Geotechnical Exploration Report
Ecusta Road Industrial
Building Addition
Brevard, North Carolina
S&ME Project No. 22410052

PREPARED FOR:

Transylvania County
152 Public Safety Way
Brevard, North Carolina 28712

PREPARED BY:

S&ME, Inc.
44 Buck Shoals Road, Suite C-3
Arden, North Carolina 28704

February 20, 2024

February 20, 2024

Transylvania County
152 Public Safety Way
Brevard, North Carolina 28712

Attention: Mr. Larry Reece

Reference: **Geotechnical Exploration Report**
Transylvania County – Ecusta Road Industrial Building Addition
Brevard, North Carolina
S&ME Project No. 23410135
NC PE Firm License No. F-0176

Dear Mr. Reece:

S&ME, Inc. (S&ME) is pleased to submit this Geotechnical Exploration Report for the referenced project. The exploration was performed in accordance with our Proposal No. 23410135 and Agreement for Services dated December 13, 2023. The proposal was authorized by Purchase Order #2400333, issued via email on January 17, 2024. The purpose of the subsurface exploration was to help determine site subsurface conditions and to evaluate these conditions relative to site preparation, foundation design, and other geotechnical aspects of design and construction. This report presents a brief confirmation of our understanding of the project, the exploration results, and our geotechnical conclusions and recommendations regarding site grading and building and pavement support.

We appreciate the opportunity to provide the geotechnical engineering services for this project. Please contact us if you have questions regarding the information in this report, or when further services are needed.

Sincerely,

S&ME, Inc.

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Appendices

1.0 Project Information

Our understanding of the project is based on the following:

- A telephone conversation between Mr. Larry Reece of Transylvania County and Mr. Joseph Laps, P.E. of S&ME, on October 27, 2023.
- Our review of the Preliminary Site and Grading Plans prepared by Mr. Michael Goforth dated January 16, 2024.
- Our review of aerial imagery and property information from the Transylvania County website and Google Earth™.
- Our experience with the previous site development, including a Preliminary Geotechnical Exploration report dated September 16, 2016, and Construction Services observations and testing provided by S&ME between January and November of 2018.

Based on the above information, we understand an addition is planned to the existing Sylvan Valley Industrial Park Building, located at 21 Welcome Street in Brevard, North Carolina. The subject property is a 6.733-acre developed lot (PIN: 8597-31-5264-000). The proposed addition is planned for the west side of the existing structure with additional employee parking located to the north and truck loading docks to the south.

Detailed structural information was not available at the time this report was prepared. Based on the provided Preliminary Site Plan, the building addition will be approximately 40,000 square feet. The civil drawings indicate the building addition will be single story with high bay ceilings on the order of 37.25 feet tall. Based on our experience with the previous site development, we anticipate the structure will consist of shallow spread footings, supported by a ground improvement system such as aggregate piers, and a concrete slab-on-grade (possibly supported by aggregate piers) with precast or tilt panel walls and a steel truss roofing system. Based on our experience with similar projects, we expect maximum column, wall, and floor live loads will likely be on the order of 100 to 150 kips, 4 to 6 kips per lineal foot, and 100 to 150 pounds per square foot, respectively. We are not aware of any special slab requirements such as very high machine or storage loads, superflat requirements, etc.

We understand some excess poor-quality soil generated from the original construction of the industrial building was placed as fill in the area of the proposed addition. Visually, it appears approximately 3 feet of old fill may have been placed in parts of the site. We assume the new grading will require excavation of several feet of soil to achieve a final grade similar to the existing construction. The finished floor elevation will be 2123.44 feet. Also, the loading dock area on the south side of the building will be about 4 feet lower than the building finished floor elevation.

2.0 Exploration Procedures

2.1 Field

The field exploration included visual site reconnaissance and boring layout by our staff professional along with the performance of six soil test borings (labeled A-1 through A-6). The borings were drilled to depths ranging from

15 to 34 feet below the existing ground surface. The boring locations were identified in the field by our staff professional using the provided site plans and using a handheld GPS unit. The boring locations are shown on a Boring Location Plan (Figure 2) in the Appendix. Because precise survey techniques were not used, the indicated locations should be considered approximate.

The borings were drilled January 30, 2024, using a CME 45 truck-mounted drill rig (with a manual safety hammer) and advanced using hollow stem auger techniques. Split-spoon samples and Standard Penetration (SPT) values (N-values) were generally obtained at 2.5-foot intervals in the upper 10 feet, and at 5-foot intervals thereafter. After completion of drilling and attempting initial subsurface water depth measurements, borings A-1, A-4, and A-5 were kept open for approximately 24 hours to allow water levels to stabilize somewhat for a final measurement. The remaining borings were measured for subsurface water and filled at the time of boring (TOB). Following subsurface water measurements, the boreholes were backfilled with soil cuttings and mechanical hole plugs were installed in each hole to help reduce borehole settlement.

Historical subsurface boring information from the previously issued Preliminary Geotechnical Exploration Report, S&ME project 1441-16-023, dated September 16, 2016, is included as part of this report. For reference, those five borings are labeled B-1 through B-5 on the Boring Location Plan, boring logs, and in discussions in this report.

2.2 Laboratory Testing

Following completion of the field work, the split-spoon samples were transported to our laboratory where a Staff Professional visually and manually classified the soils in general accordance with the Unified Soil Classification System (USCS). The field testing and classification results are presented on the individual Boring Logs in Appendix II, along with a Test Boring Log Legend, and the Field Testing Procedures in Appendix IV. Selected samples were subjected to the following tests and performed in general accordance with the applicable standards:

- Natural Moisture Content (ASTM D2216)
- Plastic Index (D4318)
- Grain Size Analysis (D1140)

A Summary of Laboratory Test Data is in Section 3.3 and individual laboratory data sheets are attached in Appendix III.

3.0 Site and Subsurface Conditions

3.1 Site Conditions

The property is a 6.733-acre lot with the existing industrial building (Sylvan Sport) located on the eastern half of the parcel. Welcome Street borders the property to the north, a wooded vacant lot is located along the western boundary, the Transylvania County Habitat for Humanity ReStore building is located to the south, and Ecusta Road bounds the property to the east. The proposed addition site is mostly flat, sloping gently downward 9 feet from west to east based upon topographic information obtained from the Grading and Stormwater Plan prepared by High Country Engineering, dated January 16, 2024. Ground surface elevations ranged from 2129 feet in the west part of the proposed building addition to about 2121 feet in the southeast and 2123 feet in a drainage area in the west. The ground surface consists of a previously graded grassed field. There is a creek located across Ecusta Road, approximately 100 feet from the eastern property. The site is in an apparent geologic floodplain.

3.2 Area Geology

The site is located within the Brevard Fault Zone at the contact of the Piedmont physiographic province of North Carolina and the Blue Ridge, an area underlain by ancient igneous and metamorphic rocks. The soils encountered in this area are the residual product of in-place physical and chemical weathering of the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of man, the typical residual soil profile typically consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined. This transitional zone, termed "partially weathered rock," is normally found overlying parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance values of at least 50 blows per 6 inches. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock (as well as hard rock) is quite irregular and erratic, even over relatively short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

The natural geological profile of portions of the site have been modified/disturbed by past grading activities that have resulted in disturbance of soils and the placement of fill. Disturbed and fill soils can vary in composition and consistency, and the engineering characteristics of these soils can be difficult to predict. Fill can be comprised of a variety of soil types and can also contain debris from building demolition, organics, topsoil, trash, etc. The engineering properties of fill depend primarily on its composition, density, and moisture content.

Typically, the upper soils along streams, creeks, rivers, drainage features, and in geologic floodplain areas are water-deposited materials (termed alluvium) that have been eroded and washed down from higher ground. These alluvial soils are usually wet, soft, and compressible, having never been consolidated by pressures in excess of their present overburden. Alluvial materials can vary from silts and clays to sand, gravel, cobbles, and boulders, and can contain organic debris.

3.3 Subsurface Conditions – New Borings A-1 through A-6 (Drilled in 2024)

The following is a brief and general description of subsurface conditions encountered at the site. More information is provided on the individual Boring Logs located in the Appendix.

3.3.1 Surface Materials

About 2 and 3 inches of topsoil is shown on the boring logs based on the driller's logs. Surface material thicknesses and types may vary from those encountered in the borings, and the organic layer of topsoil and root systems could be thicker than shown on the boring logs. Therefore, stripping depths during earthwork are often deeper than the topsoil shown on the boring logs.

3.3.2 *Existing Fill*

Beneath the topsoil in borings A-3 and A-4, existing fill soils were encountered to depths of approximately 6 and 3 feet below the ground surface, respectively. The fill materials consisted of sandy silts (USCS group symbol ML) with traces of rock pieces and some clay. Standard penetration resistance values (N-values) in the existing fill ranged between 11 and 14 blows per foot (bpf), indicating a moderate degree of compaction.

3.3.3 *Alluvium*

Alluvial soils (deposited by water) were encountered beneath the topsoil in borings A-1, A-2, A-5 & A-6 and beneath the fill in borings A-3 and A-4. The alluvium extended to depths ranging between 6 and 18.5 feet below the existing ground surface.

The sampled alluvium was generally described as moist to wet and consisted of gray, black, brown, and tan lean clay (CL), sandy silt (ML), silty clay (CL-ML), and silty sand (SM). Varying amounts of roots, mica, sand, clay, and rounded rock pieces were observed in the alluvium. Some samples contained decayed organics and one was mixed with topsoil and roots. N-values ranged from 4 to 15 bpf. It should be noted that some of the higher N-values may have been artificially inflated somewhat due to the presence of rocky materials in the alluvial layer. The N-values indicate a soft to very stiff consistency in the fine-grained soils (silts and clays) and a medium dense relative density in the coarse-grained soils (sands) and gravels.

3.3.4 *Residuum*

Residual soils were encountered beneath the alluvial soils in borings A-1, A-2, A-4, A-5, and A-6. The sampled residuum consisted of medium dense to very dense silty sands (SM) and firm to very hard sandy silts (ML). The residual soils contained traces of mica, small rocks, and rock fragments. N-values in the sampled residuum ranged between 11 and 72 bpf. Borings A-1 and A-5 were terminated in residual soils at the planned depths of 15 and 20 feet, respectfully.

