.

5.3 FOUNDATIONS AND FLOOR SLABS

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: 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 as anticipated.

If very loose sand, very soft to soft silt/clay, or otherwise inadequate or unsteady soils are observed at the footing bearing elevations, they should be undercut and removed. Undercut excavation should be backfilled with compacted structural fill, No. 57 stone wrapped in woven geotextile, flowable fill, or lean concrete ($f'_c \geq 1{,}000$ psi at 28 days) up to the original design bottom of footing elevation. The footing should be constructed on top of the compacted structural fill, No. 57 stone wrapped in woven geotextile, hardened flowable fill, or hardened lean concrete.

Slab Subgrade Verification: A representative of ECS should be called on to observe exposed subgrades within the expanded building limits prior to structural fill placement to check 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 steady, structural fill can be placed.

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 design floor slab section materials, a representative of ECS should be called on to verify the condition of the prepared soil subgrade. Prior to final floor slab section construction, the soil subgrade may require scarification, moisture conditioning, and re-compaction to restore steady conditions.

5.4 PAVEMENTS

The soil subgrade should be smooth-rolled and proofrolled prior to ABC placement. Areas that pump, rut, or are otherwise inadequate should be re-compacted or undercut and replaced. The

ABC should conform with the gradation, liquid limit, plasticity index, resistance to abrasion, and soundness per Section 1005 of the 2012 NCDOT Standard Specifications for Roads and Structures.

The ABC should be placed and be compacted in accordance with Section 520 of the 2012 NCDOT Standard Specifications for Roads and Structures. The ABC should be placed in a single lift if 10 inches or less in thickness. Two lifts of ABC should be placed for layers more than 10 inches thick. The ABC should be compacted to at least 98 percent of its Modified Proctor maximum dry unit weight per ASTM D1557 or AASHTO T180 (as modified by NCDOT), provided nuclear density testing is performed. Otherwise, at least 100% compaction is recommended.

To confirm that the specified degree of compaction is being obtained, field compaction testing should be performed in each ABC lift by the geotechnical engineer's representative. We recommend that compaction tests be performed at a minimum frequency of one test per 5,000 square feet per lift in pavement areas.

The early placement of the ABC will minimize the deterioration of the prepared soil subgrades. However, some loss of graded aggregate due to rutting and surface contamination may occur prior to final asphalt or concrete paving. Some infilling and re-grading of the aggregate base course may be required. The ABC should be smooth-rolled and proofrolled prior to asphalt or concrete pavement placement. Areas that pump, rut, or are otherwise inadequate should be wetted or dried as needed and re-compacted. Alternatively, poor areas could be undercut and replaced.

Minimum Asphalt Lift Thickness: The minimum lift thickness for S9.5B is 1.0 inch and the maximum lift thickness for S9.5B is 1.5 inches. For sections with more than 1.5 inches of S9.5B surface asphalt, it should be placed in two lifts of equal thickness. Asphalt pavement S9.5B should be compacted to least 90.0 percent of the material's specific gravity G_{mm}.

Asphalt Quality Control/Quality Assurance: We recommend that the asphalt contractor perform quality control procedures and testing per the project specifications to establish the required roller pattern(s). Quality assurance testing should be provided by the geotechnical engineer's representative and should consist of coring the placed asphalt pavement to verify thickness and compaction.