3.3.5 *Partially Weathered Rock*

Partially weathered rock (labeled IGM or intermediate geo-material on the boring logs) was encountered in boring A-2 at a depth of 23.5 feet; in boring A-3 at a depth of 18.5 feet; a ledge in boring A-4 between 8.5 feet and 9.5 feet and again from 33.5 to 33.8 feet; and in boring A-6 from 23.5 feet. The PWR consisted primarily of silty sand (SM) with fine to coarse grained particles and a trace of rock fragments in the samples. SPT N-values in the PWR ranged between 50 blows for 2 inches of penetration (50/2") and 50 blows for 5 inches of penetration (50/5").

3.3.6 *Auger Refusal Materials*

Auger refusal was encountered in boring A-3 at a depth of 23.7 feet below the existing ground surface. Refusal is a designation applied to any material having a resistance in excess of the penetrating capacity of the drilling equipment. Auger refusal materials may consist of boulders, cobbles, massive rock, rock in pinnacle form, or a thin lens of hard rock. Coring is typically required to determine the composition of the refusal material, and this was beyond our scope of services.

3.3.7 *Subsurface Water*

Subsurface water levels from the time of boring (TOB) and on the following day (approximately 24 hours) are summarized in the table below. It should be noted that subsurface water levels will fluctuate during the year and from year to year due to seasonal and climatic changes, construction activity, and other factors, and may be at different depths in the future. The following table summarizes the water levels observed at each boring.

Table 2-1 – Table of Subsurface Water Levels

Boring	Water Level at TOB (ft)	Water Level at ~24 Hours (ft)
A-1	Dry	7.0
A-2	8.0	Backfilled
A-3	Dry	Backfilled
A-4	16.0	6.7
A-5	9.0	5.5
A-6	Dry	Backfilled

3.3.8 *Laboratory Testing*

Atterberg limits tests, grain size analysis, and natural moisture contents were performed on selected site samples, and the results are summarized below. A Summary of Laboratory Test Data is in the table below and individual laboratory data sheets are attached in Appendix III.

Table 2-2 – Summary of Laboratory Results

Boring Number	Sample Number	Depth (ft)	Moisture (%)	% Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	USCS Group Symbol
A-1	SS-2	3.5-5.0	31.0	--	--	--	--	CL
A-1	SS-3	6.0-7.5	26.7	--	--	--	--	CL
A-2	SS-1	1.0-2.5	33.3	87.9	--	--	--	CL
A-2	SS-2	3.5-5.0	28.9	--	41	22	19	CL
A-3	SS-3	6.0-7.5	--	--	35	22	13	CL
A-6	SS-3	6.0-7.5	26.7	--	38	26	12	ML

3.4 Subsurface Conditions – Previous Borings B-1 through B-5 (Drilled in 2016)

A general description of subsurface conditions based on the site at the time of the previous performed Preliminary Geotechnical Investigation, dated September 16, 2016, is provided below. The approximate locations of the five borings, labeled B-1 through B-5 are provided in the Boring Location Plan (Figure-2). For more detailed information the Boring Logs in the Appendix should be reviewed.

3.4.1 *Surface Materials*

The borings initially penetrated asphalt and crushed stone associated with the existing old pavements. The asphalt encountered was about 1 to 2 inches thick and the crushed stone was about 2 to 3 inches thick. However, no asphalt was remaining at the location of Boring B-3, which initially penetrated about 1 inch of topsoil.

3.4.2 *Existing Fill*

Existing fill material was encountered in boring B-5 beneath the pavement materials to about 3 feet deep. The fill was described as medium dense, brown and gray, silty sand (USCS Group Symbol SM). The fill exhibited a standard penetration resistance value (N-value) of 11 blows per foot (bpf).

3.4.3 *Alluvium*

Beneath the fill in B-5 and beneath the pavement materials or topsoil in the remaining borings, alluvial materials were encountered. The alluvium was encountered to depths ranging from 7 to 17 feet below the surface. The alluvium was generally described as gray, brown, and tan fat clay (CH), lean clay (CL), silty sand (SM) and silty gravel with sand (GM). The alluvial soils were typically described as very moist to wet, or well above their standard Proctor optimum moisture contents. The alluvium often contained rock pieces, particularly in the lower parts of the alluvial layer. N-values ranged from 2 bpf to 50 blows for 4 inches of penetration in the alluvium. However, the higher values were most likely amplified due to the presence of larger rock materials/pieces.

3.4.4 *Residuum*

Residual materials were encountered below the alluvium in all of the borings. (The residual material consisted of partially weathered rock in borings B-2 and B-5 as discussed in the next section.) The residual soils encountered in borings B-1, B-3 and B-4 were described as very stiff to very hard, gray, tan and orange-brown, sandy silt (ML). Standard penetration resistance values in the residual soils ranged from 31 to 51 bpf. Boring B-3 was terminated in the residual soils at its planned termination depth of 20 feet.

3.4.1 *Partially Weathered Rock (PWR)*

Partially weathered rock (PWR) was encountered in borings B-1, B-2, B-4 and B-5 at depths varying from 12 to 17 feet. The PWR was described as very dense or very hard, gray, tan and orange-brown, silty sand (SM) and sandy silt (ML). These borings were terminated in the PWR at their planned termination depths of 20 feet.

3.4.2 *Subsurface Water*

Subsurface water was encountered in the borings at depths ranging from 5.5 to 7.7 feet below the surface about 24 hours after the completion of drilling. Subsurface water elevations should be expected to fluctuate due to seasonal variations in rainfall, nearby stream and river levels, construction activity, and other factors, and will be encountered at different depths in the future.

Table 2-3 – Table of Subsurface Water Levels

Boring	Water Level at TOB (ft)	Water Level at ~24 Hours (ft)
B-1	10.0	6.3
B-2	8.0	6.3
B-3	14.0	7.7
B-4	Dry	5.5
B-5	8.0	7.0

4.0 Conclusions and Recommendations

The following conclusions and recommendations presented herein are based on information and assumptions concerning structural loads, existing grades and final site grades, our understanding of the proposed project, findings of the subsurface exploration, geotechnical engineering evaluations of encountered subsurface conditions, and experience with similar projects. When reviewing this information, please keep in mind subsurface conditions vary erratically in this geologic area. This is particularly true with previously placed fill, alluvial soils, and groundwater and rock levels. The development and construction team must understand our recommendations are based on the premise that our personnel will be on-site to observe and document site work, including site preparation, proofrolling, undercutting, fill placement, and to perform density testing of fills. Proper site preparation and maintenance is very important in helping to providing time- and cost-efficient construction. Our field observations and tests are a vital component in improving the performance and efficiency of the site work.

4.1 General Discussion

Based on the encountered subsurface conditions, the site is underlain by very low to moderately low consistency alluvial soils (soil deposited over time by water or flooding) with some existing fill, and subsurface water is shallow (about 5 to 7 feet below the existing ground surface and 2 to 7 feet below final grades). Alluvial soils are typically under-consolidated and will tend to settle excessively and non-uniformly under new loads, and we would expect a high risk of settlement-related issues if the structure is built without remedial site work or special foundations.

It is our opinion the site can be developed for support of the building and pavements; however, special measures will be required to support the building (and internal heavy equipment if there is any). Special measures could include the following:

1. Undercutting some of the fill and alluvium, stabilization with geotextile fabric and crushed stone, and new structural fill placement.
2. Ground improvement with compacted aggregate piers.
3. Deep foundations such as driven or augured piles.

It is not practical to undercut <u>all</u> of the alluvial soil due to the depth of the material and the shallow groundwater across the site. Due to the cost and complications to undercut and replace even a portion of the alluvium, and the risk that would remain due to alluvial soils remaining below the undercut, we do not recommend this approach.

Deep foundations are typically the lowest risk option, but also carry the highest cost, and this does not appear to be required for the anticipated building loads. The original building on this site was constructed with support by aggregate piers, as well as the adjacent, recently-constructed Transylvania County EMS building at the northwest corner of Ecusta Road and Morris Road. Therefore, we assume aggregate piers are the preferred foundation support option and they are discussed in the following section of this report.

4.1.1 *Spread Footings with Ground Improvements (Compacted Aggregate Piers)*

Ground improvement is typically considered a lower risk option. The design and installation of the ground improvement system is handled by a design-build specialty contractor. We expect a series of compacted aggregate piers (CAPs) could be installed to support the building and any heavy internal equipment. Typically, these are installed beneath the footings and equipment mats only, but they can also be installed on a grid pattern to support the slab and reduce differential settlement across the entire structure. The CAPs would probably need to extend through the alluvial layer and into the residual soils or partially weathered rock. The aggregate piers generally have a 24- to 30-inch diameter. With this approach, because the foundations are supported on improved soils and compacted aggregate, higher bearing pressures are usually available for foundation design (typically about 4,000 to 6,000 psf). The actual bearing pressure would be determined by the design-build specialty contractor.

4.1.2 *Floor Slab Support*

As stated above, the CAPs can also be used to provide enhanced support of the slab. If CAPs are not used under the slab, we expect a large portion of the subgrade will likely require undercutting and replacement of about 2 feet (+/-) of the subgrade soils. (This would be determined by proofrolling and evaluation as described in *Section 4.2.2.*) Stabilization and replacement could require placement of a geotextile fabric or geogrid and backfilling with crushed stone. If CAPs are used for slab support, the slab subgrade stabilization measures could be reduced, but placement of about ½ to 1 foot of additional ABC stone could still be needed in problematic subgrade areas, and to reduce damage to the building pad during CAP and footing installation. The actual subgrade conditions can be observed after the pad is cut to grade, and the costs can be discussed with the specialty contractor, the Owner and design team, and S&ME to determine the slab support approach.

4.1.3 *Pavement Areas*

Pavement areas will need to be evaluated to determine if remedial work/stabilization is needed. Although there are some inherent risks associated with pavements constructed over alluvial soils, if the subgrade is firm and stable at the time of construction, the risk is relatively low, and the pavement base course can be placed without remedial work. However, we expect some areas will need to be stabilized with geotextiles and/or crushed stone. In particular, the heavy-duty truck pavement and loading dock will likely require remediation due to being cut down closer to the subsurface water level, the soft clayey soils evidenced in boring A-6, and the organics in boring A-5. During construction of the heavy-duty pavement to the east, a 2-foot-thick stabilization layer consisting of fabric, railroad ballast, geogrid, and ABC stone was required over a relatively large area.

The following sections of this report discuss the site preparation, earthwork, foundations, and pavements in more detail.

4.2 Site Preparation

4.2.1 Stripping

Site preparation should begin with stripping of all unsuitable surface materials to at least 10 feet outside the building limits and 3 feet outside pavement areas, where practical. This would include surface vegetation, organic-laden topsoil, trees, bushes and shrubs, large root systems, and remnants of previous construction.

Utility lines may be present throughout the site. For lines that lie within the footprint of the proposed building, we suggest they be relocated 10 feet beyond building lines and their trenches cleaned and properly backfilled. Our experience indicates that the backfill soils for existing utility lines could be poorly compacted. If any utility lines will remain below "green" areas or proposed pavement areas, we suggest that the trench backfill material be carefully evaluated to ensure suitability.

4.2.2 Subgrade Evaluations / Proofrolling

At multiple stages during grading (following stripping, excavation to the design subgrade levels, and after any necessary undercutting), the exposed subgrade should be thoroughly proofrolled with a heavily loaded, tandem-axle dump truck or similar rubber-tired equipment under the observation of a Geotechnical Engineer or his/her representative, where practical. Proofrolling will help reveal the presence of unstable or otherwise unsuitable surface materials and may help densify the exposed subgrade for subsequent structural fill placement and building and pavement support. Areas that are unstable should be undercut or stabilized in place as recommended by the Geotechnical Professional. Because of the fill and alluvial soils on site, proofrolling is very important at this site. However, some areas will likely be too soft and wet to proofroll and will need to be evaluated by observation of test pits, hand auger borings, and/or probing with a small-diameter steel rod.

Any recommended undercutting should extend to at least 7 feet beyond building lines and 3 feet beyond the pavement areas, where applicable. All undercutting should be closely observed by the Geotechnical Engineer or their representative to help confirm the extent and removal of unsuitable materials. As previously stated, stabilization could involve undercutting and placement of geotextiles and/or crushed stone. An alternative to undercutting could be lime or cement stabilization if the grading contractor has the equipment needed to properly mix the materials into the soil. In favorable weather (hot and dry) the remedial measures may be reduced, but during wet weather the remedial measures will likely be increased.

We recommend several backhoe-excavated test pits be made by the contractor at the beginning of earthwork (or sooner during the planning phase) in the presence of our representative to observe the character and composition of the fill and alluvial material and subsurface water levels. Additional recommendations can be made in the field when needed.

4.2.2.1 Stabilization Materials

We suggest the bidding contractors be required to provide unit rates for potential stabilization materials for comparison and so the rates are established prior to awarding a contract. The following is a list of the items we anticipate could be recommended in areas requiring stabilization:

- Railroad ballast crushed stone,
- No. 57 crushed stone,
- NCDOT Aggregate Base Course (ABC stone),
- Woven fabric - Mirafi HP570 or equivalent,
- Non-woven fabric – Mirafi 140 N or equivalent, and
- Geogrid – Tensar BX-1200 or equivalent.

4.3 Site Drainage

Grading activities typically result in areas of soil subgrade being exposed for extended periods with little to no topographic relief to drain surface water runoff. It is important the grading contractor protect the exposed soils from becoming wet or saturated during inclement weather. Positive site drainage should be maintained during all operations, including the initial stripping of the site, undercutting and backfilling, after excavation to subgrade levels, and after fill placement is complete. This may include surface ditches around the perimeter, internal ditching and in some cases French drains. Failure to provide positive site drainage can result in extensive and costly repairs to the exposed subgrade, as well as construction delays.

4.4 Excavation Considerations

The boring data indicate probable excavations during mass grading and installation of utilities will likely extend through very low to moderately low consistency fill and alluvium throughout the building site. Residual soils may also be encountered in deeper excavations and some isolated partially weathered rock (PWR) could also be encountered (about 5 feet below planned grade at boring A-4). We expect the soil materials can be excavated with conventional excavation equipment. That is, mass excavation can be accomplished by front-end loaders, large tracked excavators, and bulldozers. Excavation for shallow foundations and utility trenches can typically be accomplished with a rubber-tired or tracked excavator. PWR could require more diligent excavation efforts by the contractor or the use of pneumatic tools. Due to the soft subgrade conditions and shallow groundwater, lightweight tracked LGP (low ground pressure) equipment may be required.

Auger refusal (assumed to be bedrock) was encountered in boring A-3 within the building footprint at a depth of 23.7 feet; however, this is not within anticipated excavation depths. However, there is always a possibility that rock, boulders, partially weathered rock and very dense soils will be encountered in areas intermediate of the borings or in unexplored areas, and difficult excavation, including blasting, can be required. This is because rock in a weathered, boulder, and massive form varies very erratically in depth and location in this geologic region.

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation safety standards. We note the Contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed to be responsible for construction site safety.

4.4.1 Subsurface Water

Subsurface water was encountered as shallow as about 5.5 feet below the surface at the proposed addition site and as shallow as 2 feet below planned grade at boring A-5 and 2 ½ feet below grade at boring A-1. Depending on actual final grades, the depth of utility trenches, and undercutting depths, subsurface water will likely be encountered in some excavations unless the water levels can be lowered by use of French drains. In utility trenches that encounter subsurface water, at least 6 to 12 inches of No. 57 crushed stone bedding is normally required, and the trenches may also need to be backfilled up to the water line with No. 57 stone. If water is encountered during installation of utilities and/or undercutting, it can typically be controlled by pumping from sump pits until the initial crushed stone backfill is in place. It is also possible that gravity-flowing French drains could be needed to permanently lower the water levels if they impact the final grades. If the bedding stone below the utility pipes is wrapped in non-woven filter fabric, it can often be used as a French drain to help lower the water levels across the site. A pipe would need to be installed from the bedding stone into a downstream manhole to provide an outlet for the water. The pipe would be slotted within the stone layer and convert to solid where it enters the manhole.

4.5 Fill Placement and Compaction

After excavation and undercutting, areas requiring fill placement should be raised to their design subgrade configuration with soil free of deleterious materials. The new fill should have a maximum particle size of 4 inches or less, plasticity index less than 25, and standard Proctor maximum dry density of at least 90 pounds per cubic foot (pcf). The fill should be uniformly spread in 6- to 8-inch thick loose lifts and be compacted to at least 95 percent of the soil's maximum dry density, as determined by a laboratory standard Proctor compaction test (ASTM D698). Since pavement and floor slab support characteristics generally improve with an increase in density, we recommend the upper 1 foot of fill in slab and pavement areas be compacted to a slightly higher degree (98 percent). The moisture content should be controlled at plus to minus 3 percent of optimum; however, a slight increase in optimum moisture could be allowable if the minimum compacted density is achieved and subgrade is stable.

Fill placement should be monitored by a qualified Materials Technician working under the direction of the Geotechnical Engineer. In addition to this evaluation, the Technician should perform a sufficient amount of in-place field density tests to confirm the required degree of compaction is being attained. We recommend that field density tests, including one-point Proctor verification tests, be performed on the fill as it is being placed at a frequency of 1 test per 2,500 square feet per lift in the building and pavement areas and 1 test per lift per 100 linear feet in utility trenches.

4.5.1 Use of On-Site Excavated Soils as Fill

The majority of the soils sampled during this exploration appear to not be suitable for reuse in a well-compacted fill to support buildings and pavements. The majority of the sampled soils were wet of their estimated optimum moisture contents and the upper part of the alluvial soils are clayey with a relatively high plasticity and some contain organics. Drying will be difficult or not reasonably possible unless the weather is hot and dry, and organics would need to be removed. Chemical drying and stabilization could be achieved with lime or cement, but this would require special grading equipment. For these reasons, we expect most excavated materials will require being wasted in non-structural areas or hauled off-site. However, this can be evaluated at the time of construction based on the excavated materials and the prevailing weather conditions.

4.6 Subgrade Repair and Improvement Methods

The exposed subgrade soil of both excavation and fill areas can deteriorate when exposed to construction activity and environmental changes such as freezing, erosion, softening from ponded rainwater, and rutting from construction equipment. We recommend the exposed subgrade surfaces that have deteriorated be properly repaired by scarifying and recompacting immediately prior to further construction. If this must be performed during wet weather conditions, it would be worthwhile to consider undercutting the deteriorated soil and replacing it with compacted crushed stone.

4.7 Foundation and Floor Slab Recommendations

4.7.1 Conventional Spread Footings with Ground Improvement (Compacted Aggregate Piers)

Based on our experience and the previous site development, we assume Compacted Aggregate Piers (CAPs) will be utilized for building support. The design and installation of the ground improvement system is typically handled by a design-build specialty contractor. Often, these are installed beneath the column and wall footings only (including the loading dock walls), but they can also be installed on a grid pattern to support the slab and reduce differential settlement across the entire structure.

A highly skilled specialty contractor with CAP experience should design and install the CAP elements. We assume a performance criterion would be to limit total and differential settlement to ≤1 in. and ≤½ in., respectively. The actual design bearing pressure will be determined by the CAP spacing, size and depths as determined by the CAP contractor/designer.

CAPs are installed using augers, vibratory probes or combination thereof, and can be top or bottom fed based on subsurface conditions. Based on the shallow water, we expect a bottom-feed method will be required.

A minimum of one full-scale compacted aggregate pier Modulus Load Test should be performed to verify CAP design assumptions. The load test provides a measure of the stiffness of the CAP element and will provide quality control guidelines for the CAP installation procedures. The Modulus Load Test should be performed in the areas of the site considered to be representative of the most critical soil condition.

The CAP installer's internal Quality Control program should include monitoring drill depths, total CAP element lengths, average lift thickness, installation procedures, aggregate quality and compaction energy. These items should be documented for each CAP element installed, to provide a complete installation report. The Geotechnical Engineer or his representative should review the CAP modulus test results and execution of the installers Quality Control System during CAP construction.

4.7.2 Spread Footing Design and Construction

After ground improvement with CAPs, a design foundation bearing pressure of 3,000 psf or higher should be available, but this will need to be determined by the specialty contractor. We recommend wall footings have a minimum width of 18 inches and column footings have a minimum width of 24 inches. We also recommend a minimum footing embedment of 2 feet for frost protection.