6.0 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 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

Site Location Diagram
Boring Location Diagram
Subsurface Cross-Section

SITE LOCATION DIAGRAM
3223 BATTLEGROUND AVENUE - GREENSBORO - GEO

3223 BATTLEGROUND AVENUE, GREENSBORO, NORTH CAROLINA

MCADAMS

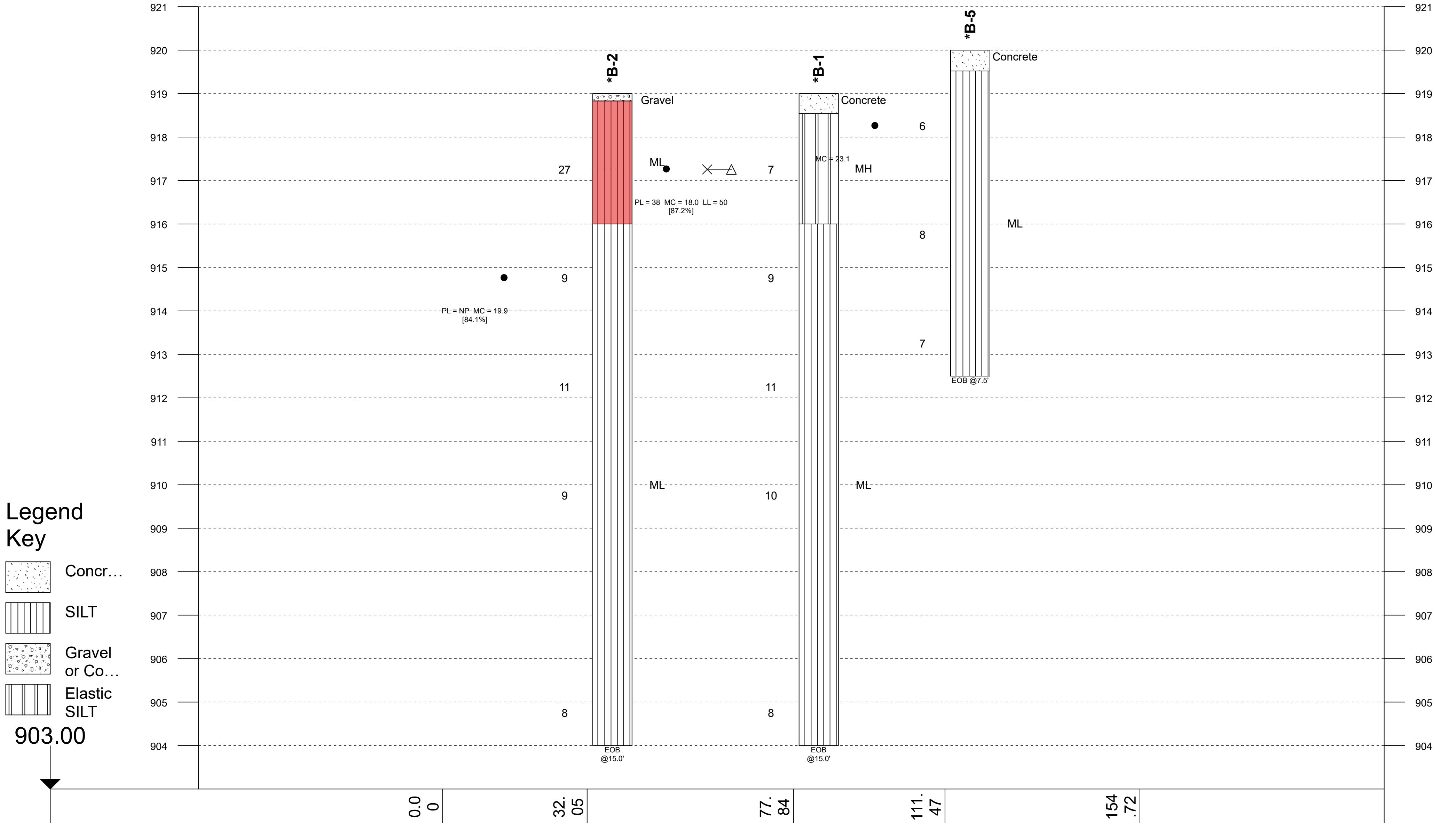
ENGINEER	JDG2
SCALE	AS NOTED
PROJECT NO.	09:29504
SHEET	1 OF 1
DATE	7/27/2021

BORING LOCATION DIAGRAM
3223 BATTLEGROUND AVENUE - GREENSBORO - GEO

3223 BATTLEGROUND AVENUE, GREENSBORO, NORTH CAROLINA

MCADAMS

ENGINEER	JDG2
SCALE	AS NOTED
PROJECT NO.	09:29504
SHEET	1 OF 1
DATE	7/27/2021



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit	WL (First Encountered)	Fill	
[FINES CONTENT %]	WL (Completion)	Possible Fill	
BOTTOM OF CASING	WL (Seasonal High Water)	Probable Fill	
LOSS OF CIRCULATION	WL (Stabilized)	Rock	

GENERALIZED SUBSURFACE SOIL PROFILE Section line A-A'

3223 Battleground Avenue - Greensboro - Geo

McAdams

3223 Battleground Avenue, Greensboro, North Carolina 27408

Project No: 09:29504 Date: 07/26/2021

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Subsurface Exploration Procedure: Standard Penetration Testing (SPT)
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

	ASPHALT	
	CONCRETE	
	GRAVEL	
	TOPSOIL	
	VOID	
	BRICK	
	AGGREGATE BASE COURSE	
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, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	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
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

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 (First Encountered)
- WL (Completion)
- WL (Seasonal High Water)
- WL (Stabilized)

FILL AND ROCK

FILL | POSSIBLE FILL | PROBABLE FILL | ROCK

[1]Classifications and symbols per ASTM D 2488-17 (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). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[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 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth

- Recording the number of hammer blows required to drive split-spoon a distance of 12 inches (in 3 or 4 Increments of 6 inches each)

- Auger is advanced* and an additional SPT is performed

- One SPT test is typically performed for every two to five feet

- Obtain two-inch diameter soil sample

**Drilling Methods May Vary—* The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
McAdams	**09:29504**	**B-1**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
3223 Battleground Avenue - Greensboro - Geo	**M & M Drilling**

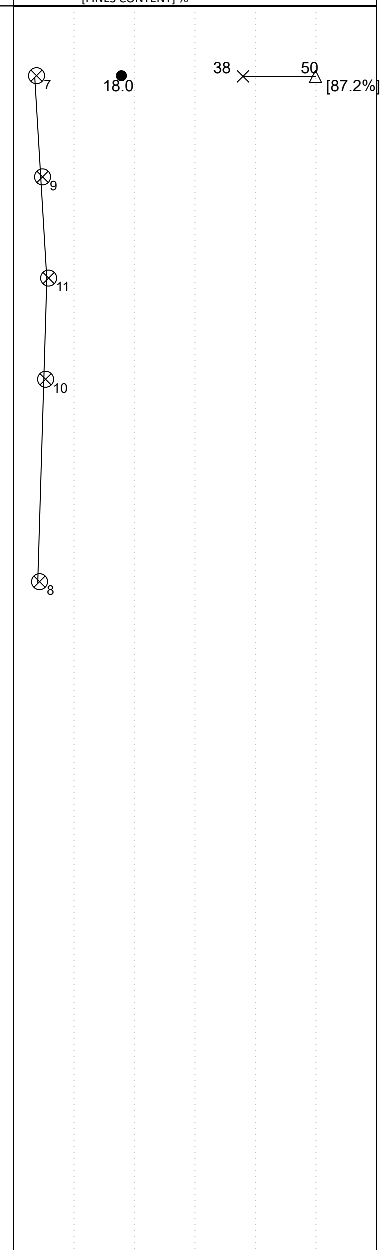
SITE LOCATION:
3223 Battleground Avenue, Greensboro, North Carolina 27408

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
863517.5	**1751306.8**		**919.0**