Individual foundation excavations require observation by S&ME prior to concrete placement. The surface of footings and aggregate piers should typically be tamped to recompact the surface after excavation. Exposure to the environment will cause the soils surrounding the piers to rapidly deteriorate. If surface water runoff collects in any excavation, it should be removed promptly by pumping to help prevent softening of foundation supporting soils. To further reduce the potential for deterioration of bearing soils, we recommend that foundation excavation, evaluation, and placement of concrete be conducted on the same day, if practical. If an excavation is to remain open overnight, or if rain is imminent, the footing subgrade can be lowered and a 3- to 4-inch thick mud mat of lean (2,000 psi) concrete placed in the bottom of the excavation to protect the bearing soils. This will help limit the potential for additional excavation of wet, softened soils which often results from footings exposed to inclement weather.

4.7.3 Floor Slab Support

We expect the floor slab will be supported by evaluated and approved subgrade soils or aggregate piers. If aggregate piers are not used for slab support, the final subgrades must be assessed to be satisfactorily stable by the Geotechnical Engineer prior to concrete placement. Typically for projects similar to this, we recommend using a 6-inch thick layer of crushed stone (NCDOT Aggregate Base Course) to separate the floor slab from the subgrade soils. This layer will provide a good capillary break, and if placed soon after completion of grading, will help protect the subgrade during construction and exposure to weather. If there are many utility stub-ups or other issues with using ABC stone, No. 57 stone could also be used. A modulus of subgrade reaction (k) of 120 pci can be used for design of the floor slab over the compacted stone and stable subgrade.

A vapor retarder should be considered beneath the grade slabs to help prevent slab dampness due to the upward migration of soil moisture. The need for a vapor retarder will also be dependent upon the floor covering design and local and state building codes.

4.7.4 Seismic Conditions

The proposed structure should be designed to resist possible earthquake effects as determined in accordance with Section 1613 of the North Carolina Building Code (NCBC) 2018 Edition (2015 International Building Code with North Carolina Amendments). The NCBC assigns a Seismic Site Class based on the type and thickness of overburden soil materials. Site Class values range from Class A for hard bedrock to Class F for deep deposits of soft bearing strata. Based on the N-values obtained in the exploration and allowances in the North Carolina Building Code, it is our opinion a Seismic Site Class C can be used in design.

There are no active earthquake fault zones within close proximity to the general area and thus the site vicinity is not known to be subject to concerns of any major geologic hazards such as significant ground shaking, liquefaction, seismically induced slope failures, etc.

4.8 Cast-In-Place Concrete Retaining Walls and Lateral Earth Pressures

A loading dock wall will be needed on the south side of the proposed building. We assume this will be a Cast-In-Place (CIP) concrete wall. Other below-grade walls could be required that we are not aware of at this time. CIP walls must be capable of resisting lateral earth pressures imposed on them, which will be partially dependent upon the method of construction. Assuming the walls are relatively rigid and structurally braced against rotation (such as a basement wall), they should be designed for a condition approaching the "at-rest" lateral pressure. However, in the event the walls are free to deflect (about 1/2 to 1 inch for a 10-foot high wall) during backfilling, as for any exterior walls that are not restrained or rigidly braced, the "active" pressure conditions will be applicable for design. The following lateral earth pressure parameters are recommended for design, based on our experience, and assuming the walls will be backfilled with new structural fill soil, a level backfill, and a frictionless wall.

Table 4-1 –Lateral Earth Pressure Parameters for Soil Backfill

Lateral Earth Pressure Condition	Coefficient		Equivalent Fluid Pressure (γ_{Eq})
At-Rest Condition	(K_o) =	0.53	61 psf/ft
Active Condition	(K_A) =	0.36	41 psf/ft
Passive Condition	(K_P) =	2.3	n/a
Unit Weight of Soil (Moist)	115 pcf		
Friction Factor for Foundations and Bearing Soils	0.35		

If No. 57 crushed stone is used for backfill of the walls a moist unit weight of 105 pcf, K_o of 0.41, and K_A of 0.26 can be used.

The recommended lateral earth pressure parameters do not consider the development of hydrostatic pressure behind the wall. As such, positive wall drainage must be provided for all earth retaining structures or full hydrostatic pressure should be added to the earth pressures. Wall drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe or weepholes. Alternatively, several wall drainage products are produced specifically for this application. Lateral earth pressures arising from surcharge loading or slopes above the wall should be added to the above earth pressures to determine the total lateral pressure.

The soil backfill placed behind retaining walls and for fill placed in the passive zone should be placed and compacted in accordance with our previous site grading recommendations. We caution that operating compaction equipment directly behind the retaining structures can create lateral earth pressures far in excess of those recommended for design. Therefore, bracing of the walls will be needed during backfilling operations. The backfill zone should be wide enough to facilitate compaction of soil backfill with compaction equipment. This will be difficult for deep excavations. For this reason, it may be more practical for at least the lower parts of the backfill to consist of No. 57 crushed stone.

5.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty, either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants, or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

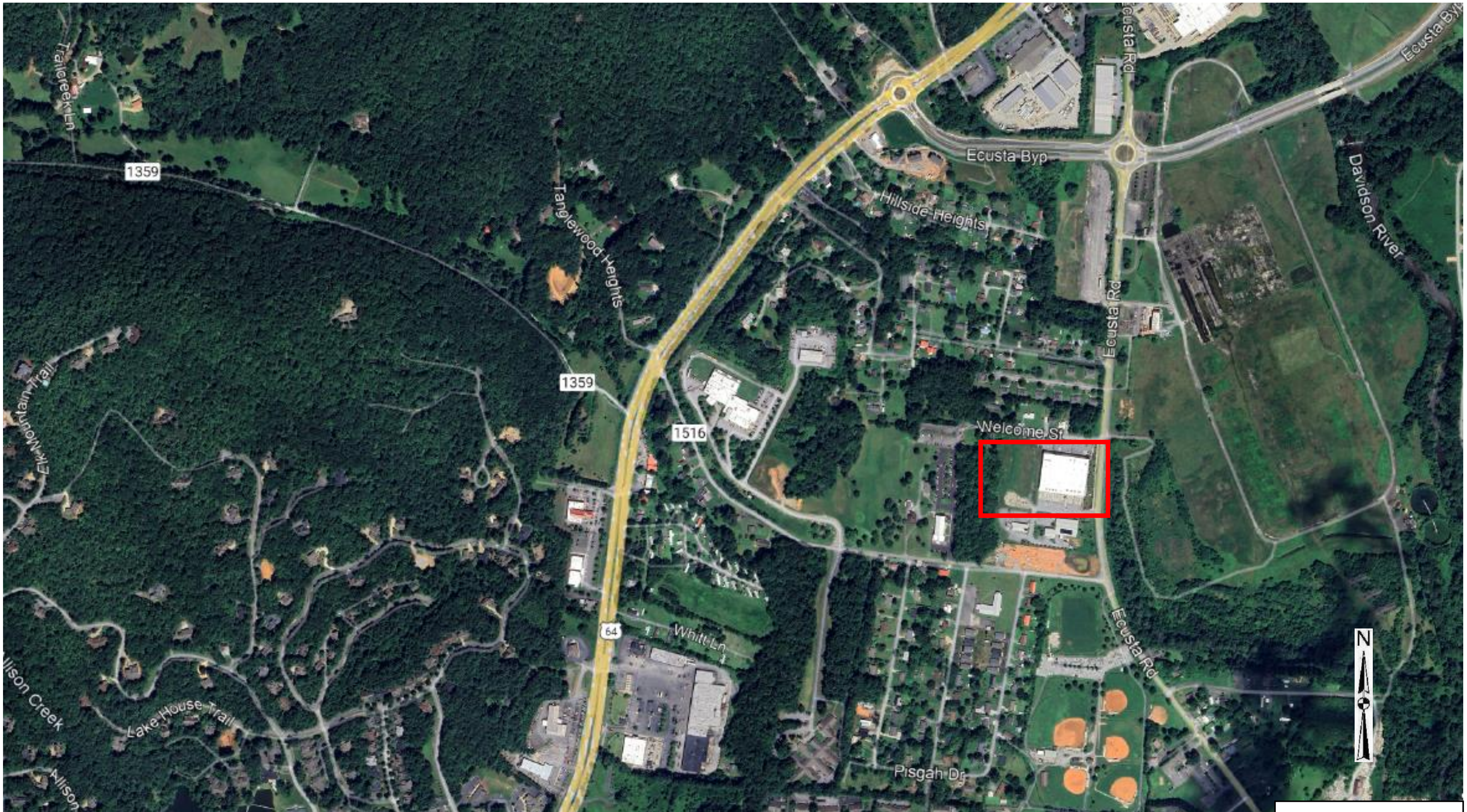
S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendices

Appendix I – Figures

Site Location (Figure 1)

Boring Location Plan (Figure 2)

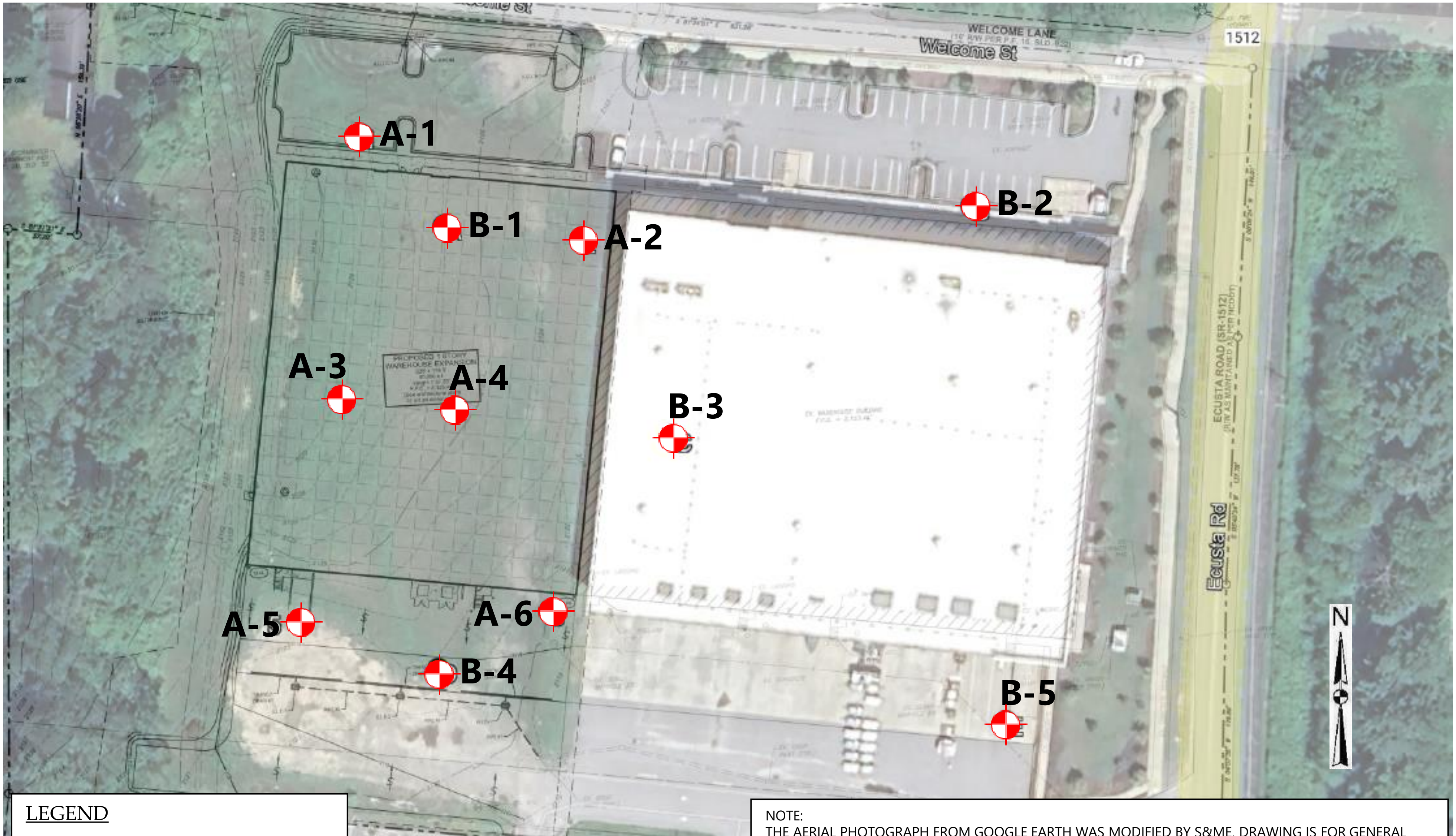


NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

LEGEND

Site Area

S&ME	**Site Vicinity Map**	SCALE: AS SHOWN	FIGURE NO. 1
	Transylvania County – Ecusta Road Industrial Building Addition 21 Welcome Street Brevard North Carolina	DATE: 02/2024 PROJECT NUMBER 23410135	



LEGEND

Approximate Boring Location

NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

BORING LOCATION PLAN

Transylvania County – Ecusta Road Industrial Building Addition
21 Welcome Street
Brevard, North Carolina

SCALE:	FIGURE NO.
NOT TO SCALE	2
DATE: 02/2024	
PROJECT NUMBER 23410135	

Appendix II – Field Data

Legend to Soil Classification and Symbols

Soil Test Boring Logs

TEST BORING LOG LEGEND

FINE AND COARSE GRAINED SOIL INFORMATION

COARSE GRAINED SOILS (SANDS AND GRAVELS)

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

FINE GRAINED SOILS (CLAYS AND SILTS)

N	Consistency	PPV, tsf
0-2	Very Soft	0.0-0.25
3-4	Soft	0.25-0.5
5-8	Firm	0.5-1.0
9-15	Stiff	1.0-2.0
16-30	Very Stiff	2.0-4.0
Over 30	Hard	4.0+

PARTICLE SIZE

Boulders	Greater than 300 mm (12”)
Cobbles	75 mm—300 mm (3-12”)
Gravel	4.75 mm—75 mm (3/16-3”)
Coarse Sand	2 mm—4.74 mm
Medium Sand	.425 mm—2 mm
Fine Sand	0.075 mm—0.425 mm
Silts and Clays	Less than 0.075 mm

The STANDARD PENETRATION TEST as defined by ASTM D 1586 is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D. / 2.0-inch O.D. split barrel sampler is driven three 6-inch increments with a 140 lb. hammer falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The blow counts required to drive the sampler the final two 6-inch increments are added together and designated the N-value defined in the above tables.

ROCK PROPERTIES

RQD

Percent RQD	Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

ROCK HARDNESS

Very Hard	Rock can be broken by heavy hammer blows.
Hard	Rock cannot be broken by thumb pressure, but can be broken by moderate hammer blows.
Moderately Hard	Small pieces can be broken off along sharp edges by considerable thumb pressure; can be broken with light hammer blows.
Soft	Rock is coherent but breaks very easily with thumb pressure at sharp edges and crumbles with firm hand pressure.
Very Soft	Rock disintegrates or easily compresses when touched; can be hard to very hard soil.

KEY

Undisturbed Sample

Standard Penetration Test Sample

Rock Core Sample

Core Diameter (I.D.)	Inches
BQ	1-7/16
NQ	1-7/8
HQ	2-1/2

RQD= (Rock Quality Designation)

$$RQD = \frac{\text{Sum of 4'' and Longer Rock Pieces Recovered}}{\text{Length of Core Run}} \times 100$$

REC= (Recovery)

$$REC = \frac{\text{Length of Rock Core Recovered}}{\text{Length of Core Run}} \times 100$$

SOIL PROPERTY SYMBOLS

N	Standard Penetration, BPF
NMC	Natural Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plasticity Index, %
PPV	Pocket Penetrometer Value, TSF
Qu	Unconfined Compressive Strength, TSF
Yd	Dry Unit Weight, PCF
F	Fines Content

At Time of Drilling (ATD)	Groundwater observation made anytime during the drilling process. Depending on time of reading and drilling methodologies, this value may be influenced by the drilling process.
End of Drilling	Groundwater measurement soon after all drilling processes are complete, and the borehole is at final depth. Drilling fluids, if introduced during drilling, may influence this measurement.
After Drilling	Groundwater measurements made in a borehole hours to days after drilling is complete. Depending on subsurface conditions, elapsed time, drilling process, etc. this observation may reflect a stabilized level.

PROJECT: Ecusta Road Industrial Building Addition Brevard, North Carolina S&ME Project No. 23410135		**BORING LOG: A-1** *Sheet 1 of 1*
DATE DRILLED: 01/30/2024	**ELEVATION:** 2128 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 15.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.263400 **LONGITUDE:** -82.707833
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0.3				TOPSOIL, 3 inches		
		Alluvium	SS-1	SANDY LEAN CLAY (CL), stiff, tan brown and gray, moist to very moist, some fat clay (CH) zones, trace roots in sample SS-1	5-5-6 N = 11	
5			SS-2		5-5-5 N = 10	2123
			SS-3		5-6-6 N = 12	
8.0	Hole Cave at 8.5 feet Hole Cave at 9.5 feet		SS-4	SILTY SAND (SM), medium dense, gray and brown, medium to coarse grained, very moist, trace rounded rock pieces	6-6-8 N = 14	2118
11.7		Residuum	SS-5	SANDY SILT (ML), very hard, dark gray, moist, trace mica, some rock fragments	18-26-35 N = 61	2113
15.0				Borehole terminated at 15.0 feet		

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
├┤ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD		01/30/2024		Not encountered
END OF DRILLING				
AFTER DRILLING		01/31/2024	7.0	
AFTER DRILLING				

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: A-2** *Sheet 1 of 1*

DATE DRILLED: 01/30/2024	**ELEVATION:** 2124 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 24.4 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.263239 **LONGITUDE:** -82.707422
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0.2		Alluvium		TOPSOIL, 2 inches		
		Alluvium	SS-1	LEAN CLAY (CL), stiff, dark gray, moist, some decayed organics in sample SS-1	4-5-6 N = 11	
		Alluvium	SS-2		3-4-5 N = 9	2119
5.5		Alluvium	SS-3	FAT CLAY (CH), stiff, light gray, very moist, some fine to coarse sand layers	3-5-6 N = 11	
8.0		Residuum	SS-4	SILTY SAND (SM), very dense, dark gray, fine to coarse grained, wet, seams of rock fragments	36-32-40 N = 72	2114
11.7		Residuum		SANDY SILT (ML), hard, light gray, very moist		
15	Hole Cave at 16.0 feet	Residuum	SS-5		16-18-23 N = 41	2109
20		Residuum	SS-6		10-14-17 N = 31	2104
23.5		IGM	SS-7	PWR SILTY SAND (SM), very dense, tan and gray, dry	32-50/5" N = 50/5"	2099
24.4				Borehole terminated at 24.4 feet		
30						2094

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
├┤ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/30/2024	8.0	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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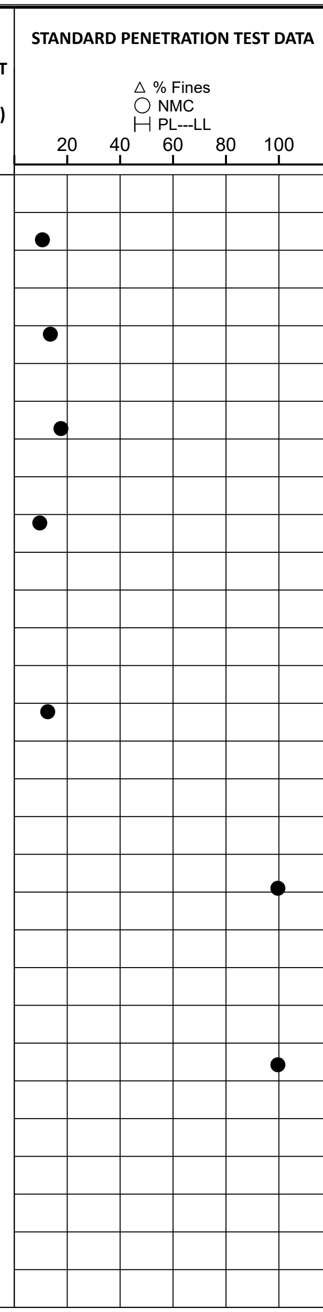
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: A-3** *Sheet 1 of 1*

DATE DRILLED: 01/30/2024	**ELEVATION:** 2128 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 23.7 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.262997 **LONGITUDE:** -82.707939
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
0.3		Fill		TOPSOIL, 3 inches	
		Fill	SS-1	SANDY SILT (ML), stiff, dark gray brown, moist, some rock pieces	4-5-6 N = 11
		Fill	SS-2		6-7-7 N = 14
6.0		Alluvium	SS-3	SANDY LEAN CLAY (CL), stiff, tan dark gray, moist	7-8-10 N = 18
8.0		Alluvium	SS-4	SANDY SILT (ML), very stiff, tan brown, moist, trace coarse sand	5-5-5 N = 10
	Hole Cave at 11.0 feet	Alluvium			
		Alluvium	SS-5		7-6-7 N = 13
14.5		Alluvium		SILTY SAND (SM), medium dense, orange tan, very moist, fine to coarse grained, some rounded gravel	
18.5		IGM	SS-6	PWR SILTY SAND (SM), very dense, gray and brown, moist, <0.5" angular rock	44-50/4" N = 50/4"
	Auger refusal at 24.0 feet	IGM	SS-7		50/2" N = 50/2"
23.7				Borehole terminated at 23.7 feet	

Depth scale: 0, 5, 10, 15, 20, 25, 30. Elevation scale: 2124, 2119, 2114, 2109, 2104, 2099.