LOSS OF CIRCULATION
BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Concrete Thickness[5.50"]			
	S-1	SS	18	16	(MH) Residuum, ELASTIC SILT, yellowish red, moist, firm			2-3-4 (7)
	S-2	SS	18	18	(ML) SANDY SILT, orangish red, moist, stiff to firm			3-4-5 (9)
5							914	
	S-3	SS	18	18				3-5-6 (11)
	S-4	SS	18	18				4-4-6 (10)
10							909	
	S-5	SS	18	18				3-4-4 (8)
15					**END OF DRILLING AT 15.0 FT**		904	
20							899	
25							894	
30							889	



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

WL (First Encountered)		BORING STARTED: **Jul 15 2021**	CAVE IN DEPTH: **9.40**
WL (Completion)	**Dry**	BORING COMPLETED: **Jul 15 2021**	HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck B-57** / LOGGED BY: **ES7**	DRILLING METHOD: **HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
McAdams	**09:29504**	**B-2**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
3223 Battleground Avenue - Greensboro - Geo	**M & M Drilling**

SITE LOCATION:
3223 Battleground Avenue, Greensboro, North Carolina 27408

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
863513.9	**1751260.8**		**919.0**

Plastic Limit X— Water Content ● Liquid Limit —△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

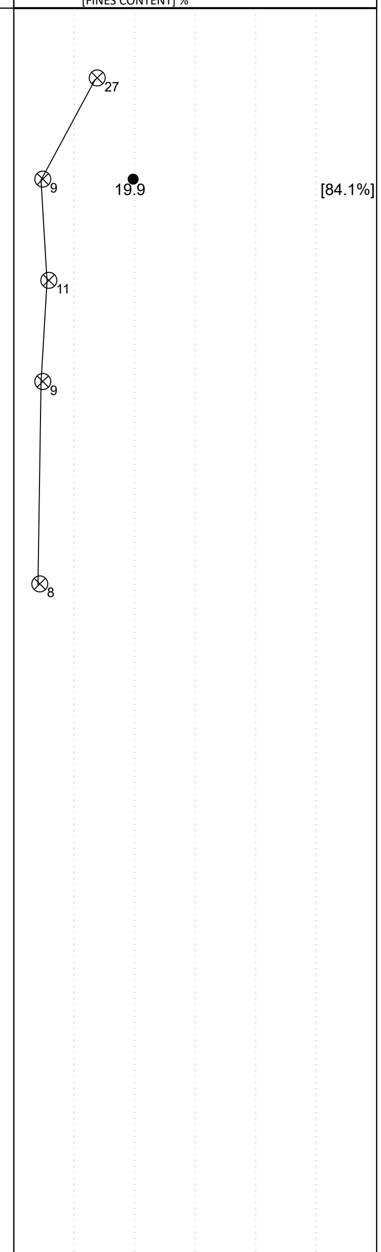
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Gravel Thickness[2.00"]			
	S-1	SS	18	9	(ML FILL) FILL, SANDY SILT, trace gravel, brown, moist, trace concrete fragments			6-5-22 (27)
	S-2	SS	18	6	(ML) Residuum, SANDY SILT, orangish red, moist, stiff to firm			4-4-5 (9)
5							914	
	S-3	SS	18	18				4-5-6 (11)
	S-4	SS	18	15				2-4-5 (9)
10							909	
	S-5	SS	18	18				2-4-4 (8)
15					**END OF DRILLING AT 15.0 FT**		904	
20							899	
25							894	
30							889	



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

WL (First Encountered)		BORING STARTED: **Jul 15 2021**	CAVE IN DEPTH: **7.80**
WL (Completion)	**Dry**	BORING COMPLETED: **Jul 15 2021**	HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck B-57** / LOGGED BY: **ES7**	DRILLING METHOD: **HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
McAdams	**09:29504**	**B-3**	**1 of 1**