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/30/2024		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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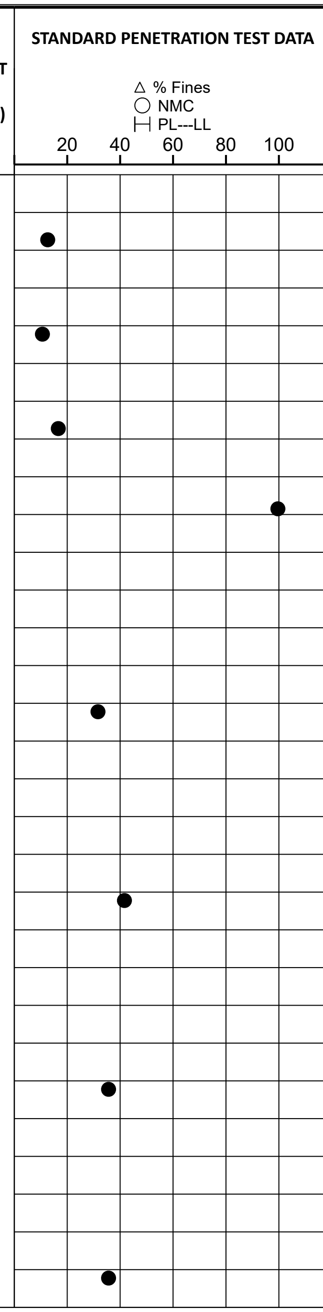
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: A-4** *Sheet 1 of 2*

DATE DRILLED: 01/30/2024	**ELEVATION:** 2126 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 33.8 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.262983 **LONGITUDE:** -82.707658
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0.2				TOPSOIL, 2 inches		
		Fill	SS-1	SANDY SILT (ML), stiff, orange brown, some clay	5-6-7 N = 13	
3.0		Alluvium	SS-2	LEAN CLAY (CL), stiff, tan brown, trace fine sand, moist	5-5-6 N = 11	2121
6.0		Residuum	SS-3	SILTY SAND with gravel (SM), medium dense, dark gray, moist, with angular rock fragments	5-8-9 N = 17	
8.5		IGM	SS-4	PWR SILTY SAND (SM), very dense, light gray to brown, dry, some rock fragments	44-50/3" N = 50/3"	2116
9.5		Residuum		SANDY SILT (ML), hard, light gray to white, moist		
			SS-5		12-15-17 N = 32	2111
	Hole Cave at 18.0 feet		SS-6		16-19-23 N = 42	2106
			SS-7		15-17-19 N = 36	2101
			SS-8		14-17-19 N = 36	2096



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD		01/30/2024	16.0	
END OF DRILLING				
AFTER DRILLING		01/31/2024	6.7	
AFTER DRILLING				

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: A-4** *Sheet 2 of 2*

DATE DRILLED: 01/30/2024	**ELEVATION:** 2126 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 33.8 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.262983 **LONGITUDE:** -82.707658
SAMPLING METHOD: SS		**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
		Residuum			SANDY SILT (ML), hard, light gray to white, moist			
	33.5			SS-9	IGM SANDY SILT (ML), hard, light gray to dark gray, moist, rock fragments	50/4" N = 50/4"	●	
	33.8				Borehole terminated at 33.8 feet			
35								2091
40								2086
45								2081
50								2076
55								2071
60								2066

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/30/2024	16.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	01/31/2024	6.7	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: A-5** *Sheet 1 of 1*

DATE DRILLED: 01/30/2024	**ELEVATION:** 2122 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager	**LATITUDE:** 35.262636 **LONGITUDE:** -82.707925
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0.3				TOPSOIL, 3 inches		
		Alluvium	SS-1	LEAN CLAY (CL), firm, tan gray, trace fine sand, moist	3-4-4 N = 8	
3.0			SS-2	SANDY LEAN CLAY (CL), firm, black gray, fine to coarse grained, with topsoil and roots, very moist	5-5-6 N = 11	2118
5.5			SS-3	SANDY SILT (ML), gray white, fine to medium grained, very moist	4-5-6 N = 11	
	Hole Cave at 10.0 feet		SS-4		5-7-7 N = 14	2113
			SS-5		10-13-15 N = 28	2108
17.0		Residuum	SS-6	SANDY SILT (ML), very hard, light gray white, fine, moist	22-30-35 N = 65	2103
20.0				Borehole terminated at 20.0 feet		

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
├┤ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/30/2024	9.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	01/31/2024	5.5	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT: Ecusta Road Industrial Building Addition
Brevard, North Carolina
S&ME Project No. 23410135

BORING LOG: A-6

Sheet 1 of 1

DATE DRILLED: 01/30/2024	**ELEVATION:** 2120 ft
DRILL RIG: CME 45	**DATUM:** NAVD88
DRILLER: Metro Drill	**BORING DEPTH:** 24.4 ft
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:** Soil cutting with hole closure device
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Mac Hager
SAMPLING METHOD:	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet

NOTES:

LATITUDE: 35.262692 **LONGITUDE:** -82.707447

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0.3		Alluvium		TOPSOIL, 3 inches		
	Hole Cave at 3.0 feet	Alluvium	SS-1	SILTY CLAY (CL-ML), firm, black, moist, some decayed organics	3-3-4 N = 7	
		Alluvium	SS-2		2-3-2 N = 5	2115
5.0		Alluvium	SS-3	SILT (ML), soft, gray, with clay, very moist, some sand in sample SS-4	2-2-2 N = 4	
		Alluvium	SS-4		2-2-2 N = 4	2110
12.0		Alluvium	SS-5	SILTY SAND (SM), medium dense, dark red brown, medium to coarse grained, trace rounded fine gravel	7-7-8 N = 15	2105
18.5		Residuum	SS-6	SILTY SAND (SM), medium dense, gray and white, fine to medium grained, moist, trace angular rock fragments	7-6-7 N = 13	2100
23.5		IGM	SS-7	PWR SILTY SAND (SM), very dense, gray and white, some angular rock fragments	30-50/4" N = 50/4"	2095
24.4				Borehole terminated at 24.4 feet		

Depth scale: 0, 5, 10, 15, 20, 25, 30. Elevation scale: 2115, 2110, 2105, 2100, 2095, 2090.

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
├┤ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD		01/30/2024		Not encountered
END OF DRILLING				
AFTER DRILLING				
AFTER DRILLING				

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT: Ecusta Road Industrial Building Addition, Brevard, North Carolina — S&ME Project No. 23410135	BORING LOG: B-1 *Sheet 1 of 1*

DATE DRILLED: 08/31/2016	**ELEVATION:** 2125 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:**	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Matt McCurdy	**LATITUDE:** 35.263261 **LONGITUDE:** -82.707681
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0	0.1			ASPHALT, 1 inch		2125
	0.3	Alluvium		Crushed stone, 2 inches		
		Alluvium	SS-1	FAT CLAY (CH), stiff, brown gray, trace fine sand, moist	4-6-5 N = 11	
5		Alluvium	SS-2		4-4-5 N = 9	2120
	6.0	Alluvium	SS-3	SILTY SAND (SM), loose, gray tan, fine to medium grained, some rounded rock pieces, moist	3-4-6 N = 10	
	8.5	Residuum	SS-4	SANDY SILT (ML), hard, gray tan, fine - no sample recovery from 8.5 to 10 feet; classified as residuum by driller	9-21-25 N = 46	
10		Residuum				2115
15		Residuum	SS-5		9-20-26 N = 46	2110
	17.0	IGM	SS-6	PWR SANDY SILT WITH GRAVEL (ML), very hard, gray, fine to coarse grained, moist, with rock pieces	26-50/5" N = 50/5"	
20	20.0			Borehole terminated at 20.0 feet		2105
25						2100
30						

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
⊢ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	08/31/2016	10.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	09/01/2016	6.3	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: B-2** *Sheet 1 of 1*

DATE DRILLED: 08/31/2016	**ELEVATION:** 2121 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:**	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Matt McCurdy	**LATITUDE:** 35.263286 **LONGITUDE:** -82.706689
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ├ PL---LL)	ELEVATION
0	0.1				ASPHALT, 1 inch			2121
	0.3				Crushed stone, 2 inches			
		Alluvium		SS-1	LEAN CLAY (CL), firm, gray black, fine, very moist	3-3-3 N = 6	● 6	
	3.0	Alluvium		SS-2	FAT CLAY (CH), soft to very soft, gray tan, fine to coarse grained, very moist to wet	2-2-2 N = 4	● 4	
5								2116
				SS-3		1-1-1 N = 2	● 2	
				SS-4		2-1-2 N = 3	● 3	
10								2111
	12.0	Alluvium		SS-5	SILTY SAND WITH GRAVEL (GM), dense, tan brown, fine to coarse grained, with rounded rock pieces and cobbles, very wet	12-26-21 N = 47	● 47	
15								2106
	17.0	IGM		SS-6	PWR SILTY SAND (SM), very dense, tan orange brown, fine to medium grained	50/5" N = 50/5"	● 50/5"	
20	20.0				Borehole terminated at 20.0 feet			2101
25								2096
30								

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	08/31/2016	8.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	09/01/2016	6.3	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT: Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: B-3** *Sheet 1 of 1*