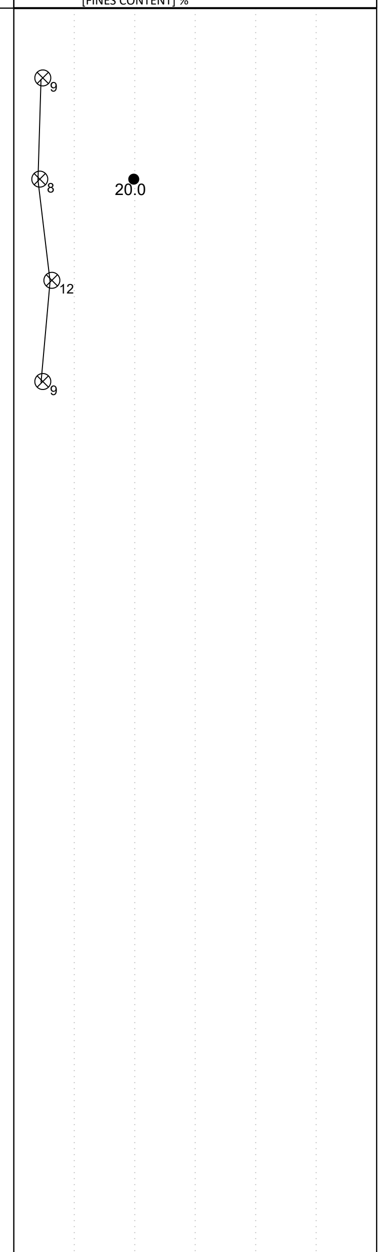
PROJECT NAME:	DRILLER/CONTRACTOR:
3223 Battleground Avenue - Greensboro - Geo	**M & M Drilling**

SITE LOCATION:	
3223 Battleground Avenue, Greensboro, North Carolina 27408	LOSS OF CIRCULATION / BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
863436.6	**1751311.9**		**921.0**

Legend: Plastic Limit (X) Water Content (●) Liquid Limit (△); ⊗ STANDARD PENETRATION BLOWS/FT; ROCK QUALITY DESIGNATION & RECOVERY: RQD, REC; ○ CALIBRATED PENETROMETER TON/SF; [FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[2.00"]			
	S-1	SS	18	12	(ML FILL) FILL, SANDY SILT, trace gravel, brown, moist			5-5-4 (9)
	S-2	SS	18	18	(ML) Residuum, SANDY SILT, purplish to orangish red, moist, firm to stiff			3-3-5 (8)
5							916	
	S-3	SS	18	15				4-5-7 (12)
	S-4	SS	18	18				3-4-5 (9)
10					**END OF DRILLING AT 10.0 FT**		911	
15							906	
20							901	
25							896	
30							891	



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

WL (First Encountered)		BORING STARTED: **Jul 15 2021**	CAVE IN DEPTH: **5.50**
WL (Completion)	**Dry**	BORING COMPLETED: **Jul 15 2021**	HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck B-57** / LOGGED BY: **ES7**	DRILLING METHOD: **HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: McAdams	PROJECT NO.: 09:29504	BORING NO.: B-4	SHEET: 1 of 1
PROJECT NAME: 3223 Battleground Avenue - Greensboro - Geo	DRILLER/CONTRACTOR: M & M Drilling		
SITE LOCATION: 3223 Battleground Avenue, Greensboro, North Carolina 27408			

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
863573.5	1751266.3		918.0

LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

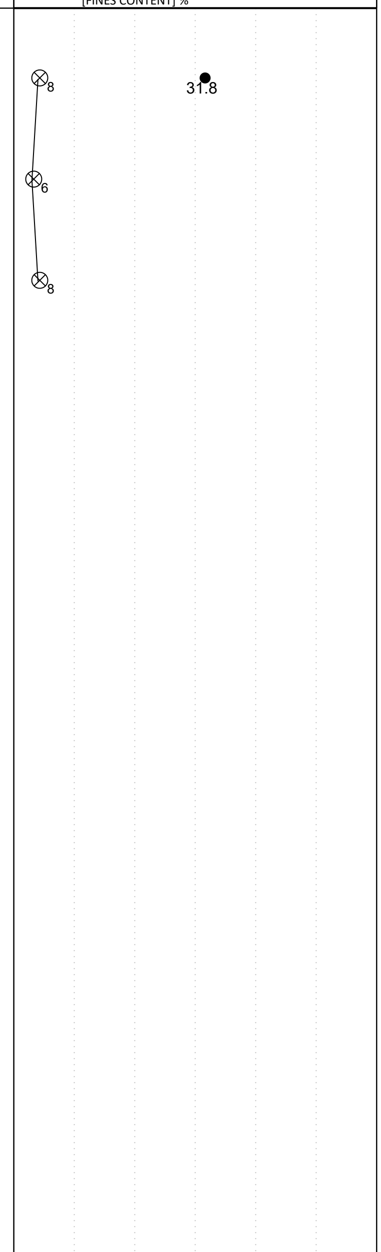
RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Concrete Thickness[7.25"]			
	S-1	SS	18	15	(ML) Residuum, SANDY SILT, red, moist, firm			2-4-4 (8)
	S-2	SS	18	13				2-3-3 (6)
5							913	
	S-3	SS	18	18				2-4-4 (8)
					END OF DRILLING AT 7.5 FT			
10							908	
15							903	
20							898	
25							893	
30							888	



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

WL (First Encountered)		BORING STARTED: Jul 15 2021	CAVE IN DEPTH: 3.80
WL (Completion)	Dry	BORING COMPLETED: Jul 15 2021	HAMMER TYPE: Auto
WL (Seasonal High Water)		EQUIPMENT: Truck B-57 / LOGGED BY: ES7	DRILLING METHOD: HSA
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: McAdams	PROJECT NO.: 09:29504	BORING NO.: B-5	SHEET: 1 of 1
PROJECT NAME: 3223 Battleground Avenue - Greensboro - Geo	DRILLER/CONTRACTOR: M & M Drilling		
SITE LOCATION: 3223 Battleground Avenue, Greensboro, North Carolina 27408			

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
863492.0	1751339.4		920.0

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT N / Water Content
					Concrete Thickness[5.75"]				
	S-1	SS	18	15	(ML) Residuum, SANDY SILT, orangish red, moist, firm			2-3-3 (6)	6; 23.1
5	S-2	SS	18	18			915	2-4-4 (8)	8
	S-3	SS	18	18				2-3-4 (7)	7
					END OF DRILLING AT 7.5 FT				
10							910		
15							905		
20							900		
25							895		
30							890		

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

WL (First Encountered)		BORING STARTED: Jul 15 2021	CAVE IN DEPTH: 4.30
WL (Completion)	Dry	BORING COMPLETED: Jul 15 2021	HAMMER TYPE: Auto
WL (Seasonal High Water)		EQUIPMENT: Truck B-57 / LOGGED BY: ES7	DRILLING METHOD: HSA
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Test Results Summary
Liquid and Plastic Limits Test Results

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-1	S-1	1-2.5	18	*MH	50	38	12	87.2					
B-4	S-1	1-2.5	31.8										
B-5	S-1	1-2.5	23.1										
B-2	S-2	3.5-5	19.9	ML	NP	NP	NP	84.1					
B-3	S-2	3.5-5	20										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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