DATE DRILLED: 08/31/2016	**ELEVATION:** 2123 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:**	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Matt McCurdy	**LATITUDE:** 35.262933 **LONGITUDE:** -82.707250
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0	0.1	Alluvium		TOPSOIL, 1 inch		2123
			SS-1	FAT CLAY (CH), firm to soft, brown tan gray, trace fine sand, very moist	3-3-5 N = 8	
	3.0		SS-2	LEAN CLAY (CL), soft to firm, tan gray, some fine to coarse sand and gravel, very moist to wet	1-2-1 N = 3	
5			SS-3		2-2-2 N = 4	2118
			SS-4		3-3-3 N = 6	
10						2113
	12.0		SS-5	SILTY GRAVEL WITH SAND (GM), very dense, brown orange-brown, fine to coarse grained, with rock pieces and cobbles, very wet	3-16-50/4" N = 50/4"	
15						2108
	17.0	Residuum	SS-6	SANDY SILT (ML), very hard, tan orange-brown, fine	8-20-31 N = 51	
20	20.0			Borehole terminated at 20.0 feet		2103
25						2098
30						

STANDARD PENETRATION TEST DATA

△ % Fines
◯ NMC
├┤ PL---LL

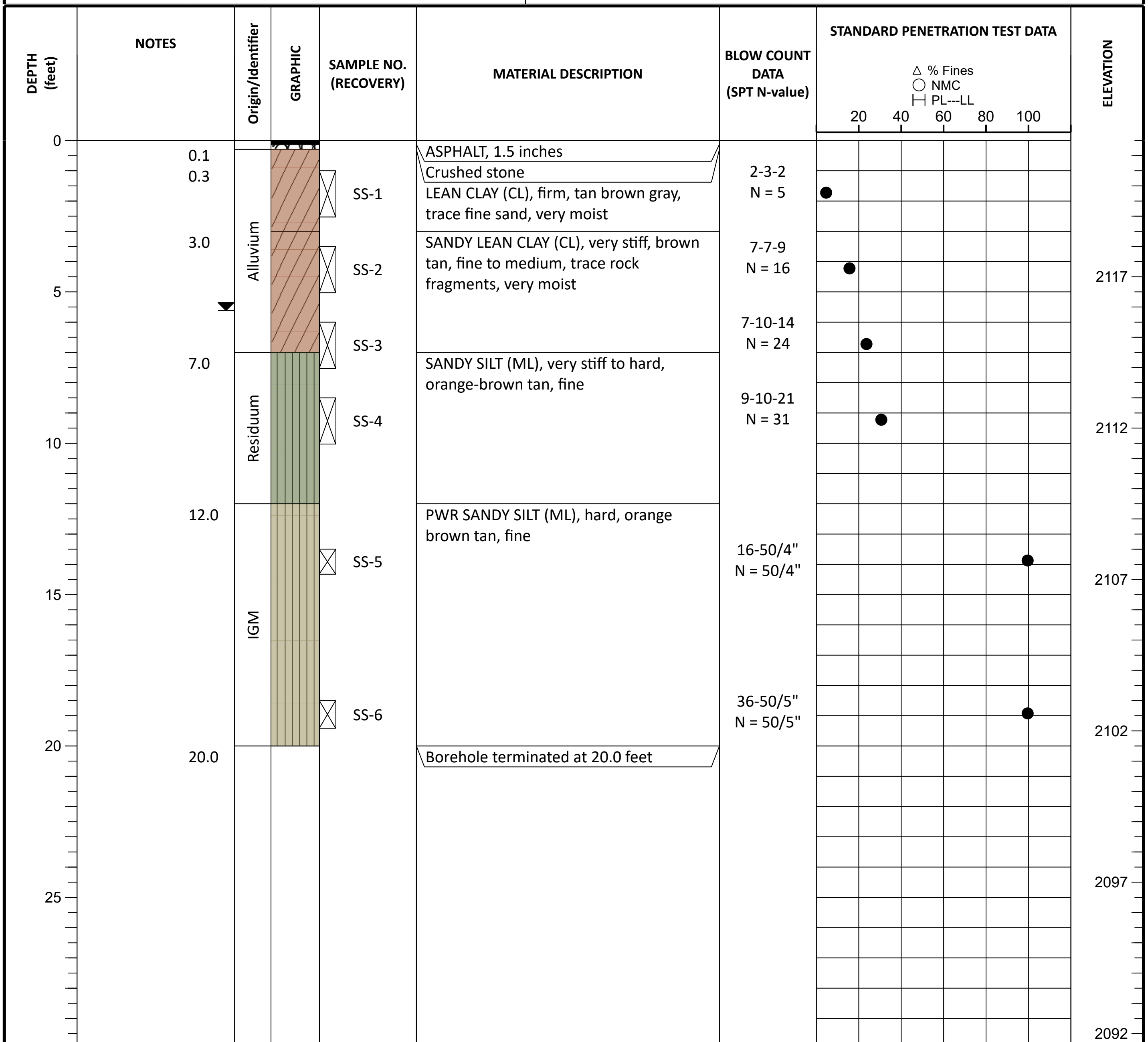
20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	08/31/2016	14.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	09/01/2016	7.7	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: B-4** *Sheet 1 of 1*

DATE DRILLED: 08/31/2016	**ELEVATION:** 2122 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:**	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Matt McCurdy	**LATITUDE:** 35.262583 **LONGITUDE:** -82.707694
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD				
END OF DRILLING				
AFTER DRILLING		09/01/2016	5.5	
AFTER DRILLING				

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	Ecusta Road Industrial Building Addition Brevard, North Carolina **S&ME Project No. 23410135**	**BORING LOG: B-5** *Sheet 1 of 1*

DATE DRILLED: 08/31/2016	**ELEVATION:** 2119 ft	**NOTES:**
DRILL RIG: CME 45	**DATUM:** NAVD88	
DRILLER: Metro Drill	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Manual Safety Hammer	**CLOSURE:**	
DRILLING METHOD: 2-1/4 HSA	**LOGGED BY:** Matt McCurdy	**LATITUDE:** 35.262497 **LONGITUDE:** -82.706628
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0				ASPHALT, 2 inches		2119
	0.2			Crushed stone, 3 inches		
	0.4	Fill	SS-1	SILTY SAND (SM), medium dense, brown gray, fine to medium grained, trace rock pieces	11-5-6 N = 11	
	3.0	Alluvium	SS-2	FAT CLAY (CH), very soft to soft, gray black, trace fine sand, very moist	1-1-1 N = 2	
5						2114
			SS-3		1-2-1 N = 3	
	8.0		SS-4	SILTY SAND (SM), loose, gray, fine to coarse grained, trace mica, wet	1-2-4 N = 6	
10						2109
	14.0	IGM	SS-5	PWR SILTY SAND (SM), very dense, tan orange brown, fine to medium grained, trace rock pieces	12-22-50/5" N = 50/5"	
15						2104
			SS-6		50/4" N = 50/4"	
20	20.0			Borehole terminated at 20.0 feet		2099
25						2094
30						

STANDARD PENETRATION TEST DATA

△ % Fines
○ NMC
├┤ PL---LL

20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	08/31/2016	8.0	
END OF DRILLING	▼			
AFTER DRILLING	▼	09/01/2016	7.0	
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal, IGM = Intermediate Geomaterial

Appendix III – Laboratory Testing

Laboratory Test Reports

Form No: TR-D2216-T265-1
Revision No. 1
Revision Date: 08/16/17

LABORATORY DETERMINATION OF WATER CONTENT

ASTM D 2216 ☑ AASHTO T 265 ☐

S&ME, Inc. - Asheville: 44 Buck Shoals Road, Unit C3, Arden, NC 28704

Project #:	23410135	Report Date:	2/16/2024
Project Name:	Transylvania Co. Ecusta Road Industrial Building Add.	Test Date(s):	2/8/24/-2/13/24
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way Brevard, NC, 28712		
Sample by:	M. Hager	Sample Date(s):	1/30/24
Sampling Method:	Split Spoon	Drill Rig :	-

Method: **A** (1%) ☐ **B** (0.1%) ☑

Balance ID.	10193	Calibration Date:	1/4/24
Oven ID.	10172	Calibration Date:	1/4/24

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft.		grams	grams	grams	grams	%	
A6	SS3	6-7.5	D2	49.06	267.51	211.01	56.50	34.9%	
A2	SS2	3.5-5	D3	48.64	237.51	195.19	42.32	28.9%	
A3	SS3	6-7.5	Z3	60.34	244.89	210.14	34.75	23.2%	
A1	2	3.5-5	Y1	60.55	265.34	216.92	48.42	31.0%	
A1	3	6-7.5	Y2	56.39	280.06	232.94	47.12	26.7%	

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Robert Davies	Robert Davies	QA Supervisor	2/16/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D1140-3
Revision No. 1
Revision Date: 8/2/17

MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Asheville: 44 Buck Shoals Road, Unit C3, Arden, NC 28704

Project #:	23410135	Report Date:	2/16/2024
Project Name:	Transyl. Co. Ecusta Road Industrial Building Add.	Test Date(s):	2/8/24-2/12/24
Client Name:	Transylvania County		
Project Address:	152 Public Safety Way Brevard, NC, 28712		
Sample by:	M. Hager	Sample Dates:	1/30/2024
Sampling Method:	Borings	Drill Rig :	-

Method: **A** ☐ **B** ☑ Soaked ☑ Soak Time 2 hrs.

Sample Identification	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
A-2, SS-1, 1-2.5	295.98	466.09	423.55	311.44	42.54	**33.3%**	**87.9%**

Balance ID. *10193* *Calibration Date:* *01/04/2023* *#200 Sieve* *02599* *Calibration Date:* *6/23/2023*

Notes / Deviations / References: ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um)) Sieve

Method B uses a deflocculating agent such as Sodium Hexametaphosphate while soaking the specimen for at least 2 hours.

Method B, Auxiliary samples are not used on this form

Robert Davies	Robert Davies	QA Supervisor	2/16/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Asheville: 44 Buck Shoals Road, Unit C3, Arden, NC 28704

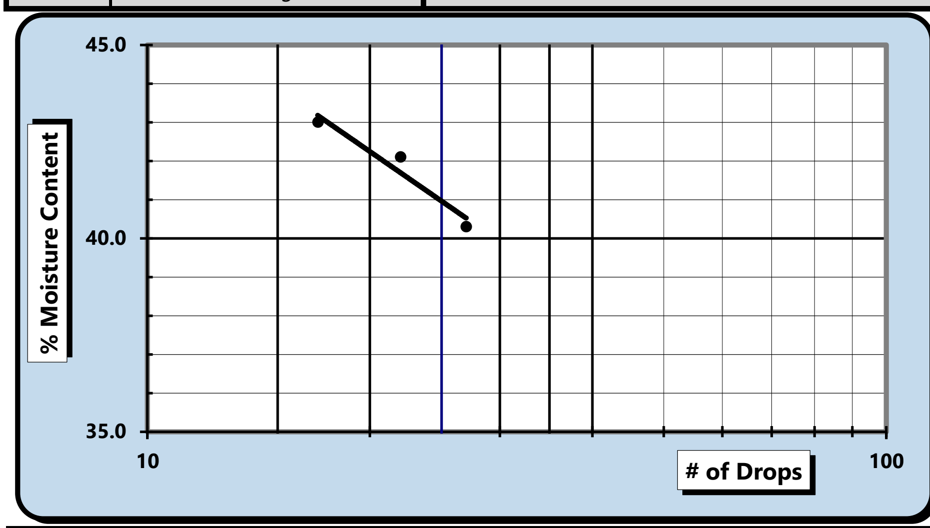
Project #:	23410135	Report Date:	2/16/2024
Project Name:	Transylvania County Ecusta Road Industrial Building Add.	Test Date(s)	2/9/24-2/12/24
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way, Brevard, NC 28712		

Boring #:	A2	Sample #:	SS-2	Sample Date:	1/30/24
Method:		Type:	-	Depth:	3.5-5

Sample Description: (CL) Lean clay, grey

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	10193	1/4/2024	Grooving tool	2401	7/13/2023
LL Apparatus	2901	1/9/2024			
Oven	2231	1/4/2024			

Pan #: Y3		Liquid Limit						Plastic Limit		
	Tare #:	DOG	CAT	BART				K-2	T-4	
A	Tare Weight	13.91	13.85	13.85				13.86	13.84	
B	Wet Soil Weight + A	23.06	20.67	21.90				19.70	19.60	
C	Dry Soil Weight + A	20.43	18.65	19.48				18.65	18.55	
D	Water Weight (B-C)	2.63	2.02	2.42				1.05	1.05	
E	Dry Soil Weight (C-A)	6.52	4.80	5.63				4.79	4.71	
F	% Moisture (D/E)*100	40.3%	42.1%	43.0%				21.9%	22.3%	
N	# OF DROPS	27	22	17				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR	**40.7%**	**41.5%**	**41.3%**						
Ave.	*Average*	**41.2%**						22.1%		



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**41**
Plastic Limit	**22**
Plastic Index	**19**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☐ % Passing #200 Sieve:

Notes / Deviations / References: Estimated % Retained on the # 40 Sieve: 6%

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Robert Davies	[signature]	QA Supervisor	2/16/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Asheville: 44 Buck Shoals Road, Unit C3, Arden, NC 28704

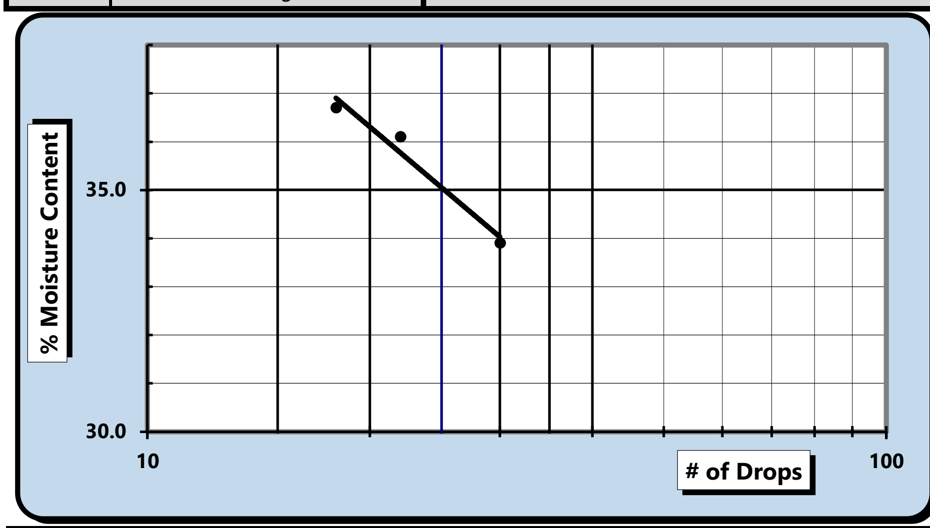
Project #:	23410135	Report Date:	2/16/2024
Project Name:	Transylvania County Ecusta Road Industrial Building Add.	Test Date(s)	2/8/24-2/13/24
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way, Brevard, NC 28712		

Boring #:	A3	Sample #:	SS-3	Sample Date:	1/30/24
Method:		Type:	-	Depth:	6-7.5

Sample Description: (CL) Lean clay, tan-yellow

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	10193	1/4/2024	Grooving tool	2401	7/13/2023
LL Apparatus	2901	1/9/2024			
Oven	2231	1/4/2024			

Pan #: Y3		Liquid Limit						Plastic Limit		
	Tare #:	Q-3	Q-5	T-2				T-3	K-4	
A	Tare Weight	13.90	13.91	13.89				13.93	13.82	
B	Wet Soil Weight + A	19.51	20.69	21.75				20.18	20.20	
C	Dry Soil Weight + A	18.09	18.89	19.64				19.04	19.06	
D	Water Weight (B-C)	1.42	1.80	2.11				1.14	1.14	
E	Dry Soil Weight (C-A)	4.19	4.98	5.75				5.11	5.24	
F	% Moisture (D/E)*100	33.9%	36.1%	36.7%				22.3%	21.8%	
N	# OF DROPS	30	22	18				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR	**34.6%**	**35.6%**	**35.4%**						
Ave.	*Average*	**35.2%**						22.1%		



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**35**
Plastic Limit	**22**
Plastic Index	**13**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☐ % Passing #200 Sieve:

Notes / Deviations / References: Estimated % Retained on the # 40 Sieve: 10%

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Robert Davies	[signature]	QA Supervisor	2/16/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Asheville: 44 Buck Shoals Road, Unit C3, Arden, NC 28704

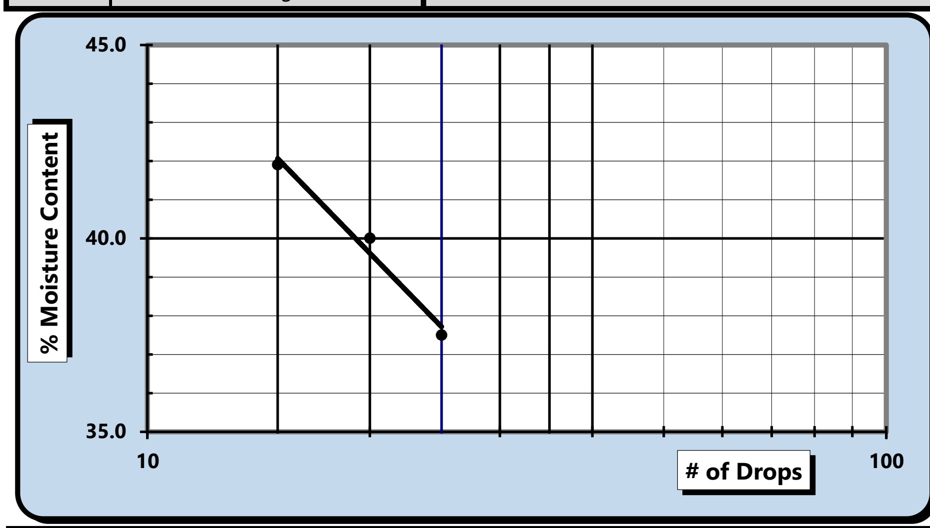
Project #:	23410135	Report Date:	2/16/2024
Project Name:	Transylvania County Ecusta Road Industrial Building Add.	Test Date(s)	2/9/24-2/12/24
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way, Brevard, NC 28712		

Boring #:	A6	Sample #:	SS-3	Sample Date:	1/30/24
Method:		Type:	-	Depth:	6-7.5

Sample Description: (ML) Silt with sand, Grey

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	10193	1/4/2024	Grooving tool	2401	7/13/2024
LL Apparatus	2901	1/9/2024			
Oven	2231	1/4/2024			

Pan #: Y3		Liquid Limit						Plastic Limit		
	Tare #:	K-3	R-5	J-3				Q-4	R-2	
A	Tare Weight	13.93	13.84	13.85				13.89	13.85	
B	Wet Soil Weight + A	20.49	21.68	19.98				19.05	18.89	
C	Dry Soil Weight + A	18.70	19.44	18.17				17.99	17.84	
D	Water Weight (B-C)	1.79	2.24	1.81				1.06	1.05	
E	Dry Soil Weight (C-A)	4.77	5.60	4.32				4.10	3.99	
F	% Moisture (D/E)*100	37.5%	40.0%	41.9%				25.9%	26.3%	
N	# OF DROPS	25	20	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR	**37.5%**	**39.0%**	**39.8%**						
Ave.	*Average*	**38.8%**						26.1%		



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**38**
Plastic Limit	**26**
Plastic Index	**12**
Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☐ % Passing #200 Sieve:

Notes / Deviations / References: Estimated % Retained on the # 40 Sieve: 3%

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Robert Davies		QA Supervisor	2/16/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Appendix IV – Miscellaneous

Field Testing Procedures

Important Information about Your Geotechnical Report

♦ Field Testing Procedures

Soil Test Borings

All borings and sampling were conducted in accordance with ASTM D-1586 test method. Initially, the borings were advanced by either mechanically augering or wash boring through the overburden soils. When necessary, a heavy drilling fluid is used below the water table to stabilize the sides and bottom of the borehole. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel or split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the "Standard Penetration Resistance" or N-value. The penetration resistance, when properly evaluated, can be correlated to consistency, relative density, strength and compressibility of the sampled soils.

Water Level Readings

Water level readings are normally taken in conjunction with borings and are recorded on the Boring Logs following termination of drilling (designated by ▽) and at a period of 24 hours following termination of drilling (designated by ▼). These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. The groundwater table may be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should also be expected with variations in surface run-off, evaporation, construction activity and other factors.

Occasionally the boreholes sides will cave, preventing the water level readings from being obtained or trapping drilling water above the cave-in zone. In these instances, the hole cave-in depth (designated by HC) is measured and recorded on the Boring Logs. Water level readings taken during the field operations do not provide information on the long-term fluctuations of the water table. When this information is required, piezometers are installed to prevent the boreholes from caving.

Important Information About Your

Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Scope of Geotechnical Services

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project. Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.