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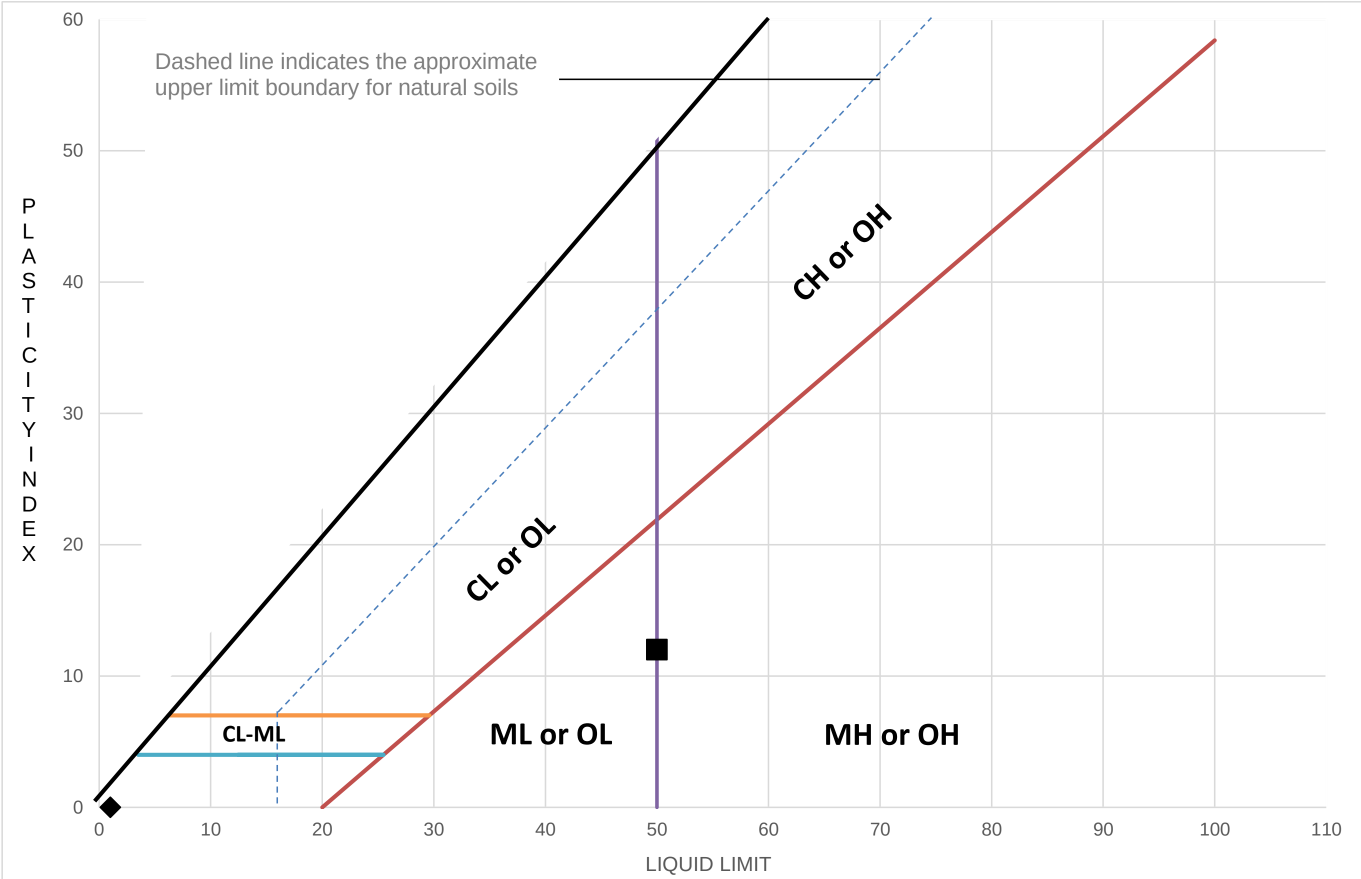
Project No.: 09:29504
Client: McAdams
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Greensboro	4811 Koger Boulevard Greensboro, NC 27407	(336)856-7150 (336)856-7160

Tested by	Checked by	Approved by	Date Received
Technician	tdissanayaka	tdissanayaka	7/19/2021

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-1	S-1	1-2.5	50	38	12		87.2			Reddish Yellow ELASTIC SILT (MH)
◆	B-2	S-2	3.5-5	NP	NP	NP		84.1			Pale Red Sandy SILT (ML)

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